

# Competitiveness Evaluation Techniques for Cosmeceuticals E-Commerce Platform

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## ABSTRACT

Currently, the popularity of cosmeceuticals e-commerce is continuously increasing. A competition level among entrepreneurs is higher precisely, especially in the e-commerce platform. As a result, this situation causes to strengthen the competitiveness of several businesses. However, an evaluation of business operation planning which directly associates with the competitiveness of entrepreneurs is still the main issue. Therefore, this study proposes the methodology to define the cosmeceuticals e-commerce competitiveness through SWOT analysis, useful clustering methods including Self-Organizing Map (SOM) and K-means clustering, and Normalized Weight of Criteria for competitiveness criteria evaluation. The SWOT analysis is a reliable algorithm, which can adequately be used to evaluate the business performance with valid questionnaires. It provides the grouped attributes as 4 groups including Strengths, Weaknesses, Opportunities, Threats. Moreover, the appropriated factors result from the previous step will be clustered by SOM and K-means clustering for better data interpretation. SOM calculated 203 instances into 3 clusters; Low, High, No Class with 18 sec for execution time and 94.98% for accuracy. Meanwhile, K-means clustered previous dataset into 2 groups; high performance business and low performance business with 91.33% accuracy. In addition, the clustered data will be specified by Normalized Weight of Criteria for most influential criteria of Strengths, Weaknesses, Opportunities, and Threats factors to accomplish the high Competitiveness level of entrepreneurs. The results from this analysis can definitely help cosmeceuticals entrepreneurs to enhance the business strategy and advanced planning.

**Keywords:** E-commerce, Cosmeceuticals, Entrepreneur, SWOT Analysis, Questionnaire, Self-Organizing Map (SOM), K-means Clustering, Normalized Weight of Criteria

Manuscript received on June 30, 2018 ; revised on February 15, 2019.

Final manuscript received on February 24, 2019.

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## 1. INTRODUCTION

Cosmeceuticals are the word that came from a combination of cosmetics and pharmaceuticals. Cosmeceuticals refer to the cosmetic products which contain biologically active ingredients in providing medical or drug like benefits [1]. Cosmeceuticals are commonly known as creams or lotions and also mainly targeted at dermatological issues [2]. This cosmetic product contains bioactive ingredients which make it accessible in the medical benefits market. Apparently, e-commerce or electronic commerce is widely conducted with many business cases, including cosmeceuticals business. It usually refers to online shopping that is associated with buying and selling products via the Internet. E-commerce also utilizes technology maintenance to support online financial transactions, as well as the service and product reservation.

Global Business to Consumer (B2C), the e-commerce market report in 2013 has provided information that over 1 billion digital buyers will spend more than 1.221 trillion USD annually with the 20% growth in Asia [3]. Besides, the Information Economy Report 2015 stated that business to consumer sales would increase by 20.1% in 2015 and reach 1.500 trillion USD. The growth will be primarily caused by the rapidly expanding online and mobile user base in emerging markets [4]. Cosmeceuticals e-commerce is also a part of the growth and adds market value continuously. It becomes the fastest growing segment of the personal care industry. The cosmetic industry has an estimated annual turnover of 170 billion USD according to the financial analysis reported by a French-based company, Eurostar in 2012 [5]. Revenue in the industry was forecasted to reach an estimate of 265 billion USD in 2017 with 3.4% of CAGR during 2012-2017. It is highly influenced by increasing demand in the Asia Pacific (APAC) and Europe due to there is an increase in GDP and improved living standard [6].

Since the growth of cosmeceuticals e-commerce business is a competitive business, being the most profitable business and remaining entirely in the market are under conditions of sustainable market change. However, the cosmeceuticals e-commerce market conditions have a variety of competitive models because of the complexity and problems in changing customers' demand. It includes the product prices that should fit the product according to the situation of the market, planning the promotion to suit the sea-

son, and selecting the advertising to suit the product and the customers. It directly impairs the business opportunities and budget investments, which significantly affect the business operation. Cosmeceuticals e-commerce entrepreneurs have two main problems of business operation which are a business risk and insufficient information. Generally, entrepreneurs have high business risks due to there are extremely stressful market competition, complicated marketing plan, and challenging marketing strategy. These cause inaccessible of entrepreneurs in business capabilities and resulting in unable to persuade the customer. In the case of new entrepreneurs, they have insufficient information regarding business performances. This problem will cause them to be unable to analyze and manage their business according to the changed marketing situation. Therefore, this issue represents the statement of the problem of this paper.

Consequently, this study proposes the methodology to solve the mentioned problem by defining the competitiveness level of cosmeceuticals entrepreneurs and performing a reliable algorithm, namely SWOT analysis with an appropriated questionnaire. Also, the analyzed factors with questionnaire results will be clustered via Self-Organizing Map (SOM) and K-means clustering method for better data interpretation. In the last step, Normalized Weight of Criteria algorithm will be performed as a criteria definition and results explanation. This result can be implemented to enhance the decision making which is specific for the strategic planning of cosmeceuticals business.

## 2. THEORIES AND METHODS

A competitiveness assessment of cosmeceuticals enterprises is highly necessary due to the enterprises require to analyze the status of cosmeceuticals market competition all the time. Therefore, this study proposes an evaluation of the competitiveness of the cosmeceuticals business regarding the principles and theories. In this paper, data was collected from a survey with 203 samples of cosmeceuticals enterprises from small to large enterprises including both new and old organizations. Notably, the data collected from Small and medium-sized enterprises came from the mixed zone in Bangkok (Thailand) and surrounding suburbs.

