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## E-business development for competitive advantages: a case study

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### Abstract

Electronic business (e-business) today plays a major role in the world's economy. Forester Research estimated that, by 2003, the value of e-commerce of US and Europe will reach US\$ 3 trillion. As the e-marketplace becomes more lucrative, it attracts new entrants and created turmoil in the market. There have been many spectacular successes and many failures.

This paper presents a study of e-business competitive advantage strategies using the success at Intel. After the initial deployment of its e-business pilot system in July 1998, Intel ramped US\$ 1 billion sales on e-business each month for the rest of the year. Intel became the fifth most profitable company in the US in the year 2000, up from the rank of eighth in 1999. Despite the rapid decline in stock values of many Internet related companies and the recession, Intel is still successful. By the end of 2001, Intel was the seventh largest market capitalization company in the US.

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### 1. Introduction

E-business has received much attention from entrepreneurs, executives, investors, and industry observers recently. As information technologies (IT) develop, novel ways of business process redesign (BPR) emerged, creating turmoil in the industry. Organizations today frequently integrate Internet technology to redesign processes in ways that strengthen their competitive advantages. Success breeds imitation and invites more entries.

The rapid expansion of e-commerce values in the past few years convinced many people that a new economy has emerged. Chairman of Microsoft, Bill

Gates, frequently expressed his fear that Microsoft is about 2 years away from failure, that somewhere out there is a formidable competitor, unborn and unknown, who will use better business models to put companies like Microsoft into obsolescence. And the most successful new business models are probably those that can integrate Internet technology to all activities of the enterprise-wide value chain.

### 2. E-business concepts, strategies, and frameworks

Based on various types of trading partners, there are many categories of e-business, for example: Business to Business (B2B), Business to Consumer (B2C), Consumer to Business (C2B), Consumer to Consumer

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(C2C), People to People (P2P), Government to Citizen (G2C), Citizen to Government (C2G), Exchange to Exchange (E2E) and Intra-business (Organization Unit to Organization Unit). Without the use of face to face operations, all e-business transactions are performed electronically by using computer and communication networks. The three principal categories of e-business applications are:

1. Electronic markets or e-marketplaces: buying and selling goods and services.
2. Inter-organizational systems: facilitating inter- and intra-organization flow of goods, services, information, communication, and collaboration.
3. Customer service: providing customer service, help, handling complaints, tracking orders, etc. [13].

### 2.1. Information systems strategies for competitive advantage

Studying the evolution of business organizations has received much of attention in organization theory and MIS research [2,8]. Because organizations are not internally self-sufficient, they require resources from the environment, and thus become interdependent with those elements of the environment with which they transact. Organizational and ecological theorists [6,7] argued that organizations develop internal and external strategies which seek to minimize the uncertainty arising from dependence on the environment for resources.

As the technology advances and the e-business market develops and grows, market niches open and

close frequently, creating rapid changes in the market. The prevalence of technical innovations may be regular, sporadic, or seldom; these patterns of change have different implications for business organizations. When innovations occur often, a niche may open up and the organization competes to take the advantage of cost savings and market penetration that often results in better profits and market share.

From the IS perspective, the value chain model [9] highlights interdependence activities in businesses where competitive strategies can be best applied and where IS are most likely to have strategic impact (Fig. 1).

As information technologies developed, novel ways of business process redesign emerged. Most organizations today use Internet technology to redesign their processes in ways that provide new competitive advantage. Through the infrastructure of existing B2B exchanges in the e-marketplaces, many organizations will eventually be able to integrate activities of their value chain encompassing suppliers, customers, and distribution channels within an industry or across industries. The potential of e-business is so great that many believe that e-business is the new economy that decides the success of future business organizations. Andy Grove, Chairman of Intel boldly stated in 1998: “*Within 5 years, all companies will be Internet companies or they would not be companies*” [4]. Despite the fact this prediction was greatly exaggerated, this statement showed a strong belief in the potential of e-business.

However, Porter [10] has argued that the key question is not whether to deploy e-business now to take advantage of Internet technology, but how to deploy it.

