Applying AHP method select online shopping platform

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ABSTRACT

This paper proposes a case of the traditional market retailers in central Taiwan. Applying Analytical Hierarchy Process (AHP) method is to find the best online shopping platform to begin e-commerce. Traditional retail market is usually the purchase store that is to buy food and daily necessities place of the Taiwan people. However, according to the consumers lifestyle change, the fresh supermarkets and e-commerce development, there are to cause loss the customers of traditional markets. In Taiwan, according to Market Intelligence & Consulting institute (MIC) research online shopping market is grow NT$71,700 million in 2008, it is more than global growth rate. Thus, online shopping market is important. First, the study follows literature review to find six important factors (shop fee, annual fee, publication costs, transaction costs, shop constraints and security) by shopping platform vendors, merchants and customers; Secondly, applying expert questionnaires method that according to six factors to choice the six shopping platform (yahoo auction, ruten auction, rakuten ichiba, ihergo, PChome online shopping mall and yahoo super mall) in Taiwan. Finally, the best choice is ihergo online shopping platform through AHP method. More generally, the work carried out in this paper is an example of illustration of how AHP can be used as a decision-support tool. The study will promote the AHP method in decision-making management application.
Keywords: Traditional market, AHP, online shopping platform.

1. INTRODUCTION

Information technology and e-commerce development caused the internet is no longer just "media" and the "distribution"; even present the complete "market supply and demand". The internet will not be limited at the time and locale, and the customers can participate at any time to communicate with the content and change the form. Furthermore, it's more mature on payment flow and physical flow distribute now, so more and more people choose to purchase and browse on line, instead of purchase physically. This also make amount of online store grow speedily year by year. According to JupiterResearch [1] indicates that in 2010 there having 71% internet users will take on the online shopping activities in the global. And online retailers will spend NT$ 43,200 million in online transactions. Through MIT date shows, the selling value of global online shopping market is reaches NT$ 234,600 million in 2008, and forecasts to grow NT$ 249,090 in 2009 and NT$9514 million in 2010; In Taiwan, the online shopping market makes NT$ 71,700 million in 2008, it is much more than global growth rate [2]. On above we can see, online shopping become the most beneficial business, every big company wants to share this business, especially in Taiwan's market.

Traditional market is buy food or daily necessities place before development of the e-commence and chain retailers in Taiwan. The product diversification, fresh ingredients, reasonable price and has a human touch in the traditional market. Nevertheless, according to changing times and technological advances, people change the consumer habits, and then the fresh supermarkets and discount stores…etc chain stores development induce traditional market runs off customers. Furthermore, the realistic shop is limited by many elements, such as area, working time, water and electricity supply, store range fee and so on. This makes traditional shop work more difficult. To them, survivability becomes a very big question. In Taiwan, lots of relative institutions actively help those traditional stores to transform and rework their shop in a new way to prolong the business life [3]. However, the organization of tradition marker is more complex and vendors are also more conservative and feel unsecure, so the situation didn't improve well. On above, traditionally market vendors need a new effective way to increase their efficiency. Therefore, in this research is on online shopping, which makes tradition vendors to get rid of working time, area limitation and save the cost of water, electricity and renting fee. However, online shopping platform for many kinds and uneven quality, and there are also different services and fees in Taiwan. Thus, how can choose the best online shopping platform is a major challenge of the store owners.

AHP is a popular method for assessing multiple criteria and deriving priorities for decision-making purposes. The AHP is a highly flexible decision methodology that can be applied in a wide variety of situations. It is typically used in decision situations which involve selecting one (or more) decision alternatives from several candidate decision alternatives on the basis of

multiple decision criteria of a competing or conflicting nature [4]. Saaty [5] purpose AHP to help the decision-makers solved multi-criteria decision-making method. As a result of this research using the AHP method to approach and select the required and considerate factors of online shopping platform, and select an appropriate online shopping platform of traditional market to be a place of developing the new sources. It is benefit to promote the business performance and improve the confronted predicament.

