

Measuring the Competitiveness of Ecommerce by the MCIM Modeling Indicator

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Abstract

Competition is a challenge for both new and old entrepreneurs. In particular, e-commerce businesses face ever-changing market conditions and extremely competitive. However, the existing study focuses on measuring nationwide overview competitiveness without clear process and neglecting firm or entrepreneur competitiveness. The purpose of this paper is to fill this gap by developing of competency indicators by applying basic models of competitiveness analysis and strengths, weaknesses, opportunities, threat (SWOT) analysis methods model to understand the ecommerce entrepreneur competitiveness. The model is used to develop the measuring competitiveness index model (MCIM) to help company in self-assessment of their competitiveness which are shown in the following format: $MCIM = C_e + S_p + C_a$. The experimental result from this implementation revealed that performance measurement of MCIM model accuracy is rated over 80 percent.

Keywords: Measuring competitiveness, Ecommerce, Indicator, MCIM, Measuring, SWOT

INTRODUCTION

The competition has been studied and defined as the basic principle of competitiveness measurement by international organizations, the World Economic Forum (WEF), which was established in Switzerland [1]. However, in the initial stage the competency assessment will focus on macro level or national level only. After that, Michael Porter's adopted the basic principles of competency measurement to improve and apply to organizations and companies. In his theory provides the key factors forcing all firms. Those factors in the industry, which will lead to more competition, he called the Forces Driving Industry Competition. He starts from the interaction of four factors that present a "diamond" strategy; structure and firm rivalry; conditions of input factors; demand conditions and related and supporting industries [2]. Competitiveness is the ability and potential of the company to operate on a daily basis. "Unless there are appropriate improvements at the micro level, macroeconomic, political, legal and social reforms will not be fully realized" [3].

Nowadays, e-commerce (electronic commerce or EC) businesses are a new business model that has been famously conducted with steadily growth rate for over a decade. Most e-commerce (EC) refers to the buying and / or selling products via the Internet, and is often associated with online shopping. In addition Information Economy Report 2015 business to

consumer (B2C) ecommerce sales will increase by 20.1% in 2015 to reach \$1.500 trillion. Growth will come primarily from the rapidly expanding online and mobile user bases in emerging markets, increases in m-commerce sales, advancing shipping and payment options, and the push into new international markets by major brands [4]. Due to the changing situation of the e-commerce business, the ecommerce operators are facing the problem of measuring their competitiveness. Competitiveness measurement of ecommerce business are essential for firm or an entrepreneur because it is a policy-making tool. Therefore, the company must have the most accurate procedures and methods to assess the competitiveness of the company in order to ensure stable business operation. The development concept of the ecommerce business competitiveness index is shown in Figure 1.

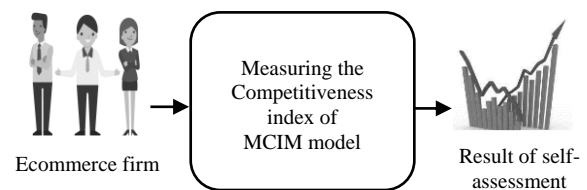


Figure 1: The concept of measuring the competitiveness index

The purpose of this paper is to developing of competency indicators by applying basic models of competitiveness analysis and strengths, weaknesses, opportunities, threat (SWOT) analysis methods model to understand the ecommerce entrepreneur competitiveness. Competitive benchmarks need to be collected data by e-commerce operators, which are a large group of online merchants, both small and large. And also are new and old entrepreneurs amount 204 operators. The process of creating a competitive index of ecommerce business operators has 3 main processes. The first is to assess the competency to find the factors in modeling by clustering data with k-mean clustering method and model selection using decision tree method. The second step is to analyze the ecommerce business strategy to use linear regression analysis to select the appropriate ecommerce strategy. The last step is to mapping the model using the two steps above to analyze it to create a competitive indicator of ecommerce business by using support vector machine (SVM) method. Summarize all three steps to developing the model of a competitive indicator of e-commerce is called the measuring competitiveness index model (MCIM).All of the detail description on next stage.

