

# An E-Commerce Platform Development Using AHP in Product Selection

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## Abstract

E-commerce is a very popular and growing area. In this study, a new e-commerce platform called “SmartStore” is developed with product comparison feature (named as “SmartCompare”). The platform is actually a decision support system that helps users while they make comparisons among products. The methodology of the study is Analytical Hierarchy Process (AHP). At the first stage of the study, product categories and criteria are determined. The platform includes three product categories as computing (desktops, laptops and tablets), mobile (cellular phones and smart phones) and TVs (LCD TVs, LED TVs and Plasma TVs). For each category, the criteria that may be used in product comparison stage are determined. In the process of decision support, “SmartCompare” applies AHP methodology and shows the best alternative products according to users’ preferences. The platform also includes an administration panel from which new categories, criteria, and products can be added, deleted or edited.

**Key words:** e-commerce, AHP, product comparison, decision support system,

## 1. Introduction

E-commerce is a new and very popular shopping way for users. E-commerce stands for shopping via a secure online platform and people can buy everything by using their laptops, mobile phones or desktops. They only need an Internet connection. The term E-commerce is defined as “sharing of business information, maintaining business relationships, and conducting business transactions by means of Internet based technology” [1].

From the point of vendors, e-commerce platforms cost less than brick and mortars, so the number of these platforms increases dramatically and vendors begin to find new ways for customer retention and differentiation. In this study, a new e-commerce platform called “SmartStore” is developed. Different than the other e-commerce platforms, “SmartStore” has a feature that is called as “SmartCompare” for customers to choose the best alternative products while doing shopping. “SmartCompare” uses Analytical Hierarchy Processing (AHP) methodology to decide the best alternative among the products that are selected by customers. In addition, this e-commerce platform does not only include customer activities but also includes administration activities. The platform has a dynamic structure, so product categories and criteria can be manipulated.

## 2. Literature Review

Analytical Hierarchy Process is one of the most-commonly used methodologies of decision-supporting. It is proposed by Saaty [2, 3] and is a very powerful and flexible decision making process to aid decision-makers by setting priorities to both criteria and alternatives. It finds the best choice by considering both qualitative and quantitative aspects of a decision that need to be considered. The power of AHP approach comes from the fact that it organizes both tangible and intangible factors in a well-constructed way and results in a relatively simple solution to the decision-making cases. Additionally, using pair-wise comparisons of both criteria and alternatives via ratio-scaled ratings, AHP formulates a clear suggestion about alternatives.

In the literature, there are various studies on e-commerce platforms and making the best decision using AHP. One of them is about cell phone selection which is a complex decision due to the fact that every individual has his own needs and there are so many alternatives to choose [4]. In this research, a set of 5 alternatives have been chosen from 26 alternatives and they have been compared with respect to 6 criteria (dimensions, weight, screen colours, phonebook capacity, memory, and price) selected from a set of 41 attributes.

Another study which is proposed by Işıklar and Büyüközkan [5], is for mobile phone selection using AHP. In this study, the criteria list has been specified from a generic view and constructed in two levels: 6 criteria are decomposed into 21 sub-criteria as product related and user related. According to the classical AHP calculation method, criteria are compared in pairs initially; however in this research, sub-criteria have been grouped and each of them has been compared within its group, initially. Once all sub-criteria are compared, criteria are compared in pairs.

The study by Sudiarso and Nugraheni [6] aims to compare some popular MP4 players with the similar products by taking into consideration some relevant criteria. The methods used in this study are AHP and Fuzzy Analytical Hierarchy Process (FAHP). The results of analysis show that there is no significant difference between these two methods. They rank the products in the same order but with different total weights.

According to Gefen [7], e-commerce platforms should have some features. Both the influence of familiarity and trust are especially strong on people's intentions to purchase. It is shown that trust and familiarity are distinctly different constructs, and both of them influence people's behavioral intentions. Hsu, Yang, Chen and Chen [8] apply AHP methodology to find the best online shopping platform. Another research is conducted by Chen, Tseng and Lin [9]. In order to find the best shopping platform, 6 criteria have been determined after a literature survey and fuzzy AHP has been used as a decision support tool. The paper proposed by Zhu and Tong [10] builds the evaluation model of fashion B2C e-commerce website based on online consumption by

using AHP. The results have a reference value to select the fashion website for online consumer and how to operate one fashion website as well.