<b>Support Activities</b>	Firm Infrastructure: Administration and Management				
	Human Resources				
	Technology				
	Procurement				
<b>Primary Activities</b>	Inbound Logistics	Operations	Outbound Logistics	Marketing and Sales	Services

Fig. 1. The value chain model.

Gaining competitive advantage requires building on the proven principles of effective strategy. Business enterprise can gain competitive advantage by operational effectiveness, doing the same as your competitors do but doing it better, and by strategic positioning, doing things differently from competitors in a way that delivers a unique type of value to customers. Key principles of strategic positioning are: goals that aim at long-term return on investment, distinctive value chains, trade-offs for uniqueness in the market, strategies that fit together, and continuity of corporate direction.

Porter also argued that Internet technology should be used as a “complement to” rather than a “cannibal of” traditional ways of competing. The companies that will be most successful will be those that use e-business to make traditional business processes better and those that invent and implement new combinations of virtual and physical activities. Without understanding how to deploy Internet technology, entering e-business can bring disastrous consequences.

In recent years, the business community and the public have been confused by distorted market signals of many dotcoms, such as the exponential growth in number of customers, artificially-low operation costs, and inflated revenues. Some companies even resorted to dubious accounting methods to inflate revenues and deflate costs. Somehow these distorted signals have misled many people into a belief that the e-marketplaces have rendered old rules of competition obsolete. As a consequence, many companies decided to shift their fundamental ways of doing business from quality, feature, innovations, service, and profits toward mainly low price and revenue growth. Without long-term profits, they failed.

To succeed, companies will need to search and implement innovative strategies that capitalize on both the power of the Internet and the changes in both traditional and electronic markets. Companies that run e-business should have tight supply chain relationships with customers, suppliers, and distributors [12]. In addition, the supply chain within e-business companies also continues to change. Businesses need to be sure that customers and suppliers can easily gain access to their websites to gain important product information for decision making.

Currently, the major barrier to customers’ and suppliers’ access to the web is ease and speed of

access, e-loyalty, and e-trust. Because the use of e-commerce technology tends to reduce the switching cost, it is important for e-business companies to build its strategic position by focusing on e-loyalty which encompasses good relationships and trust with value chain partners. B2B procurement of direct goods requires a relationship, usually long-term, with a vendor who will deliver a known quality of goods. With mission critical buying, companies cannot just buy from anyone in the e-marketplace. If an order for supplies goes unfilled, the missing goods could shut down a production line or an entire factory. In B2B procurement of direct goods, tight integration with major suppliers along the supply chain is absolutely essential.

Major success factors for e-business include [5,11,15]:

- Internet technology fully integrated into the company’s overall strategy.
- Competitive advantage maintained in both operational efficiency and distinctive strategic positioning.
- Basis of competition not shifted from traditional competitive advantage, such as cost, profit, quality, service, and features.
- Company’s strategic positioning well maintained.
- Support from top management.
- Buyer behavior and customer personalization.
- Quick time to market.
- Right systems infrastructure.
- Good cost control.
- Good e-business education and training to employees, management and customers.
- Customer’s and partners’ expectations well-managed.
- Good products and services offered by e-business.
- Current e-business systems expanded to cover entire supply chain.
- New competitors and market shares tracked.
- Website of high quality that meets or exceed user expectations.
- Company’s virtual marketplace established.

### 3. Intel and its e-business development strategies

Intel Corp. located in Santa Clara, California, is the world’s largest producer of Integrated Circuits Chips

today. Incorporated in 1968, Intel supplies the computing and communications industries with chips, boards and systems building blocks that are integral to computers, servers, and networking and communications products. Its products are offered at various levels of integration, and are used by industry members to create advanced computing and communications systems. Today, the company has evolved from a processor maker into a supplier of network and server hardware, Internet hosting services, and other e-business components. Its technological leadership ranges from microprocessor design to advanced manufacturing and packaging.

Most of Intel's business is in the PC market. In past years, it was under intense competition from other chip makers, such as Advanced Micro Devices (AMD), Texas Instruments, Motorola, and IBM. It then customized its paper catalogs and sent them to potential customers along with product availability information. Until summer 1998, this process was performed entirely on paper. However in 1996, when key value chain partners, such as Dell Computers and Cisco Systems, started their B2B e-procurement systems, they pressured Intel to convert B2B activities online.

