Designing and Implementing an E-Commerce System

Zinovy Radovilsky

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California State University, East Bay

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www.cognella.com

ISBN-13: 978-1-63157-210-4 (e-book)
Collection ISSN: 2156-8200 (electronic)

www.businessexpertpress.com

A publication in the Business Expert Press Supply and Operations Management collection

Cover and interior design by S4Carlisle Publishing Services Private Ltd., Chennai, India

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Preface

E-commerce is mushrooming in both business-to-business and business-to-consumer sectors. It shakes the foundation of most industries, leads to entirely new kinds of businesses, and directly affects both our careers and the way we live. One of the most significant changes is the manner in which companies conduct business. Specifically, how they manage their resources, connect and communicate with customers, and negotiate and outsource from suppliers.

In many cases, the management of enterprise resources is based on e-commerce systems and applications. E-commerce may be defined in a variety of ways: as a technological tool for web development, as an online transaction between a buyer and a seller, or as an activity that adds value to business customers and consumers. The main goal of this book is to explain in a systematic way the managerial aspects of various e-commerce models and applications, as well as to demonstrate their value-added capabilities.

Designing and Implementing an E-Commerce System provides a detailed description and analysis of e-commerce business models, including their components, classification, and performance results. This book also presents managerial aspects of various up-to-date e-commerce models. Among them are:

- Demand-side e-commerce models associated with selling goods, services, and information to business customers and consumers.
- Supply-side e-commerce models used for purchasing and outsourcing from suppliers.
- Collaborative commerce models involved in sharing information and business data, and also providing collaborative decisions for new product design and development.
- Mobile commerce models that employ wireless devices and wireless communication for buying, selling, and collaborating online.

- Electronic payment models used for making payment transactions via the Internet.
- Electronic services employed for supporting and facilitating e-commerce.

Designing and Implementing an E-Commerce System provides methodology and practical examples of selecting and implementing e-commerce business models and associated online applications. It also emphasizes managerial aspects of enterprise resources planning (ERP) systems, which are considered an integral part of e-commerce management today.

I hope that after reading this book you will not only gain knowledge but also develop essential skills required for managing e-commerce models and applications. You will obtain a clear understanding of the current development and future trends in e-commerce. All this will better prepare you to take on responsibilities in managing and improving e-commerce models and applications.

Sincerely,
Zinovy Radovilsky

CHAPTER 1

What is E-Commerce?

1.1 The Internet ERA

In 2005, the CNN channel conducted a survey of the most important global innovations in the past quarter century. What do you think was the top-rated innovation? What would you rate as innovation #1? You are correct—the ***Internet*** was voted as the most important innovation in the past quarter century along with other important inventions like the cell phone, the personal computer, fiber optics, e-mail, and others[1].

The Internet's infrastructure is networked computing that connects computers and other electronic devices by telecommunication networks. In the recent years, the Internet has become a global phenomenon that has profoundly changed the nature of communication between people and businesses. It has also become a major distribution channel, where transactions to purchase goods and services are made. The Internet has profoundly changed economics, markets, and even industry structures in many countries[2].

The ***World Wide Web,*** commonly abbreviated as ***WWW*** or the ***Web,*** is one of the main ways of accessing and utilizing information over the Internet. It is an information-sharing model that is built on top of the Internet [3]. The Web employs the Hyper-Text Transmission Protocol (HTTP), the main tools used in the Internet, to transmit Internet-based documents (data). It also uses browsers like Internet Explorer and Firefox to access and view documents called web pages (web sites) that are linked to each other via hyperlinks. Web documents also contain graphics, sounds, text, and video. The Internet, not the Web, is also used for e-mail, instant messaging, and file transferring (using file transfer protocol or FTP)[3].

The growth of Internet-related activities has been tremendous from the last decade of the 20th century to the modern time (see Figure 1.1) [4]. The number of Internet domain hosts (companies and consumers that have

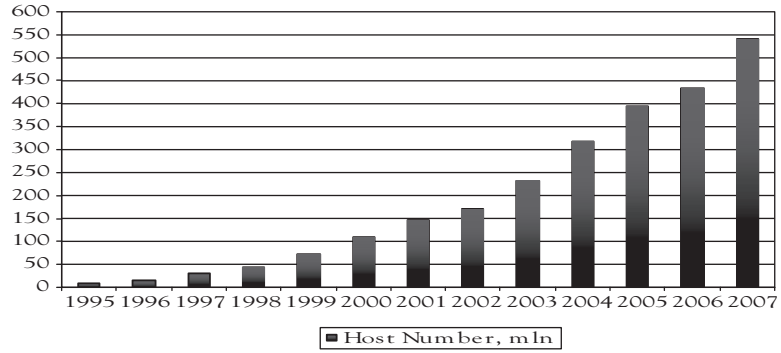

Figure 1.1 Internet hosts' growth

their own web pages and provide web site service to others) has grown, at an accelerated rate, from less than 10 million hosts in 1995 to near 550 million hosts in 2007[3]. This number will certainly continue to grow in the future.

What drives people and organizations to increase their utilization of the Internet and World Wide Web? Why is it so popular today? The answers to these questions can be quite clear if we consider the Internet as an incredible medium that provides:

- Rich sources of information and news for different subjects that may not be available in other media.
- Quick access to this information and news at any time and at any place in the world, provided Internet access may be established.
- Easy search, selection, and retrieval of information and news.
- Easy communication and information sharing.
- Extensive business opportunities in terms of selling, buying, transacting, and communicating on the Internet.

The last point is in the core of developing commercial solutions on the Internet called "e-commerce."

1.2 E-Commerce and E-Business Definitions

E-commerce has become a significant element in the modern global economic environment. "E-commerce" is defined as the use of a computer

network, primarily the Internet, to buy and sell products, services, information, and communication. However, e-commerce may also be considered as an application of technology using the Internet. It may also represent another aspect of being a tool for increasing efficiency and lowering costs in organizations. The three definitions of e-commerce are summarized in Table 1.1.

All aspects of e-commerce are important and deserve in-depth explanation. In this chapter and other chapters of this book, we will concentrate on the business side of e-commerce, considering e-commerce as a business phenomenon (second definition), and as a tool that adds value to business and customers (third definition).

As we mentioned before, e-commerce communication and transactions are predominantly done through Internet-based web sites. These online web sites may be used to sell products through electronic storefronts, provide customer service, disseminate information, provide business intelligence (for example, create recommendations of what products to purchase), and many other possible value-added offerings or activities (see Figure 1.2). Sometimes, the e-commerce web sites are available only to internal customers or employees of an organization, and are not to anyone outside the organization. ***Enterprise Intranet*** is usually an organization's internet, which is accessible to employees of this organization and other responsible parties using the secure login environment. This is done to protect the organization's sensitive information, and not allow

Table 1.1 Definitions of E-Commerce

E-Commerce aspects	E-Commerce definitions
Technology	E-commerce is the ***application of technology*** used to automate and improve business transactions utilizing predominantly Internet-based web sites.
Business	E-commerce is used to provide the ***capability of buying and selling*** products, services, and information on predominantly Internet-based web sites.
Value	E-commerce is a ***tool*** that may be used by business customers and consumers to create value in the Internet-based transactions by increasing efficiency and cutting costs while improving the quality of goods and services.

Figure 1.2 E-Commerce networking

all kinds of online "intruders" to access this information (see Figure 1.2). Companies are also required, in many cases, to have protected and safe connections between their web sites and those of their suppliers, distributors, logistics and financial services, and many others. ***Enterprise Extranet*** uses internet technology to establish a private network connection between a company's e-commerce web site and its external suppliers, service, and information providers (see Figure 1.2). In some cases, an extranet may be regarded as a part of the company's intranet that is expanded to users outside the company.

In many cases, instead of "e-commerce" the term "***e-business***" is used. Are these terms different or the same? In general, these terms are, in fact, different. "E-business" is a broader concept than "e-commerce," in that it does not only represent commercial applications of buying and selling. It is also associated with servicing customers and collaborating between business partners, as well as conducting Internet-related business transactions within or outside an organization. However, in modern practice, these two terms are used interchangeably, and become almost like synonyms. Most e-business web sites contain e-commerce-related activities like selling or buying online. At the same time, many e-commerce web sites have elements of collaboration with customers or business partners, as well as online service and support. In this book, we will be using the term "e-commerce" to designate both commercial and business activities, i.e., e-business and e-commerce on the Internet.

1.3 History and Current Development of E-Commerce

The "life" of e-commerce as a business system is relatively short as compared with many other existing business and management systems.

E-commerce started around 1995, and since then has had an interesting and sometimes turbulent history.

The proliferation of Internet-based computer technology in the last five years of the 20th century triggered extensive development of different kinds of e-commerce tools and applications. Many new e-commerce companies were born at that time. Their intention was to sell products to business and individual consumers, outsource/buy products from businesses, or provide a virtual environment to facilitate the exchange of products and services between the companies. It was a time of "irrational exuberance," when every day several Internet-based companies started their e-commerce business online with great expectations of soon becoming a publicly traded company and earning a tremendous amount of cash after its initial public offerings (IPO) in the stock market. The notion behind this was that the stock market would quickly appreciate almost any new e-commerce development. This was the era of the so called ***"dot-com bubble"*** of e-commerce. The term evidently came from the point that most of these companies had an Internet name of their web site ending with ".com."

By the year 2000, the dot-com bubble reached its peak, from which started an almost freefall of the dot-com stock prices, overall customer excitement and expectation, and venture investments in e-commerce. Between 2000 and 2003, a significant number of dot-com companies closed, were acquired, or merged with other businesses. The many reasons for this crash of the dot-com bubble have been well documented in various literature sources. However, the main reason for the disappearance of these companies was their inability to be profitable and to provide value to their customers. "If it does not make cents, it does not make sense." Many companies were created by bright computer professionals who knew how to design and start a technologically advanced e-commerce solution. However, these professionals had little to no ability to provide an efficient and effective business-related model for their solutions.

At the end of the crash in 2001–2002, a new trend appeared evident within e-commerce—a trend of developing and implementing e-commerce solutions that were not only more business-oriented and targeted the need to provide significant value to the customers but also by doing that, be more financially sound, i.e., profitable. This designated

a new era of e-commerce that had some major differences with the previously used "dot-com" approach in e-commerce (see Table 1.2).

The table clearly depicts the main differences between the old and new approaches to e-commerce. Instead of old e-commerce decisions being based on technology innovations and revenue emphasis, the new e-commerce development is mostly based on the need to develop a solid business model that would emphasize value-added offerings for the customers and profits for the company. According to some literature sources [5], more than 60% of all e-commerce companies were profitable in 2004 as opposed to only 10% of them being profitable in 2001. Instead of the entrepreneurial nature of most dot-com companies and pure online strategies (doing all business online), the new e-commerce development is mostly associated with traditional firms. These firms range from large companies like IBM and GE to a myriad of small and mid-size enterprises (SME) who embrace an e-commerce strategy as a part of the overall business strategy. In this case, it may be called a ***mixed*** or ***"click-and-brick" strategy.*** Finally, during the e-commerce evolution, many special standards regulating its activities and communication through e-commerce have been developed or improved. For example, XML (eXtensible Markup Language) and XBML (business XML) computer languages were developed to improve communication between different e-commerce web sites. The Electronic Product Code (EPC) was created to recognize the product being sold or delivered using mobile commerce equipment.

A new changing trend in e-commerce is associated with utilization of the Internet-related technology and software for improving

Table 1.2 Dot-Com and new E-Commerce compared

"DOT-COM" E-Commerce	New E-Commerce
Technology-driven	Business-driven
Revenue growth emphasis	Earning and profits emphasis
Venture capital financing	Traditional financing
Pure online strategies	Mixed "click-and-brick" strategies
Entrepreneurial	Traditional firms
Lack of standards	Stronger regulation/standards

communication, information sharing, collaboration, and functionality of the Web, which is commonly defined as ***Web 2.0.*** Web 2.0 means proliferation of connectivity and interactivity of web-delivered content that allows users to—besides obtaining information from a web site—own the data on the Internet, gain control over this data, and add value to the web site as they use it. The key Web 2.0 applications and services include[6]:

- ***Blog (web-log)–a*** webpage consisting of brief user opinions, views, and information, or links (also called posts), arranged chronologically within a menu-driven format.
- ***Wiki–a*** webpage or set of web pages that can be easily edited by anyone who is allowed access. A well-known example is Wikipedia, the free Internet encyclopedia.
- ***Podcast–audio*** recordings, usually in MP3 format, of talks, interviews and lectures, which can be played either on a desktop computer or on a wide range of handheld MP3 devices.
- ***Multimedia sharing–***services that facilitate the storage and sharing of multimedia content such as video (YouTube), photos (Flickr), and podcasts (Odeo).
- ***Social*** networking–professional and social networking sites like facebook.com and myspace. com that facilitate meeting people, finding like minds, and sharing content.
- ***RSS–a*** family of formats which allow users to find out about updates to the content of RSS-enabled websites, blogs or podcasts without actually having to go and visit the site. Information from the website (typically, a new story's title and synopsis, along with the originating website's name) is collected within a feed (which uses the RSS format) and 'piped' to the user in a process known as syndication.

1.4 E-Commerce Growth

Since its creation, e-commerce has experienced steady growth with an increasing rate of growth in the first decade of the 21st century. Survey after survey conducted by a variety of companies has indicated an accelerating

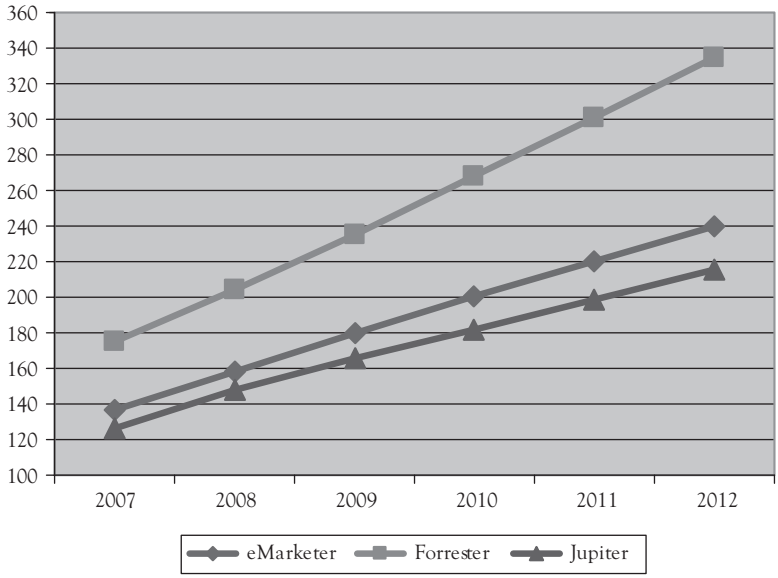

Figure 1.3 Comparative estimates: U.S. retail E-commerce sales, (billions)[10]

volume of transactions in business-to-consumer (B2C) and particularly in business-to-business (B2B) e-commerce. In 2003–2005, more than 70% of companies in the United States have experimented with purchasing online; and around 15–20% of their total spending was being channeled via the Internet[7, 8]. According to the U.S. Census Bureau, B2B e-commerce covers more than 20% of all business transactions in the U.S.A[9].

Although B2B sales continue to dwarf B2C sales, many retailers now see online sales as their best opportunity for new growth. The estimates made by different consulting firms[10] show that by the end of 2012, the sales through e-commerce will be between 210 and 340 billion dollars (see Figure 1.3). The average growth of retail e-commerce is estimated to be from 12% to 14% annually[11]. In addition, the proportion of retail e-commerce in the total U.S. retail sales is predicted to grow from approximately 4% in 2006 to 13% in 2010[11].

