

## AXIOMATIC DESIGN FOR THE DEVELOPMENT OF ENTERPRISE LEVEL E-COMMERCE STRATEGIES

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### ABSTRACT

Electronic commerce is dramatically changing the traditional way of doing business and moreover, the growth of the Internet is creating new business opportunities. Today many products, processes and organizations are complex systems that have to be designed in order to meet specific customer requirements.

In this paper, axiomatic design is used to provide a framework for the e-commerce applications in electronic retailing. The high level goals and strategies form the roots of the decomposition tree for the e-commerce strategy, and the process continues to zigzag back and forth between the goal domain and the strategy domain until the design is completely decomposed. The structured design and decomposition method assures that the decisions made in the strategy development are made in proper sequence. The model developed in this paper can be used in the strategy formulation of an Internet business, as well as in the organizational analysis of an e-commerce strategy in order to identify goals without corresponding strategies or strategies that have no corresponding goals.

**Keywords:** Electronic commerce, strategy, electronic retailing, axiomatic design

### 1 INTRODUCTION

The Internet is bringing profound change to the business world by enabling a new way of conducting commerce. To compete in the emerging digital economy, companies need to change their business models, rethink the way they work and form new relationships with their trading partners and customers.

In the physical world, customers are limited in their knowledge of what they want, where to buy and who to buy from. Customers with misleading or incomplete information often make decisions that affect their utility from a transaction negatively. Information technology can help customers find information more easily thereby reducing the problems of imperfect information that leads to higher prices. Therefore,

the Internet represents a nearly “frictionless market” for the customers [1]. For markets, the Internet is a tool for almost instantaneous customer feedback. Internet commerce reduces the market friction of physical market transactions and while there is lower friction in many dimensions of Internet competition; branding, awareness and trust remain important sources for Internet retailers [2].

The purpose of this paper is to set up a model for developing a company’s online sales and marketing strategy based on the principles of axiomatic design [3,4].

#### 1.1 HOW THE INTERNET CHANGES BUSINESS

In the last few years, globalization and advances in information technologies required that businesses and organizations enter a period of significant changes [5]. The Internet continues to grow as a medium for commerce, allowing a company to conduct business everywhere, all the time. E-commerce and the Internet eliminate the constraints of time and distance in operating a business and enable a multitude of connections between customers, suppliers and trading partners. The characteristics of the digital economy has increased the level of competition in all the industries and the internet presents an important opportunity for even small firms to launch new products or services by reducing cycle time and cost of doing business.

In today’s new business environment, power has shifted toward consumers who demand intelligent products that deliver new dimensions of value -time and content- in addition to the current ones -price and quality [6]. By assembling a network of partners that specialize and excel in the links of the value chain, it is possible for organizations to achieve new levels of quality, flexibility and cost savings. Electronic marketplaces also reduce inefficiencies caused by buyer search costs to obtain information about the price and product offerings as well as the cost of sellers to communicate information about their prices and product offerings [7,8].

When a company interacts electronically with customers, buying behavior can be analyzed so that the company can customize its product and service offerings to the individual

customers in the new economy [9,10]. Customization is the essence of the one-to-one marketing revolution. The ability to customize products, combined with the ability of sellers to access substantial information about prospective buyers, such as demographics, preferences and past shopping behavior, is also an opportunity for improving sellers' ability of price discrimination that allows sellers to charge different prices for different buyers [11].

As a result of globalization and developments in information technologies, the Internet has become a great equalizer [12] allowing the smallest of businesses to access markets and have a presence that allows them to compete against the current competitors of their industry.

## **1.2 BASIC CHARACTERISTICS OF ELECTRONIC MARKETPLACES**

All traditional and electronic marketplaces perform three main functions: matching consumers and sellers; facilitating the exchange of information, goods, services and payments, and providing an institutional infrastructure [11]. By the recent developments in information technologies and electronic commerce tools, electronic marketplaces have had a major impact on these roles. The use of Web-based online storefronts provides firms with new capabilities for competing in each business dimensions [13], such as product offerings, pricing, time to market, consumer relations and service through a chain of relationships.

The Internet creates a new way of pricing precision and flexibility [14]. The ability of electronic marketplaces to reduce search costs for price and product information may significantly affect competition. Lower buyer search costs in electronic marketplaces promote price competition among sellers. Thus, the Internet provides a significant reduction in the costs of production and distribution for these goods. This creates new opportunities for repackaging content through strategies such as bundling, site licensing, subscriptions, rentals, differential pricing, and per-use fees [15]. Sellers in Internet marketplaces are typically responsible for delivery services, and therefore delivery providers are emerging as major Internet intermediaries.