In 1997, Intel began to investigate the feasibility of building an e-business system. The project started with the forming of a Virtual Worldwide E-Business Project Team. Because the project strongly emphasized customer market needs, Intel's sales and marketing was given overall management responsibility. At that time, converting all operations to e-business for a company with a large global operation was perceived as a daunting task. Under the mandate from the chairman to make Intel an 'Internet company,' Sandra Morris, Vice President of Sales and Marketing Group, and Director of Internet Marketing and E-Commerce at Intel stated: "*a lot of people feel overwhelmed by 'The Task'.*"

### 3.1. Project structure

From pressure exerted by many value chain partners who wanted Intel to play a leadership role, Intel's management decided to advise customers that Intel was serious about e-business. It created an 'e-business program' (a self-service extranet) which focused on procurement and customer support for Intel products.

Access to the site was restricted to Intel's authorized business partners and customers.

Project teams that participated in the early development of the e-business system included:

- A project planning team that consisted of customer, technical and logistical representatives was created to define the scope and objective of the project.
- Business analysts were brought in during the early stages to help define the business workflow and to assess how information was given to customers.
- Intel's sales and marketing staff were told to study and define how to work with customers via the e-business system.
- Intel's Planning and Logistics Group was included on the planning team to help the IT department to develop the solutions to integrate the new e-business with existing business activities.
- The IT department was positioned as an "enabler" of business. Its role was to implement the solutions from the Planning and Logistic Groups.

### 3.2. Intel's mission and goals

With over 50% of its revenues and many customers coming from outside the US, the benefits of a global e-business system for Intel were too great to be ignored. To support over US\$ 25 billion annual sales in 1998 and a worldwide network of business partners, resellers, and original equipment manufacturers (OEM), Intel had to improve its efficiency by automating its business to business processes. Traditional business processes at Intel at that time were too slow and thus a decision was made to deploy a web-based order management system.

Intel's early mission was to use Internet technology to improve the competitive advantage of its value chain activities. The goals were to design and deploy a worldwide e-business solution for its current business, and build an infrastructure that worked with existing business processes. The intent was to integrate Internet technology into the company's overall strategy in order to gain competitive advantage in both operational effectiveness and strategic positioning.

In order to avoid potential software engineering problems created by the enormous task of building a new Intel's e-business system, Intel development teams started cautiously. Rather than cannibalizing the

entire business structure, Intel project teams used an iteration approach in building its first e-business system. They first focused on building an extranet B2B system to support direct customers on-line. “We picked one thing that we could build very quickly and deploy to our customers,” said Sandra Morris.

### 3.3. E-business strategies for value chain

Intel aimed to achieve its competitive advantage by both operational efficiency and strategic positioning.

1. *Operational efficiency*: In order to improve efficiency, Intel helped its value chain partners connect to the worldwide-web to access information on-line. To do this Intel automated its order management and information delivery system. The greatest efficiency improvement in 1997 was to customers who were not already electronically connected to Intel. By converting the “unwired” to “wired,” Intel replaced traditional phone and fax lines to PC-based on-line communication. By providing access to real-time information, Intel allowed customers to know more about Intel products and future direction. On-line access also made customers feel more connected with access to more Intel resources, and thus having a closer business relationship.

For Intel, having customers electronically connected brought multiple benefits. First, the company was able to move resources towards a more efficient and productive technology. Second, sales people no longer needed to hand deliver confidential product information as they had in the past. Third, potential sales were enormous, because Intel was dealing with billions of dollars of orders per quarter.

2. *Distinctive strategic positioning in the value chain*: In 1998, Intel was well positioned with its Pentium processor product lines and enjoyed a distinctive strategic positioning in the market thanks to its unique R&D programs and good supply chain relationships with partners. To further strengthen this position, Intel focused on building on-line relationships with direct customers, including OEMs and distributors. Intel worked hard to convert its system and data from the old vendor-centric model to the new customer-centric model.