Additionally, these cosmeceuticals enterprises have highly participated in e-commerce, which has a store in the system of online business. Survey tools and data collection for this study are questionnaires and interviews. The evaluation of the competitiveness level will be conducted via these following theories.

### 2.1 SWOT Analysis

The SWOT analysis is a planning technique for supporting a person or business to analyze the

Strengths (S), Weaknesses (W), Opportunities (O), and Threats (T) which is related to project planning as well as business competition [7]. The purpose of this technique is to identify the objectives of the organization or project and to specify the internal and external factors that can lead to achieving the objectives.

Internal factors consist of the strengths and weaknesses internal to the organization. The strengths refer to characteristics of the business that provide advantages over others. The weaknesses present attributes of the business that demonstrate disadvantages of the business when relative to others. Examples of the internal factors within an organization are physical resources (building, location, and equipment), human resources (staff, volunteers and board members), finance (funding agencies, grants and other sources income), activities and processes (running programs and employing systems) [8].

External factors comprise the opportunities and threats that are indicated by the environment external to the organization. The opportunities are elements in the environment that the organization could exploit to its advantages. The threats indicate elements in the environment that the organization could face troubles for their business. Examples of the external factors include the economy and future trend that are related to objectives of the business, the physical environment, legislation, demographics (changes in age, race, gender, culture) [8].

Therefore, SWOT analysis is a suitable method to acquire the problem solution for cosmeceuticals e-commerce entrepreneurs. The extracted strategy of the SWOT matrix includes four categories of factor combinations [9], shown in Table 1.

**Table 1:** *The extracted strategy of SWOT matrix.*

External / Internal	Strengths	Weaknesses
Opportunities	S-O	W-O
Threats	S-T	W-T

Strengths and opportunities (S-O); this state focuses on how to use the strengths of the business to take advantage of opportunities or strategies may focus on growth.

Strengths and threats (S-T); this state attempts to utilize the strengths of a company to avoid threats or strategies may focus on birth.

Weaknesses and opportunities (W-O); this state eliminates weaknesses to open new opportunities or strategies may focus on harvesting.

Weaknesses and threats (W-T); this state primarily performs the minimization on weaknesses, and threats avoiding focuses on storage performance [10].

### 2.2 Competitiveness

Competitiveness is a multidimensional concept. It is possibly considered based on three levels which in-

clude country, industry, and firm level. Competitiveness generated from a Latin word which is a computer. This word means an involvement in a business competition for markets. Competitiveness can describe being an economic strength of an entity regarding its competitors in the global market which goods, services, people, skills, and ideas move independently across geographical borders [11].

The competitiveness at the firm level can be defined as an ability of the company to compete in the competition of creating products and capabilities in marketing, which is determined by product quality and price competition. Furthermore, the competitiveness of the firm level comprises three factors which are the ability of the asset, a capacity of the business process and an ability of performance as described follows.

- Competitiveness in assets of the business refers to the company's ability to provide or seek the assets that can contribute to the stability and advantages when competing with the competitors. Examples of this factor include brand, reputation, culture, systems, human resources, and technology.

- Competitiveness in the business process can identify the importance of effective management of the factor. Examples of this factor are strategic management, quality management processes, managing relationships, marketing, technology management, manufacturing, and flexibility.

- Competitiveness in performance represents the ability of the company to reflect the advantages of using existing resources reasonably and an appropriate productivity. Examples of this kind of factor comprise value creation, customer satisfaction, productivity, market share, cost, price, profitability and variety or range [12].

### 2.3 Questionnaire Creation

Questionnaires are divided into two sets which are the questionnaires for SWOT factors analysis and the questionnaires for Competitiveness factor analysis. The cosmetics market is highly competitive because there is a large number of a factor affecting the business. Consequently, creating questionnaires is very necessary to find attributes or factors for SWOT analysis and competitive analysis.

Furthermore, a series of questions regarding SWOT factors in the survey were divided into two parts. In the first step is a fundamental question. The second part is related to the factors which are expected to be a vital element of the SWOT analysis. Similarly, the series of competitiveness's questions are identical as SWOT analysis.

### 2.4 Validity and Reliability

An analysis of the validity and reliability of the questionnaires is a technique to determine the tools

that will be used to collect data for obtaining the accurate data and contents. Direct measurement is based on expert judgment, with the following criteria.

Score +1 means that confident on the objective or content test.

Score -1 means that a test does not measure the purpose or content.

The information is obtained from the expert's consideration. It can be used to specify the consistency between each question for the purpose or content (Index of Item - Objective Congruence or IOC). The IOC formula is shown in equation 1.

$$IOC = \frac{\sum R}{N} \quad (1)$$

Where  $\sum R$  represents the summation of expert judgment scores.

$N$  represents a number of experts.

If a value is equal to 0.50 or higher, it indicates that the question is measurable in IOC. The content indicates that the question is useful [13]. The calculation of reliability can be applied by using the Alpha coefficient formula as Cronbach Alpha, shown in equation 2 [14].

$$\alpha = \frac{k}{k-1} \left( 1 - \frac{\sum S^2}{\sigma^2} \right) \quad (2)$$

Where  $\alpha$  is coefficient alpha.  $k$  is a number of items.  $S^2$  is the variance of one item.  $\sigma^2$  is the variance of the total test scores.