Firms are also expanding their use of networked systems to improve internal business processes -to coordinate product design, manage inventory, improve customer service, and reduce administrative and managerial costs.

## **1.3 EXTENDED MARKETING MIX FOR INTERNET BUSINESS**

Traditional management tools and marketing principles may not be sufficient in the development of e-commerce strategies if they are not used within the rules of doing business in the new business environment. Customer loyalty is one of the main aspects in gaining and keeping the market leadership and the web has made customer loyalty much harder to achieve than it was before [16].

Before the Internet and e-commerce started to play their roles in the economy and business world, companies had been planning marketing processes based on two main factors; identifying customer needs and defining a value proposition that will meet them at a profit. The value proposition must then be delivered through the right product or service and the right channels, and it must be communicated consistently. In order to create a winning business strategy, companies have to rebuild the traditional marketing strategies around the facts of the new business environment and the Internet. In the traditional economy, the marketing mix was explained with the 4P's that are product, price, place and promotion [17]. In the new business environment and the network economy, a new marketing mix including 4P+7C (content, customization, convenience, connectivity, communication, community and customer care) should be considered. The companies that desire to rank among the leaders in today's competitive marketplace should adopt these factors successfully into their corporate goals and implement the essential strategies efficiently.

## **2 STRATEGY AXIOMS FOR BUSINESS APPLICATIONS**

Design involves a continuous interplay between what we want to achieve and how we want to achieve it [3]. Therefore a rigorous design approach must begin with an explicit statement of what we want to achieve and end with a clear description of how we will achieve them. Axiomatic design theory can be applied recursively throughout the design hierarchy. Design problems are stated; solutions are proposed and analyzed; and decisions are made. The components that distinguish axiomatic design from other design theories are domains, hierarchies, zigzagging, and the two design axioms: independence and information.

According to Kotler [17], goals indicate what a business unit wants to achieve, and strategy is the game plan to get there. Every business must tailor a strategy for achieving its goals.

Axiomatic design can be used as a tool for the design of non-engineering design objects, such as business plans and organizations [4,18]. The use of axiomatic design in strategic formulation and business planning assures a strong relationship between the goals and the strategies defined [19]. A successful design approach should begin with a definition of what we want to achieve and end with a clear description of how we will achieve them. The two concepts pertain to the business goals and strategies in the strategic design of the corporate plans.

## **2.1 THE DESIGN FRAMEWORK FOR STRATEGY DEVELOPMENT**

Axiomatic design provides an effective methodology for the mapping and decomposition of business strategies. A strategy development process based on axiomatic design guides designers through the process of first evaluating internal and external factors, stakeholder and market needs in order to

determine business goals, then breaking up these goals into strategies, and finally translating them to actionable tasks. The strategy development process based on axiomatic design can be explained within a continuous process (Figure 1).



Figure 1. Design of Organizational Goals and Strategies

Leading to the statement of business mission and goals, a careful analysis of customer needs and expectations represents one of the critical success factors of the strategy development. Then, decomposition of business goals into strategies can be made based on the principles of axiomatic design, which make the designers go through a process whereby they zigzag between goals and corresponding strategies.

## 2.2 MAPPING FROM BUSINESS GOALS TO STRATEGIES

The situation analysis that includes an analysis of internal and external strategic factors affecting the organizational performance, inputs from the stakeholders and the market needs guide the definition of the corporate goals. Strategy development based on axiomatic design starts with setting high-level goals, and then corresponding strategies are defined to achieve these goals. The four domains being used during this process are the customer domain, the goal domain, the strategy domain, and the task domain (Figure 2).

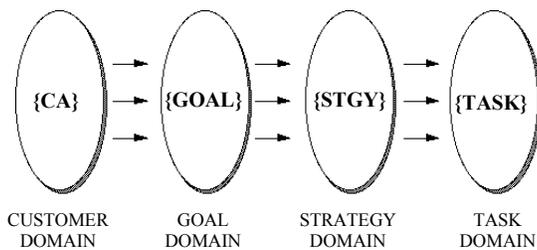


Figure 2. Four Domains in Strategic Design

The strategic design process progresses from a system level to levels of more detail. High-level goals and the corresponding strategies are decomposed into more detailed sub-goals and strategies in terms of a design hierarchy. The decisions at higher levels affect the statement of the goals at lower levels.