Because management, procurement, sales and marketing, and engineering functions of value chain partners and customers all have different informational needs, Intel customized its websites within customer accounts. Being able to deliver personalized information on-line allowed Intel to support multiple levels of the customer organization in a manner that best met the individual’s needs. This makes it easier for every customer to do his/her own research and to take appropriate action.

Customers visiting the Intel extranet website now find their name and specific applications available to them, based on their personal profile. This user profile allows a customer to obtain confidential information important to him or her alone.

### 3.4. E-business deployment

The initial e-business pilot system launched in 1998 consisted of 240 one-stop shopping sites for customers around the world. Using an iterative development approach to build the system, Intel’s e-business website was serving more than 350 top customer accounts and thousands of individual users within the first year. Personalized data and applications were tailored to users’ needs to provide an individualized experience [Fig. 2](#).

### 3.5. Quick deployment of access manager application

One of the early incremental development efforts at Intel after the launch of their e-business website was an Access manager application that automated the creation of account user IDs and passwords to access the unified environment known as the “Landing Zone.” In the past, Intel account supervisor often spent over an hour in creating user IDs and passwords for a new customer. With the Landing Zone environment, Intel customers may log into one place and have access to many other intra/extranet sites; this convenience attracted many users. “The people want to come to the environment because it offers these common services of security and entitlement ...” commented M. Kantipudi, the B2B Platform and e-Content Application Manager of Intel’s Sales and Marketing Application Group.



Fig. 2. Intel's developer site.

### 3.6. E-business infrastructure

In order to simplify system maintenance and support activities, Intel decided to standardize the e-business architecture to one hardware vendor, one operating system, and minimized the number of database and application vendors. In addition to lower cost, the infrastructure was designed to be flexible and scalable as the system grew.

**Servers:** Intel's initial e-business system infrastructure was built around three main clusters of Pentium based servers: web-servers, database servers, and data analysis servers. Standardizing on one hardware vendor simplified maintenance costs, made growth easier, and allowed Intel to interchange components as necessary without compatibility issues.

**OS and databases:** Intel's e-business system was standardized on Microsoft's Windows NT. For their databases, Intel limited its operation to two vendors.

**Application development:** Intel provided a number of applications that serve specific needs and has made an effort to use off-the-shelf applications [14].

### 3.7. Deployment problems and challenges

For transaction security, Intel sites allow customers to place and track orders using standard web browsers with Secure Socket Layer (SSL) encryption. However, the US government previously banned the export of 128-bit encryption technology to foreign nations. To maintain a strong encryption technology worldwide without violating this export ban, Intel encouraged its customers to acquire a third-party 128-bit encryption application developed outside the US for their own protection. Commenting about Intel's success in the deployment of the 128-bit SSL encryption, Phuc Than, General Manager of Intel Vietnam, stated: "Intel's customers in southeast Asia found the use

of the 128-bit encryption technology a necessary step to trust Intel's e-business system, especially in nations where e-business is relatively new."

With the 128-bit encryption model resolved, the project moved forward to deploy the pilot system. During the first month of deployment, Intel found that encrypted file transfer was very sensitive to packet loss when using SSL security. When packet loss rate exceeded 15%, the download times for encrypted pages skyrocketed. It was critical for Intel to reduce the packet loss rate to successfully deliver its e-business system. In addition, most of the transmission problems at customers' sites were located in the connection between customer's workstations to end-offices and tandem offices of the telephone companies. One solution was to reduce the number of elements that had to be transferred through the network. This was done by using data compression and redesigning the web pages so that only compressed data had to be transferred. Another solution was to improve connection quality and increase bandwidth between customers' sites and the tandem office. With some incentives, Intel urged all of its value chain partners to upgrade their connections to ISP servers with high bandwidth pipes and high speed network and routers.

Despite the strong encryption technology that was used worldwide within Intel's value chain of partnership, Intel's choice of Pentium servers and Windows operating systems created some security concerns. System security is only as good as the weakest link in the security chain. At Intel's e-business system, the weak links include Microsoft Windows Operating Systems and Windows NT networks. Problems caused by hackers on Windows-based web-servers are commonplace. Fortunately, Intel conducts B2B e-commerce mainly among trusted partners via Virtual Private Networks (VPN) and thus its security risks are reduced.

