Evaluating and Ranking Digital Stores’ Suppliers using TOPKOR Method

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1. INTRODUCTION

Online stores can be considered as one of the most important strategic points for business growth. There are several factors for the decision-maker to consider when evaluating and ranking online store suppliers. Nowadays, the need for online stores is increasing. Various factors in the evaluation and ranking of online store suppliers are effective and it can be considered as a multi-criteria decision problem. Multi-criteria decision making is considered as the most important branch of operational research; because, it involves complex decisions of people's lives. There are several multi-criteria decision models. Researchers by considering current problems and criteria, use decision-making techniques. Analytical Hierarchy Process with multi-criteria decision model which has been introduced by Saaty [1] is one of the most powerful methods for calculating the weight of criteria and sub-criteria. Weight criteria and sub-criteria are calculated by the pairwise comparison matrix. Uncertainty is not considered in the main model of the analytical hierarchy process, also several researchers have integrated the fuzzy model with an analytical hierarchy process to reduce inaccuracies in decision making.

The model is also widely used in a variety of fields including engineering, economics and operations management. Factors such as environmental and social factors to choose the source of supply for online businesses and economics and building a long-term
relationship with it is crucial to maintain a competitive advantage. For example, the environmental criterion is one of the considered factors by societies and governments that has been highly emphasized and for this criterion, there are many programs for companies, such as the use of environmentally-friendly and degradable materials, the design of environmental products and pollution monitoring in production processes [2, 3].

However, an organization's environmental performance depends not only on its sustainable behaviors but also on its suppliers and how they work. Consequently, choosing a good supplier that meets these criteria in the supply chain is a top priority for companies. In the current study, this research provides a method for evaluating and ranking suppliers in digital stores. First, effective criteria in evaluating and ranking suppliers in digital stores are identified and the score of each supplier is determined in each criterion. Then a hybrid approach by combining of two multi-criteria decision-making (MCDM) techniques called Analysis Hierarchy Process (AHP) and TOPKOR are provided for ranking suppliers.

The main research question of this research is as follow:

How the digital stores’ suppliers are ranked using a combination of AHP and TOPKOR techniques?

The research sub-questions are as follows:

What criteria should be used to rank digital stores’ suppliers?

What is the weight of each used criterion?

What is the score of each alternative in each criterion?

2. LITERATURE REVIEW

These days in digital age, the way we choose and understand the structures of online businesses has changed. Retail section in recent years has seen significant changes and continues to grow at an unprecedented rate [4]. Therefore, the nature of retail the tradition has shifted to online retail. As a result of the emergence of online retail from the early twentieth century by the emergence of international big brands such as, M&H, Mango and ZARA, which have started digital stores are identified and the score of each supplier is determined in each criterion. Then a hybrid approach by combining of two multi-criteria decision-making (MCDM) techniques called Analysis Hierarchy Process (AHP) and TOPKOR are provided for ranking suppliers.

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2.1. MCDM Technique

Liu, Quan, Li and Wang [17] also wrote a new decision model and alternative method of queuing 6 multi-criteria for selecting a sustainable supplier by combining the best and worst methods at a valuable time interval. Also, Kaushik, Khare, Boardman and Cano [18] examined the factors...
that motivate consumers to buy online fashion retailers and these factors were evaluated using the analytical hierarchy process method. Sánchez-Lozano, Teruel-Solano, Soto-Elvira and García-Cascales [19] in their research which was based on a geographic information system (GIS) and they used multi-criteria decision-making methods the optimal choice of solar power plants. They calculate the weight of these criteria using the analysis process Hierarchical (AHP) and TOPSIS method to evaluate the criteria. Konstantinos, Georgios and Garyfalos [20] used the combined AHP method and Geographic Information System (GIS) to determine the most appropriate sites used to install wind farms and then the TOPSIS method to rank the construction sites of wind farms. Sedady and Beheshtinia [21] described a new method for prioritizing the construction of renewable power plants which their evaluating factors are: technical factors, economic, social, political and environmental criteria, each of which includes five sub-criteria, and using Hierarchical analysis method and a new method called TOPKOR to prioritize places.

2. 2. Sustainability Supply Chain On the other hand, Liou, Chang, Lo and Hsu [22] in a study ranked and evaluated the criteria of green supply chain in the field of electronic services. They ranked and evaluated the criteria by combining the best and worst fuzzy methods with fuzzy TOPSIS. Hsu, Yu, Chang, Liu and Sun [23] in their study, they reduced the destructive effects on the sustainable supply chain in the electronics manufacturing industry. By evaluating the effective criteria using QFD and FMEA methods, they evaluated and ranked the criteria by combining AHP and DEMATEL methods with a grey approach. Zukeri, Yang and Konstantas [24] in their research, they evaluated and ranked suppliers in order to select them correctly in the sustainable supply chain. They used the ARPASS\(^2\) method for ranking and final selection of suppliers.