### 3. A New E-Commerce Platform “SmartStore”

“SmartStore” is a new developed e-commerce platform using ASP and .NET technologies. It includes a product comparison feature named as “SmartCompare”. In order to decide the product categories in this new platform, the most popular e-commerce platforms in Turkey (Walmart, Hepsiburada, Teknosa, Webdenal, Bimeks, Darty, Vatan Bilgisayar and Gold Computer) are examined. Three popular product categories are defined as: *Mobile*, *TVs*, and *Computing*. In addition, for each product category various sub categories are defined. *Mobile* category has two sub categories as Cellular Phones and Smart Phones. LCD, LED and Plasma TVs are under *TVs* product category. Sub categories of *Computing* category are Desktops, Laptops and Tablets.

Figure 1 shows the main page of “SmartStore”.



**Figure 1.** “SmartStore” Main Screen

In this platform, customers can login or can be a new member and register. They create their own accounts, add their addresses, see their order details and order history. On the main page, the product categories are on the top. Customers can select products under these categories. They can also categorize products according to manufacturers from the left menu. “SmartStore” platform has also a search function through which customers can make product search by product name or

description. When customers want to purchase products, they select and add them to their shopping cart. They have the possibility of comparing these items using decision support property of the platform. In Figure 2, customer selects three products and checks “Select to SmartCompare” button. Then the system applies AHP methodology and ranks the product from the best alternative to the worst.

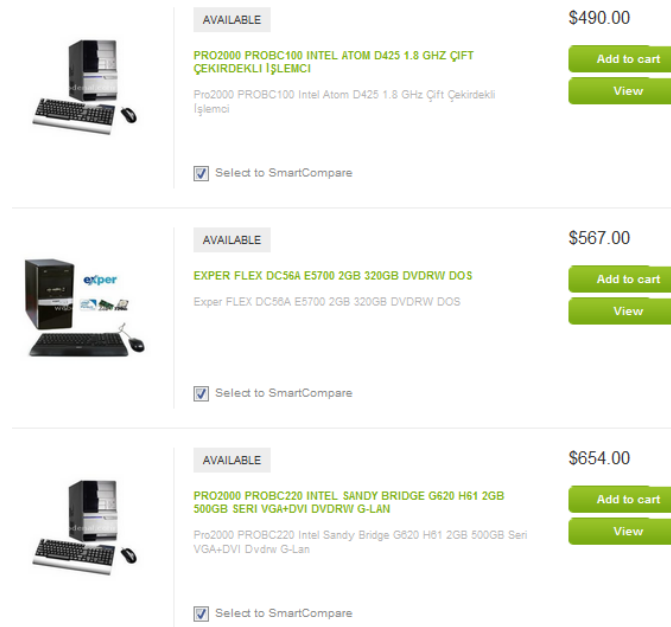


Figure 2. Selecting the Products and “SmartCompare” Feature

#### 4. “SmartCompare” Feature

“SmartCompare” feature helps customers to make comparisons and to find best alternative products over “SmartStore” platform. Criteria determination and application of AHP methodology are the most important steps of the “SmartCompare”.

