METHODOLOGY FOR APPRAISAL OF DYNAMIC E-COMMERCE BUSINESS MODELS

by

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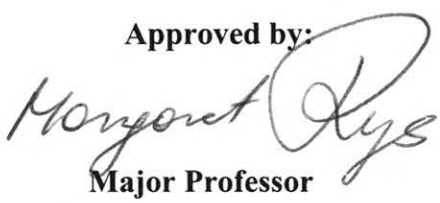

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ABSTRACT

E-commerce is transforming the way products, services and information are bought, sold and exchanged. Companies are discovering that a well-planned and executed e-commerce presence is crucial to overall business success. Statistics show that e-commerce is growing very rapidly. According to Goldman Sachs Investment Research [May 2000], the expected worldwide gross value of commerce transactions being done online is to grow to 7.6 trillion by 2005 from 225 billion in 1999.

One of the most significant determinants of online business performance is the business model. The business model spells-out how a company makes money by specifying where it is positioned in the value chain. Given the central role the business models play in a firm's performance, it is important to be able to understand how one business model compares with another. When making choices about the components and linkages of a business model, a firm needs to be able to determine which business model alternatives are best. A good analysis of competitors also ought to include a comparison of business models.

This thesis aims at developing a methodology to compare the e-commerce business models with respect to pre-defined parameters, which signify the robustness of any e-commerce business model. After a detailed literature review of the broad business model categories (B2B, B2C, C2B and C2C) and current e-commerce business models, generic models were selected and a taxonomy for the models was developed. Parameters for appraisal of the business models were identified. Each attribute for all the business models was assigned a numerical score (based on sub-attributes and qualitative factors) on a bipolar scale and normalized weights were assigned for each attribute. Different Multiple Attribute Decision Making (MADM) techniques were applied to the decision matrix to rank the business models, and the results of the techniques were then compared. Sensitivity analysis was performed to evaluate the effect of changes in input variables on the ranking of business models. Programs in C language were developed for carrying out both MADM and Sensitivity Analysis simulations. Results show that the Auction model is the strongest business model while Advertising model is the weakest.

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Chapter 1

E-COMMERCE TRENDS AND STATISTICS

1.1 Introduction

The rapid growth of the Internet and World Wide Web in recent years has led to the development of new ways to conduct business. Electronic commerce, or e-commerce, has been the booming industry worldwide and is viewed by many as the gold rush of the new millennium. In fact, the so-called "dot.com" revolution has seen the formation of multi-billion dollar companies in an extraordinarily short period of time [E-commerce white paper –IBM, 2000]. Crucial to the success of these businesses, is the manner in which they have adapted to this new and untested medium called e-commerce.

1.1.1 What is e-commerce?

E-Commerce is the practice of buying and selling products and services over the Internet, utilizing technologies such as the Web, electronic data interchange, email, electronic fund transfers, and smart cards [Afuah and Tucci, 2000]. E-commerce is a very broad field and incorporates business transactions, dealings and the transfer of information. The mechanism used is electronic and is used over connected networks. For example, the vast growth of the Internet has made it the main proponent in E-commerce. Although there are other mechanisms to transfer data and include Local Areas Networks (LAN's), Wide Area Networks (WAN's), and Metropolitan Area Networks (MAN's), the Internet is however the largest network [Rand and Nawaz, Lancaster University Management School, 2000]. E-commerce originated with the intention of providing a link between customers and businesses. Practically speaking when two businesses interact over the Internet this process is termed E-business and is a constituent element of E-commerce. Electronic commerce is now one of the most significant drivers of both successful business development and national economic development of any country. It is a form of business operation in which the era of truly global markets and global competition has

arrived. Throughout the world, leading enterprises in all sectors of economic activity are changing their business strategies to make more effective use of Internet technologies in their operations – including marketing, product development and distribution.

1.1.2 Why should companies adopt e-commerce?

The compelling reasons to bring the businesses to the Web apply to just about any organization, whether manufacturing, distribution, merchant, service or any vertical industry marketplace. Foremost, the growth of e-commerce is explosive [Merrill Lynch Internet Research; Forrester Research, 1999]. E-commerce is more than online transactions between buyers and sellers. It's the only way to compete in today's changing business environment. The real power of the Internet comes from improved business efficiency and customer service. Effective e-commerce solutions focus on the complete sales process—marketing, sales, customer support and communication with suppliers. By integrating proven business applications, systems and data with the rich multimedia functionality of the Internet, companies can streamline their entire operation while building a solid customer base and driving sales. While the size of the business, its position in the marketplace and the strategic objectives may direct exactly how they use this medium, e-commerce offers unlimited opportunities to leverage the Web's global reach and generate new revenues by evolving their business model to the Web. Following are the few advantages of adopting e-commerce [E-commerce white paper – IBM, 2000]:

a. Opening of new marketing and sales channels

As a marketing and sales channel, the Internet provides new ways to reach wider markets, enhance service in local geographies and accommodate seasonal sales cycles. By leveraging the established business model, e-commerce presents opportunities to complement existing channels and relationships while reducing business cycle times, improving cash flows, reducing inventories, decreasing administrative costs and opening new marketing and sales channels.

b. Enabling customers to reach 24 hours a day

Using e-commerce, companies can offer products and services to a global market and expand sales season without investing in bricks-and-mortar storefronts worldwide. When they offer 24/7 access to their products and information, they make it easier for customers to make intelligent purchasing decisions, saving them both time and money. They add value to their business while providing the convenience that will keep their customers coming back.

c. Delivery of high-availability customer support

Providing self-service opportunities through the Web allows the companies to deliver high quality, low-cost customer support. By creating an easy-to-use Web site that enables customers to view instructions and download how-to documents, they can support a larger number of customers without growing their support staff in proportion—which can result in higher profits. Providing after-sale customer support can transform customer satisfaction into customer loyalty while decreasing the cost to service each customer.

d. Building of customized e-commerce sites

Customization of the web sites (appearance and functionality) according to the tastes and interests of the customers helps attract customers. Web technologies and databases give the companies the opportunities to customize and personalize products and increase the usability of services offered on the site. They can leverage the power of the Internet with a transaction-ready online catalog with buy-now buttons, shopping carts, payment processing and customer-service links. This increases convenience for new and existing customers. The companies can broaden their presence through online banner advertisements that promote their site and reinforce branding messages.

1.2 Determinants of Business Performance

Most firms are in business to win, to outperform their competitors. They are in business to make money. They are adopting **e-commerce** to fend off new competition, reinforce an existing business advantage, leapfrog competitors, or just to make money in the new markets [Afuah and Tucci, 2000]. Only by understanding the determinants of business performance, firms would be in a better position to comprehend how a technology such as **Internet** impacts that performance and how firms can exploit the new technology. There are three major determinants of business performance: business models, the environments in which businesses operate, and change [Afuah and Tucci, 2000].

a. Business Model

A business model is the method by which a firm builds and uses its resources to offer its customers better value than its competitors and make money doing so. The model is what enables the firm to have a sustainable competitive advantage to perform better than its rivals in the long term. The business model spells-out how a company makes money by specifying where it is positioned in the value chain. It specifies the value that a firm offers its customers, the segment of customers it targets to offer the value to, the scope of products/services it offers to which segment of customers, its sources of revenue, the prices it puts on the value offered its customers, the activities it must perform in offering that value, the capabilities these activities rest on, what a firm must do to sustain any advantages it has, and how well it can implement these elements of the business model. The selected business model components and linkages do not last forever, because everything is relative. What may be right today may not be right in the changed technological and competitive environment tomorrow. Managers often have to change some components or relationships before competitors do it for them. Firms have to keep reinventing their business models. They have to cannibalize themselves before someone else does.

b. Competitive and Macro environment

Firms formulate and execute their business models in a competitive environment. They face competitors who have their own business models, who are just as interested in making money, and who may be equally capable of offering the same level of value to the customers. Beyond the competitive environment is the macro environment of government policies, natural environment, national boundaries, deregulation/regulation and technological change. The government plays one of the most important roles of the macro environment in terms of firm profitability.

c. Change

The last determinant of firm performance is change. Change can come from competitors, suppliers, customers, demographics, the macro environment, or the firm itself. Its role is more indirect than direct. Change impacts business models or their environments, which can translate into higher or lower profitability. The impact of change on a firm's performance is a function of the type of change. Radical or disruptive change can render existing business models obsolete and drastically alter the competitive landscape in existing industries or create entirely new industries while killing old ones.

1.3 Business Models for E-commerce

As defined earlier, a business model is the method of doing business by which a company provides value to its customers and in turn makes money. Internet commerce is currently comprised of four categories of business models [Rappa and Timmers, 2000]:

1) B2B (Business to Business)
2) B2C (Business to Consumer)
3) C2C (Consumer to Consumer)
4) C2B (Consumer to Business)

Business to Business

B2B electronic commerce allows businesses to sell between each other in a streamlined and paperless manner. B2B reduces company-operating expenses, broadens the reach of potential suppliers, and generally reduces the price paid for product components and services. Dell is an example of B2B company: Suppliers and corporate consumers visit Dell's Web site to both exchange corporate information and transact business. Component suppliers make bids and financial exchanges via the Dell Web site, which results in reduced operating costs for both Dell and the supplier in addition to speeding the flow of orders. Corporate consumers speed the purchase of computer hardware, customize their company's computer configurations, and track orders in real time via Dell.com. A B2B exchange like PaperExchange (see figure 1.1) brings together buyers and sellers of paper, and can significantly reduce the costs of searching for suppliers, keeping track of prices and creating the perfect match between buyer and seller.

B2B can be further categorized into two fields [Goldman Sachs Investment Research, November 1999]:

Vertical Marketplace: B2B marketplace for a specific industry, such as electronics component marketplace, semiconductor marketplace, automobile industry marketplace, etc. A typical example of Vertical market place is Metalsite.com, which caters to the vertical market of metals.

Horizontal Marketplace: B2B marketplace for a particular function across general industries, very suitable for application service providers (ASP's) to develop digital marketplace for small-to-medium size businesses. A typical example is MRO.com, which caters to the maintenance, repair, and operating procurement of small businesses.

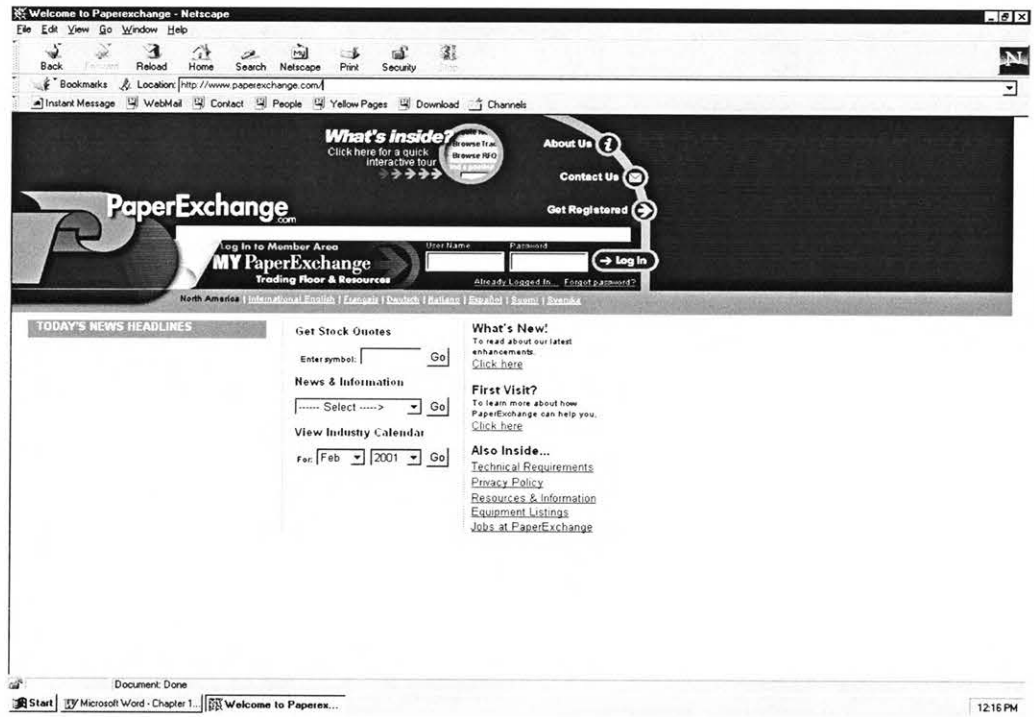


Figure 1.1 B2B example: Paperexchange (Source : *www.paperexchange.com)*

The nascent market for B2B Internet commerce would experience tremendous growth in the future [Merrill Lynch Internet Research; Forrester Research, 1999]. While forecasts for B2B currently span a wide range of estimates, they all demonstrate the immensity of the space, both in the short and long term. As B2B technology infrastructure and new commerce models (such as online auctions) continue to develop, it is expected that B2B Internet commerce will amplify as well.

Business to Consumer

In this form of electronic commerce, businesses sell directly to end consumers via their corporate Web sites (example Barnesandnoble.com – see figure 1.2). B2C permits businesses to foster a direct relationship with customers and also reduces company-operating expenses. The most visible of all B2C businesses is Amazon.com: consumers browse and/or search online catalogs of products, select, and often fill "shopping carts"

with products. In addition to displaying product pictures and prices, B2C sites often provide consumer reviews and assist in product recommendations. Forrester Research [Forrester Research, 2000] expects B2C Internet commerce in the United States to increase to approximately $108 billion in 2003 from $8 billion in 1998. Widespread consumer adoption of the Internet as a medium for purchasing products and services has led to the rise of numerous online retailers such as Amazon.com, Barnesandnoble.com, and CDnow. The leading product categories for B2C

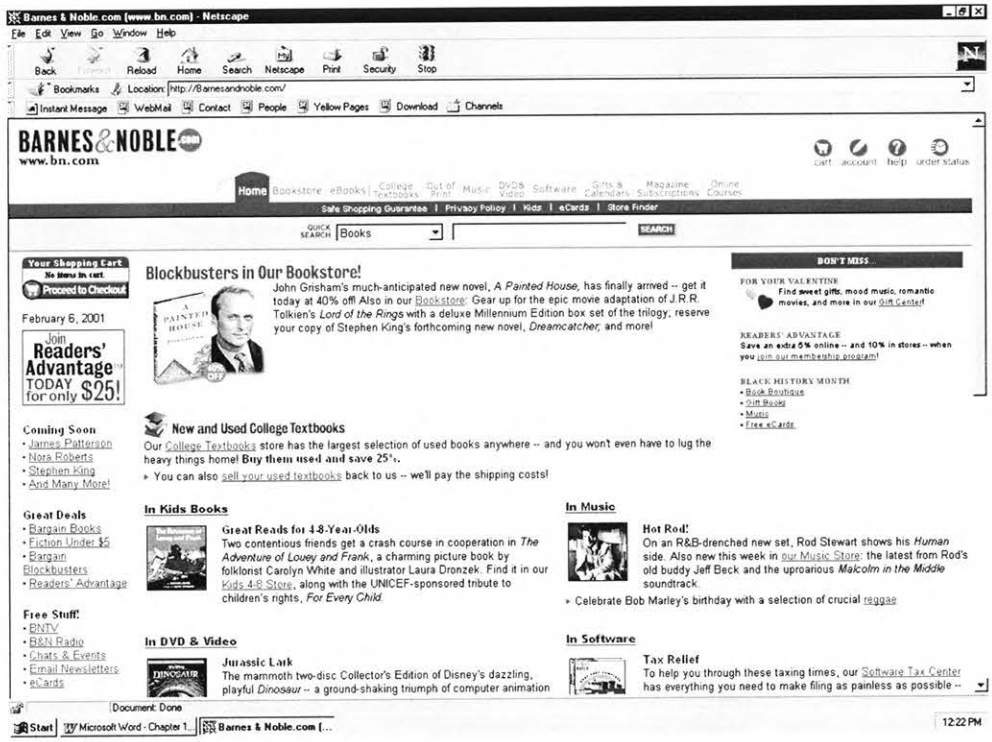


Figure 1.2 B2C example: Barnesandnoble (Source: *www.barnesandnobles.com)*

Internet commerce includes technology products (computers and electronics), books, apparel, groceries, and music.

Consumer to Consumer

This includes online trading activities conducted between individual consumers only, such as eBay (see figure 1.3), Yahoo Auction and Amazon Auction. In C2C, consumers

sell to other consumers. It also includes building an online community and networking special interest groups. Internet commerce has traditionally been conducted through trading forums such as classified advertisements, collectibles shows, garage sales, and flea markets, or through intermediaries, such as auction houses and local dealer shops. These markets are highly fragmented and inefficient, making C2C trading difficult. Despite these obstacles, it is believed that the U.S. market for traditional C2C trading, including auctions, classified ads, and collectibles, exceeded $100 million in goods sold

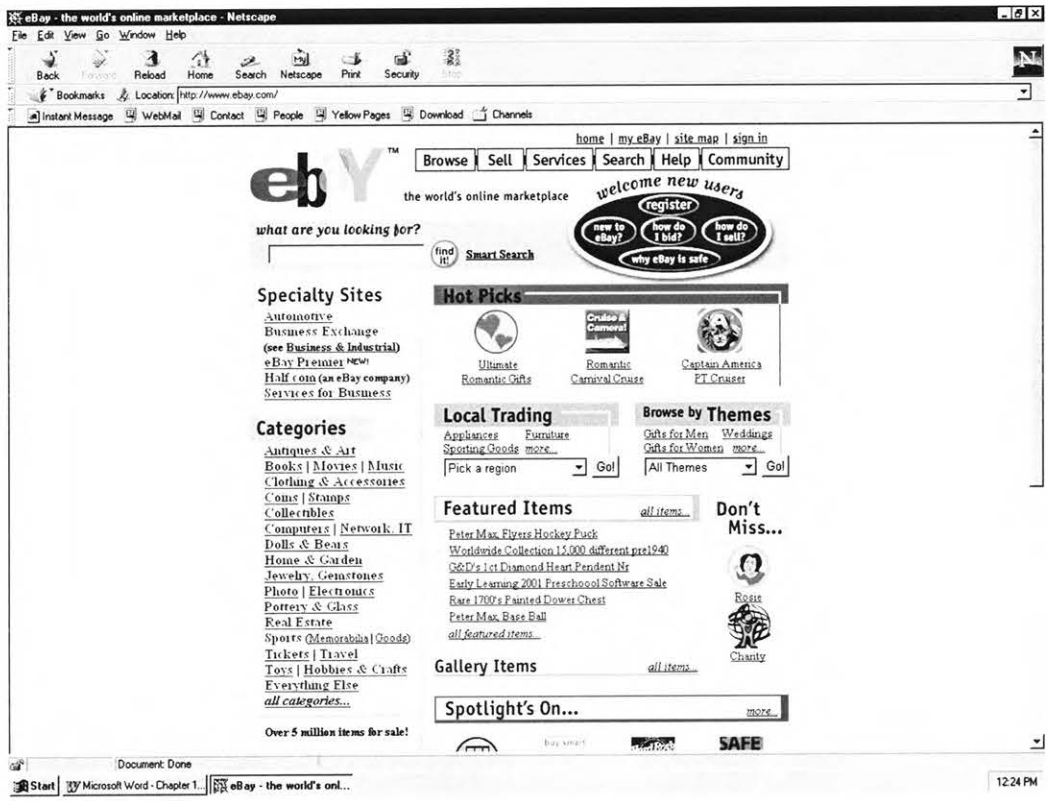


Figure 1.3 C2C example: ebay (Source: *www.ebay.com)*

in 1997 [Goldman Sachs Investment Research, November 1999]. Applying the Internet medium to C2C trading has the potential to expand this market, creating a substantial market opportunity. The online portion of this market could grow 145% annually to $3.8 billion in 2001 from $0.1 billion in 1997 [Goldman Sachs Investment Research, 1999]. eBay was the pioneer and is currently the dominant market leader of this large and rapidly growing market.

Consumer to Business

This includes online requesting-for-quotation (RFQ) activities conducted between individual consumers and business, and allowing consumers to send purchase requests or quotations (Build-To-Order or Design-To-Order request) directly to business, such as Dell, eWanted and eWork. In PriceLine's (see figure 1.4) consumer-to-business model,

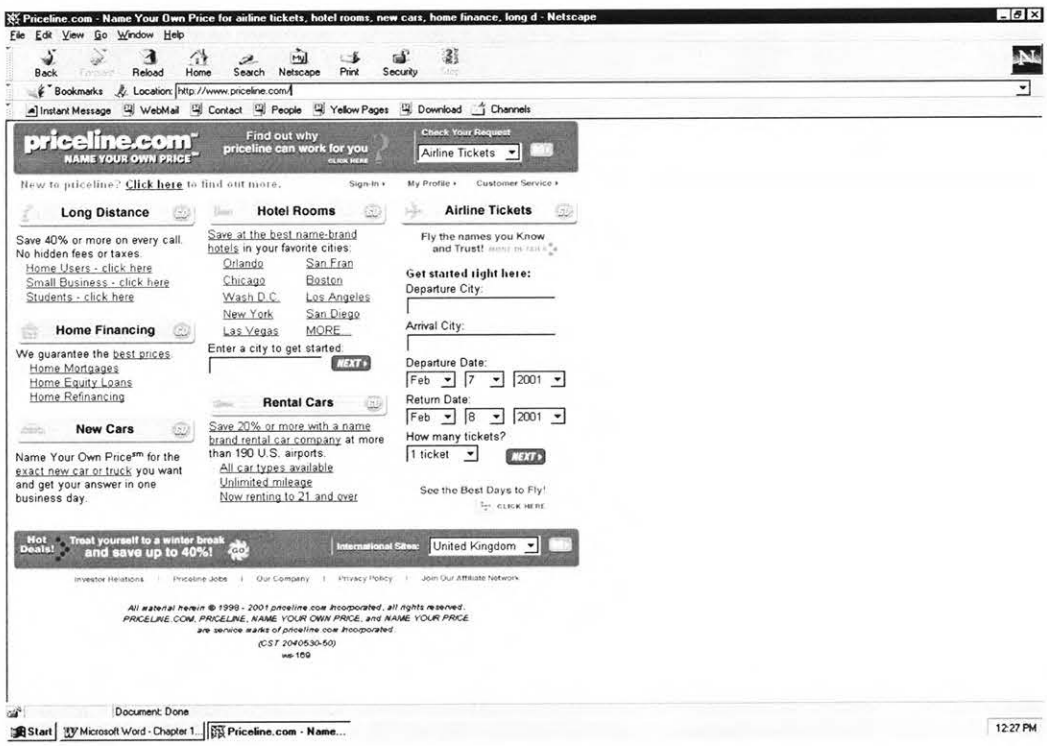


Figure 1.4 C2B example: priceline (Source: *www.priceline.com)*

consumers state their price, the firms take it or leave it. Under Priceline's model, potential customers name their prices for a flight and leave them for the airliner to accept or reject. This contrasts with B2C where a firm usually states its price for a product or service and customers take it or leave it. While no traditional model exists for C2B Internet commerce, the market for C2B is significant. Priceline.com's enormous success has proven that C2B presents a viable market opportunity. It is estimated that C2B Internet commerce in the United States will grow to $135 billion in 2003 from $106 billion in 1998 [Goldman Sachs Investment Research, November 1999]. These estimates

are restricted to C2B models that are currently Web-enabled, and it is expected that the estimates would increase substantially as new models move online.

Figure 1.5 shows the split between B2B, B2C and C2C market as of 1999. Business-to-business commerce on the Internet is generating significant capital market attention.

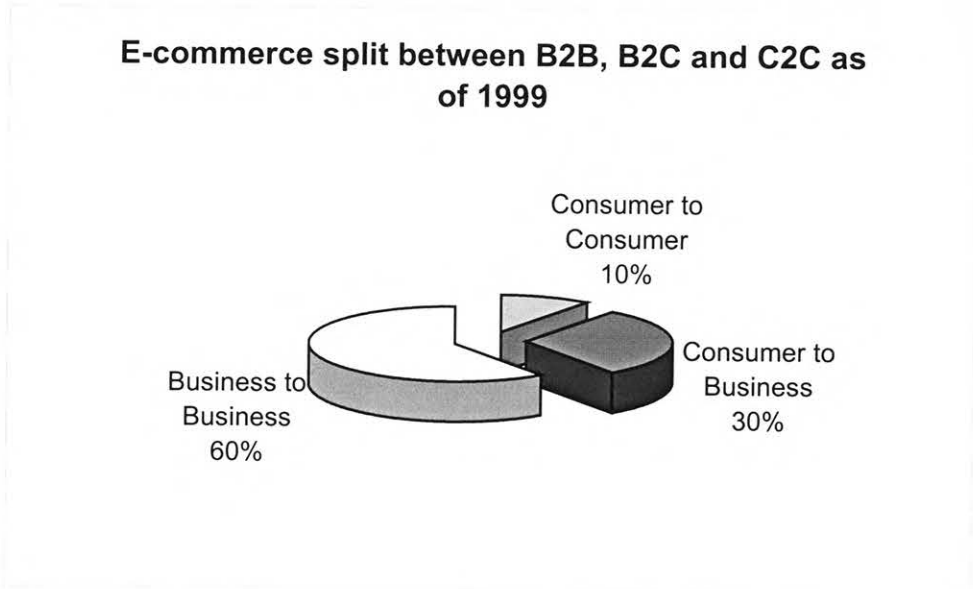


Figure 1.5 E-Commerce Split between B2B,B2C and C2C as of 1999
Source: *GOLDMAN SACHS Research estimates, November 1999.*

Market valuations of B2B companies were initially based on the size of the addressable market (i.e. gross transaction values) and the apparent opportunity to remove inefficiencies (i.e. cost savings) from the supply chain. In B2B there is a much sharper needs-based segmentation. Figure 1.6 shows anticipated share of B2B economy by industry segment. Projections show that B2B market is very large and is anticipated to have tremendous growth (Figure1.7) [Merrill Lynch Internet Research; Forrester Research, 1999]. As more companies move portions or all of their business operations online, the gap between the market size of B2B and B2C Internet commerce should continue to widen. Nearly $7.3 trillion will be exchanged globally through B2B e-commerce by 2004, according to GartnerGroup. This is staggering when we consider the value of all goods and services currently sold in the US – the Gross Domestic Product

(GDP) is approximately $9 trillion [Goldman Sachs Investment Research, November 1999]. The rise of B2B e-commerce would radically alter the fundamental inner-workings of the business economy.

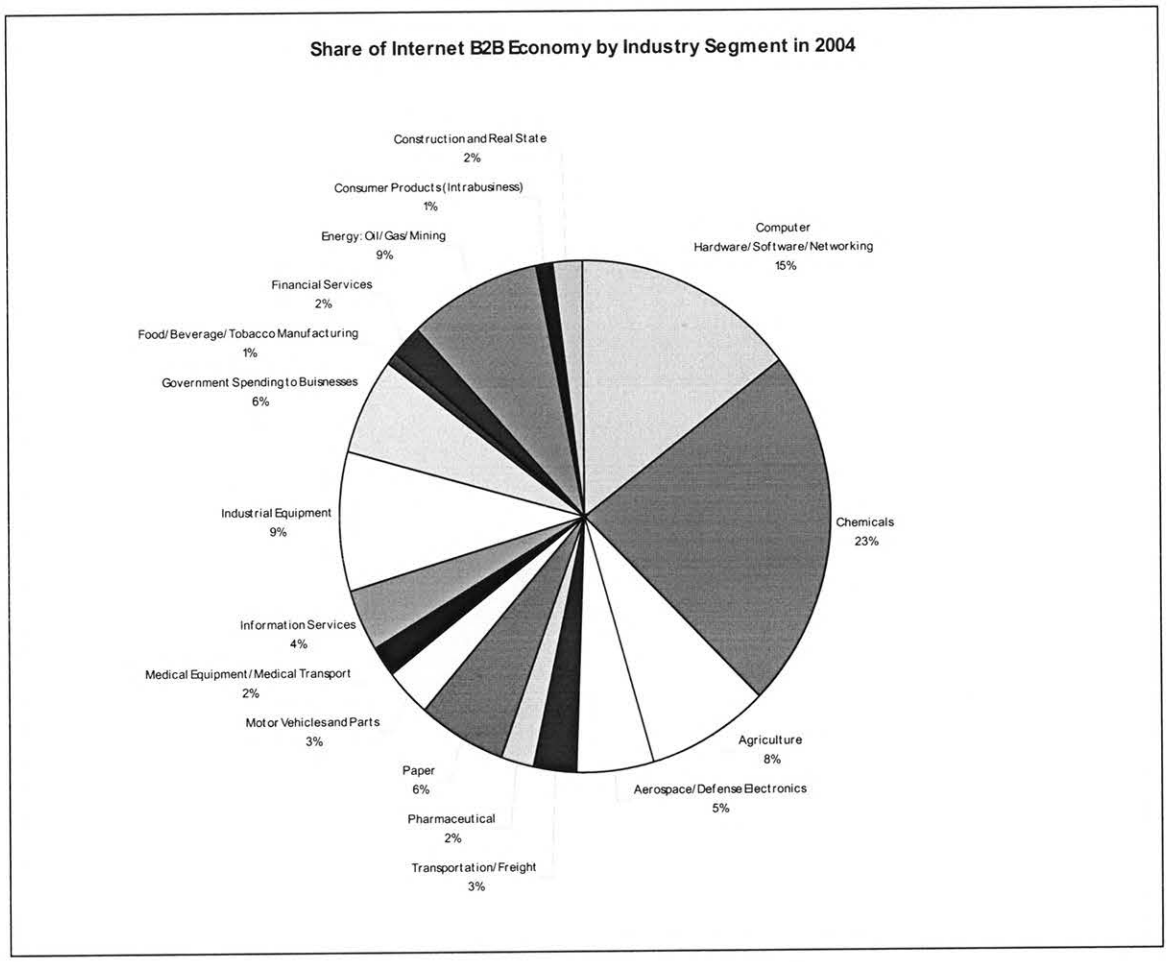


Figure 1.6 Anticipated share of B2B economy by Industry Segment

Source: *Goldman Sachs Investment Research, 1999.*

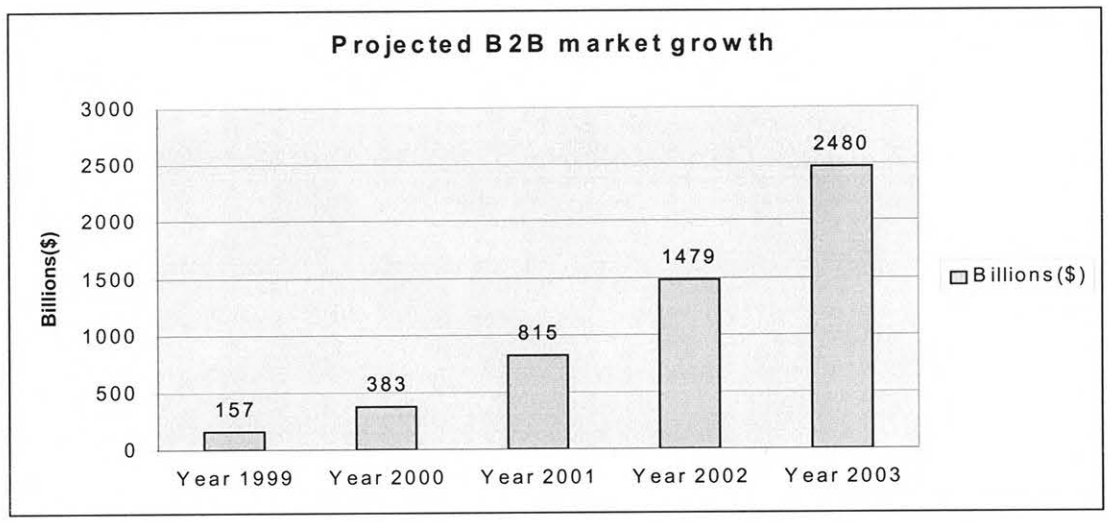


Figure 1.7 Projected B2B Market growth

Source: *Merrill Lynch Internet Research; Forrester Research*

1.4 Research Objectives

E-commerce is growing at a rapid pace. According to Goldman Sachs Investment Research [Goldman Sachs Investment Research, May 2000], the expected worldwide gross value of commerce transactions being done online is to grow to 7.6 trillion by 2005 from 225 billion in 1999. Table1.1 shows the worldwide figures for online gross revenues.

Table 1.1 Worldwide E-commerce gross revenues in billions (US dollars), 1999-2005
Source: *GOLDMAN SACHS Research estimates, May 2000.*

	1999	2000	2001	2002	2003	2004	2005
USA	178	395	744	1174	1791	2655	3530
CANADA	3	13	28	53	84	128	190
EU	44	173	380	713	1122	1708	2527
JAPAN	-	-	19	76	167	314	495
LATIN AMERCIA	-	-	6	24	53	102	164
MIDDLE EAST & AFRICA	-	-	-	1	6	12	23
EASTERN EUROPE	-	-	2	9	20	38	60
NON-JAPAN ASIA	-	13	54	123	237	378	584
TOTAL WORLD	**225**	**595**	**1234**	**2714**	**3840**	**5335**	**7572**

As figure 1.8 shows, the E-commerce revenue is growing at an exponential rate. At this rate, if the companies fail to adopt the change now, their vary survival will be at stake. To paraphrase Nicholas Negraponte from the MIT Media Lab: "Not knowing how to incorporate e-commerce into a business strategy will be more lethal than not knowing how to use the telephone for business". E-commerce is happening, and people are making enormous success out of it, sometimes giving brick-and-mortar establishments a run for their money as Amazon has done. In a rapidly changing world, if one is not focusing on the opportunities and advantages opened by e-commerce, the customer, supplier and the competitor is; companies should better focus on the opportunities for defensive purposes, if not using it as a potential offensive weapon.

