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Selection Of E-Commerce Entrance Channel By AHP And TOPSIS Methods

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Abstract: *In today's digital world, it is unlikely that businesses will be left out of e-commerce. But businesses should take accurate decisions to get involved in the electronic world and should not waste limited resources such as time, money and labor. Therefore, the selection of the entry channel in e-commerce of a SME which is in book and stationery retailing sector, has been decided using by AHP and TOPSIS methods.*
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I. Introduction

It has become almost impossible not be in the digital World for firms with increasing use of the internet and using mobile devices for shopping. Along with the fact that early participants of digital World will be profitable, those who are not involved in this race would probably face some difficulties. For this reason, both big and small, today's enterprises want to be in the e-commerce. In the widespread of e-commerce, despite the psychological distance factors such as trust and financial risk, it is important to include shopping easiness and convenience (McKnight, Choudhury and Kacmar, 2012). While technological developments begin to remove psychological distances and perceived risks, emerging e-commerce types can address different consumer groups. For example, consumers that have low technology level and only use social media, can shop through applications such as instagram. Of course, these types of applications are not very developed for shopping. However consumers can purchase by communication is made similar to traditional retailing and shopping systems as payment at the door etc. Therefore, marketplaces such as n11 and gittigidiyor and large retailers as hepsiburada allow to open stores through their web sites, provides convenience for SMEs to take part in e-commerce. At this places, it is possible to open stores for certain fees or sales commissions. The need for high software costs and technical knowledge has led to the creation of e-commerce software such as ideasoft. Worldwide shopping cart software such as Woocommerce and Shopify also facilitates e-commerce entry with relatively low cost and high technical knowledge. Ready-to use e-commerce software can be used as a lease or can be bought and operated by their own web addresses. Besides these, the most known system is that business having a suitable software and design for its own business model, through their web address. Most of large companies use their own software. While this provides flexibility to businesses, leads to management difficulty. In this work, a SME which is a book and stationery products retailer in Ankara wants to make a decision to take place in the e-business world. It has become compulsory that large have already entered the e-commerce sector and competitors are slowly taking part in the digital world.

II. Method

2.1 AHP (Analytic Hierarchy Process)

The Analytical Hierarchy Process (AHP), one of the most commonly used and most well-known multi-criteria decision-making methods, was developed by Thomas L. Saaty. The qualitative and quantitative variables can be evaluated at the same time and it is a suitable method to solve the problems in the complex structure (Zahedi, 1986). A large number of hybrid and integrated applications are seen in the literature because of its compatibility with fuzzy logic, linear programming and other multi-criteria decision making methods. The independence of the criteria makes the method easy to implement (Murat and Çelik, 2007). The aim of the method is to determine the priorities and weights of the independent criteria through pairwise comparisons.There are 3 steps of the AHP Method, including the creation of hierarchies, pairwise comparisons and calculation of priorities (Dündar and Ecer, 2008).First, a hierarchical structure is formed according to the structure of the problem. At the top of the hierarchy is the target. In order to design the hierarchical structure, firstly a target should be determined and the sub-targets affecting the decision should be determined (Saaty,

1994). Then, criteria, sub-criteria and alternatives are determined. At this stage, it is decided who or who are the decision makers.After the step of building the hierarchical structure, pairwise comparisons are made. As a result of pairwse comparisons made by decision makers or experts, relative importance are set. By means of pairwise comparisons, the problem is divided into smaller pieces and the best solution is obtained for the decision makers rather than the best solution (Saat, 2000). Comparisons are made according to Table 1 below.

Table 1: Pairwise Comparison Scale

Value	Definition	Explanation
1	Equal	Both factors have equal importance
3	Moderate	Factor 1 is slightly more important than factor 2
5	Strong	Factor 1 is more important than factor 2
7	Very Strong	Factor 1 is very important
9	Extreme	Factor 1 is absolutely superior to factor 2
2,4,6,8	Intermediate values	Can be used when reconciliation is needed
If factor 1 is less important than factor 2, 1/3, 1/5, 1/7 and 1/9 values are used.		

Source: Saaty (1977)

To determine the significance of the criterion after pairwise comparisons, the pairwise comparison matrix (decision matrix) seen in Equation (1) is formed. If there are more than one respondents, the geometric mean of the answers of the decision makers is taken. Symbols explanations are at this matrix are below:

n: the number of criteria to be evaluated

C_i: *i*th criterion

c_{ij}: indicates the degree of importance according to criterion *i* to criterion *j*.

$$C = \begin{array}{c} \\ C_1 \\ C_2 \\ \vdots \\ C_n \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \\ \begin{bmatrix} 1 & c_{12} & \cdots & c_{1n} \\ c_{21} & 1 & \cdots & c_{2n} \\ \vdots & \vdots & 1 & \vdots \\ c_{n1} & c_{n2} & \cdots & 1 \end{bmatrix} \end{array} \quad (1)$$

After the decision matrix is constructed, the eigenvalue method is applied to find the relative importance of decision elements. If the calculations are briefly mentioned, the matrix is normalized such that the column sums of the matrix are "1". For this, each element of the matrix is divided to the sum of the columns. Finally, the mean of each line in the normalized matrix is taken, and the criteria weights (w) are obtained.