2. LITERATURE REVIEW

2.1 E-commerce

Zwass [6] made the e-commerce at a definition "It can share the business information, preserve the enterprise relationship and then execute the business transactions by communication network". According to Kalakota and Whinston [7] e-commerce is a business model of the modern enterprise. The enterprise can use the computer and the internet technology, collect the information of supported decision, and allow the enterprise to follow the improved products and the service quality. Furthermore, it promotes the speed of communication services and reduces the cost on the same time. E-commerce performs the business transaction collectively by two or more organizations from a technical point of view. Thus the business process modeling is using the e-mail to transmit the transaction information in the organizations [8]. Efraim et al. [9] presents that the e-commence was divided into business to business e-commence (B2B), business to consumer e-commence (B2C), the consumers sale the products or services to the organizations by internet (C2B), and the consumer executes the interactive transactions of products or services with the other consumers directly (C2C).

E-commerce industry provides products and services, will also affect the operating performance of the industry's performance. Saini and Johnson [10] do research of the service performance of 122 e-brokerage service providers, indicate that the performance of website, strategic flexibility and information technology capability affect performance given the right market orientation. Therefore selecting a wonderful e-commence online shopping is to be a position of exhibiting and selling the products for the industry for the important issue certainly.

2.2 Online shopping platform

The internet store presents the website of online ordering products or services for customers by internet features. The coverage of services includes of the customers searching for products, payment processing, online consulting and services functions…etc, all of that are different to the physical store [11]. Then the form of the internet store building is applied by industries of

online shopping platform, the presenting services and the standard of expenses are different by reason of the different online shopping platforms.

In the e-commence the industry of online shopping platform act as a seller role of presenting the services and the businessman act as a buyer role. The seller presents the reasonable prices and services, so that can finish the trading mechanism by bilateral negotiation [12]. The e-marketplaces create more values; it not only earns the transactions returns, but also receives the expenses by presenting value-added of the information services. For instance integrating the computer information systems of seller and buyer give consulting services to change [13]. As the eBay's shopping platform will receive the publication costs of product, transaction costs, advertisement costs…etc. from the sellers [14].

Wolfinbarger and Gilly [15] to present the security of e-commence could affect the customer satisfaction. Also concentrating on eBay's online shopping platform, Gregg and Scott [16] investigate the role of reputation systems in documenting, predicting, and reducing fraud that get more buyers' confidence then improve the transactions willingness. Qu et al. [17] to indicate the retailers audit mechanism of the online shopping platform is an important mechanism to promote consumers' trust, and then improves the overall service quality and increases the repeat purchasing. However when the barriers to entry builds too high it could create the adverse effect of limited attraction for buyers.

Thus, this study systemizes the most representational building conditions of the six online shopping platforms now in Taiwan, and combines the previous references, the concerned factors of industries and customers for example the published expenses, security…etc. The Table 1 is concluded six factors. There into the highest limited condition is that the online shopping platform should use the human resources to investigate the sellers have or not the physical store and normal business. The secondary limited condition is that it builds the store by mobile authentication and credit card holder. Finally the low limited condition is using the mobile authentication or no specific authentication mechanism.

2.3 Analytical hierarchy process (AHP)

As a multi-criteria decision-making method, AHP is widely used as one of the major methods in solving a wide variety of problems that the involved complex criteria across different levels where the interaction of criteria is common [18]. The AHP method is developed by Saaty, and it is based on the use of pair-wise comparisons, which lead to the elaboration of a ratio scale. Moreover, the AHP permits to refine the decision-making process while examining the global coherence of the user's preferences, as it can include the calculation of an overall consistency ratio [19].

Shopping platform	Shop fee	annual fee	Publication costs	Transaction costs	Shop constraints	Security
Yahoo Auction	No	No	3/ Item	3%	Middle	low
Ruten Auction	No	No	No	1.5%	low	low
Rakuten Ichiba	No	63000	No	0.03%	High	High
ihergo	No	No	No	No	low	Middle
PChome Online Shopping Mall	30000	3000	No	2%	High	High
Yahoo Super Mall	15000	36000	No	5%	High	High

<div align="center">Table 1 Comparison online shopping platform (Unit:NT$)</div>

In short, we can see the AHP results of verifiable by a rigorous mathematical theory with judgments consistency ratio capacity.

In recent years, most studies have used traditional analytical hierarchy process (AHP) to solve and decision-making the problems in various disciplines such as [20] using Fuzzy AHP to improve the imprecise ranking of customer requirements on bicycle splash guard design. Yoon and Im [21] adopted AHP to development a customer satisfaction evaluation system. Kwong et al. [22] combined AHP and Quality Function Deployment (QFD) to fined consumers critical needs of the digital camera. Vidal et al. [19] achieved by evaluating how AHP can support the drug production planning process from a French hospital. Thus, we can see that AHP is a decision-making method when decision-makers need judgments multi-criteria.

