

Analyzing the Criteria of Shopping Mall Customers via Expert System

Fatih Başçiftçi¹, SüleymanBurçin Şüyun²

¹(Department of ComputerEngineering / Selçuk University, TURKEY)

²(Graduate School of Natural and Applied Sciences / Selçuk University, TURKEY)

ABSTRACT: In this study, the aim is to identify the points to which people pay attention when choosing the shopping malls, and the logical functions were inspected with eight (8) variable options (in $2^8=256$ different situations) by simplification. The customer choices were evaluated via the software which was developed based on the dissertations and scientific publications of the experts. In this way, 20 rules were obtained by reducing the number via the simplification of Boolean Functions (BFs). Expert Systems (ES) are the software that perform modeling and reasoning, and monitor the decision-making processes of one or more individuals on specific areas. Through the use of ES, the reason why the visitors of a target shopping mall prefer it can be understood via the database. Thanks to such researches, shopping mall customers are able to choose whichever is suitable for them. Moreover, shopping malls can analyze what type of customers they appeal to, and maintain the advertisement and brand diversity.

Keywords: Expert Systems, Simplification of Boolean Functions, Shopping Malls, Shopping Mall Selection Criteria of Shopping Mall Customers, Shopping Mall Preferences of Customers

I. INTRODUCTION

Shopping malls are the areas that are developed to bring together a group of business owners and a group of retailers, and that are managed for a single reason enhanced with some features such as parking garage which typically involve some of other business organizations in its body [1]. In global terms, shopping mall concept has been a characteristic founded on the urban structure for the last thirty years [2]. In the study titled as "Young People and Shopping Malls" by GülizMuğanAkıncı (2013), it is seen that the changing global values and the liberal economy which has been established in our country especially for the last 30 years have been effective to enable the shopping malls to become a part of the city [3].

Shopping malls not only provide opportunities to the customers just for the product that they would like to get, but also intend to include them in a process in which they would enjoy. They offer events to the customers in which they can attend individually or with a group. At this point, we need to know the customer's expectations from the shopping mall and their motivations to choose this shopping mall [4].

Similarly, in the study titled as "Identifying the Shopping Mall Preferences of Female Consumers" by Ahmet Şekerkaya and EmrahCengiz (July 2010), the shopping habits were examined. As it is explained in this study, the significant indicators of advanced economies are shopping malls and their numbers in a country. As in the developing countries, the uptrend continues in our country as well. In parallel to this uptrend, it is also observed that the target customers, product ranges and services of shopping malls vary as well [5].

BanuDinçer and Caner Dinçer, in their study titled as "Shopping Mall Visits and Behaviors of Consumers", listed the shopping motivations in furtherance of the researches of Ahmet Şekerkaya and EmrahCengiz. These topics can be summarized as Aesthetic Level, Escape Level, Time Flow Level, Exploration Level, Role-Taking Level, Social Level, and Convenience Level [6].

Consumer behaviors are affected from demographical, economic, social, psychological and cultural factors as well as product, price, distribution and promotion decisions. The combination of all these factors defines the frame of the consumer behaviors [7]. The change on the perception of public relations concept affected the sense of public spheres as well, and shopping malls have become today's new public spheres [8].

Consumers with high purchasing power would like to benefit from the opportunities that credit cards provide. In addition, thanks to the attraction of advertisements displayed in streets and broadcast on TV & internet, promotional activities, the diversity of social activities, strong competition and the acceleration of purchasing decisions, the quality standards of expectations from a shopping mall improve day by day [9].

When the horizontal/vertical cultural trends or contexts of cultural variables in a human life are examined, it is observed that there is a distinction and that the customers with different cultural background have different shopping behaviors [10].

The analysis of the path that people follow during shopping shows that it has a strong impression on the perception of consumers in a shopping mall and on their intention during shopping [11].

In this study, the aim is to identify the points to which people pay attention when choosing the shopping malls. The logical functions were inspected with eight (8) variable options (in $2^8=256$ different situations) by simplification.

The customer choices were evaluated via the software which was developed based on the dissertations and scientific publications of the experts. Thus, rules are obtained via the simplification of Boolean Functions (BFs). 256 different situations were evaluated by using 8 criteria which were identified for customers, and 20 functions were obtained after the simplification process.

II. MATERIALS AND METHOD

Characteristics of shopping malls: It becomes easier to understand the basic elements that constitute shopping malls when the common characteristics in addition to the definitions of shopping malls are listed. Basic common characteristics: Operating within a designed architectural structure, systematically managing the shopping mall as a whole, managing all the tenants by providing them with equal service as the management is under a single roof, maintaining short walk ways on the area by the entrance of the shopping mall to access every store, maintaining accessibility to the goods receiving areas and other supply systems of stores (cargo, mail, etc.) without disturbing the consumers, proper lighting in the shopping mall, placing direction plates and signs, attractive decoration, locating the sales goods by complementing each other in order to optimally fulfill the consumer needs, paying attention to creating a suitable environment for social and cultural activities [9].