At each level of the strategy development, there exists a set of goals. Before a certain goal is decomposed, the corresponding strategies must be determined. Once a business goal can be

satisfied by a corresponding strategy, that goal can be decomposed into a set of sub-goals, and the zigzagging process is repeated. This process of mapping and zigzagging must continue until the design is completed.

Hierarchy of goals and strategies is one of the major concepts of axiomatic design. The basis of decomposing high level goals and strategies into lower levels is the zigzagging back and forth between the goal domain and the strategy domain while developing the goal and strategy hierarchies.

## 2.3 DESIGN AXIOMS IN STRATEGY DEVELOPMENT

During strategy development, a strategic design process includes high-level decisions that make up the corporate level strategy and progresses to levels of increasing detail. The business and functional level strategies are formed in the lower levels of decomposition. The strategic design axioms provide a tool for assessing goals and strategies facing one another. The two basic axioms may be stated as follows:

**The Independence Axiom:** The goals should be independent from each other. In a successful strategic design, the strategies and the goals are related in such a way that a specific strategy can be adjusted to satisfy its corresponding goal without affecting others.

**The Information Axiom:** The information content of a design should be minimized. Among alternative designs that satisfy the independence axiom, the best one has the minimum information content, which represents the maximum probability of success.

The two strategic design axioms are used to evaluate the proposed designs according to the independence of the goals and information content of the design. Because companies want to minimize the amount of resources needed to achieve their goals, they have to minimize repetition of decisions during the decomposition [20]. This benefit is mainly provided by the design axioms.

## 2.4 EVALUATING THE STRATEGIC DESIGN MATRIX

As the strategy designers map “what” they want their design to accomplish (using goals) to “how” they want to accomplish these goals (using the strategies), they have to think of all alternatives to fulfill the goals by identifying rational strategies. The information generated during mapping is captured in a strategic design matrix, which shows the relationships between each goal and strategy.

The mapping process between the domains can be expressed mathematically in terms of the characteristic vectors that define the design goals and the design solutions. At a given level of the design hierarchy, the set of goals that define the specific objectives constitutes a vector {GOALS} in the goal domain. Similarly, the set of strategies constitutes a vector {STGYs}. The relationship between these two vectors is:

$$\{GOAL_s\} = [A] \{STGY_s\}$$

where [A] is defined as the design matrix that characterizes the design and shows the relationships between the GOALs and STGYs at a given level of the design hierarchy. There are two special cases for the design matrix: the diagonal matrix where all  $A_{ij}$ 's except those  $i=j$  are equal to zero, and the triangular matrix where either upper or lower triangular elements are equal to zero.

To satisfy the independence axiom, the design matrix must be either diagonal or triangular. When the design matrix [A] is diagonal, each of the GOALs can be achieved independently by means of one STGY. Such a design is called uncoupled design. When [A] is triangular, the independence of GOALs can be guaranteed if and only if the STGYs are changed in a proper sequence. This results in a decoupled design. Any other matrix shows a coupled design.

In strategic design matrices, X represents a strong effect by a strategy on a goal, while zero indicates a weak effect, relative to the tolerance associated with the goal. To satisfy the independence axiom, the strategic design matrix must be either diagonal or triangular (Figure 3). When the design matrix is diagonal, each of the goals can be satisfied independently by means of its own strategy (uncoupled design). When the matrix is triangular, the independence of goals can be guaranteed if and only if the strategies are organized in a proper sequence (decoupled design).

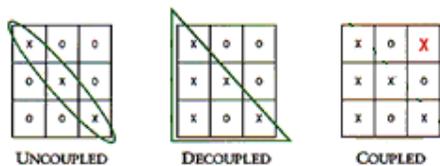


Figure 3. The Three Possible Design Matrix

When designers analyze an existing strategic plan and find out that it is coupled, they have two alternative ways to follow. Either designers can try to decouple the design through developing new strategies to satisfy the goals, or they can seek an operating point where the design is less sensitive to the coupling through optimization. Design matrices contain valuable information about the strategic plan and are central to the application of axiomatic design in strategy formulation.

## 2.5 BENEFITS OF AXIOMATIC DESIGN APPROACH IN STRATEGY DEVELOPMENT

Axiomatic design helps designers create new business plans and strategies, and evaluate existing ones by determining the probable causes of trouble. The structured design and decomposition method assures that decisions are made rationally. The design axioms and the decomposition principles prevent the designer from setting a goal or determining a strategy without having a clear understanding of its need.