When

$$s^2 = \frac{n \sum x^2 - (\sum x)^2}{n^2}$$

And

$$\sigma^2 = \frac{n \sum x^2 - (\sum x)^2}{n^2}$$

Where  $x$  is a variable.

### 2.5 Self-Organizing Map

Self-Organizing Map or SOM, a self-organizing feature map algorithm, is based on the principle of the artificial neural network. A training data process in this method is applied via unsupervised learning for data dimension reduction. An input space of the training sample is called map, for computation. The process of this method begins with declaring node position in the data space. The node which is nearest to the training data will be selected and moved toward space. It will approximate the data distribution at the last point.

The weight of neuron between each node is initialized by the random value of subspace, as a principle of weight multiple in artificial neural network algorithm [15]. Space defines a map weight initial in the first component [16], considered the best ini-

tialization method by the geometry of each dataset [17]. However, this method intends to use a large number of samples for better closing the dataset, and this study proposes 203 samples which match with this requirement. Since machine learning can specify dataset quickly, an implementation of the clustering application like Rapid Minor in this study will make clustering method faster.

## 2.6 K-Means Clustering

K-means clustering algorithm is a widely implemented method and considered as the most popular clustering algorithm because of its simplicity and efficiency. Clustering data into areas of data analysis will use machine learning principles which have to analyze many methods. The K-means clustering data will be supplied by measuring the similarities of attribute data. This algorithm calculates the distance between the points by means of Euclid's distance. The objective of K-means is to minimize the sum of the squared error over all K clusters [18]. A previous research work considered using the K-means algorithm on the clustering method [19]. They studied evaluation of Croatian development strategies by using SWOT analyses with fuzzy TOPSIS method and K-means methods. They used K-means to cluster group strategies of Croatian in the last process for the experiment. Also, this study applied the Rapid Minor application for accurately simple clustering process.

## 2.7 Normalized Weight of Criteria

Data normalization has several definitions which depend on the study field. The most common definition in statistics and its applications is the adjusting values process that is measured on various scales to a common scale which often computes prior to aggregating or averaging those [20]. In general, the normalization in Multi-Criteria Decision Making (MCDM) is a process of transformation to acquire numerical and comparable input data by applying a common scale [21]. After gathering input data, the weight of criteria is computed to ensure a comparability of criteria; therefore, this is useful for decision modeling. There are three steps of determining the weight of criteria as shown follows.

Step 1 Construct a pairwise comparison matrix.

A pairwise comparison matrix  $C = \{a_{ij}\}$  will be constructed by using adapted Saaty's scale for pairwise comparison as represented in Table 2 [22]. The matrix C refers to an  $n \times n$  real matrix, where n is the number of considered criteria. Each entry  $a_{ij}$  of matrix C presents the importance of the  $i^{th}$  criterion relative to the  $j^{th}$  criterion. If  $a_{ij} > 1$ , then the  $j^{th}$  criterion is more important than the  $i^{th}$  criterion, while if  $a_{ij} < 1$ , then the  $j^{th}$  criterion is less critical than the  $i^{th}$  criterion. Moreover, if  $i^{th}$  criterion and  $j^{th}$  criterion have the same importance, then the entry  $a_{ij}$  is 1.

**Table 2:** Saaty's scale for pairwise comparison.

Intensity of importance	Definition
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong importance
9	Extreme importance
2, 4, 6, 8	Intermediate values

Step 2 Compute the normalized pairwise comparison matrix ( $\bar{a}_{ij}$ ) by using equation 3.

$$\bar{a}_{ij} = \frac{a_{ij}}{\sum_{i=1}^n a_{ij}} \quad (3)$$

Where  $\sum_{i=1}^n a_{ij}$  is the summation of the pairwise comparison matrix.

$j$  in this equation indicates an entrepreneur.

Step 3 Define the criteria weight vector ( $w_{ij}$ ) by using equation 4.

$$w_{ij} = \frac{\sum_{i=1}^n \bar{a}_{ij}}{n} \quad (4)$$

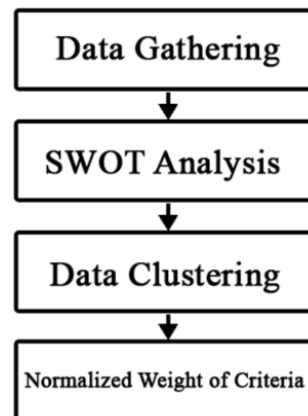
Where  $\sum_{i=1}^n \bar{a}_{ij}$  is the summation of the normalized pairwise comparison matrix of  $i^{th}$  criterion.

$j$  in this equation indicates an entrepreneur.

$n$  represents the number of total considered criteria.

## 3. RESULTS

The results of this research work present the methodology to define the e-commerce competitiveness through SWOT analysis, clustering methods including Self-Organizing Map (SOM) and K-means clustering. Also, Normalized Weight of Criteria technique is used for competitiveness criteria evaluation which affects the competitiveness level of cosmeceuticals e-commerce. The experimental process runs on Figure 1.