2.1 Database

A database was built considering the undermentioned criteria. The variables are listed in Table 1.

Autonomy: Factors can act without being affected by people, and they somehow have a control over their own actions and inner states;

Sociality: Factors can communicate with other factors and people via a factorial communicative language;

Reactance: Factors can sense their environments and react to the changes occurred in these environments;

Pre-efficiency: Factors do not take action just to react to their environment. They also display behaviors to make an attempt towards their targets;

Mobility: The ability to move on an electronic network;

Honesty: Not misleading on purpose and willfully.

Kindness: It is assumed that factors do not have any conflicting targets and each factor endeavors to do its duty.

Rationality: A factor acts to attain its goal; it does not display behaviors that will prevent it from attaining this goal [12].

Table 1. The criteria to which customers pay attention when choosing a shopping mall

Number	Name of Criterion
1	Autonomy
2	Sociality
3	Reactance
4	Pre-efficiency
5	Mobility
6	Honesty
7	Kindness
8	Rationality

2.2 Expert Systems

Expert Systems are the software that perform modeling and reasoning, and monitor the decision-making processes of one or more individuals on specific areas. The main idea behind the ES is to simply transfer the duty-specific information to a person and to a computer. Specialized knowledge is obtained by the transfer of personal experiences such as perspectives and objectives for long years; therefore, an absolute objectivity is quite difficult [13].

Expert Systems can solve problems that require specialized knowledge on a specific area, and represent & preserve this knowledge in a specific format. Therefore, these systems are also named as Knowledge-Based Systems. Expert Systems consist of these elements:

- Knowledge Base

- Reasoning Unit
- User Interface
- Information Retrieval Unit
- Explanation Unit [14]

Expert systems use experience-based deductive methods instead of exact algorithms, therefore, the designing process of expert systems is complicated and time-consuming [15].

Structure of Expert Systems: Users, namely requires, direct the system in accordance with the requirements in a system designed as an expert system. Database is the most important element of expert systems, and new data input in an expert database is again conducted by an expert.

Modeling is conducted through the data in the data system, and the database expands when a new data is input in the system. That does not point to the need for new software, because results can be recreated via rational test mechanisms. There are some rules for logical tests. When setting these rules, "If-Then" structures are used. The use of these structures is as follows.

If (you encounter one or multiple situations), Then (give result)

Multiple conditions can be created during the formation of *If-Then* structure. According to the circumstances, the conditions can be linked via 'and' and 'or' expressions. For example, 'and' expression signifies that the result is logically validated when both conditions are logically validated. We need to use 'or' expression if we would like the result to be correct when either of the conditions is logically validated [13].

2.3. Simplification of Boolean Functions Method

Fewer cases are obtained by simplifying the logical functions using the simplification of Boolean functions (BFs) method. Fewer rules are evaluated with BFs. Reducing the number of rules makes ES more efficient, saves time and makes it easier to transfer the rules to the ES. BFs rules, methods and practices are explained in references [13] [16] [17] [18] [19].

III. APPLICATION

In this study, expert system software was developed and the shopping mall selection criteria of people were analyzed. In this system, although all the rules were set based on expert opinions, they were analyzed as the entire data with the user data in the database. It is not suitable to inspect every rule, which consequently leads us to the logical 1, in terms of performance efficiency. Therefore, the simplification of Boolean functions method is ideal in order to get a refined result. Eight (8) shopping mall selection criteria were used in this study. Based on 8 criteria, 256 different situations were evaluated and the system was analyzed. In this way, the shopping mall selection criteria of people were determined. While these 8 factors represent an input with different values, they also give an output value for shopping mall selection. Detailed illustration is shown in Table 2.

Table 2. Input name and output symbol corresponding to the input symbol in the database

Input No	Input Symbol	Input Name	Output No	Output Symbol
1	K1	Autonomy	1	Y1
2	K2	Sociality		
3	K3	Reactance		
4	K4	Pre-efficiency		
5	K5	Mobility		
6	K6	Honesty		
7	K7	Kindness		
8	K8	Rationality		

All conditions are represented with 0 and 1, which are Boolean values. Input values which are created under certain circumstances are examined one by one, and the output values are expressed with Boolean values. In order that "Different from Other Shopping Malls" criterion, which is the first input value, can be logical 1, the participant must select the "Strongly Agree" or "Agree" options; however, if the participants select the "Strongly Disagree" or "Disagree" options, then it is logical 0 for output. The values from [K1] to [K8] criteria transferred from the real world to the database were represented with Boolean 0 and 1 values. Actual values and their Boolean equivalents are shown in Table 3. A conclusion section must be included and should indicate

clearly the advantages, limitations, and possible applications of the paper. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