Following axiomatic design principles, the designer works in a systematic way, always completing prerequisite tasks before moving on to the next stage. While evaluating an existing business plan, axiomatic design highlights problems like coupling and clarifies the relationships between the symptoms of the problem (e.g. one or more goals not being achieved) and their causes (e.g. the specific strategy affecting those goals).

Axiomatic design also provides an efficient project workflow by identifying tasks, setting a task sequence from the system architecture, and assigning resources effectively. Using this powerful tool during the course of strategy development, designers can prevent coupling at any level of the strategic design process and ensure that the system will satisfy their customers' requirements. Briefly, axiomatic design provides a structured methodology that assures that all vital aspects of a business strategy are addressed in an orderly and simple manner.

## 3 BUILDING AN E-COMMERCE STRATEGY USING AXIOMATIC DESIGN

In the new business environment, existence of a technological and legal infrastructure is the key factor in ensuring the success of e-commerce, together with a drive for optimization of business practices. Widespread access to the Internet is an important component of this infrastructure for electronic retailing marketplace.

In this section, axiomatic design approach to the development of e-commerce strategies is presented. The adoption of physical retail stores to the Internet (i.e. electronic retailing), is considered and all the necessary actions are organized, based on the principles of axiomatic design [21].

At each level of the work, the strategic design matrix is used to determine the state of the design -uncoupled, decoupled or coupled. Based on these principles and the decomposition hierarchy, axiomatic design will provide a strong relationship between the goals and the essential strategies on how to fulfill these goals during the development of e-commerce strategies of a company. The axiomatic design approach and new relations derived during these investigations may form a new methodology for the development of business strategies.

### 3.1 DECOMPOSITION OF THE E-COMMERCE STRATEGIES

An electronic commerce strategy should include a clear view of how the organization will use the electronic marketplace. Since the electronic channel ranks among the most important tools to conduct business, companies have to plan how to attract the consumers, take orders and payments, obtain the on-line security, distribute products and services and support their customers in this new business environment.

E-commerce is a new methodology for doing business in the digital marketplace, and a number of management level issues must be addressed prior to deciding the implementation steps. In the decomposition of the e-commerce business plan according to the principles of axiomatic design, higher level hierarchy presents the main goals and strategies to be realized. As the mapping from goals to strategies continues, implementation guidelines are developed. During these interrelations in the strategic design process, each set of decomposition should be evaluated by using design matrix.

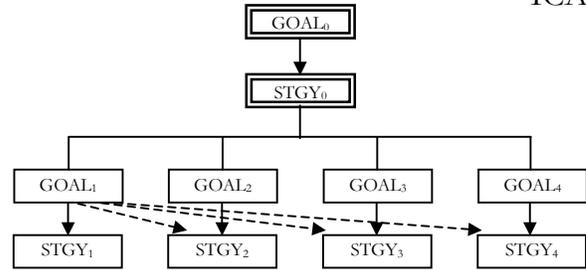


Figure 4. Decomposition Level 1: Strategic Level

### 3.2 DECOMPOSITION LEVEL 1

The high level goals and strategies will form the roots of the expansive decomposition tree (Figure 5) for the e-commerce business plan. They provide the basis for the strategic design of the entire electronic commerce system, which will be obtained in the mid-level and low-level decomposition of the strategic design process. The main goal and strategy in an e-commerce application can be stated as follows:

GOAL<sub>0</sub>: Organize enterprise B2C e-commerce applications  
 STRATEGY<sub>0</sub>: Enterprise e-commerce strategy

The critical first step of the electronic retailing is to bring people to the site for the first time. Building awareness among the target market is one of the goals, but the crucial issue is communicating value to the consumers. Building customer loyalty -thereby getting them to revisit the website- requires improvement in customer interaction through enhanced offerings, and targeted marketing actions and communications.

The main objective in launching an e-retail store and using the Internet as a sales channel is to provide customers with a more convenient channel that assures a quick, simple, enjoyable and secure shopping process while emphasizing the brand personality. Figure 4 shows the position in the strategic decomposition phase (Level 1). In the strategic level, we have the following goals:

GOAL<sub>1</sub>: Get customers to the website  
 GOAL<sub>2</sub>: Provide the customers with easy and secure online shopping  
 GOAL<sub>3</sub>: Deliver the purchased products  
 GOAL<sub>4</sub>: Provide after sales service

And their corresponding strategies are:  
 STRATEGY<sub>1</sub>: Marketing strategy  
 STRATEGY<sub>2</sub>: Website development strategy  
 STRATEGY<sub>3</sub>: Product delivery system  
 STRATEGY<sub>4</sub>: Customer support system

