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Full Length Research Paper

An e-service quality assessment of house rental websites based on the Kano model and Multiple Criteria Decision Making method (MCDM) in Taiwan

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Amidst the advanced Internet and mounting popularity in network users, information transmission has become easily accessible to all. As a natural result, house leasehold websites have been mushrooming exactly like bamboo shoots after a spring rain. How can these websites better strengthen services to create more competitive edge? This is exactly the very motive behind the present study. According to the study results, it is concluded that (i) an electronic service quality (e-SQ) scale proposed by ZPM (2005) is highly applicable to the e-SQ assessment of house rental websites; (ii) the three criteria of greatest importance are contact, responsiveness and compensation, which all belong to restored dimensions; (iii) compared with DEMATEL graphics, Kano graphics can present a more authentic world and provide more precise information concerning decision making.

Key words: ANP, e-service quality, house rental website, Kano model, multiple criteria decision making method (MCDM).

INTRODUCTION

With the trend of growing aging population with low birthrate (Ministry of the Interior Website, 2011), the aging population problem will become more serious in the future and the younger generation will have to spend more to take care of the older generation. The older generation would otherwise choose a mortgage to support themselves and reduce their children's burden.

The Financial Supervisory Commission in Taiwan is discussing a policy whereby the older people sell their house in instalments in order to support themselves. Nevertheless, house prices may rise because of extensions to mortgage years. Consequently, developing the house rental market ought to be an effective way of restraining the rise in house prices [DGBAS, 2008;

Institute for Physical Planning and Information, 2009]. The Institute for Physical Planning & Information pointed out the housing need in Taiwan in the first half, 2009 through its studies that up to 67% of the new house tenants believe that they could not at all pay for buying a house. In the five major metropolis regions (Taipei City, Taipei County, Taoyuan/Hsinchu County/City, Taichung County/City and Kaohsiung County/City), the house price and income ratio is 6.65 times. The house loan burden eats out 27.69% of their income. Among those regions, Taipei City citizens shoulder the heaviest house price ratio, at 8.89 times of their income, with loan percentages of up to 33.56%. Further, as indicated by the household revenues and expenditures reports officially revealed by

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the Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Republic of China in 2008, the house ownership ratio has reduced from 88.14 to 87.36% and house leasehold ratio from 7.89 to 8.37%. Nobody would be wealthy enough unless he or she owns land. That very firm concept makes the house prices consistently going high, bringing heavy burden to house buyers, especially in the metropolis area, making the house dwellers to use their houses by only leasehold. The report on wideband network use revealed by the Taiwan Network Information Center 2010 suggests that in Taiwan, up to 16.22 million of the total population use wideband, as popular as 67.21% to the total population. Market Intelligence & Consulting Institute anticipated that in 2009, the Internet shopping values in the online markets came to NT\$31.16 billion, growing by 30.4% over the preceding year. The computer use statistics conducted by Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Republic of China 2008 indicate that up to 56,500 households use computers rendering selling or services, selling up to 12.91% which would account for more than 25% of the total sales values. These figures suggest that e-commerce must inevitably become next stellar industry. The ones who own and operate a superior electronic quality services commercial website will gain strengthened advantage in boosting their enterprises.

In recent years, the popularity of the Internet and the e-commerce on the rise [DGBAS, 2008; 23] will help firms to enhance their competitive advantage. The major motive of this research is to determine how to improve service quality of house rental websites in order to obtain their best competitive advantage. Based on the research background and motivation, this study intends to achieve the following goals: to build up the criteria of an e-service quality assessment questionnaire on house rental websites; to study the relational influences of these criteria; and to explore the degree of importance of these criteria, as well as the performance of the assessment plan.

Literature review

P.Z.B Model

Gronroos (1982) defined service quality as the comparison result between customers' expectations and their perception toward services. Later, Parasuraman et al. (1985), extended Gronroos's definition, and they suggested that service quality should be based on a customer's perception, which is the gap between perceived quality and expected quality. The PZB Model and SERVQUAL, also proposed by them, are widely accepted and applied. Moreover, after Parasuraman et al. 1988, added external communication as an additional influential factor of customers' expected service, Yang (2009), a domestic scholar of quality management, added

service price as a new factor. Therefore, there are five factors, namely, word of mouth, personal needs, past experience, external communication and service price.