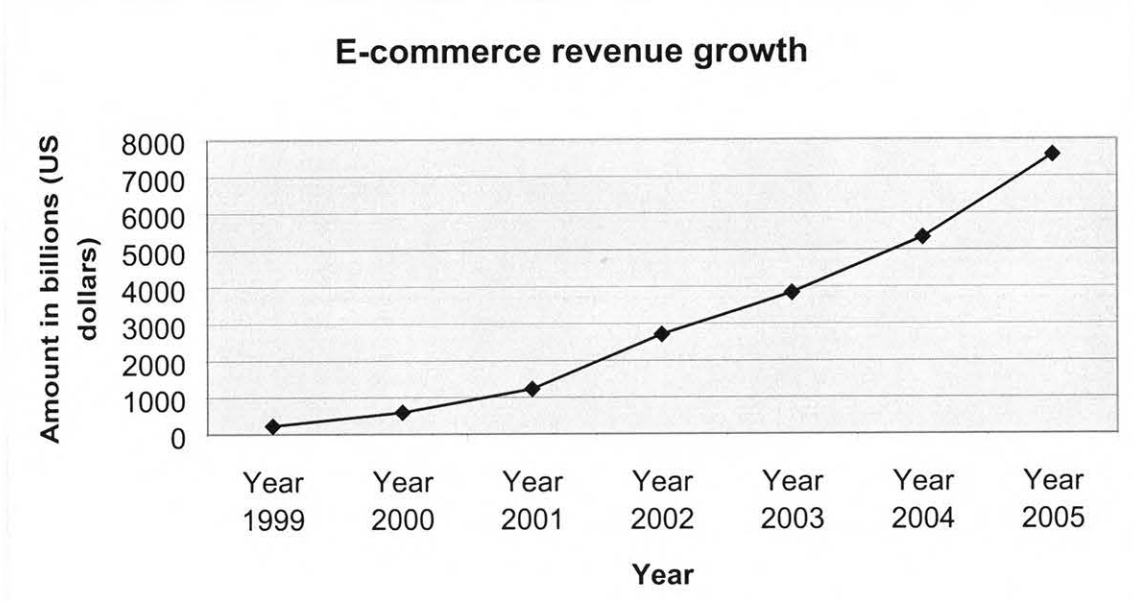


Figure 1.8 E-commerce revenue growth

Source: *GOLDMAN SACHS Research estimates, May 2000.*

Given the growth (see figure 1.9) and potential of e-commerce, it has attracted a lot of attention, both from industry and academicians. Since this technology is relatively new, people are still trying figure out how to harness the power of electronic commerce. Lot of research is going on, in various fields of e-commerce. One of the most significant

questions grappling the companies today is - what is the best E-commerce business model for them? As of now, no formal methodology exists to compare the diverse business models, which would aid in model selection.

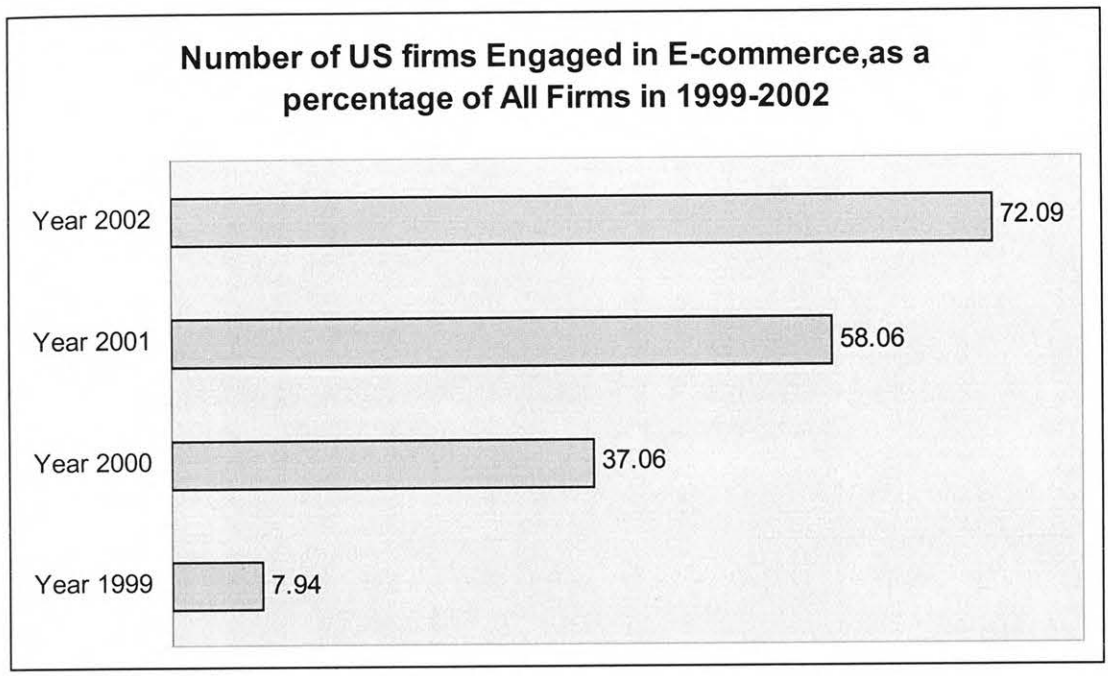


Figure 1.9 No. of US firms Engaged in E-commerce, as a percentage of all firms(1999-02)
Source: *eMarketer, 2000*

Business model plays a central role in a firm's performance. Success of a company highly depends upon the choice of the business model. How can a company decide which business model is most suitable? There is a need for such a methodology, whereby the different business models can be compared on a common platform with respect to pre-defined dimensions, to aid in model selection. Many of the traditional brick-and-mortar companies, which have been late in adopting the e-commerce, are now vehemently trying to adopt Internet and make an existence on the web. Which business model should these companies choose? This thesis would tend to answer such questions, which are significant to a company's strategic decisions.

The goal of this research is to develop a methodology to appraise diverse business models, which would aid the new startups and the existing brick and mortar companies to

choose the right business model for them. This research should also aid the existing e-commerce companies to have a good analysis of their competitors.

The research objectives can be broadly summarized into following areas:

- Identification of existing Internet business models and development of a taxonomy for the models.
- Identification of parameters for appraisal of the business models.
- Development of a methodology for comparison of the business models.
- Application of Multiple Attribute Decision Making techniques for appraising the business models.
- Verification and Validation of the comparison model to gauge robustness of the model and obtained results.

1.5 Thesis Overview

The remainder of the thesis is arranged into six chapters.

Chapter 2 gives an overview of the existing business models. Chief characteristics of all the business models are discussed and a taxonomy is formed whereby all models can be properly classified.

In Chapter 3, a discussion of real life examples of all major identified business models is carried out, to correlate theory with actual world. Some major companies (representative of the identified business model) are studied and their strategic initiatives, market potential, financial status and growth are discussed, which determine the strengths and weaknesses of the business models.

In Chapter 4, a methodology is developed for comparing the e-commerce business models. The parameters on which the business models can be compared are identified and techniques of Multiple Attribute Decision Making are applied to the decision matrix

thus formed. UNIX based C programs are developed to crunch the matrices for MADM methods.

In Chapter 5, verification and validation of the results obtained in Chapter 4 is carried out. A sensitivity analysis is done, studying the effect of change in values of input attributes on the final rankings of business models.

Chapter 6 contains the final conclusion with scope for future research.

Chapter 2

E-COMMERCE BUSINESS MODELS – REVIEW AND ANALYSIS

2.1 Introduction

The Internet has changed the way the world does business. Buyers and suppliers around the globe can now network with the click of a mouse. Information — from terms and conditions of service to specifications and complete, in-depth product catalogs — can be accessed in real-time. And electronic commerce is affordable for even the smallest home office.

There are tremendous advantages in doing business on the Internet [office.com, Jan 2001]. It can:

- Drastically increase sales
- Improve efficiencies and lower operating costs
- Enhance customer service and communication
- Expand marketing opportunities
- Provide the venue for growing operations from local to global

One of the greatest advantages of doing business on the Web is that it allows businesses to save money and time in their own operations. For example, the Internet can considerably reduce the costs associated with customer service. But how do we get to this promised land? Businesses must rethink the issues of marketing, supply-chain management, inventory and customer support, then formulate a Web-oriented business model. It's a new way of doing business. In essence, the existing business model has to be adapted to meet the technological requirements and advantages of this new landscape.

We now have a look at the existing online business models and determine: What are the main types of online business models? What are their advantages and disadvantages?

2.2 Business Model - defined

A business model can be completely defined by defining [Paul Timmers, 1998]:

- The architecture for the product, service and information flows, including a description of the various business actors and their roles
- Description of the potential benefits for the various business actors; and
- Description of the sources of revenues

The core of any e-commerce business model is built on the following five areas [office.com, Jan 2001]:

a. Service

Service is truly the key to the company's success. For that matter, all good retailers and e-tailers realize the critical role that quality customer service plays in their success. There exists, however, a strong dichotomy between what the brick-and-mortar retailer knows about customer service and what the online retailer knows. Many e-commerce sites view transactions as technical processes and not as interactions between people. As more companies realize that the buying experience and what follows after the sale are just as important, if not more so, as technology, e-commerce sites will reach new highs in sales and popularity. For example, with personalized recommendations, online/off-line customer service and strong post-sale follow-up, amazon.com has created one of the most successful e-commerce brands on the Web.

b. Selection

As with any off-line experience, e-tailers need to offer customers the right mix and quantity of products. On the Web, this equates to building a site with personalization and partnering with suppliers that can scale. Food.com is a good example of both extensive selection and targeted offerings. Food.com's food-shopping service offers the same

amount of product selection one would find in a brick-and-mortar grocery store. Through personalization, the site also offers products that shoppers are more likely to buy based on previous clickstreams and purchase behavior.

c. Emotion

Emotion speaks to the overall user experience: How do customers feel as they are navigating the site? Do they feel as if they are taking a leisurely stroll through one of their favorite stores? Or, do they feel like they are confused and rushed through the shopping experience? It's important for the type of products and target audience to match the design and level of intimacy.

Forrester Research [Forrester Research, 2000] says that 46 percent of Web users currently research purchases online. This behavior change will put e-marketers closer to a consumer's purchase decision than traditional media. This also brings them closer to the "emotional 3 feet" that manufacturers have dealt with for years, which is defined as the short distance between a consumer buying your product instead of the competitor's. Today, that emotional 3 feet isn't just a movement to the left or right on the supermarket shelf but a simple click of a mouse. Because of this, brand loyalty and user experiences need to be that much stronger.

d. Efficiency

When it comes to efficiency, we can think of the express lane in a grocery store. Can we imagine what would happen if every store had 1,000 lanes and no waiting? It is possible online, where customers want to move through the transaction process as quickly and as painlessly as possible. This means not having to input the same information twice in one visit; it means offering one-click ordering; it means tying inventory into the real-time database systems so customers can check quickly to see if a product can be shipped immediately. Efficiency is especially important now, in the initial stage of e-commerce, as the majority of consumers are purchasing for the first time.

e. Cost

While cost is always important, saving money is not one of the top reasons why consumers are currently shopping on the Web. One of the most important aspects is convenience, and if the site is extremely convenient, consumers will be willing to pay a little more for the products. Of course, as online competition heats up, price will become more important as the majority of products become commodities. The bottom line of the cost issue to charge as little as possible, but still be able to maximize cash flow enough to fund the technical improvements on the back end to deliver a powerful and convenient user experience. These are the same five building blocks as in traditional business operations. The difference, however, lies in how the strategies are executed. For instance, in traditional business operations, quality customer service is achieved through developing and implementing policies that allow for open communication with customers that enhance the experience they have with the organization.

On the Web, good customer service is achieved through a combination of technology and human interaction that personalizes the experience, answers questions and guides customers through the site.

By definition, traditional retail operations are also, by nature, somewhat limited in providing convenience, mostly because customers have to drive to a physical location. And most do a poor job of really knowing a customer's purchase history and preferences.

E-commerce breaks down the majority of barriers that most traditional brick-and-mortar operations face. A robust e-commerce site has the ability [office.com, Jan 2001]:

- Streamline inventory management, hence shipping goods seamlessly and directly from a wholesaler/distributor to the end customer.
- Penetrate markets worldwide.
- Enhance a brand through an "instant" global presence.
- Improve customer service by leveraging the Web as a communication tool.

- Cross-connect buyers and suppliers in a "virtual" manner via the Internet, thus providing a forum where a buyer's exposure to wanted goods and services and a seller's exposure to prospective buyers, are limitless and without boundaries.
- Decrease most of the associated traditional costs — rent, capital, inventory, sales and marketing — associated with a traditional company's operations.
- Provide an easy and inexpensive way to test a product or service before full deployment.

An example of a site that was able to improve its business model using the Web is musical equipment auctioneer RockAuction.com. RockAuction is operated by Daddy's Junk Music Stores, a traditional brick-and-mortar store specializing in used musical equipment. RockAuction leverages its online business model (with auction software provided by OpenSite Technologies Inc.) to sell its inventory of close-out and lesser selling items at a profit. They were selling such goods at a loss until they incorporated an e-commerce model with auction capabilities. Their first year in sales is projected to be in the several-hundred-thousand-dollar range.

Due to the expansiveness of the Internet, companies of all sizes and from all industries are scrambling to test a wide variety of business models to see what really works. Some of the models are well developed and carefully thought out; others are not. The following section discusses some areas, on which the business models are based.

2.2.1 Selling own products and services

The biggest advantage of selling own products online is control over quality, price, inventory and distribution. With centrally located operations and no dependency on suppliers who can hold up shipping time frames, risk of error is limited. Middlemen are cut out of the deal, saving another layer of expense. The real challenge lies in developing the infrastructure to manufacture and ship products at break-neck speed and on an affordable scale. One company that is using this model successfully is Omaha Steaks [office.com, Jan 2001]. This 92-year-old company has effectively adapted its mail-order

business model to work on the Web. By selling their own high-quality, high-end meats and gourmet foods online, the firm has increased sales exponentially through its newfound sales outlet. Omaha Steaks' online strategy is revolutionary from the perspective that they are doing it "right." Unlike many other online retailers, they are incorporating a well-rounded e-commerce approach, including:

- Offering Internet-only specials (i.e., a free knife set with an Internet order) to drive sales, thus recognizing that the cost of acquisition per customer from the Internet is less than the cost from traditional channels (i.e., mail-order catalogs).
- A partner program that gives other Web sites the opportunity to earn referral fees for any visitors they refer to the company who complete a purchase.
- Incorporating customer-retention tactics by adding value-added information to their site (i.e., recipes, "Food Facts") and community-building forums with its "Recipe Exchange," a place where visitors can share information.
- On the downside, a company like Omaha Steaks, which has to handle everything itself, can experience manufacturing and inventory headaches along with the challenge of effectively balancing supply and demand. Most companies need at least the following to establish their own e-commerce [office.com, Jan 2001]:

    1. In-house Web server, co-location Web server or hosting provider;
    2. Internet Merchant Account (IMA) (with bank or other 3rd party financial institutions);
    3. Credit-Card Processing Technology (Cash Register Service, i.e., CyberCash);
    4. Shopping Basket Technology (Virtual Shopping Cart);
    5. Security/Digital Certificates Technology (SSL);
    6. Fulfillment systems/database integration;
    7. E-commerce enablement software.

Start-up costs for an e-commerce site typically run from $1,000 to $100,000 and up, depending on the solution desired [office.com, Jan 2001]. Traditional "levels" of solutions include:

A. "Starter" Level — under $1,000

Basic Web storefronts that require little up-front investment for the "mom-and-pop" operation. Typical features at this level are:

- Rental-style solutions — lease commerce space from a hosting provider
- Simple tools for setup and configuration
- Template solutions
- Transaction-based fees

B. Merchant Level — $5,000 - $10,000

Turnkey, complete solutions for setting up shop on own server. Typical features at this level are:

- Templates for online catalogs and databases
- Interface for changing items and prices
- Database interfaces to existing back-end systems for order fulfillment and a range of automatic payment options
- Cash register software or integration with leading providers

C. Corporate Level — $10,000 - $100,000 and up

This level includes companies with high-volume sales level. Typical features are:

- All features of merchant and starter levels
- Enhanced interface support for existing systems (i.e., solutions are open and scalable for exponential growth)
- Integration with legacy systems and external data sources
- Intranet and extranet functionality for particular audiences (business partners, premier customers)
- Cross selling, up selling and personalization features that enable richer relationships with customers.
- Highest levels of data integrity and security for authentication and authorization

2.2.2 Distributing products for a specific industry

When a company decides to act as a distributor for one specific industry, it gains deep product knowledge across several manufacturers and the opportunity to offer a good selection. At the same time, the firm learns about its customers' purchasing habits, thus opening the door to cross selling and up selling opportunities (offering similar items from different lines, or items that complement a customer's original purchase). Requirements for this model are similar to those in the "Selling Own Products and Services" model, though some of the third-party solutions available are specifically geared to particular vertical markets. (Example: Web Catalog from Pacific Coast is tailored for traditional catalog merchants.)

On the other hand, supply-chain issues may crop up when promises are made to customers and vendors don't deliver on time. So real-time inventory management software (which allows retailers to know where an item is and in what quantity — even at the manufacturer's location) is key, and a common stumbling block to many burgeoning Web start-ups. They may experience limited price flexibility.

2.2.3 Selling a Variety of Goods and Services

With this model, a company offers a wide variety of goods and/or services across many industries, attracting a wide demographic of customers. BigSmart.com is a good example of a company that is currently using this model successfully. BigSmart's own "shops" include one for gifts (with search capabilities based on gender and age), flowers, music, video games and lingerie. Collectively, BigSmart.com's stores offer consumers a selection of more than 2 million items. The site also has "private-label storefronts" that are essentially links to other Internet sites.

The downside of this "private label" model lies in branding and positioning. For example, if one hosts a store on his site from a third-party provider, such as BigSmart.com, he should be sure to extend his brand to the end customer so that when they get the product

in the mail, the firm is somehow represented in the packaging. The inherent challenge here is that if the packaging or product is not entirely up to snuff, it will reflect poorly on the company; so partners should be chosen wisely.

Trying to be all things to all people can alienate some users and cause headaches on the back end. To effectively build this type of model, a company will need a well-developed back-end system whose logistics are closely managed.

2.2.4 The online auction

With this model, real-time interaction is exciting to consumers, who can bid on low- and high-ticket items from their computer keyboards. To succeed in the auction category, companies need cutting-edge technology in order to return accurate results and data-parsing capabilities, and to understand and translate trends in consumer buying cycles.

One need only look as far as eBay to see how successful the auction model can be. With humble beginnings as a place to trade Pez dispensers, eBay created a new market; efficient one-to-one trading in an auction format on the Web. Individuals not big businesses, use eBay to buy and sell items in more than 1,000 categories, including collectibles, antiques, sports memorabilia, computers, toys, Beanie Babies and more.

By purchasing auction software from a vendor (e.g., OpenSite Technologies, WebVision or Moai), an auction Web site can be established. Competing online customers will typically set the prices. Some Web auction sites are used to move inventory at a single clearinghouse; others invite sellers to provide their goods and services to prospective buyers at the site.

The downside is that the sellers may become irate if there are technical problems (such as access to the site) that cut down on the bids they receive. There is also the danger that sellers will not deliver the items as they were represented in the online sale.

By offering items at full price, companies benefit from higher margins, the ability to compete on "added value" (giving customers more than just the product) and strong brand positioning. Many sites actually charge more than traditional businesses when all is said and done after shipping. However, to compete effectively in the full-price realm, a firm must have status as well as enough value and brand equity to drive sales.

Convenience is king and will be the reason most users will buy online. Future online loyalty programs will provide some form of discount to dedicated customers

By featuring discounted merchandise, companies can attract high traffic levels and post high-volume sales. But competing solely on price can be dangerous, both for the company and its suppliers. Margins can only go so low, and it often turns into a matter of "survival of the fittest." The more successful sites will not compete on price alone. For discounters, the major requirement is having enough cash flow to keep operations running. At the same time, a firm needs to have strong marketing skills to spread the word that they are the "low-price leaders."

As competition heats up between online sites, price will become more important as the majority of products become commoditized. This is especially true with the proliferation of price bots, services that assist online shoppers with finding the lowest-priced goods on the Net. Outside of the prestige marketplace, the bottom line with cost is to charge as little as possible but still be able to maximize cash flow enough to fund the technical improvements on the back end to deliver a powerful and convenient user experience.

2.2.5 Co-branding

This model, which involves an online site that acts as a platform where site members go to purchase goods and services from third-party suppliers being used successfully by Amazon's zshops.com. Companies using this model have created a new way for consumers to shop online by gathering a variety of Web merchants together on one e-commerce site. For example, zshops's home page provides members with access to other

popular online venues, allowing them to purchase anything from music and electronics to computer hardware and software, often at special member prices.

Labeled a "zero-gravity" business model, zshops.com acts as a platform where members go to purchase goods and services from third-party suppliers, all under the Amazon brand name. Beyond zshops.com's eclectic array of free services that bring members back again and again, the site permits members to pick and grab zshops.com's services for use in other venues on the Web.

On the back end, sites like Amazon stock some inventory. But the vast majority of its sales are made up of products that the company never physically touches, instead acting as an eclectic platform for the goods of other online merchants.

2.3 Taxonomy of E-commerce Business Models

After having discussed the various areas where Internet business models are venturing, we aim at developing a taxonomy of all existing business models present on the Internet. From the literature we find that business models can be categorized in different ways [Timmers, 1998]. Presently there is no single comprehensive taxonomy of web business models that one can point to. Moreover they are still evolving. Based on the research on online companies and literature on E-commerce, a list of generic business models has been prepared and discussed. These business models can be implemented in a variety of ways. Any given firm may combine different models as a part of its web strategy. Almost all present online models can be classified in any one or more of the following comprehensive list of business models:

1. **E-shop**
2. **Merchant (Retail)**
3. **Brokerage**
4. **Advertising**
5. **Subscription**

6. **Infomediary**
7. **Affiliate**
8. **Community**
9. **Utility**

2.3.1 E-shop

This model is based on the power of the web to allow manufacturers to reach buyers directly and thereby compress the distribution channel (i.e., eliminate wholesalers and retailers). This model can be based on efficiency (cost-savings that may or may not be passed on to consumers), improved customer service, and a better understanding of customer preferences. In effect this model is the Web marketing of a company or a shop. In first instance this is done to promote the company and its goods and services. Increasingly added is the possibility to order and possibly to pay, often combined with traditional marketing channels. Benefits sought for the company are increased demand, a low cost route to global presence, and cost reduction of promotion and sales. Benefits for the customers can be lower prices compared to the traditional offer, wider choice, better information, and convenience of selecting, buying and delivery, including 24-hour availability. Where repeat visits to the e-shop are done, one-to-one marketing can increase those benefits for both seller and buyer. Seller revenues are from reduced cost, increased sales, and possibly advertising. Most commercial Web sites are business-to-consumer electronic shops, selling for example flowers, by Fleurop (www.fleurop.com). The model has the potential for channel conflict with a manufacturer's established supply chain (for example intel and apple) [Timmers, 1998]. In late 1990s computer maker Compaq decided to drop the computer dealers who had been its distributors and go directly to customers. The distributors fought the changes and Compaq had to reconsider its decisions. Dell.com is the one of the most successful examples of this model. Dell sells its computer products directly to the customers through its web site, which boosts advanced features such as shopping cart and user-friendly product customization. This way Dell eliminates the need for retailer's distributors, thus saving on costs and also eliminating the idle inventory sitting at the retailers' and distributors' end. In an industry

like computer hardware, obsolescence is very fast. New faster processors are replacing the old ones. By this model, dell even prevents its products from being obsolescent at the retailer or distributor's end, since it directly caters to the market, strictly according to the market demands.

2.3.2 Merchant (Retail)

In this model the wholesalers and retailers sell goods and services over the Internet. The goods can be sold by list prices or through auctions. In some cases, the goods and services may be unique to the web and not have a traditional "brick-and-mortar" storefront. Companies that are both making money and pushing the retail envelope share three characteristics – first they have created a strong brand identity. Second, they know their customers. And third, they sell relatively inexpensive products that the buyer doesn't spend much time deciding to purchase. Walmart and Kmart are the good examples of this model. Market results show that both Walmart's site walmart.com and Kmart's bluelight.com did very well in online sales.
Online retailers can further be categorized into following categories:

a. Virtual Merchant

It is a business that operates only over the web and offers either traditional or web-specific goods or services. The method of selling may be list price or auction. An example of a service merchant is Facetime, which calls itself an "application service provider". It offers live customer support for websites. Other examples are Amazon.com , Eyewire and OnSale.

b. Click and Mortar

These are the traditional brick and mortar establishments with web storefront. The model has the potential for channel conflict. Physical stores can prove to be an asset if cleverly

integrated into web operations. Some examples are gap.com, walmart.com and barnesandnoble.com.

2.3.3 Brokerage

In the brokerage model, firms act as market makers who bring buyers and sellers together and charge a fee for the transactions that they enable. They can be business-to-business, business-to-consumer or consumer-to-consumer brokers. Examples include travel agents, online brokerage firms and online auction houses. Brokerage model is one of the most significant models in E-commerce, in terms of revenue and growth potential.

Brokerage models can be categorized into [Rappa, 1998]:

a. Virtual Mall

It is a site that hosts many online merchants. An electronic mall, in its basic form, consists of a collection of e-shops, usually enhanced by a common umbrella, for example of a well-known brand. The Mall typically charges setup, monthly listing, and/or per transaction fees (for example Yahoo Store terms at store.yahoo.com/vw/howitor.html). The virtual mall model may be most effectively realized when combined with a generalized portal. Also, more sophisticated malls will provide automated transaction services and relationship marketing opportunities (for example stores such as Yahoo Stores, ChoiceMall, iMall and Women.com's Shopping Network).

b. Metamediary

It is a business model that brings buyers and online merchants together and provides transaction services such as financial settlement and quality assurance. It is a virtual mall, but one that will process the transaction, track orders, and provide billing and collection services. The metamediary protects consumers by assuring satisfaction with merchants. The metamediary charges a setup fee and a fee per transaction. We can expect to see virtual malls move more in this direction. Some examples are HotDispatch and Amazon 's zShops.

c. Auction Broker

It is a site that conducts auctions for sellers (individuals or merchants). Broker charges the seller a fee, which is typically scaled with the value of the transaction. Seller takes highest bid(s) from buyers above a minimum. Other sources of income for the auction provider are in selling the technology platform and in advertising. Benefits for buyers and suppliers are increased efficiency and timesavings, no need for physical transport until the deal has been established and global sourcing. Because of the lower cost it becomes feasible to also offer for sale small quantities of low value, i.e. surplus goods. Auctions can vary in terms of the offering and bidding rules. Typical examples are eBay, AuctionNet and Onsale.

d. Reverse Auction

This is the "name-your-price" business model, also called "demand collection" and "shopping by request". Prospective buyer makes a final (sometimes binding) bid for a specified good or service, and the broker seeks fulfillment. In some models, the broker's fee is the spread between the bid and fulfillment price and perhaps a processing charge. It is frequently aimed at high-priced items like automobiles or airline tickets. Examples include Priceline.com, Respond.com, eWanted.com and MyGeek.com.

e. Classifieds

In this model there is a listing of items for sale or wanted for purchase, typically run by local news content providers. The price may or may not be specified. Listing charges are incurred regardless of whether a transaction occurs.

f. Search Agent

An agent (i.e., an intelligent software agent or "robot") used to search-out the best price for a good or service specified by the buyer, or to locate hard to find information. (typical examples are DealTime, MySimon, RoboShopper, R U Sure and ShopFind). An employment agency can act as a search agent broker, finding work for job-seekers or finding people to fill open positions listed by an employer (for example CareerCentral).

g. Bounty Broker

In this model there is an offer of a reward (usually a significant monetary sum) for finding a person, thing, idea, or other desired, but hard to find item. The broker may list items for a flat fee and a percent of the reward, if the item is successfully found. Typical example is BountyQuest.

h. Buyer Aggregator

This model was pioneered by Accompany.com, which describes buyer aggregation as the process of bringing together individual purchasers from across the Internet to transact as a group so they can receive the same values traditionally afforded to organizations that purchase in volume. Sellers pay a small percentage of each sale on a per-transaction basis. Examples include Mobshop, Volumebuy, and Etrana.

i. B2B Exchanges

The B2B exchanges bring buyers and sellers together and facilitate transactions. The broker typically charges the seller a transaction fee based on the value of the sale. The pricing mechanism can be a simple offer/buy, offer/negotiated buy, or an auction offer/bid approach. According to the market surveys and forecasts by major market research agencies [Goldman Sachs Investment Research, May 2000, Forrester Research,2000, Morgan Stanley Dean Witter, April 2000], B2B e-commerce is going to take the center stage of e-commerce. The stakes in B2B e-commerce are clearly enormous. Since B2B e-commerce is very important and large, we'll discuss about B2B e-commerce and the various models in B2B, in detail in section 2.5.

2.3.4 Advertising

In the advertising model, the owner of a website provides some content and services that attract visitors. The website owner usually makes money by charging advertisers fees for banners, permanent buttons, and other ways of getting a client's messages to the visitors. Some of the most famous users of the advertising model are Yahoo!, Excite@Home, and AltaVista. Almost anyone with a website that attracts visitors has a potential to compete

in this model. This model only works when the volume of viewer traffic is large (for example Yahoo) or highly specialized (as in Vertical exchanges, for example e-Chemicals.com). Advertising on Internet enables one-to-one advertising or "narrow casting". Advertisers and web publishers find it difficult how to price ads on the web and monitor their effectiveness. Advertisers have started to experiment with different strategies. The Procter and Gamble Co. started a well-publicized deal with Yahoo Whereby rather than paying a set fee to place its banner on Yahoo's site, P&G would pay only for customers who actually click on the banner. Advertising models can further be broken down into [Rappa, 1998]:

a. Generalized Portal

This model drives high-volume traffic - typically tens of millions of visits per month. It is driven by generic or diversified content or services (for example search engines and directories like Excite, AltaVista and Yahoo! or content driven sites like AOL). The high volume makes advertising profitable and permits further diversification of site services. Competition for volume has led to the packaging of free content and services, such as e-mail, stock portfolio, message boards, chat, news, and local information.

b. Personalized Portal

The generic nature of a generalized portal undermines user loyalty. This has led to the creation of portals (for example My.Yahoo, My.Netscape) that allow customization of the interface and content. This increases loyalty through the user's own time investment in personalizing the site. The profitability of this portal in based on volume and the value of information derived from user choices. Personalization can support a "specialized portal" model.

c. Specialized Portal

This is also called a "vortal" (i.e., vertical portal). Here volume is less important than a well-defined user base (perhaps 0.5-5 million visits per month). For example, a site that attracts only golfers, or home buyers, or new parents, can be highly sought after as a venue for certain advertisers who are willing to pay a premium to reach that particular audience.

d. Attention / Incentive Marketing

This is the "pay for attention" model. It pays visitors for viewing content and completing forms, or sweepstakes, or frequent flyer-type point schemes. The attention marketing approach has the most appeal to companies with very complex product messages, which might otherwise find it hard to sustain customer interest. CyberGold, with its "earn and spend community" that brings together advertisers interested in incentives-based marketing with consumers looking to save, pioneered the concept. To facilitate transactions, the company developed and patented a micro payment system. Other loyalty-based relationship marketing approaches are Netcentives, or MyPoints.

e. Free Model

This model thrives on the following strategy - give users something for free, for example site hosting (FreeMerchant.com), web services, Internet access, free hardware, electronic greeting cards (BlueMountain.com). Freebies create a high volume site for advertising opportunities. Viability is hardest when based purely on advertising revenue. It has opportunity to blend with infomediary model.

f. Bargain Discounter

The most notable example of this model is Buy.com, which sells its goods typically at or below cost, and seeks to make a profit largely through advertising.

2.3.5 Subscription

In this model access to a website is not free. Members pay a subscription price and in return receive high quality content. Some sites offer both subscription and non-subscription content with difference in service to match. For this model to succeed, the content should be very high value-added. Generic news content, viable on the newsstand, has proven less successful as a subscription model on the web. A 1999 survey by Jupiter communications found that 46 percent of the Internet users would not pay to view content on the web. Some businesses have free content (to drive advertisement volume and revenue) with premium content or services for subscribers only. Some analysts argue that

the existence of vast quantities of free information on the Net will actually make people more willing to pay for the best stuff. As the amount of free-garbage on the Web goes up, more people will be willing to pay for branded information. Even if mass marketing and a subscription service to consumers don't work, business-to-business niche subscription services may have a chance. As more and more of the Web will commercialize, the freebie culture will start to disappear. If a company can build subscribers in a small but rapidly growing market with low costs and maintain that share when the market gets bigger, it should reap good profit margins. Another approach to revenue potential is micro subscriptions, whereby hundreds of thousands of users pay pennies for snippets of information. Instead of paying $20 for an entire cookbook, for example, a consumer would shell out five cents for a single recipe. Software for accepting such minuscule payment has already been developed.

2.3.6 Infomediary

In the infomediary model, a firm collects valuable information on consumers and their buying habits and sells it to firms, which in turn can mine it for important patterns and other useful information to help them better serve their customers. Data about consumers and their buying habits are extremely valuable. Especially when that information is carefully analyzed and used to target marketing campaigns. The infomediary firm usually offers consumers something in return, such as "free" content, cash or gifts. The infomediary may offer users free Internet access (for example NetZero.com) or free hardware (for example eMachines.com) in exchange for detailed information about their surfing and purchasing habits. This is more likely to succeed than the pure advertising model. The infomediary model can also work in the other direction: providing consumers with useful information about the web sites in a market segment that compete for their dollar. One such example is Gomez. This model is more likely to succeed than a pure advertising model.

Infomediary models can further be broken down into:

a. Recommender System

In this model, the site allows users to exchange information with each other about the quality of products and services or the sellers with whom they have had a purchase experience, good or bad, (for example Deja.com and ePinions). ClickTheButton.com takes the concept a step further by integrating the recommender system into the web browser. Such agents monitor a user's habits, thereby increasing the relevance of its recommendations to the users needs and the value of the data to the collector. Recommender systems can take advantage of the affiliate model offered by merchants to augment revenue from the sale of consumer information.

b. Registration Model

Content-based sites those are free to view but require users simply to register (other information may or may not be collected). Registration allows inter-session tracking of users' site usage patterns and thereby generates data of greater potential value in targeted advertising campaigns. This is the most basic form of infomediary model (for example NYTimes.com).

2.3.7 Affiliate

In the affiliate model, a merchant has affiliates whose websites have clickthrough to the merchant. Each time a visitor to an affiliate's site clicks through to the merchant's site and buys something, the affiliate is paid a fee, usually a percentage of the revenues. In contrast to the generalized portal, which seeks to drive high volume traffic to one site, the affiliate model provides purchase opportunities wherever people may be surfing. It is a pay-for-performance model- if an affiliate does not generate sales, it represents no cost to the merchant. The affiliate model is inherently well-suited to the web, which explains its popularity. Variations include, banner exchange, pay-per-click, and revenue sharing programs. Potential problems loom ahead that may inhibit the diffusion of the affiliate model due to the granting of a broad patent to Amazon.com.