### 3.8. Success

On 1 July 1998, Intel officially began taking orders from OEM and distribution customers using its new personalized websites. This system enabled approximately 200 of Intel's customers in almost 30 countries to place orders for Intel products, check product availability and inventory status, receive marketing and sales information, and obtain customer support in real-time, 24 h a day, 7 days a week. Prominent

applications in the value chain model at Intel are presented in Fig. 3. Major successes are:

- Intel moved US\$ 1 billion dollars in revenue to its on-line e-business system in the first 15 days, surpassing the company's initial goal of doing this in the first 3 months.
- The company was able to eliminate most faxes to its customers worldwide. For value chain partners in Taiwan alone, this eliminated 45,000 faxes per quarter. This produced significant cost savings for Intel and its value chain partners in reduced international long distance phone costs.
- After the first month of deployment, Intel continued to receive US\$ 1 billion value of orders on-line each month for the rest of 1998.
- Independent customer surveys rated Intel's e-business at a 94% satisfaction level.
- Intel became the eighth most profitable company in the US in 1999 and climbed to the fifth in 2000.
- Amid the collapse of many dotcoms and click-and-mortars in recent years and the 2001 recession, Intel remains profitable and retained the value of its equity. For the year 2001, Intel's income was US\$ 1.29 billion. At US\$ 211 billion, Intel was the seventh largest US company in market capitalization values at the end of 2001 [1,16].
- Many of Intel's employees who participated in the development of the e-business system continue to receive promotions many years after its successful deployment. Sandra Morris was promoted to the CIO position.

### 3.9. Lessons learned and success factors

Despite thorough planning by Intel's worldwide team, the most significant payoff from deploying the e-business solution was what the company learned. Key success factors ranked by level of importance are:

- *Building and continuing to strengthen their distinctive strategic position in the market:* Intel had the right goals, unique product lines, and was able to deliver a value proposition that is equal or better than that of its competitors. Thanks to its distinctive strategic positioning, buyers continue to pay a premium price for Pentium products. By building its B2B system as early as 1998, Intel further strengthened its strategic position with value chain partners.

<b>Firm Infrastructure: Administration and Management</b> Web based and distributed financial and planning				
<b>Human Resources</b> - On-line personnel and benefits administration, sharing and dissemination of company information, time and expense reporting				
<b>Technology Development</b> -XML -RosettaNet standard -Common Access Manager with Landing Zone application for access control -128 Bit Third-party SSL Encryption and Global Server ID (GSID) -VPN - Collaborative product design - Knowledge sharing with value chain partners - On line access of R&D information for sales and services				
<b>Procurement</b> Online direct payment and e-procurement via exchanges and market places.				
Inbound Logistics	Operations	Outbound Logistics	Marketing and Sales	Services
- ERP, integrated scheduling, shipping, warehousing of inbound inventory -On-line web based procurement order tracking.	- Integrated information exchange, scheduling of manufacturing and production - On-line monitoring available for sales offices -On-line collaboration.	- Real time transactions initiated by salespersons or partners - On-line access of delivery schedule -Online tracking from logistics providers loaded to partner's account website.	- Web based collaboration, access to customers and partners on product info, and features. - Customer-centric, and CRM that tailored to customer profile.	- Web based on line customer supports - On-line customer education and training -On-line collaboration and knowledge sharing with value chain partners - On-line ordering and order error correction - Web based customer account access for field service and sales representatives - Web based order tracking, production schedule, delivery date, etc. loaded into customer's account site.

Fig. 3. E-business applications of Intel's value chain.

- *Building e-business to complement rather than cannibalize traditional ways of competing:* Intel's e-business system was intended to strengthen its market, profits, and competitive advantage. Intel was able to fend off lower cost substitute products with its Celeron products while maintaining good profit margins on its Pentium lines. By continuing to maintain innovation and tight supply chain rela-

tionships with value chain partners, Intel strengthened its strategic market position.