The implementation of e-commerce also varies across the globe. The highest level of e-commerce sales as a proportion of the total sales is in Australia, South Korea, and France—with more than 16% of the total sales in 2004, United States—more than 13%, and Japan—around 9%[12].

The projected e-commerce growth raises the interest of researchers to understand how effective and efficient this e-commerce implementation has been, and what influences e-commerce results in manufacturing and service organizations. Despite the evident increase in importance of e-commerce and effectiveness of its implementation, until recently little research has been undertaken to investigate factors that influence the results of e-commerce solutions. This knowledge not only has potential benefits for organizations considering e-commerce implementation but also for those organizations that have already engaged in such implementations, because it can provide them with an understanding of how to facilitate and improve their implementation processes.

1.5 Main Characteristics, Dimensions, and Types of E-Commerce

The main characteristics of e-commerce are its pervasiveness and inexorability. ***Pervasiveness of e- commerce*** means its persistent development and proliferation in business and non-profit organizations of various sizes. ***Inexorability of e-commerce*** represents its inevitable and unstoppable nature in terms of the high rates of growth that were described in the previous section. Inexorability also means that e-commerce tends to transcend geographical, cultural, and political differences of nations and countries and enables common business information and web sites for the entire world. Finally, inexorability represents the ability of e-commerce to change the business environment, and create completely new business relations. E-commerce development has completely revitalized different industries including jewelry, banking, telecommunications, hotels, real estate, software, and many others[13].

If you ask yourself why e-commerce development is so pervasive and inexorable, the answer should come from the simple fact that e-commerce can be a rich source of value for organizations that employ it. This value comes from ***e-commerce disintermediation***, which means an act of taking out an intermediary organization used for channel delivery of products and services. For example, direct sales of computers through the Internet by Dell or Hewlett-Packard (HP) eliminates any intermediate organizations like distributors and retailers. This leads to reduced cost

of product delivery to the customers and increased profits. At the same time, ***e-commerce re-intermediation*** facilitates creation of third party organizations that provide virtual environments for connecting buyers and sellers or, generally, business partners for transactions on the Internet. The creation of companies like eBay or Amazon is a typical example of e-commerce re-intermediation.

Organizations may have various levels of e-commerce implementation. The differentiation between these organizations is based upon three dimensions[14]:

- ***Products and services*** produced and sold by an organization that can range from traditional physical to fully digitized products (services).
- ***Processes*** established in the organization that can also vary from physical to fully digitized (online) processes.
- ***Agent***, which is an organization itself, ranging from a traditional "brick-and-mortar" firm to a virtual online organization.

Pure e-commerce organizations are characterized by their products/services and processes being completely digitized, as well as the whole organization being a digital agent company. These organizations are also known as ***virtual or pure-play e-commerce*** companies. An example of such an organization is www.YouTube.com, a famous online site for uploading, storing, and sharing videos worldwide. It is a pure e-commerce company, because all its products/services, like video play lists or subscriptions, are digitized; its processes like video search, creating video play lists, etc. are also digitized; and, finally, this organization is a virtual (completely online) digital agent.

Partial e-commerce organizations are those organizations that may have some physical e-commerce dimensions like physical products or processes. For example, Amazon purchases and stores books (physical products) that it then sells online. The company also organizes a logistics (physical) process of book delivery to the customers. However, Amazon also sells many digital products (like videos and music) and provides a variety of digitized processes. In this case, Amazon is a typical partial e-commerce organization.

"Click-and-mortar" organizations are companies that conduct some e-commerce activities, for example, selling computers, printers, or software through e-commerce channels like HP or Gateway, but provide their primary business in the physical world. Contrary to that, ***"brick-and- mortar" organizations*** perform all their business without the Internet by selling their physical products in stores or conducting processes by means of physical agents only. The number of "brick- and-mortar" companies have significantly shrunk over the years as e-commerce proliferation has grown in a variety of traditional companies.

E-commerce organizations are also differentiated by the transactions and interactions they make. One of the common types are the ***Business-to-Business (B2B) e-commerce*** organizations that provide transactions, communication, and interactions between business partners. ***B2B transactions*** may include selling products and services to businesses, outsourcing from suppliers, logistics, and distribution of products to companies, financial transactions, and others. B2B transactions may be done on the downstream of the organization's supply chain, i.e., from raw materials, to manufacturing organizations, and then to distribution and retail (see Figure 1.4). B2B can also be done on the upstream of the company supply chain, for example purchasing materials from suppliers, or outsourcing a logistics provider for a manufacturing organization (see Figure 1.4).

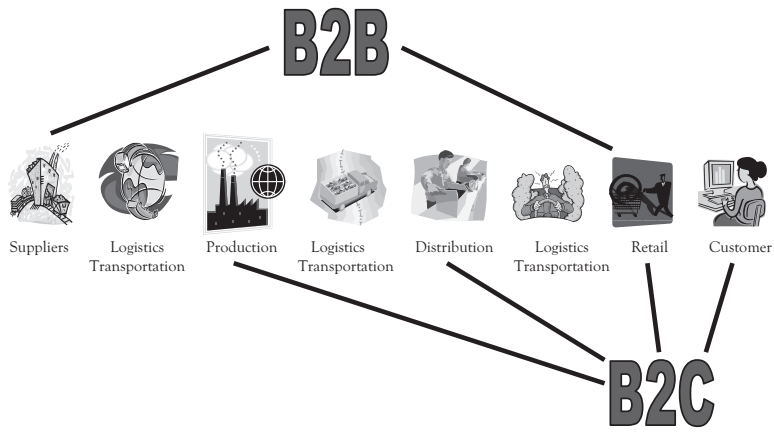

Figure 1.4 B2B and B2C E-Commerce

Another very common type is ***Business-to-Consumer (B2C) e-commerce*** organizations which provide transactions, communication, and interactions with consumers (end users). These organizations can be manufacturing, distribution, retail, or other companies that sell their products or services to consumers online. B2C transactions and interactions are done on the downstream of the organization's supply chain (see Figure 1.4).

Since the beginning of the e-commerce era, both B2B and B2C transactions have experienced consistent growth in revenues. These revenues are derived from selling products and services online to business customers or end consumers. They also include revenues from financial transactions via the Internet.

The volume of transaction revenues in B2B e-commerce is substantially larger than that of B2C. For example, in 2004 the B2B transaction revenues in U.S.A were around $1,812 billion or 93% of all e-commerce revenues. At the same time, the revenues from B2C e-commerce transactions were $130 billion, which was just 7% of the total business-related e-commerce transactions[9].

Besides B2B and B2C transactions, e-commerce transactions and interactions may have other types:

- ***Consumer-to-Consumer (C2C)*** e-commerce is used in organizations that provide private sales and auctions between individual consumers.
- ***Peer-to-Peer (P2P)*** e-commerce allows networked peer computers to share data and processing with each other directly; can be used in C2C, B2B, and B2C e-commerce.
- ***Government-to-Business (G2B)*** and ***Government-to-Consumer (G2C)*** e-commerce enable government organizations to provide information, interaction, business, and services to companies and consumers respectively.
- ***Business-to-Business-to-Consumer (B2B2C)*** e-commerce organizations provide some products or services to client businesses that maintain their own customers. eBay, for example, provides a virtual marketplace to its customers

(business and individuals) that sell products through eBay to their own customers.

- ***Mobile Commerce (M-commerce)*** makes possible e-commerce transactions and activities to be conducted in a wireless environment, for example, buying products and services from a web site on a cell phone.
- ***Location-based Commerce (L-commerce)*** provides m-commerce transactions targeted at individuals in specific locations and at specific times, like navigation systems in cars.
- ***Intra-business e-commerce*** includes all internal organizational activities that involve the exchange of goods, services, or information.
- ***Collaborative Commerce (C-commerce)*** creates an environment where individuals or groups communicate or collaborate online.

Many of these transactions types, including mobile and location-based commerce, collaborative commerce, and business-to-business-to-consumer commerce will be discussed in this book.

1.6 Value Creation in E-Commerce

As previously mentioned, the main reason for the growth and proliferation of e-commerce (pervasiveness and inexorability) is its ability to create value for an organization that implemented the e-commerce solutions, for the customers of this organization, and for its partners and suppliers. ***Value creation*** represents the potential or expected and actual ***monetary and non-monetary results*** of utilizing an e-commerce business model. The main monetary results of value creation include ***revenue enhancement*** through sales growth and price differentiation, and ***cost reduction*** related to cost of goods sold, operating costs, and asset intensity reduction (see Figure 1.5).

Revenue enhancement is the first aspect of value creation. E-commerce develops a new online channel for selling a company's products and services along with existing traditional channels. This potentially generates additional sales volume through this channel, and, at the same time, can

facilitate product sales through the existing channels. For example, a consumer may use Walmart's web site to purchase a variety of products that can be then sent to a nearby store for customer pickup. At the same time, while coming to the store for the pickup, the consumer may potentially end up buying some more products from the company. In this case, the channels do not cannibalize, but rather complement each other and provide higher sales volumes and revenues. The revenue increase may be also associated with the ability to quickly adjust prices depending on customer segments (for example, repeat customers will pay a higher price than new customers will) or by increasing prices through building the company's brand name recognition on the Internet. In addition, e-commerce can enable quick matching of customer demand with existing supply of products, and, thus, provide better knowledge of what prices need to be established and promoted.

Besides the opportunity of increased revenue, e-commerce is also an important source of ***cost reduction.*** This is the second aspect of value creation through e-commerce (see Figure 1.5). The cost of goods sold through online web sites may be reduced by providing a direct selling channel to the customers and reducing the need for intermediaries like wholesalers and retailers. Taking out the intermediaries can reduce the cost of sales up to 25–30%. At the same time, by using e-commerce for outsourcing materials, components, and services, companies can reduce process and transaction costs associated with outsourcing. E-commerce enables companies to simplify outsourcing processes and reduce related

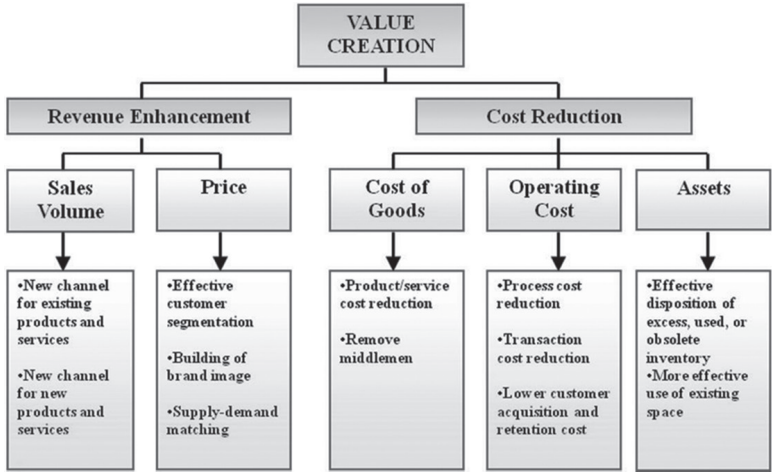

Figure 1.5 Creating monetary value in E-Commerce

costs. Finally, e-commerce creates opportunities for ***asset intensity reduction,*** which means (a) reducing capital costs by effective, speedy disposition (selling) of unnecessary or old equipment as well as excess or obsolete inventory, and (b) more effectively using existing space by reducing inventory clutters with e-commerce.

The results of the survey conducted among the companies that implemented e-commerce solutions[15] revealed that more than 61% of respondents stated that implemented e-commerce solutions increased or significantly increased revenues. At the same time, 58% of those responding achieved a decrease or significant decrease in costs through the implementation of e-commerce solutions. According to the survey results, the most important cost categories that were reduced appeared to be transactional cost specifically in terms of paperless transactions, administrative cost associated with reduction of purchasing procurement personnel, inventory cost, and reduction of prices of materials and services. All this represents typical cost savings results associated with e-commerce implementation.

The ***non-monetary value creation*** may incorporate a variety of tangible and intangible results relevant to e-commerce development:

Improved customer satisfaction through providing more choices of products, services, and information.
Customization and personalization of product and service offering.
Improved quality of products and services.
Faster delivery schedules.
Extended hours of work (24 hours, 7 days a week).
Global outreach of products, services, and information.
Permanent access to information.

According to the survey [15], organizations that implemented e-commerce presented relatively evenly distributed answers about the benefits of e-commerce implementation, which are shown in Table 1.3.

However, responses to the question of drawbacks and problems in implementing e-commerce solutions demonstrated that the three most critical problems in e-commerce implementation were high costs of implementation, data security, and low liquidity (not enough buyers and sellers), which covered 66.7% of responses (see Table 1.4).

Table 1.3 Benefits of implementing E-Commerce solutions

Main benefits of implementing E-Commerce solutions in organizations	Number of responses (%)
Shorter procurement cycle	13.3%
Improve communication and relationships with suppliers	13.3%
Improve communication and relationships with customers	12.6%
Better reliability and control of purchase orders	11.9%
New channel of marketing and sale with global outreach	10.4%
Reduce inventory level and cost	8.9%
Eliminate or reduce the number of middlemen	8.9%
Reduce purchase prices	7.4%

Table 1.4 Drawbacks and problems in E-Commerce implementation

Main drawbacks and problems in implementing E-Commerce solutions in organizations	Number of responses (%)
High costs of implementing e-commerce solutions	26.7%
Data security	26.7%
Not enough buyers and/or sellers online	13.3%
Poor integration with internal "back-office" systems	8.9%
Low return on investment and/or long payback period	6.7%
Not enough speed of connection/bandwidth problems	6.7%

1.7 Chapter Summary: Managerial Aspects of E-Commerce

1. ***E-commerce*** has become a significant element in the modern global economic environment. It represents the use of a computer network, primarily the Internet, to buy and sell products, services, information, and communication. E-commerce is also an application of technology using the Internet. In addition, it is a tool for increasing efficiency and lowering costs in organizations.
2. The main characteristics of e-commerce are its ***pervasiveness*** and ***inexorability.*** Pervasiveness of e-commerce means its persistent development and proliferation in business and nonprofit organizations of various sizes. Inexorability of e-commerce represents its inevitable and unstoppable nature in terms of the high rates of growth that were described in the previous section.
3. e-commerce can be a rich source of value for organizations that employ it. E-commerce ***disintermediation*** means an act of taking out

intermediary organizations used for channel delivery of products and services though e-commerce supply chain. At the same time, e-commerce ***re-intermediation*** facilitates creation of third party organizations that provide virtual environments for connecting buyers and sellers or generally, business partners for transactions on the Internet.

4. Organizations may have various levels of e-commerce implementation. ***Pure e-commerce*** organizations are characterized by their products/services and processes being completely digitized. ***Partial e-commerce*** organizations are those organizations that, besides digital products and processes, may have some physical e-commerce dimensions like physical products or processes. ***"Click-and-mortar"*** organizations are companies that conduct some e-commerce activities, but provide their primary business in the physical world.
5. E-commerce organizations are also differentiated by the transactions and interactions they make. The most common types are Business-to-Business (B2B) and Business-to-Consumer (B2C) e-commerce transactions. Besides B2B and B2C transactions, e-commerce transactions and interactions may have other types: consumer-to-consumer (C2C), business-to-business to-consumer (B2B2C), government-to-business (G2B), mobile commerce (M-commerce), Location-based Commerce (L-commerce), and some others.
6. Value creation in e-commerce represents the potential or expected and actual monetary and non-monetary results of utilizing an e-commerce business model. The ***main monetary results*** of value creation include revenue enhancement through sales growth and price differentiation, and cost reduction related to cost of goods sold, operating costs, and assets intensity reduction. The ***non-monetary value creation*** may incorporate a variety of tangible and intangible results relevant to e-commerce development like improved customer satisfaction and quality, faster delivery schedules, extended hours of work, global outreach, and permanent access to information.