**Fig. 1:** Experimental process.

### 3.1 Data Gathering

203 Entrepreneurs and five experts of cosmeceuticals companies are surveyed through a questionnaire in this study. The data from the two surveys are analyzed by using quantitative statistical analysis to distinguish the related factors from the obtained results. The queries in these sets of the questionnaire are developed based on the real attributes which are acquired from the surveys and derived by statistical analysis.

### 3.2 SWOT Analysis

After receiving the data from the surveys, the data extraction and screening at this stage is a priority of the data and extracting incorrect information or the least importance by using basic qualitative statistics with the standard deviation, mean and range. The next step is the process of data preparation for an analysis by grouping and mapping of attributes into the SWOT analysis table as illustrated in Table 3, Table 4, Table 5 and Table 6, respectively.

*Table 3: Strengths factors.*

Strengths	
S1	Sufficient knowledge and ability to conduct business
S2	Adequate experience to conduct business
S3	Appropriate technology and stylish tools to conduct business
S4	Sufficient funding to conduct business
S5	Low manufacturing product cost
S6	Acceptable service and low price in the market
S7	High quality and adequate complication to prevent counterfeit products
S8	Marketing activities and continuous public relation
S9	Suitable channel distributions and suitable location for production distribution
S10	Product guarantee and acceptable service
S11	Credit advance for customers
S12	A well-known brand of products
S13	Validation and evaluation systems
S14	Excellent management and administration
S15	Successful customer relationship systems
S16	Certified standard from international standard organizations

### 3.3 Data Clustering

This step begins with SOM performance through Rapid Minor application. According to Table 3, Table 4, Table 5 and Table 6, the grouped attributes; (SWOT analysis table), Strengths (S1-S16), Weaknesses (W1-W16), Opportunities (O1-O10), Threats (T1-T10) are using for this process. The validity and reliability of the questionnaires is declared by cosmeceuticals entrepreneur as +1 for confident, 0 for unsure, and -1 for does not measure on the objective (one value for each subject). It assigned 203 instances with values into 3 clusters; Low, High, No class (error during the clustering process). It is a performance

*Table 4: Weaknesses factors.*

Opportunities	
O1	Being in the prominent flow of customer and market
O2	Gaining acceptance from government officers or other involved organizations
O3	Obtaining significant market share
O4	Having various and stable distribution channels
O5	Relying on technology and adding new opportunities
O6	Being supported by government or other involved organizations
O7	Obtaining archive support from financial institution
O8	Encountering low competition and an insignificant number of competitors
O9	Achieving profit from government policy and law
O10	Acquiring an acceptable business image for both social and environmental sustainability

*Table 5: Opportunities factors.*

Weaknesses	
W1	Lack of knowledge and ability to conduct business
W2	Inexperience to conduct business
W3	Lack of technology and stylish tools to conduct business
W4	Insufficient funding to conduct business
W5	High manufacturing product cost
W6	Unsatisfied service and high price in the market
W7	Inefficient quality and lack of complication to prevent counterfeit products
W8	Lack of public relation and marketing activities
W9	Lack of channel distribution and unsuitable location to the distribution
W10	Lack of guarantee and unacceptable service
W11	Lack of credit advance for customers
W12	Inconspicuous brand of products
W13	Lack of validation and evaluation systems
W14	Inferior management and administrative
W15	Unsatisfied customer relationship
W16	Lack of certified standard from international standard organizations

*Table 6: Threats factors.*

Threats	
T1	Being in the inconspicuous flow of customer and market
T2	Being not accepted by government officers, organizations, and other sectors
T3	Obtaining an insignificant market share
T4	Lacking variety and stability of distribution channels and certainly
T5	Not relying on technology and decreasing new opportunities
T6	Lacking support from government or other organizations
T7	Lacking archive support from financial institution
T8	Encountering high competition and a large number of competitors
T9	Not achieving profit from government policy and law
T10	Degrading business image on both social and environmental sustainability

level of competitiveness. A calculation spent 18 sec for execution time.

As a result, this method provided 94.98% for accuracy, as shown in Table 7. No class cluster which is an error during the clustering process will be getting rid in K-means clustering step.

**Table 7:** SOM clustered competitiveness results.

SOM Performance			
Clusters	Instance No.	Execution Time	Accuracy
Low	51		
High	151	18 sec	94.98%
No Class	1		

After mapping high-dimensional vectors into a smaller dimensional space in previous step, K-means clustering provides the level of competitiveness by two groups linked with factors. The first group is high competitiveness and the second group is low competitiveness. The results are shown in Table 8.