Karami, Ghasemy Yaghin and Mousazadegan [25] enabled the logistics department to evaluate and systematically select suppliers using quantitative and qualitative decision criteria. They also built a three-step approach to tackle selection problem and evaluation in the industry. Abdel-Basset, Manogaran, Mohamed and Chilamkurti [26] presented a new evaluation function to calculate the weight of options for a better choice in his paper. As well as the selected criteria to increase the quality and service and reduce costs and control time to select the best suppliers. Fanita and Sinaga [27] in their paper provide a framework based on the integrated fuzzy-hierarchical analysis approach for selecting a global supplier that considers sustainability risks from sub-suppliers. Boran, Genç, Kurt and Akay [28] also presented an approach for the problem of selecting a model supplier based on fuzzy decision making with TOPSIS method. Mohammed, Yazdani, Oukil and Gonzalez [29] they examined the impact of environmental, social and economic disturbances on the selection of suppliers in the sustainable supply chain. Using the DEMATEL method, they measured the impact of these disorders on supplier selection and combined the MABAC-OCRA-TOPSIS-VIKOR (MOTV) methods to rank suppliers.

De Boer [30] has worked on procedural rationality issue in supplier selection, in which he provided three innovative methods for selecting supplier selection criteria. Laurentia and Septiani [31] have focused on choosing a place issue YPBM University of Tourism by combining the two methods of cutting point and hierarchical analytical process to investigate that their goal was analyzing the location for the construction of the new campus. Torkayesh, Iranizad, Torkayesh and Basit [32] also examined the methods of selecting suppliers in the online sustainable supply chain. They used a combination of BWM and WASPAS methods to rank suppliers by determining the criteria influencing supplier selection.

Ghorui, Ghosh, Algehyne, Mondal and Saha [33] have worked on hierarchical analysis issue and order prioritization analysis by similarity of the answer to the idea of TOPSIS to choose the place of purchase with fuzzy data. Accordingly, to select the place of purchase from the analysis process, Fuzzy hierarchy and fuzzy analysis were used to prioritize the order by similarity to the ideal answer. The dynasty hierarchy analysis was used to obtain the weight factors and also the fuzzy hierarchical analysis process were used to rank the criteria, and the sub-criteria were used to integrate fuzzy weights. Qu, Zhang, Qu and Xu [34] have worked on selecting a green supplier based on procedure issue with the help of TOPSIS fuzzy approaches. These researches were accompanied by a case study in a Chinese Internet company which was aimed to show the appropriate green chain suppliers based on a framework with the help of fuzzy TOPSIS and ELECTRE. This framework is presented based on green supply chain management. The TOPSIS and ELECTRE approaches were used to rank green chain suppliers and the results of the proposed framework with the obtained ratings, by higher grades and incompatibility was compared with the measurements of the fuzzy electro-method. Shaikh, Memon, Prokop and Kim [35] have worked on a hybrid approach issue based on the hierarchical analysis process and TOPSIS to select the optimal location using spatial data. Štirbanović, Stanujić, Miljanović and Milanović [36] in their studies on multi-criteria decision-making methods, such as TOPSIS and VIKOR focused that they used these methods to select floating vehicles as a result,
in this research. The AHP and TOPKOR methods have been used to select the right supplier among the 11 available suppliers. Table 1 summarized the researches in the scope of sustainable supplier selection. The innovations of this research are as follows:

- Providing a comprehensive list of criteria in the scope of sustainable supplier selection.
- Employing these criteria to evaluate and rank the digital stores’ suppliers.
- Using a combination of AHP and TOPKOR methods in sustainable supplier selection scope.

### 3. METHODOLOGY

#### 3.1. Research Steps

To answer the research questions, the following steps are implemented:

Step 1: Determine the effective criteria in evaluating and ranking suppliers in digital stores.