These goals and strategies yield the strategic design matrix for this level as:

$$\begin{Bmatrix} \text{GOAL}_1 \\ \text{GOAL}_2 \\ \text{GOAL}_3 \\ \text{GOAL}_4 \end{Bmatrix} = \begin{bmatrix} X & X & X & X \\ 0 & X & 0 & 0 \\ 0 & 0 & X & 0 \\ 0 & 0 & 0 & X \end{bmatrix} \begin{Bmatrix} \text{STGY}_1 \\ \text{STGY}_2 \\ \text{STGY}_3 \\ \text{STGY}_4 \end{Bmatrix}$$

This matrix shows a decoupled system. An order in the strategies must be followed to satisfy the independence axiom. That is;

1. Set up customer support system to provide after sales services,
2. Set up product delivery system to deliver the purchased products,
3. Set up website development strategies to provide the customers with easy and secure online shopping,
4. Then set up the development of marketing strategies after setting up #1, #2 and #3 to get customers to the website.

This system derived by decomposition level 1 forms a “customer focused” marketing strategy. Getting customers to the website is related with all the elements of the total e-commerce strategy. Number of customers visiting the website is influenced by changes in website development strategy, product delivery system and customer support activities. The other three goals (goals 2,3 and 4) can be achieved by conducting only the corresponding strategies and the success of these strategies affects the web site visits together with the marketing strategy.

Further decomposition will be focused on marketing and website development strategies. The others -product delivery system and customer support- will be decomposed only in level 2.

### 3.3 DECOMPOSITION LEVEL 2

Level 2 includes decompositions of marketing strategy, website development strategy, product delivery system and customer support system. However, in this paper, only the decomposition of marketing strategies is shown. Entire ecommerce strategy developed in this work can be found in tables 1 and 2.

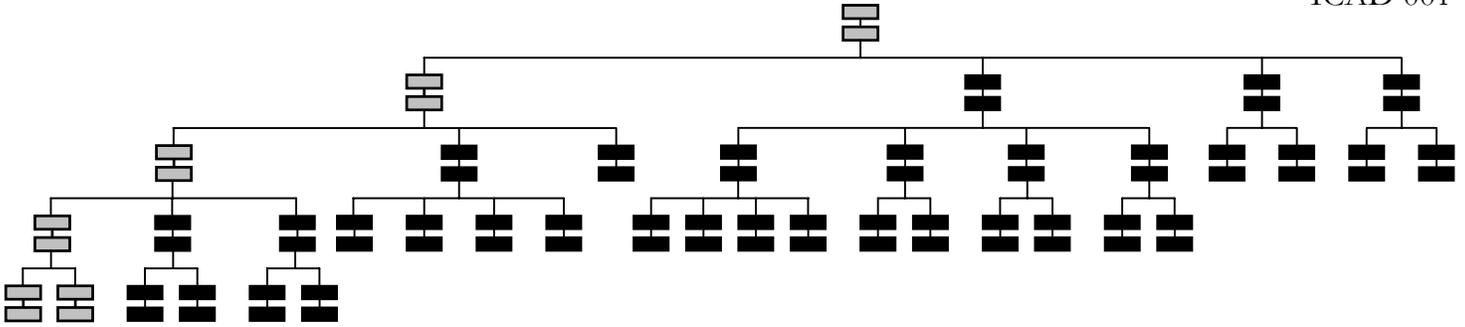


Figure 5. Goal-Strategy Decomposition Tree

GOAL<sub>1</sub>: Get customers to the website  
 STRATEGY<sub>1</sub>: Marketing strategy

A firm moving onto the Internet is likely to find it competing for potential customers' attention with hundreds of similar firms. With so many companies on the Internet offering similar products and services, creating a brand image, which separates the company from its competitors, is one of the most important challenges.

The Internet provides an effective channel for brand communication and advertising. It also has many tools for measuring the impact of web advertising and determining company's customer profiles. Another marketing issue is the development of pricing strategies unique to the Internet.