##### 4.1. Criteria Determination

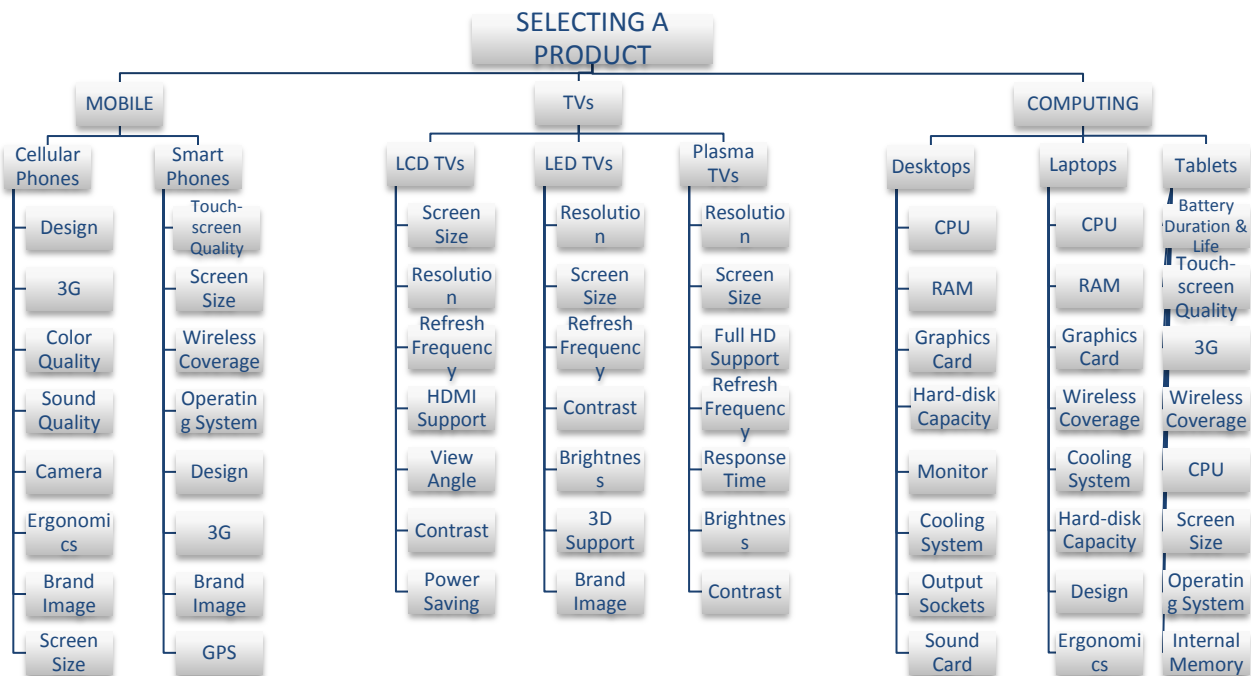
Under the three main categories *Mobile*, *TVs*, and *Computing* there are various sub categories. For each of these product sub categories, different criteria are determined. To perform this step, a simple questionnaire including possible criteria for each sub category is prepared and conducted to a group of knowledgeable people. It is important that “SmartCompare” compares product under the same sub category. Therefore, the common features of each sub category that are

supported by most of the experts are considered as important criteria in making comparisons. Figure 3 shows all product sub categories and their criteria used in AHP criteria hierarchy.

*Mobile* category has two sub categories; cellular phones and smart phones. Cellular phones category has important criteria such as; design, 3G support, color quality, sound quality, camera, ergonomics, brand image, and screen size. The important features of smart phones are touch screen quality, screen size, wireless coverage, operating system, design, 3G support, brand image and GPS.

LCD TVs subcategory contains screen size, resolution, refresh rate, HDMI support, view angle, contrast, and power saving criteria. LED TVs have resolution, screen size, refresh rate, contrast,

brightness, 3D support, and brand image criteria. The last sub category is Plasma TVs. Resolution, screen size, full HD support, refresh frequency, response time, brightness and contrast are included as important criteria in comparisons.



**Figure 3.** AHP Criteria Hierarchy

Common criteria of desktop computers and laptops are CPU, RAM, graphics card, hard-disk capacity, and cooling system. For desktops, other important criteria are monitor, output sockets, and sound card, whereas for laptops they are wireless coverage, design, and ergonomics. Tablet

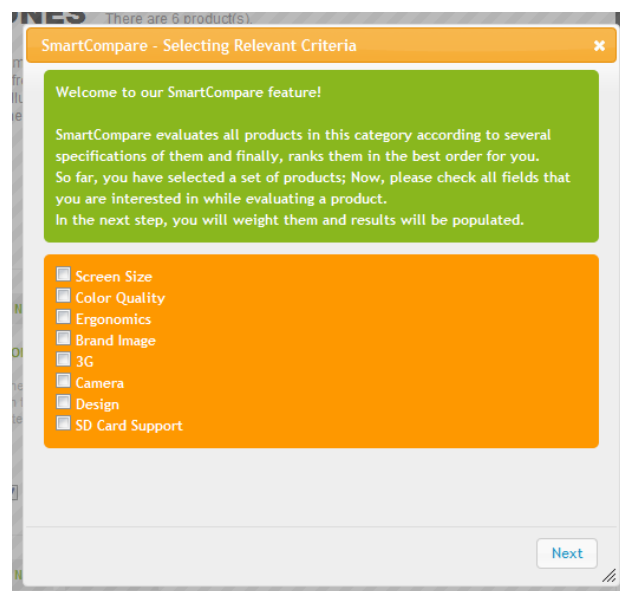
computers include battery duration & life, touch-screen quality, 3G support, wireless coverage, CPU, screen size, operating system, and internal memory features.