Step 2: Determine the weight of the criteria using the AHP method. The steps of the AHP method are as follows:

Step 2.1: Form a matrix of pairwise comparisons: If \( n \) criteria exist and the numerical equivalent of the two

| Criteria          | Boran, Genç, Kurt and Akay [28] | De Boer [30] | Devi and Wardhana [37] | Abdel-Basset, Manogaran, Mohamed and Chilamkurti [26] | Štirbanović, Stanujkić, Miljanović and Milanović [36] | Qu, Zhang, Qu and Xu [34] | Shaikh, Memon, Prokop and Kim [35] | Liou, Chang, Lo and Hsu [22] | Mohammed, Yazdani, Oukil and Gonzalez [29] | Hsu, Yu, Chang, Liu [23] | Mohammedi, Yazdani, Oukil and Gonzalez [29] | Laurentia and Septiani [31] | Karami, Ghasemy Yaghin and Mousazadegan [25] | Liou, Chang, Lo and Hsu [22] |
|-------------------|----------------------------------|--------------|------------------------|------------------------------------------------|-------------------------------------------------|--------------------------|---------------------------------|--------------------------|-----------------------------------|---------------------|-----------------------------------|---------------------------------|------------------------------------|----------------------|
| Economical        | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Environmental     | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Social            | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Quality           | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Competitors       | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Easy availability | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Supported         | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Geographical location | ✓                          | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |

| Criteria          | Qu, Zhang, Qu and Xu [34] | Boran, Genç, Kurt and Akay [28] | De Boer [30] | Devi and Wardhana [37] | Abdel-Basset, Manogaran, Mohamed and Chilamkurti [26] | Štirbanović, Stanujkić, Miljanović and Milanović [36] | Qu, Zhang, Qu and Xu [34] | Shaikh, Memon, Prokop and Kim [35] | Liou, Chang, Lo and Hsu [22] | Mohammed, Yazdani, Oukil and Gonzalez [29] | Hsu, Yu, Chang, Liu [23] | Mohammedi, Yazdani, Oukil and Gonzalez [29] | Laurentia and Septiani [31] | Karami, Ghasemy Yaghin and Mousazadegan [25] | Liou, Chang, Lo and Hsu [22] |
|-------------------|---------------------------|----------------------------------|--------------|------------------------|------------------------------------------------|-------------------------------------------------|--------------------------|---------------------------------|--------------------------|-----------------------------------|---------------------|-----------------------------------|---------------------------------|------------------------------------|----------------------|
| Economical        | ✓                        | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Environmental     | ✓                        | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Social            | ✓                        | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Quality           | ✓                        | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Competitors       | ✓                        | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Easy availability | ✓                        | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Supported         | ✓                        | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
| Geographical location | ✓                       | ✓                                | ✓            | ✓                      | ✓                                               | ✓                                               | ✓                        | ✓                               | ✓                        | ✓                                 | ✓                                 | ✓                                 | ✓                                 | ✓                                 |
The steps of this method are as follows:

Step 1: Consider the $X$ as decision matrix in which $X_{ij}$ is the score of alternative $i$ in criterion $j$. Additionally, consider $W_i$ is the weight of criterion $i$. Also, $n$ is the number of criteria and $m$ is the number of alternatives.

$$X = \begin{bmatrix}
A_1 & \cdots & A_n \\
\vdots & \ddots & \vdots \\
A_m & \cdots & A_n
\end{bmatrix}, \quad X_{ij} \quad i, j = 1, 2, \ldots, n \quad (4)$$

Step 2: Obtain the normalized decision matrix using Equation (5), where $n_{ij}$ is the normalized value of $x_{ij}$. 

$$n_{ij} = \frac{x_{ij}}{\sum_{j=1}^{n} x_{ij}^2} \quad \forall \ i, j \quad (5)$$

Step 3: Form the normalized weighted decision matrix using Equation (6).

$$V_{ij} = x_{ij} \times w_{ij} \quad \forall \ i, j \quad (6)$$

Step 4: Using Equations (7) and (8), obtain PIS and NIS.

$$PIS_j = \max_{i \in B} v_{ij} \quad \text{and} \quad NIS_j = \min_{i \in B} v_{ij} \quad \forall \ j \in B \quad (7)$$

$$PIS_j = \max_{i \in C} v_{ij} \quad \text{and} \quad NIS_j = \min_{i \in C} v_{ij} \quad \forall \ j \in C \quad (8)$$

Step 5: Calculate the distance of each alternative from PIS and NIS.

$$d_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - NIS_j)^2} \quad i = 1, \ldots, m \quad (9)$$

$$d_i^+ = \sqrt{\sum_{j=1}^{n} (v_{ij} - PIS_j)^2} \quad i = 1, \ldots, m \quad (10)$$

$d_i^+$ and $d_i^-$ the sum of the distance from PIS and NIS, respectively.