During the initial decomposition of marketing strategy, the following goals and strategies are determined:

- GOAL<sub>11</sub>: Perform effective advertising
- GOAL<sub>12</sub>: Offer competitive prices and payment terms
- GOAL<sub>13</sub>: Establish efficient communication among customers
- GOAL<sub>14</sub>: Create a brand image
- STRATEGY<sub>11</sub>: Advertising strategy
- STRATEGY<sub>12</sub>: Pricing strategy
- STRATEGY<sub>13</sub>: Customer communities
- STRATEGY<sub>14</sub>: Market positioning and branding

The strategic design matrix for this level is:

$$\left\{ \begin{matrix} \text{GOAL}_{11} \\ \text{GOAL}_{12} \\ \text{GOAL}_{13} \\ \text{GOAL}_{14} \end{matrix} \right\} = \begin{bmatrix} \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \end{bmatrix} \left\{ \begin{matrix} \text{STGY}_{11} \\ \text{STGY}_{12} \\ \text{STGY}_{13} \\ \text{STGY}_{14} \end{matrix} \right\}$$

This results in a coupled system. According to the independence axiom, goals #1 and #3 cannot be adjusted without affecting the performance of each other. Interrelations of all the goals and strategies should be analyzed again and the current design has to be changed.

After the assessment of marketing and advertising levels, an "improvement" in design has been made in order to reduce the coupling. The current position of the decomposition is shown in Figure 6. The new marketing goals and their corresponding strategies can be stated as:

- GOAL<sub>11</sub>: Perform effective advertising
- GOAL<sub>12</sub>: Offer competitive prices and payment terms
- GOAL<sub>13</sub>: Create a brand image
- STRATEGY<sub>11</sub>: Advertising strategy
- STRATEGY<sub>12</sub>: Pricing strategy
- STRATEGY<sub>13</sub>: Market positioning and branding

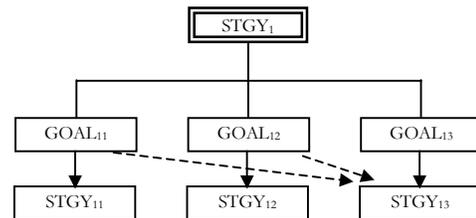


Figure 6. Decomposition Level 2: Marketing Strategy

The strategic design matrix for this level is:

$$\left\{ \begin{matrix} \text{GOAL}_{11} \\ \text{GOAL}_{12} \\ \text{GOAL}_{13} \end{matrix} \right\} = \begin{bmatrix} X & 0 & X \\ 0 & X & X \\ 0 & 0 & X \end{bmatrix} \left\{ \begin{matrix} \text{STGY}_{11} \\ \text{STGY}_{12} \\ \text{STGY}_{13} \end{matrix} \right\}$$

The design at this level is a decoupled design. Market positioning and branding are critical factors that affect both advertising and pricing strategies. However, the independence of related goals can be guaranteed if the strategies are developed in a proper sequence and these two marketing sub-strategies have to be developed after market positioning strategies.

According to the independence axiom of axiomatic design, coupled design matrices cause inefficiencies in the system. In order to set up the total strategy, the designer should re-evaluate the couplings that occur during the design process and try to decouple the design through developing appropriate strategies to satisfy the goals. Couplings among different levels should also be reduced to improve the strategy and to have a better design.

### 3.4 DECOMPOSITION LEVEL 3

At this stage of the strategy development process, the pre-determined mid-level goals and strategies including advertising and pricing strategies, online sales process, e-store design, creative website design and customization, will be decomposed in order to obtain low-level goals and their strategies. This paper presents the decomposition of advertising strategies.

GOAL<sub>L11</sub>: Perform effective advertising  
 STRATEGY<sub>111</sub>: Advertising strategy

Unlike mass-marketing media, Internet has the ability to enable companies to target specific markets and create one-to-one relationships with customers in the most desirable segments. Banners and targeted online messages, as well as television, magazine, and other advertising outlets, make up the channels through which companies can communicate with potential customers. The ability to establish various types of customer communities easily is another advantage of e-commerce applications. The current hierarchical position is in Figure 7. Decomposition of goals and strategies at this step is as follows:

GOAL<sub>L111</sub>: Attract surfers on the web  
 GOAL<sub>L112</sub>: Send e-mails to consumers  
 GOAL<sub>L113</sub>: Establish efficient communication among customers  
 GOAL<sub>L114</sub>: Take traditional consumers to the e-store

The corresponding strategies are:  
 STRATEGY<sub>111</sub>: Banner advertising  
 STRATEGY<sub>112</sub>: E-mail advertising  
 STRATEGY<sub>113</sub>: Customer communities  
 STRATEGY<sub>114</sub>: Traditional media and direct mailing