**Table 8:** K-Means clustered competitiveness results.

K-means Performance and Competitiveness Level		
High	Low	Accuracy
A1, A2, A3, A5, A6, A7, A11, A14, A15, A16, A17, A20, A23, A25, A27, A30, A32, A34, A35, A37, A38, A40, A41, A43, A46, A47, A48, A51, A53, A55, A57, A58, A60, A62, A63, A64, A65, A66, A67, A68, A69, A70, A71, A72, A74, A75, A76, A77, A78, A80, A81, A82, A83, A84, A85, A86, A87, A88, A89, A90, A91, A92, A94, A95, A96, A97, A99, A100, A101, A102, A103, A104, A105, A106, A107, A108, A109, A110, A112, A113, A114, A115, A116, A117, A118, A119, A120, A121, A122, A123, A124, A125, A126, A127, A129, A130, A131, A132, A134, A135, A136, A137, A138, A139, A140, A141, A142, A143, A144, A146, A147, A148, A149, A150, A152, A154, A155, A156, A158, A159, A160, A161, A164, A165, A166, A167, A168, A169, A170, A171, A173, A174, A175, A176, A179, A182, A183, A184, A185, A186, A187, A189, A191, A193, A194, A196, A198, A199, A200, A201, A202, A203	A4, A8, A9, A10, A12, A13, A18, A19, A21, A22, A24, A26, A28, A29, A31, A33, A36, A39, A42, A44, A45, A49, A50, A52, A54, A56, A59, A61, A73, A79, A93, A98, A111, A128, A133, A145, A151, A153, A157, A162, A163, A172, A177, A178, A180, A181, A188, A190, A192, A195, A197	91.33%

It includes the clustered competitiveness factors from SWOT analysis step. In addition, the clustered competitiveness of the cosmeceuticals entrepreneurs is represented by A with a number from 1 to 203 (number of surveyed entrepreneurs in this study).

Also, the accuracy of clustering is 91.33%, which is acceptable for this study.

According to Table 8, there are two groups of 203 entrepreneurs with a rating factor that offers the ability of business. The first group has the sufficient ability to compete for the business (152 entrepreneurs). The second group is the group which has low performance (51 entrepreneurs). Apparently, the second group has a higher risk to run the business. Additionally, this paper does not disclose the information or name of each entrepreneur that is used as variable A1 to A203 in this experiment.

In addition, cross validation approach has been declared as algorithm performance comparison. It includes SOM and K-means (proposed method; SOM then K-means), K-nearest neighbour's algorithm (K-NN), Neural Network and Support Vector Machine (SVM) method, shown in Table 9.

**Table 9:** Algorithm performance comparison.

Methods	Accuracy	Precision	Recall
SOM & K-means	91.33%	92.12%	90.34%
K-NN	84.74%	86.87%	84.62%
Neural Network	81.77 %	81.82%	81.73%
SVM	85.81%	81.82%	89.42%

According to Table 9, the proposed method is most worth for this study as highest accuracy, precision, and recall in this case. Apparently, this method is accurate to implement with identification of competitiveness level in next step.

### 3.4 Normalized Weight of Criteria

The normalized weights of criteria are used to identify the important criteria of Strengths, Weaknesses, Opportunities, and Threats factors that impact the results of the clustered competitiveness level. This study proposes only one example of this method because each entrepreneur can only provide the importance of each criterion of each factor related to competitiveness. Moreover, there is much information collected from the surveys which are too difficult to represent all entrepreneurs in this paper.

The result of this technique is to identify the most influential criteria of each factor related to the clustered competitiveness level. Therefore, the normalized weight of Strengths factor for entrepreneur 1 (A1) is presented as an example with three steps as presented below.

Step 1: the pairwise comparison matrix of Strengths factor for A1 is constructed as shown in Table 10. According Table 10, 1/3 or 0.33 in comparison of "S2" criterion with "S1" criterion means that "S2" criterion is less important than the "S1" criterion.

Step 2: the normalized pairwise comparison matrix of S1 criterion for A1 ( $\bar{a}_{S11}$ ) is computed as followings:

**Table 10:** The pairwise comparison matrix of strengths for entrepreneur 1.

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
S1	1	3	5	7	5	1/9	1/3	5	2	3	3	2	2	1/9	1/3	1/4
S2	1/3	1	6	4	3	7	2	4	5	2	5	5	5	3	4	1/2
S3	1/5	1/6	1	6	4	4	7	8	3	8	8	3	3	2	2	5
S4	1/7	1/4	1/6	1	9	6	5	1/5	4	4	6	4	4	1/7	5	4
S5	1/5	1/3	1/4	1/9	1	2	6	1/5	9	6	5	9	2	5	3	3
S6	9	1/7	1/4	1/6	1/2	1	3	1/5	8	8	4	1/3	5	6	4	5
S7	3	1/2	1/7	1/5	1/6	1/3	1	3	2	2	1/6	2	3	4	2	3
S8	1/5	1/4	1/8	5	5	5	1/3	1	5	1/3	5	7	4	3	5	2
S9	1/2	1/5	1/3	1/4	1/9	1/8	1/2	1/5	1	2	1/2	5	1/9	5	3	1/7
S10	1/3	1/2	1/8	1/4	1/6	1/8	1/2	3	1/2	1	2	1/6	8	8	1/4	5
S11	1/3	1/5	1/8	1/6	1/5	1/4	6	1/5	1/2	2	1	4	5	1/6	2	6
S12	1/2	1/5	1/3	1/4	1/9	3	1/2	1/7	1/5	6	1/4	1	1/5	1/5	5	4
S13	1/2	1/5	1/3	1/4	1/2	1/5	1/3	1/4	9	1/8	1/5	5	1	5	4	3
S14	9	1/3	1/2	7	1/5	1/6	1/4	1/3	1/5	1/8	6	5	1/5	1	3	1/5
S15	3	1/4	1/2	1/5	1/3	1/4	1/2	1/5	1/3	4	1/2	1/5	1/4	1/3	1	1/5
S16	4	2	1/5	1/4	1/3	1/5	1/3	1/2	7	1/5	1/6	1/4	1/3	5	5	1

$$\bar{a}_{S11} = \frac{1}{(1+0.33+0.2+0.14+0.2+9+3+0.2+0.5+0.33+0.33+0.5+0.5+9+3+4)} = 0.03$$