Consistency indices are calculated after the criterion weights are obtained. Firstly;

$$\lambda_{max} = \frac{1}{n}\sum_{i=1}^{n}\left[\frac{\sum_{j=1}^{n} c_{ij}W_j}{w_i}\right] \quad (2)$$

λ_{max} is calculated with equation. The obtained λ_{max} value,

$$CI = \frac{\lambda_{max}-n}{n-1} \quad (3)$$

is used to calculate Consistency Index in this equation. "*n*" in the Equation (3) shows the matrix size. Then;

$$CR = \frac{CI}{RI} \quad (4)$$

Consistency Ratio is calculated by the equation. The low consistency ratio value indicates the high reliability of the model and is expected to be lower than 0.1. The *RI* that used when calculating consistency ratio shows Random Index value and is given in Table 2.

Table 2: Random Index Table

n	**3**	**4**	**5**	**6**	**7**	**8**
RI	0.5247	0.8816	1.1086	1.2479	1.3417	1.4057

Source: Alonso and Lamata (2006)

Finally, in order to find the weight of the criteria within the system, each criterion is multiplied by the weights of the top criteria or criteria to which it is hierarchically connected. Thus, criteria weights are obtained. The weight sums at each decision level are equal to "1".

2.2 TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution)

The TOPSIS method was developed by Hwang and Yoon to solve multi-criteria decision making problems (Chen, 2000). The method sorts alternatives based on the relative closeness to the optimal solution and the relative distance to the worst solution (Zanakis et al., 1998). In this method, the values of the alternatives must be measurable or converted to be measurable in order to be able to perform the calculations. Since the calculations are simple and the method is useful, it is possible to see many applications in the literature.

Steps of the TOPSIS method are as follows (Opricovic and Tzeng, 2004, Uygurtürk and Korkmaz, 2012).

At first step after the generation of decision matrix;

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}} \quad (5)$$

Decision matrix is normalized with equation. Then, weighted normal value v_{ij};

$$v_{ij} = r_{ij} \times w_{ij} \quad (6)$$

Is calculated with equation. Ideal and negative ideal solutions are;

$$A^* = \{(\max V_{ij} \mid j \in J\} \quad (7)$$

$$A^- = \{(\min V_{ij} \mid j \in J\} \quad (8)$$

Obtained by equation (7) and (8.). In this step, if the aim is maximization A^* will take high value, if minimization will take low value. Then;

$$S_i^* = \sum_{j=1}^{n} (v_{ij} - v_j^+)^2 \quad (9)$$

$$S_i^- = \sum_{j=1}^{n} (v_{ij} - v_j^-)^2 \quad (10)$$

Separation measures are calculated by this equations. C_i^* value is calculated by way of separation measures with the following equation.

$$C_i^* = \frac{S_i^-}{S_i^* + S_i^-}, \quad 0 < C_i^* < 1 \quad (11)$$

According to this value, alternatives are sorted in descending order.

III. Application

In this study, a decision is tried to make for a book and stationery products vendor SME, wants to enter e-commerce, with multi-criteria decision making methods in order to select which way to go for entrance. In the first phase of the study, e-commerce experts were interviewed to determine criteria and alternatives. Criteria and alternatives are given in Figure-1.

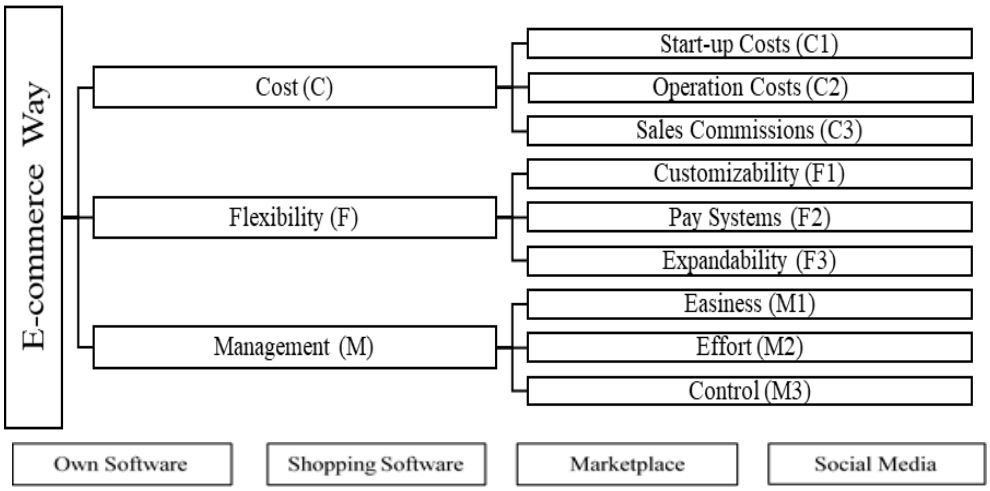

Figure 1: Criteria and Alternatives

After criteria were determined, they were evaluated by firm's decision makers and experts by the pairwise comparison scale. Following the evaluations, the decision matrices were created by taking the geometric means of responses.