3. METHODS

AHP method is a systematic approach to the complicated problem. It aims at quantifying relative priorities for a given set of alternatives on a ratio scale, basing on the judgment of the decision-maker, and stressing the importance of the intuitive judgments of a decision-maker as well as the consistency of the comparison of alternatives in the decision-making process [23]. In general, Choi and Hartley [24] purpose of using the AHP steps analysis: 1. construct a hierarchy structure of the factors; 2. the pair-wise comparisons are done in terms of which element dominates the other through decision-makers and experts; 3. calculate the best result after propose recommendations.

Developed [23, 25-26] the following steps for calculating the AHP:

1. Construct a set of pair-wise comparison matrices (size $n \times n$) for each of the lower levels with one matrix for each element in the level immediately above by using the relative 9 scale measurement, and then evaluation the reciprocals (1).

$$a_{ji} = 1 / a_{ij} \qquad (1)$$

where the factor levels are specified as: $i, j = 1, 2, \ldots, 9;$

2. Calculating a new standardized matrix of $A = [a_{ij}]$ (2);

$$a_{ik} = a_{ij} / \sum_{i=1}^{n} a_{ij} \qquad (2)$$

3. Calculating the priority vector for a criterion of $W = [wk]$ (3);

$$W_k = \sum_{j=1}^{n} a_{ij} / n \qquad (3)$$

4. Hierarchical synthesis is now used to weight the eigenvectors by the weights of the criteria and the sum is taken over all weighted eigenvector entries corresponding to those in the next lower level of the hierarchy (4).

$$\text{Let} \quad AW^{\cdot} = \begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ \vdots \\ X_n \end{bmatrix}$$

$$\text{then} \quad \lambda_{max}^{\cdot} = \frac{1}{n} \left[\frac{X_1}{W_1^{\cdot}} + \frac{X_2}{W_2^{\cdot}} + \frac{X_3}{W_3^{\cdot}} + \ldots + \frac{X_n}{W_n^{\cdot}} \right] \qquad (4)$$

5. Having made all the pair-wise comparisons, the consistency is determined by using the eigenvalue, λ_{max}, to calculate the consistency index (CI), CI as follows: $CI = (\lambda_{max} - n) / (n-1)$, where n is the matrix size. Judgment consistency can be checked by taking the consistency ratio eigenvalue o (CR) of CI with the appropriate value in Table 2. The CR is acceptable, if it does not exceed 0.1. If it is more, the judgment matrix is inconsistent. To obtain a consistent matrix, judgments should be reviewed and improved.

4. SAMPLE

This research case is one of the traditional market retailers in central Taiwan. The case founded in 1980, started a bas mainly on selling pork products, always adhere to the principles of "Quality First" in the long time, it is not added preservatives and artificial coloring in production proceed, and only choose the day of high quality pork to produce dried meat floss and dried meat products…etc. In addition to the requirements in quality, the store owner becomes the diversification products of sale goods (such as shredded squid, dried fish floss and candy cookies…etc). However, according to the consumers lifestyle change, and added the fresh supermarkets and hypermarket development, caused rapidly decline of the traditional markets. Based on this, the store owner is urgent need of improving method to recycle once again drive the traditional markets,

upgrading, and then reproduce the traditional markets high-quality features and create new value.

In this study, using of AHP methods to choose an online shopping platform fit for the traditional market retailers. According to Saaty [23] mentioned that the AHP steps, conducted experts and decision-maker questionnaire survey before construction a hierarchy structure of each individual by the factors.