Step 3: the criteria weight vector ( $w_{ij}$ ) of S1 criterion for A1 ( $w_{S11}$ ) is computed as followings:

$$w_{S11} = \frac{0.03+0.32+0.32+0.22+0.17+0.00+0.01+0.19+0.04+0.06+0.06+0.04+0.05+0.00+0.01+0.01}{16} = 0.10$$

Finally, all criteria weight vector of each factor including Strengths ( $w_{S1}$ ), Weaknesses ( $w_{W1}$ ), Opportunities ( $w_{O1}$ ) and Threats ( $w_{T1}$ ) for A1 is demonstrated in Table 11.

**Table 11:** All Criteria weight vector of each factor for entrepreneur 1 ( $w_1$ ).

S	W <sub>S1</sub>	W	W <sub>W1</sub>	O	W <sub>O1</sub>	T	W <sub>T1</sub>
S2	0.11	W2	0.04	O2	0.06	T2	0.14
S3	0.11	W3	0.05	O3	0.08	T3	0.10
S4	0.09	W4	0.04	O4	0.05	T4	0.11
S5	0.07	W5	0.03	O5	0.07	T5	0.12
S6	0.08	W6	0.08	O6	0.12	T6	0.06
S7	0.04	W7	0.08	O7	0.11	T7	0.09
S8	0.08	W8	0.09	O8	0.09	T8	0.05
S9	0.03	W9	0.11	O9	0.17	T9	0.12
S10	0.05	W10	0.09	O10	0.17	T10	0.12
S11	0.04	W11	0.03				
S12	0.03	W12	0.04				
S13	0.04	W13	0.10				
S14	0.06	W14	0.08				
S15	0.02	W15	0.06				
S16	0.05	W16	0.06				

After receiving all criteria scores for each factor, the highest score of each factor will be considered to be an important criterion in achieving the competitiveness level. Therefore, Table 12 represents the most important criteria of SWOT factors to the high Competitiveness level for A1.

Furthermore, the most important criteria for high

**Table 12:** The most important criteria of SWOT factors to the high competitiveness level for entrepreneur 1.

High Competitiveness Level of Entrepreneur 1		
Factors		
Strengths	(S2)	Adequate experience to conduct business
	(S3)	Appropriate technology and stylish tools to conduct business
Weaknesses	(W9)	Lack of channel distribution and unsuitable location to the distribution
Opportunities	(O9)	Achieving profit from government policy and law
	(O10)	Acquiring an acceptable business image for both social and environmental
Threats	(T2)	Being not accepted by government officers, organizations, and other sectors

performance entrepreneurs are shown in Table 13. In addition, the most important criteria for low performance entrepreneurs are shown in Table 14.

According to Table 13 and Table 14, it is clearly that most of high performance entrepreneurs have more than one Strengths and Opportunities, which is the better chance for competition. On the other hand, some low performance entrepreneurs who have more than one Weaknesses and Threats could have higher risk to run the business.

#### 4. DISCUSSION

According to the other business segments at a certain level, the business management processes can have errors that are caused by several factors, data collection process. It can cause a bad attitude in providing suitable information for business management. Furthermore, the number of samples is limited because the cosmetics business is rarely operated a business. Nevertheless, the number of samples in this study considered as sufficient to create the model. Data collections of competitiveness factors

**Table 13:** The most important criteria of SWOT factors to the high competitiveness level for high performance entrepreneurs.