Price is not included under any of categories, because price is determined after a product's specifications are determined. In other words, price mainly depends on product's feature.

#### 4.2. Criteria Comparison with “SmartCompare” Feature

The system does not allow selecting more than seven or less than three products. After products are selected, “SmartCompare” button may be clicked. “SmartCompare” shows a window including all the criteria of that sub category. The user selects his most important criteria from the list before making a decision. Once the user selects his criteria, “SmartCompare” apply AHP methodology to find the best alternative for the user. The system does not show the details of the methodology, but only ranks products in a new window.

Figure 4 shows a cellular phone sub category example. Here, firstly customer selects three products in cellular phones sub category and then determine criteria which are important for him.

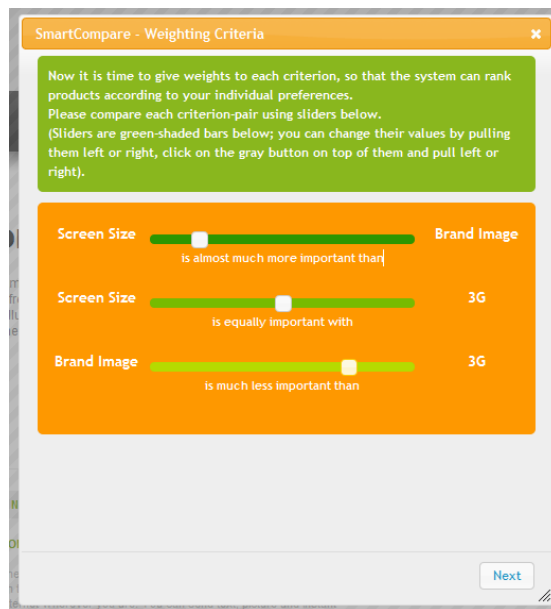


**Figure 4.** “SmartCompare” Criteria Selection Screen

Customer selects screen size, brand image and 3G criteria. After criteria selection, customer weights each criterion. In other words, customer makes pair-wise comparisons using

“SmartCompare” feature (Figure 3). Customer makes comparison between screen size and brand image, screen size and 3G, brand image and 3G. Every paired comparison corresponds to a question such “how criteria A have more or less important relative to the criteria B”.

AHP uses numbers scaling from 9 to 1/9 representing importance levels between criteria; greater than 1 corresponds to higher importance (9 meaning the maximum importance) whereas lower than 1 corresponds to lower importance levels (1/9 meaning minimum importance). In the platform, users can use sliders to give importance to each criterion as in Figure 5. Sliders actually keep values from 9 to 1/9 at the background and these values can be manipulated by dragging sliders left or right. In addition, when user drags them, the description below each slider changes and explains the users’ importance level.



**Figure 5.** Pair-Wise Comparison Screen

The system transforms these user preferences into a pair-wise comparison matrix of AHP. Table 1 shows the comparison matrix of the criteria.

**Table 1.** Pair-Wise Comparison Matrix of AHP

	Screen Size	Brand Image	3G
Screen Size	1	6	1
Brand Image	1/6	1	1/5
3G	1	5	1

### 4.3. Consistency Check and Normalization

Once the pair-wise comparison matrix is obtained, the matrix is normalized and priority vector is computed by taking row averages of the normalized matrix (Table 2).

**Table 2.** Priority Vector of Criteria Comparison

	Screen Size	Brand Image	3G	Priority Vector
Screen Size	0,46	0,50	0,45	0,40
Brand Image	0,08	0,08	0,09	0,08
3G	0,46	0,42	0,45	0,44

Then the system performs the consistency check of AHP methodology. Based on the pair-wise comparisons, if consistency level is not acceptable the system gives a warning message which also contains some suggestions to help the user. The system repeats these steps until the user enters consistent inputs, thus consistency level is satisfied.