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CHAPTER 2

How to Develop and Implement E-Commerce

2.1 Main Steps in Development and Implementation

In this chapter, we will be discussing the development and implementation of e-commerce models. The material presented in the chapter may be relevant to developing a new e-commerce model as well as improving existing e-commerce model(s) or solution(s).

In practice, there are a number of online guides and recommendations on the implementation of e-commerce. Some of these guides present implementation steps for specific e-commerce models or solutions. In this chapter, we introduce a sequence of strategic steps for the e-commerce development and implementation processes that may be employed for any type of e-commerce solution (either a new development or existing one) for an organization of any size (see Figure 2-1). These steps are also related to the e-commerce business model methodology.

The first step of the e-commerce development process is ***identifying the e-commerce business model.*** This is a critical step in the overall e-commerce development process because it establishes a strategic vision and, to some extent, guides the long-term decisions of what the e-commerce system should be, how it is going to perform, and what specific e-commerce models need to be implemented. At this step, a company needs to establish the five main components of the e-commerce business model 2. These are the value proposition, e-commerce offerings (value-added activities), supporting resources, revenue and cost models, and value creation (expected

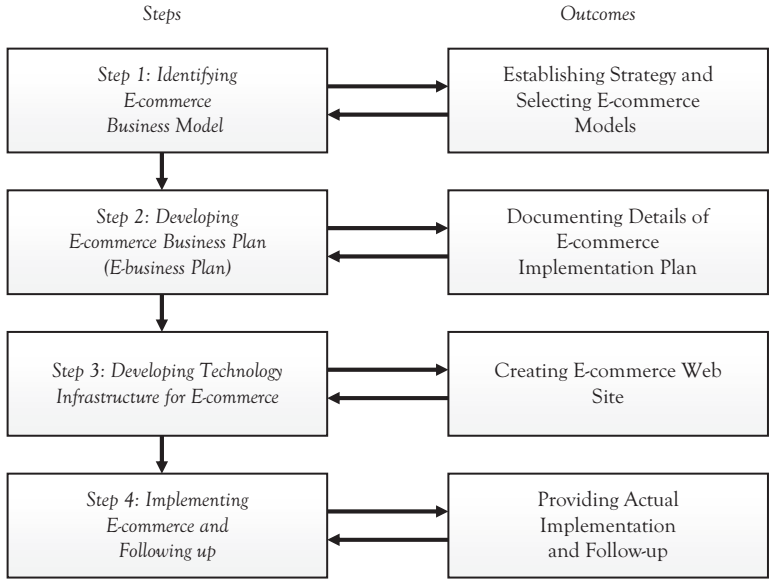

Figure 2.1 Steps of E-commerce development and implementation

benefits). Based on the established e-commerce model components, the company may develop and evaluate several alternative e-commerce models selected from demand-side or supply-side e-commerce, c-commerce, m-commerce, e-services, etc. Then, the company needs to compare these alternatives using qualitative and quantitative measurements, for example, ROI analysis. Finally, the company identifies the best e-commerce model or models to be developed.

The second step in the development of the e-commerce model is to design an ***e-commerce business plan or e-business plan***. The goal is to create a detailed written document that will explain how the company intends to achieve its e-commerce goals and fulfill the strategy formulated in the previous step. An e-business plan should include a business description (mission statement, business goals, project objective) of the proposed e-commerce implementation, along with market and competitor analyses. It should also contain operations decisions and financial statements associated with projected costs (cost of ownership) and benefits (revenue, profits, ROI). There may be some other items included in the plan (see section 2.3 of this chapter).

The third step involves ***developing the technology infrastructure for e-commerce***, which in most cases ends up being the creation of the e-commerce web site. This web site contains all features and elements necessary to fulfill the main strategic vision and strategic goals of the developed e-commerce model(s). The development of the technological infrastructure includes selecting a company that will be hosting the web site (internally or externally), identifying the best development software for the e-commerce models under development, and registering a domain name. This step can also involve creating and managing web site content, constructing and testing the web site, and marketing and promoting the web site. In addition, the company needs to identify the performance measurements for utilizing the web site for e-commerce implementation (see sections 2.4 and 2.5 of this chapter for details on developing technological infrastructure and performance measurements).

The last (but certainly not the least) step in the e-commerce development process includes actual ***implementation and follow-up***. This step involves creating an e-commerce implementation strategy. The strategy describes the long-term decisions necessary to successfully introduce and sustain the new e-commerce model(s). This may include marketing of the web site, sales promotions, customer service and support, web site maintenance, and other decisions. All these aspects of the implementation strategy would be specified in the implementation plan. Upon implementing the new or improved e-commerce model(s), the company would have to follow up on the implementation results. The company will collect customer feedback and measure implementation results based on the performance measurements introduced in the previous step. This may potentially lead to changes in the current online procedures and workflows.

In the next several sections of this chapter, we will detail the first three steps of the e-commerce implementation process.

2.2 Identifying E-Commerce Model

The development of an e-commerce business model is based on the five major components. We briefly summarize these components and their elements in Table 2.1.

Table 2.1 Components of an E-commerce business model

Components of E-Commerce Model	Description of Components	
Value Proposition	Construction of a value proposition requires specification of two things: • *Target market segments* • *Core customer benefits*	
Value-added e-commerce Offerings	Represents value-added activities in the following components: • *Scope of offerings* • *E-commerce products and services* • *E-commerce processes* • *Relationships between e-commerce products/ services and e- commerce processes*	
Supporting Resources	A company must select and then align its resources to deliver the value proposition. These resources may include • *E-commerce technology* • *Brand name* • *Quality of products and services* • *Distribution network* • *Supplier network* • *Buyers' and sellers' base* • *Personnel* • *Integrated software ERP system* • *Outsourcing*	
Revenue Model and Cost Model	Revenue generation options • *Product, service, or information sales* • *Transaction fees* • *Subscription fees* • *Advertising* • *Affiliate fees* • *Licensing fees*	Cost reduction options • *Direct and/or indirect cost* • *Paperless environment* • *Administrative expenses* • *Quality cost*
e-commerce Value Creation	Represents potential/expected monetary and non-monetary results of utilizing an e-commerce business model • *Revenue enhancement* • *Cost reduction* • *Asset intensity reduction*	

An Example of Developing an E-commerce Business Model: Cathay Pacific Airways

Cathay Pacific Airways is an international airline registered and based in Hong Kong. It offers scheduled passenger and cargo services to 92 destinations around the world. The multiple award-winning airline has won

the prestigious "Airline of the Year 2006" designation by global travel and transport information company Official Airline Guides as well as by Air Transport World magazine[1].

Cathay entered the new millennium in full stride, with profits peaking at US$650 million in 2000. However, in the following years, the airline faced some of its greatest commercial challenges: the attacks on the United States on September 11, 2001, a second Gulf War in 2003 and the outbreak of the SARS epidemic in China in November 2002, as well as increasing fuel prices. The profit attributable to shareholders was lower by 25.33%, to US$422.8 million in 2005[2]. In addition, the profit margin decreased by (34.5% or 3.9 percentage points) (this seems contradictory) because escalating fuel costs reduced the profit in the second half of the year, which is traditionally the stronger period. For the full year of 2005, fuel expenditure increased by 67.2% to about US$2 billion, with fuel surcharges on tickets only partially offsetting this additional cost[2].

One of the big areas of concern in the company was online booking. Cathay's online bookings had been consistently weak since they began in 1999. Online booking had grown by about 100% per year, excluding 2003 (the year of SARS) to only 2% of all seat bookings in 2005. Competitors were more successful in obtaining online bookings (see Table 2.2)[2, 3 4 5 6].

Obviously, short-haul domestic flights make up a large portion of United's flights. However, the percentage of total number of seats booked online in 2005 for each airline revealed the issue of how poorly Cathay's online booking has penetrated the market. Factors contributing to this

Table 2.2 Passenger bookings online (per week)

Cathay and its Major Competitors	Average Number of Seats Booked Online Per Week	Percentage of Total Number of Seats Booked online in 2005
Cathay Pacific Airways	6,000	2%
Singapore Airlines	49,000	15%
Emirates Airlines	56,000	20%
British Airways	80,000	27%
United Airlines	660,000	47%

low percentage are that Cathay offers only limited discounts during the low flying season, which are not marketed well, and does not always offer the lowest price. For some customers, Cathay has proven neither that online buying is price competitive nor that the experience is more efficient than using a travel agent. Cathay Pacific decided to undertake the development of a new e-commerce environment to increase the number of online bookings.

Value Proposition

The development started with identifying the elements of the value proposition: The ***Target market segment*** includes individual travelers across various classes (first class, business class, economy unrestricted and restricted classes) as well as the loyal Marco Polo Club members (exclusive traveler's club). In addition, the target market segment may be corporate customers with consistent and frequent business travel requirements.

The Cathay's *core customer benefits* may involve:

- ***Timely information:*** Cathay offers its target segments the core benefits of 24/7 access to up-to-date, accurate and detailed information by removing the intermediary, the travel agent
- ***Travel information aggregation:*** Benefits include the aggregation of all personal travel information in one location or site, especially for Marco Polo members. This includes, but is not limited to, checking flight schedules, fare rates, seat availability, arrival and departure times, and baggage information, etc.
- ***Abundant choice:*** Cathay's customers have the ability to choose the best quality travel experience.

Value-added e-commerce Offerings

- ***Cross-category dominance:*** Cathay extends its product offerings online from strictly air flights to package holidays, duty free items, and Cathay merchandizing products

- ***Predominantly intangible products:*** Cathay offers intangible services and experiences, with a minor offering of tangible duty free items and its own products
- ***Low customization:*** There is some customization for Marco Polo Members through password-protected entry into personal information requests
- ***Average level of digitization:*** Although Cathay will courier tickets free-of-charge to certain areas of Hong Kong, it also offers e-tickets as an option to anyone, anywhere. Therefore, the travel product experience is a physical service, the purchase of the ticket is digitized, and, if not an e-ticket, the ticket is sent by courier or mail
- ***Cross-functional integration:*** Cross-functional information such as flight scheduling, reservations, e-ticket purchasing, airport check-in, and baggage lost and found is integrated on the web site
- ***Customer online booking processes:*** Processes include information search, product offerings, evaluation of alternatives, purchase decision, a checkout process, order tracking through a confirmation number, and post sales service and support through e-mail or telephone. The purchase decision is acknowledged with real time validation of personal travel details and booking information. Advanced information is available online on a real-time basis, for example, possible flight delays, weather forecasts, and duty-free products that can be ordered prior to the flight and then received when in flight, etc.

Supporting Resources

There are strong links among the online resources in the system. These resources include:

- ***Strong brand name:*** Cathay's brand is vital for successful development and implementation of its online bookings
- ***Premium quality of products and services:*** Cathay differentiates itself from its competitors by providing a travel

experience with outstanding service for First Class, Business class, Economy Unrestricted and Restricted classes, including Marco Polo Club members

- ***Wide network:*** Cathay provides a wide range of flight alternatives or schedules to satisfy customer needs. Cathay itself flies to 92 destinations
- ***Forward-thinking customer service:*** There is a comprehensive 'Frequently Asked Questions' (FAQ) section built into the searchable database which helps answer questions raised by the travelers in a timely manner
- ***Award-winning partnership:*** The *One World* Alliance, Cathay's partner, has been rated as the world's leading alliance for the third year in the World's Travel Award, winning over the competing alliances of Star and Skyteam, etc. Available via a link on Cathay's web site, the Alliance enables its member customers more service and benefits via, for example, a broader network of destinations, the redemption of frequent flyer miles and points across the combined worldwide network, and the access to shared airport lounges
- ***Technology outsourcing:*** Cathay has outsourced its online booking engine to Amadeus, which was founded by Air France, Lufthansa, Iberia, and SAS in 1987. It is a leading provider of IT solutions to the travel and tourism industry and is the first Global Distribution System (GDS) to offer neutral (unbiased) flight availability data.

Cathay has selected and aligned most of its online booking resources to deliver the benefits of the Value Proposition (Table 2.3).

In terms of fulfilling expectations, success demands success. Based on the course in-class discussion and a small sampling of other travelers, most had a positive online booking experience while others expressed some level of inadequacy. Overall, all the benefits of the Value Proposition (e.g. quality in terms of customer satisfaction) are not being delivered to their fullest potential.

Table 2-3 Resources that relate to each benefit

Core Benefits in Value Proposition	Resources	Degree of Delivery
Brand equity	Strong brand name	High; but creates expectations difficult to consistently fulfill
Travel information aggregation	Premium quality products & services	High degree providing a sustainable advantage
Up-to-date, accurate information	Forward-thinking customer service	Medium, because of poorly-marketed specials and frustrating-at-times online experience
Wide network of travel destinations	Award-winning partnership	High in terms of choice; supportive, complementary links among resources in the system; strong link between resources and value proposition; convenience
Easy, efficient access to information	Technology Outsourcing: Amadeus	Low degree of uniqueness in terms of resource system; ubiquitous in airline industry

Revenue Model/Cost Model

As an e-tailer, Cathay earns revenue using online booking as a complementary means of increasing its sales volume. It represents a new channel for the existing product portfolio parallel with the existing channel of travel agents.

Cathay strives to reduce costs by employing online booking. This includes:

- ***Servicing cost savings:*** Fewer phone calls to, and less hands-on time with, Cathay staff means a reduction in human resources costs.
- ***Distribution cost savings:*** This involves a lower level of distribution of fare information to different travel agencies at locations throughout the world, originally done by fax and mail. It saves on labor as well as traffic costs.

- ***Commission savings:*** Reducing the commission payable to travel agents or any third-party channel that sells tickets provides a cost savings for Cathay in terms of the commission itself and the administrative costs associated with the commission payment.
- ***Paper savings:*** There is a potential reduction in the paper required in a transaction with online bookings that is realized when the customer chooses an e-ticket.

To summarize, the above four types of savings implemented by Cathay through online bookings would generate a significant direct and indirect savings on a yearly basis.

Value Creation

Cathay uses the value creation levers of revenue enhancement and cost reduction to develop monetary value in online booking. Revenue enhancement and market share growth include:

- ***Volume growth:*** There is revenue enhancement through the increased sales volume of convenient e-tickets.
- ***Price differentiation:*** Catering to certain customer segments, there are limited time-sensitive price discounts through online booking. This increases the sales volume and revenue accordingly.
- ***Other revenues/benefits:*** These include the e-store selling Cathay Pacific accessories and items, e-marketing such as ticket discount, Cathay's holiday packages, promotions, and affiliations with different hotels.

Cost reduction may be based on lowering operating costs: This involves resource savings such as the administration costs included with general office costs as well as human resource costs in relation to direct customer service and the distribution saving costs as defined in above.

Other elements of value creation may represent:

- ***Extensive monitoring capabilities:*** Effective and efficient tracking facilitation is available through Amadeus.
- ***Improved customer satisfaction:*** Improving service levels and customer satisfaction from average to high, for example,

with the availability of real time online information, timely feedback and a convenient portal all foster the e-commerce culture. The frontline services facilitation, for example, Customer Relationship Management (CRM) of e-ticketing, the e-store and e-marketing via email are available globally on a 24/7 basis.

Selecting E-commerce Alternatives

After the five components of the new or improved e-commerce business model are defined and explained, the next step is to identify potential alternative business models. These potential e- commerce business models are presented in Table 2.4.