The paper has five sections. After this short introduction, Section 2 presents literature review on measuring competitiveness of ecommerce business and other principle include. Section 3 methodology and experiment of measurement models adapted in practice. Section 4 result of experimental represent to the new model developed and result of model performance. Final section summarizes the contribution of the paper, its implications and suggestions for further studies.

BACKGROUND THEORY

Competitiveness

Competitiveness is a multidimensional concept. It can be looked at from three different levels: country, industry, and firm level. Competitiveness originated from the Latin word, *competere*, which means involvement in a business rivalry for markets. It has become common to describe economic strength of an entity with respect to its competitors in the global market economy in which goods, services, people, skills, and ideas move freely across geographical borders [5]. Michael Porter's theory about competitiveness has been extremely popular. In his theory provides the key factors forcing all firms. Forces Driving Industry Competition is illustrated in Figure 2.

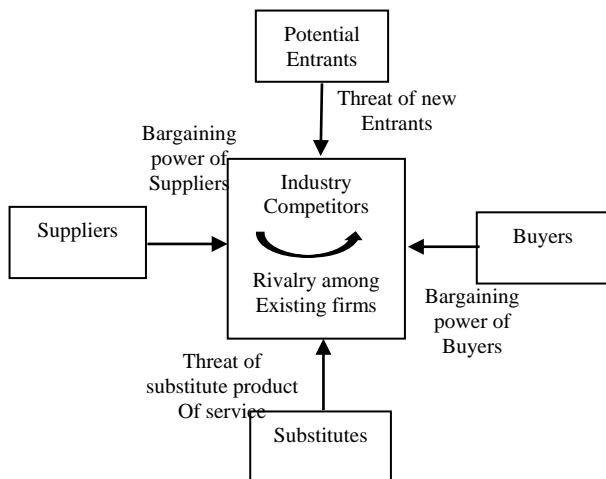


Figure 2: Forces Driving Industry Competition [6]

Those factors in the industry, which will lead to more competition, he called the Forces Driving Industry Competition. He starts from the interaction of four factors that present a “diamond” strategy; structure and firm rivalry; conditions of input factors; demand conditions and related and supporting industries [7].

There are considerable research relate on competitiveness such as Cabral Alexandra Maria Rios and Ramos Francisco de Sousa studied to Cluster analysis of the competitiveness of container ports in Brazil. They focuses on the Brazilian container terminals that handled containers in 2009 and compares port competitiveness. They used Hierarchical algorithm evaluate its. The result indicated distinct groups of terminals. Within each cluster, the terminals are similar to one another or have similar port competitiveness. While compared

to terminals in the other groups, there are differences in competitiveness [8]. Dilek Cetindamar and Hakan Kilitcioglu studied to measuring the competitiveness of a firm for an award system. Their research offers a framework for measuring the competitiveness of businesses which the result found that the company could establish a set of managerial processes where these resources are flourished and utilized. The framework of comprehensive model is shown in Figure 3.

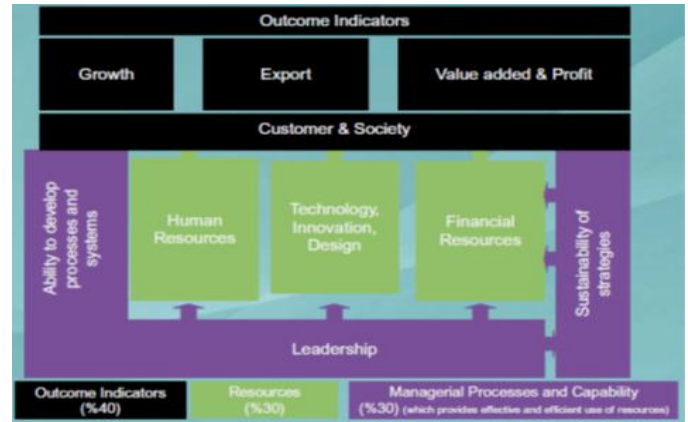


Figure 3: The model for competitiveness of firms [9]

There are ten criteria: four of them help to capture the outcome indicators measuring of the competitiveness 40%, three of them measure company resources measuring of the competitiveness 30%, and the remaining three criteria assess managerial processes and capabilities measuring of the competitiveness 30%.