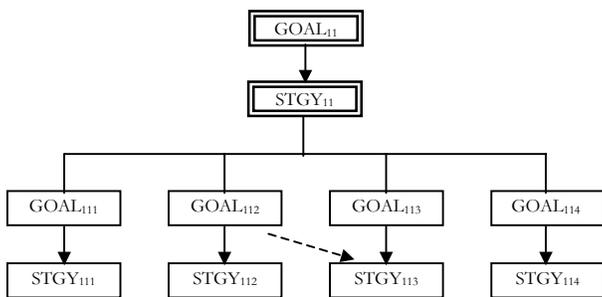


Figure 7. Decomposition Level 3: Advertising Strategy

And the strategic design matrix is:

$$\begin{Bmatrix} \text{GOAL}_{L111} \\ \text{GOAL}_{L112} \\ \text{GOAL}_{L113} \\ \text{GOAL}_{L114} \end{Bmatrix} = \begin{bmatrix} X & 0 & 0 & 0 \\ 0 & X & X & 0 \\ 0 & 0 & X & 0 \\ 0 & 0 & 0 & X \end{bmatrix} \begin{Bmatrix} \text{STGY}_{111} \\ \text{STGY}_{112} \\ \text{STGY}_{113} \\ \text{STGY}_{114} \end{Bmatrix}$$

The only coupling at this level shows the affect of the efficiency and the number of customer communities on e-mail

advertising. E-mail advertising tools can be used more effectively if customer communities are well established. Traditional media and banner advertising strategies can be set up independently.

### 3.5 DECOMPOSITION LEVEL 4

This section shows the decomposition of banner advertising strategies in the lowest level of the decomposition tree.

GOAL<sub>L111</sub>: Attract surfers on the web  
 STRATEGY<sub>111</sub>: Banner advertising

There are various types of banners, such as static, animated and interactive banners that may include a game offer or a question. Banners should have the ability to invoke curiosity and use minimum text in the banner area. The goals and strategies in this level (Figure 8) are:

GOAL<sub>L1111</sub>: Communicate a simple and focused message  
 GOAL<sub>L1112</sub>: Give the surfer reason to click  
 STRATEGY<sub>1111</sub>: Banner content  
 STRATEGY<sub>1112</sub>: Banner objective and attractiveness

The strategic design matrix is:

$$\begin{Bmatrix} \text{GOAL}_{L1111} \\ \text{GOAL}_{L1112} \end{Bmatrix} = \begin{bmatrix} X & X \\ 0 & X \end{bmatrix} \begin{Bmatrix} \text{STGY}_{1111} \\ \text{STGY}_{1112} \end{Bmatrix}$$

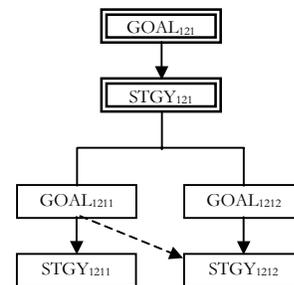


Figure 8. Decomposition Level 4: Banner Advertising

Table 1. List of Goals

GOAL <sub>0</sub> :	Organize enterprise B2C e-commerce applications
GOAL <sub>1</sub> :	Get customers to the website
GOAL <sub>11</sub> :	Perform effective advertising
GOAL <sub>111</sub> :	Attract surfers on the web
GOAL <sub>1111</sub> :	Communicate a simple and focused message
GOAL <sub>1112</sub> :	Give the surfer reason to click
GOAL <sub>112</sub> :	Send e-mails to consumers
GOAL <sub>1121</sub> :	Set focused mail groups by subscription
GOAL <sub>1122</sub> :	Send e-mails related with the products and payment offerings
GOAL <sub>113</sub> :	Establish efficient communication among customers
GOAL <sub>1131</sub> :	Establish communication among customers
GOAL <sub>1132</sub> :	Support the sharing of experiences among customers
GOAL <sub>114</sub> :	Take traditional consumers to the e-store
GOAL <sub>12</sub> :	Offer competitive prices and payment terms
GOAL <sub>121</sub> :	Offer various payment terms to the customer
GOAL <sub>122</sub> :	Offer special prices and/or payment terms to the re-visitors
GOAL <sub>123</sub> :	Offer special discounts and/or marketing programs
GOAL <sub>13</sub> :	Create a brand image
GOAL <sub>2</sub> :	Provide the customers with easy and secure online shopping
GOAL <sub>21</sub> :	Have a logically organized and convenient website
GOAL <sub>211</sub> :	Arrange the products according to customer interests or product types
GOAL <sub>212</sub> :	Provide quick loading web pages
GOAL <sub>213</sub> :	Provide quick and accurate search results
GOAL <sub>214</sub> :	Provide knowledge to solve any problem
GOAL <sub>22</sub> :	Provide customized sales constancy to the consumers
GOAL <sub>221</sub> :	Make product/service recommendations for every individual customer
GOAL <sub>222</sub> :	Provide expert opinions about specific products
GOAL <sub>23</sub> :	Set up a secure payment system
GOAL <sub>231</sub> :	Get optimum personal information from the customer
GOAL <sub>232</sub> :	Provide a secure payment process
GOAL <sub>24</sub> :	Set up an interesting web site
GOAL <sub>241</sub> :	Give an equivalent feel for the use of the products
GOAL <sub>242</sub> :	Make the customers contribute to the website
GOAL <sub>3</sub> :	Deliver the purchased products
GOAL <sub>31</sub> :	Deliver digital goods and services
GOAL <sub>32</sub> :	Deliver material goods
GOAL <sub>4</sub> :	Provide after sales service
GOAL <sub>41</sub> :	Provide customer support at all stages of the relationship
GOAL <sub>42</sub> :	Provide quick response to the customers