If we return to the Cathay Pacific example, the alternatives that may be considered will be a modified storefront or forward auction. However, it needs to be connected to the internal Cathay system of ticket reservations as well as to the travel agents and operators. One of the potential alternatives will be to design a customer web portal that would provide a variety of access methods to Cathay Pacific's information, ticket booking, business partners, discounts, etc.

Table 2.4 E-commerce model alternatives

Groups	Models
Demand-side (Sell-side) E-commerce	Storefront Forward Auction Infomediary/ Affiliate
Supply-side (Buy-side) E-commerce	Reverse Auction E-procurement with Catalog E-sourcing Exchange
Collaborative commerce	Collaborative Design Collaborative Planning
E-services	Web Portal Mobile Service/M-commerce E-payment E-logistics ISP/Web Hosting EDI

2.3 Developing an E-Commerce Business Plan

The development of an e-business plan is the second major step in the e-commerce implementation process. An ***e-commerce business plan*** or ***e-business plan*** is a formal statement (written document) of a set of business goals that will be achieved by developing a new e-commerce model (or improving an existing model) and associated applications, the reasons why they are believed to be attainable, and the plan for reaching those goals for e-commerce development. It may also contain background information about the organization or team attempting to reach those goals.

In many cases, the e-business plan is prepared for external audiences such as investors, potential business partners, or prospective managers. It can also be done for an internal audience like high-level management that needs to consider and approve a new e-commerce project. An ***e-business case*** is a special case of a business plan that explains in a written form a new initiative or project inside an existing company. Its purpose is to justify a specific investment of funds. The e-business case will be presented to the company's board of directors and senior management. As a special case of e-business plan, it has contents very similar to that of the business plan. However, an e-business case involves more operational detail and it fits the project within the organizational context.

One of the main differences between organizations with successful e-commerce results and those who failed in the Internet market is that the successful companies had a proper e-business plan. Failure to have a proper e-commerce business plan can have severe consequences for the business:

- The internet is a very competitive medium and failure to launch e-commerce without a proper e-commerce business plan could quickly crash the business.
- If an e-commerce business were launched without an e-commerce business plan, then maintaining the business would be an impossible task.
- The lack of a plan would indicate the unprofessional establishment of the online business.

- The online customers are very intelligent and could easily judge the instability of an unplanned e-commerce business. Therefore, it is necessary to have a proper e-commerce business plan.

These points lead to the question of what the differences are between a business plan and e-business plan. First, an e-business plan should recognize the ***different and unique capabilities of the Internet***. While developing a new e-commerce model, decision makers should think differently and creatively about the opportunities and problems the Internet presents. Second, the created ***e-commerce solutions are global*** in providing visibility to an international audience. This introduces complexity for payment options, distribution channels, web site design, and others. Third, the e-commerce solutions are usually ***24/7 operations*** and, thus, the e-business plan must account for this difference in Web hosting and customer service requirements. Fourth, the e-commerce models provide greater ***opportunities for personalization of content and customer self-service***. Fifth, ***e-commerce is conducted at Internet speed***. This means that e-commerce development and implementation must be planned in months, or even weeks, not years. The sixth and final point is that the ***e-commerce business models are different***, and thus require special considerations for choosing the best e-commerce business model for the new development and implementation.

The creation of an e-business plan may be done for a variety of reasons. We have already mentioned that it is usually done for external audiences like investors, banks, and financial markets (in the case of an initial public offering—IPO) for acquiring funding to proceed with the e-commerce project. In addition, the e-business plan may be done to obtain necessary or extra resources including equipment supplier, Internet service provider, applications service provider, business partner, or even for recruiting senior management to lead the e-commerce development and implementation.

The process of writing the plan forces a decision maker to think ahead, set goals, anticipate problems, and set some measures for success. This ultimately makes the e-commerce business model more specific and detailed. In addition, it enables the decision maker to identify revenue stream, expense statement, and potential problems. All this provides a

more realistic approach to e-commerce business development, and makes a decision maker a more informed owner. It may also keep the company on track by setting targets for e-commerce development, and allows it to measure actual performance against these targets. One more reason for building an e-business plan is that after a detailed analysis, the company may decide not to develop the business. Many owners of failed businesses would have saved considerable time, money, and heartbreak if a proper business plan had been created.

The e-business plan may include the following sections:

- Executive Summary
- E-commerce Description
- Marketing Plan
- Research and Development
- Operations Management
- Financial Statements
- Implementation

The ***Executive Summary*** section should concisely communicate the basics of the entire e-business plan. It is usually written after the rest of the plan has been completed. It includes tangible benefits that occur because of e-commerce, e.g., increase of sales, reduction of cost, reduction of errors, improved cash management, easier access to procurement information, possible business reengineering, just in time/direct site delivery purchasing, etc. The executive summary also details the major costs of implementation, e.g. software and hardware, upgrading, employee education, and marketing.

The ***e-commerce Description*** section should include the main goals and objectives, business model components and how they are associated with the company's products or services along with information about the industry and the internet. These goals and components should be kept simple and easily understood. It should also discuss which of the products/services make the most sense to bring online. Discussions in this section should also include access to the global marketplace, the possibility of global market growth, customers buying online from the comfort of their home, possible elimination of the intermediary, etc. While talking

new technology every opportunity should be taken to keep the goals of the business simple and easily understood.

The ***Marketing Plan*** section should discuss the target market, the company plans to reach customers with this site, identify competitors, describe the different types of product advertising, and explain product pricing, delivery and payment mechanisms. The plan should describe the potential customer target markets and answer several questions, including: Who are your customers? How many of them exist on the internet? How many of them are international? What are the implications of this? Does the company have the resources in place to process online orders and keep its customers satisfied? How will it encourage repeat a business? What techniques will it use to build and maintain customer interest?

In developing the Marketing Plan, the company should look for competitors with similar products or services to its products and services, and explain their strengths and weaknesses within that context. It is very easy to identify competitors' weaknesses, but hard to identify their strengths. It takes time to learn your competitors' strengths and the planners have to make sure they incorporate those into their plan.

A part of the Marketing Plan should be dedicated to the ***Advertising Plan***, which describes how the target markets are to be reached. It should also describe how the company is going to tell the internet community about its products or services. Designing the web pages is only a part of the puzzle. Another part of the Marketing Plan should involve discussion of pricing in terms of how the company is setting prices for its products or services. If the product is intangible information delivered over the internet, it should try creating a pricing model to justify its prices. Again, the company can start by researching what others are charging for similar products. Finally, the Marketing Plan should provide description of delivery and payment, i.e., how the company will deliver its product or service and is paid for that.

In the ***Research and Development*** section of the e-business plan, the company needs to provide the technical and technological aspects of its proposed e-commerce project. It should address the R&D efforts that will be required to bring it to completion, and a forecast of how much the project will cost.

The ***Operations Management*** section of the e-business plan should discuss the major aspects of the business including daily operations and

physical location. In addition, it should include what equipment the business will require. Will it be using its own Web server, or will it be contracting with another company? How will the company recruit its employees? Will it hire internet knowledgeable staff, or train them in-house? What will be the cost associated with either option? What features will be incorporated into this site initially and what are the plans for future expansion? Who will help design the web site? What will be the domain name and how many will be purchased? What will be the URL or web site address? Who will take care of search engine placement? Who will determine keywords, key phrases, and meta tags? What will they be? The Operations Management section should also address who will be running the business and their expertise. What is management's level of internet expertise? Where did they gain it? If no expertise, whom will they use as a consultant? Resumes for the management team are usually included in this section.

The ***Financials*** section presents and explains the potential investors and/or banks or other financial institutions that may be approached for financing for the project will pay close attention to this area, since it is a forecast of profitability. As in a regular business plan, include all pertinent financial statements. This should include three to four years of profit/loss statements, cash flow statements, and balance sheet as well as startup balance statements.

In the last section of the e-business plan, ***Implementation Timeline***, the company should enumerate the steps it will take to make its proposal a reality and how long it will take to establish its Internet presence.

It is worthwhile to mention that a number of web sites may provide detailed information on how to develop an e-commerce business plan. Some of these web sites are listed in Table 2.5.

Table 2-5 Example of web sites with e-business plan information

Web Site	Brief Description
myphliputil.pearsoncmg.com/student/bp_turban_introec_1/TutIntro.html	Introduction to the e-business tutorial with details for each section of the plan
www.webpractices.com/ebizplans.htm	Contains a number of references to web sites with e-business plans
www.smallbusinesscomputing.com/emarketing/article.php/3553126	Explains how to develop an e-business plan for a new e-commerce web site
www.bplans.com/eb	Provides general templates and software to develop an e-business plan

2.4 Developing Technology Infrastructure for E-Commerce

The third step in the e-commerce development and implementation process is concerned with selecting and installing technology infrastructure for the e-commerce project. The elements that are selected, installed, and maintained at this step are the following:

- ***Select a web host***–make a decision of either outsourcing the web site development and location to a hosting company, or developing everything inside the company, or doing a combination of hosting and development
- ***Select development tools/software***–identify the tools/software that will be used in developing the web site
- ***Register a domain name***–select an appropriate domain name for the developed web site
- ***Design the web site***-provide the logical and physical design of the web site including site layout, location of the site information, color schemes, graphics, etc.
- ***Construct the web site and test***–use of a standalone or hosted software to construct the web site and test it.

We now discuss these elements in more detail.

Web Hosting

In general, ***web hosting*** is the business service of housing and maintaining data files, audio, video, images, or any other content accessible via the Internet. A company can do ***self-hosting by*** acquiring all components of a web site including hardware, software, staff, and dedicated telecommunications service. This is usually used by large and sometime by mid-size companies. However, the hosting is predominantly done by outsourcing some or all elements of the web site to a web-hosting organization.

The companies that do web hosting provide two types of hosting: pure hosting service or design-and-host service. The ***pure host service*** is usually done by ***Internet Service Providers (ISP)*** (see a list of those companies at www.thelist.com), which are organizations that offer customers access to the Internet and related services (see, for example,

www.appsitehosting.com). Besides providing the Internet access, these organizations are also able to store customer data and web sites on shared or dedicated web servers. The customer uses the extranet access to these servers to login to a web site, and develop, modify or change data informatiwon or web site design.

The pure host service can also provide ***mirror sites*** that duplicate the original web site, physically located on a web server, in different countries or even continents. In addition, the pure host service company can offer ***co-location***, in which case the customer purchases or leases a web server (with control over its operations), but the server is located in the hosting company's physical facility. The pure host service may be used by all kinds of companies, but it is specifically useful for medium-size and large corporations, which generally have skilled staff available to design and create the web site.

By utilizing a pure host service strategy, a company that develops an e-commerce project can reduce the cost of acquiring Internet-based infrastructure and computer hardware for this project. In addition, the company can lower the cost of maintenance and service of the hardware, and better concentrate on its core competencies. However, the pure host service does not provide the software and development tools and environment to develop a web site. These should be purchased or outsourced in addition to the hosting service.

The second type of hosting service is ***design-and-host service***. In this case, a hosting company, sometimes called ***storebuilder***, provides full hosting service including not only disk space on a server for storing company's data and web sites, but also software tools (templates) to design and develop web sites. The hosting company also provides customer service and support, and timely upgrades to the hosted web sites. Examples of the design-and-host service include the Microsoft's Office Life (e-commerce Manager), eBay Stores, Yahoo! Merchant Solutions, and others. This particular service is most popular with small and medium-size (SME) companies that would like to get a relatively simple and quick design and development of their web site.

E-commerce Software Selection

The selection of the e-commerce software environment is one of the critical elements in e-commerce web site development. In practice,

companies use several ways of acquiring this software. The software can be ***built from scratch*** by utilizing internal IT resources. In this case, the company designs software for e-commerce development using standard and universal programming languages like Java, JavaScript, C++, SQL, tools like Macromedia flash, and database programming tools, etc. While the tools are readily available with relatively low investments, the cost of designing and developing the e-commerce software internally could be quite significant. This option is ultimately used by large corporations for B2B and B2C e-commerce development.

A more common option in the software development is to use ***packaged tools***. In this case, a company purchases e-commerce software development tools from a vendor. These tools are used internally to develop e-commerce web site. The examples of these solutions may include Microsoft Commerce Server, IBM WebSphere, Oracle iStore , AbleCommerce, and many others. These vendor programming tools are effectively employed by a variety of large and mid-size companies that design and develop B2B and B2C e-commerce web sites.

Finally, a company may employ ***pre-built templates*** or, as we discussed in the previous section, ***design-and-host (storebuilder) services***. The company may employ e-commerce templates for full design of the e-commerce web site without additional programming. This is usually used by small companies for B2C e-commerce development.

To choose the best option of the e-commerce software, companies can employ ***Vendor Evaluation and Selection*** methodology. This methodology is based on ***three phases***. In the first one, ***Internal Needs Assessment***, the company needs to establish the software requirements based on functions and features that the company wants to have in a web site, which may be directly gathered from the e-business plan. Then the company needs to identify software vendor alternatives, i.e., software companies that should be considered for selection. To identify a set of prospective vendors, companies may use:

- Available industry public and private research on software vendors produced by e-commerce consulting firms like Gartner, AMR, Forrester, and others[7,8, and 9]
- Vendors' web sites
- Vendor references ("word of mouth").

Finally, at the ***Internal Needs Assessment*** phase, the company needs to establish and send to the prospective vendors ***Requests for Proposal*** (RFP). In the RFP, the company specifies the required functionality and capability of the software that it needs to acquire, and requests this information, along with the associated cost, service and support guaranties, and other related information from each vendor.

At the second phase, ***Vendor Analysis***, the company receives completed RFPs from prospective software vendors, and then performs a detailed analysis and comparison of vendors. The result of this analysis is the creation of a short-list of two to three finalists who will be considered further for the selection. At the third phase, ***Negotiation and Selection***, the company prepares its negotiation strategy, develops critical terms and conditions for the contract, and then tries to negotiate with vendor finalists for the best contract terms. The negotiations process will allow the company to finalize the selection of the best software company for the e-commerce project. An effective selection methodology ensures that the project team outlines appropriate evaluation criteria, gathers the most objective industry data possible, and evaluates that information in a structured manner.

The analysis and comparison of different software alternatives is based on ***four primary criteria:*** Functionality, Cost, Service and Support, and Ability to Execute. The first criterion, ***Functionality***, defines capabilities that the software contains to fulfill the customer's needs in the development of the e-commerce web site. These capabilities depend on the type of developed web site (demand-side e-commerce, supply-side e-commerce, c-commerce, etc.). For example, for the demand-side storefront, the functionality may include:

- Viewing and maintaining catalog information
- Pricing capabilities
- Customer outlining (interface with the customers' e-commerce applications)
- Shopping cart (add, delete, and edit items in the shopping cart)
- Bidding capabilities for exchanges and auctions
- Order tracking capabilities

The second criterion is ***Cost***, which should include not only the initial license costs, but also installation and maintenance costs, help and support costs, ongoing education and training, and professional service such as customization and integration. The third criterion, ***Service and Support***, defines quality of general support including the vendors' product installation capabilities, vendors' service availability, quality, and timeliness of service and support. It also represents quality of professional services including business consulting skills, system integration, and project management.

The fourth criterion, ***Ability to Execute***, defines each vendor's financial viability to provide long-term service for the company. The measurements may include the vendor's revenues, growth margins, earnings per share, and other fundamental financial ratios. It also defines technical execution—ability of the vendor to meet industry milestones like innovative R&D capabilities in comparison to those of other vendors.

In addition to the four key criteria, the company may incorporate other criteria in software selection including development time, customer references, personal connections to the software vendor, existing partnership with the vendor, and some others.