2.3.8 Community

The viability of the community model is based on user loyalty (as opposed to high traffic volume). Users have a high investment in both time and emotion in the site. In some cases, users are regular contributors of content and/or money. Having users who visit continually offers advertising, infomediary or specialized portal opportunities. The community model may also run on a subscription fee for premium services. A good example is iVillage.com, which is an online community for women.

Community models can further be categorized into:

a. Voluntary Contributor Model

It is similar to the traditional public broadcasting model - the listener or viewer contributor method used in not-for-profit radio and television broadcasting. The model is predicated on the creation of a community of users who support the site through voluntary donations. Not-for-profit organizations may also seek funding from charitable foundations and corporate sponsors that support the organization's mission. The web holds great potential as a contributor based model because the user base is more readily apparent (for example National Public Radio-npr.org).

b. Knowledge Networks

These are the expert sites that provide a source of information based on professional expertise or the experience of other users. Sites are typically run like a forum where persons seeking information can pose questions and receive answers from (presumably) someone knowledgeable about the subject. The experts may be employed staff, a regular cadre of volunteers, or in some cases, simply anyone on the web who wishes to respond. Typical examples include Deja.com, ExpertCentral.com, KnowPost.com, Xpertsite.com and Abuzz.com. There are fee-based model also (for example Guru.com, Exp.com and Arzoo.com).

2.3.9 Utility

The utility model is a metered usage or pay as you go approach. Its success may depend on the ability to charge by the byte, including micropayments (that is, the payments are too small to pay by credit card due to processing fees). Examples include FatBrain.com, SoftLock.com and Authentica.com.

2.4 B2B e-commerce models

2.4.1 Introduction

Business-to-business sales have already eclipsed the higher profile business-to-consumer market by a long shot. Nearly $7.3 trillion will be exchanged globally through B2B e-commerce by 2004, according to GartnerGroup. As shown in Figure 1.5, on page 11, B2B market in 1999 was 60% of the total e-commerce market.
In B2B e-commerce, businesses buy and sell goods and services to and from each other. The universality property [Afuah and Tucci, 2000] suggests that buyers can put out requests for new bids for supplies on their websites and sellers from all over the world have a chance to bid. The network externality property suggests that more the number of buyers, better off the sellers will be and vice-versa.

A problem arises when sellers and buyers are highly fragmented, that is, there are great many small sellers and buyers. Because buyers are fragmented, a seller may not even know who all the buyers are and vice versa. Each supplier has to search through the web pages of all the buyers to find out what they want, give them the product descriptions they need, find out about their creditworthiness, complete the buyer's request for quotations (RFQs), and so on. Thus, the more sellers and buyers and more fragmented both are, the higher the transaction costs. To explain this, let us consider Figures 2.1 a, b and c.

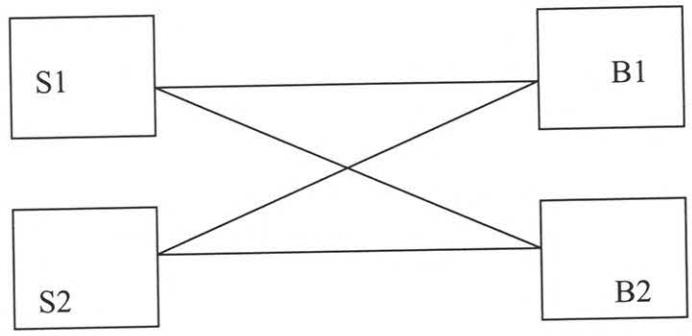


Figure 2.1a Four contacts between fragmented sellers and buyers (2 sellers and 2 buyers)

Figure 2.1a shows only two sellers S1 and S2 and two buyers B1 and B2. It takes each of the two sellers just two searches for a total of 4 contacts with the buyers. When the number of buyers and sellers goes up to four each, the number of contacts that the sellers have to make goes up to 16 as each of the four sellers must look out for four buyers as shown in figure 2.1b. Figure 2.1c shows figure 2.1b with hub added. Thus the costs of sellers and buyers undertaking transactions with each other increases rapidly as the

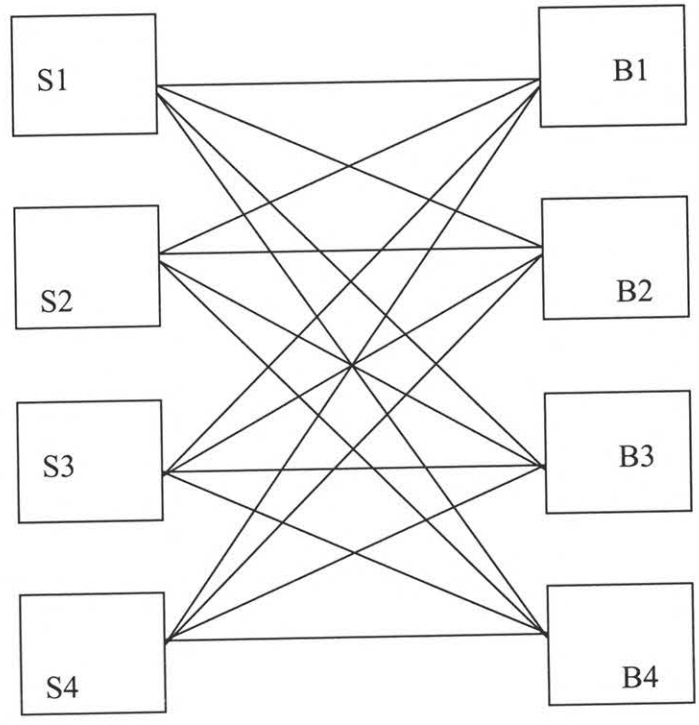


Figure 2.1b Sixteen contacts between fragmented sellers and buyers (4 sellers and 4 buyers)

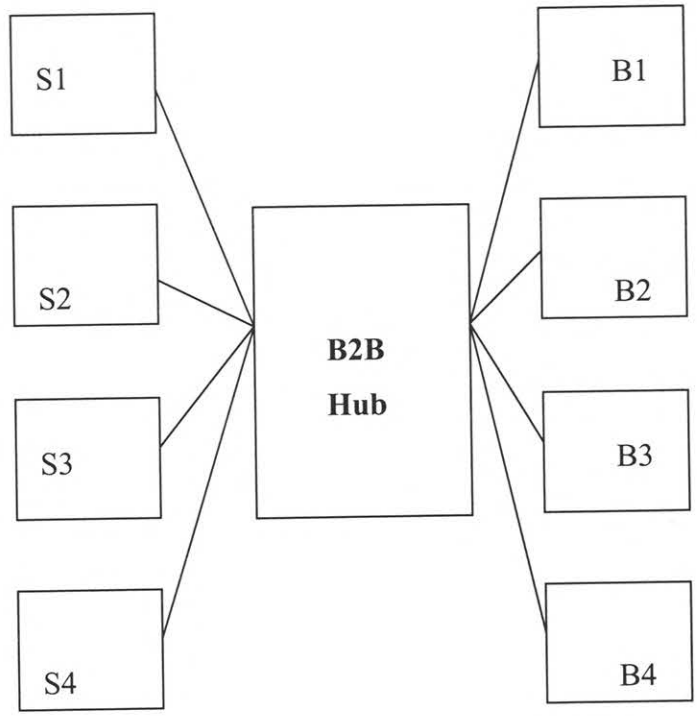
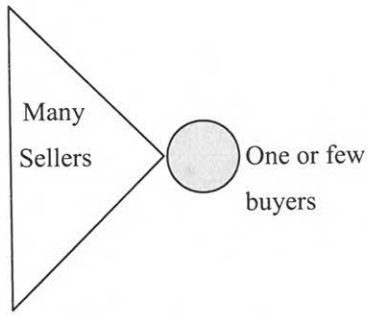


Figure 2.1c Only eight contacts between sellers and buyers with B2B Hub (4 sellers and 4 buyers)

number of buyers and sellers increases. This is where **B2B hubs** – also known as B2B intermediaries or **B2B exchanges** – come in. They provide a central point in the value system where sellers and buyers can go and find each other. Now instead of 16 contacts (n^2), only 8 (2n) are needed. The four sellers make four postings on the hub's website and four buyers view the postings for the total of eight. Thus sellers enjoy the benefits of a network of size n^2 but only have to make 2n contacts. More importantly the hubs can offer software to further reduce the number of contacts.

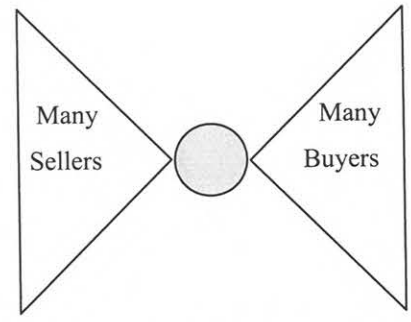
2.4.2 Basic B2B Organizational Models

In terms of organizational models there are currently two basic forms as shown in figures 2.2a and 2.2b. The first is the "pyramid" model, centered on one or few large industry buyers. General Electric's Trading Process Network (TPN) was the first prominent example. The Sears/Carrefour venture is another.



Pyramid Model

Figure 2.2a B2B pyramid model



Butterfly Model

Figure 2.2b B2B butterfly model

The second is the "butterfly" model or, as some people call them, "vortex businesses". This type of marketplace brings many buyers and sellers together and has typically been launched by independent and third parties, either start-ups or solutions providers. Example includes Ariba Network, which serves users of the firm's procurement applications. An assessment of pyramid and butterfly models has been shown in table 2.1. The pyramid shaped B2B marketplaces aim to reduce input costs for the large buyers who form the core of the marketplace as well as administrative costs for both buyers and suppliers. Firms tend to focus on the latter benefit in public, even though the real money comes from lower prices for input goods and services. By creating an easy and efficient way to allow more suppliers to bid on their contracts, companies should be able to increase competition among suppliers and lower the margins they can charge.

Thus the real challenge for buyer-focused marketplace is, convincing enough suppliers to participate to realize these prizing benefits. But suppliers will only come online if there are compelling reasons. Companies of the size of General Electric, Ford and Wal-Mart have the power to make participation mandatory. But for others, it's not as easy. They have to first ensure sufficient purchasing power is in place to attract the attention of the largest, lowest cost suppliers. Perhaps for this reason, many of the pyramid shaped B2B marketplaces are actively striving to become more like butterflies.

Table 2.1 Assessment of B2B Organizational Models

	Pyramid Model	Butterfly Model
Advantages	• Launched with substantial buying power • "Brand name" participation helps build market awareness	• More credible as an "honest broker" • Provides clear value to both buyers and sellers
Challenges	• Value proposition to suppliers in the long term is unclear • May not be able to build sufficient scale to achieve real pricing benefits	• Lack brand strength and broad industry relationships • Major industry players want to own their exchange platforms • Markets are becoming increasingly crowded • May not be able to build sufficient scale to achieve real pricing benefits
Examples	• GE Trading Process Network • GM/Ford/DaimlerChrylser • Sears/Carrefour (GlobalNetXchange)	• Ariba Network • PaperExchange • Golfish

2.4.3 B2B hubs

B2B hubs are Internet-based intermediaries that focus on specific industry verticals or specific business processes, host electronic marketplaces, and use various market-making mechanisms to mediate any-to-any transactions among businesses.

They create value by aggregating buyers and sellers, creating marketplace liquidity (a critical mass of buyers and sellers), and reducing transaction costs. In contrast to pure financial marketplaces, hubs are contextual marketplaces; hubs focus on a specific dimension of it. Attempting to be everything to everybody is a recipe for failure [Sawhney and Kaplan, September 1999]. Nets Inc. was designed as a B-to-B shopping mall across different verticals and different functions. One of the primary reasons it failed is that it had no focus or context. It was neither vertical nor functional, and never able to attract enough buyers and sellers to generate liquidity. A hub, though, can specialize vertically along a specific industry or market, or it can specialize horizontally along a specific function or business process. Based on these dimensions, the universe of hubs boils down to two primary types: vertical and functional [Sawhney and Kaplan, September 1999]. Together, they form the quilt of B-to-B e-commerce.

2.4.3.1 Vertical hubs

Vertical hubs serve a vertical market or industry focus. They provide deep domain-specific content and domain-specific relationships. Examples: Altra Energy (energy), Band-X (telecommunications), Cattle Offerings Worldwide (beef and dairy), SciQuest.com (life sciences), e-Steel (steel), Floraplex (florists), IMX Exchange (mortgages), PaperExchange (paper), PlasticsNet.com (plastics), and Ultraprise (secondary mortgage exchange). Vertical hubs typically start out by automating and hosting the procurement process for a vertical industry type, and then supplement their offerings with industry-specific content.

The likely success of a vertical hub increases with:

- Greater fragmentation among buyers and sellers.
- Greater inefficiency in the existing supply chain.
- Creating critical mass of key suppliers and buyers.
- Domain knowledge and industry relationships.
- Creating master catalogs and sophisticated searching.
- Adjacent verticals for leveraging existing supplier or buyer base.

The primary challenge for vertical hubs is the difficulty of diversifying and extending their business into other vertical markets, because their expertise and relationships are fairly domain-specific.

2.4.3.2 Functional hubs

Functional hubs focus on providing the same functions or automating the same business process across different industries. Their expertise usually lies in a business process that is fairly horizontal, which means that it is scalable across vertical markets. iMark.com, for example, focuses on buying and selling used capital equipment. Its target participants are investment-recovery managers responsible for the equipment. Other examples of functional hubs include Processors Unlimited (reverse logistics), MRO.com (maintenance, repair, and operating procurement), Employease (employee benefits administration), Celarix (global logistics monitoring and tracking), BidCom (project management), Adauction (media buying), and YOUtilities (energy management).

The likely success of a functional hub increases with:

- Degree of process standardization.
- Process knowledge and workflow automation expertise.
- Complementing process automation with deep content.
- Ability to customize the business process to respond to industry-specific differences.

The primary challenge for functional hubs is to deliver industry-specific content. They target functional managers who affiliate and organize their work primarily around their

functional area, and not their industry. But many functional managers also affiliate with their industry. The risk: They will gravitate toward a vertical hub for their industry and relegate the functional hub to become a back-end service provider for the vertical hub.

2.4.4 Taxonomy of B2B hubs

As new entrants with new business models pour into the business-to-business space, it's increasingly difficult to make sense of the landscape. Therefore let us first start by first looking at various dimensions of purchasing. To understand B2B hubs and develop a taxonomy, it is first useful to understand what businesses buy and how they buy [Kaplan and Sawhney, December 1999].

2.4.4.1 What do businesses buy?

Businesses buy a diverse set of products and services ranging from paper clips to computer systems, and steel to machinery. At the broadest level, business purchases can be classified into manufacturing inputs and operating inputs.

Manufacturing inputs are raw materials and components that go directly into the manufactured product or manufacturing process. Manufacturing inputs tend to be vertical in nature, because the finished products that they go into are industry-specific. They are typically sourced from industry-specific suppliers and distributors, and they require specialized logistics and fulfillment mechanisms. For instance, UPS is not a good fulfillment provider for Hydrochloric Acid or High Density Polyethelene.

Operating inputs are indirect materials and services that do not go into finished products. Operating inputs, sometimes called MRO (Maintenance, Repair, and Operating) inputs, include industrial supplies, capital equipment, services, and travel-related services. Unlike manufacturing inputs, operating inputs tend to be horizontal in nature (with the exception of capital equipment and some industrial supplies). For instance, every business needs computers, office supplies, and airline tickets. But an

advertising agency does not buy steel, and a chemicals company does not buy semiconductors. Another important difference is that operating inputs are much more amenable to being shipped through third party logistics providers like UPS. Operating inputs have been traditionally sourced from MRO suppliers like W.W.Grainger (grainger.com), who aggregate MRO catalogs for a diverse set of industries.

2.4.4.2 How businesses buy?

Businesses can either engage in systematic sourcing or in spot sourcing [Kaplan and Sawhney, December 1999].

Systematic sourcing involves buying through pre-negotiated contracts with qualified suppliers. These contracts are often long-term in nature; so systematic sourcing tends to be relationship-oriented. A large proportion of manufactured inputs are purchased through this mechanism. In the semi-commodity chemicals, for instance, over 90% of purchasing is through pre-negotiated catalog-based mechanisms.

On the other hand, businesses can also buy commodity-like products on the spot market from anonymous sellers. Commodity trading for commodities like oil, steel, and energy exemplifies this mechanism. **Spot sourcing** is transaction-oriented, and rarely involves a long-term or ongoing relationship between buyers and sellers.

2.4.4.3 Taxonomy of B2B Hubs based on Purchase Situations

This simple two-way classification - manufacturing inputs versus operating inputs (the "what"); and systematic sourcing versus spot sourcing (the "how") allows us to classify B2B hubs into four categories (see figure 2.3):

a. MRO hubs (operating supplies, systematic sourcing, horizontal focus)

MRO hubs focus on improving the efficiencies in the procurement process for operating supplies for a diverse set of industries. Classic examples of these players are W.W. Grainger, Ariba, and Commerce One. These firms started out with an enterprise focus by

licensing expensive "buy-side" software for eProcurement to large enterprises. These MRO players are now scrambling to reinvent themselves as MRO hubs on the Internet, by moving from a licensed model to a hosted model for software, and by moving from an enterprise-centric model to a network-centric model, where all catalogs are hosted on a common hub that businesses connect into. Newer entrants who have started out with the hub architecture in this space include Bizbuyer.com, MRO.com, PurchasingCenter.com, and ProcureNet.com. These players are horizontal in nature, because operating inputs are common to a significant extent across a wide variety of industries. Given their horizontal nature, MRO hubs tend to use "horizontal" third-party logistics. Therefore, they can disintermediate existing middlemen in the channel, without having to replicate the fulfillment capabilities and assets owned by the current channel.

b. Yield managers (operating supplies, spot sourcing, horizontal focus)

Yield managers focus on the spot procurement of operating inputs. Examples include human resources (Employease.com, Elance.com), utilities (Youtilities.com), capital equipment (iMark.com), manufacturing capacity (CapacityWeb.com), and advertising inventory (AdAuction.com). These yield managers aim to insulate buyers and sellers from ups and downs in operations by allowing them to scale their operating resources upwards or downwards at short notice by participating in the spot market. They add most value in situations where there is high degree of price and demand volatility (for example utilities), or where there are huge fixed-cost assets that cannot be liquidated or acquired at short notice (for example manpower or manufacturing capacity). Yield managers tend to be more vertical in nature than MRO hubs, but are less vertical in nature than industry-specific vertical hubs like Chemdex or PlasticsNet.com.

c. Catalog hubs (manufacturing inputs, systematic sourcing, vertical focus)

Catalog hubs streamline the systematic sourcing of manufactured input within specific vertical industries. These players start out by putting industry-specific catalogs online, and creating a large universe of supplier catalogs within the vertical. They aim to

automate the systematic sourcing process, and create value for buyers by lowering transaction costs.

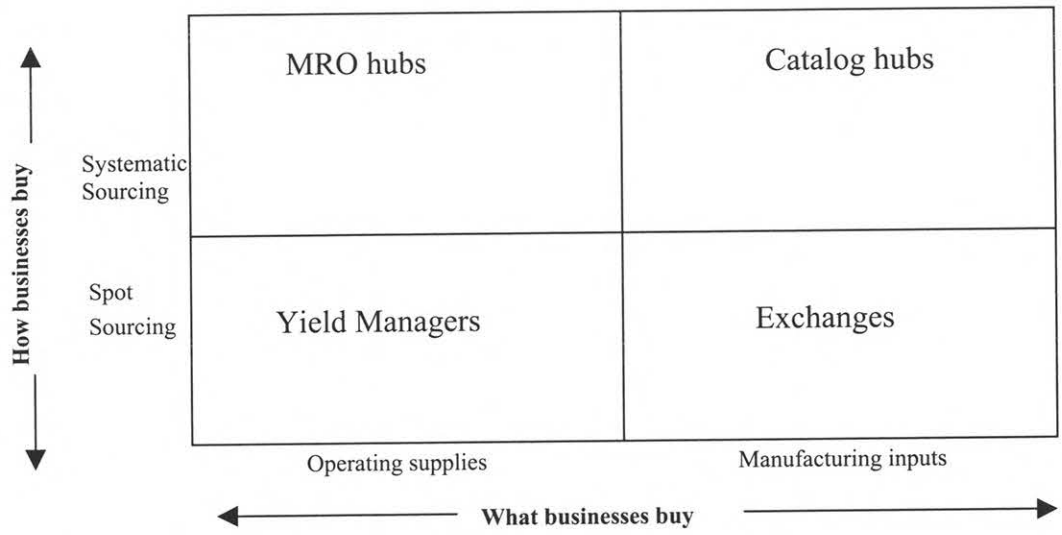


Figure 2.3 Classifying business-to-business hubs
Source: *Kaplan and Sawhney, December 1999*

These catalog hubs can be buyer-focused or seller-focused, depending upon who they create more value for. Examples include PlasticsNet.com, Chemdex, and SciQuest. Catalog hubs need to work closely with distributors, especially on specialized fulfillment and logistics requirements for each vertical. A listing or catalog model creates value by "aggregating" buyers and sellers, i.e., prices are static or pre-negotiated.

d. Exchanges (manufacturing inputs, spot sourcing, vertical focus)

Exchanges aim to create spot markets for commodities or near-commodities within specific industry verticals. These exchanges approximate commodity exchanges, and largely focus on transactional sourcing. The exchange maintains relationships with buyers and sellers, but buyers and sellers rarely have direct relationships. In fact, in many exchanges, buyers and sellers may not even know each other's identities. Exchanges serve a yield-management role, because they allow purchasing managers to smooth out the peaks and valley in demand and supply by "playing the spot market". Examples of

exchanges include E-Steel, PaperExchange, and IMX Exchange. Exchange models create value by "temporal matching" of supply and demand, i.e. prices are dynamic and negotiated at the time of purchase.

Aggregation Vs Matching

Drilling deeper into this B2B matrix, it is seen that e-hubs create value through aggregation and matching:

The **Aggregation** mechanism works to bring together many buyers and sellers under one virtual roof by reducing transactions costs with one stop shopping with fixed number of suppliers and buyers. Here price are static or pre-negotiated. The aggregation can be either forward or reverse. It is successful when:

- Cost of processing purchase order is high
- Products are specialized
- Number of individual products are large in number
- Suppliers are fragmented
- Buyer is not sophisticated
- Purchasing is by pre-negotiated contracts

The **Matching** mechanism is to bring buyers and sellers together on real time basis to negotiate the price. It is required in situations where prices are determined at the moment of purchase. The matching mechanism can also take form of auctions. The model is fluid and can take form of the buyer or the supplier. It works well for:

- Commodities
- High Volume low transaction cost
- Buyers and sellers sophisticated
- Spot purchasing
- Logistics by third parties
- Demand and price volatile

Matching is more powerful business model than aggregation, but the matching mechanism is far more complex and far more difficult to scale.

Biased Vs Neutral

Although many e-hubs are neutral, they're operated by independent third parties, some favor the buyers, some the sellers. Most of e-Hubs are operated by independent third parties who are not inclined to buyer or seller. When they are biased toward sellers to give momentum to supply and operate to move in the supply chain towards buyers are known as **Forward Aggregators**. An example is Ingram Micro in the computer industry. The biased e-hubs that favor buyers are known as **Reverse aggregators** or reverse auctioneers. By reverse it is meant that these hubs bring together large number of buyers and then bargain with suppliers on their behalf (for example FOB.com).

Neutral hubs are the true market makers as they work towards both the interests of the buyer and the seller. This works well when the market is fragmented for the both the supplier and the buyer.

2.4.5 B2B Revenue Models

B2B companies exhibit varying financial models, depending upon the key products and services they offer [Goldman Sachs Investment Research, November 1999]. The core sources of B2B revenue in these models, include the following:

- Transactions: buying and selling
- Auction-driven commissions
- Software licensing
- Cost savings compensation
- Advertising fees
- Content subscriptions

2.4.5.1 Transactions: Buying and Selling

Many companies that host or manage e-markets take a percentage of the aggregate sales transaction that is conducted through the e-market. The two main financial approaches to generating revenue through buying and selling in the e-market are high-touch and low-touch. In the high-touch model, used by companies such as Chemdex, W.W. Grainger, and IGetSmart, the e-market takes possession, warehouses, and fulfills the inventory. Usually, these companies have lower gross margin due to the high cost of goods sold. Although, when they are run efficiently they can exhibit superior operating margins. The low-touch models used by companies such as Neoforma, National Transportation Exchange, and FastParts, make markets between buyers and sellers and never take possession of inventory. Consequently they have a low cost of goods sold and higher gross margin. However the low-touch e-market model typically has lower operating margin than the best-run high-touch models as they exhibit minimal barriers to entry.

2.4.5.2 Auction-Driven Commissions

Many companies that conduct e-market auctions take a percentage of the revenues from auction-driven transactions. These companies usually charge the seller a commission fee based on the percentage of the total revenue generated at auction. For example, PaperExchange charges sellers 3% of the purchase price of the transactions conducted in the auction. Other companies adopting this model include TradeOut.com, Industry To Industry, and CattleOfferings. From the seller's perspective, this approach is attractive since there is no fee unless a transaction is consummated.

2.4.5.3 Software Licensing

Software licensing fees are a primary source of revenue for B2B companies that develop and market proprietary software solutions. For example, auction software providers Moai Technologies and OpenSite Technologies both license their auctioning solutions to their client base. Ariba and Intelisys, developers of more comprehensive e-commerce

solutions, also sell licenses to their software. In addition, Open Market generates a significant portion of its revenues from licensing fees.

2.4.5.4 Cost Savings Compensation

An alternative for companies that host e-markets is to capture a percentage of the savings that are realized when the customer joins the e-market. In this model, the e-market benchmarks the costs of products generated through the legacy system, and then take a percentage of the savings generated through the e-market. Savings are defined as the difference between the e-market and legacy price for the same good or service. Clearly there are issues with this model. First, what happens in year two when the savings have already been captured in the comparable year? Second, what happens if prices go up, due to inflation, supply scarcity, or heightened demand? Compensation based on cost savings is frequently used in the consulting industry. The main strength of this model is its appearance as a "no brainer" - the ROI is built into the compensation, so it makes the sales proposition easier. It is as if to say, who would not want a model where you do not have to pay if you do not save?

2.4.5.5 Advertising Fees

The majority of e-markets base some portion of their financial model on advertising fees for online storefronts, sponsorships, and banner ads. In addition, auction-driven e-markets often charge a fee to list the merchandise. While these e-markets do not generally view product listings as a profit center, they levy listing fees to ensure the quality of the merchandise that sellers advertise. Currently, advertising fees account for a significant portion of B2B revenue. Advertising driven revenue will eventually become ancillary to more comprehensive models. For example, some e-markets are already beginning to give away complimentary storefront ads, pursuing more robust revenue contributions from auction commissions and savings. These e-markets believe that they can capture more reliable revenue streams while giving away complimentary advertising.

2.4.5.6 Content Subscriptions

Some e-markets aggregate compelling content to which they sell subscriptions. For example, pcOrder has created a database that contains more than 600,000 computer products from more than 1,000 manufacturers. This database is one of the world's largest repositories for computing product specifications and includes details on product categorization, compatibility, pricing, and availability. Customers can access the database for an annual, monthly, or per-usage fee.

Chapter 3

ANALYSIS OF E-COMMERCE COMPANIES

3.1 Introduction

In this chapter an analysis of some of the existing on-line e-commerce companies has been done. Their business processes and revenue models have been identified. Most of the companies have hybrid revenue models (i.e. multiple sources of revenue). A discussion of the business models, described in chapter 2, has been carried out as to how the models have been actually implemented, what are the strategic initiatives these companies are taking, what is the market potential in the chosen area of the company, who are the other major players in their field, and finally what is the financial status and growth of the company which gives an idea about the strength of the business model. The financial and other general information about the companies was compiled from various business magazines -Wall Street Journal, msnbc.com, cnnfn.com, yahoo financials etc. and the specific company websites.

3.2 VerticalNet, Inc.

Business Model: B2B Exchange (Many Vertical Exchanges)

Company Profile

Established in 1995, VerticalNet, Inc. is the Internet's leading business-to-business e-commerce enabler, providing end-to-end e-commerce solutions that are targeted at distinct business segments [verticalnet.com]. VerticalNet (see figure 3.1) is a leading developer and operator of industry-specific communities on the Internet. These vertical communities serve as trading exchanges, not only facilitating B2B commerce but also fostering an environment through which buyers and sellers can exchange information and resources. It comprises of 58 industry-specific VerticalNet Marketplaces as well as

VerticalNet's core horizontal services, supports commerce, content and community in a hosted environment and leverages the resources of VerticalNet Solutions to continually

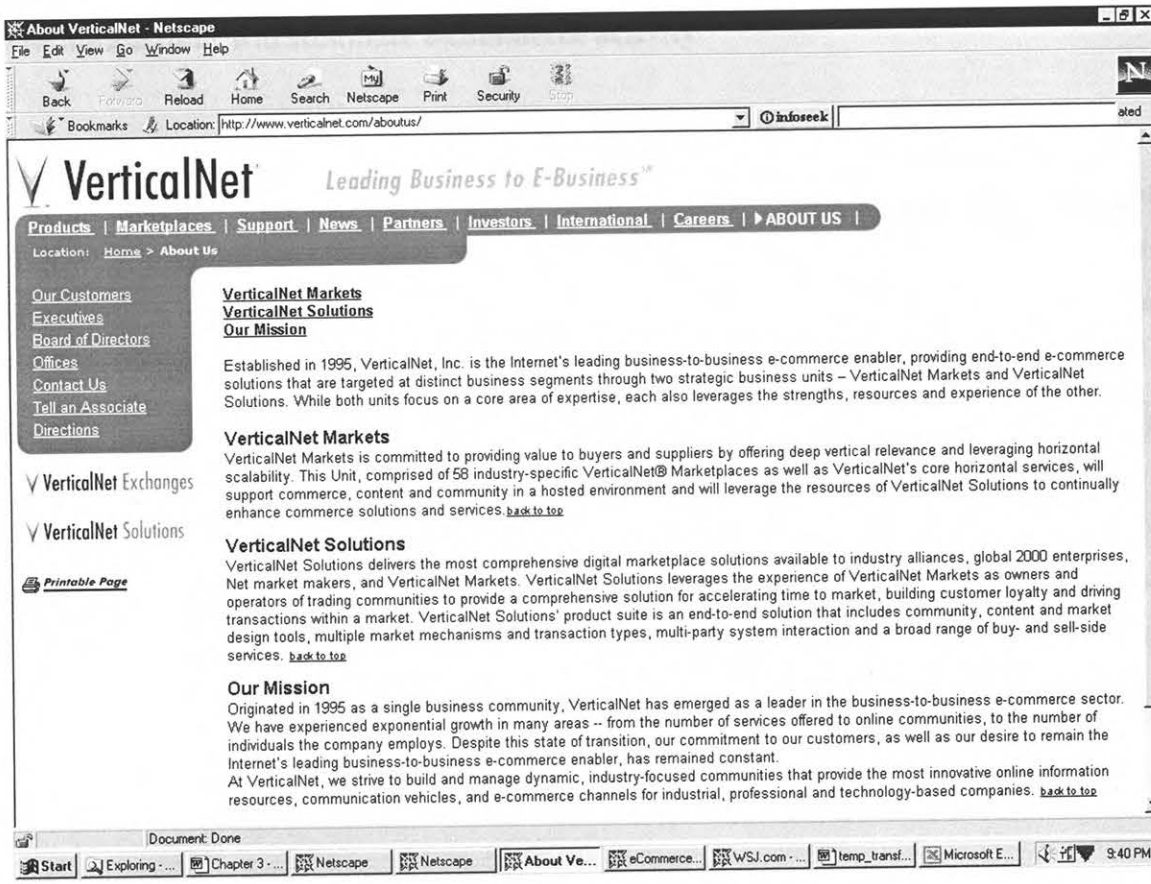


Figure 3.1 VeticalNet (Source: *www.Vetricalnet.com)*

enhance commerce solutions and services. For the 9 months ended 9/30/00, revenues totaled $154.7 million, up from $10.7 million last year. Net loss totaled $121.1 million, up from $38.2 million. Results reflect increased exchange revenues, offset by higher amortization.

Investment Summary

The company operates around 58 industry-specific communities. Attracting 2 million visitors per month, VerticalNet's online communities include Aerospace Online, Food

Online, and Oil & Gas Online. VerticalNet is growing its community offerings both organically and via acquisitions.

Online auctions will stimulate e-commerce activity

VerticalNet has launched new auctioning capabilities, employing software from OpenSite Technologies, that are currently integrated into half of its community sites. The auction service allows buyers to browse through items and place bids at no cost. At the same time, sellers can advertise their products and auction excess inventory and merchandise. Prior to Online Auctions, transactions on VerticalNet were completed offline.

Key strategic alliances

VerticalNet has partnered with content providers and online portals including AltaVista, Excite, and Yahoo [Verticalnet.com]. The company has also formed strategic alliances with First Sierra, IBM, and PaperExchange.com.

Market potential and first-mover advantage

The number of businesses employing the Internet to improve operating efficiencies continues to grow. VerticalNet, in its role as a horizontal e-market, will capitalize on B2B commerce.

Financial overview

Revenues are primarily derived from storefront and sponsorship advertising. "Storefronts" are Web pages with information on advertisers' products. The company also generates revenues from transactions (book and software titles) through its e-Commerce Centers. VerticalNet receives a fee on products sold. At this time, revenue from transactions via auctions remains insignificant. VerticalNet estimates that its revenues will be comprised of 50% advertising and 50% e-commerce (including

auctions) within five years. The company expects its growth strategy to result in operating losses in the near future. Internet Capital Group holds a 37% stake in VerticalNet. The quarterly earnings and selected balance sheet have been shown in tables 3.1 and 3.2.

Table 3.1 Quarterly earnings of VetticalNet Inc. ***Source:*** *Wall Street journal*

Quarter Ended:	**3/31/99**	**6/30/99**	**9/30/99**	**12/31/99**	**3/31/00**	**6/30/00**	**9/30/00**
Revenues	1.93	3.55	5.18	10.09	27.45	53.56	73.73
Net Income	(5.61)	(6.76)	(25.83)	(15.28)	(42.09)	(87.15)	(76.01)
Shares Outstanding	66.61	67.79	70.42	71.47	76.42	84.42	86.84
Earnings per Share (Diluted NetIncome)	(0.14)	(0.10)	(0.37)	(0.21)	(0.45)	(1.05)	(0.88)

Figures in millions except earnings per share. US dollars except shares outstanding. Brackets indicate losses.