Entrepreneur No.	Most Important Criteria	Entrepreneur No.	Most Important Criteria	Entrepreneur No.	Most Important Criteria
A1	S2,S3,W9,O9,O10,T2	A82	S1,S4,W1,O6,T6	A138	S6,W2,O2,O4,T10
A2	S4,W6,O8,T7	A83	S3,S9,W9,O4,T6	A139	S5,W6,O7,T10
A3	S4,S7,W15,O8,T4	A84	S6,S13,W9,O2,T8	A140	S5,W7,O8,T5
A5	S3,S7,W9,O9,T3	A85	S6,W2,O4,T9	A141	S12,W4,O5,T5
A6	S6,S11,W9,O1,T6	A86	S11,W9,O3,T4	A142	S9,W16,O1,O6,T1
A7	S5,S6,W10,O4,T6	A87	S12,W13,O3,O5,T2	A143	S2,W14,O2,O3,T3
A11	S9,S13,W12,O8,T9	A88	S8,W10,O1,O2,T10	A144	S12,W15,O4,T7
A14	S5,S6,W12,O1,T2	A89	S4,W4,O4,O6,T2	A146	S9,W9,O1,O2,T6
A15	S5,S8,W4,O10,T9	A90	S9,W13,O9,T4	A147	S13,W10,O1,O2,T7
A16	S7,S16,W14,O2,O5,T6	A91	S7,W15,O4,O5,T2	A148	S7,S4,W8,O1,O3,T2
A17	S9,S13,W5,O1,O7,T8	A92	S3,W2,O3,T8	A149	S4,S14,W8,O1,O5,T1
A20	S9,S11,W15,O2,O10,T4	A94	S12,W9,O9,T6	A150	S1,S13,W11,O2,O6,T1
A23	S1,W15,O1,O6,T7	A95	S8,W13,O3,T7	A152	S7,W2,O4,O8,T5
A25	S1,W16,O9,O10,T9	A96	S1,S12,W8,O2,O8,T5	A154	S15,W15,O8,T6
A27	S3,S5,W1,O1,O10,T2	A97	S9,S1,W16,O6,T7	A155	S5,W2,O10,T5
A30	S7,S16,W12,O8,T8	A99	S8,S10,W9,O10,O1,T9	A156	S11,W14,O9,T6
A32	S1,S12,W9,O4,T8	A100	S4,S1,W11,O10,T10	A158	S1,W8,O4,T4
A34	S5,S15,W16,O1,T2	A101	S5,S12,W15,O1,T8	A159	S1,S9,W13,O2,T9
A35	S12,S13,W2,O4,O7,T3	A102	S15,W13,O7,T9	A160	S8,W14,O10,T6
A37	S5,S9,W13,O2,O3,T8	A103	S13,W1,O3,T2	A161	S7,S12,W11,O9,T9
A38	S3,W15,O1,T2	A104	S9,W12,O1,O6,T5	A164	S13,W14,O2,O3,T1
A40	S2,W13,O4,T2	A105	S6,W16,O8,O9,T7	A165	S6,W1,O1,T8
A41	S9,W3,O10,T3	A106	S5,W10,O8,O10,T4	A166	S13,W2,O1,O10,T4
A43	S3,S9,W16,O8,T3	A107	S6,W4,O2,O7,T1	A167	S14,W4,O3,O7,T3
A46	S3,S8,W3,O7,T3	A108	S15,W2,O10,T9	A168	S15,W16,O5,O10,T10
A47	S12,S14,W8,O3,T6	A109	S5,W12,O9,T1	A169	S6,W6,O2,O9,T8
A48	S1,S7,W11,O9,T4	A110	S8,W1,O7,T10	A170	S3,W14,O1,O3,T6
A51	S1,S4,W11,O6,T9	A112	S7,W8,O3,T2	A171	S8,W13,O3,O9,T5
A53	S1,S10,W10,O7,T10	A113	S16,W5,O1,O4,T3	A173	S8,W8,O5,T3
A55	S8,W14,O1,T9	A114	S12,W2,O3,O7,T3	A174	S11,W2,O2,O9,T1
A57	S1,W6,O3,T6	A115	S15,W11,O10,O8,T10	A175	S16,W10,O3,O7,T2
A58	S14,W13,O7,T7	A116	S14,W9,O7,T9	A176	S7,W14,O5,T8
A60	S1,W11,O8,T7	A117	S4,W7,O2,T10	A179	S13,W10,O1,O4,T3
A62	S13,W15,O7,T3	A118	S13,W4,O9,T10	A182	S7,W5,O2,T1
A63	S9,W16,O4,T7	A119	S14,W5,O2,T8	A183	S2,W4,O1,T2
A64	S3,W14,O1,T3	A120	S3,W14,O6,T3	A184	S10,S11,W12,O6,T10
A65	S5,S12,W16,O6,T3	A121	S14,W8,O7,T6	A185	S13,W10,O1,T4
A66	S3,S5,W1,O5,T9	A122	S16,W9,O4,T8	A186	S9,S15,W8,O2,T3
A67	S10,S11,W11,O5,T5	A123	S3,W10,O10,T2	A187	S7,S12,W5,O5,O10,T2
A68	S1,S13,W6,O7,T8	A124	S15,W14,O7,T8	A189	S13,W1,O10,T3
A69	S9,W7,O5,T1	A125	S3,W14,O6,T1	A191	S3,W6,O10,T7
A70	S15,W15,O3,O5,T8	A126	S14,W5,O5,T1	A193	S6,W11,O8,T9
A71	S14,W5,O7,O8,T1	A127	S4,W1,O3,T2	A194	S16,W3,O1,T3
A72	S1,W1,O6,O9,T2	A129	S6,S7,W15,O1,T6	A196	S7,W14,O3,O8,T10
A74	S9,W12,O3,O7,T9	A130	S4,S12,W7,O4,T2	A198	S6,W7,O5,T3
A75	S4,W13,O1,O8,T6	A131	S4,S14,W8,O3,T5	A199	S10,W7,O2,O4,T2
A76	S5,W2,O7,T4	A132	S6,W1,O4,T5	A200	S3,W6,O4,T2
A77	S3,S5,W2,O3,T3	A134	S6,W13,O10,T7	A201	S11,W11,O7,T8
A78	S11,S15,W10,O7,T10	A135	S8,S11,W3,O1,O6,T4	A202	S12,W8,O2,T6
A80	S1,S9,W8,O8,T3	A136	S13,W12,O2,O3,T10	A203	S3,W11,O4,O5,T10
A81	S7,S14,W9,O3,T6	A137	S11,W9,O5,O10,T9		

with SWOT analysis are quite complex and difficult in the stage of data gathering. As a result, it is apparently useful for entrepreneurs who interested in enhancing their business planning.