The importance of the four criteria and their ranking depend on the specific e-commerce project and the company's need to emphasize specific development and implementation targets. Typically, however, the *Functionality* criterion represents up to 1/3 of the total criteria weight. Up to 33% of the total weight, is usually given to the Cost criterion, and the other two criteria (*Service and Support*, and *Ability to Execute*) together represent the remaining 1/3 of the total weight.

An example of criteria performance measurements for four software vendor alternatives is presented in Table 2.6.

From analyzing and comparing the table's data, it becomes clear that different criteria may give preference to different alternatives. For example, the Functionality measurement identifies Vendor 4 to be the preferred, because it provides the highest number of applicable software options. At the same time, the Cost measurement points to Vendor 1 to be the best, because it offers the lowest cost of implementation. The Service and Support measurement clearly identifies Vendor 3 to be the best. Thus, it is hard

Table 2.6 Example of alternatives and measurements

Alternative	Functionality: Number of Applicable Options	Cost: Total Cost of Implementation	Service and Support: Service Availability	Service and Support: Quality of Support	Ability to Execute: Analystrating (1 Thru 5, 1 Being the Best)
Vendor 1	8	19,300	24/7	Mediocre	3.1
Vendor 2	12	22,500	10/5	Good	3.5
Vendor 3	14	29,950	12/6	Excellent	2.1
Vendor 4	15	27,500	24/7	Very good	2.7

to make a selection decision based on separate criteria. In addition, each criterion has different units of measurement (number of options vs. dollars of cost vs. available times, etc.).

To overcome this problem, we need to identify an integrated measure for each alternative, which combines all criteria with their respective weights. We also need to normalize the otherwise different measurements by ranking vendors within each criterion. The method that can be used in this case is referred to as the ***Weighted Score*** method or ***Factor Rating*** method. It involves the following steps:

1. Choose vendor alternatives.
2. Identify criteria/factors and their measurement.
3. Develop factors' weights–***Wi*** for each ***i-th*** criteria measurements *(i=1...k).* The sum of all weights should be equal to 1.0 or 100%.
4. Estimate criteria/factor ratings–***Fij*** for each vendor alternative *j (j=1...n).* The ratings should have the same range spread for all factors, for example from 1 to 10, or from 0 to 100.
5. Determine integrated weighted score ***(TWR)*** for each alternative:

$$TWRj = \Sigma\ (Wi*Fij)$$

6. Choose the alternative with the largest total weighted score ***(maximum TWR)***.

Let us show how this method works using the data in Table 2.6. According to this table, we have identified four software vendor alternatives

from Vendor *1* through Vendor 4, and five measurements. This completes *Steps 1* and *2* of the *Weighted Score* method.

According to ***Step 3***, we need to establish measurement weights. As we discussed, the first two measurements (*Functionality* and Cost), are each assigned 30% (0.3) of the total weight. The *Availability* weight is the next in importance measurement, and we assign 20% (0.2) of the total weight to this criterion. Finally, the remaining two measurements (*Quality of Service and Ability to Execute*) will each be assigned a weight of 10% (0.1) (see Table 2.7). The total weight of all criteria is 100%. The weights, however, have been assigned subjectively, and may require more attention and possible reevaluation in the future.

Step 4 of the method requires providing factor ratings based on ranging each criterion on a normalized scale. Let us establish this scale of ratings from 0 to 100, where the rating of 0 represents the worst outcome, and the rating of 100 represents the best outcome. Thus, for the *Functionality* measurement, the rating of 100 will be assigned to Vendor 4, which has the best functionality of 15, and the rating of 0 will be assigned to Vendor 1, which has the lowest functionality of 8. The spread then will be 7 units (15-8) and 100 points of rating (100-0). Vendors' 2 and 3 ratings will be somewhere in between 0 and 100. For Vendor 2, the associated *Functionality* rating will be (see Table 2.7):

$$(100/7)*(12-8) = 57.14$$

For Vendor 3, the associated Functionality rating will be (see Table 2-7):

$$(100/7)*(14-8) = 85.71$$

Similar calculations can be done for the Cost measurement. However, in this case, the best outcome with a rating of 100 will belong to Vendor 1 with the lowest cost, and the worst outcome with the rating of 0-to Vendor 4 with the highest cost.

For Vendor 3, we converted weekly availability to weekly hours for each Vendor. Thus, Vendors 1 and 4, each with availability of 168 hrs (24*7), Vendor 2, with availability of 50 hrs (10*5), and for Vendor 3, which has an availability of 72 hrs (12*6).

For the Quality of Service measurement, we need to convert qualitative attributes into measurable units. For this, we use a 5-unit scale,

Table 2.7 Example of weighted score method

Weight		0.30			0.30			0.20			0.10			0.10		1.00
	Functionality			Cost			Availability			Quality of Service			Ability to Execute			Weighted
	Orig.	Rating		Orig.	Rating		Orig.	Rating		Orig.	Rating		Orig.	Rating		Score
Vendor 1	8	0.00		19,300	100.00		168	100.00		2	0.00		3.1	28.57		52.86
Vendor 2	12	57.14		22,500	69.95		50	0.00		3	33.33		3.5	0.00		41.46
Vendor 3	14	85.71		29,950	0.00		72	18.64		5	100.00		2.1	100.00		49.44
Vendor 4	15	100.00		27,500	23.00		168	100.00		4	66.67		2.7	57.14		69.28

where "Excellent" is defined as 5 points, "Very Good" = 4, "Good" = 3, "Mediocre" = 2, and "Poor" = 1. The scores are entered in Table 2.7, and then respective ratings are estimated. The table seems inconsistent with the explanation here.

Finally, we can estimate the integrated weighted score for each vendor alternative. For example, for Vendor 1:

$$TWR1 = \Sigma\ (Wi*Fi_1) = 0.3*0 + 0.3*100 + 0.2*100 + 0.1*0 + 0.1*28.57 = 52.86.$$

The same calculations have been done for other three alternatives. As can be seen the best alternative is Vendor 4. The second best is Vendor 1. These two vendors may be considered for further considerations and contract negotiations at Phase 3 of the software selection.

Domain Name

A ***Domain name*** is a unique name within the Internet space, and identifies an Internet web site. Domain names have two or more parts, separated by periods (dots). For example, www.microsoft.com is a domain name for Microsoft Corporation web site. On the web, the domain name is a part of the ***Uniform Resource Locator (URL)*** that tells a domain name server using the ***Domain Name System (DNS)*** whether and where to forward a request for a web site. The domain name is mapped to an ***IP (Internet Protocols)*** address, which represents a unique physical resource on the Internet.

More than one domain name can be mapped to the same Internet address. This allows multiple individuals, businesses, and organizations to have separate Internet identities while sharing the same Internet server. Every domain name has a suffix that indicates the ***top-level domain (TLD)*** to which it belongs. There are only a limited number of such domains, which either represent the type of organization to which the web site belongs or the country where the web site is located. For example, ***.com*** means a commercial web site; ***.edu*** represents an educational institution; ***.gov*** points to a US government agency; ***.mil*** is a U.S. military TLD; ***.net*** usually stands for a network organization; and ***.org*** usually

represents a nonprofit organization. Country TLDs are, for example, .us for the United States, .de for Germany, .jp for Japan and .tv for Tuvalu. Other newer TLDs are ***.info, .biz,*** etc.

To register and start using a domain name for a web site, a company needs to use the services of a ***Domain Name Registrar***. The domain name industry is regulated and overseen by ICANN, the organization that is responsible for certifying companies as domain name registrars. To register a domain name, a variety of accredited registrars may be used. Some of the popular domain registrar web sites are: www.alldomains.com, www.directnic.com, www.godaddy.com, www.nameboy.com, and www.aboutdomains.com.

The chosen registrar will determine the annual cost of registering a domain name. Some registrars will offer discounts if the registration lasts for more than one year or if the web site for which the domain name was acquired is hosted at a site affiliatd with the registrar. However, no registrar has the authority to sell more than a 10-year registration contract for any domain name. The registrar will ask to provide some contact and technical information to have on record. This information is stored in a registry, which other computers can access to find information on the registered web site. The most popular destination for such queries is the InterNIC (Internet Network Information Center) site, www.internic.net.

Web Site Design, Construction and Testing

The web site design should start with the ***site design specifications***. A well-written site design specification is a powerful daily tool for judging the effectiveness of a development effort. It provides the team with directions of how to keep the development process focused on the ultimate purposes of the site. As such, it quickly becomes a daily reference point to settle disputes, to judge the potential utility of new ideas as they arise, to measure progress, and to keep the development team focused on the ultimate goals. At a minimum, a good site specification should define the content scope, budget, schedule, and technical aspects of the web site. The best site specifications are short and to the point, and are often just outlines or bullet lists of the major design or technical features planned. The finished site specification should contain the goals statement from the

planning phase, as well as the structural details of the web site. A detailed description of the web site design can be found in www.webstyleguide.com, www.websitetips.com or www.web-source.net.

System design specification can be broken down into two parts:

- ***Logical design*** represents a dataflow diagram (blueprint) that describes the flow of information at the site, processing functions that must be performed, and databases that will be used (see Figure 2.2) It may also contain descriptions of the security and emergency backup systems, and controls that will be used.
- ***Physical design*** also translates the logical design into physical components. Physical components may include: (a) a database with product catalog; (b) customer and order information; e-commerce software system with web design tools; (c) advertisement and e-mail servers; and (d) networking elements (web server, internet service provider, security, firewalls, etc.). The web site physical design can be also done in the form of a flowchart diagram.

The ***site design specifications*** are directly used for the ***site design*** step, at which the web site project acquires its look and feel, as the page grid, page design, and overall graphic design standards are created and approved. Now the illustrations, photography, and other graphic or audiovisual content for the site need to be commissioned and created. Research, writing, organizing, assembling, and editing the site's initial text content is also performed at this stage. Any programming, database design, data entry, and search engine design should be well under way by this point. The goal is to produce all the content components and functional programming and have them ready for the final production stage: the construction of the actual web site pages.

The ***construction of the web site*** is the final step in creating a web site. At this step, all elements of the site design are connected together in a functional web site. The results of web construction should include:

- Finished HTML for all web pages
- All page content is in place

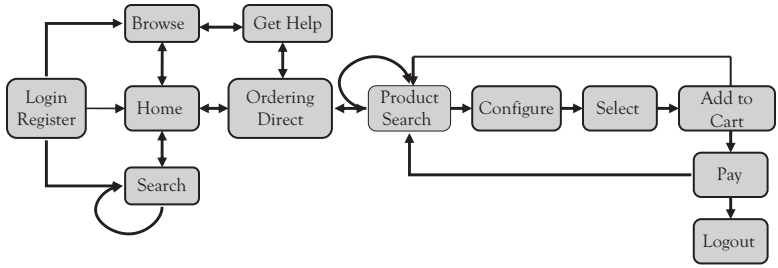

Figure 2.2 Examples of logical design blueprint

- Finished navigation link structure
- All programming in place and linked to pages, ready for testing
- All database components in place and linked to site pages
- All graphic design, illustration, and photography in place
- Final proofreading of all site content
- Detailed testing of database and programming functionality
- Testing and verification of database reporting features
- Testing of web site's support procedures, answering e-mail, etc.
- Archives of all site content components, HTML code, programming code, and any other site development materials.

Once the site has been constructed with all pages completed, and all database and programming components linked, it is ready for ***testing***. Testing should be done primarily by quality assurance (QA) specialists outside of the site development team. The QA specialists must be willing to supply informed criticism and report programming bugs, typographical errors, and review the overall design and effectiveness of the site. The QA specialists will inevitably notice things that the development team has overlooked.

Overall, the web site testing process may include several types of testing. ***Unit Testing*** involves testing program modules one-at-a-time, using a variety of factors[10] (see Table 2.8). ***System testing*** provides evaluation of the web site as a whole, in the same way a typical user would be using the site. ***Acceptance testing*** requires that the firm's key personnel (marketing, finance, operations) use the site on a test Internet or Extranet sever.

Table 2.8 Factors for successful web site design[10]

Factor	Description
Functionality	Pages that work, load quickly, and point the customer toward product offerings
Informational	Links that customers can easily find to discover more about products
Ease of use	Simple foolproof navigation
Redundant navigation	Alternative navigation to the same content
Ease if purchase	One or two clicks to purchase
Multi-browser functionality	Site works with the most popular browsers
Simple graphics	Avoid distracting, obnoxious graphics and sounds that the user cannot control
Legible text	Avoid backgrounds that distort text or make it illegible

While doing testing, the specialists need to pay attention to specific features of the web site that may annoy the customers, for example:

- Links that cause error reports
- Pages that are too slow to load
- Forced to download plug-ins
- Site times out
- Poorly named links
- Poor navigation design leading to too many clicks
- Crowded layout
- No skip button at introduction if user is greeted by animation
- No search engine
- Confusing layout
- No site map for navigation reference

2.5 E-Commerce Implementation Measurements

The purpose of measuring e-commerce implementation is to get support for the continuation of the e-commerce project, measure the progress of work on the project, and determine whether the expected benefits were achieved from investments in the e-commerce project. The measurements

should reflect the value proposition of the designed e-commerce project, and need to reflect monetary and non-monetary results of e-commerce. These results can be clustered into five main groups:

- Revenue and Profit
- Cost Reduction
- Customer and Supplier Satisfaction
- Web Site Development
- Web Site Performance

Performance indicators for each group are presented in Table 2.9.

Table 2.9 Performance indicators of E-commerce[10]

Group of Measurement	Performance Indicators
Revenue and Profit	Gross revenue generated by the web Profits from web sales Comparative costs of web versus traditional business Return on investments
Cost Reduction	Operational cost of production use Cost to maintain, enhance, and support the system Direct staff cost Management cost Overhead cost
Customer and Supplier Satisfaction	Average time of using the web site Number of customers/suppliers using the web Number and percentage of repeat customers Number of customer complaints per unit time
Web Site Development	Ease of navigation around the web Amount of information available Number of products or services available Flexibility in handling change
Web Site Performance	System response time System throughput—volume of work per unit time Downtime and time to repair or recover Number of simultaneous users in the system Availability of systems and technology for work

2.6 Chapter 2 Summary: Managerial Aspects of E-Commerce Development and Implementation

1. The first step of e-commerce development and implementation is to ***identify the e-commerce business model.*** This is a critical step in the overall e-commerce development process because it establishes a strategic vision and, to some extent, guides the long-term decisions of what the e-commerce system should be, how it is going to perform, and what specific e-commerce models need to be implemented. At this step, a company needs to establish the five main components of the e-commerce business model. These are the value proposition, e-commerce offerings (value-added activities), supporting resources, revenue and cost models, and value creation (expected benefits).
2. Based on the established e-commerce model components, the company may develop and evaluate several alternative e-commerce models selected from demand-side or supply-side e-commerce, c-commerce, m-commerce, e-services, etc. Then, the company needs to compare these alternatives using qualitative and quantitative measurements, for example, ROI analysis. Finally, the company identifies the best e-commerce model or models to be developed.
3. The second step of e-commerce development and implementation is to design an ***e-commerce business plan or e-business plan.*** The goal is to create a detailed written document that will explain how the company intends to achieve its e-commerce goals and fulfill the strategy formulated in the previous step.
4. An e-business plan should include a business description (mission statement, business goals, project objective) of the proposed e-commerce implementation, along with market and competitor analyses. It should also contain operations decisions and financial statements associated with projected costs (cost of ownership) and benefits (revenue/profits and ROI).
5. The third step of e-commerce development and implementation involves ***developing the technology infrastructure for e-commerce,*** which in most cases ends up being the creation of the e-commerce

web site. This web site contains all features and elements necessary to fulfill the main strategic vision and strategic goals of the developed e-commerce model(s).