SWOT and TOWs matrix analysis (Strengths, Weaknesses, Opportunities and Threats)

SWOT analysis is a process to indicate the strengths, weaknesses, opportunities and threats of the organization. Specifically, SWOT is a basic, analytical framework that assesses action suitability of the organization as well as its potential opportunities and threats [10]. SWOT and TOWS Strategic alternatives matrix associate with the externally-focused TOWS Matrix, external opportunities and threats with business internal strengths and weaknesses. The extracted strategy of SWOT and TOWS matrix includes four categories of factor combinations as illustrated in the matrix below:

- 1) Strengths and opportunities (S-O); Strategies that use strengths to maximize opportunities called dissemination strategies.
- 2) Strengths and threats (S-T); Strategies that use strengths to minimize threats called preventive strategies.
- 3) Weaknesses and threats (W-T); Strategies that minimize weaknesses and avoid threats called defensive strategies.
- 4) Weaknesses and opportunities (W-O) Strategies that minimize weaknesses by taking advantage of opportunities called improve strategies [11]. SWOT table and TOWS matrix is illustrated in Table I

Table 1: SWOT table and TOWS matrix [12]

SWOT table and TOWS matrix		
External / Internal	Strengths	Weaknesses
Opportunities	S-O Dissemination strategies	W-O Improve strategies
Threats	S-T Preventive strategies.	W-T Defensive strategies

There are considerable research on using SWOT applied more widely, for example Reza Eslamipoor, Abbas Sepehriar studied about “Firm relocation as a potential solution for environment improvement using a SWOT-AHP hybrid method”. The result found that decision makers have considered the results of SWOT and it appears that the expulsion of large markets are the most important and the government's concerns about not diminish air pollution is ranked third [13].

EXPERIMENTAL SETUP

In this paper aims to create model for measuring the competitiveness of ecommerce business index model (MCIM). MCIM can be written as an equation: $MCIM = C_e + S_p + C_a$. There are 3 stage of research methodology as follows.

Frist stage

Competitiveness evaluating and analyzing factors that affect the competitiveness of ecommerce business, which using C_e defined as the abbreviation for meaningful understanding. At this stage, the purpose is to find a model that will be used to model the competency of ecommerce. The process of classification the C_e as follows in table 2.

Table 2: Process and method of C_e modeling

Process steps	Methods
1. Data collection from ecommerce business	Questionnaire and entrepreneur interview
2. Competitiveness and SWOT factors analysis	Mean value ,standard deviation value and k-mean clustering
3. Factors classification	Decision tree method
4. Measuring performance	Decision Tree performance method

Table 2 demonstrates the stage of C_e detailing as the following:

1) Data collection from ecommerce business, a step for survey entrepreneur and expert. This step process of bringing a questionnaire survey of entrepreneurs and experts to get

attributes were built or real factor. Then the data from the two surveys were analyzed using quantitative statistical analysis to select the factors or attributes are truly, then it will lead to the creation of a questionnaire to collect data and analysis. In this exploration phase will provide operators with a questionnaire and interview some operators to get accurate data.

2) Analysis SWOT and competitiveness factors, analyze the data obtained from the survey by using statistical analysis for mean and standard deviation. The preliminary data for selected variables is essential. The cutting parameters of a preliminary analysis of 102 variables remain 52 key variables by the average of a value greater than 3.50 which is a threshold to consider an average score of 5.0 on a lot of levels. The next step is divide competitiveness data into two groups, which using K-mean clustering method. The first group is capable of high competition and the second group is a group capable of a little competition. The reason to divide the data into two groups for the purpose of the study was to evaluate the SWOT of entrepreneurs affect their ability to compete, more or less.