Step 6: Find the maximum distance between each alternative from PIS in each criterion. This parameter in the VIKOR method is called the regret index and is denoted by $R_i$.

$$R_i = \max_{j} d_{ij}(v_{ij}, PIS_j), \quad i = 1, 2, \ldots, m \quad (11)$$

Step 7: Obtain the VIKOR index $(Q_i)$ from Equation (12).

$$Q_i = v \times \left[ \frac{d_i^+ - \min_{i} d_{i}^+}{\max_{i} d_{i}^+ - \min_{i} d_{i}^+} \right] + (1 - v) \times \left[ \frac{R_i - \min_{i} R_i}{\max_{i} R_i - \min_{i} R_i} \right] \quad (12)$$

In Equation (12), $D\min_i = \min_{i} d_{i}^+; \ D\max_i = \max_{i} d_{i}^+; \ R\max_i = \max_{i} R_i$. Also, $v$ is a parameter that its value is between 0 and 1 and represents the relative importance of total distance from PIS against regret index. In this research, the value of this parameter is considered 0.5.

Step 8: Calculate the closeness coefficient for each alternative $i$ ($CC_i$) using Equation (13). Any alternative with a higher $CC_i$ value is a better alternative.

$$CC_i = \frac{d_i^-}{d_i^- + Q_i} \quad i = 1, 2, \ldots, m \quad (13)$$

3.2. The Used Questionaries

Two questionnaires are used to perform the research steps. The first questionnaire is related to the pairwise comparisons in AHP technique. In this questionnaire, the answer of each question is determined by the shown choices in Table 2. The second questionnaire was also used to determine the score of each supplier (alternative) in each criterion (to form a matrix decision) based on the Likert scale has been used (Table 2). Both questionnaires are answered by a sample of 10 expert including 5 academics staff and 5 managers with more than 8 years’ experience in the digital stores industry. The used questionaries are standard questionaries and their validity is versified. Moreover, the reliability of the first questionnaire is justified.
The hierarchical inconsistency ratio with value of 0.06 verifies the reliability of the first questionnaire. Moreover, Cronbach’s alpha with the value of 0.88 verifies the reliability of the second questionnaire.

### 4. RESULTS

Results of the performance of research steps are presented in this section. First, we identify the effective criteria for evaluation and suppliers ranking using subject literature and expert opinions. A list of identified criteria is shown in Table 3. Then, using the first questionnaire and hierarchical analysis, the weight of each effective criteria was calculated and shown in Table 3.

Finally, after identifying 11 suppliers for one item of the products, each supplier’s score on each of the criteria (The decision matrix) was determined using the experts’ opinions and according to the Likert scale, the results of which are shown in Table 4.

The calculations based the research method according to the criteria and decision matrix (experts’ opinion) with TOPKOR method final ranking are shown in Table 5.

### TABLE 2. The used linguistic variables in each questioner and their values

| First questioner | Second questioner |
|------------------|-------------------|
| 1 Very low preference | 1 Very little |
| 3 Low preference | 2 Low |
| 5 Medium preference | 3 Medium |
| 7 High preference | 4 High |
| 9 Very high preference | 5 Very high |

### TABLE 3. Effective criteria in evaluating and ranking suppliers

| Row | The final criterion is selected | Type of criteria | Weight criteria |
|-----|---------------------------------|------------------|----------------|
| 1   | Economical                      | Profit           | 0.12043383     |
| 2   | Supported                       | Profit           | 0.20690794     |
| 3   | Environmental                   | Cost             | 0.09808552     |
| 4   | Work experience                 | Profit           | 0.06197201     |
| 5   | Social                          | Profit           | 0.09105958     |
| 6   | Quality                         | Profit           | 0.10985684     |
| 7   | Easy availability               | Profit           | 0.17477045     |
| 8   | flexibility                      | Profit           | 0.13691384     |

### TABLE 4. Decision matrix

| The final matrix of alternative/criteria | Economical | Supported | Environmental | Work experience | Social | Quality | Easy availability | flexibility |
|-----------------------------------------|------------|-----------|---------------|-----------------|--------|---------|-------------------|-------------|
| Supplier 1                              | 5          | 5         | 5             | 4               | 4      | 5       | 5                 | 2           |
| Supplier 2                              | 4          | 2         | 4             | 1               | 2      | 4       | 4                 | 2           |
| Supplier 3                              | 3          | 3         | 3             | 2               | 2      | 1       | 4                 | 1           |
| Supplier 4                              | 3          | 4         | 4             | 2               | 3      | 5       | 5                 | 2           |
| Supplier 5                              | 5          | 4         | 3             | 2               | 3      | 3       | 3                 | 3           |
| Supplier 6                              | 4          | 5         | 5             | 4               | 4      | 5       | 5                 | 4           |
| Supplier 7                              | 1          | 1         | 2             | 4               | 5      | 4       | 2                 | 5           |
| Supplier 8                              | 2          | 3         | 2             | 5               | 4      | 2       | 5                 | 4           |
| Supplier 9                              | 3          | 2         | 5             | 3               | 3      | 3       | 4                 | 3           |
| Supplier 10                             | 5          | 2         | 5             | 5               | 1      | 4       | 2                 | 3           |
| Supplier 11                             | 3          | 4         | 3             | 3               | 4      | 4       | 2                 | 2           |
TABLE 5. Ranking of suppliers by TOPKOR method