6. The development of the technological infrastructure includes selecting a company that will be hosting the web site (internally or externally), identifying the best development software for the e-commerce models under development, and registering a domain name. This step can also involve creating and managing web site content, constructing and testing the web site, and marketing and promoting the web site. In addition, the company needs to identify the performance measurements for utilizing the web site for e-commerce implementation.
7. The selection of the e-commerce software environment is one of the critical elements in e-commerce web site development. In practice, companies use several ways of acquiring this software. The software can be ***built from scratch*** by utilizing internal IT resources. It can be created using ***packaged tools*** form a vendor (IBM, Oracle, etc.), or a company may employ vendor's ***pre-built templates*** that do not require additional programming.
8. To choose the best option of the e-commerce software, companies can employ ***Vendor Evaluation and Selection*** methodology that is based on ***three phases: Internal Needs Assessment*** for establishing the software requirements, ***Vendor Analysis*** for creating a short-list of two-three finalists that will be considered further for the selection, and, finally, ***Negotiation and Selection*** for negotiating with vendor finalists for the best contract terms. The negotiations process will allow the company to finalize the selection of the best software company for the e-commerce project.
9. The analysis and comparison of different software alternatives should be based on ***four primary criteria:*** Functionality, Cost, Service and Support, and Ability to Execute. The ***Weighted Score method*** may be used to identify an integrated measure for each alternative, which combines all criteria with their respective weights. This method also normalizes the otherwise different measurements by ranking vendors within each criterion.

10. The last (but certainly not the least) step in the e-commerce development and implementation includes actual ***implementation and follow-up.*** This step involves creating an e-commerce implementation strategy. The strategy describes the long-term decisions necessary to successfully introduce and sustain the new e-commerce model(s). This may include marketing of the web site, sales promotions, customer service and support, web site maintenance, and other decisions. All these aspects of the implementation strategy would be specified in the implementation plan.
11. Upon implementing new or improved e-commerce models, companies would have to follow up on the implementation results. The company will collect customer feedback and measure implementation results based on the performance measurements introduced in the previous step. This may potentially lead to changes in the current online procedures and workflows.
12. The purpose measuring e-commerce implementation is to get support for the continuation of an e-commerce project, measure the progress of work on the project, and determine whether the expected benefits are achieved from investments in the e-commerce project. The measurements should reflect the value proposition of the designed e-commerce project, and need to reflect monetary and nonmonetary results of e-commerce. These results can be clustered into five main groups: revenue/profit, Cost reduction, customer and supplier satisfaction, web site development, and web site performance.

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CHAPTER 3

Management and ERP Systems

3.1 What is Enterprise Resource Planning?

Defining ERP

Enterprise Resource Planning (ERP) systems and their implementation are one of the most important issues in information technology (IT) business today. These computer-based systems provide integration of all functions inside an organization and automation of business-related processes. ERP also serves as a backbone of the modern e-commerce systems. ERP systems experienced a significant growth in sales in the last decade of the 20th century. They will continue to be one of the largest, fast-growing, and most influential players in the IT field well into the new millennium. According to AMR Research, the ERP market grew to $25.4 billion in 2005 with a forecast of $29 billion in 2006. In 2006–2010, the market will grow at an average of 10% per year[1].

Enterprise Resource Planning (ERP) is defined as an integrated computer-based system that manages internal and external organization resources. These resources include tangible assets, financial resources, materials, and human resources. At the same time, ERP is an application and software architecture that facilitates information flows between various business functions inside and outside an organization and, as such, is an enterprise-wide information system. Using a centralized database and operating on a common computing platform, ERP consolidates all business operations into a uniform system environment.

The word "enterprise" in the ERP name represents the fact that this system integrates and automates processes within an entire organization

regardless of the organization's nature. In fact, ERP systems have been implemented in manufacturing, distribution, transportation, education, healthcare, banking, and other industries. The word "resource" in the ERP name reflects the system's intention to rationalize the usage of an organization's resources. Finally, the word "planning" describes one of the main functions of resource management, i.e., planning resources through a variety of business processes.

Introduced in the early 1990s, the term "ERP" does not reflect the real capabilities of the system it represents. First, ERP systems provide not only planning but also other management functions such as organizing, controlling, scheduling, reporting, and analyzing business processes. Second, a traditional approach to ERP considers it a "back-end" computerized system for managing the internal resources of an organization. However, the ERP has crossed the boundaries of being just a system for planning internal resources. It may often contain "front-end" applications of managing customers and improving customer satisfaction—customer relationship management (CRM); collaborating with suppliers through applications of supply chain management (SCM); and utilizing business-to-business (B2B) e-commerce. As such, this integrated system combines external (front-end) and internal (back-end) business applications and should be defined as an extended enterprise management system or extended ERP system (see Figure 3.1).

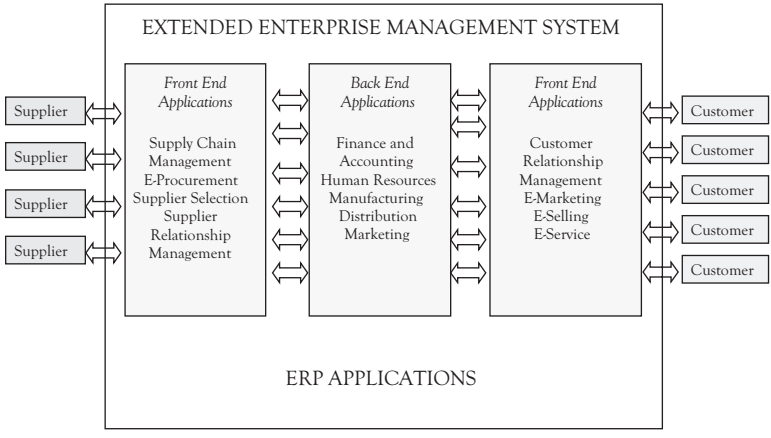

Figure 3.1 General ERP structure

As the original term "ERP" does not fully describe existing integrated solutions, many ERP software vendors avoid using this term to represent their extended enterprise management systems. For example, these systems are called "Total Integrated Solutions," "E-Business Platform," "E-Business Suite," etc. Regardless, the term "ERP" or "ERP system" continues to be the most popular term to describe a suite of integrated applications of an extended enterprise management system.

History of Evolution

ERP systems have almost a 40-year history of evolution. Understanding this evolution is important for comprehending current ERP systems and seeing perspectives of their future development. The idea of integrating and automating business processes utilizing computer programs was first introduced in the late 1960s and early 1970s with the development of ***Material Requirements Planning (MRP)***. This coincided with the time when manufacturing companies started to employ extensively computers, specifically mainframes and minicomputers, in business and management decisions. MRP is an integrated computer-based system for calculating material and delivery schedules. It combines inventory management, materials planning, capacity planning, purchasing, and distribution. Later MRP systems also generated purchase orders to suppliers and work schedules for internal production.

The next major step in the evolution of ERP was the development in the early to mid-1980s of a new breed of integrated systems called ***Manufacturing Resource Planning (MRP II)***. This system fully integrated materials and capacity planning with distribution planning, sale ordering, marketing, finance/accounting, and human resources. Besides planning material and capacity resources, MRP II integrated inventory with financial/accounting transactions, sales orders with materials planning and accounting/finance transactions, marketing and sales analysis with demand forecasting, etc. All inputs and outputs, analysis, and reporting were based on one centralized database system. MRP II was very popular and widely utilized by a variety of large and midsize companies that employed predominately mainframe and minicomputer technology.

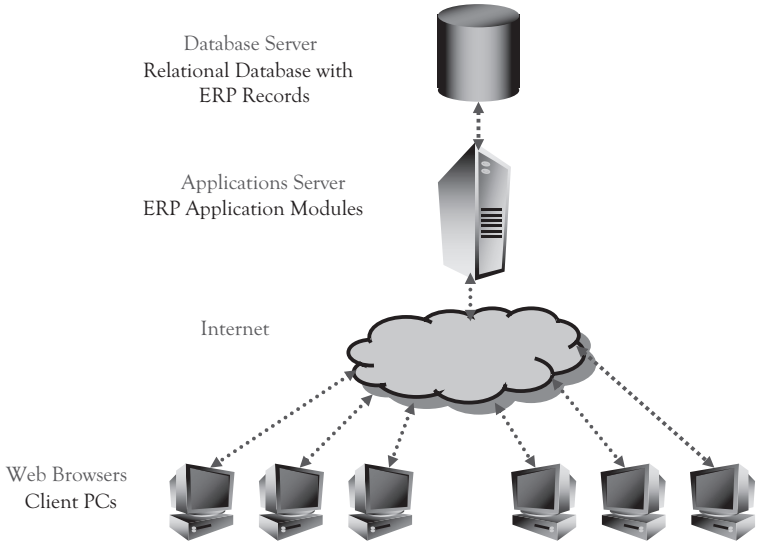

Figure 3.2 Typical architecture of web-enabled ERP systems

Modern ERP systems were established in the early 1990s. This coincided with the proliferation of personal computers, which replaced the old mainframe capabilities with the new client-server technology. Considered as an advanced MRP II system, modern ERP has several major differences from MRP II systems. These differences include: utilization of the client-server technology and its ability to run on personal computers (clients) and powerful servers utilizing multiple operating platforms (Unix, NT, etc.); advent of ERP into non-manufacturing companies ("enterprise" rather than "manufacturing" resource planning); and integration of MRP II applications with new business processes like supply chain management and customer relationship management. In the mid- and late 1990s, a large number of companies converted their existing computer systems to ERP.

The latest evolution of ERP systems started at the end of the 1990s with the introduction of Internet-enabled ERP systems. This introduction correlated again with major changes in IT systems that were signified by the Internet and e-commerce revolution. The new systems were characterized by internet-enabled ERP architecture; new front-end e-commerce

solutions; easy access to the system by employees, customers, and suppliers; collaborative planning and scheduling; and optimized operations, finance, and marketing decisions.

ERP and E-commerce

The majority of modern ERP systems are fully internet-enabled systems. This means that communication between a server where an ERP system is installed and many clients (end-user PCs) is done through the Internet.

An ERP system may comprise three main tiers: clients, applications server, and database server (see Figure 3.2). Clients are end-users that connect to the system via internet browsers. An applications server incorporates a Web server, forms, system tools, and a variety of ERP programs. A database server includes a relational database with ERP records. Some ERP systems have been developed with separate applications and Web servers, which would define them as four-tier systems (clients, Web server, applications server, and database server).

ERP systems are considered a backbone of e-commerce solutions. Successful utilization of the "front-end" e-commerce solutions is unimaginable without strong support by and cooperation with the internal "back-end" computer systems. In fact, many ERP vendors combine ERP applications and e-commerce solutions in one integrated computer system.

3.2 ERP Principles, Features, and Classification

Main ERP Principles

In many respects, ERP is a result of modern organizations' efforts in designing management information systems. Various processes of an organization have to be linked together so that whenever a change in an external or internal process takes place, the company is able to adjust all other related processes immediately and effectively. ERP systems enable this to happen, not only at the information systems level but also at the applications level, by utilizing certain principles and features. The two main ERP principles are integration and automation.

ERP integration is based upon:

- A single logical database system operating on a common computing platform. All ERP applications would input data and retrieve information from the same database and all employees would have the same point of access to get necessary information
- An integrated set of commonly designed business applications including manufacturing, distribution, marketing, accounting, finance, and human resources. This set consolidates all business processes into a uniform system environment
- Integration between internal company applications and external applications for accessing customers and suppliers.

ERP automation represents the ability of an ERP system to automatically process business transactions and information between different processes and functions inside an organization, as well as between this organization and its customers and suppliers. The elements of ERP automation are:

- Automated business transactions. For example, these can include calculation of production and material schedules, demand forecasts, inventory levels, and production costs.
- Automatic information sharing between numerous organization functions. Data created in one application become available to other related applications. For example, a new employee input made in a human resources module may be available in other applications like purchasing and marketing, which utilize this employee information.
- Automated recording, monitoring, and reporting of the data generated in ERP.

ERP Features

One of the most important ERP features is that it is a ***process-driven system***. In contrast to individual and function-driven computer applications in marketing, finance, or operations, an ERP system integrates these

functions into a variety of computer-based processes. They represent real business processes that companies apply to managing resources, working with customers and suppliers, etc. In general, an ERP system may include a variety of business processes like:

- Order fulfillment
- Production planning and scheduling
- Capacity planning
- Outsourcing materials from suppliers (purchasing)
- Shipping products to the customers
- Product costing, payments, and receipts
- Managing customers
- Selecting and managing suppliers.

Some of these processes are interrelated and dependent on one another (see Figure 3.3). Integrating these business processes into a company's ERP system provides the necessary environment for running the company in real time with all functions being interoperable in the system.

Other features of ERP systems include:

- ***A relational database*** that integrates all data inputs, transactions, and outputs of ERP systems. This can substantially reduce or even eliminate inaccuracy and inconsistency of records that might have existed in separate individual databases.

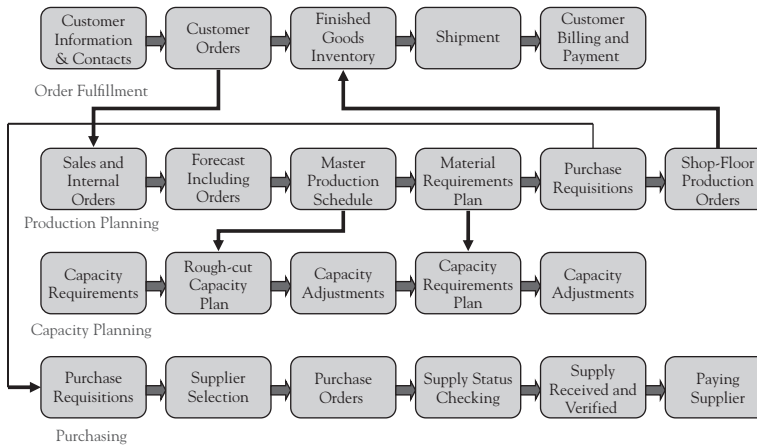

Figure 3.3: Example of interrelated ERP processes

The Oracle database is the most popular relational database used in ERP systems.

- ***On-Line Transaction Processing (OLTP)***, which is an ERP operational system for collecting and managing the basic data in an organization, such as sales, order processing, inventory, accounts payable, accounts receivable, and other important transactional data.
- ***Company-wide access to information*** from a relational database. Transactions that are taking place in each ERP-driven business process may be visible, in principle, to anyone in an organization. In practice, however, the level of an employee's visibility of and access to ERP processes depends on the employee's role (responsibilities) in the company.
- ***Multiple simultaneous accesses*** to the ERP system by many users and in various locations. This feature may be used by a company that has multiple domestic and international locations/divisions and wants to integrate all business functions into one computer system. This feature also enables fast and reliable information sharing among different parts of the company. The ERP ***On-Line Analytical Processing (OLAP)*** provides the ability to access, present and analyze database records across several dimensions like time, place, and product line. OLAP also serves as a foundation of the business intelligence module in ERP (Motiwalla and Thompson, 2008).
- ***Scalability,*** which means that an ERP system provides adequate capabilities in the situation where the total number of users of the system is growing. This may be due to the company's expansion or to its merger with or acquisition of another company. A scalable ERP system should also accommodate a growing number of users and applications without jeopardizing the speed of transactions or the performance of the entire system.
- From a technical standpoint, ERP systems should be flexible enough to run on ***various implementation platforms*** and operating systems like Unix, Linux, and Windows.
- ***Internet-enabled architecture*** of ERP systems (see Figure 3.2).