- *Support from top management:* Thanks to the early vision and support from Andy Grove, all Intel e-business teams received necessary resources and cooperation to develop and test the new system.
- *Focusing on quality of connections:* For a global company like Intel, connectivity can be a real



challenge, especially in parts of Europe and Asia. After its deployment, Intel tested connectivity with customers in a real production environment on a frequent basis. Because performance can vary significantly in different countries, Intel network engineers worked hard to help customers keep up their network connections. While it was not Intel's responsibility to install high quality connections between value chain partner's sites to local tandem offices and ISPs, helping some partners to upgrade their connection bandwidth was crucial to Intel's deployment success during the first year.

- *Providing worldwide support and customer training:* In order to promote e-business cooperation to value-chain partners, Intel built an e-business case study website to educate its partners. Intel also developed on-line training to reduce the number of support calls. Intel engineers also provided basic training to its customers in many parts of the world.
- *Deploying the best security protections:* Despite the export ban of the US government, Intel required 128-bit encryption technology to be used worldwide from the start, ahead of many US companies. Along with firewalls, VPN, access restrictions, and security audits, Intel provided adequate security, privacy, and confidentiality to customers and value chain partners in using its e-business system.
- *Building and maintaining solid e-business architecture:* A robust system will allow e-business to move ahead quickly. By separating front-end functionality of the website from back office systems, applications were developed for customers with frequent updates without being affected by enterprise-type applications.
- *Following good e-business project management strategies:* Having clearly defined scopes, goals, and requirements, and following an iteration approach during the development of Intel's e-business system helped them to avoid many traditional software engineering problems, such as schedule delays, cost overruns, and failure to meet user requirements. Intel strategies of "build a little, test a little" and "walk first, run later" worked.

### 3.10. Room for improvement

Despite the successes, there is still room for improvement of Intel's e-business. First, attention

must be paid to the reliability of Intel's PC servers. Rapid improvements in technology and competitive environment have forced many software vendors to shorten development cycle and rush software products to market without having thorough integration testing. The decline of Windows system reliability was observed by Larry Constantine:

When we look back over the evolution of software, we see fewer clearly defined landmarks, and what dominates the landscape is the relentless trend toward ever larger, more complex, and less reliable systems loaded down with a panoply of bewildering features of questionable utility . . . . . Ironically, even as hardware has become increasingly reliable and dependable, software has become far less so. It has been years since I have had to deal with a disk crash, yet hardly a day passes without the operating system and application software conspiring to crash one or more of the machines in my office. A 6-year-old machine that serves as our firewall sits with its disk spinning away 24/7 for years with nary a glitch, yet Windows goes brain-dead if it is not rebooted at least once a week [3].

Second, PC workstations and PC-based networks are more vulnerable to security break-in or virus attack due to its relatively simple architecture. Reliability and security are important factors in building trust from Intel's B2B partners. A failure of delivery on mission critical products could shut down a factory of Intel's customers and cause them to look for substitute products. An error in the database could cause incorrect parts to be shipped at the wrong time at an incorrect price. Therefore, using PCs as servers to support mission critical B2B operations is risky. Because it is in Intel's interests to promote the use of PCs it must take extra measures to maintain the reliability and security of its e-business servers.

## 4. Conclusions

With rapid advances in technology, novel ways of business process redesign, which include entering the e-business marketplace have emerged. Organizations today frequently redesign their processes in ways that provide competitive advantage.

However, gaining competitive advantage requires building on the proven principles of effective strategy. Key success factors include maintaining distinctive strategic positioning, using e-business technology to improve efficiency and competitive advantage, maintaining support from top management, putting emphasis on the quality of e-business operations, and maintaining good system security.

Although one can argue that the spectacular successes of many e-businesses may be due to the advance of e-commerce today, we have seen that those who abandoned fundamental ways of competing eventually fail. Good e-business strategies have contributed to Intel's long lasting and solid financial success. By using e-business to enhance its distinctive positioning, operational efficiency, and competitiveness, Intel has continued to strengthen its strategic position in the global market.

The strategies and success factors discussed here can help managers to develop and integrate e-business technology into their overall business.

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