5. RESULTS

This study distributed a total of 25 of the questionnaire survey, 20 valid questionnaires were analyzed, with 63% being man, and the age distribution as follows: 24% is below 25 years old, 32% aged 26-30 years old, 16% aged 31-40 years old, and 28% is over 41 years old. And then 12% is below 10 years old, 36% 11-20 years old, and 52% 21-30 years old of the company is formed. The results shows the survey objects in this questionnaire are the second generation of more than 20 years old traditional shop owner. In this research, professional commercial software, Expert Choice, developed by Expert Choice, Inc. [27], is available on the market which simplifies the implementation of the AHP's steps and automates many of its computations. Thus, the study is using Expert Choice software of AHP, each individual by the factor weight matrix (see Fig. 1).
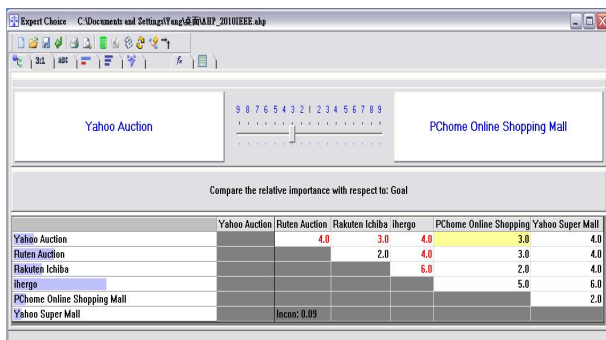

Fig. 1 Each individual by the factor weight matrix

Expert Choice software to show the CR by Inconsistency Ratio (IR) value, when IR=0.09 (CR 0.1) that compliance with the CR. And then, the study is to compare weight for six online shopping platforms (see Fig. 2).
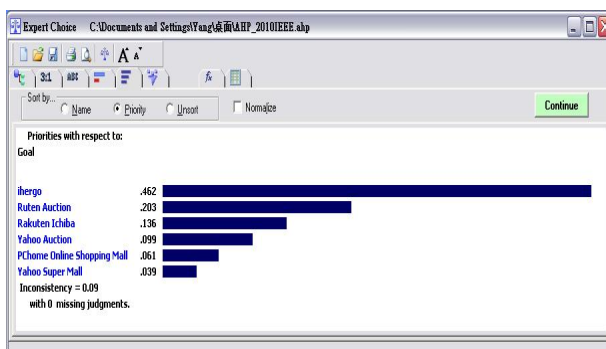

Fig. 2 Compares weight for online shopping platforms

According the Fig. 2 shows, using AHP method make a comparison between the six shopping platform and open an online store must evaluation factors, shop fee, publication costs and security…etc. The results showed that ihergo (0.462) is highest of appropriate degree in all online shopping platforms. Thus, we see ihergo is the best online shopping platform for the traditional market retailers in this case.

6. CONCLUSIONS AND RECOMMENDATIONS

AHP method is a systematic approach to the alternative selection and justification problem. This study is applying a decision-making method by AHP. First, based on literature review to selected shop fee, annual fee, publication costs, transaction costs, shop constraints and security six factors evaluate criteria through shopping platform vendors, merchants and customers. The second is using expert questionnaires method that according to six factors to judgments the six shopping platform in Taiwan. Finally, AHP implementation and evaluation steps will be simplified by using the "Expert Choice". The result selected one of the best online shopping platform-ihergo for the traditional market retailer in this case.

Traditional market (purchase store) is to buy food or daily necessities place before development of the e-commence (virtual store) and chain retailers in Taiwan. However, traditional market has more and more difficulties because the consumers have lifestyle changes and fresh supermarkets development. Thus, traditional market retailers are urgently needed of an effective method of improves business performance. The model constructed in this study doesn't affect the existing traditional market retailers of business method, and that is evaluation shopping platform vendors (audit mechanism), merchants (cost) and customers (security). Through the use of this model can to develop new consumers for traditional market retailers then further enhance profitability.
The method can be applied to another industry. In further study, we may add, for instance, website hits, user interface or government policy and so on.

REFERENCES

[1] Jupiter Media, *Forecasts Online Retail Spending Will Reach $144 Billion in 2010, a Cagr of 12% from 2005*, NY: Jupiter Research, 2006.

[2] IT Services Industry Yearbook 2009 editorial panel, *IT Services Industry Yearbook 2009*, Taipei: Ministry of Economic Affairs, R.O.C., 2009.

[3] Ministry of Economic Affairs, R.O.C. 2008, updating and management of traditional markets, Retrieved December 10, 2010, from http://gcis.nat.gov.tw/introduction_4_3_5.htm.

[4] Schniederjans, M.J., T. Garvin, "Using the Analytic Hierarchy Process and multi-objective programming for the selection of cost drivers in activity-based costing", European Journal of Operational Research, Vol. 100, No. 1, pp72-80, 1997.

[5] Saaty, T.L., L.G. Vargas, *Models, methods, concepts and applications of the analytic hierarchy process*, Massachusetts: Luwer Academic, 2001.