3) Factors classification, the purpose of this step is to selection competitiveness factors by using decision tree method. The process of experimental show that the attributes or factors of SWOT derived from the data results will be corresponded or affected to the competitiveness factors. The classification of factors to get C_e model. The classification of the factor can indicate which factor is irrelevant and which factor should be selected as a factor influencing modeling.

4) Measuring performance, in these step using decision tree performance methods as a tool to measure the performance of this model. The measuring performance of cross validation which are shows how to split training set and validation set of the last step the partition data to measure the performance of the models in this measurement can be classified performance for 4-fold cross validation.

Second stage

The strategic planning of ecommerce business, which using S_p as a variable instead of this model. This step is the process of finding an ecommerce business strategy that a part of the competitiveness index framework. The MCIM measurement method requires the selection of operators, using the frame work of SWOT as a finding S_p model. The process of classification the S_p as follows in table 3.

Table 3: Process and method of S_p modeling

Process steps	Methods
1. Data collection from ecommerce business	Questionnaire and entrepreneur interview
2. TOWS matrix factors analysis	Mean value ,standard deviation value and k-mean clustering
3. Factors selection	Linear regression
4. Measuring performance	Vote performance method

Table 3 demonstrates the stage of S_p detailing as the following:

1) Data collection from ecommerce business, develop tools to explore and collect data using structured questionnaires, theories, principles and experts to determine the reliability and reliability of the analysis. The collection of data from 204 households comprised of over 10 experienced entrepreneurs, medium-sized and 5 to 10-year-old entrepreneurs is a small entrepreneurs.

2) TOWS matrix factors analysis, analyze data from the survey using statistical analysis for mean and standard deviation. Introduction to selected variables is important. Machining parameters of the 90 variables were still 22 variables, with an average of more than 3.50, which was considered to be an average score of 5.0 on many levels after clustering using K-means clustering of 204 entrepreneurs in medium to large enterprises. The target group is divided into two groups: Cluster 0 and Cluster 1 with high and low ability.

3) Factors selection, analyze information on business strategy theories as part of SWOT and TOWS matrix in creating and implementing strategies. Using linear regression can examine and select the possible strategies that will lead to business success.

4) Measuring performance, the performance measurement method is modeling for accuracy and accuracy. At this stage, the display of the S_p model is measured in several experiments. Comparison between subsequent models for best results. Choose a vote performance method for the experiment to measure the performance of the S_p model.

Third stage

Matching model is a process that take into the result of C_e model and S_p model combine with the model competitiveness of firm. Using C_a as a variable instead of this model. Matching process is as follows.

1) Take a result of C_e into the TOWS model. After that insert factors into the model for competitiveness of firm. Matching requires that the variables match the topic of each index correctly. In the framework of the pillar competitiveness model of firm is clearly defined.

2) Take a result of S_p into the model for competitiveness of firm. After that insert factors into the model for competitiveness of firm.

3) Calculate the value of the variance index according to the competency index. According to the frame work of the competitive index weight ratio which consist of; outcome indicator 40%, resource 30% and managerial processes and capability 30%.

4) Determine the criteria for assessing the competency, which is the general weighting criterion. First, the criteria less than 49 % has low competitiveness. Secondary, the criteria 50-74% has middle competitiveness and the last criteria more than 75% has high competitiveness.5) Measuring performance of C_a model using support vector machine method for the experiment.

EXPERIMENTAL RESULTS

The research results in this paper are divided into the equation model of measuring the competitiveness of ecommerce business as follows: $MCIM = C_e + S_p + C_a$

The result of first stage

C_e is a model of competitiveness evaluating and analyzing which the result of preliminary analysis factor with competitiveness evaluation, SWOT factors analysis and K-mean clustering. The example illustration in table 4 and table 5.