| Suppliers | Distance from PIS | Distance from NIS | Index R | Index $CC_i$ | Rank |
|-----------|------------------|------------------|--------|--------------|------|
| 1         | 0.004398         | 0.010882         | 0.003092 | 0.13968      | 3    |
| 2         | 0.010243         | 0.005125         | 0.0088485| 0.007004     | 9    |
| 3         | 0.011217         | 0.003553         | 0.0088485| 0.004521     | 11   |
| 4         | 0.007391         | 0.007783         | 0.005899 | 0.019238     | 6    |
| 5         | 0.007236         | 0.007403         | 0.005899 | 0.018727     | 7    |
| 6         | 0.003375         | 0.011096         | 0.0029495| 0.966391     | 1    |
| 7         | 0.00366          | 0.013247         | 0.0029427| 0.447672     | 2    |
| 8         | 0.005128         | 0.010249         | 0.0033441| 0.076901     | 5    |
| 9         | 0.007146         | 0.007079         | 0.005899 | 0.01816      | 8    |
| 10        | 0.012111         | 0.006184         | 0.011798 | 0.006164     | 10   |
| 11        | 0.0051           | 0.009869         | 0.003092 | 0.084322     | 4    |

5. CONCLUSION

This research provided a way to evaluate and rank suppliers in digital stores. First, the effective criteria in identifying and ranking suppliers in digital stores were identified and the rating of each supplier in each criterion was determined. Then a hybrid approach with a combination of hierarchy analysis methods and TOPKOR for supplier ranking is presented. As it can be seen, the effectiveness of the criteria is, from big to small, as follows: support, accessibility, flexibility, economic, quality, environmental, social status and finally work experience, which is the result of TOPKOR method calculations, the order of suppliers is shown in Table 5. Suppliers No. 6, 7 and 1 have allocated to themselves first to third, respectively. TOPKOR method is a combination of two different multi-criteria decision-making methods called TOPSIS and VIKOR. In TOPSIS method, a good alternative is one that its total distance from the positive ideal solution (PIS) is low and its total distance from the negative ideal solution (NIS) is high. But in VIKOR method, a good alternative is one that its total distance from PIS (utility index) and its maximum distance from PIS in each criterion (regret) are low. It means, TOPSIS neglects the distance of each alternative from PIS in each criterion while VIKOR neglects the total distance from NIS.

TOPKOR method tries to integrate both mentioned methods. In TOPKOR, a good alternative is one that its total distance from PIS and its maximum distance from PIS in each criterion are low and simultaneously its total distance from NIS is high. It means that TOPKOR have a more comprehensive view than TOPSIS and VIKOR and considered all the three parameters.

Providing other multi-criteria decision-making methods for evaluating and ranking digital store suppliers can be considered as a basis for future research. Also identifying newer criteria about supplier evaluation can be considered as another field for future research.

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چکیده
با توجه به گسترش فضای مجازی در بستر استفاده از اینترنت و دسترسی همگانی به این بستر، کمتر از پیش تولید کنندگان و فروشگاه‌ها به صورت مستقیم بازاریابی را انجام می‌دهند. بلکه بیشتر معنی می‌کنند از بستر فروش اینترنتی برای خود استفاده می‌کنند تا حتی امکان در تامین بهای تمام شده، کاهش هزینه‌های حمل و نقل، سرعت ارسال محصول و غیره دارد. در نتیجه استفاده از فروشگاه‌های دیجیتالی به صورت همزمان به بهبود در صورت فراهم‌اندیشن بازاریابی خودکار و رتبه‌بندی در سایت‌های امروزی بسیاری از این نوع فروشگاه‌های دیجیتالی افزایش در زمان تامین و رتبه‌بندی تامین کننده در فروشگاه‌های دیجیتالی نشان می‌دهد. این منجر به ارائه یک رویکرد ترکیبی برای تامین کننده در فروشگاه‌های دیجیتالی می‌شود.

نتایج
نتایج نشان می‌دهد که معیارهای پشتیبانی، سهولت دسترسی و انعطاف پذیری به ترتیب بیشترین اهمیت را در ارزیابی رتبه‌بندی تامین کننده فروشگاه‌های دیجیتالی دارند.