[6] Zwass, V., "Electronic Commerce: Structures and Issues", *International Journal of Electronic Commerce*, Vol. 1, No. 1, pp3-23, 1966.

[7] Kalakota, R., A.B. Whinston, *Electronic Commerce: A Manager's Guide*, MA: Addison-Wesley, 1997.

[8] Huemer, C., "Managing Different Interfaces in Electronic Commerce", *Proceedings of the 9th International Workshop on Database and Expert Systems Applications 1998*, pp644 -649, 1998.

[9] Efraim, T., K. Dave, L. Jae, V. Dennis, *Electronic Commerce 2006: A Managerial Perspective*, NJ: Prentice Hall, 2005.

[10] Saini, A., J.L. Johnson, "Organizational capabilities in e-commerce: An empirical investigation of e-brokerage service providers", *Journal of the Academy of Marketing Science*, Vol. 33, No. 3, pp360-375, 2005.

[11] Lin, H.F., "The Application of Fuzzy Analytic Hierarchy Process on Service Quality Evaluation of Online Retailers", *Journal of E-Business*, Vol. 8, No. 3, pp347-372, 2006.

[12] Ba, S., P.A. Pavlou, "Evidence of the effect of trust building technology in electronic markets: price premiums and buyer behavior", *MIS Quarterly*, Vol. 26, No. 3, pp243-268, 2002.

[13] Buyukozan, G., "A success index to evaluate e-Marketplaces", *Production Planning & Control*, Vol. 15, No. 7, pp761-775, 2004.

[14] eBay's, Fees for selling on eBay. Retrieved January 10, 2010, from http://pages.ebay.com/help/sell/fees.html.

[15] Wolfinbarger, M., M.C. Gilly, "eTailQ: dimensionalizing, measuring and predicting etail quality", *Journal of Retailing*, Vol. 79, No. 3, pp183-198, 2003.

[16] Gregg, D., J. Scott, "The role of reputation systems in reducing on-line auction fraud", *International Journal of Electronic Commerce*, Vol. 10, No. 3, pp 95-120, 2006.

[17] Qu, Z., H. Zhang, H. Li, "Determinants of online merchant rating: Content analysis of consumer comments about Yahoo merchants", *Decision Support Systems*, Vol. 46, No. 1, pp440-449, 2008.

[18] Korpela, J., A. Lehmusvaara, "A customer oriented approach to warehouse network evaluation and design", *International Journal of Production Economics*, Vol. 59, No. 4, pp135-146, 1999.

[19] Vidal, L-A., E. Sahin, N. Martelli, M. Berhoune, B. Bonan, "Applying AHP to select drugs to be produced by anticipation in a chemotherapy compounding unit", *Expert Systems with Applications*, Vol. 37, No. 2, pp1528-1534, 2010

[20] Kwong, C.K., H. Bai, "A fuzzy AHP approach to the determination of importance weights of customer requirements in quality function deployment", *Journal of Intelligent Manufacturing*, Vol. 13, No. 5, pp367-377, 2002.

[21] Yoon, Y., K.S. Im, "An evaluation system for IT outsourcing customer satisfaction using the analytic hierarchy process", *Journal of Global Information Management*, Vol. 13, No. 4, pp55-78, 2005.

[22] Kwong, C.K., Y. Chen, H. Bai, D.S.K. Chan, "A methodology of determining aggregated importance of engineering characteristics in QFD", *Computer & industrial engineering*, Vol. 53, No. 5, pp667-679, 2007.

[23] Saaty, T.L., *The Analytic Hierarchy Process*, NY: McGraw-Hill, 1980.

[24] Choi, T.Y., J.L. Hartley, "An exploration of supplier selection practices across the supply chain", *Journal of Operations Management*, Vol. 14, No. 4, pp333-343, 1996.

[25] Al-Harbi, K.M.A-S., "Application of the AHP Project Management", *International Journal of Project Management*, Vol. 19, No. 1, pp19-27, 2001.

[26] Chu, H.L., C.J. Cheng, "An Empirical Investigation of the Governmental Performance Management System: Using the Balanced Scorecard and the Analytic Hierarchy Process", *Journal of Management*, Vol. 24, No. 6, pp689-705, 2007.

[27] Expert Choice, Inc., *Expert Choice software and manual*. 4922 Elsworth Ave., Pittsburgh, PA 15213, USA, 2000.