Table 3.2 Selected balance sheet, ratios and comparisons of VerticalNet Inc. (As of 01/08/2001)

Source: *Wall Street journal*

Assets	1,083.69
Price-to-Earnings	n.a.
Price-to-Book Value	0.43
Debt-to-Equity	0.03
Return-on-Equity	(26.03%)
Long-Term Debt	23.03
Price-to-Earnings Versus Industry	n.a.
Price-to-Book Value Versus Industry	3.81%
Debt-to-Equity Versus Industry	6.91%
Return-on-Equity Versus Industry	(271.77%)

Assets and long-term debt in millions of U.S. dollars. Equity figures refer to common equity. Price ratios based on recent share price of $4.00. Price-to-earnings and return-on-equity based on most recent announced earnings. Comparison against MarketGuide Computer Services industry.

Competition

VerticalNet faces competition not only from other horizontal e-markets, but also from vertical e-markets that are able to offer robust commerce and compelling content targeted toward a particular industry segment.

3.3 W.W. Grainger, Inc.

Business Model : B2B MRO

Company Profile

W.W. Grainger is the largest distributor of equipment and supplies for the maintenance, repair, and operations (MRO) market to the commercial, industrial, contractor and institutional markets in North America (see figure 3.2). Grainger's main catalog contains more than 80,000 items. For the financial year ended 12/31/00, net sales increased 7% from last year to $4.98 billion. Net income increased 7% to $192.9 million. Revenues reflect volume growth in the Branch-based businesses. Earnings also reflect an improvement in gross profit and $29.8 million unclassified gains.

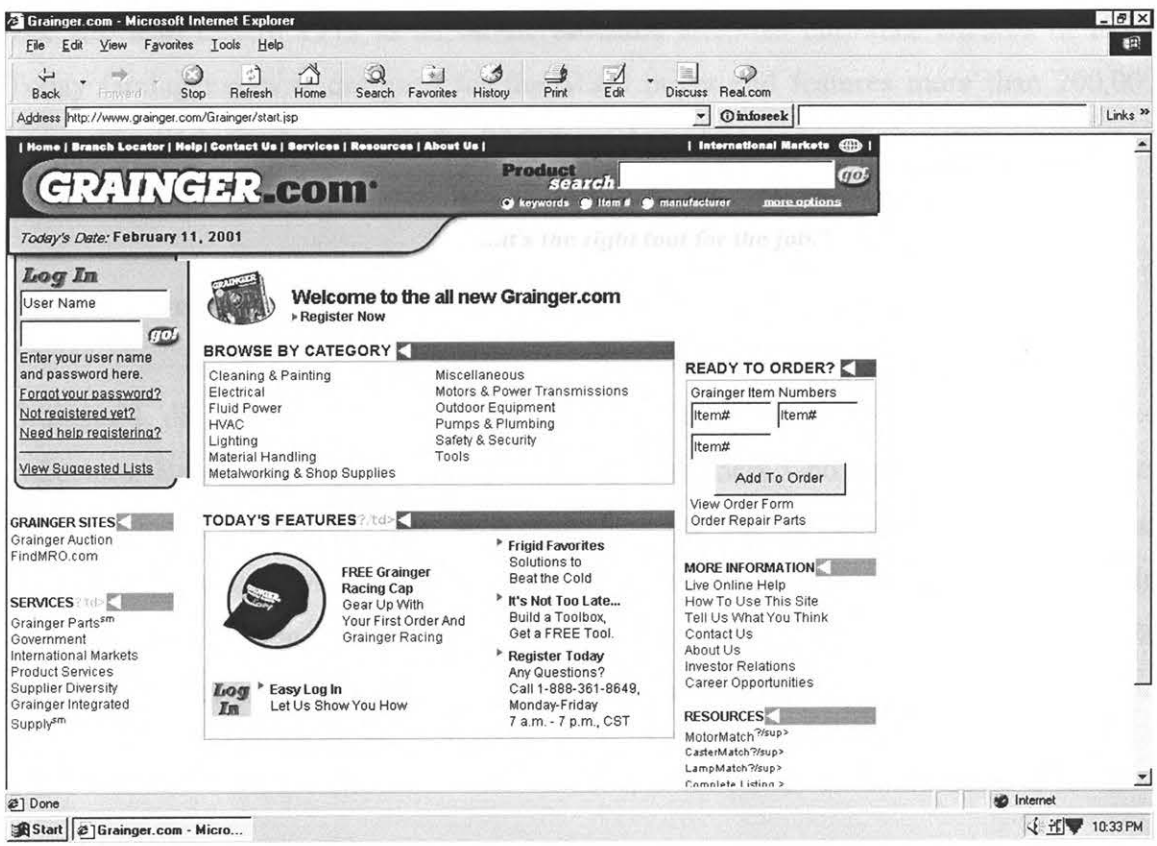


Figure 3.2 Grainger (Source: www.grainger.com)

Investment Summary

Aggressive strategy to migrate into internet and e-commerce realms

As Grainger observed the growing opportunity of the Internet, management established a separate headquarters for its Internet group and staffed the effort with more than 85 dedicated personnel. Grainger's upper management conferred the fledgling Internet group the mandate to "beat our business." By 1999, the Internet team has returned meaningful and accelerating results. Grainger has invested $25 million to date in its Web suite of solutions, and had reached $70 million in run-rate Internet revenue at the end of April 1999 [www.grainger.com].

Grainger.com

The site launched in 1995 as an online brochure and was customer enabled in 1996. Today Grainger.com is designed for the MRO buyer and features more than 200,000 items. The Web site handles all the 80,000 products featured in the printed catalog, and extends the offering to include additional specifications.

Financial overview

Grainger's diagnostic research of behavior on its Web site yielded some unique indicators. Based on a random sample of 600 customers who had purchased on line, Grainger found that the average Web-based revenue per transaction was $240, versus $130 for traditional transactions previously executed by the same sample population. In addition, sales among this population grew 32% when they went online versus 7% growth in the same population when it had purchased offline. The quarterly earnings and selected balance sheet have been shown in tables 3.3 and 3.4 [Wall Street journal].

Table 3.3 Quarterly earnings of W.W. Grainger, Inc. ***Source:*** *Wall Street journal*

Quarter Ended:	3/31/99	6/30/99	9/30/99	12/31/99	3/31/00	6/30/00	9/30/00
Revenues	1,090.84	1,146.18	1,175.39	1,121,44	1,195.19	1,242.02	1,241.73
Net Income	56.26	50.55	45.76	28.16	41.21	55.66	48.11
Shares Outstanding	93.25	93.35	93.39	93.38	93.65	93.91	93.97
Earnings per Share (Diluted NetIncome)	0.60	0.54	0.49	0.30	0.44	0.59	0.51

Figures in millions except earnings per share. US dollars except shares outstanding. Brackets indicate losses.

Table 3.4 Selected balance sheet, ratios and comparisons of W.W. Grainger, Inc. (As of 01/08/2001)

Source: *Wall Street journal*

Assets	2,555.04
Price-to-Earnings	17.57
Price-to-Book Value	2.24
Debt-to-Equity	0.08
Return-on-Equity	12.91%
Long-Term Debt	120.05
Price-to-Earnings Versus Industry	101.11%
Price-to-Book Value Versus Industry	69.78%
Debt-to-Equity Versus Industry	15.53%
Return-on-Equity Versus Industry	83.36%

Assets and long-term debt in millions of U.S. dollars. Equity figures refer to common equity. Price ratios based on recent share price of $35.96. Price-to-earnings and return-on-equity based on most recent announced earnings, Comparison against MarketGuide Misc. Capital Goods industry.

Risks

Cannibalization

Grainger.com may represent a direct threat to Grainger's core brick-and-mortar business model.

Cyclicality

The company has direct exposure to the cyclical trends in the economy.

3.4 MetalSite, Inc.

Business Model : Vertical B2B Exchange

Company Overview

MetalSite operates a deep vertical e-market bringing together buyers and sellers of metals and related products. Customers can source, buy, and sell metal products, review the top news of the day, and connect with other professionals around the world. Launched in 1998 to conduct online sales of steel products, today MetalSite (see figure 3.3) offers a range of metal products (such as copper, aluminum) and an abundance of tonnage from a wide range of suppliers. The company has 30-plus employees and is based in Pittsburgh, Pennsylvania. Senior management has significant experience in the steel and technology industries. The company functions as a sealed bid auction ex-change, online catalog, and information aggregator for metal industry players. It offers prime and non-prime metal products including hot rolled, cold rolled, galvanized, tinplate, and slab steel, and is currently expanding operations to service wire, rod, tubular, structural, scrap and plate steel, in addition to stainless steel, aluminum, brass, and copper. MetalSite was formed through an alliance of three large steel industry players - Weirton Steel, LTV Steel, and Steel Dynamics - who committed initially to providing liquidity to market [www.metalsite.com]. As of March 15, 2000, the company has over 50 listed sellers and over 10,000 users. MetalSite charges 1-2% commissions on auctioned products, and 1/4-1% commissions on products in its List Price Catalog. MetalSite allows steel sellers to maintain their current customer relations, as well as expand them to reach new buyers. The company's current bidding structure allows sellers to give preferential treatment to certain customers, by allowing them to award bids to customers in any way they choose. This allows sellers to cultivate existing relationships without jeopardizing them by entering a competitive exchange.

Product/Services

The company provides a buyer-driven B2B Internet auction forum for metals products.

Figure 3.3 MetalSite (Source: *www.metalsite.com)*

Sellers can post their wares for up to five daily on the site. Bidders then place their offers in a secure, timed environment. Sellers are responsible for fulfillment. MetalSite's Quickbid Auction Forum boasts a number of customized features that wrap around the participants and keep them coming back.

Bidding Histories - Users can track their bidding activity and retrieve histories of their bids.

Detailed Product Descriptions - Merchandise is backed with detailed product descriptions.

Bidding Analysis – Participants can analyze their bidding activity and calculate win-loss percentage to adjust future bidding strategies.

In addition to commerce, MetalSite provides users with content and collaboration, essentially serving as an infomediary for the metals community. MetalSite posts news updates, acts as a forum for the major metals associations, hosts chat rooms, and logs industry statistics.

Major suppliers include Wierton Steel, LTV Steel, Paragon Steel, Mid-America Steel, JR Metals, and Atlas Steel Products.

Strategic Initiatives

The company plans to develop affiliate revenue streams and build its corporate sales force in the near future.

Financial Overview

MetalSite is a privately held company.

MetalSite generates revenues by charging sellers listing and commission fees. Commission fees are driven by a percentage of the final sales price. The company also generates revenue through offering online banner advertising.

Investors in the company include Weirton Steel, LTV Steel, and Steel Dynamics.

Competitors

- e-STEEL
- VerticalNet

3.5 eBay Inc.

Business Model : Auction

Company Profile

Founded in September 1995, eBay is a powerful marketplace for the sale of goods and services by a passionate community of individuals and small businesses (see figure 3.4). Today, the eBay community includes 18.9 million registered users [www.ebay.com].

EBay recently launched the eBay Business Exchange, an online auction exchange for small business products. Using the Internet, eBay has created a new market for efficient, one-to-one trading of goods using an auction format. Sellers pay a fee to have their items listed on the company's Web site, where potential buyers browse the merchandise and make bids. Once an item is sold, eBay charges the seller a percentage of the closing price. In an effort to serve the small business segment of the economy, eBay structured a Business Exchange that offers 34 business-related categories available on the online trading site. At the time of the launch, B2B listings on the exchange totaled nearly 60,000 listings. Categories include computer hardware, software, electronics, industrial equipment, office equipment and professional tools. Small businesses represent a segment that has not fully embraced the efficiencies and cost savings when utilizing the Internet as a core platform. With its large base of 18.9 million users, many of which use eBay for business needs, eBay is well positioned to get fast traction on its new B2B offering. The new trading marketplace, targeting businesses with fewer than 100 employees, is featured prominently on the eBay homepage, attracting users, and advertising the new functionality of the site.

Market

In 2000, the eBay community transacted over $5 billion in annualized gross merchandise sales (value of goods traded on the eBay site). On any given day, there are millions of items listed on eBay across thousands of categories.

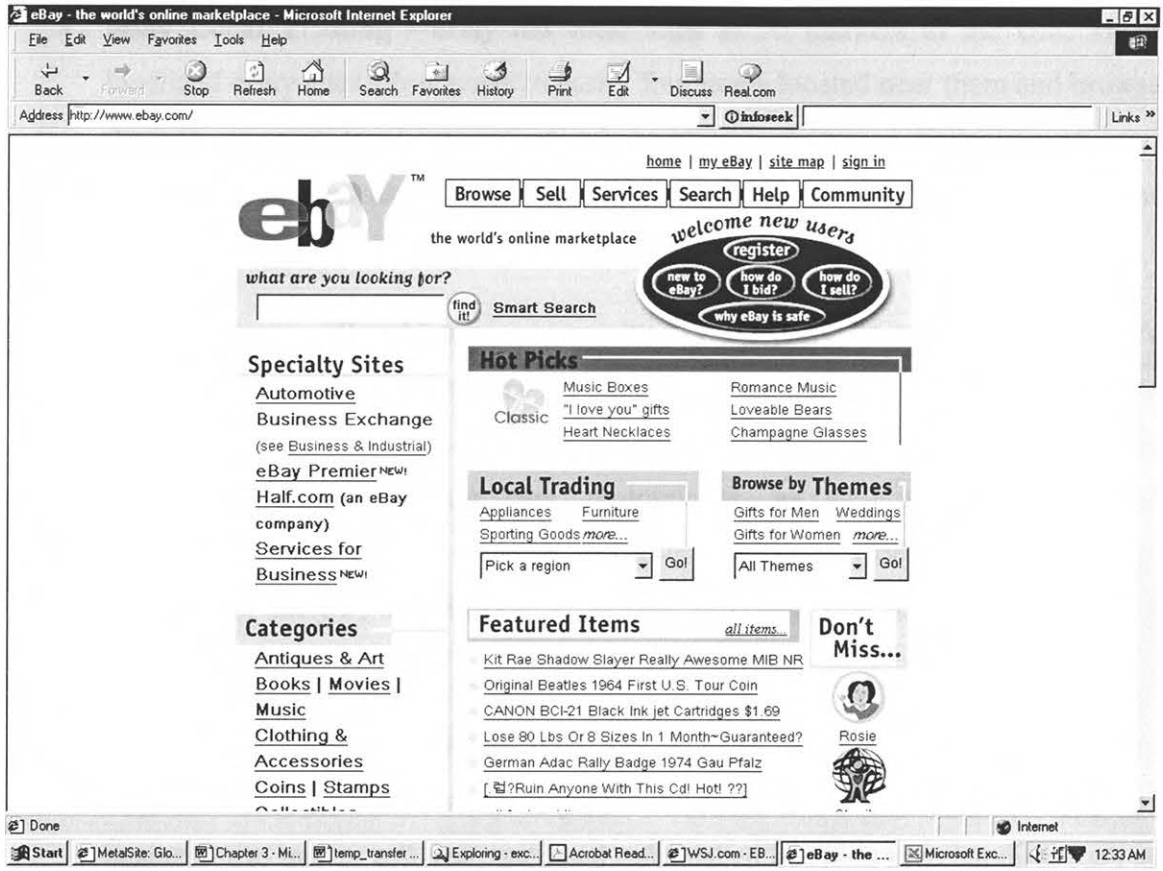


Figure 3.4 eBay (Source: www.ebay.com*)*

People come to eBay to buy and sell everything from the practical, unique, and interesting - such as automobiles, jewelry, musical instruments, photographic equipment, computers, furniture, and sporting goods.

With the recent acquisition of Half.com, eBay's community now benefits from a marketplace combining traditional auction style trading and fixed-price trading.

eBay enables trade on a local, national and international basis. It features a variety of specialty sites, categories and services that aim to provide users with the necessary tools for efficient online trading. Areas of specialty include:

- **eBay International** - Users on eBay represent over 150 different countries. Currently, eBay has country specific sites in the United Kingdom, Canada, France, Germany, Japan and Australia.

- **eBay Local Trading** - eBay has local sites in 53 markets in the U.S. These localized eBay sites allow users to easily find items located near them and browse through items of local interest. eBay's local sites deliver a distinctive regional flavor, while giving users the convenience to shop for more difficult-to-ship items such as automobiles or heavy antique furniture.

- **eBay Motors** - eBay Motors, a specialty site on eBay, is one of the Internet's largest auction-style marketplace for buying and selling all things automotive. At any given time, eBay Motors has a wide variety of vehicles listed for sale. The site also features collector cars, motorcycles, as well as auto parts and automobilia. eBay Motors provides end-to-end online services such as financing, inspections, escrow, auto insurance, vehicle shipping, title & registration, and a lemon check.

- **Business Exchange** - Business Exchange on eBay services the fast growing and fragmented small business marketplace. It provides a destination on eBay for businesses to buy or sell new, used and refurbished business merchandise, such as industrial equipment, office equipment, computers, and professional tools.

- **Premier** - eBay Premier is a specialty site on eBay, which showcases fine art, antiques and rare collectibles from leading auction houses and dealers from around the world. Now with the introduction of the eBay Live Auctions feature, eBay Premier also offers real-time online bidding on items that are available on auction house floors. eBay Premier revolutionizes the way fine art and antiques are bought and sold and brings the traditional auction world to the Internet.

- **Half.com** - With the recent acquisition of Half.com, eBay has extended its business model to Half.com's fixed-price trading. Founded in July 1999, Half.com offers people an organized online marketplace to buy and sell high quality, previously owned mass-market goods. Unlike auctions, where the selling price is based on bidding, the seller sets a fixed price for items at Half.com at the time an item is listed.

- **Billpoint** - Billpoint is eBay's online bill payment service that facilitates credit card payment between buyers and sellers on eBay. In a strategic alliance with Wells Fargo, together they ensure the expedient and secure completion of each transaction.

Financial Overview

For the financial year ended 12/31/00, revenues of eBay rose 92% to $431.4 million. Net income totaled $48.3 million, up from $9.6 million in last year. Revenues reflect continued growth in the number of users and listings. Earnings also benefited from improved operating margins. The quarterly earnings and selected balance sheet have been shown in tables 3.5 and 3.6.

Table 3.5 Quarterly earnings of EBay Inc. Source: *Wall Street journal*

Quarter Ended:	3/31/99	6/30/99	9/30/99	12/31/99	3/31/00	6/30/00	9/30/00
Revenues	49.48	58.53	73.92	85.75	98.29	113.38	134.01
Net Income	0.82	1.19	4.90	6.29	2.93	15.21	23.87
Shares Outstanding	256.88	258.2	262.09	261.02	262.96	267.39	259.79
Earnings per Share (Diluted NetIncome)	0.00	0.00	0.02	0.02	0.01	0.05	0.09

Figures in millions except earnings per share. U.S. dollars except shares outstanding. Brackets indicate losses.

Table 3.6 Selected balance sheet, ratios and comparisons of EBay Inc. (As of 01/22/2001)

Source: *Wall Street journal*

Assets	1,182.40
Price-to-Earnings	259.09
Price-to-Book Value	11.42
Debt-to-Equity	0.01
Return-on-Equity	5.17%
Long-Term Debt	12.15
Price-to-Earnings Versus Industry	661.04%
Price-to-Book Value Versus Industry	139.25%
Debt-to-Equity Versus Industry	4.05%
Return-on-Equity Versus Industry	35.09%

Assets and long-term debt in millions of U.S. dollars. Equity figures refer to common equity. Price ratios based on recent share price of $44.56. Price-to-earnings and return-on-equity based on most recent announced earnings. Comparison against MarketGuide Business Services industry

Competitors

- Amazon
- Yahoo!
- FairMarket

3.6 Amazon.com Inc.

Business Model : Merchant

Company Profile

Amazon.com is the leading B2C e-commerce destination on the Internet. Amazon.com (see figure 3.5) opened its virtual doors in July 1995 with a mission to use the Internet to transform book buying into the faster, easier, and enjoyable shopping experience. Today it is an online retailer, offering millions of items, that serves over 17 million customer accounts in over 150 countries [www.amazon.com]. The Company directly offers for sale millions of distinct items in categories such as books, music, DVDs, videos, toys, electronics, software, video games and home improvement products. Through its marketplace services such as Amazon.com Auctions, zShops and sothebys.amazon.com, the Company has created Web-based marketplaces where buyers and sellers can enter into transactions with respect to a wide range of products. In addition to its US Web site, the Company currently has
two internationally focused Web sites located at www.amazon.co.uk and www.amazon.de. The Company also has invested in and developed strategic commercial relationships with a number of selected e-commerce companies. The company has developed a scalable e-commerce platform that allows it to move quickly into new commerce categories, and is expanding aggressively into new sectors and internationally, thereby increasing its target market. By focusing on providing its customers with the best

possible shopping experience and an excellent customer service, the company has established a 17 million customer base (adding nearly 4 million in the last quarter) with a

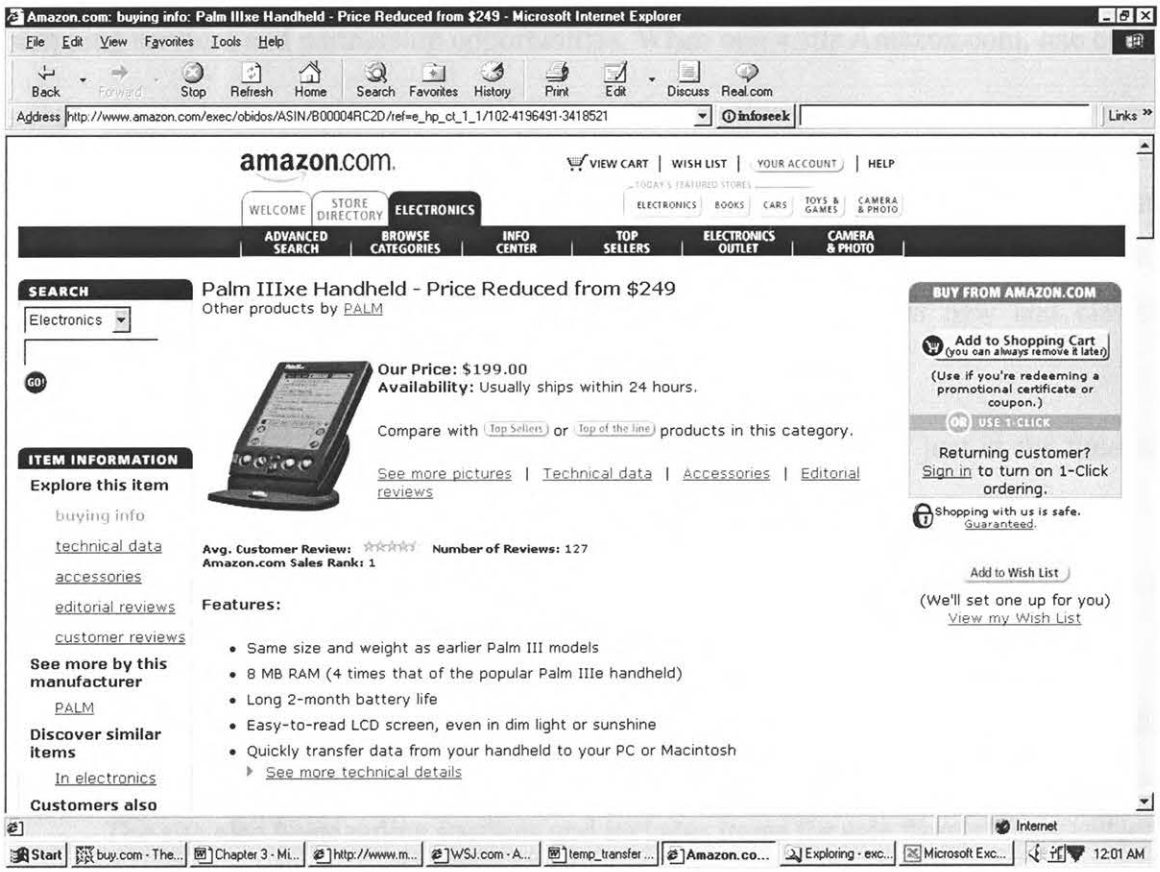


Figure 3.5 Amazon (Source: *www.amazon.com)*

73% repeat customer order rate in fourth quarter of 1999. Though Amazon.com has not made an official foray into the business-to-business e-commerce market, the company already has a series of small businesses selling products in its zShops and auctions sections. Given its powerful database of 17 million registered users (with names, addresses, and credit cards), Amazon.com is in a powerful position to not only maintain its place as the e-commerce leader but also to enter B2B markets targeted at small businesses and home offices. Given its scalable e-commerce platform and its complex yet user-friendly transaction system, the company is positioned to be a strong player in the field.

Product /Services

Along with an extensive catalog of products, Amazon.com offers a wide variety of other shopping services and partnership opportunities. When one visits Amazon.com, one can:

- Search for books, music, videos, and more,
- Browse the virtual aisles in hundreds of product categories-everything from audiobooks, jazz, and video documentaries to coins and stamps up for auction. On the Essentials lists, amazon.com's editors guide on the best new and classic products in all amazon.com's stores,
- Get personalized recommendations based on prior purchases, just at the time of logging in,
- Sign up for Delivers, an e-mail subscription service, to receive the latest reviews of new titles in categories that interest the user,
- Find 1.2 million British books in print at Amazon.co.uk, plus over 250,000 U.S. titles. In addition, one can find 220,000 CDs, and 23,000 VHS and DVD titles. The site also hosts online auctions and includes items for sale from zShops sellers. At Amazon.de, there are over 1 million books--half of which are U.S. titles--plus 200,000 CDs, and all DVDs and videos that are available in Germany,
- Sign up for Special Occasion Reminder service which reminds of important days for sending gifts etc,
- Become an Amazon.com Associate and earn money by selling books, CDs, DVDs, videos, and many other products the users' Web site.

Other Amazon.com Family of Web Sites

- Internet Movie Database (www.imdb.com), the Web's comprehensive and source of information on more than 250,000 movies and entertainment programs and 1 million cast and crew members dating from 1891 to the present.

- LiveBid.com (amazon.livebid.com), the provider of live-event auctions on the Internet.

In addition, Amazon.com has invested in leading Internet retailers. Some of the partners include:

- drugstore.com, an online retail and information source for health, beauty, wellness, personal care, and pharmacy, at www.drugstore.com.
- Ashford.com, an online retailer of luxury and premium products offering new and vintage watches, fragrances, leather accessories, sunglasses, and writing instruments, at www.ashford.com.
- eZiba.com, a leading online retailer of handcrafted products from around the world, at www.eziba.com.

Financial Overview

For the financial year ended 12/31/00, revenues increased 68% to $2.76 billion. Net loss increased 96% from last year to $1.41 billion. Revenues reflect growth in electronics due to great prices and deep selection and increased customer accounts. Higher loss reflects higher impairment charges and investment losses. The quarterly earnings and selected balance sheet have been shown in tables 3.7 and 3.8.

Table 3.7 Quarterly earnings of Amazon.com Inc. ***Source:*** *Wall Street journal*

Quarter Ended:	6/30/99	9/30/99	12/31/99	3/31/00	6/30/00	9/30/00	12/31/00
Revenues	314.38	355.78	676.04	573.89	577.88	637.86	972.36
Net Income	(9.59)	(23.36)	(39.89)	(88.26)		(68.38)	(37.56)
Shares Outstanding	336.31	339.24	345.16	349.96	355.4	356.1	357.14
Earnings per Share (Diluted NetIncome)	(0.43)	(0.59)	(0.96)	(0.90)	(0.91)	(0.68)	(1.53)

Figures in millions except earnings per share. U.S. dollars except shares outstanding. Brackets indicate losses.

Table 3.8 Selected balance sheet, ratios and comparisons of Amazon.com Inc. (As of 01/31/2001)

Source: *Wall Street journal*

Assets	2,135.17
Price-to-Earnings	
Price-to-Book Value	
Debt-to-Equity	
Return-on-Equity	
Long-Term Debt	2127.46
Price-to-Earnings Versus Industry	
Price-to-Book Value Versus Industry	
Debt-to-Equity Versus Industry	
Return-on-Equity Versus Industry	

Assets and long-term debt in millions of U.S. dollars. Equity figures refer to common equity. Price ratios based on recent share price of $13.38. Comparison against MarketGuide Retail (Specialty) industry.

Competitors

- Bestbuy.com
- Buy.com
- Barnesandnoble.com
- Yahoo!

3.7 Dell Computer Corp.

Business Model : E-shop

Company Profile

Dell Computer Corporation, headquartered in Round Rock, Texas, near Austin, is the world's leading direct computer systems company and a premier supplier of technology for the Internet Infrastructure [www.dell.com]. Dell Computer Corporation (see figure 3.6) is the world's largest direct computer systems company. The Company offers its customers a full range of computer systems, including desktop computer systems, notebook computers, workstations, network servers and storage products, as well as an

extended selection of peripheral hardware, computing software and related services. Additionally, the Company offers an array of services to support its customers' online initiatives. The Company's direct model offers in-person relationships with corporate and institutional customers, as well as telephone and Internet purchasing, built-to-order computer systems, telephone and online technical support and onsite product service. Dell sells its products and services to large corporate, government, healthcare and education customers, small-to-medium businesses and individuals. Dell is the No. 2 and fastest growing among all major computer systems companies worldwide, with more than 36,500 employees around the globe. The company ranks No. 1 in the United States, where it is a leading supplier of PCs to business customers, government agencies, educational institutions and consumers.

The Company was founded in 1984 by Michael Dell on a simple concept: By selling computer systems directly to customers, the Company could most efficiently understand and satisfy the computing needs of customers. Dell offers in-person relationships with corporate and institutional customers; telephone and Internet purchasing; customized computer systems; phone and online technical support; and next-day, on-site product service. Dell operates one of the world's largest and most profitable e-commerce sites with more than $40 million in sales daily [www.dell.com]. Today, Dell is enhancing and broadening the fundamental competitive advantages of the direct model by increasingly applying the efficiencies of the Internet to its entire business. Nearly 50 percent of Dell's sales currently are Web-enabled, and about 40 percent of Dell's technical support activities and about 70 percent of Dell's order-status transactions occur online. And Dell is a key partner with many of its customers in helping them deploy the technology they need to capitalize on the efficiencies of the Internet.

Products and Services

The Company offers a wide range of products and services, including desktop computer systems, notebook computers, workstations, servers and storage products, as well as software, peripherals and service and support programs.

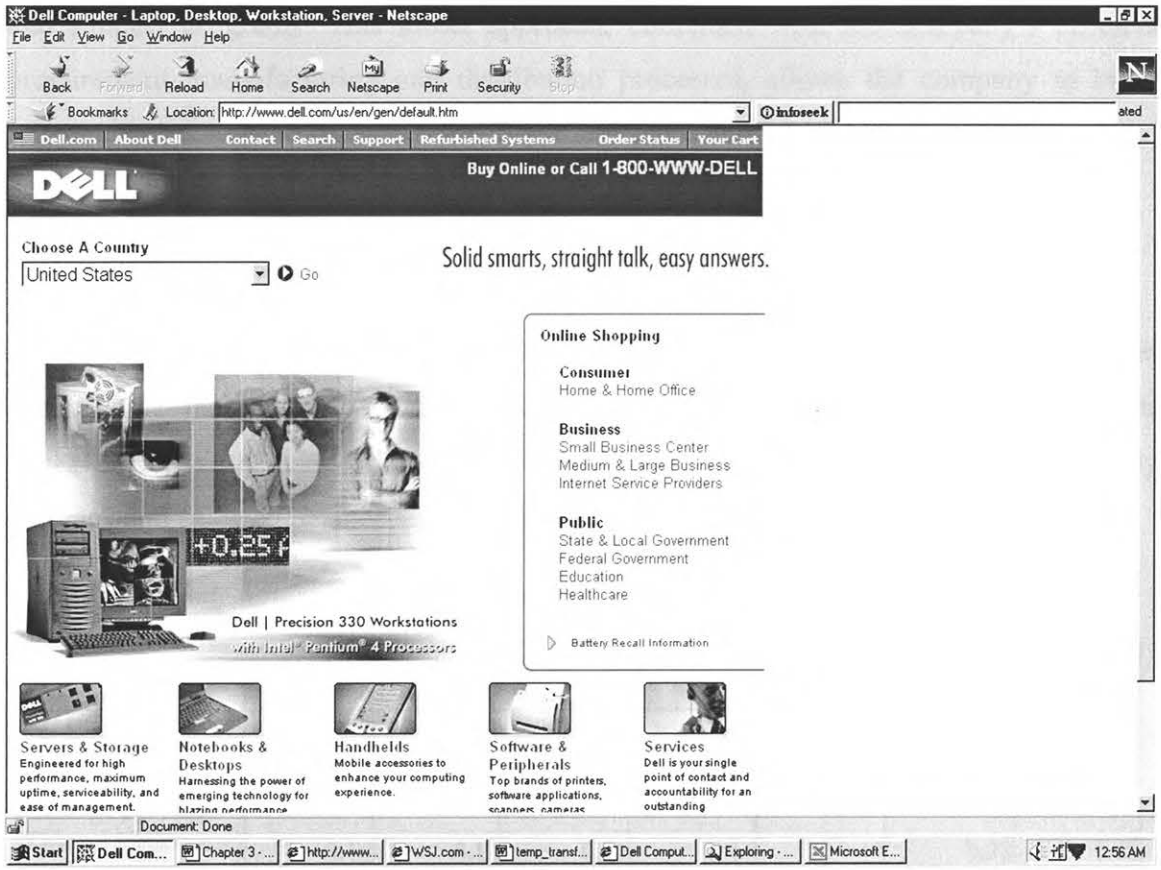


Figure 3.6 Dell (Source: www.dell.com)

Business Strategy

The Company's business strategy is based on its direct business model. The company's business model seeks to deliver a superior customer experience through direct, comprehensive customer relationships, cooperative research and development with technology partners, computer systems custom-built to customer specifications and service and support programs tailored to customer needs. The company believes that the direct model provides it with several distinct competitive advantages. The direct model eliminates the need to support an extensive network of wholesale and retail dealers, thereby avoiding dealer mark-ups; avoids the higher inventory costs associated with the wholesale/retail channel and the competition for retail shelf space; and reduces the high risk of obsolescence associated with products in a rapidly changing technological market. In addition, the direct model allows the company to maintain, monitor and update a customer database that can be used to shape future product offerings and post-sale service

and support programs. This direct approach, combined with the company's efficient procurement, manufacturing and distribution processes, allows the company to bring relevant technology to its customers faster and more competitively priced than many of its competitors.