The results are very high confidence due to the performance of reliable method procedures, which conducted based on the high accuracy relevant research. Some research studied the evaluation of Croatian development strategies using SWOT analysis with Fuzzy TOPSIS method and K-means clustering [19]. Previously, they used k-mean to cluster the group of strategies in Croatian business. Meanwhile, et al. also studied the data classification using support vector machine and SWOT analysis. Their experiment provided the support vectors, which are critical for classification. Also, the training samples showed the comparative results of learning via different kernel functions under mentioned algorithms [23]. Conse-

quently, the results of this study can be implemented as a trustable method, which can help the cosmeceuticals business enhancement, especially in the e-commerce platform.

As a result, the clustered competitiveness of entrepreneurs' results as shown in Table 8 provides the level of competitiveness with low and high levels. Moreover, Table 12 represents the most important criteria of SWOT factors with the highest scores to the high Competitiveness level of entrepreneur 1. It means that the entrepreneur one should increase the Strengths factor related to an adequate experience, and appropriate technology and stylish tools to conduct business. Similarly, increasing of the Opportunities factor related to achieving profit from government policy and law, and acquiring an acceptable business image for both social and environmental are significant. On the other hand, the Weaknesses in



**Table 14:** The most important criteria of SWOT factors to the high competitiveness level for low performance entrepreneurs.

Entrepreneur No.	Most Important Criteria
A4	W6,W13,O8,T7,T4
A8	W15,W4,O8,T4,T4
A9	W9,W11,O9,T3,
A10	W9,W12,O1,T6,
A12	W10,W7,O4,T6,T10
A13	W12,O8,T9,T3
A18	W12,O1,T2,
A19	W4,W15,O10,T9,
A21	W14,W9,O2,T6,T5
A22	W5,W15,O7,T8,T8
A24	W15,W15,O2,T4,
A26	W15,W9,O1,T7,
A28	W16,W7,O9,T9,
A29	W1,O10,T2,
A31	W12,W7,O8,T8,
A33	W9,W8,O4,T8,
A36	W16,W9,O1,T2,
A39	W2,O4,T3,T2
A42	W13,O3,T8,T3
A44	W15,W16,O1,T2,
A45	W13,W13,O4,T2,T1
A49	W3,W13,O10,T3,
A50	W16,W11,O8,T3,
A52	W3,W10,O7,T3,T2
A54	W8,W13,O3,T6,
A56	W11,O9,T4,
A59	W11,W4,O6,T9,
A61	W10,W16,O7,T10,
A73	W14,W2,O1,T9,T9
A79	W6,W9,O3,T6,T7
A93	W13,W6,O7,T7,T6
A98	W11,W11,O8,T7,
A111	W15,W16,O7,T3,
A128	W16,W1,O4,T7,T8
A133	W14,W4,O1,T3,
A145	W16,W13,O6,T3,
A151	W1,W7,O5,T9,
A153	W11,O5,T5,
A157	W6,O7,T8,
A162	W7,O5,T1,
A163	W15,O5,T8,T1
A172	W5,O8,T1,T5
A177	W1,O9,T2,T3
A178	W12,W2,O7,T9,T10
A180	W13,W4,O8,T6,T10
A181	W2,O7,T4,
A188	W2,O3,T3,
A190	W10,O7,T10,
A192	W8,W13,O8,T3,T10
A195	W9,O3,T6,T10
A197	W1,O6,T6,

lacking channel distribution and unsuitable location to the distribution should be decreased. Also, the entrepreneur one should consider the Threats in being unaccepted by government officers, organizations, and other sectors. Consequently, these important criteria can encourage the entrepreneur to achieve Competitiveness in the high level.

## 5. CONCLUSIONS AND FUTURE WORK

This study proposes the methodology to define the e-commerce competitiveness. Firstly, the SWOT analysis is used to provide the factors of competi-

tiveness. There is implementation between reliable questionnaire and SWOT analysis that can evaluate of entrepreneur performance. According to Table 3, Table 4, Table 5 and Table 6, this process provides the grouped attributes as 4 groups (SWOT analysis table), which are Strengths (S1-S16), Weaknesses (W1-W16), Opportunities (O1-O10), Threats (T1-T10). Secondly, SOM is applied to obtain the level of competitiveness. As a result, there are calculated 203 instances into 3 clusters; Low, High, No class (error during the clustering process) with 18 sec for execution time and 94.98% for accuracy. The competitiveness levels refer to a capacity of the e-commerce competition of their business. There are 151 entrepreneurs for high performance and 51 entrepreneurs for low performance.

Furthermore, the reliable factors results from the previous step are clustered via K-means clustering method for better data demonstration. According to Table 8, the first group has the sufficient ability to compete for the business (152 entrepreneurs) and the second group is the group which has low performance (51 entrepreneurs) to run the business. In addition, it provides 91.33% accuracy. Finally, the normalized weight of criteria is used to indicate the most influential criteria of Strengths, Weaknesses, Opportunities, and Threats factors to accomplish the high Competitiveness level of entrepreneurs, shown in Table 13 and Table 14. The normalized pairwise comparison matrix of criterion is computed to all criteria weight vectors. It also can help to evaluate the factors that lead to the entrepreneurs have the low competitiveness level. In conclusion, the results from these processes can definitely help entrepreneurs to make a proper decision for enhancing their business strategy and advanced planning, specifically for cosmeceuticals entrepreneur.

## ACKNOWLEDGMENT

This research is part of a study on the Mae Fah Luang University. The authors thank advisors and consultants engaged in consulting and research as well as entrepreneurs who cooperate in questionnaires and interviews.

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