Table 3.1 Groups and categories of ERP applications

	Core Applications	Applications' Enhancements Business Intelligence	Application E-commerce
Supply Chain Management (SCM) Group	• Inventory • Supply Chain Planning • Materials Requirements Planning • Capacity Requirements Planning • Shop Floor Management • Warehouse Management • Purchasing • Quality Management	• Manufacturing Intelligence (Analytics) • Advanced Planning and Scheduling • Supply Chain Intelligence (Analytics) • Supplier Relationship Management	• Electronic Storefront • E-Procurement • E-Supplier Portals • Private Exchange • Online Auction • Collaborative Supply Chain • E-Design • Mobile Supply Chain Commerce
Financial Management Group	• General Ledger • Accounts Receivable • Accounts Payable • Asset Management • Cash Management • Activity-based Costing • Property Management • Treasury Management	• Financial Intelligence (Analytics) • Balanced Scorecard	• E-Expenses • E-Receivables • E-Payment
Human Resources Management (HRM) Group	• Personnel Administration • Payroll • Employee Benefits and Compensations • Time Management • Training Administration	• Human Resources Intelligence (Analytics) • Organizational Development	• Self-Service Human Resources • E-Recruitment • E-Learning • HR-Centric Web Portal • Information Collaboration • Mobile Commerce

(*Continued*)

Table 3.1 (Continued)

	Core Applications	Applications' Enhancements Business Intelligence	Application E-commerce
Customer Relationship Management (CRM) Group	• Order Management • Product Configuration • Order Fulfillment • Customer Management • Service Management • Marketing • Sales • Field Customer Service	• Marketing Intelligence (Analytics) • Service Intelligence (Analytics) • Advanced Demand Management • Customer Interaction Center (Call Center)	• E-Marketing • E-Selling • E-Fulfillment • E-Service • Mobile Sales
Product Lifecycle Management (PLM) Group	• Product Data Management • Direct Material Sourcing • Customer Needs Management • Project Management • Quality Management	• New Product Design and Development Analytics • Knowledge Management	• E-design • Collaborative Product Commerce • Collaborative Product Design

Classification of ERP Applications

The ERP applications can be classified according to ***four main dimensions***:

- Groups of applications
- Categories of applications
- Industry applications (vertical integration)
- Customer size (large, medium-size, and small companies)

In addition, The ERP system can be clustered into ***five groups of applications*** (see Table 3.1):

- Supply Chain Management (SCM)
- Financial Management or Financials

- Human Resource Management (HRM)
- Customer Relationships Management (CRM)
- Product Lifecycle Management (PLM).

The ***Supply Chain management (SCM)*** group is associated with the applications of planning, scheduling, executing, monitoring, and reporting material and information flows from suppliers to a manufacturing/service organization, then managing and executing production in this organization, and finally distributing finished products to the customers. ***Financial Management (Financials)*** is another major group that includes accounting and financial applications, as well as applications to analyze and optimize market forecasts, credit risk of new contracts, cash flow and liquidity, financial portfolio, and market risk.

The ***Human Resource Management (HRM)*** group of applications is capable of performing a variety of human resources functionalities, i.e. maintaining employee records, recruitment, payroll, administration, compensations and benefits, education and training, employee self-service, etc. The ***Customer Relationship Management (CRM)*** group of applications includes a set of applications related to customer interactions with the company, managing customers' demands and orders, and improving customer satisfaction. Finally, the ***Product Lifecycle Management (PLM)*** group is a relatively new group of ERP applications used to provide information, planning, and analysis of product lifecycle processes including research and development, product introduction, product service and support, and end-of-life processes.

Within each group, the ERP system may be clustered into ***three categories of applications*** (see Table 3.1):

- ***Core applications*** are comprised of traditional applications of business and management existing in current as well old versions of ERP software. These applications mainly perform transaction processing, data entry, planning, scheduling, executing and monitoring processes, and reporting.
- ***Applications' enhancements/business intelligence*** is a set of applications, which has analytical, and decision-support nature. They are added to the core applications mainly to

perform measurement and analytical functions, forecasting, advanced planning and scheduling, and optimized decision-making in order to enhance business decisions and processes in each ERP group.

- ***E-commerce applications*** are comprised of various applications of B2B and B2C e-commerce that have capabilities to perform collaborative commerce; buy/sell and outsource products and services; communicate, share and/or exchange information with employees, customers, suppliers, partners, manufacturers, or distributors.

These categories enable to see a variety of application offerings within each ERP group in a structured and systemized manner. In addition, the ERP categories systemize traditional and modern applications of ERP, like those of intelligence/analytical nature and B2B e-commerce solutions. In general, the introduced classification enables standardization of the existing ERP systems. It can also serve as a basis for comparison of various ERP systems. The groups and categories of the ERP system form a matrix with various applications that may be used in ERP (see Table 3.1).

The third dimension of the established ERP classification is ***industry applications (vertical integration)***. This implies customization of ERP systems for specific industries. Today, top-ranked ERP vendors have vertically customized their systems toward a variety of industries. Fore example, SAP established customized solutions for more than 25 different industries that include Aerospace and Defense, Automotive, Banking, Chemical, Consumer Products, Engineering and Construction, Healthcare and some others. Each industry-related ERP system contains industry specific applications, for example, Profit Management and Risk Management applications for banks or Healthcare E-business Applications for the healthcare industry. Besides, an industry-related system may also include standardized ERP applications like Accounting/Finance, CRM, Human Resources, and others relevant to that industry.

The fourth classification dimension is ***customer size*** for which ERP applications are developed. According to this dimension, the ERP systems are grouped into groups of applications for large, middle-size and small companies. Oracle has introduced, along with its well-known E-Business

Suite, an integrated set of applications for middle size and small companies. This system consists of less comprehensive but still versatile set of ERP applications including Accounting, Customer Support Management, Employee Expenses, Time and Billing, Payroll, Online Bill Payment, Web Store and Customer Care. Due to a relatively small number of applications and their limited capabilities, the total cost of ownership of for this set of applications is lower that that of a general ERP system.

Major ERP Vendors

The number of software companies that develop ERP software runs in the hundreds. Many of these companies provide limited ERP functionality as market niche players; others focus on some vertical markets (industries). However, a relatively large segment of these companies provides comprehensive solutions to their customers. The largest and most popular ERP vendors are SAP and Oracle. These two companies have 68% of the global ERP market share (see Figure 3.4)[1].

SAP is the largest ERP vendor in the world. The most famous SAP system, ***SAP R/3***, includes all common groups of the ERP applications. SAP is especially popular with large manufacturing companies that run their manufacturing, distribution, and supply-chain applications. Realizing that its R/3 architecture could not meet the challenges of e-commerce in the late 1990s, SAP started implementing an Internet-based solution.

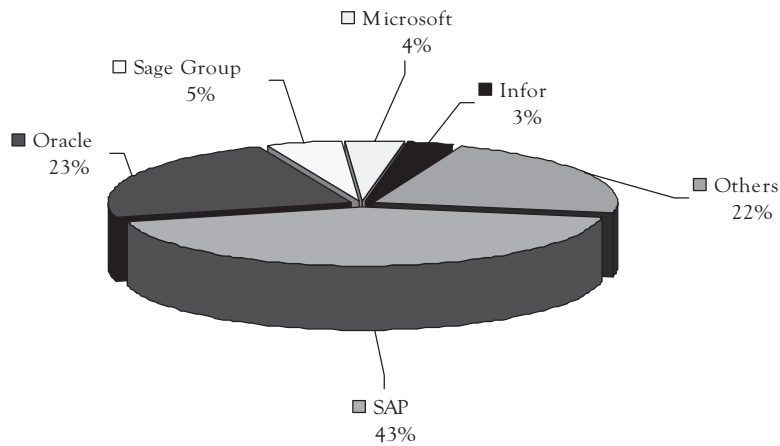

Figure 3.4 Main ERP vendors

For that, SAP launched its totally redesigned, Internet-based solution—mySAP.com, also known as SAP Business Suite. It is a broad undertaking by SAP to extend its back-office suite to the Web. This suite is a single entry point for a range of front-end, back-end, and e-commerce ERP applications. The SAP software has been implemented in a variety of companies (predominately, large companies) including IBM, Hewlett-Packard, Philips, Siemens, Chevron, and many others.

SAP delivers a comprehensive e-business platform designed to help companies collaborate and succeed—regardless of their industry or network environment. *SAP Business Suite* includes *mySAP ERP* (Financials, Human Resource Management, Operations, Corporate Service), *mySAP Business Suite* (Customer Relationship Management , Product Lifecycle Management , Supplier Relationship Management, Supply Chain Management), and *SAP Manufacturing* and *SAP Service and Asset Management.* As mentioned before, SAP also provides a variety of ***Industry Solutions and Small and Medium Size Business Solutions***. Finally, SAP is involved in variety of services like hosting, consulting, custom development, global customer support, and education.

Oracle Corporation is the second largest ERP vendor after SAP (see Figure 4). Oracle was the first company to offer a fully integrated, Internet-enabled suite of business applications—***E-Business Suite***. This system runs entirely on the Internet, supporting e-business across the SCM, Financial, Human Resources, and CRM groups. However, Oracle's Financials and Customer Relationship Management groups of applications are the company's most popular among its customers.

Oracle's E-Business Suite, along with SAP, is also commonly used by large and mid-size manufacturing and service companies. These include Cisco, Sun Microsystems, Visa International, Alcoa, Xerox, and many others. In recent years, Oracle pursued an aggressive expansion by acquiring a number of large ERP vendors like PeopleSoft (with JD Edwards), Siebel, Retek, and some others. The goal was to increase market share and become more competitive with Oracle's major rival in enterprise applications—SAP. Oracle main products and services are:

- Database systems (database, database design and development tools)
- Middleware applications (application server, developer tools, business integration, business intelligence, and collaboration suite)

- Business applications: Oracle E-business Suite, PeopleSoft Enterprise, JD Edwards EnterpriseOne, JD Edwards World, Siebel CRM
- Consulting, education, and support services.

Besides SAP and Oracle, the ERP market contains other popular systems like Sage Software, Microsoft Dynamics, Infor ERP, Epicor ERP, IFS ERP Applications, and QAD. These ERP systems are typically developed for and implemented in mid-size and small companies. For example, the focus of Sage Software is to provide business and management ERP applications and services to small and mid-size enterprises (SMEs). These applications cover a full range of business requirements including accounting, customer relationship management, contact management, human resources, warehouse management, specialized industry needs, and others. The Sage Software markets its applications in four customer-focused divisions: Business Management, Healthcare, Payment Solutions, and Industry & Specialized Solutions.

Microsoft Dynamics is a line of integrated software management systems for SMEs that provide ERP applications. For example, Microsoft Dynamics AX delivers a range of core ERP applications including:

- Business intelligence and reporting
- Collaborative workplace
- Configuration and development
- Customer relationship management for sales and marketing
- Customer relationship management for field service
- Financial management
- Human resource management
- Project management
- Supply chain management

Infor is another popular ERP software company for SMEs. It offers a full range of enterprise business software including customer relationship management, enterprise asset management, enterprise resource planning, financial management, human capital management, performance management, product lifecycle management, supplier relationship management, and supply chain management, including business specific

inventory management, transportation logistics and warehouse management software. The company also provides ERP solutions and service for various vertical markets including manufacturing, distribution, and service industries.

3.3 ERP Benefits and Issues

ERP Benefits

The rapid growth and proliferation of ERP systems indicates the great importance of these systems to businesses. According to a survey conducted in 2007–2008[3], the majority of the respondents view ERP as a strategic weapon to streamline and automate business processes in order to improve efficiencies. In general, the implementation of an ERP system should increase the reliability of a company's information, provide full access to this information at any point of time, automate a variety of tasks and processes in different organizational functions, and improve forecasting, planning, scheduling, and reporting. These improvements may lead to a shorter order-to-market time, lower inventory levels, more efficient and effective management of resources, and, as a result, major cost savings.

Koch[2] suggests that the median annual savings from a newly implemented ERP system are approximately $1.6 million. Results of a survey of over 1,400 manufacturing companies showed that the best-in-class ERP implementations led to 23.7% reduction of inventory costs, 18.3% decrease in manufacturing operations costs, and 17.8% decline in administrative costs[3]. Through best-in-class ERP implementations, the manufacturing companies achieved 97% of complete and on-time shipments, 92% of inventory accuracy, and 96% of manufacturing schedule compliance[3]. These results coincide with some previously done surveys[4], which identified important improvements due to the ERP implementation:

Improved interaction with customers
Improved on-time delivery
Improved interaction with suppliers

Lowered inventory levels
Improved cash management
Reduced direct operating costs.

The same survey also recognized that areas benefiting the most from ERP were availability and quality of information and integration of business operations/processes, as well as the three functional areas of inventory management, financial management, and supplier management and procurement.

ERP Issues

Despite the benefits, ERP systems remain the most complicated, time-consuming, and costly computer-based systems. Implementation time and software cost depend on the company's size, number of implemented applications (modules), and level of planning and preparation of the implementation process.

A survey conducted by Mabert et al.[4] showed that the ERP implementation time for a large or mid-size company could vary from 23 to 35 months, on the average. The average implementation cost for a large or mid-size company could be around $20 million, and smaller firms may spend up to $12 million[4, 5]. A substantial portion of companies, while implementing ERP, had major cost overruns exceeding the original estimated budget by an average of 60%[5].

Implementation is only one element of the total cost of ownership (TCO) of an ERP system. In general, TCO includes software license fees, hardware cost, installation and implementation fees (consulting, additional personnel, training, testing, etc.), cost of maintenance, and customer support. The average TCO of an ERP system could run up to $85 million, but for some large organizations could reach $400 million[2]. In several cases, documented in the literature sources, a long and inefficient implementation led to substantial drawbacks in the companies' performance, loss of sales and customers, and strained relationships with suppliers. Among numerous companies that experienced costly problems with their ERP implementations were W.L. Gore and Associates (with PeopleSoft) and Whirlpool, Hershey Foods, Allied Waste Industries, and

Volkswagen (all with SAP). In recent years, however, more businesses have grown weary of big up-front investments in ERP applications, causing vendors increasingly to offer modular packages of software and services. For their part, businesses seem to have learned from past mistakes and pay more attention now to issues such as process standardization and minimal customization to help keep costs more in line[6].

Analysis of ERP implementation practices revealed the following major issues that companies need to deal with while implementing an ERP system:

- ERP is a complex and rather rigid system that may require a company to redesign its business processes. The top ERP systems are based on best business practices, and a company must accept the assumptions inherent in those systems. This pushes the company toward generic processes established in ERP. Thus, the company needs to ensure that adopting generic processes does not sacrifice its production results, customer service, and competitive advantage.
- Successful ERP implementation is nearly impossible without thorough preparation and efficient management of the implementation process. These require strong executive commitment and involvement in the ERP implementation process from start to finish; an empowered implementation team that needs to define objectives, outcomes, and implementation strategy; clearly developed education and training strategies; and full communication of ERP plans to the company's employees.
- ERP systems require virtually a life-changing experience for everyone involved. A company that implements ERP and its employees need to overcome traditional conservatism in utilizing a previously unknown computer system which has new input forms, output reports, functionality, etc. Thus, extensive and consistent training of all involved employees becomes a critically important element of a successful ERP implementation.

A top-ranked ERP system, being a time- and money-consuming system, may not be suitable for implementation in small and mid-size companies. In addition, a standard ERP system, which is developed with generalized business processes and applications, may not be appropriate for certain industries. To address these issues, the leading ERP vendors provide a host of solutions that include:

- Customizing ERP systems for individual industries
- Developing ERP solutions for small and mid-size companies
- Lowering applications costs by selling individual modules
- Providing ERP hosting solutions.