Financial Overview

For the 39 weeks ended 10/27/00, revenues rose 26% to $23.21 billion [Wall Street Journal]. Net income rose 47% from last year to $1.80 billion. Results reflect higher sales of servers and notebooks, along with increased financing and other income. The quarterly earnings and selected balance sheet have been shown in tables 3.9 and 3.10.

Table 3.9 Quarterly earnings of Dell Computer Corp. ***Source:*** *Wall Street journal*

Quarter Ended:	4/30/99	7/30/99	10/29/99	1/28/00	4/28/00	7/28/00	10/27/00
Revenues	5,537.00	6,142.00	6,784.00	6,802	7,280.00	7,670.00	8,264.00
Net Income	434	507	289	436	525	603	674
Shares Outstanding	2,539	2,540	2,551	2,575	2,589	2,596	2,590
Earnings per Share (Diluted NetIncome)	0.16	0.19	0.11	0.16	0.19	0.22	0.25

Figures in millions except earnings per share. U.S. dollars except shares outstanding.

Table 3.10 Selected balance sheet, ratios and comparisons of Dell Computer Corp. (As of 12/11/2000)

Source: *Wall Street journal*

Assets	13,324.00
Price-to-Earnings	28.69
Price-to-Book Value	10.05
Debt-to-Equity	0.08
Return-on-Equity	40.31%
Long-Term Debt	510
Price-to-Earnings Versus Industry	93.92%
Price-to-Book Value Versus Industry	127.51%
Debt-to-Equity Versus Industry	18.63%
Return-on-Equity Versus Industry	135.30%

Assets and long-term debt in millions of U.S. dollars. Equity figures refer to common equity. Price ratios based on recent share price. Price-to-earnings and return-on-equity based on most recent announced earnings, Comparison against MarketGuide Business Services industry.

Competitors

- Gateway
- Compaq
- HP

3.8 iVillage Inc.

Business Model : Community

Company Profile

iVillage Inc. operates an online network of sites tailored to the interests and needs of women and is engaged in the development of programming material for distribution through online service providers and the Internet. iVillage.com (see figure 3.7) is the leading women's network online providing practical solutions and everyday support for women between the ages of 25 and 54 [www.iVillage.com]. iVillage.com is organized into branded communities across 17 content channels that focus on issues of most importance to women and provide interactive services, peer support and online access to experts and tailored shopping opportunities. Content channels include allHealth, Astrology, Beauty, Click!: Where Computers Make Sense, Diet & Fitness, Food, Home & Garden, Lamaze.com, MoneyLife, ParentsPlace, Parent Soup, Pets, Readers & Writers, Relationships, Travel, Work from Home and Working Diva. Established in 1995 and headquartered in New York City, iVillage Inc. is a new media company, recognized as an industry leader in developing innovative sponsorship and commerce relationships that match the desire of marketers to reach women with the needs of iVillage.com members for relevant information and services.

iVillage Targets a Fast-Growing Market

The Online Marketplace Is Booming

- The number of Internet users will reach approximately 502 million in 2003. (IDC)

- Online advertising revenues are projected to grow to $12.2 billion in 2003. (Jupiter)

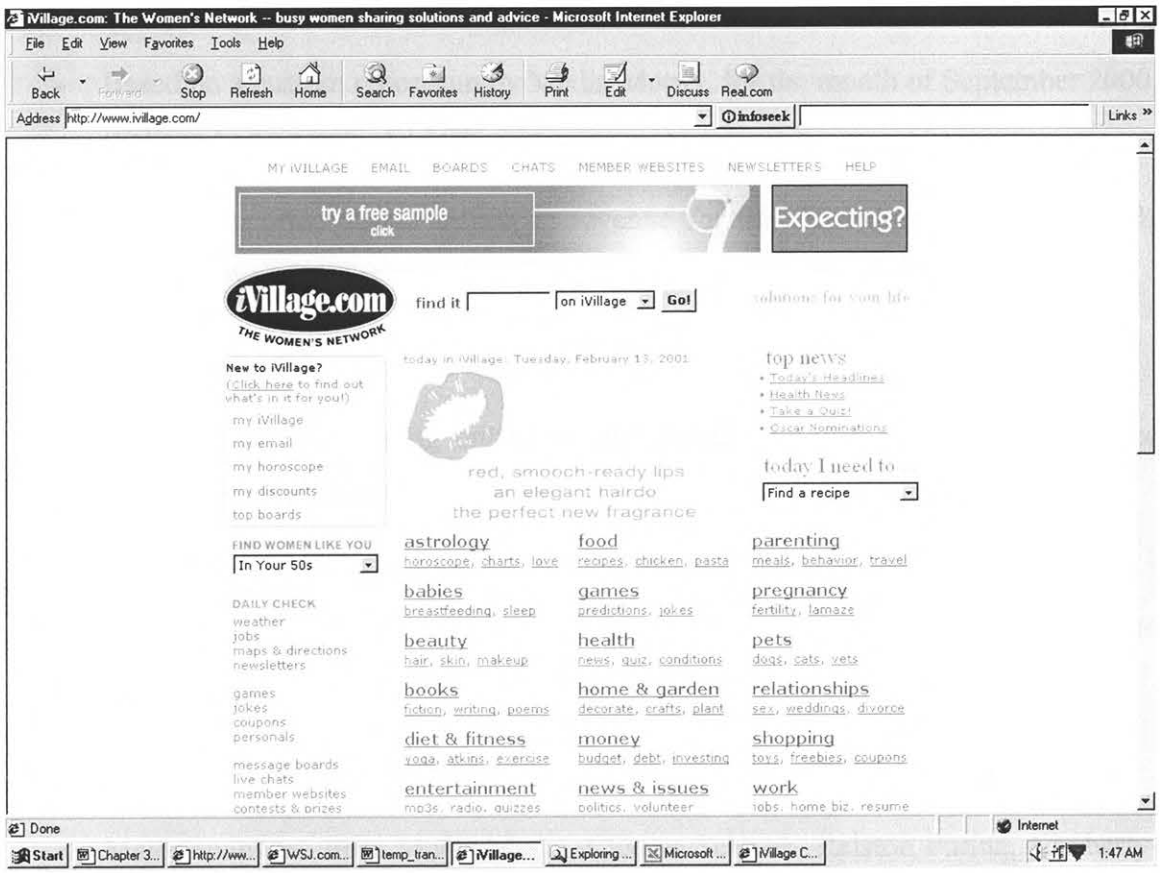


Figure 3.7 iVillage (Source: *www.iVillage.com)*

Women Are Driving Internet Growth

- Women already comprise 50% of all Internet users. (Nielsen)
- Women control or influence over 80% of all purchase decisions. (Ad Age)
- Women make up 63% of online shoppers who buy more than once a week. (eMarketer)

iVillage Investment Highlights

iVillage Is a Vibrant Community (all numbers exclude iBaby)

- iVillage.com traffic grew 22%, to 204 million average monthly page views during the third quarter of 2000 compared to average monthly page views of 166 million in the second quarter 2000.
- Based on a custom report run by Media Metrix, for the month of September 2000, iVillage had a reach of 12.0%.
- iVillage reported $20.2 million in revenue for the third quarter 2000, a 133% increase over revenue of $8.7 million for the comparable year-ago quarter.

The iVillage Difference

- iVillage.com, the leading online women brand, provides relevant and targeted information and tools to women.
- iVillage.com provides interactive services and online access to experts in 17 content channels from careers and health, to money, parenting, relationships and travel.
- Brand-name strategic partners: AOL, NBC, Unilever, Tesco (U.K.).
- Major sponsors: Ford Motor Media, Charles Schwab, Ralston Purina, Kimberly-Clark, Amazon.com, Glaxo Wellcome, PNC Bank, Johnson & Johnson, Unilever, Hertz, Fujifilm, Ortho-McNeil.

iVillage Growth Drivers

- Members: Membership grew to approximately 5.7 million for the third quarter, an increase of 111% over 2.7 million for the third quarter of 1999.
- In September 2000, iVillage ranked 23rd out of the top 50 sites in minutes spent per month, as well as 30th in pages per visitor per month. (Media Metrix)
- Strategic partners leverage brand across various media platforms: AOL, NBC, TCI, Cox.

Financial Overview

For the FY ended 12/31/00, total revenues totaled $76.4 million, up from $36.6 million. Net loss from rose 70% from last year to $179.5 million. Results reflect the addition of new sponsors, offset by higher impairment & amortization costs. The quarterly earnings and selected balance sheet have been shown in tables 3.11 and 3.12.

Table 3.11 Quarterly earnings of iVillage Inc. ***Source:*** *Wall Street journal*

Quarter Ended:	6/30/99	9/30/99	12/31/99	3/31/00	6/30/00	9/30/00	12/31/00
Revenues	6.42	8.66	19.26	18.10	19.39	20.19	18.67
Net Income	(14.96)	(24.94)	(29.93)	(22.28)	(28.01)		(9.85)
Shares Outstanding	24	27	30	30	30	30	30
Earnings per Share (Diluted NetIncome)	(0.63)	(0.98)	(1.04)	(0.75)	(0.94)	(4.02)	(0.33)

Figures in millions except earnings per share. U.S. dollars except shares outstanding.

Table 3.12 Selected balance sheet, ratios and comparisons of iVillage Inc. (As of 02/06/2001)
Source: *Wall Street journal*

Assets	132.46
Price-to-Earnings	n.a.
Price-to-Book Value	0.55
Debt-to-Equity	0
Return-on-Equity	(91.88%)
Long-Term Debt	0
Price-to-Earnings Versus Industry	n.a.
Price-to-Book Value Versus Industry	4.88%
Debt-to-Equity Versus Industry	0.00%
Return-on-Equity Versus Industry	(959.22%)

Assets and long-term debt in millions of U.S. dollars. Equity figures refer to common equity. Price ratios based on recent share price. Price-to-earnings and return-on-equity based on most recent announced earnings, Comparison against MarketGuide Business Services industry.

Competitors

- Oxygen.com
- Women.com

Chapter – 4

APPRAISAL OF E-COMMERCE BUSINESS MODELS

4.1 Introduction

In this chapter, the components and dynamics of business models would be explored and a method for appraising them would be developed. As discussed before, there are three major determinants of business performance (Fig 4.1): business models, the environment in which the businesses operate, and rapidly changing Internet technology. Given the landscape transforming properties of the Internet, business model is one of the most significant factors affecting firm performance [Afuah and Tucci, 2000].

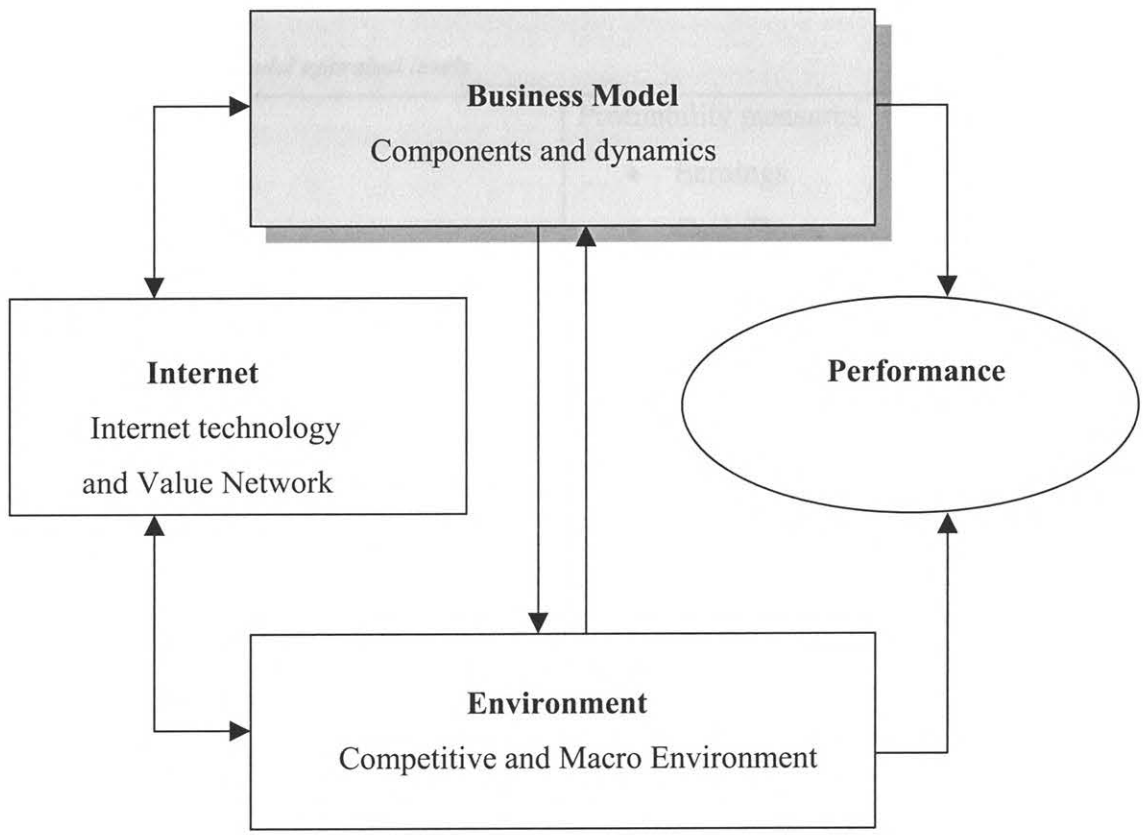


Figure 4.1 Role of business model in firm performance

Source: *"Internet Business Models and Strategies: Text and Cases"- Afuah and Tucci, 2000*

Given the central role that business models play in firm performance, it is important to be able to understand how one business model compares with another. Such an appraisal is important for several reasons. First while making choices about components and linkages of a business model, a firm needs to be able to determine which business model alternatives are best. Second, a good analysis of competitors ought to include a comparison of business models; such a comparison needs some way of appraising business models. Various elements of such an appraisal are now discussed:

4.2 Business models appraisal levels

It can be measured how good a business model is at three levels: measures of profitability, profitability prediction and component attributes (see Table 4.1)

Table 4.1 Business model appraisal levels

Level 1	Profitability measures • Earnings • Cash Flows
Level 2	Profitability predictor measures • Margins • Market share
Level 3	Component attribute measures • Online Niche • Customer Value • Scope • Revenue Driver

Profitability measures

The aim of a business model is to make money, henceforth one of the best ways to measure how a business model is to compare its profitability to that of its competitors. If

a firm's earnings or cash flows are better than that of competitors, it implies it has a competitive advantage. This suggests that the firm has a good business model. The problem with using profitability as a measure of soundness of a business model is that many businesses with solid business models, especially start-ups, are not profitable even though down the line they might become very profitable. Moreover a business, which is profitable today, may have a poor business model whose effects are still trickling down the profit chain. These two reasons suggest that there ought to be a more comprehensive measure.

Profitability predictor measures

Profit margins, market share, and revenue growth rate are good profitability predictor measures and can be used to appraise Internet business models. The procedure is to compare a firm's profit margins, revenue market share and revenue growth rate with those of industry competitors. A firm has competitive advantage if it scores higher in these measures than the industry competitors. Since these profitability predictor measures rest on the components of a business model and linkages between them, there may be factors about the business model, which have not yet percolated down the chain to profit margins, market share, and revenue growth rate. Henceforth the most significant and fundamental measure of a business model is the measure of the components of the business model.

Business model component measures

While not as objective or as easily available as the measures of the first two levels of Table 4.1, business models components get to the source itself- the business model. The aim of this research is to compare the business models on these fundamental attributes. In the next section some specific parameters, which define the business model components, would be identified and then a methodology would be developed to compare these fundamental attributes for currently identified generic business models in Chapter 2.

4.3 Parameters for comparing business models

While all the business models are different and serve their owners well, they have one thing in common: they are designed to make money for their owners in the long term. Rather than try to enumerate the numerous and changing business models in different industries, those elements that are common to all business models and on which money making rests, would be explored. For a firm to keep making money, it must keep offering customers something that they value and the competitors cannot offer [Afuah and Tucci, 2000]. Customer value can take the form of differentiated or lower-cost products. Such a firm must also target the right market segments with products or services that have the appropriate value mix since not all customer value is meant for all customers. That is, market and product scopes are also important. Offering the right customers the right value is only part of the equation. The firm must price them properly. To offer value to customers, the firms must perform the activities that underpin the value [Afuah and Tucci, 2000]. Often a firm has more than one revenue source and should take all sources into consideration as it decides what value to offer to customers, how to price it, what activities to perform, and so on. A well conceived business model with all these components could be profitable. Once a firm starts making money, however, competitors usually want a part of the action. A firm, which has such an advantage, must also worry about the sustainability of profits. It must find ways to keep making money. Taking all these factors into consideration, some parameters (see Table 4.2) have been selected to compare the business models.

4.4 Formation of Business Model Comparison Matrix

4.4.1 Introduction

The aim of this thesis is to compare the business models with respect to the above identified, broad parameters (which in turn consist of various sub-parameters as discussed later). The generic business models chosen for comparison are listed in Table 4.3.

Table 4.2 Parameters for comparison of generic business models

- Customer value
- Market segment scope
- Geographical scope
- Revenue
- Market state
- Capabilities
- Sustainability
- Timing

Since these are subjective parameters, in order to compare them effectively they first need to be converted into objective attributes by assigning numerical values to these parameters, for the different business models. The values imply, what is the maximum the business model is capable of contributing in a positive way in each category (maximum capability of the business model to exploit the factors), which is further determined by the characteristics of each business model. The assignment of values and the justification will be discussed in section 4.4.3. Each of these parameters has a different significance and contributes differently to the business model performance. Henceforth weights are assigned to these parameters depending upon the importance of the parameter. Finally a matrix as shown in Table 4.4 is formed. Now Multi Attribute Decision Making (MADM) techniques [Hwang and Yoon, 1981]. are applied to the decision matrix (table 4.4) to find the rankings of the business models. If the interattribute numerical weights can be assigned (as in our case), then linear assignment method [Hwang and Yoon, 1981], simple additive weighting [Hwang and Yoon, 1981], hierarchical additive weighting [Hwang and Yoon, 1981], ELECTRE [Hwang and Yoon, 1981], and TOPSIS [Hwang and Yoon, 1981] can be utilized. ELECTRE is believed to be the most refined method in this class [Hwang and Yoon, 1981] because of its simple

logic, full utilization of information contained in the decision matrix, and refined computational procedure.

Table 4.3 Generic business models

- E-shop
- Merchant
- Exchange
- Virtual Mall
- Auction
- Advertising
- Subscription
- Infomediary
- Affiliate
- Community
- Utility

Table 4.4 Comparison Matrix for e-commerce business models

	Business Model	Customer Value	Market Segment Scope	Geog. Scope	Revenue	Market State	Capabilities	Sustainability	Timing
1	E-shop								
2	Merchant								
3	Exchange								
4	Virtual Mall								
5	Auction								
6	Advertising								
7	Subscription								
8	Infomediary								
9	Affiliate								
10	Community								
11	Utility								
	Weights	w1	w2	w3	w4	w5	w6	w7	w8

Two methods – Topsis and Electre are used for the decision matrix obtained. TOPSIS evaluates the problem with respect to relative closeness to the ideal solution whereby ELECTRE uses the concept of outranking relationships.

4.4.2 Discussion of parameters values

Since the parameters are subjective, the first step is to convert these parameters into objective quantities so that they can be effectively compared. There are three kinds scales of measurement that can be employed for the measurement of quantities; ordinal, interval, and ratio [Hwang and Yoon, 1981]. An ordinal scale puts the measured entities (i.e., alternatives) in rank order but tells nothing of the relative distance between the ranks. An interval scale provides equal intervals between entities and indicates the difference or distances of entities from some arbitrary origin. The ratio scale provides equal intervals between entities and indicates the difference or distances of entities from some non-arbitrary origin. Since the transformation of a qualitative attribute into a ratio scale is extremely hard, most MADM methods resort to either the ordinal or the interval scale [Hwang and Yoon, 1981]. For quantification of qualitative attributes, interval scales have been used in this thesis. Bipolar scale [Hwang and Yoon, 1981] has been utilized to for conversion into an interval scale. A 5 point scale has been used. A value of 5 represents extremely favorable characteristics; thus 'Very High' is assigned the value of 5. This in turn constrains 'High' to the value of 4.On the low end, 'Very Low' is associated with value of 1, and 'Low' with value of 2. 'Medium' is given the value of 3. This scale has been chosen due to its several implications. This scaling signifies that the value 5 is five times as favorable as a scale value 1. That means 'Very High' is 5 times more favorable than 'Very Low'. In addition, it satisfies the condition that the difference between 'High' and 'Low' is the same as the difference between 'Very Low' and 'Medium' (2 scale points). Further, the combination of values across attributes implies that the difference between any two specific value (say, 'High' and 'Low') is the same for each attribute. It should be noted that many other scales are possible [Hwang and Yoon, 1981], but this scale was considered most appropriate in this case. The correctness of the result depends upon the accuracy of these objective parameters; therefore great

care has been taken to see that these objective parameters reflect the factual characteristics of the business models. As discussed later the values have been derived through deep literature review, after studying the characteristics of the business models. Each parameter is termed as:

- Very High (VH)
- High (H)
- Medium (M)
- Low (L)
- Very Low (VL)

They represent how much the attribute is capable of contributing to the model. For example 'customer value' is very high (VL) for a 'Exchange' model and is very low (VL) for an 'Advertising' model. This implies an 'Exchange' or brokerage model is capable (note: capable, not that every 'Exchange' *would* provide a high value- that largely depends upon the business strategies and management of the company besides the business model) of providing high customer value by aggregating buyers and suppliers. Typical example could be online travel exchanges like travelocity.com for B2C and VerticalExchange.com for B2B. In travel exchanges, customers can search for exact dates, availabilities and lowest prices of the airline tickets with the click of a button. Clearly they provide high customer value by saving them time and money. B2B exchanges provide very high customer value, since they drastically cut searching and transaction costs. In the case of advertising, the customer comes to know of a product through the advertisement, but the actual value added is not substantial. The site may host interesting content to attract visitors to the site, but still the real value added is very less as there is no cost or time saving nor any added convenience.

After giving the assignments to the attributes as VH, H, M, L or VL they are then assigned numerical values from 5 to 1 respectively (i.e. 5 for VH, 4 for H, 3 for M, 2 for L and 1 for VL).

4.4.3 Discussion of Parameters and Assignment of Values

a. Customer Value

Customers want satisfaction, which means to save money, time and energy and get more value than the existing method. When they find a better way, they hardly go back to old way, which is expensive, and time, and energy consuming. Easy duplicability of digital way makes our life convenient than analog way. Travel, search, evaluate and select by physical driving are 100 times less competitive than riding on information superhighway-Internet. New business models to serve global customers are emerging to compete against high-overhead players. As the names suggests this attribute measures the value added to the customers in terms of:

- Cost savings
- Time saving
- Added convenience

Table 4.5 Customer Value for business models

Business Model	Attribute (Customer Value)
E-shop	M
Merchant	H
Exchange	VH
Virtual Mall	H
Auction	VH
Advertising	VL
Subscription	M
Infomediary	L
Affiliate	L
Community	M
Utility	H

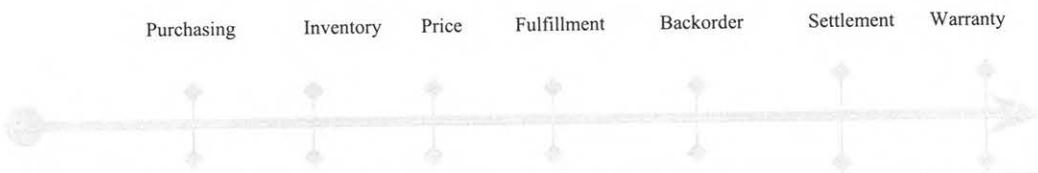
Values are now assigned to the different business models for this attribute depending upon how much the attribute is capable of providing value to the customer (Table 4.5).

E-shop is the Web marketing of a company or a shop. It provides value by offering convenience to the customers by enabling them to shop from home or remote site. Customer does not have to physically drive to the shop. E-shop will always have all displays (never out of stock, as in actual shops). E-shop will often have products, which are, cheaper than in brick and mortar stores because there are no overhead costs (shop staff, decoration, flashy displays, lights and maintenance of the store). Henceforth there is saving of time, money and added convenience to the customer. The drawback of this model is that the customer has to visit many E-shops if he has to buy different kinds of products. For example in order to buy clothes the customer might go to gap.com for his/her needs. But in order to buy a camera he will have to go altogether to a different E-shop for Camera, for example CameraWorld.com. This would result in getting used to different interfaces (websites) and entering the purchasing information (credit card etc) all over again. This results in inconvenience and waste of time. Therefore, the value **'M'** is assigned for Customer Value in E-shop model.

In **Merchant** model the wholesalers and retailers sell goods and services over the Internet. It has all the benefits of the E-shops with the added benefit that the customers can choose from diverse brands for the same product and can purchase products for many of their needs at the same place. With the shopping cart technology the customer can browse through different categories of products, put them in their cart as they are browsing and finally pay for all the products at the same go (as in traditional click and mortar stores like Wal-Mart). Typical example would be Wal-Mart's online store WalMart.com and Kmart's online store bluelight.com. Considering all the above factors this model is given the value **'H'**.

In **Exchange** model, firms act as market makers who bring buyers and sellers together. B2B Exchanges result in tremendous cost savings by eliminating a large chunk of the cost from the supply chain, by bringing together suppliers and customers. The

communication, searching, physically traveling, and negotiating costs are decreased substantially. As shown in figure 4.2, the benefits are tremendous.



Seller	• Reduce manual costs • Reinforce preferred provider status	• Limit excess inventory • Early notice of demand	• Dynamic pricing • Access to increased # of buyers	• Increase logistics efficiency • Aggregate orders • Aggregate shipments	• Re-route inventory • Real-time substitutions	• Reduce billing cycle • Improve cash flow	• Data mining opportunity by customer base
Buyer	• Reduce manual costs • Reduce maverick buying • Aggregate district level purchasing	• More efficient discovery	• Greater transparency • Access to increased # of suppliers	• Real-time order status • Coordinate multiple shipments	• Faster response time	• Reduce manual costs	• Measure supplier performance

Figure 4.2 Supply Chain benefits through Exchange

Given the tremendous cost saving and benefits achieved enhancing customer value, as shown is the figure 4.2 a value **'VH'** is given for this model.

A **Virtual mall**, in its basic form, consists of a collection of e-shops, usually enhanced by a common umbrella, for example of a well-known brand. It has all the qualities of an E-shop with the added advantage that there are many E-shops, so the customer can compare and purchase many different products at the same place, without taking the trouble to individually search sites and then browse them. In customer value it is very similar to the Merchant or Retail model. So it gets **'H'**.

Auction: It is a site that conducts auctions. Benefits for buyers and suppliers are increased efficiency and time savings, no need for physical transport until the deal has been established and global sourcing. Because of the lower cost it becomes feasible to also offer for sale small quantities of low value, i.e. surplus goods. Clearly auctions

provide great value to customers, enabling them to browse through numerous categories of items and bid for them, sitting in front of their desktops. This results in convenience (crossing geographical boundaries) and getting even small items through online auction which otherwise would have been impossible. Therefore it gets **'VH'.**

In the **Advertising** model, the owner of a website provides some content and services that attract visitors. Since there is hardly any material benefit in terms of cost, time and energy the value provided to the customer is very less and therefore it is assigned **'VL'**.

Subscription: In this model access to a website is not free. Members pay a subscription price and in return receive high quality content. Usually customers would pay for information only if it of very high quality and indeed worth paying for. Customer value is only for a class of people for whom the information may be of great value, for example Wall Street journal for investors and market savvy people. Since it targets specific customers and perception of value highly differs from customer to customer (Wall street journal might be of very less use to a carpenter, off course if he is not into big time investing!), it is given **'M'.** Also this model only provides the contents which does not have much value in itself, the actual value comes from utilizing that content.

In the **Infomediary** model, a firm collects valuable information on consumers and their buying habits and sells it to firms, which in turn can mine it for important patterns and other useful information to help them better serve their customers. The value to the customers comes as a result of actions taken by the firms for web-customization, customer interests etc. to serve the customers better. Clearly the value provided to the actual customer is very less. Hence it is assigned **'L'**.

In the **Affiliate** model, a merchant has affiliates whose websites have clickthrough to the merchant. Value to the customer is **'L'**, since the only advantage the customer gets is, if he is browsing through a content which he is interested in, the website might have a affiliate banner of a website which might have products on that content. For example, if

one is reading about of MRP (Material Requirements Planning) on a website, an affiliate website might show books on MRP which the user might want to purchase.

Community model is targeted towards a particular group (community) of people for example iVillage.com for women. They cater to the needs of specific community, and might provide very rich in content information on matters of interest i.e. child care, beauty, diet, etc for women. Henceforth **'M'** is assigned for customer value.

The **Utility** model is a metered usage or pay as you go approach. For example paying for watching multimedia (movies), music, television channels (for example numtv.com), online multimedia games etc. Though technological limitations are inhibiting the success of this model, this model has a great future in terms of customer value. Customers might be willing to pay for content they are using, for example 5 cents for listening to a good song, rather than buying the whole CD for 20 dollars. Therefore it is assigned **'H'**.

b. Market Segment Scope

This parameter compares on the basis of which and how many market segments is the business model capable of catering to. A firm can either market to businesses or households. Amongst households it might be specific to men, women or children. The attribute value depends upon how many market segments the model is capable of catering to (Table 4.6).

E-shop generally caters to households (for example gap.com for all family apparels) or particular business segment (for example dell.com for computer needs of a business, educational institution or household). Another fleurop.com which mostly caters to teens and young people sending flowers to each other on various occasions. Though perceptions for value for this attribute for e-shop model might vary between 'M' and 'H', it is assigned **'M',** relative to other models.

A **Merchant** model is certainly capable of catering to more market segments than E-shop, so it gets **'H'**.

Table 4.6 Market Segment Scope for business models

Business Model	Attribute (Market Segment Scope)
E-shop	M
Merchant	H
Exchange	L
Virtual Mall	H
Auction	VH
Advertising	VH
Subscription	M
Infomediary	M
Affiliate	VH
Community	L
Utility	H

A **Exchange** model usually caters to only one market or business segment. For example a B2B exchange like MetalSite.com caters only to metal industry. Similarly there are Vertical exchanges for other segments like Steel and Paper. In B2C, typical brokerage example is air ticket booking, henceforth catering to this vertical segment. There are exceptions too like 'VerticalNet' which is catering to many Vertical markets, but the viability of such a model is very difficult. For example PaperExchange.com, which caters only to paper industry, can concentrate more on its activities and can add more value rather than a segment of VerticalNet, which is catering to Paper industry, along with other vertical segments. Henceforth on generalizing we give it a value **'L'**, since success in this area is more if focused on specific market segment.

As in the case of Merchant model, Virtual Mall is also capable of catering to decent number of market segments so it gets **'H'**.

The **Auction** model is capable of catering to almost all market segments. Online auctions can cater to goods from children's toys to hi-fi electronic systems. Even in big business transactions, auctions have taken a major role. Big companies now dispose off their excess inventories through online actions. Henceforth auction model gets **'VH'**.

The **Advertising** model has no limitations on market segment and can cater to all possible market segments. Henceforth it gets **'VH'**.

A **Subscription** model (for example newspaper or magazine) can cater to a decent number of segments – for example sports magazine for the sports savvy (might include teens and grownups alike), women's magazine only for women or business magazines for all the business news hungry people. Hence this model gets **'M'**.

Infomediary model might serve to diverse business segments providing knowledge about the various segments of customers to the businesses which inturn cater to various segments of customers. It is assigned **'M',** since in effect it can gather information about all categories of household customers and businesses too.

Affiliate model as in case of advertising is capable of catering all possible market segments. Hence it gets **'VH'**

The success of **Community** model is again, based upon catering to a particular segment. For example iVillage catering only to women. Almost all B2B exchanges have their own community models for providing expert opinion and information on that particular market segment. Hence it is assigned **'L'** since it serves to specific segments.

Utility models can again cater to a decent number of segments, for example music and video for the whole household (children, teens and grownups), secure communications for businesses (for example Authentica.com). Henceforth it assigned **'H'**.

c. Geographical Scope

This parameter measures, to which customers (demographic and geographic) is the model capable of offering the value. Greater the geographical area covered, higher is the value of the attribute. The values assigned to the models are as shown in table 4.7.

Table 4.7 Geographical Scope for business models

Business Model	Attribute (Geographical Scope)
E-shop	M
Merchant	M
Exchange	M
Virtual Mall	M
Auction	H
Advertising	VH
Subscription	VH
Infomediary	VH
Affiliate	M
Community	VH
Utility	VH

E-shop, **Merchant**, **Exchange**, **Virtual Mall** and **Affiliate** models generally do not cross national boundaries (considering only United States, the situation in European countries might be different). Henceforth since they cannot cater to international customers, all of these get **'M'.** B2B Exchange will highly benefit if it crosses International boundaries

(though it is moving in that direction), substantial progress has yet to be made to bring it in the category where it would get 'H'.

Advertising, Subscription, Infomediary, **Community** and **Utility** can very easily cross national boundaries. An advertisement of PEPSI on Yahoo.com would be as good in India as in United States. A recent example is the worldwide premier of the famous singer Britney Spears's Pepsi advertisement on Yahoo, before the actual launch on television (April 2001). People from all over the world can subscribe to the Wall Street Journal. An infomediary can collect information from websites distributed throughout the world. A community can be a world wide forum of similar people, where they all exchange their views and take or give expert advice on subject of their interest. One of the most positive factors of utility model is that people from throughout the world can access a service or utility online, and pay for direct usage. Therefore if a music CD is available in US but not in UK, the person from UK can hear the music online without having to wait for the CD to come to UK. Hence they all get **'VH'**.