Table 2. List of Strategies

STGY <sub>0</sub> :	Enterprise e-commerce strategy
STGY <sub>1</sub> :	Marketing strategy
STGY <sub>11</sub> :	Advertising strategy
STGY <sub>111</sub> :	Banner advertising
STGY <sub>1111</sub> :	Banner content
STGY <sub>1112</sub> :	Banner objective and attractiveness
STGY <sub>112</sub> :	E-mail advertising
STGY <sub>1121</sub> :	E-mail newsletters
STGY <sub>1122</sub> :	Direct e-mailing
STGY <sub>113</sub> :	Customer communities
STGY <sub>1131</sub> :	Discussion forums, e-mail groups etc.
STGY <sub>1132</sub> :	Interest groups
STGY <sub>114</sub> :	Traditional media and direct mailing
STGY <sub>12</sub> :	Pricing strategy
STGY <sub>121</sub> :	Payment options
STGY <sub>122</sub> :	Customized pricing
STGY <sub>123</sub> :	Promotions
STGY <sub>13</sub> :	Market positioning and branding
STGY <sub>2</sub> :	Website development strategy
STGY <sub>21</sub> :	E-store design
STGY <sub>211</sub> :	Market and product segmentation
STGY <sub>212</sub> :	Web page content size
STGY <sub>213</sub> :	Search functions
STGY <sub>214</sub> :	Instructions and help facilities
STGY <sub>22</sub> :	Customization
STGY <sub>221</sub> :	Tracking customers' interests and purchase behaviors
STGY <sub>222</sub> :	Expert insights
STGY <sub>23</sub> :	Online payment system
STGY <sub>231</sub> :	Customer identification
STGY <sub>232</sub> :	Payment process
STGY <sub>24</sub> :	Creative website design
STGY <sub>241</sub> :	Creative design
STGY <sub>242</sub> :	Interactive tools
STGY <sub>3</sub> :	Product delivery system
STGY <sub>31</sub> :	Delivery over the Internet
STGY <sub>32</sub> :	Physical product distribution network
STRATEGY <sub>4</sub> :	Customer support system
STGY <sub>41</sub> :	Integrated service
STGY <sub>42</sub> :	Contact management

## 4 CONCLUSIONS

This paper presents axiomatic design application in the field of strategy formulation. After the fundamentals of axiomatic design, strategy axioms for business applications are provided and explained.

Based on the principles of axiomatic design, an infrastructure for the development of e-commerce strategies is created. This is a new approach to strategy development and formulation in electronic commerce, with the decomposition of goals and strategies. This model can be used in the following cases:

- Strategy formulation of a new internet-only business,
- Organizing e-commerce applications of a company that aims to launch an e-store and conduct electronic retailing, in order to combine existing retail stores and traditional marketing tools with Internet presence,
- Analyzing the design of an existing e-commerce strategy for identifying goals without corresponding strategies or strategies that have no corresponding goals. By creating hierarchies in the design domains using the existing goals and strategies, it can be determined whether the decomposition of the goals is sufficient, or if new sub-goals have to be introduced.

The structured design and decomposition method assures that the decisions made in the design are made in proper sequence. It assures that “What to do” is answered before “How to do it”; and that “How to do it” is answered before “What resources are needed”. This concept prevents the designer from designing all kinds of processes or systems without having a clear understanding of its need. Using the Aclaro software, designers can evaluate decisions at each level and specify the relationships between FRs (goals) and DPs (strategies) to any level of detail [22]. It also does matrix manipulations, checks for design problems such as coupling, and communicates information to the designer.

Finally, the decomposition of the electronic commerce strategies has provided an insight into the application of axiomatic design to both organizational design and strategy formulation.

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