Table 3: Pairwise Comparison Matrix for Main Criteria

	C	F	M
C	1.00	0.28	1.44
F	3.56	1.00	2.08
M	0.69	0.48	1.00

After creating the pairwise comparison matrices of all sub-criteria, the AHP method was followed by calculation steps and the following criteria weights (w) were obtained.

Table 4: Criteria Weights

Code	Criteria	Local Weight	Weight (*w*)
C	Cost	0.22	
F	Flexibility	0.57	
M	Management	0.21	
C1	Start-up Costs	0.59	0.132
C2	Operation Costs	0.15	0.032
C3	Sales Commission	0.26	0.058
F1	Customizability	0.44	0.251
F2	Pay Systems	0.11	0.063
F3	Expandability	0.45	0.254
M1	Easiness	0.22	0.047
M2	Effort	0.18	0.037
M3	Control	0.60	0.125

As seen in the table, the cost and management have almost the same importance, while the flexibility has a great weight of 0.57. Since the degree of importance of the flexibility criterion is high, personalization and growth among the sub-criteria hold an important place in the system with the weights of 0.251 and 0.254. Then, the organization cost and control criteria have importance with weights of 0.132 and 0.125. This shows that the web page for e-commerce should be able to be personalized and able to grow. In addition, it is important that the business control ability on their e-commerce system and the start-up costs are also important. Consistency ratios were calculated after the criterion weights were obtained and it is 0.09 for the main criteria matrix. For the sub-criteria matrices C, F and M, 0.02, 0.01 and 0.02 respectively. Thus, it is possible to say that the models are consistent. It is necessary to evaluate the alternatives after determining the criterion weights. 4 alternatives are evaluated with TOPSIS methods which are its own web page/software, to get a ready-to-use platform / software, to sell through a marketplace or to sell through social media. For this, a decision matrix is formed first. The values in the decision matrix are scored by experts. Following the formation of the decision matrix, the steps of TOPSIS method are followed. First the matrix is normalized and then weighted. Table 5 contains weighted decision matrix and positive ideal solutions (PIS) and negative ideal solutions (NIS)

.**Table 5**: Weighted Decision Matrix, PIS and NIS Values

	C1	C2	C3	F1	F2	F3	M1	M2	M3
A1	0.019	0.057	0.184	0.859	0.190	0.833	0.039	0.029	0.460
A2	0.078	0.010	0.184	0.550	0.190	0.675	0.077	0.029	0.295
A3	0.311	0.042	0.007	0.215	0.121	0.300	0.101	0.116	0.074
A4	0.487	0.117	0.090	0.215	0.017	0.133	0.128	0.016	0.018
PIS	0.487	0.117	0.184	0.859	0.190	0.833	0.128	0.116	0.460
NIS	0.019	0.010	0.007	0.215	0.017	0.133	0.039	0.016	0.018

In the final stage, the separation measures are calculated using by Equations (9) and (10), and C_i^* values which indicate the relative closeness to the solution were obtained by Equation (11). Sorting by or the evaluated alternatives; S_i^* and S_i^- values and C_i^* values, and sorting of alternatives are given in Table 6.

Table 6: S^*, S^- and C^* Values and Sortings

	S^*	S^-	C^*	Rank
A1	0.487	1.079	0.689	1
A2	0.580	0.740	0.561	2
A3	0.960	0.376	0.282	4
A4	1.072	0.494	0.316	3

As seen in the Table, the A1 coded alternative, which is the establishment of its own web page, has emerged proposed entrance way as the result of this work. Subsequently, shopping cart software, marketplace store and sales on social media follows respectively.

IV. Conclusion

As a result of the work, an attempt was made to suggest a solution for a SME who wants to enter e-commerce. Criteria are weighted by the AHP method and alternatives are evaluated by the TOPSIS method. Consequently, establish its own web page and software is the recommended solution in accordance to expert opinions and own decision makers' responses. This result is seen suitable the fact that the business is known as flexible and growth-oriented. The firm will encounter with some difficulties as installation and high start-up costs, more effort, work and technical knowledge requirements by using its own web page and software. On the contrary, SME will have a chance to control their e-commerce, will not pay sales commissions, can create own brand and can use as company web page. After choosing to set up its own webpage and software, firm will also have to consider the preferences of the software vendor, freelance software developer, or software developer and designer as employee. This result, of course, takes into account the subjective state of the business. It is possible to select one of the other 3 alternatives in applications to be made with other enterprises. Later on, it is possible to increase the number of criteria, to differentiate the alternatives and to use other multi-criteria decision-making methods to evaluate the alternatives. In addition, fuzzy methods or if it is considered that there is a relationship between the criteria, studies with ANP may be carried out.

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