Parasuraman et al. (1990) integrated the ten factors of measuring service quality, concluded before, into five major factors of SERVQUAL. These are formality, reliability, responsiveness, guaranty and empathy (Parasuraman et al., 1985). By connecting these factors with the gap-causing problems, they came up with an expanded model of service quality. Electronic Service Quality (e-SQ) may be understood by other scholars to be website service quality or online service quality. In this study, it was understood to be e-SQ for the sake of consistency. Zeithaml et al. (2005) defined e-SQ as the increased level of effectiveness of products and services, which are delivered via a website. Additionally, the conceptual model of e-SQ was proposed by the three scholars in 2002, and has been used to teach the differences between customers' perceptions and those of practitioners' with regard to the service quality of an e-commerce website (Zeithaml et al., 2005). According to the three scholars, when a service is provided for customers through a website, there are four gaps that prevent e-SQ to meet customers' expectations. These gaps are the design, communication, information and fulfilment gaps.

Based on the criteria, namely efficiency, system availability, fulfilment, privacy, responsiveness, and compensation, as well as contact, Zeithaml et al. furthered their research in 2005. They used an e-SQ scale that they had developed to undertake empirical research on Amazon online bookstores and Wal-Mart shopping websites. Their research achieved tremendous results (Zeithaml et al., 2000). This study was also based on the criteria mentioned above. However, as the pattern of online bookstores and shopping websites is different for house rental websites, it was inappropriate to directly adopt the assessment model mentioned above. Therefore, the assessment criteria of e-SQ ought to be modified with the help of experts. It is hopeful that the suggestions given by experts and scholars can make the assessment criteria more applicable to the research on house rental websites.

The e-SQ of various types of website

The Internet can be divided into four major types in terms of its transaction objectives, namely B2C, B2B, C2C and P2P (Turban and Lang, 2009). (1) B2C (Business to Consumer): this refers to an e-commerce operational model in which firms use the Internet to trade with customers and provide commercial services for them. Laudon and Traver (2004) pointed out that it mainly includes: 1. Portal; 2. e-Tailer; 3. Content Provider; 4. Transaction Broker; 5. Market Creator; 6. Service Provider; and 7. Community Provider. (2) B2B (Business to Business): this refers to an e-commerce operational

model which is used to integrate the information of different firms through the Internet. Laudon and Traver, 2004 suggested that it included: 1. e-Distributor; 2. e-Procurement; 3. Marketplace; 4. Industry Consortia; 5. Private Industrial Network; and 6. Industrial Network. (3) C2C (Consumer to Consumer): this refers to an e-commerce operational model that allows a large number of buyers and sellers to communicate in order to provide information for each other to share. A typical example is eBay. (4) P2P (Peer to Peer): through P2P, users can share with each other the soft and hardware resources, but they may often have concerns that their intellectual property rights will be violated by others.

The above literature shows that e-SQ assessment criteria frequently appear and can enjoy a high level of application to different types of website. Therefore, in this study, they are adopted as the basic criteria for the e-SQ assessment of house rental websites. The assessment criteria of e-SQ should be modified with the help of experts and scholars as well as the Fuzzy Delphi method. It is hopeful that the suggestions given by the experts can make the assessment criteria more applicable to research on house rental websites.

Kano model

The Kano model was proposed by the Japanese quality controller, Kano et al. (1984). They extended the Motivation-Hygiene Theory, proposed by Herzberg (Herzberg, 1959), into the field of quality management, pointing out that the sufficiency of quality factors and customer satisfaction are not traditionally one-dimensionally related, but two-dimensionally related. The attributed differences are attractive quality, one-dimensional quality and must-be quality, as well as indifferent quality, and even reverse quality.

The classification of quality attributes in this study is in accordance with the two-dimensional quality attribute classification version, which was modified by Matzler and Hinterhuber (1998). A is attractive quality; O is one-dimensional quality; M is must-be quality; I is indifferent quality; R is reverse quality. They are classified based on the quality attributes of the largest number of samples. When these samples are non-existent and there is no significant difference between these samples, these quality attributes are regarded as multiple quality attributes (Yang, 2009).