ERP Hosting Solutions

Due to the ERP complexity and costs, ERP hosting/outsourcing became a popular option for small- and mid-size companies that lack capital and resources to do in-house implementation. An ERP hosting provider hosts, manages, maintains, and monitors computer applications on behalf of its customers. The hosting provider assumes responsibility for the underlying delivery mechanisms, which include networking infrastructure and hardware requirements. The hosting organization may be also responsible for application maintenance and upgrades, training, technical support and overall systems management. Typically, the hosting provider charges an end-user organization a fixed monthly fee based on the application usage and services rendered. These services may include hardware installation, customer support, maintenance, and upgrade.

Many companies outsourcing ERP-related applications evidenced benefits of hosting solutions. A research, conducted by the author, identified the following important benefits of outsourcing enterprise applications through hosting solutions versus implementing them in-house (the benefits are presented in a descending order of their importance):

- ***Various cost savings/cost reductions, which improve companies' return on investments (ROI)***. These reduced costs include: costs of additional IT staff to manage implementation,

maintenance and support of the applications; expenses of creating, running and maintaining a complex infrastructure; cost of installing and running servers and other hardware; and cost of software upgrades/updates.

- ***Companies can concentrate on their core competencies.*** Outsourcing complex ERP systems allows companies to focus on their core strategic activities and achieve greater competitive differentiation in its principal business areas.
- ***Fast implementation schedule.*** According to various researches, the average time to implement outsourcing solutions is around 6 months, which is lower than the average time for implementing an ERP system in-house.
- ***Investment risk reduction.*** The hosting model reduces companies' risk of making huge investments in the software implementation and purchasing soon-to-be obsolete software.
- ***Regular software upgrades/updates.*** In many cases, hosting providers are responsible for the timely upgrade of their software according to customer suggestions and requests.

While selecting a hosting company, customers should consider a combination of factors representing major aspect of the hosting model. Based upon several research reports and information from the hosting-related web sites, the author identified important factors that customers need to look into while selecting a hosting provider. These factors are presented below in a descending order of their importance to the customers:

- ***Guaranteed delivery (reliability of vendor).*** Customers would need to get a reliable hosting company that provides service virtually all time, with the uptime of at least 99%, guaranteed access 24 hours a day and 7 days a week.
- ***Quick implementation time.*** The implementation cycle time should be no more than 6–9 months.
- ***Vendor's reputation.*** Customers should select a well-referenced vendor that has a successful track of implementations, excellent customer service and maintenance.

- ***Financial stability.*** A hosting provider's financial position is very critical to support the ongoing business so that it can provide services over long term. Therefore, a customer, prior to making its final hosting decision, needs to fully investigate the hosting company's financial performance and results.
- ***Scalability.*** Hosting providers should offer services that scale as quickly as company develops.
- ***Appropriate security.*** Customers would need to get a hosting provider that provides layered data security and backup service. Moreover, only authorized escorted personnel should have access to data center.

3.4 Implementation and Future Development

Implementation Steps

The selection and implementation of an ERP system consists of several major steps that prepare a framework for successful implementation, identify an ERP software vendor and applications to be implemented, and install and implement the software. The main steps and their elements are presented in Table 3.2.

One of the critical elements in the first step is to develop a company's ERP vision. The vision should include objectives, needs, and expectations for implementing such a system, as well as an implementation model. Today, companies utilize several implementation models. One of them is associated with a combination of the "***best-of-breed***" applications, which are generally leading edge solutions developed independently by different ERP vendors and then often arranged into suites of ERP vendors or integrated by other specialized providers. For example, a company might decide to select SCM applications from SAP, HR from PeopleSoft Enterprise, and Financials from Oracle E-Business Suite. In this case, separate subsystem solutions are interfaced and not integrated[7]. However, a best-of-breed system requires addition efforts and software to integrate the system using enterprise application integration (EAI).

Another model is a "***single-source***" integrated ERP system from an ERP software vendor. This model provides an easy integration of all ERP applications, and component modularity give end-users greater purchasing

Table 3.2 Selection and implementation of ERP

Steps	Elements
Step 1 **Vision and Implementation Model**	• Form ERP selection and implementation team • Develop ERP vision (needs, objectives, implementation scope, and outcomes) • Identify the implementation model (one-vendor solution, best-of-breed solution, or outsourcing)
Step 2 **Vendor Selection**	• Develop selection criteria • Establish ERP software candidate list (four to six candidates) • Create Request for Proposal (RFP), and send it to the prospective candidates • Review their responses and identify three-four finalists • Request the finalists to demonstrate their packages • Select the winner and negotiate the contract
Step 3 **Analysis and Design**	• Identify implementation approach ("Big Bang" versus "Step-by-Step" approach, vanilla implementation vs. customization) • Process and data mapping • Prototype development
Step 4 **Development and Installation**	• Organize the implementation project • Justify the investment and budget the project • Define the performance measures for the new system • Create the initial detailed implementation project plan • Educate the project team • Assess integrity of the existing database • Install new or upgrade existing hardware • Install the ERP software • System conversion using the phased, pilot or parallel approach • Educate the ERP users • Define and refine procedures for the new system • Ensure integrity and accuracy of the data
Step 5 **Go Live and Operations**	• Bring the first module/product/plant live, refine and adjust. Repeat the same for other modules/products/plants • Improve continually • Support and ongoing training • Patching and upgrades of the software

flexibility and lower implementation costs. However, issues remain over scope of functionality and better ROI for type and size of users. It has been a ***periodically alternating pattern*** in terms of preferring best-of-breed or single-suite ERP systems. According to some sources, the integrated vs. best-of-breed ERP debate still goes on in some organizations, but the suite advocates are clearly winning[1]. To choose a specific implementation model, a company needs to take into consideration a variety of factors including size of the company, industry the company belongs to, ability to integrate various applications, and projected investments.

Selection of the best ERP vendor should be based on the following criteria:

- ***Features and functionality***–the capabilities that ERP software has to fulfill the company's needs; the multiplicity of features and applications that the vendor can provide
- ***Estimated total cost of ownership (TCO)*** as defined in ERP Issues
- ***Provided service and support***-quality and timeliness of a vendor's product installation, service availability, customer service, business consulting, and system integration
- ***Financial viability*** of the vendor to provide long-term service for the company (vendor's revenues, growth margins, earnings per share, fundamentals ratios, etc.)
- ***Technical execution***-ability of the vendor to meet industry milestones (R&D capabilities in comparison to those of other vendors).

In addition to the four key criteria, the company may incorporate in software selection other criteria including development time, customer references, personal connections to the software vendor (I don't think this is a valid criterion, since it is subjective rather than objective, though I suppose it brings the human element into consideration), existing partnership with the vendor, and some others.

The importance of the four criteria and their ranking depend on the specific e-commerce project and the company's need to emphasize specific development and implementation targets. Typically, however, the

Functionality criterion represents up to 1/3 of the total criteria weight. The same, up to 33% of the total weight, is usually given to the *Cost* criterion, and the other two criteria (*Service and Support,* and *Ability to Execute*) represent together the remaining 1/3 of the total weight.

Measuring Implementation Results

To monitor and analyze implementation processes and results, a company needs to put in place a system of ERP key performance measurements. This system should describe financial results of implementing ERP, process and operational improvements, customer and supplier satisfaction, and system/IT performance results. Possible measurements of ERP implementation are presented in Table 3.3.

Table 3.3 ERP Implementation measurements

Key Performance Measurements' Group	Possible Indicators	
Financial Results	• Inventory cost reduction • Labor cost reduction • Quality cost reduction • IT cost reduction	• TCO cost reduction • Return on investments • Financial payback • Higher revenue/profit
Process and Operational Improvements	• Increased sales • Improved product and service quality • Productivity growth • Improved planning and scheduling	• Order-to-fulfillment time reduction • Procure-to-pay time reduction • Inventory level reduction
Customers, Employee, and Supplier Satisfaction	• Improved stakeholder service and support • Improved customer satisfaction • Improved employee satisfaction • Improved supplier relationship	• Successful employee training • Number of customer complaints • Number of employee complaints
Systems/IT Performance Results	• Increased IT infrastructure capability • Availability of information • Reliability of information	• System response time • Data accuracy and responsiveness • System integration

The Future of ERP

In more than 30 years of evolution, ERP systems have undertaken a significant transformation from function-specific applications to fully integrated process-driven systems. These systems operate over the Internet and contain both back-end and front-end capabilities. Being one of the main enterprise-based computer architecture and business applications, ERP systems have been experiencing a dramatic growth in sales for the past 10–12 years, and, according to various forecasts will continue to grow in the future. The further development of ERP systems will be associated with[8, 9]:

- ***Merger and acquisition of ERP systems***, as well as their *consolidation*. For example, in 20042008 Oracle Corporation acquired a variety of ERP-related companies including PeopleSoft with JD Edwards, Siebel, Retek, Hyperion, Agile Software, BEA Systems and others. In addition, implementing these applications separately, Oracle is working on combining all these software applications into one integrated system—Oracle Fusion. Microsoft Corporation also acquired a number of ERP-related applications that have been consolidated into the Microsoft Dynamics unit. This unit in the future will be integrated with Microsoft Office applications.
- ***Increased penetration into the small and mid-size enterprise (SME) market,*** which represents developing and marketing low cost ERP systems for SME
- ***Continuous development of specialized (vertical) ERP systems*** for different industries (retail, health care, education, etc.)
- ***Development of service-oriented architecture (SOA) and web services.*** This designates a possibility of using on-demand (as needed) ERP applications for SME. In addition, it will facilitate the modular design of the ERP software. For example, SAP NetWeaver platform will allow customers to select different ERP applications as needed and connect them to existing systems.

3.5 Chapter 3 Summary: Managerial Aspects of ERP

1. ***Enterprise Resource Planning (ERP)*** is an integrated computer-based system that manages internal and external organization resources. ERP is also an application and software architecture that facilitates information flows between various business functions inside and outside an organization and, as such, is an enterprise-wide information system.
2. Introduced in the early 1990s, the term "ERP" does not reflect the real capabilities of the system it represents. First, ERP systems provide not only planning but also other management functions such as organizing, controlling, scheduling, reporting, and analyzing business processes. ERP has crossed the boundaries of being just a system for planning internal resources. It may often contain "front-end" applications of managing customers and collaborating with suppliers As such, this integrated system should be described as an extended enterprise management system or extended ERP system.
3. The majority of modern ERP systems are fully Internet-enabled systems that usually contain three main tiers: clients, applications/Web server, and database server. Some ERP systems have been developed with separate applications and Web servers, which would define them as four-tier.
4. ERP systems are considered a backbone of e-commerce solutions. Successful utilization of the "front-end" e-commerce solutions is unimaginable without strong support by and cooperation with the internal "back-end" computer systems. In fact, many ERP vendors combine ERP applications and e-commerce solutions in one integrated computer system.
5. The two main ERP principles are integration and automation. ***ERP integration*** is based upon a single logical database system operating on a common computing platform, an integrated set of commonly designed business applications, and integration between internal company applications and external applications for accessing customers and suppliers. ***ERP automation*** represents the ability of an ERP system to automatically process business transactions and

information between different processes and functions inside an organization, as well as between this organization and its customers and suppliers.

6. One of the important ERP features is that it is a ***process-driven system***. In contrast to individual and function-driven computer applications in marketing, finance, or operations, an ERP system integrates these functions into a variety of computer-based processes. They represent real business processes that companies apply to managing resources, working with customers and suppliers, etc. Other features of ERP systems include: relational database, company-wide access to information with multiple simultaneous accesses, scalability, internet-based architecture, and various implementation platforms.
7. The ***Supply Chain management (SCM)*** group of ERP is associated with the applications of planning, scheduling, executing, monitoring, and reporting material and information flows from suppliers. ***Financial Management (Financials)*** is another major group of ERP that includes accounting and financial applications, as well as applications to analyze and optimize market forecasts, credit risk of new contracts, cash flow and liquidity, financial portfolio, and market risk. The ***Human Resource Management (HRM)*** group of applications is capable of performing a variety of human resources functionalities, i.e. maintaining employee records, recruitment, payroll, administration, compensations and benefits, education and training, employee self-service, etc. The ***Customer Relationship Management (CRM)*** group of applications includes a set of applications related to customer interactions with the company, managing customers' demands and orders, and improving customer satisfaction. Finally, the ***Product Lifecycle Management (PLM)*** group is a relatively new group of ERP applications used to provide information, planning, and analysis of product lifecycle processes including research and development, product introduction, product service and support, and end-of- life processes.
8. Within each group, the ERP system may be clustered into ***three categories of applications*** including core (traditional) applications,

applications' enhancements and business intelligence, and e-commerce applications.

9. In general, the implementation of an ERP system should increase the reliability of a company's information; provide full access to this information at any point of time; automate a variety of tasks and processes in different organizational functions; improve forecasting, planning, scheduling, and reporting; and facilitate external collaboration with customers and suppliers. These improvements may lead to a shorter order-to-market time; lower inventory levels; more efficient and effective management of resources; and, as a result, major cost savings and increased return on investments (ROI).
10. Despite the benefits, ERP systems remain the most complicated, time-consuming, and costly computer-based systems. Implementation time and software cost depend on the company's size, number of implemented applications (modules), and level of planning and preparation of the implementation process. Successful ERP implementation is impossible without thorough preparation and efficient management of the implementation process. These require strong executive commitment and involvement in the ERP implementation process from start to finish; an empowered implementation team that needs to define objectives, outcomes, and implementation strategy; clearly developed education and training strategies; and full communication of ERP plans to the company's employees.
11. ERP systems require virtually a life-changing experience for everyone involved. A company that implements ERP and its employees need to overcome traditional conservatism in utilizing a previously unknown computer system, which has new input forms, output reports, functionality, etc. Thus, extensive and consistent training of all involved employees becomes a critically important element of a successful ERP implementation.
12. The selection and implementation of an ERP system consists of several major steps that prepare a framework for successful implementation, identify an ERP software vendor and applications to be implemented, and install and implement the software. Today, companies utilize several implementation models. One of them is associated with a combination of the *"best-of-breed"* applications,

which are generally leading edge solutions developed independently by different ERP vendors and then often arranged into suites of ERP vendors or integrated by other specialized providers. Another model is a *"single-source"* integrated ERP system from an ERP software vendor. This model provides an easy integration of all ERP applications, and component modularity give end-users greater purchasing flexibility and lower implementation costs.

13. To monitor and analyze implementation processes and results, a company needs to put in place a system of ERP key performance measurements. This system should describe financial results of implementing ERP, process and operational improvements, customer and supplier satisfaction, and system/IT performance results.
14. The further development of ERP systems will be associated with merger and acquisition of ERP systems, as well as their consolidation; increased penetration into the small and mid-size enterprise (SME) market; continuous development of specialized vertical ERP systems for different industries (retail, health care, education, etc.), and development of ERP service-oriented architecture (SOA) and web services.

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Designing and Implementing an E-Commerce System

Zinovy Radovilsky

Dr. Zinovy Radovilsky is Professor of Management in the College of Business and Economics at California State University, East Bay. He has more than 20 years of experience in teaching operations and supply chain management courses. Dr. Radovilsky has been a business consultant to leading U.S. companies and organizations and has done extensive research in the areas of enterprise resource planning (ERP), e-commerce business models and management, quality management, and quantitative business methods. He published a number of papers in international and domestic peer-reviewed journals. Dr. Radovilsky is also a managing editor of two research journals

BUSINESS EXPERT PRESS

cognella academic publishing
www.cognella.com 800-200-3908

e-ISBN 978-1-63157-210-4