At the next step, AHP compares alternatives with respect to each criterion selected. Within the platform, for each product, system admin enters product grades in a range of 0 to 100. In this way, each product's features are evaluated and stored in a database for AHP product comparison step. By using grades in the database, a matrix is formed. Table 3 shows grades entered by system admin for each criterion of alternative products.

**Table 3.** Priority Matrix

Product\Criteria	Screen Size	Brand Image	3G
CellPhone A	50	70	100
CellPhone B	40	70	100
CellPhone C	30	50	100
Grand Total	120	190	0

At the next step, system applies normalization and prepares the priority matrix (Table 4).

**Table 4.** Normalized Priority Matrix

Product\Criteria	Screen Size	Brand Image	3G
CellPhone A	0,42	0,37	0,33
CellPhone B	0,33	0,37	0,33
CellPhone C	0,25	0,26	0,33

Total	1	1	1
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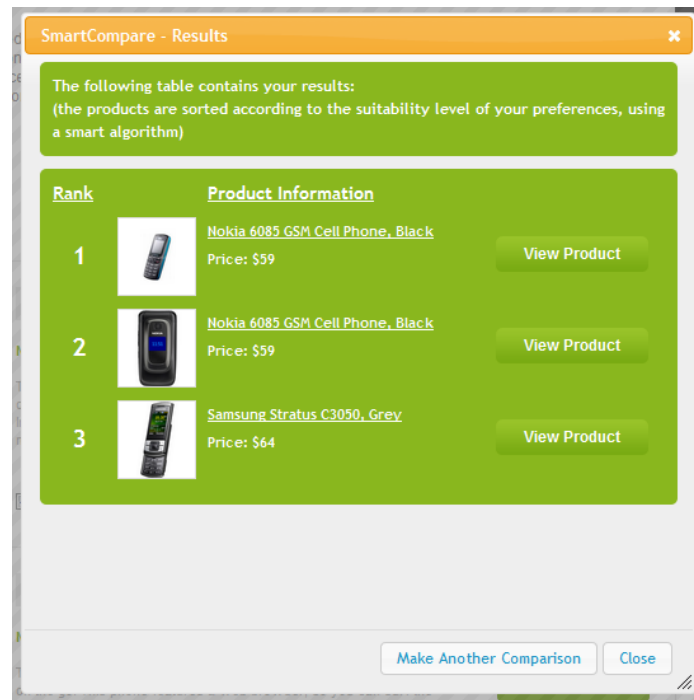
After the normalization step, the next step is ranking. In order to rank alternatives, AHP requires a matrix multiplication: priority vector of criteria has to be multiplied with priority matrix of the alternatives.

The results of matrix multiplication are shown in Table 6. The alternative cell phones are ranked with respect to the overall results. According to Table 5, the most suitable product is CellPhone A, followed by CellPhone B and CellPhone C.

**Table 5.** Overall Results

Product\Criteria	Screen Size	Brand Image	3G	Priority Vector of Criteria	Results
CellPhone A	0,42	0,37	0,33	0,48	0,38
CellPhone B	0,33	0,37	0,33	0,08	0,34
CellPhone C	0,25	0,26	0,33	0,44	0,29
Total	1,00	1,00	1,00	1,00	1,00

Additionally, the platform shows products in a sorted list according to suitability level of the user's preferences (Figure 6).



**Figure 6.** Results Screen

“SmartStore” platform has also an administration panel. The system admin can add a new admin, a new product, a new product category and manufacturers and list all of them. Under “SmartCompare” section, he can add new product category, sub-categories, and their criteria. He can give product ratings for each product and also define values of each criterion.

## 5. Conclusion

In the study, “SmartStore” is developed as an e-commerce platform and classical product comparison feature of other e-commerce platforms are enhanced with AHP methodology. To be able to apply AHP methodology “SmartCompare” function is developed. This feature with its user friendliness and dynamic structure provides to perform effective and efficient comparisons of different alternatives. Therefore, it can be said that, this new platform acts as a decision support system while making a purchase.

In order to enhance the platform, a real online payment system may be integrated. Additionally, filtering option can be applied to the categories page. Thus, products will be able to be filtered according to specific filters such as price, range, and brands.

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