Auction gets **'H'**, because besides having become highly successful within national boundaries, it has made its ventures outside US too. For example eBay now hosts worldwide auctions.

d. Revenue

A critical part of a business model analysis is the determination of the sources of revenue and profits. Each business model may have more than one sources of revenue. Also some sources of revenue are more robust and stable than other sources. Henceforth we compare on the basis of number of revenue sources and the strength of each revenue source. Studying the literature and the revenue models of current online companies, the sources of revenue have been classified according to their decreasing strength as:

- Product Revenue
- Transaction Fee
- Subscription Fee

- Advertising
- Referral Fee
- Services

The final values assigned are as shown in table 4.8.

Table 4.8 Revenue for business models

Business Model	Attribute (Revenue)
E-shop	H
Merchant	VH
Exchange	VH
Virtual Mall	VH
Auction	VH
Advertising	VL
Subscription	M
Infomediary	H
Affiliate	VL
Community	M
Utility	H

The robustness (margins, sustainability and market growth) of each revenue source differs significantly. For example transaction fee revenues are much more robust then advertising, since transaction ensures that the firm gets a portion of the transaction every time it takes place, whereby advertising solely depends upon viewership (number of hits to the site) which depends upon many factors and is extremely dynamic and can change anytime. Depending upon the robustness of the revenue numerical values are given to the revenue sources as shown in table 4.9, on a ten-point scale (the maximum realizable value being 10 and minimum 1). Since a model might be capable of generating revenues from more than one source, in that case the sum of the numerical values is calculated to find the net value. After addition, the values are compared against a scale table (see table 4.10) where the models are assigned the values VH, H, M, L or VL.

Table 4.9 Ranking of Revenue Sources

Revenue Source	Intensity of Importance
Transaction Fee	10
Product Revenue	8
Service	5
Subscription	3
Advertising	2
Referral	1

Table 4.10 Scaling of Intensity for Revenue Sources

Range of Intensity Factor	Value
x <= 3	VL
3 < x <= 4	L
4 < x <= 7	M
7 < x < 10	H
x >= 10	VH

Now the values are actually assigned to the various models (Table 4.11 to 4.21).

E-shop

Table 4.11 Revenue Sources and Intensity Values for E-shop Model

Revenue Source	Intensity of Importance	Revenue sources in this model	Intensity Values
Transaction Fee	10		
Product Revenue	8	⇐	8
Service	5		
Subscription	3		
Advertising	2		
Referral	1		
TOTAL			8
		Value	H

Looking across Table 4.11 E-shop model gets **'H'**. Similarly we get the values for all models.

Merchant

Table 4.12 Revenue Sources and Intensity Values for Merchant Model

Revenue Source	Intensity of Importance	Revenue sources in this model	Intensity Values
Transaction Fee	**10**		
Product Revenue	**8**	⇐	8
Service	**5**		
Subscription	**3**		
Advertising	**2**	⇐	2
Referral	**1**	⇐	1
TOTAL			**11**
		Value	**VH**

Exchange

Table 4.13 Revenue Sources and Intensity Values for Exchange Model

Revenue Source	Intensity of Importance	Revenue sources in this model	Intensity Values
Transaction Fee	**10**	⇐	10
Product Revenue	**8**		
Service	**5**	⇐	5
Subscription	**3**		
Advertising	**2**	⇐	2
Referral	**1**	⇐	1
TOTAL			**18**
		Value	**VH**

Virtual Mall

Table 4.14 Revenue Sources and Intensity Values for Virtual Mall Model

Revenue Source	Intensity of Importance	Revenue sources in this model	Intensity Values
Transaction Fee	**10**	⇐	10
Product Revenue	**8**		
Service	**5**	⇐	5
Subscription	**3**		
Advertising	**2**	⇐	2
Referral	**1**	⇐	1
TOTAL			**18**
		Value	**VH**

Auction

Table 4.15 Revenue Sources and Intensity Values for Auction Model

Revenue Source	Intensity of Importance	Revenue sources in this model	Intensity Values
Transaction Fee	**10**	⇐	10
Product Revenue	**8**		
Service	**5**	⇐	5
Subscription	**3**		
Advertising	**2**	⇐	2
Referral	**1**	⇐	1
TOTAL			**18**
		Value	**VH**

Advertising

Table 4.16 Revenue Sources and Intensity Values for Advertising Model

Revenue Source	Intensity of Importance	Revenue sources in this model	Intensity Values
Transaction Fee	**10**		
Product Revenue	**8**		
Service	**5**		
Subscription	**3**		
Advertising	**2**	⇦	2
Referral	**1**	⇦	1
TOTAL			**3**
		Value	**VL**

Subscription

Table 4.17 Revenue Sources and Intensity Values for Subscription Model

Revenue Source	Intensity of Importance	Revenue sources in this model	Intensity Values
Transaction Fee	**10**		
Product Revenue	**8**		
Service	**5**		
Subscription	**3**	⇦	3
Advertising	**2**	⇦	2
Referral	**1**	⇦	1
TOTAL			**6**
		Value	**M**

Infomediary

Table 4.18 Revenue Sources and Intensity Values for Infomediary Model

Revenue Source	Intensity of Importance	Revenue sources in this model	Intensity Values
Transaction Fee	10		
Product Revenue	8		
Service	5	⇐	5
Subscription	3		
Advertising	2	⇐	2
Referral	1	⇐	1
TOTAL			8
		Value	H

Affiliate

Table 4.19 Revenue Sources and Intensity Values for Affiliate Model

Revenue Source	Intensity of Importance	Revenue sources in this model	Intensity Values
Transaction Fee	10		
Product Revenue	8		
Service	5		
Subscription	3		
Advertising	2	⇐	2
Referral	1	⇐	1
TOTAL			3
		Value	VL

Community

Table 4.20 Revenue Sources and Intensity Values for Community Model

Revenue Source	Intensity of Importance	Revenue sources in this model	Intensity Values
Transaction Fee	**10**		
Product Revenue	**8**		
Service	**5**		
Subscription	**3**	⇦	3
Advertising	**2**	⇦	2
Referral	**1**	⇦	1
TOTAL			**6**
		Value	**M**

Utility

Table 4.21 Revenue Sources and Intensity Values for Utility Model

Revenue Source	Intensity of Importance	Revenue sources in this model	Intensity Values
Transaction Fee	**10**		
Product Revenue	**8**		
Service	**5**	⇦	5
Subscription	**3**		
Advertising	**2**	⇦	2
Referral	**1**	⇦	1
TOTAL			**8**
		Value	**H**

e. Market State

This attribute compares on the basis of two questions: What are the characteristics of the model at this stage of life cycle and what will they be down the line? What is the potential growth rate of this model depending upon the present conditions? Depending upon the present market conditions (as of March 2001) the assignments are as shown in Table 4.22

Table 4.22 Market State for business models

Business Model	Attribute (Market State)
E-shop	M
Merchant	H
Exchange	VH
Virtual Mall	M
Auction	VH
Advertising	L
Subscription	M
Infomediary	M
Affiliate	M
Community	VH
Utility	H

f. Capabilities

With the aid of this attribute, two things are compared: To what extent are the models capabilities distinct and inimitable? To what extent the model's capabilities are extendable to other models, features and products? The values assigned to the models are as shown in Table 4.23

Table 4.23 Capabilities of business models

Business Model	Attribute (Capabilities)
E-shop	L
Merchant	H
Exchange	H
Virtual Mall	M
Auction	VH
Advertising	M
Subscription	H
Infomediary	M
Affiliate	L
Community	M
Utility	VH

g. Sustainability

It compares on the basis of how sustainable the business model is. There are three generic strategies that play a key role in building business models to attain and maintain a competitive advantage. In the world of Internet nothing is static. Firms with a competitive advantage must find ways to defend it if they want to maintain it. There is also a constant threat of potential new entrants. On the top of all that the technology itself is evolving; what was the right move yesterday might not be today. Initiating or responding to change in an effort to sustain an advantage or gain one usually entails some combination of three generic strategies: block, run or team-up [Afuah and Tucci, 2000].

In a **block strategy,** a firm tries to erect barriers around its business model to prevent others from imitating it. For example Priceline.com took a patent on its reverse auction

model to prevent imitators from easily copying that part of business model. Copyrights, unique capabilities patents and the threat of retaliation all constitute instruments for blocking. The problem with blocking is that competitors can always find a way around it. Moreover the usefulness of the blockades lasts only until discontinuities such as deregulation/regulation, changing customer preferences and expectations, or radical technological change render them obsolete.

A **run strategy** admits that perfect protection is not always possible. Sitting behind barriers only gives time to competitors to catch up. The innovator must run; that is, it must keep innovating its business model. Often however, a firm cannot do it all alone. It must team up with others through some kind of alliance, joint venture, or acquisition.

In a **team-up strategy**, a firm can pool other resources to strengthen its business model. For example, users who accessed AOL's service in the 1990s using slower technologies, such as twisted copper wires, often found they had to wait longer than they would like. By teaming up with a firm that could provide fast access over the Last Mile to homes and businesses, AOL could greatly improve its service. That is why its teaming up with Time Warner made sense.

It can be shown after studying the above three strategies, team-up and run are the best strategies. Block strategy is not sustainable in the long run.

Keeping the above strategies in mind and the firms using these business models who have incorporated these strategies into their systems, and the business model characteristics, the values are assigned for this attribute as shown in Table 4.24. For example it is difficult for a Subscription model to sustain until and unless it continuously supplies compelling content which the users are ready to pay for. For a short period the users might be interested, but to retain the users the content should be always fresh and of high quality. Henceforth the chance for sustainability of subscription model is difficult and therefore low.

Table 4.24 Sustainability of business models

Business Model	Attribute (Sustainability)
E-shop	M
Merchant	M
Exchange	H
Virtual Mall	M
Auction	H
Advertising	VL
Subscription	L
Infomediary	M
Affiliate	L
Community	M
Utility	H

h. Timing

A business model or strategy that is appropriate early in the evolution of a technology may no longer be so when the technology is mature. A strategy that works when a firm is the first in a market may not work when the firm is a follower. Henceforth a business model can be in three phases:

Emerging or fluid phase: This is the onset of the innovation and there is a great deal of product and market uncertainty in this phase. Firms are not quite sure what should go into the product. There is competition between the new and old technologies as well as between different designs using the new technology.

Growth or Transitional Phase: In this phase some standardization of components, market needs, and product design features takes place, and a standard or common

framework emerges signaling a substantial reduction in uncertainty, experimentation, and major changes. The customer base increases to mass market during the growth phase.

Mature or Stable Phase: In this phase products built around the common framework or standard proliferate. Products are highly defined with differences fewer than similarities between competing products. Here a firm's strategies focus on defending its position and watching out for the next technological change that could start the life cycle over again.

As seen from the above discussion, the best phase of a business model is the Growth or Transitional phase. Then comes Mature or stable phase and the last is the emerging or fluid phase. Henceforth 'H' is assigned for models which are in the growth phase, 'M' for which are in the Mature phase and 'L' for which are still in the developing phase. The values assigned are shown in Table 4.25

Table 4.25 Timing of business models

Business Model	Attribute (Timing)
E-shop	M
Merchant	M
Exchange	H
Virtual Mall	H
Auction	H
Advertising	M
Subscription	M
Infomediary	H
Affiliate	M
Community	M
Utility	L

4.4.4 Formation of Matrix and Assignment of Weights

From the discussion in section 4.4.3 we are now in a position to develop the comparison matrix. Gathering the values from the individual tables the decision matrix is formed, as shown in table 4.26.

Table 4.26 Decision Matrix for business models

	Business Model	Customer Value	Market Segment Scope	Geog. Scope	Revenue	Market State	Capabilities	Sustainability	Timing
1	E-shop	M	M	M	H	M	L	M	M
2	Merchant	H	H	M	VH	H	H	M	M
3	Exchange	VH	L	M	VH	VH	H	H	H
4	Virtual Mall	H	H	M	VH	M	M	M	H
5	Auction	VH	VH	H	VH	VH	VH	H	H
6	Advertising	VL	VH	VH	VL	L	M	VL	M
7	Subscription	M	M	VH	M	M	H	L	M
8	Infomediary	L	M	VH	H	M	M	M	H
9	Affiliate	L	VH	M	VL	M	L	L	M
10	Community	M	L	VH	M	VH	M	M	M
11	Utility	H	H	VH	H	H	VH	H	L
	Weights	w1	w2	w3	w4	w5	w6	w7	w8

Each of these attributes or parameters has different relative importance to the success or strength of the business models. For example revenue is more important than the Market state. Whatever Market Segments the model might focus, but unless the model provides significant customer value it would not succeed. Hence Customer value is one of the most significant attributes – other factors (for example revenue) depend on it. Judging the relative importance of the parameters, weights are assigned as shown in table 4.27. The weights are normalized to the sum of 1. For calculating the normalized weights, intensity factors are assigned to the attributes on a ten-point scale (the maximum realizable value being 10 and minimum 1).

Table 4.27 Assigning Weights to business model attributes

Attribute	Intensity Factor (I.F.)	Normalized Weight (= I.F./ Sum1)
Customer Value	10	0.238
Market segment scope	5	0.119
Geographical scope	2	0.048
Revenue	8	0.190
Market State	3	0.071
Capabilities	6	0.143
Sustainability	7	0.167
Timing	1	0.023
	Sum1 = 42	Sum = 1

The symbols VH, H, M, L and VL, are now replaced with their respective values i.e. 5,4,3,2 and 1 and the above-calculated numerical weights are assigned to the attributes. The final matrix obtained is shown in table 4.28.

Table 4.28 Final Comparison (decision) Matrix

	Business Model	Customer Value	Market Segment Scope	Geog. Scope	Revenue	Market State	Capabilities	Sustainability	Timing
1	E-shop	3	3	3	4	3	2	3	3
2	Merchant	4	4	3	5	4	4	3	3
3	Exchange	5	2	3	5	5	4	4	4
4	Virtual Mall	4	4	3	5	3	3	3	4
5	Auction	5	5	4	5	5	5	4	4
6	Advertising	1	5	5	1	2	3	1	3
7	Subscription	3	3	5	3	3	4	2	3
8	Infomediary	2	3	5	4	3	3	3	4
9	Affiliate	2	5	3	1	3	2	2	3
10	Community	3	2	5	3	5	3	3	3
11	Utility	4	4	5	4	4	5	4	2
	Weights	0.238	0.119	0.048	0.190	0.071	0.143	0.167	0.023

4.5 Multiple Attribute Decision Making (MADM)

Multiple Attribute Decision Making refers to making decisions in the presence of multiple, usually conflicting criteria. The thrust of MADM is to find the best alternative by considering the various interactions within the design constraints. The qualitative variables are first converted into definite numerical values (see section 4.4).

Multi-attribute Decision Making incorporates following steps:

1. Definition of the alternatives and relevant attributes
2. Quantification of qualitative Attributes
3. Assignment of relative weights to Attributes
4. Combination of attribute weights and the attribute values to yield an overall evaluation of each alternative

There are various methods for MADM, which are used according to various situational conditions. The methods for MADM are classified based upon different forms of preference information from a Decision Maker [Hwang and Yoon, 1981].

Two methods for evaluating the Decision Matrix- Topsis and Electre Method are used and then the results from both are compared. As discussed in section 4.4.1 Electre and Topsis methods are amongst the best methods for MADM for the cases where interattribute numerical weights (cardinal) can be assigned.

4.5.1 Topsis Method

Yoon and Hwang, 1981 developed the technique for order preference by similarity to ideal solution (TOPSIS) based upon the concept that the chosen alternative should have the shortest distance from the ideal solution and farthest from the negative ideal solution. This method is simple and yields an indisputable preference order of solution.

The TOPSIS method evaluates the following decision matrix which contains m alternatives associated with n attributes (or criteria):

$$D = \begin{array}{c} \\ A_1 \\ A_2 \\ \vdots \\ A_i \\ \vdots \\ A_m \end{array} \begin{array}{c} \begin{array}{cccccc} X_1 & X_2 & \cdots & X_j & \cdots & X_n \end{array} \\ \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1j} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2j} & \cdots & x_{2n} \\ \vdots & \vdots & & \vdots & & \vdots \\ x_{i1} & x_{i2} & \cdots & x_{ij} & \cdots & x_{in} \\ \vdots & \vdots & & \vdots & & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{m3} & \cdots & x_{mn} \end{bmatrix} \end{array}$$

where

A_i = the i [th] alternative considered,

x_{ij} = the numerical outcome of the i[th] alternative with respect to the j[th] criterion.

The TOPSIS method consists of the following steps [Hwang and Yoon, 1981]:

Step 1. Construct the normalized decision matrix: this process tries to transform the various attribute dimensions into non-dimensional attributes, which allows comparison across attributes. An element r_{ij} of the normalized decision matrix R can be calculated as

$$r_{ij} = x_{ij} / \sqrt{\sum_{i=1}^{m} x_{ij}^2}$$

Consequently, each attribute has the same unit length of vector.

Step 2. Construct the weighted normalized decision matrix: A set of weights $\underline{w} = (w_1, w_2, \ldots, w_j, \ldots, w_n)$, $\sum_{j=1}^{n} w_j = 1$, from the decision maker is accommodated to the decision matrix in this step. This matrix can be calculated by multiplying each column of

the matrix R with its associated weight w_j. Therefore the weighted normalized decision matrix V is equal to

$$V = \begin{bmatrix} V_{11} & V_{12} & \cdots & V_{1j} & \cdots & V_{1n} \\ \vdots & \vdots & & \vdots & & \vdots \\ V_{i1} & V_{i2} & \cdots & V_{ij} & \cdots & V_{in} \\ \vdots & \vdots & & \vdots & & \vdots \\ V_{m1} & V_{m2} & \cdots & V_{mj} & \cdots & V_{mn} \end{bmatrix} = \begin{bmatrix} w_1r_{11} & w_2r_{12} & \cdots & w_jr_{ij} & \cdots & w_nr_{1n} \\ \vdots & \vdots & & \vdots & & \vdots \\ w_1r_{i1} & w_2r_{i2} & \cdots & w_jr_{ij} & \cdots & w_nr_{in} \\ \vdots & \vdots & & \vdots & & \vdots \\ w_1r_{m1} & w_2r_{m2} & \cdots & w_jr_{mj} & \cdots & w_nr_{mn} \end{bmatrix}$$

Step 3. Determine ideal and negative-ideal solutions: Let the two artificial alternatives A^* and A^- be defined as

$$A^* = \{(\max_i v_{ij} | j \in J), (\min_i v_{ij} | j \in J') | i = 1,2,\ldots,m\}$$

$$= \{v_1^*, v_2^*, \ldots, v_j^*, \ldots, v_n^*\}$$

$$A^- = \{(\min_i v_{ij} | j \in J), (\max v_{ij} | j \in J') | i=1,2,\ldots,m\}$$

$$= \{v_1^-, v_2^-, \ldots, v_j^-, \ldots, v_n^-\}$$

where J = {j=1,2,…,n| j associated with benefit criteria}

J`={j=1,2,…,n| j associated with cost criteria}

Then it is certain that the two created alternatives A^* and A^- indicate the most preferable alternative (ideal solution) and the least preferable alternative (negative-ideal solution) respectively.

Step 4. Calculate the separation measure: The separation between two alternatives can be measured by the n-dimensional Euclidean distance. The separation of each alternative from the ideal one is then given by

$$S_{i*} = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^*)^2}, \quad i = 1,2,\ldots,m$$

Similarly, the separation from the negative-ideal one is given by

$$S_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^-)^2}, \quad i=1,2,\ldots,m$$

Step 5. Calculate the relative closeness to the ideal solution: The relative closeness of A_i with respect to A^* is defined as

$$C_{i*} = S_i^- / (S_{i*} + S_i^-), \quad 0 < C_{i*} < 1, \quad i=1,2,\ldots,m$$

It is clear that $C_{i*} = 1$ if $A_i = A^*$ and $C_{i*} = 0$ if $A_i = A^-$. An alternative A_i is closer to A^* as C_{i*} approaches to 1.

Step 6. Rank the preference order: A set of alternatives can now be preference ranked according to the descending order of C_{i*}.

4.5.2 Electre Method

The ELECTRE method uses the concept of an `outranking relationship`. It was originally introduced by Benayoun et al [Benayoun, Roy and Sussman, 1966]. The outranking relationship of $A_k \rightarrow A_l$ says that even though alternatives k and l do not dominate each other mathematically, the decision maker accepts the risk of regarding A_k as almost surely better than A_l. Through the successive assessments of the outranking relationships of the other alternatives, the dominated alternatives defined by the outranking relationship can be eliminated. This method consists of a pairwise comparison of alternatives based on the degree to which evaluations of the alternatives and the preference weights confirm or contradict the pairwise dominance relationships between alternatives. It examines both the degree to which the preference weights are in agreement with pairwise dominance relationships and the degree to which weighted evaluations differ from each other. These stages are based on a `concordance and discordance` set, hence this method is also called concordance analysis.

The ELECTRE method consists of the following steps [Hwang and Yoon, 1981]:

Step 1. Calculate the normalized decision matrix: this procedure transforms the various attribute scales into comparable scales. Each normalized value r_{ij} of the normalized decision matrix R can be calculated as:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}, \quad R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & & & \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix}$$

so that all attributes have the same unit length of vector.

Step 2. Calculate the weighted normalized decision matrix: This matrix can be calculated by multiplying each column of matrix R with its associated weight w_j. Therefore, the weighted normalized decision matrix V is equal to

$$V = RW$$

$$= \begin{bmatrix} v_{11} & \cdots & v_{1j} & \cdots & v_{1n} \\ \vdots & & & & \\ v_{m1} & \cdots & v_{mj} & \cdots & v_{mn} \end{bmatrix} = \begin{bmatrix} w_1 r_{11} & \cdots & w_j r_{1j} & \cdots & w_n r_{1n} \\ \vdots & & & & \\ w_1 r_{m1} & \cdots & w_2 r_{mj} & \cdots & w_n r_{mn} \end{bmatrix}$$

where

$$W = \begin{bmatrix} w_1 & & & 0 \\ & w_2 & & \\ & & \ddots & \\ 0 & & & w_m \end{bmatrix}$$

Step 3. Determine the concordance and discordance set: For each pair of alternatives k and l (k, l=1,2,…,m and k ≠ l), the set of decision criteria J = {**j** | **j** = 1,2,…,n} is devided into two distinct subsets. The concordance set C_{kl} of A_k and A_l is composed of all criteria for which A_k is preferred to A_l. In other words,

$$C_{kl} = \{j | x_{kj} \geq x_{lj} \}$$

The complimentary subset is called the discordance set, which is

$$D_{kl} = \{j | x_{kj} < x_{lj} \} = J - C_{kl}$$

Step 4. Calculate the concordance matrix: The relative value of the concordance set is measured by means of the concordance index. The concordance index is equal to the sum of the weights associated with those criteria which are contained in the concordance set. Therefore, the concordance index c_{kl} between A_k and A_l is defined as:

$$c_{kl} = \sum_{j \in C_{kl}} w_j \; / \sum_{j=1}^{n} w_j$$

For the normalized weight set

$$c_{kl} = \sum_{j \in C_{kl}} w_j$$

The concordance index reflects the relative importance of A_k with respect to A_l. Obviously, $0 \leq c_{kl} \leq 1$. A higher value of c_{kl} indicates that A_k is preferred to A_l as far as

the concordance criteria are concerned. The successive values of the concordance indices c_{kl} (k, l = 1,2,…,m and k ≠ l) form the concordance matrix C of (m x m):

$$C = \begin{bmatrix} - & c_{12} & \cdots & \cdots & c_{1m} \\ c_{21} & - & c_{23} & & c_{21} \\ \vdots & & & & \\ c_{m1} & c_{m2} & \cdots & c_{m(m-1)} & - \end{bmatrix}$$

It should be noted that matrix C is, in general, not symmetric.

Step 5. Calculate the discordance matrix: The concordance index reflects the relative dominance of a certain alternative over a competing alternative on the basis of the relative weight attached to the successive decision criteria. So far no attention has been paid to the degree to which the evaluations of a certain A_k are worse than the evaluations of competing A_l. Therefore a second index, called the discordant index, has to be defined,

$$d_{kl} = \frac{\max_{j \in D_{kl}} | v_{kj} - v_{lj} |}{\max_{j \in J} | v_{kj} - v_{lj} |}$$

It is clear that $0 \leq d_{kl} \leq 1$. A higher value of d_{kl} implies that, for the discordance criteria, A_k is less favorable than A_l, and a lower value of d_{kl}, A_k is favorable to A_l. The discordance indices form the discordance matrix D_x of (m x m):

$$D_x = \begin{bmatrix} - & d_{12} & \cdots & \cdots & d_{1m} \\ d_{21} & - & d_{23} & & d_{21} \\ \vdots & & & & \\ d_{m1} & d_{m2} & \cdots & d_{m(m-1)} & - \end{bmatrix}$$

Obviously, matrix D_x is, in general, asymmetric.

It should be noticed that the information contained in the concordance matrix differs significantly from that contained in the discordance matrix, making the information content C and D_x complementary; differences among weights are represented by means of the concordance matrix, whereas differences among attribute values are represented by means of the discordance matrix.

Step 6. Determine the concordance dominance matrix: This matrix can be calculated with the aid of a threshold value for the concordance index. A_k will only have a chance of dominating A_l, if its corresponding concordance index c_{kl} exceeds at least a certain threshold value $\bar{c}$, i.e.,

$$c_{kl} \geq \bar{c}$$

This threshold value can be determined, for example, as the average concordance index, i.e.,

$$\bar{c} = \sum_{k=1,k\neq l}^{m} \sum_{l=1,l\neq k}^{m} c_{kl} / m(m-1)$$

On the basis of the threshold value, a Boolean matrix F can be constructed, the elements of which are defined as

$f_{kl} = 1$, if $c_{kl} \geq \bar{c}$

$f_{kl} = 0$, if $c_{kl} < \bar{c}$

Then each element of 1 on the matrix F represents a dominance of one alternative with respect to another one.

Step 7. Determine the discordance dominance matrix: This matrix is constructed in a way analogous to the F matrix on the basis of a threshold value $\bar{d}$ to the discordance indices. The elements of g_{kl} of the discordance dominance matrix G are calculated as

$$\bar{d} = \sum_{k=1,k\neq l}^{m} \sum_{l=1,l\neq k}^{m} d_{kl} / m(m-1)$$

$g_{kl} = 1$, if $d_{kl} \geq \bar{d}$

$g_{kl} = 0$, if $d_{kl} < \bar{d}$

Also the unit elements in the G matrix represent the dominance relationships between any two alternatives.

Step 8. Determine the aggregate dominance matrix: The next step is to calculate the intersection of the concordance dominance matrix F and discordance dominance matrix G. The resulting matrix, called the aggregate dominance matrix E, is defined by means of its typical elements e_{kl} as:

$e_{kl} = f_{kl} \cdot g_{kl}$

Step 9. Eliminate the less favorable alternatives: The aggregate dominance matrix E gives the partial-preference ordering of the alternatives. If $e_{kl} = 1$, then A_k is preferred to A_l for both the concordance and discordance criteria, but A_k still has the chance of being dominated by the other alternatives. Hence the condition that A_k is not dominated by ELECTRE procedure is,

$e_{kl} = 1$, for at least one l, l = 1,2,…,m, $k \neq l$

$e_{ik} = 0$, for all i, i= 1,2,…,m, $i \neq k$, $i \neq l$

This condition appears difficult to apply, but the dominated alternatives can be easily identified in the E matrix. If any column of the E matrix has at least one element of 1,

then this column is `ELECTREcally` dominated by the corresponding row(s). Hence we simply eliminate any column(s) which have an element of 1.

4.6 Application of Topsis Method to Business Model Decision Matrix

4.6.1 Development of a UNIX based C Program for MADM for Topsis Method

The business model decision matrix contains 11 rows (alternatives) and 8 columns (attributes). Considering the dynamics of the business models and the attributes, and to generalize the problem, the situation whereby more business models can be added for comparison and the number of attributes can be increased, are taken care of. Future business models might require comparison of many more attributes. Henceforth a C program was developed on UNIX platform for MADM incorporating TOPSIS Algorithm, which is capable of handling infinite order matrix (m x n). The program listing is attached in Appendix A. The program was first tested for correctness using a sample MADM problem with known results. The results matched perfectly, signifying the correctness of the C program.

4.6.2 Decision Matrix analysis using Topsis Method – Intermediate and final results from the program

ORIGINAL INPUT MATRIX :

3.00 3.00 3.00 4.00 3.00 2.00 3.00 3.00
4.00 4.00 3.00 5.00 4.00 4.00 3.00 3.00
5.00 2.00 3.00 5.00 5.00 4.00 4.00 4.00
4.00 4.00 3.00 5.00 3.00 3.00 3.00 4.00
5.00 5.00 4.00 5.00 5.00 5.00 4.00 4.00
1.00 5.00 5.00 1.00 2.00 3.00 1.00 3.00
3.00 3.00 5.00 3.00 3.00 4.00 2.00 3.00
2.00 3.00 5.00 4.00 3.00 3.00 3.00 4.00
2.00 5.00 3.00 1.00 3.00 2.00 2.00 3.00
3.00 2.00 5.00 3.00 5.00 3.00 3.00 3.00
4.00 4.00 5.00 4.00 4.00 5.00 4.00 2.00

WEIGHTS:

0.24 0.12 0.05 0.19 0.07 0.14 0.17 0.02

NORMALIZATION FACTORS:

Column(1): 11.58
Column(2): 12.57
Column(3): 13.64
Column(4): 12.96
Column(5): 12.49
Column(6): 11.92
Column(7): 10.10
Column(8): 11.05

WEIGHTED NORMALIZED MATRIX:

0.06 0.03 0.01 0.06 0.02 0.02 0.05 0.01
0.08 0.04 0.01 0.07 0.02 0.05 0.05 0.01
0.10 0.02 0.01 0.07 0.03 0.05 0.07 0.01
0.08 0.04 0.01 0.07 0.02 0.04 0.05 0.01
0.10 0.05 0.01 0.07 0.03 0.06 0.07 0.01
0.02 0.05 0.02 0.01 0.01 0.04 0.02 0.01
0.06 0.03 0.02 0.04 0.02 0.05 0.03 0.01
0.04 0.03 0.02 0.06 0.02 0.04 0.05 0.01
0.04 0.05 0.01 0.01 0.02 0.02 0.03 0.01
0.06 0.02 0.02 0.04 0.03 0.04 0.05 0.01
0.08 0.04 0.02 0.06 0.02 0.06 0.07 0.00

IDEAL AND NEGATIVE IDEAL SOLUTIONS (MAXIMUM AND MINUMUM VALUES IN EACH COLUMN):

COL 1: max=0.10 , min= 0.02
COL 2: max=0.05 , min= 0.02
COL 3: max=0.02 , min= 0.01
COL 4: max=0.07 , min= 0.01
COL 5: max=0.03 , min= 0.01
COL 6: max=0.06 , min= 0.02
COL 7: max=0.07 , min= 0.02
COL 8: max=0.01 , min= 0.00

SEPERATION MEASURES:

Sep. Ideal(row=1) : 0.06
Sep.Neg-Ideal(row=1): 0.07

Sep. Ideal(row=2) : 0.03
Sep.Neg-Ideal(row=2): 0.10

Sep. Ideal(row=3) : 0.03
Sep.Neg-Ideal(row=3): 0.12

Sep. Ideal(row=4) : 0.04
Sep.Neg-Ideal(row=4): 0.09

Sep. Ideal(row=5) : 0.00
Sep.Neg-Ideal(row=5): 0.12

Sep. Ideal(row=6) : 0.12
Sep.Neg-Ideal(row=6): 0.03

Sep. Ideal(row=7) : 0.07
Sep.Neg-Ideal(row=7): 0.06

Sep. Ideal(row=8) : 0.07
Sep.Neg-Ideal(row=8): 0.06

Sep. Ideal(row=9) : 0.10
Sep.Neg-Ideal(row=9): 0.04

Sep. Ideal(row=10) : 0.06
Sep.Neg-Ideal(row=10): 0.06

Sep. Ideal(row=11) : 0.03
Sep.Neg-Ideal(row=11): 0.10

RELATIVE CLOSENESS TO IDEAL SOLUTION:

Row(1): 0.52
Row(2): 0.75
Row(3): 0.79
Row(4): 0.71
Row(5): 0.97
Row(6): 0.21
Row(7): 0.48

Row(8): 0.46
Row(9): 0.28
Row(10): 0.50
Row(11): 0.78

RANKING THE PREFERENCE ORDER FROM BEST OPTION TO WORST OPTION:

Rank 1: Row(5) 0.97
Rank 2: Row(3) 0.79
Rank 3: Row(11) 0.78
Rank 4: Row(2) 0.75
Rank 5: Row(4) 0.71
Rank 6: Row(1) 0.52
Rank 7: Row(10) 0.50
Rank 8: Row(7) 0.48
Rank 9: Row(8) 0.46
Rank 10: Row(9) 0.28
Rank 11: Row(6) 0.21

FINAL RESULT OF TOPSIS METHOD (ORDER OF BUSINESS MODELS FROM STRONGEST TO WEAKEST)

Table 4.29 Final Result - ranks of business models using Topsis Method

RANKING	BUSINESS MODEL
Rank 1:	Auction
Rank 2:	B2B Exchange
Rank 3:	Utility
Rank 4:	Merchant
Rank 5:	Virtual Mall
Rank 6:	E-shop
Rank 7:	Community
Rank 8:	Subscription
Rank 9:	Infomediary
Rank 10:	Affiliate
Rank 11:	Advertising

As shown table 4.29, Auction model has come out to be the strongest business model, and on the other end Advertising model has come out to be the weakest business model. Electre method is now used for ranking the business models.

4.7 Application of Electre Method to Business Model Decision Matrix

4.7.1 Development of a UNIX based C Program for MADM for Electre Method

In Electre method too, considering the dynamics of the business models and the attributes, and to generalize the problem, the situation whereby more business models can be added for comparison and the number of attributes can be increased, is taken care of. Future business models might require comparison of many more attributes. Henceforth a C program was developed on UNIX platform for MADM incorporating ELECTRE Algorithm, which is capable of handling infinite order matrix (m x n). Considering the programming aspect, the program for ELECRE was more involved than the TOPSIS method, since it required formation of Concordance and Discordance matrices and operations upon them. The program listing is attached in Appendix A. The program was first tested for correctness using a sample MADM problem with known results. The results matched perfectly, signifying the correctness of the C program.