Table 4: Preliminary analysis of factor

Var.	Strengths	Mea n	Std.
S1	Sufficient knowledge and ability to conduct business	4.91	0.36
S2	Adequate experience to conduct business	4.94	0.24
S3	Appropriate technology and stylish tools to conduct business	4.77	0.42
S4	Sufficient funding to conduct business	4.64	0.48
S5	Low manufacturing product cost	4.31	0.46
S...n	xxxxxxxxxxxxxx	xxx	xxx

Table 5: K-mean clustering of entrepreneur

Cluster	Company	Label Score
cluster_1	A1	-3.92
cluster_1	A2	1.42
cluster_1	A3	-8.70
cluster_1	A6	2.38
cluster_0	A7	0.88
cluster_1	A8	9.56
cluster_0	A9	10.35
cluster_1	A10	9.90
XXX	A11...A204	XXX

The result of classification criteria factors consist of S7, O8, S8, and O1 which the competitiveness are consistency with the factors. The result of Decision Tree classify model illustrated in Figure4.

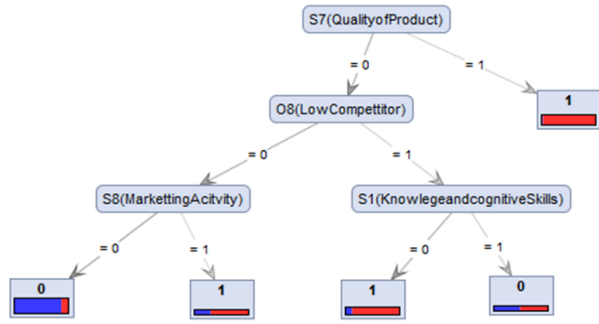


Figure 4. Classify of factor

Modeling of competitiveness evaluation described as simple the rules and conditions as show in set and subset below

$$C_e = \{(S7) \geq 1\} \{(S7, O8) \geq 1 (S1) \leq 0\} \{(S7, O8) \leq 0 (S8) \geq 1\}$$

Result of measuring performance for 4-fold cross validation. The result of 4-fole cross validation is the best accuracy. The details shown in Table 6.

Table 6: Result of performance for 4-fold cross validation

Accuracy Decision tree	86.21%	Prediction	True Positive	False Positive	Class Precision
False Negative		257	44	85.38%	
True Negative		40	268	87.01%	
Class Recall		86.53%	85.90%		

The result of Second stage

S_p is a model to selection of the strategic planning of ecommerce business which the result of factor selection by linear regression analysis. It's applied to obtain strategies and models for high entrepreneurial competency. The analysis of example dissemination strategy analysis is shown in table 7.

Table 7: Dissemination strategy analysis

Attribute	Coefficient	Std. Error	Std. Coefficient	Tolerance	T-stat	P-value	Code
S1	-0.50	0.13	-0.76	0.62	-3.83	0.00	****
S2	0.00	0.18	0.00	0.68	0.00	1.00	
S3	0.00	0.10	0.00	0.85	0.00	1.00	
S4	0.86	0.11	1.33	0.93	8.15	0.00	****
O8	0.86	0.10	1.39	1.00	8.89	0.00	****
O9	-0.86	0.14	-1.33	0.55	-6.30	0.00	****
O10	0.00	0.10	0.00	0.81	0.00	1.00	

The results of selecting a strategy and a model are summarized based on dissemination strategies (S-O), improve strategies

(W-O), defensive strategies (W-T) and preventive strategies (S-T) in TOWS matrix table shown in table 8.

Table 8: results of selecting a strategy

Strategy of TOW'S Matrix		
	Internal Strengths	Weaknesses
External Opportunities	S-O S1 S2 S3 S4 S5 O8 O9 O10	W-O W1 W2 W3 W4 W5 W8 O8 O9 O10
External Threats	S-T S1 S2 S3 S4 T8 T9 T10	W-T W1 W2 W3 W4 T8 T9 T10

The result of third stage

C_a is a model to matching and assessing between competitiveness framework and SWOT analysis framework. The result of C_a model as illustrated in table 9.