Table 3. Boolean Equivalents of the Real-World Data in the Surveys

K1	K2	K3	K4	K5	K6	K7	K8
Strongly Agree	Agree	Disagree	Unanswered	Strongly Disagree	Agree	Disagree	Unanswered
Agree	Agree	Agree	Agree	Strongly Agree	Agree	Disagree	Agree
Unanswered	Unanswered	Strongly Agree	Agree	Disagree	Agree	Disagree	Disagree
Boolean Data							
1	1	0	0	0	1	0	0
1	1	1	1	1	1	0	1
0	0	1	1	0	1	0	0

Each different input variable was expressed as Boolean values. 256 situations shaped based on 8 input values were placed on the truth table. Each situation which is formed based on 8 input variables is analyzed in accordance with the expert opinions and the reviews of participants, and the result is evaluated as 1 or 0. The truth table is shown in Table 4.

Table 4. The Truth Table Consisting of the Survey Data

Order No	K1	K2	K3	K4	K5	K6	K7	K8	Y1
1	1	1	0	0	0	1	0	0	0
2	1	1	1	1	1	1	0	1	0
3	0	0	1	1	0	1	0	0	1
4	1	1	0	0	0	1	0	0	0

20 results obtained via the expert systems are shown in Table 5. The "-"symbol between the values in Table 5 is insignificant.

Table 5. 20 Results Obtained via the Simplification of Expert Systems

1	000-0010	6	00110000	11	01110001	16	1-110011
2	-000010-	7	00110101	12	100-01-0	17	10111000
3	000001-1	8	01000110	13	10001001	18	11000-01
4	000-0001	9	01010011	14	1-010111	19	11000010
5	-0010110	10	01010101	15	10-00101	20	11110110

Out of 20 criteria, three criteria which were defined based on "if-then" structure within the expert systems were selected and arranged. The modeling of the three rules based on "if-then" structure is shown in Table 6. When the results were evaluated, it was observed that the selection criteria of the participants varied; therefore, the shopping mall management needs to aim the researches with more participants in order to get more specific results.

Table 6. Examining the Three of the Expert Systems Results

x000010x	100x01x0	11110110
IF	IF	IF
Autonomy is <i>Insignificant</i>	Autonomy is <i>Available</i>	Autonomy is <i>Available</i>
Sociality is <i>N/A</i>	Sociality is <i>N/A</i>	Sociality is <i>Available</i>
Reactance is <i>N/A</i>	Reactance is <i>N/A</i>	Reactance is <i>Available</i>
Pre-efficiency is <i>N/A</i>	Pre-efficiency is <i>Insignificant</i>	Pre-efficiency is <i>Available</i>
Mobility is <i>N/A</i>	Mobility is <i>N/A</i>	Mobility is <i>N/A</i>
Honesty is <i>Available</i>	Honesty is <i>Available</i>	Honesty is <i>Available</i>
Kindness is <i>N/A</i>	Kindness is <i>Insignificant</i>	Kindness is <i>Available</i>
Rationality is <i>Insignificant</i>	Rationality is <i>N/A</i>	Rationality is <i>N/A</i>
Then	Then	Then
<i>This Customer is a Shopping Mall Customer</i>	<i>This Customer is a Shopping Mall Customer</i>	<i>This Customer is a Shopping Mall Customer</i>

IV. CONCLUSION

In this study, an expert system was developed by considering the shopping mall visiting criteria of a group of people from Izmir (Turkey), who had a habit of visiting shopping malls. 100 individuals living in Izmir city were tested regarding which criteria they pay attention to when choosing a shopping mall and a database was built by using these records. The group consists of 62 females and 38 males between 16 and 21 ages. The output statements were analyzed according to $2^8 = 256$ different input data. 256 different conditions were reduced to 20 via the simplification of logical functions method. Expert systems rule base was created with these refined conditions. Through the use of expert systems, the reason why the visitors of a target shopping mall prefer it can be understood via the database. Thanks to such researches, shopping mall customers are able to choose the suitable customer strategy for them. Moreover, shopping malls can analyze what type of customers they appeal to, and maintain the advertisement and brand diversity. This may be a basic idea for campaigns and other promotional strategies, which are an important factor in terms of competition. Expert systems, which are a far more effective method to get a result, can be used without waiting for the results of some customer experiences which shopping malls offer with great expenses. In this way, the cost per lead of shopping malls will decrease. Another item of savings would be time; the shopping mall management can save time without initiating any wrong practices in the light of the information that they gain via such pre-experiences.

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