4.7.2 Decision Matrix analysis using Electre Method – Intermediate and final results from the program

ORIGINAL INPUT MATRIX :

3.00 3.00 3.00 4.00 3.00 2.00 3.00 3.00
4.00 4.00 3.00 5.00 4.00 4.00 3.00 3.00
5.00 2.00 3.00 5.00 5.00 4.00 4.00 4.00
4.00 4.00 3.00 5.00 3.00 3.00 3.00 4.00
5.00 5.00 4.00 5.00 5.00 5.00 4.00 4.00
1.00 5.00 5.00 1.00 2.00 3.00 1.00 3.00
3.00 3.00 5.00 3.00 3.00 4.00 2.00 3.00
2.00 3.00 5.00 4.00 3.00 3.00 3.00 4.00
2.00 5.00 3.00 1.00 3.00 2.00 2.00 3.00
3.00 2.00 5.00 3.00 5.00 3.00 3.00 3.00
4.00 4.00 5.00 4.00 4.00 5.00 4.00 2.00

WEIGHTS:

0.24 0.12 0.05 0.19 0.07 0.14 0.17 0.02

NORMALIZATION FACTORS:

Column(1): 11.58
Column(2): 12.57
Column(3): 13.64
Column(4): 12.96
Column(5): 12.49
Column(6): 11.92
Column(7): 10.10
Column(8): 11.05

WEIGHTED NORMALIZED MATRIX:

0.06	0.03	0.01	0.06	0.02	0.02	0.05	0.01
0.08	0.04	0.01	0.07	0.02	0.05	0.05	0.01
0.10	0.02	0.01	0.07	0.03	0.05	0.07	0.01
0.08	0.04	0.01	0.07	0.02	0.04	0.05	0.01
0.10	0.05	0.01	0.07	0.03	0.06	0.07	0.01
0.02	0.05	0.02	0.01	0.01	0.04	0.02	0.01
0.06	0.03	0.02	0.04	0.02	0.05	0.03	0.01
0.04	0.03	0.02	0.06	0.02	0.04	0.05	0.01
0.04	0.05	0.01	0.01	0.02	0.02	0.03	0.01
0.06	0.02	0.02	0.04	0.03	0.04	0.05	0.01
0.08	0.04	0.02	0.06	0.02	0.06	0.07	0.00

THE CONCORDANCE MATRIX:

0.00	0.00	0.12	0.00	0.00	0.67	0.36	0.24	0.60	0.31	0.02
0.76	0.00	0.12	0.21	0.00	0.81	0.78	0.76	0.81	0.69	0.21
0.83	0.50	0.00	0.62	0.00	0.83	0.69	0.81	0.83	0.76	0.52
0.71	0.02	0.12	0.00	0.00	0.69	0.74	0.55	0.76	0.57	0.21
1.00	0.81	0.31	0.79	0.00	0.83	0.95	0.93	0.88	0.88	0.64
0.31	0.17	0.17	0.17	0.05	0.00	0.12	0.12	0.19	0.12	0.14
0.19	0.05	0.17	0.19	0.05	0.81	0.00	0.38	0.62	0.26	0.02
0.21	0.07	0.17	0.05	0.05	0.69	0.38	0.00	0.57	0.33	0.02
0.12	0.12	0.12	0.12	0.00	0.48	0.12	0.12	0.00	0.12	0.14
0.26	0.12	0.05	0.12	0.05	0.67	0.24	0.31	0.86	0.00	0.09
0.79	0.36	0.31	0.43	0.05	0.81	0.93	0.74	0.86	0.86	0.00

Sum of Concordance Matrix Elements: 43.41

Average (Threshold Value) of Concordance Matrix: 0.39

CONCORDANCE DOMINANCE MATRIX:

0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00
1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00
1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00

THE DISCORDANCE MATRIX:

0.00	1.00	1.00	1.00	1.00	0.43	1.00	0.58	0.43	0.82	1.00
0.00	0.00	1.00	0.17	1.00	0.15	0.24	0.17	0.16	0.24	1.00
0.23	0.92	0.00	0.92	1.00	0.35	0.23	0.15	0.46	0.17	0.92
0.00	1.00	1.00	0.00	1.00	0.15	0.41	0.17	0.16	0.39	1.00
0.00	0.00	0.00	0.00	0.00	0.04	0.09	0.06	0.00	0.09	0.17
1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
0.69	1.00	1.00	1.00	1.00	0.46	0.00	0.80	0.65	1.00	1.00
1.00	1.00	1.00	1.00	1.00	0.43	1.00	0.00	0.43	1.00	1.00
1.00	1.00	1.00	1.00	1.00	0.58	1.00	1.00	0.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	0.69	0.73	0.71	0.97	0.00	1.00
0.06	0.89	1.00	0.61	1.00	0.15	0.06	0.10	0.22	0.24	0.00

Sum of Discordance Matrix Elements: 73.95
Average (Threshold Value) of Discordance Matrix: 0.67

DISCORDANCE DOMINANCE MATRIX:

0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00
1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00
1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00
1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00
1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00

THE AGGREGATE DOMINANCE MATRIX:

0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00
1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00
1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00
1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00

FINAL RESULT - THE BEST OPTIONS:

Option 1 is better than option 6
Option 1 is better than option 9

Option 2 is better than option 1

Option 2 is better than option 6

Option 2 is better than option 7

Option 2 is better than option 8

Option 2 is better than option 9

Option 2 is better than option 10

Option 3 is better than option 1

Option 3 is better than option 6

Option 3 is better than option 7

Option 3 is better than option 8

Option 3 is better than option 9

Option 3 is better than option 10

Option 4 is better than option 1

Option 4 is better than option 6

Option 4 is better than option 7

Option 4 is better than option 8

Option 4 is better than option 9

Option 4 is better than option 10

Option 5 is better than option 1

Option 5 is better than option 2

Option 5 is better than option 4

Option 5 is better than option 6

Option 5 is better than option 7

Option 5 is better than option 8

Option 5 is better than option 9

Option 5 is better than option 10

Option 5 is better than option 11

Option 7 is better than option 6

Option 7 is better than option 9

Option 8 is better than option 6

Option 8 is better than option 9

Option 9 is better than option 6

Option 11 is better than option 1

Option 11 is better than option 4

Option 11 is better than option 6

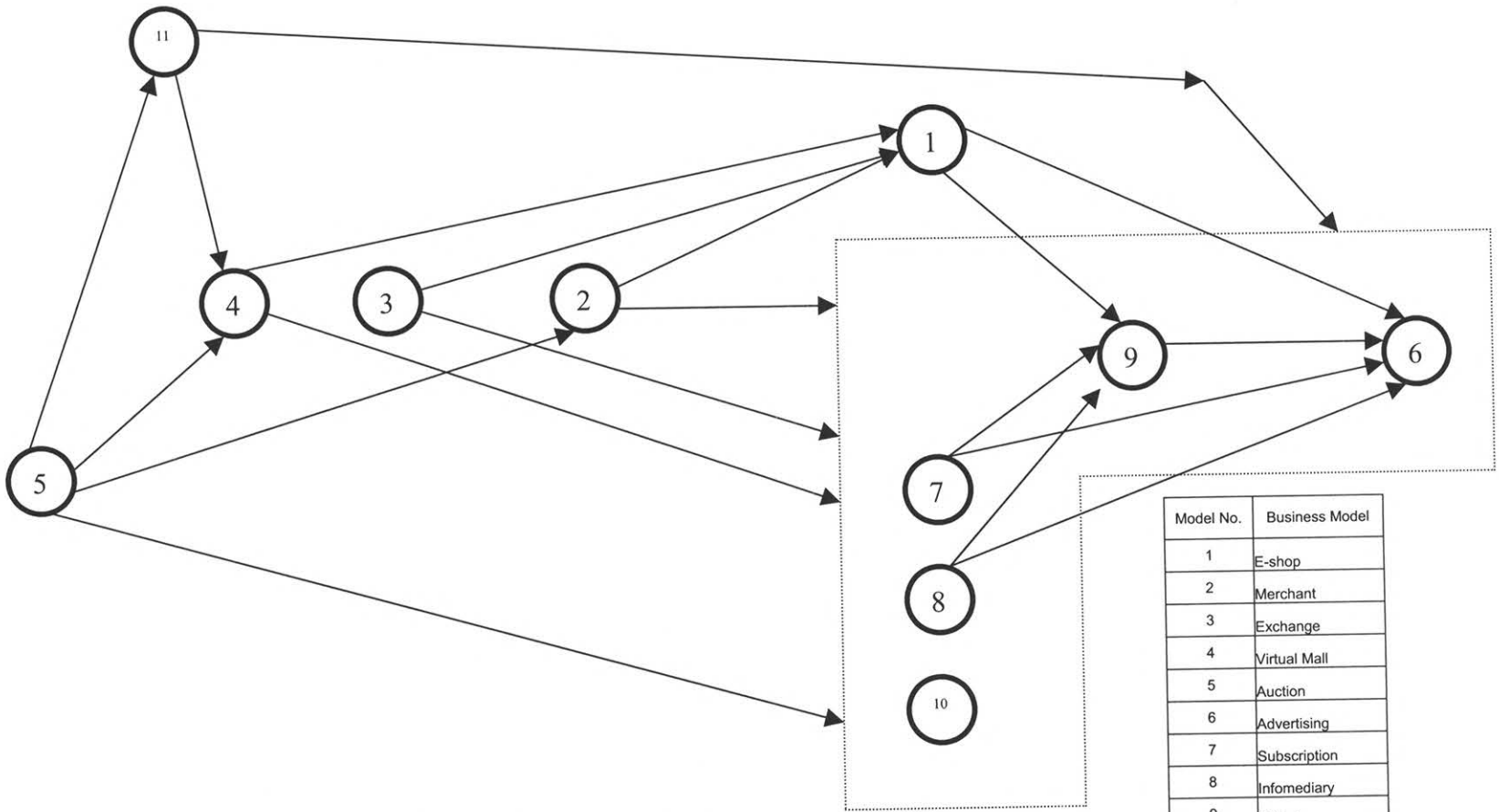
Option 11 is better than option 7

Option 11 is better than option 8

Option 11 is better than option 9

Option 11 is better than option 10

Ranking the Business Models



Model No.	Business Model
1	E-shop
2	Merchant
3	Exchange
4	Virtual Mall
5	Auction
6	Advertising
7	Subscription
8	Infomediary
9	Affiliate
10	Community
11	Utility

Fig 4.3 Relationship amongst Models as obtained by Electre Method for MADM

4.8 Discussion of Results

The results of the two methods discussed complement each other. Each method has given the ranking of the business models, though the Topsis method ranks all the options while the Electre method just gives the relationships between the options (see figure 4.3). The drawback of Electre method is that we cannot tell the preference relation between some options, for example between 2, 3 and 4 (Merchant, Exchange and Virtual Mall) in figure 4.3. Electre does not also specify the ranking between models 3 and 5 (Exchange and Auction), but it does tells us that Auction Model is better than all other models (except for 3, for which it doesn't show the relationship) Looking at the results of both the methods, it can be asserted that the Model 5, that is, the Auction Model is the strongest business model. Also both models suggest that the advertising model (model 6 in figure 4.3) is the weakest model. If the present market scenario (as of March 2001), is taken into consideration the results are in line with the actual situation. Ebay with its Auction model is doing very well as compared to companies with other e-commerce business models (see figure 4.4 a, b and c). Also, companies with sole model as the advertising model are finding it extremely difficult to sustain. Even Yahoo, which was one of the largest portals for advertisements on the Internet (90% of its revenues were from advertisements) has started switching to other sources of revenue. For example it has introduced, fees for listing in its search engine (which was free before). The companies now have to pay a fee to Yahoo, if they want to be listed in the yahoo search, whereby when a search is made for the company or the related field, it would be listed in the results, thus allowing people to access the company website or related information. Yahoo has also introduced listing fees for Yahoo auctions.

Next chapter (Chapter 5) would carry out the validation and testing of the results obtained in this chapter.

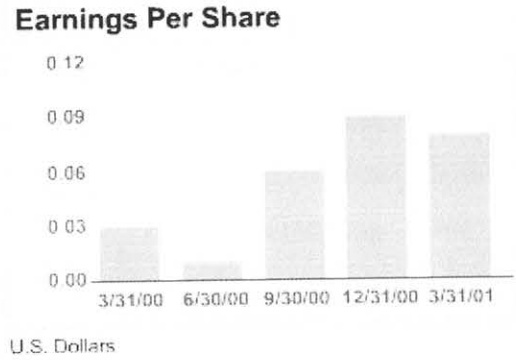


Figure 4.4a Quarterly earnings per share of Ebay Inc. (Auction Model)

Source: *Wall Street journal*

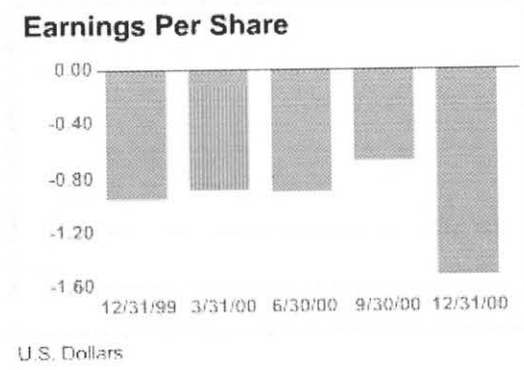


Figure 4.4b Quarterly earnings per share of Amazon.com (Merchant Model)

Source: *Wall Street journal*

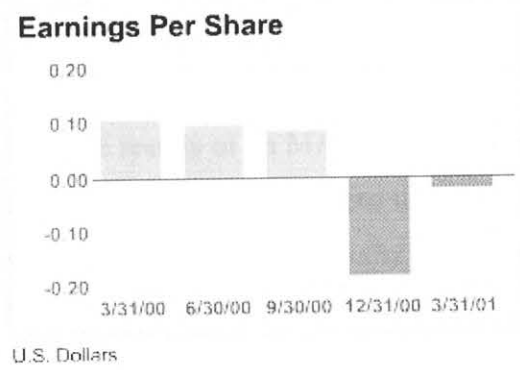


Figure 4.4c Quarterly earnings of Yahoo.com (Advertising + other Models)

Source: *Wall Street journal*

Chapter 5

VERIFICATION AND VALIDATION

5.1 Introduction

Having discussed the MADM models for ranking business models in Chapter 4, the aim now is to verify the robustness of the ranking method. In this chapter a sensitivity analysis would be carried out on the weights for the various attributes. Effect of variation in weights on the ranking of business models would be analyzed. This would also ensure the effect of change in attribute values on the ranking of business models.

5.2 Sensitivity analysis

Sensitivity analysis is the analysis of the influence of one or a group of observations to a statistical model [Canada and White, 1980]. Sensitivity analysis measures the impact on project outcomes of changing one or more key input values about which there is uncertainty. For example, a pessimistic, expected, and optimistic value might be chosen for an uncertain variable. Then an analysis could be performed to see how the outcome changes as each of the three chosen values is considered in turn, with other things held the same.

An important question about the results of an MADM procedure is: How sensitive is this recommendation to the numbers I put in? If I changed the ranks of some attributes, would I still get the same recommendation? If I changed my evaluation of some attributes for some alternatives, would I get the same recommendation?

Sensitivity analysis of MADM proceeds by doing exactly those kinds of things: considering places in the analysis where values might not be exact, and varying them to see what happens to the final recommendation. If the final recommendation is insensitive to these changes, it's said to be "robust".

5.3 Sensitivity analysis on business model rankings

Each of the attributes or parameters used for comparing the business models (for example customer value, revenue etc.) has different relative importance to the success or strength of the business models. Henceforth depending upon the importance, weights were assigned to these attributes (see section 4.4.4). A sensitivity analysis is now carried out on these weights to see the effect of change in weights on the ranking of business models. As discussed in section 4.4.4, normalized weights (sum equal to 1) have been used, which were obtained by first assigning the Intensity factors to the attributes (see table 4.27). This makes the analysis a little complicated. This is due to the fact that now intensity factors have to be first varied (see table 4.27), then normalized weights are calculated and then finally the rankings are estimated with these weights. Therefore intensity factors are varied for each attribute by +5,+10,+20 and -5,-10 and -20 percent, and for each variation normalized weights are re-calculated, and then simulation is run for each variation. This leads to 48 (8 attributes x 6 percent values(+/-5,+/-10,+/-20)) combinations. This number of combinations is very difficult to simulate manually, henceforth C programs were developed to crunch the numbers.

5.3.1 C Program for Sensitivity Analysis Simulation

Two programs were developed in C language to aid the simulation. The first program calculates the normalized weights for each variation of Intensity Factor. The weights for all attributes for each change (48 changes) are then dumped in a data file. The second program does the actual sensitivity analysis, by feeding the weights to the TOPSIS algorithm (see section 4.5.1 and 4.6.1). The weights are continuously read from the data file (created by the first program) in a loop, and the rankings calculated. The program listing is attached in Appendix A.

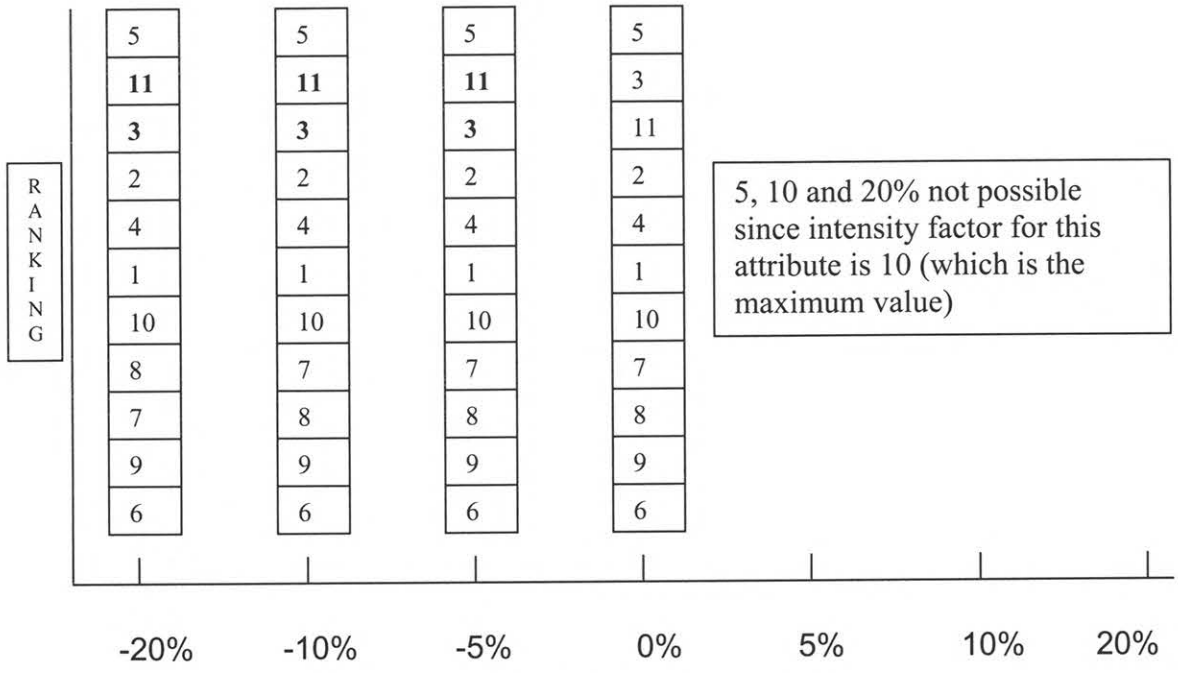
5.3.2 Result of Sensitivity Analysis on weights

Now the results of sensitivity analysis for weights, are presented, one by one for each attribute. Figures 5.1 through 5.8 show the effect of change in weight on the ranking of the business models. The Intensity factors (used in the calculation of normalized weights) are varied by +/-5,+/-10, and +/-20 percent, and then the models are ranked with these variations. The rankings are shown in the vertical boxes. The models are represented by their model numbers (table 5.1), and the rankings are best to worst from top to bottom. That is, the topmost option is the best option and the bottom most is the worst option.

Table 5.1 Business Models represented by their model numbers

Model No.	Business Model
1	E-shop
2	Merchant
3	Exchange
4	Virtual Mall
5	Auction
6	Advertising
7	Subscription
8	Infomediary
9	Affiliate
10	Community
11	Utility

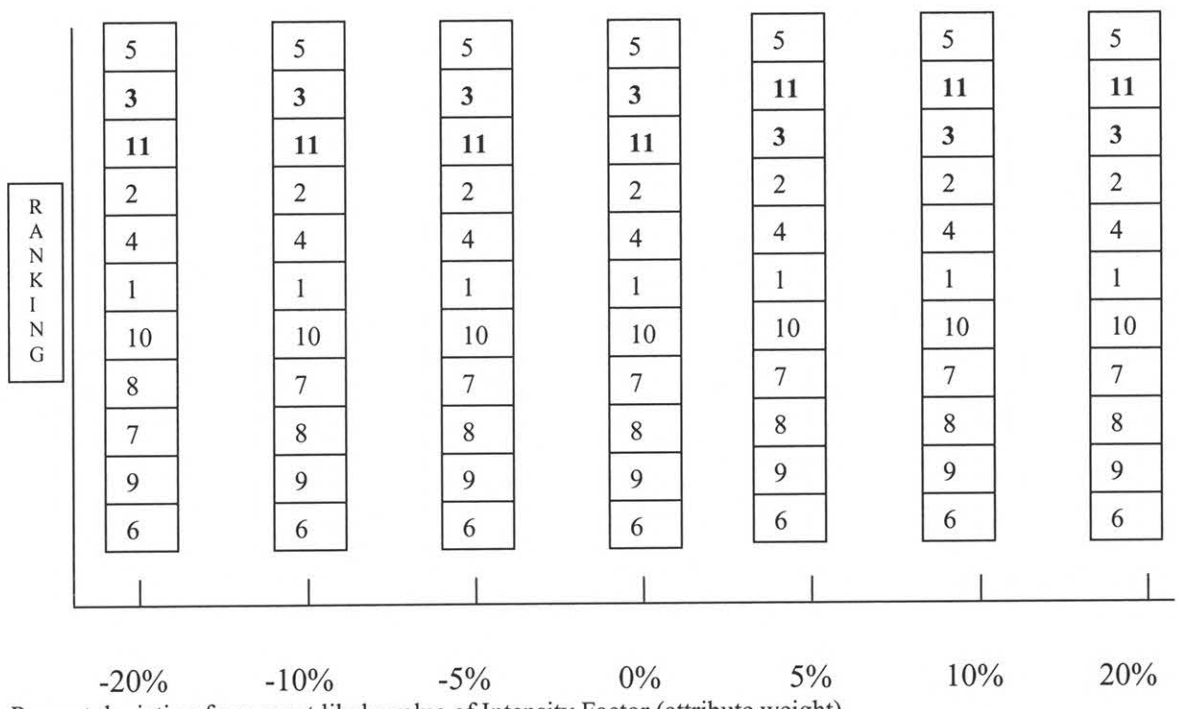
Weight of Attribute 1: Customer Value



Percent deviation from most likely value of Intensity Factor (attribute weight)

Figure 5.1 Sensitivity Analysis for Weight of Attribute- Customer Value

Weight of Attribute 2: Market segment scope



Percent deviation from most likely value of Intensity Factor (attribute weight)

Figure 5.2 Sensitivity Analysis for Weight of Attribute– Market Segment Scope

Weight of Attribute 3: Geographical scope

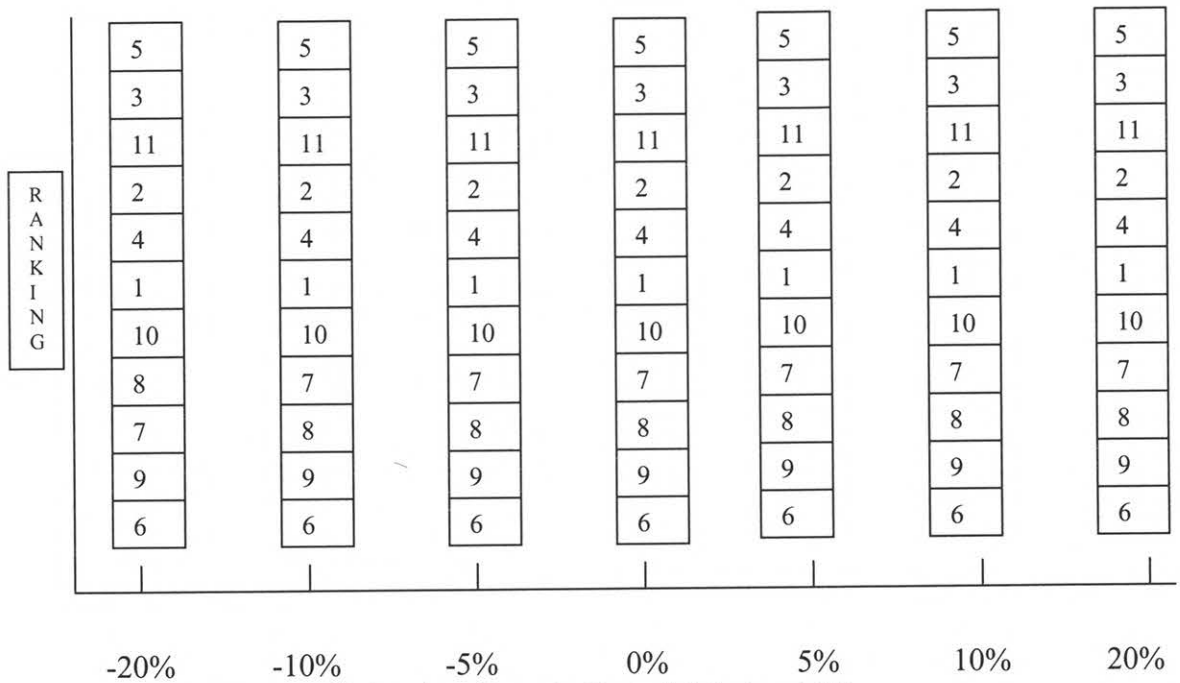


Figure 5.3 Sensitivity Analysis for Weight of Attribute- Geographical scope

Weight of Attribute 4: Revenue

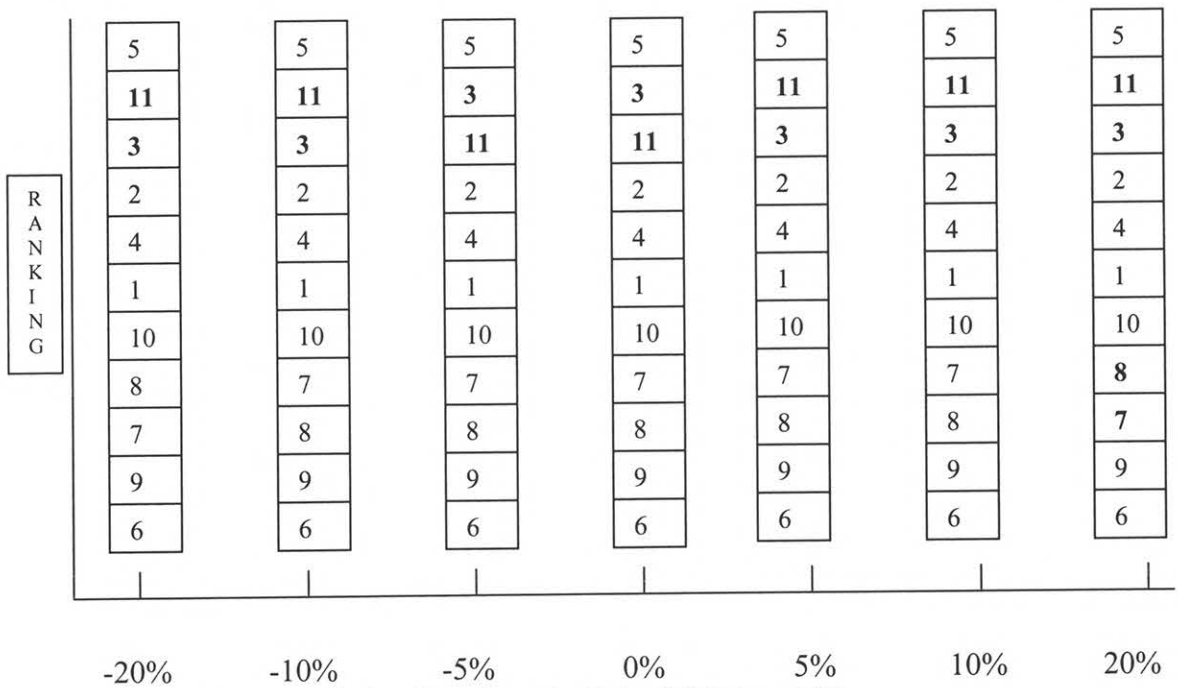
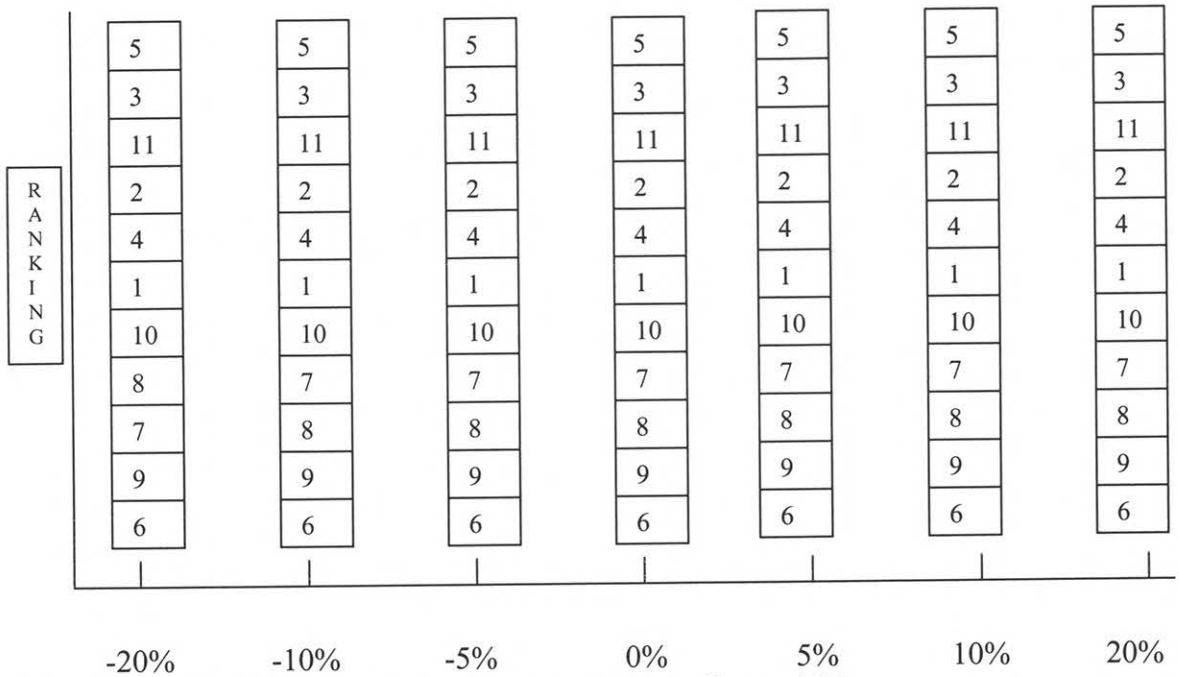


Figure 5.4 Sensitivity Analysis for Weight of Attribute- Revenue

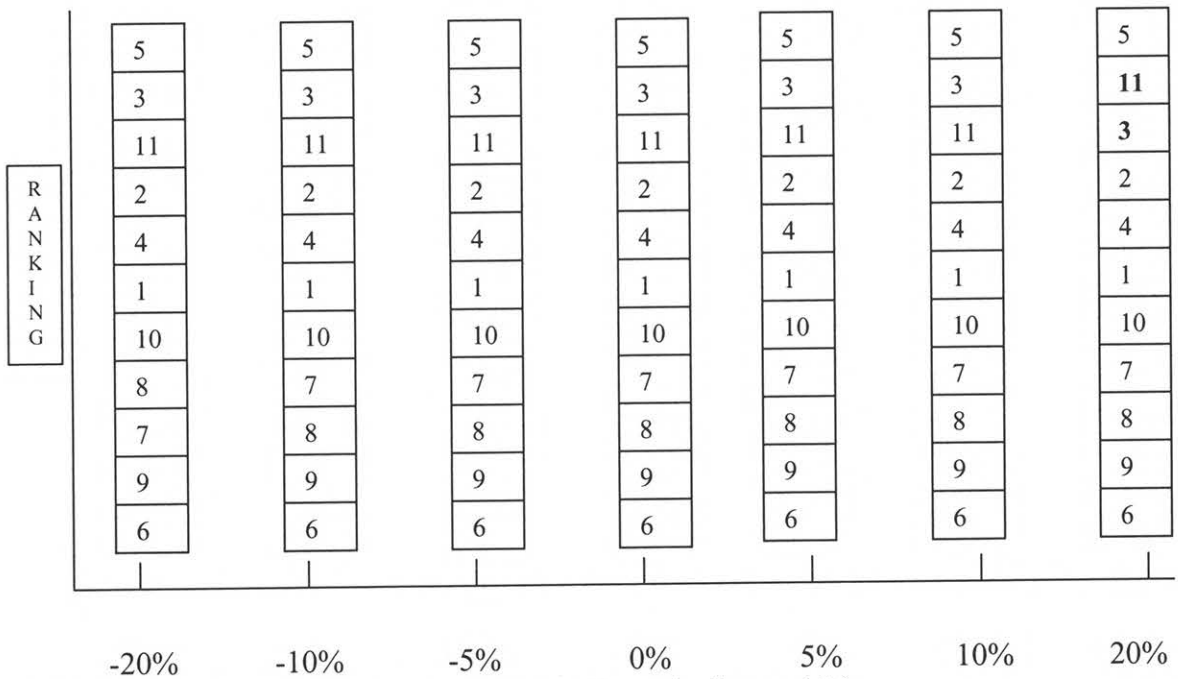
Weight of Attribute 5: Market state



Percent deviation from most likely value of Intensity Factor (attribute weight)