Table 9: Competitiveness assessment model (C_a)

Competitive index	pillar	Factors of C _e & S _p	Firm	Competitiveness assessment
Outcome indicator & SO+WO	Growth	S1, S7,	A1,	High
	Export	S8.,O8,	A2,	
	Value & profit	F1,F2,	A3,	
	Customer & society	F3,F5	A5,	
	Human resource	S1, S7,	A6,	
Resource & ST+WT	Technology	T1.,O1	A7,	Middle
	&innovation	F1,F2,	A11,	
	Financial resource	F3,F5	A14,	
	Ability to develop	S1,S7,	A15,	
	Leader ship	S8.,O8,	A16,	
Managerial processes & SO+WO	Ability strategies	F1,F2,	A17,	Low
	F3,F5			
	Growth	S1, S7,	A4,	
	Export	S8.,O8,	A8,	
	Value & profit	F1,F2,	A9,	
SO+WO	Customer & society	F3,F5	A10,	Low
	Human resource	S1, S7,	,A26	
	Technology	T1.,O1	,A28	
	&innovation	F1,F2,	,A29	
	Financial resource	F3,F5	,A31	
Managerial processes & SO+WO	Ability to develop	S1,S7,	,A33	Low
	Leader ship	S8.,O8,	,A36	
	Ability strategies	F1,F2,	,A45	
	F3,F5		,A49	

Performance: >80% High , 50-74% Middle ,< 49% Low

In the competitive evaluation process of ecommerce business which calculation of the weighting of the competency assessment illustrated in table 10.

Table 10: Weighting of the competency assessment

Factor s of C _e & S _p	Weight	Score	Firm	Competitiveness assessment
S1, S7, O8,	5*0.40=2 5*0.40=2 5*0.40=2	S1=5 S7=5 O8=5	A1, A2, A3, A5, A6, A7, A11	C _a =15.60*100/16. 5 =94.54%
S1, S7, T1,	5*0.30=1.5 5*0.30=1.5 2*0.30=0.6	S1=5 S7=5 T1=2	,A1 4,A 15, ,	High
S1,S7, S8,,O8,	5*0.30=1.5 5*0.30=1.5 5*0.30=1.5 5*0.30=1.5	S1=5 S7=5 S8=5 O8=5		

The result of measuring performance of competitiveness assessment model (C_a) which the most accuracy is support vector machine method with 85.88%.The results of the experiment are shown in table 11.

Table 11: Measuring performance of C_a model

Methods	Accuracy	Precision	Recall
Support vector machine (SVM)	85.88% +/- 10.27%	84.60% +/- 8.21% (positive class: 0.0)	89.36% +/- 6.82% (positive class: 0.0)

CONCLUSION

This research demonstrates the method of developing indicators for assessing the competitiveness of ecommerce business. The process of developing a competency indicator is called "Measuring competitiveness index model (MCIM)". The development of MCIM has set the equation for the measurement of competitiveness as $MCIM = C_e + S_p + C_a$. There is a division of MCIM which three-stage. First stage is a competitiveness evaluation and analyzing by C_e model. There are method for development as a questionnaire to data collected and used mean and standard deviation to selection of the basic factors. After that analysis factors of SWOT and competitiveness by using k-mean clustering and decision tree method for classification. Last once using the support vector machine method for measuring performance. Second stage is finding the strategic planning by S_p model. The method to used

questionnaire for data collection and adoption with TOWS matrix analysis factor by using linear regression to classify strategic factor and measuring performance with vote performance method. Third stage is a matching model process and implement C_a model for measuring competitive. Last stage for development of MCIM model is measuring performance which the most accuracy by using support vector machine method with 85.88%.

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