Figure 5.5 Sensitivity Analysis for Weight of Attribute- Market State

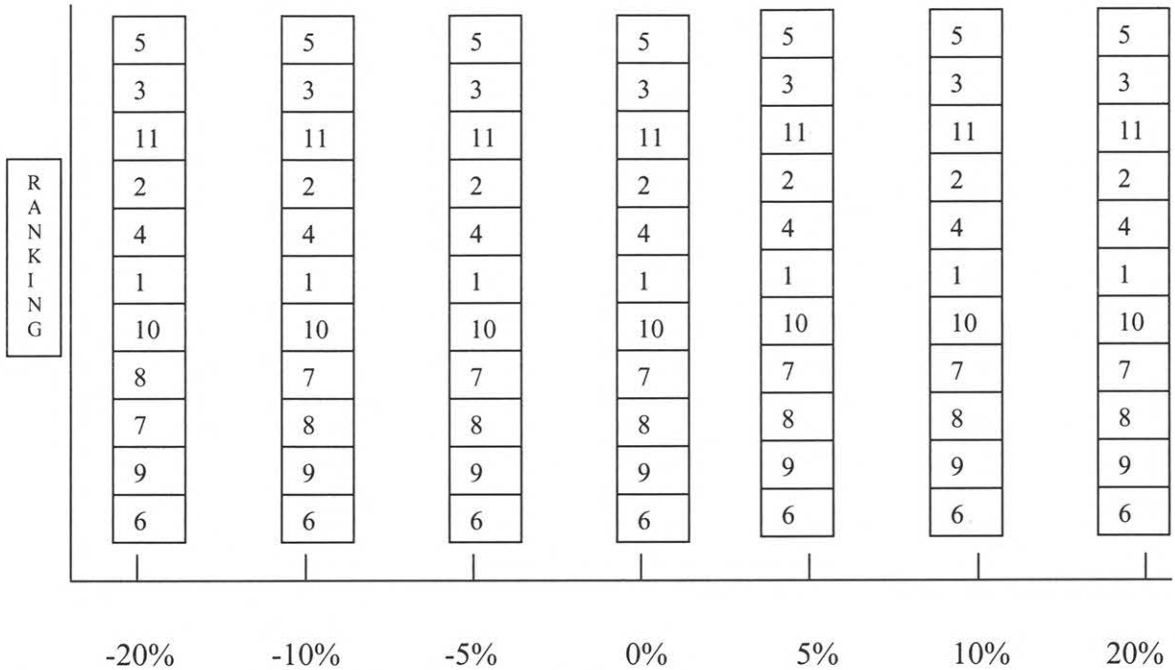
Weight of Attribute 6: Capabilities



Percent deviation from most likely value of Intensity Factor (attribute weight)

Figure 5.6 Sensitivity Analysis for Weight of Attribute- Capabilities

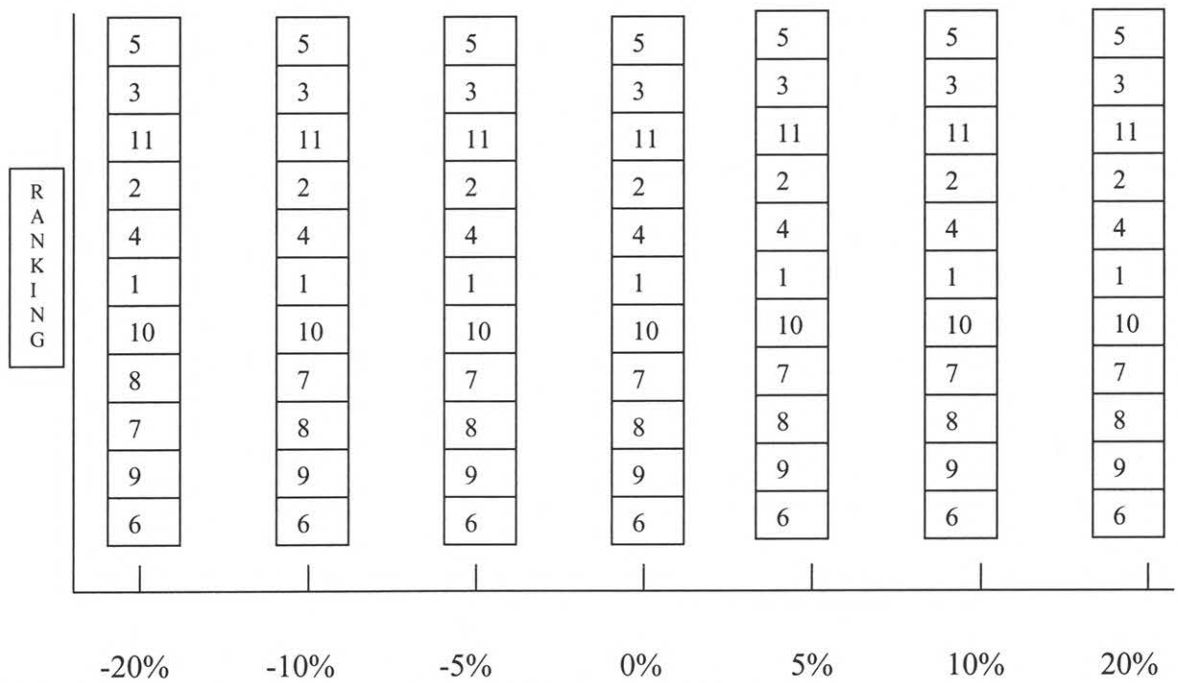
Weight of Attribute 7: Sustainability



Percent deviation from most likely value of Intensity Factor (attribute weight)

Figure 5.7 Sensitivity Analysis for Weight of Attribute- Sustainability

Weight of Attribute 8: Timing



Percent deviation from most likely value of Intensity Factor (attribute weight)

Figure 5.8 Sensitivity Analysis for Weight of Attribute- Timing

5.3.3 Discussion of Results

Figures 5.1 through 5.8 show the ranking of the models with the change in the weights. As we see from the figures, the ranking of the models to not change substantially with the change in the weights.

In figure 5.1, -5, -10 and -20% change in the intensity factor of attribute 1 (Customer Value) results in reversing for ranks for models 3 and 11. Model 11 is Utility model and model 3 is Exchange model. All other ranks remain same.

In figure 5.2, again models 3 and 11 exchange their positions when the intensity factor of attribute 2 (Market segment scope) changes by +5, +10 and +20%.

In figure 5.4 on 20% change in attribute 4 (Revenue), models 7 and 8 exchange their rankings. Model 7 is subscription model and model 8 is infomediary model.

In figure 5.6, with 20% change in attribute 6 (Capabilities) models 11 and 3 exchange their ranks.

The +/-20% change in weights has very little effect on business model rankings; henceforth our recommendation is be robust.

It is to be noted here, that sensitivity analysis should also be done on the actual attribute values (besides the weights), changing values of each attribute (keeping other attributes unchanged, see table 5.2) by definite percentage and then studying the effect on the ranking of business models. On careful analysis, we find that this has already been taken care of while doing the sensitivity analysis of weights. We change the intensity factors by a definite percentage, hence changing the normalized weight. Now these weights are for their unique attributes. While calculating the ranking, the attributes are first normalized and then multiplied by their respective weights, which have been changed by a definite percentage. This multiplication in turn changes the normalized attribute values by the same percentage, henceforth serving our purpose of doing sensitivity analysis on the attributes.

The results of the sensitivity show that minor changes in the attribute values do not significantly affect the rankings. Henceforth this gives an implication that our model is robust.

Chapter 6

CONCLUSION AND SCOPE FOR FUTURE RESEARCH

6.1 Internet - A Corporate view

The Internet will require and truly enable the companies to become round the clock operations that can act more quickly and more flexibly [Callahan and Pasternack, 1999]. It will restructure roles within the value chain by blurring boundaries between companies and their customers, suppliers, partners and even competitors. It will force CEOs to create new business cultures where innovation, change management and leadership through shared mission are paramount. Although no one has figured out all the ramifications yet, most senior executives are certain that they must invest in the Internet and related technology or lose market share. By ceasing to reply on the old tools and traditional business rules, companies are preparing to emerge from the coming transformation on the top.

6.2 Conclusion

One of the chief components in the success of any e-commerce venture is the business model. A business model is the way the firm intends to position itself in the value chain and make money doing so. One of the key questions for online companies is – which e-commerce business model to adopt? This thesis aimed at appraising the business models by first understanding the broad categories of business models (B2B, B2C, C2C and C2B), and their characteristics and then developing taxonomy of the existing business models. Selecting a business model involves a clear understanding of all the business models and knowledge of how the business models compare with each other, given the macro environment. After having studied business models, the attributes that define the success of business models were identified. Using intensity factors, the qualitative information for the attributes for all the identified business models were quantified on a common scale. Weights were assigned to the attributes depending upon their relative

significance. Two approaches for Multiple Attribute Decision Making (MADM), namely Topsis and Electre methods were then used to evaluate the ranking of the business models. After having calculated the ranking, the results were verified using sensitivity analysis. Since the matrix thus formed was an 11x8 (11 business models and 8 attributes), C programs were developed to crunch the matrix for both MADM methods. C programs were also developed for the sensitivity analysis simulation, which would have been extremely time consuming and error prone if done manually. There were 48 simulations in all, which resulted in complete re-evaluation of the MADM matrix in each simulation.

Both the approaches of MADM signified the importance of Auction model (e.g. eBay.com). Second in the line was the Exchange model (for example VetricalNet.com). The weakest model came out to be the advertising model. Given the present market scenario, the results of the analysis match with the present market results. General perception was that the retail model (for example Amazon.com) is one of the strongest model. The results suggest the retail or the merchant model ranks fourth. As of April 2001, it can be seen that while eBay is doing well financially, Amazon is not only yet to breakeven, but the stock prices are sliding too. A little unexpected result was the standing of the Utility model at the third place. Utility model has not been fully exploited by online companies as yet, but it holds great potential. Community, subscription, infomediary and affiliate models have also come out to be weak business models. These models would be better off, if used in conjunction with other business models. In effect, these should be complementary to the major business model. This can be seen as more and more models like B2B Exchanges are building their own online communities for better exchange of information on a subject of common interest. The Exchange models have also adopted subscription model.

6.3 Scope for Future Research

This thesis basically aimed at developing a method to appraise business models with respect to certain pre-determined attributes, by quantifying the attributes, creating a numerical matrix and then crunching the numbers through the methods of MADM. Only

broad (generic) business models were considered in the evaluation. Future research might aim at comparing all the models as discussed in Chapter 2, with increased number of attributes to more accurately rank specific business models. Moreover for a complete analysis, companies need to consider some other factors too, including intangibles like strategic management capabilities etc. All the values for the parameters have been currently assigned depending upon model characteristics. Future research might include the assignment of values through a survey from experienced managers from existing online companies.

Future research might also include the development of a computer program, which would dynamically show the effect of changing attribute values on the strength of the business models.

A logical extension of the present work can be the valuation of e-commerce companies (for stock evaluation etc.) by considering the profitability and profitability predictor measures. As discussed in Chapter 4 (table 4.1), a company can be measured at three levels:

- Profitability measures
- Profitability predictor measures
- Component attribute measures

Business models in this thesis have been measured with respect to the third level, the component attribute measure, which is the most fundamental measure. Addition of profitability measure (earnings and cash flows) and profitability predictor measures (margins and market share) can result in a very effective system for valuation of companies for stock markets etc.

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APPEDDIX A

PROGRAM LISTING FOR MADM AND SENSITIVITY ANALYSIS

PROGARM 1:

/*TOPSIS METHOD FOR MULTIPLE ATTRIBUTE DECISION MAKING*/

```
#include<stdio.h>
#include<math.h>
#define MAX_ROWS 11
#define MAX_COLS 8
#define NULL 0

main()
{

int i;
int j;
float sum =0;
float sum2 = 0;
float matrix[MAX_ROWS][MAX_COLS];
float weight[MAX_COLS];
float normal[MAX_COLS];
float max[MAX_COLS];
float min[MAX_COLS];
float separation_ideal[MAX_ROWS];
float separation_Nideal[MAX_ROWS];
float rel_closeness[MAX_ROWS];
float temp;
int order[MAX_ROWS];
float copy_rel_closeness[MAX_ROWS];

void print_output(float a[][]);


/***************** READING INPUT MATRIX DATA FILE */

FILE *fpt;
if ((fpt = fopen("input.txt","r")) == NULL)
printf("\nSorry! Could not open file\n");

printf("\n\nINPUT File open successfull!\n\n");

for (i=0; i < MAX_ROWS ; i++)
{

        for(j=0; j < MAX_COLS ; j++)
        {
        fscanf(fpt,"%f ",&matrix[i][j]);
        }
}
```

```
printf("\n\nORIGINAL INPUT MATRIX :\n\n");
print_output(matrix);

/********* READING WEIGHTS FROM THE DATA FILE */
printf("\n\nWEIGHTS:\n\n");

for (j=0; j < MAX_COLS ; j++)
{
fscanf(fpt,"%f",&weight[j]);
printf("%f  ",weight[j]);
}

fclose(fpt);

/********* NORMALIZING THE MATRIX */

/* STEP-1 FINDING THE NORMALIZATION FACTORS */
printf("\n\nNORMALIZATION FACTORS:\n\n");

for(j=0; j < MAX_COLS; j++)
{
        for(i =0; i < MAX_ROWS;i++)
        {
        sum += pow(matrix[i][j],2);
        }
        normal[j] = sqrt(sum);
        printf("\nColumn(%d): %f",j+1,normal[j]);
        sum = 0;
}


/* STEP-2 : FINDING THE WEIGHTED NORMALIZED MATRIX */

for(i=0; i < MAX_ROWS; i++)
{
        for(j=0; j < MAX_COLS; j++)
        {
        matrix[i][j] = (matrix[i][j]/normal[j])*weight[j];
        }
}

printf("\n\nWEIGHTED NORMALIZED MATRIX: \n\n");
print_output(matrix);


/******* DETERMINING IDEAL AND NEGATIVE IDEAL SOLUTIONS */
/* GETTING MAX AND MIN IN EACH COLUNM */

printf("\n\nIDEAL AND NEGATIVE IDEAL SOLUTIONS\n");
printf("(MAXIMUM AND MINUMUM VALUES IN EACH COLUMN):\n\n");

for (j =0 ; j < MAX_COLS; j++)
{
        max[j] = matrix[0][j];
        min[j] = matrix[0][j];
        for(i =0; i < MAX_ROWS; i++)
```

```
        {
        if ( matrix[i][j] >=  max[j]) max[j] = matrix[i][j];
        if ( matrix[i][j] <=  min[j]) min[j] = matrix[i][j];
        }
        printf("\nCOL %d: max=%f , min= %f",j+1, max[j], min[j]);

}


/******* CALCULATING SEPARATION MEASURES */
sum =0;

printf("\n\nSEPERATION MEASURES:\n\n");

for (i =0; i < MAX_ROWS; i++)
{
        for(j =0; j < MAX_COLS; j++)
        {
        sum  += pow((matrix[i][j]-max[j]),2);
        sum2 += pow((matrix[i][j]-min[j]),2);
        }
        separation_ideal[i] = sqrt(sum);
        separation_Nideal[i] =sqrt(sum2);
        sum=0;
        sum2=0;
    printf("\nSep. Ideal(row=%d)   : %f",i+1, separation_ideal[i]);
        printf("\nSep.Neg-Ideal(row=%d): %f\n",i+1,separation_Nideal[i]);
}


/********** DETERMINING RELATIVE CLOSENESS TO IDEAL SOLUTION */
printf("\n\nRELATIVE CLOSENESS TO IDEAL SOLUTION:\n\n");

for(i = 0; i < MAX_ROWS; i++)
{
rel_closeness[i]= separation_Nideal[i]/(separation_ideal[i] +
separation_Nideal[i]);
copy_rel_closeness[i] = rel_closeness[i];

printf("\nRow(%d): %f  ",i+1,rel_closeness[i]);
}


/********* RANKING THE PREFERENCE ORDER */


for(i=0; i < MAX_ROWS-1; ++i)
{
        for(j =i+1; j < MAX_ROWS ; j++)
        {
                if (rel_closeness[j] >  rel_closeness[i])
                {
                temp = rel_closeness[i];
                rel_closeness[i] = rel_closeness[j];
```

```
                    rel_closeness[j] = temp;
                    }

          }
}

/************ FINDING THE RANK */
for(i = 0 ; i < MAX_ROWS ; ++i)
{
          for(j=0; j < MAX_ROWS; ++j)
          if ( rel_closeness[i] == copy_rel_closeness[j]) order[i]=j;
}

printf("\n\nRANKING THE PREFERENCE ORDER\n");
printf("FROM BEST OPTION TO WORST OPTION:\n\n");

for (i =0; i < MAX_ROWS; i++)
{
printf("\nRank %d:  Row(%d) %f",i+1,order[i]+1,rel_closeness[i]);
}


printf("\n\nTask finished !\n\n");

} /* This is the ending bracket for main */


/* THIS FUNCTION IS JUST FOR PRINTING THE MATRIX */
void print_output(float  a[MAX_ROWS][MAX_COLS])
{
int i;
int j;

for (i=0; i < MAX_ROWS ; i++)
{

      for(j=0; j < MAX_COLS ; j++)
      {

      printf("%f  ",a[i][j]);
      }
          printf("\n");
}

}
```

PROGRAM 2:

/* ELECTRE METHOD FOR MULTIPLE ATTRIBUTE DECISION MAKING */

```
#include<stdio.h>
#include<math.h>
#define MAX_ROWS 11
#define MAX_COLS 8
#define NULL 0

main()
{

int i;
int j;
float sum =0;
float matrix[MAX_ROWS][MAX_COLS];
float weight[MAX_COLS];
float normal[MAX_COLS];
float temp;
int order[MAX_ROWS];
static float c[MAX_ROWS][MAX_ROWS];          /* NxN concordance matrix */
static float d[MAX_ROWS][MAX_ROWS];          /* NxN discordance matrix */
static float Agg[MAX_ROWS][MAX_ROWS];        /* NxN aggregate dominance matrix */
int k;
float average=0;
float max=0;
float diff=0;

void Print_MxN_Matrix(float a[][]);
void Print_NxN_Matrix(float a[][]);
float  Max_All_Col(float a[][],int,int);

/***************** READING INPUT MATRIX DATA FILE */

FILE *fpt;
if ((fpt = fopen("input.txt","r")) == NULL)
printf("\nSorry! Could not open file\n");

printf("\n\nINPUT File open successfull!\n\n");

for (i=0; i < MAX_ROWS ; i++)
{
        for(j=0; j < MAX_COLS ; j++)
        {
        fscanf(fpt,"%f ",&matrix[i][j]);
        }
}
printf("\n\nORIGINAL INPUT MATRIX :\n\n");
Print_MxN_Matrix(matrix);


/********* READING WEIGHTS FROM THE DATA FILE */
printf("\n\nWEIGHTS:\n\n");
```

```
for (j=0; j < MAX_COLS ; j++)
{
fscanf(fpt,"%f",&weight[j]);
printf("%f  ",weight[j]);
}

fclose(fpt);

/********* NORMALIZING THE MATRIX */

/* STEP-1 FINDING THE NORMALIZATION FACTORS */
printf("\n\nNORMALIZATION FACTORS:\n\n");

for(j=0; j < MAX_COLS; j++)
{
        for(i =0; i < MAX_ROWS;i++)
        {
        sum += pow(matrix[i][j],2);
        }
        normal[j] = sqrt(sum);
        printf("\nColumn(%d): %f",j+1,normal[j]);
        sum = 0;
}


/* STEP-2 : FINDING THE WEIGHTED NORMALIZED MATRIX */

for(i=0; i < MAX_ROWS; i++)
{
        for(j=0; j < MAX_COLS; j++)
        {
        matrix[i][j] = (matrix[i][j]/normal[j])*weight[j];
        }
}
printf("\n\nWEIGHTED NORMALIZED MATRIX: \n\n");
Print_MxN_Matrix(matrix);


/* DETERMINING THE CONCORDANCE SET AND MATRIX */
/* Note that concordance and discordance matrices are NxN matrix with
number of columns equal to the number of rows  */

for( i = 0; i < MAX_ROWS; i++)
        {
                for(j=0;j<MAX_ROWS;j++)
                        {
                                if(i==j)
                                {
                                c[i][j] = 0;
                                continue; // Bypass rest of the j loop
                                }
                        for(k=0;k<MAX_COLS;k++)
                                {
                        if(matrix[i][k]>matrix[j][k]) c[i][j]+=weight[k];
                                }
                        }
```

```
        }
printf("\n\n");
printf("THE CONCORDANCE MATRIX:");
printf("\n\n");
Print_NxN_Matrix(c);

/* DETERMING CONCORDANCE DOMINANCE MATRIX ( 0'S AND 1'S MATRIX) */

/*FINDING THRESHOLD VALUE (AVERAGE CONCORDANCE INDEX) */
sum =0;
for(i=0;i<MAX_ROWS;i++)
        {
                for(j=0;j<MAX_ROWS;j++)
                        {
                                sum+=c[i][j];
                        }
        }
average = sum/ (MAX_ROWS*(MAX_ROWS-1));
printf("\n\nSum of Concordance Matrix Elements: %f",sum);
printf("\n\nAverage (Threshold Value) of Concordance Matrix: %f",average);

/* Concordance Dominance Matrix */
for(i=0;i<MAX_ROWS;i++)
        {
                for(j=0;j<MAX_ROWS;j++)
                        {
                        if(c[i][j]>=average) c[i][j]=1;
                        else c[i][j] =0;
                        }
        }
printf("\n\n");
printf("CONCORDANCE DOMINANCE MATRIX:");
printf("\n\n");
Print_NxN_Matrix(c);


/*DETERMINING DISCORDANCE SET AND MATRIX*/
max = 0;
for(i=0;i<MAX_ROWS;i++)
        {
        for(j=0;j<MAX_ROWS;j++)
                {
                if (i==j)
                        {
                                c[i][j] = 0;
                                continue; // Bypass rest of the loop
                        }
                for(k=0;k<MAX_COLS;k++)
                        {
                                if(matrix[i][k] < matrix[j][k])
                                {
                                diff = fabs(matrix[i][k]-matrix[j][k]);
                                if(max<diff) max=diff;
                                }
                        }
                        d[i][j] = max/Max_All_Col(matrix,i,j);
```

```
                    max = 0;
                }

        }

printf("\n\n");
printf("THE DISCORDANCE MATRIX:");
printf("\n\n");
Print_NxN_Matrix(d);


/* DETERMING DISCORDANCE DOMINANCE MATRIX ( 0'S AND 1'S MATRIX) */

/*FINDING THRESHOLD VALUE (AVERAGE DISCORDANCE INDEX) */
sum =0;
for(i=0;i<MAX_ROWS;i++)
    {
        for(j=0;j<MAX_ROWS;j++)
            {
                sum+=d[i][j];
            }
    }
average = sum/ (MAX_ROWS*(MAX_ROWS-1));
printf("\n\nSum of Discordance Matrix Elements: %f",sum);
printf("\n\nAverage (Threshold Value) of Discordance Matrix: %f",average);


/* Discordance Dominance Matrix */
for(i=0;i<MAX_ROWS;i++)
    {
        for(j=0;j<MAX_ROWS;j++)
            {
                    if(i==j) {d[i][j]=0;continue;} //Diagnol elem. 0
            if(d[i][j]<=average) d[i][j]=1;
            else d[i][j] =0;
            }
    }
printf("\n\n");
printf("DISCORDANCE DOMINANCE MATRIX:");
printf("\n\n");
Print_NxN_Matrix(d);

/*DETERMINING THE AGGREGATE DOMINANCE MATRIX (MULTIPYING THE
CORRESPONDING
ELEMENTS OF CONCORDANCE AND DISCORDANCE MATRICES) */

for(i=0;i<MAX_ROWS;i++)
        {
            for(j=0;j<MAX_ROWS;j++)
                {
                    Agg[i][j]=c[i][j]*d[i][j];
                }
        }
printf("\n\nTHE AGGREGATE DOMINANCE MATRIX:");
printf("\n\n");
Print_NxN_Matrix(Agg);
```

```
printf("\n\n");
printf("FINAL RESULT - THE BEST OPTIONS:");
printf("\n\n");

/*DETERMINING FAVOURABLE ALTERNATIVES*/

for(i=0;i<MAX_ROWS;i++)
      {
            for(j=0;j<MAX_ROWS;j++)
              {
              if(Agg[i][j]==1)
                    printf("\nOption %d is better than option %d",i+1,j+1);
              }
      }
printf("\n\n");

}



/* THIS FUNCTION IS JUST FOR PRINTING THE MATRIX */
void Print_MxN_Matrix(float  a[MAX_ROWS][MAX_COLS])
{
int i;
int j;

for (i=0; i < MAX_ROWS ; i++)
{

      for(j=0; j < MAX_COLS ; j++)
      {

      printf("%f  ",a[i][j]);
      }
          printf("\n");
}

}



/* THIS FUNCTION IS JUST FOR PRINTING THE MATRIX */
void Print_NxN_Matrix(float  a[MAX_ROWS][MAX_ROWS])
{
int i;
int j;
float sum;
for (i=0; i < MAX_ROWS ; i++)
{
      for(j=0; j < MAX_ROWS ; j++)
      {
      printf("%f  ",a[i][j]);
           }
      printf("\n");
}
```

```
}

/* THIS FUNCTION IS FOR COMPARING TWO ROWS (FINDING MAX |ROW1-ROW2|)
float Max_All_Col(float a[MAX_ROWS][MAX_COLS],int row1,int row2)
{
float max =0;
float diff;
int k;

for(k=0;k<MAX_COLS;k++)
        {
        diff=fabs(a[row1][k]-a[row2][k]);
        if(max<diff) max=diff;
        }
return max;
}
```

PROGRAM 3:

/* THIS PROGRAM IS FOR CALUCULATING THE WEIGHTS FOR ALL ATTRIBUTES WITH +-5,+-10 AND +-20 % OF THEIR ACTUAL VALUES. THESE WIEGHTS WOULD THEN BE USED TO FIND THE RANKINGS. */

```
#include<stdio.h>
#define MAX_ATTRIBUTES 8
#define FOR_OUTPUT 1 /*for printing for output*/

void PrintInLine(float[],float per,int attrib,FILE*);/*For printing
weights
in one line*/


main()
{

float NormalizedWeights[MAX_ATTRIBUTES];
int i;
int k;
int j;
int posNeg=1;
float sum;
float per[4]={0,40,60,80}; /*Percentages*/

/* Original Intensities on a 10 point scale*/
float IntensityFactor[MAX_ATTRIBUTES] = {10,5,2,8,3,6,7,1};
float NewIntensityFactor[MAX_ATTRIBUTES];
```

```
void CalAndPrintWt(float[],float per,int attrib,FILE*);

FILE *fpt;
fpt=fopen("weights.dat","w");

/*Initailizing NewIntensityFactor[]*/
for(i=0;i<MAX_ATTRIBUTES;i++)
NewIntensityFactor[i]=IntensityFactor[i];

/*Printing the original Normalized Weights(sum of weights =1)*/
CalAndPrintWt(IntensityFactor,per[0],0,fpt);


/*Finding the N Wts for +-5,10 and 20 per deviation of orig. Inten Fac*/

for(k=0;k<2;k++) /*for - and + percentages*/
{
 for(i=1;i<=3;i++) /*for 5,10 and 20 percentages*/
    {
        for(j=0;j<MAX_ATTRIBUTES;j++) /*for MAX_ATTRIBUTEs*/
         {

         NewIntensityFactor[j]+=posNeg*IntensityFactor[j]*per[i]/100;
        /*In.Factor should not exceed 10*/
        if(NewIntensityFactor[j]>10)
                {
                        NewIntensityFactor[j]=IntensityFactor[j];
                        continue;
                }
         CalAndPrintWt(NewIntensityFactor,posNeg*per[i],j+1,fpt);
        /*Changing New IFac. back to original for further calculations*/
        NewIntensityFactor[j]=IntensityFactor[j];
         }
    }
 posNeg=-1;
}
fclose(fpt);
}/* end of main*/



/*This function prints the weights in one line and in the data file*/
void PrintInLine( float a[MAX_ATTRIBUTES],float per, int attrib,FILE* fpt)
{
int i;
```

```
printf("\n\n\n");
printf("The Weights for %f per change in IF of Attr. %d are :\n",per,attrib);
fprintf(fpt,"\n%2.1f %d ",per,attrib);
for(i=0;i<MAX_ATTRIBUTES;i++)
{
printf("%.3f  ",a[i]);
fprintf(fpt,"%.3f  ",a[i]);
}
printf("\n\n");
printf("**********************************************************\n\n")
;
}


void CalAndPrintWt(float a[MAX_ATTRIBUTES], float per,int attrib,FILE*fpt)
{
int i;
float nwt[MAX_ATTRIBUTES];
float sum=0;

for(i=0;i<MAX_ATTRIBUTES;i++)
sum+=a[i];
printf("\n\nSum of the Intensity Factors = %f\n\n",sum);
for(i=0;i<MAX_ATTRIBUTES;i++)
{
nwt[i]=a[i]/sum;
printf("\nWeight of Attrib %d with %f per change in IF of Attb. %d:
%f",i+1,per,attrib,nwt[i]);
}
printf("\n");
if(FOR_OUTPUT) PrintInLine(nwt,per,attrib,fpt);
}
```

PROGRAM 4 :

/*TOPSIS METHOD FOR SENSITIVITY SIMULATION ON WEIGHTS FOR EFFECT ON MULTIPLE ATTRIBUTE DECISION MAKING*/

```
#include<stdio.h>
#include<math.h>
#define MAX_ROWS_IN_WT_FILE 46
#define MAX_ROWS 11
#define MAX_COLS 8
#define NULL 0
```

```
int k;
int i;
int j;
float sum =0;
float sum2 = 0;
float matrix[MAX_ROWS][MAX_COLS];
float weight[MAX_COLS];
float normal[MAX_COLS];
float max[MAX_COLS];
float min[MAX_COLS];
float separation_ideal[MAX_ROWS];
float separation_Nideal[MAX_ROWS];
float rel_closeness[MAX_ROWS];
float temp;
int order[MAX_ROWS];
float copy_rel_closeness[MAX_ROWS];

float per;
int attrib;

void print_output(float a[][]);

void Do_SensitivitySimulation(void);

main()
{
FILE*fwt;
FILE*fpt;

/******OPENING FILE FOR READING WEIGHTS ********/
fwt=fopen("weights.dat","r");

/***************** READING INPUT MATRIX DATA FILE */
if ((fpt = fopen("input.txt","r")) == NULL)
printf("\nSorry! Could not open file\n");
for (i=0; i < MAX_ROWS ; i++)
{
        for(j=0; j < MAX_COLS ; j++)
        {
        fscanf(fpt,"%f ",&matrix[i][j]);
        }
}

/********* READING WEIGHTS FROM THE DATA FILE *******/
for(k=0;k<MAX_ROWS_IN_WT_FILE;k++)
{
        fscanf(fwt,"%f",&per);
        fscanf(fwt,"%d",&attrib);

printf("\n\n*************************************************");
printf("\nSENSITIVITY RESULT FOR: %2.1f per CHANGE in IN.FAC. of ATTRIBUTE %d",per,attrib);
printf("\n*************************************************");
        for (j=0;j<MAX_COLS;j++)
        {
                fscanf(fwt,"%f",&weight[j]);
        }
```

```
        Do_SensitivitySimulation();
}
fclose(fpt);
fclose(fwt);
} /* end of main */

void Do_SensitivitySimulation()
{

/********* NORMALIZING THE MATRIX */

/* STEP-1 FINDING THE NORMALIZATION FACTORS */

for(j=0; j < MAX_COLS; j++)
{
        for(i =0; i < MAX_ROWS;i++)
        {
        sum += pow(matrix[i][j],2);
        }
        normal[j] = sqrt(sum);
        sum = 0;
}


/* STEP-2 : FINDING THE WEIGHTED NORMALIZED MATRIX */

for(i=0; i < MAX_ROWS; i++)
{
        for(j=0; j < MAX_COLS; j++)
        {
        matrix[i][j] = (matrix[i][j]/normal[j])*weight[j];
        }
}


/******* DETERMINING IDEAL AND NEGATIVE IDEAL SOLUTIONS */
/* GETTING MAX AND MIN IN EACH COLUNM */


for (j =0 ; j < MAX_COLS; j++)
{
        max[j] = matrix[0][j];
        min[j] = matrix[0][j];
        for(i =0; i < MAX_ROWS; i++)
        {
        if ( matrix[i][j] >=  max[j]) max[j] = matrix[i][j];
        if ( matrix[i][j] <=  min[j]) min[j] = matrix[i][j];
        }

}


/******* CALCULATING SEPARATION MEASURES */
sum =0;
```

```
for (i =0; i < MAX_ROWS; i++)
{
        for(j =0; j < MAX_COLS; j++)
        {
        sum  += pow((matrix[i][j]-max[j]),2);
        sum2 += pow((matrix[i][j]-min[j]),2);
        }
        separation_ideal[i] = sqrt(sum);
        separation_Nideal[i] =sqrt(sum2);
        sum=0;
        sum2=0;
}


/************ DETERMINING RELATIVE CLOSENESS TO IDEAL SOLUTION */

for(i = 0; i < MAX_ROWS; i++)
{
rel_closeness[i]= separation_Nideal[i]/(separation_ideal[i] +
separation_Nideal[i]);
copy_rel_closeness[i] = rel_closeness[i];

}


/********* RANKING THE PREFERENCE ORDER */


for(i=0; i < MAX_ROWS-1; ++i)
{
        for(j =i+1; j < MAX_ROWS ; j++)
        {
                if (rel_closeness[j] >  rel_closeness[i])
                {
                temp = rel_closeness[i];
                rel_closeness[i] = rel_closeness[j];
                rel_closeness[j] = temp;
                }

        }
}

/************ FINDING THE RANK */
for(i = 0 ; i < MAX_ROWS ; ++i)
{
        for(j=0; j < MAX_ROWS; ++j)
        if ( rel_closeness[i] == copy_rel_closeness[j]) order[i]=j;
}

printf("\n\nRANKING THE PREFERENCE ORDER\n");
printf("FROM BEST OPTION TO WORST OPTION:\n\n");

for (i =0; i < MAX_ROWS; i++)
```

```
{
printf("\nRank %d:  Row(%d) %f",i+1,order[i]+1,rel_closeness[i]);
}


} /*end of function Do_Sensitivity Simulation */


/* THIS FUNCTION IS JUST FOR PRINTING THE MATRIX */
void print_output(float  a[MAX_ROWS][MAX_COLS])
{
for (i=0; i < MAX_ROWS ; i++)
{
      for(j=0; j < MAX_COLS ; j++)
      {
      printf("%f  ",a[i][j]);
      }
          printf("\n");
}
}
```