According to Matzler et al. (1996), traditional two-dimensional quality attributes take $M > O > A > I$ as the prior ranking of improvement. However, some peoples pointed out that taking the relational influence between quality attributes into account, it is necessary to make proper modifications based on the two-dimensional graphic so that the research results will be more valuable for decision making. If the reverse quality attribute is added, it is necessary to stop putting more resources so as to avoid wasting resources and decreasing customer

satisfaction (Lee, 2008).

Based on the viewpoint mentioned above, this study adopted the Multiple Criteria Decision Making method (MCDM) as the research method to ascertain the real ranking of e-SQ factors of house rental websites. In addition, with the concepts of aspired level and assessment plans as examples, this study has put forward some suggestions for improvements.

METHODOLOGY

Assessment dimensions and criteria

The dimensions and criteria of this study are based on the assessment scale of e-SQ proposed by ZPM (Zeithaml, 2002). In accordance with the differences between website operational models and with reference to research on various websites, this study has made a proper modification to the dimensions and criteria.

Additionally, with the help of experts and scholars (by sending questionnaires to them), the dimensions and criteria were further improved.

With reference to the Fuzzy Delphi proposed by Hsu et al. (2007), this study adopted the 0~10 grading method, meaning that a higher grade represents better applicability. It is assumed that α -cut is 6.0. Then, experts of different expertise give the highest grade (the most appropriate grade: A^i), the minimum grade (the most pessimistic grade: C^i), as well as the maximum grade (the most optimistic grade: O^i). In addition, these experts put down their suggestions and opinions attached to the questionnaires so that their ideas could be fully expressed. The specialist consensus value (G^i) was calculated based on the double-triangle fuzzy number proposed by Cheng (2001), which is more objective than the single-triangle fuzzy number, in order to integrate the experts' perceptions. The convergent gray zone test can then be used to test whether specialist consensus value is convergent or not.

The method of establishing the double-triangle fuzzy number is to take each minimum value (C^i_L, O^i_L), and maximum value (C^i_U, O^i_U), as well as the geometric mean (C^i_M, O^i_M) of C^i and O^i . Furthermore, this study referred to the water-jumping rules of the Fédération Internationale de Natation Amateur (FINA), which is a marking method involving 5 judges and 7 judges, as the way of deleting the extreme values.

According to the loose standard (5:2) and strict standard (7:4), the highest and lowest extreme values are directly deleted and the differences in the results can be observed (Tables 4-7).

The research framework

This study is based on the criteria of the e-SQ assessment scale proposed by Zeithaml et al. (2000), and adopts the Fuzzy Delphi Method (FDM) which requires scholars and professionals to modify the criteria so as to meet the requirements of an e-SQ assessment of house rental websites. In addition, the DEMATEL was used to analyze the relational influences of these criteria and a DEMATEL with ANP was adopted as the weight calculation of these criteria. The performance value was calculated by multiplying the weight with the satisfaction value drawn from the questionnaires.

Finally, the method of VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) was adopted to arrange the calculation order of the assessment plan and how to achieve the aspired level was considered in order to put forward suggestions for improving the e-SQ of house rental websites.

This study assumes that the criteria of the e-SQ assessment scale, proposed by ZPM (Zeithaml et al., 2005), were inter-

influenced. Additionally, with the aim of exploring the best assessment plan of e-SQ, an e-SQ assessment framework of house rental websites was established (Figure 2).

ANALYSIS METHOD

DEMATEL

A DEMATEL can help to effectively explore the complex causal structure. Through observation of the influence degree of two factors, and by using a matrix and its related mathematic theory, the causal relation and its influence degree of all factors can be figured out. A DEMATEL can be generally divided into the following steps:

(1) Figuring out the average matrix: Suppose there are R experts and factors in this study, and each expert is required to indicate the

influence level of *i* on *j*, then a comparative matrix a_{ij} will be formed between each of two factors. In this matrix, the contact is orderly represented by 0, 1, 2, 3, 4, meaning no influence (0), low-level influence (1), middle-level influence (2), high-level influence (3), and extremely high-level influence (4). All these values made by the experts can form a $n \times n$ matrix of non-negative value $X^k = [X^k_{ij}] \quad 1 \leq k \leq R$, which indicates that

X^1, X^2, \dots, X^R represents each matrix of non-negative value among the R experts. Each factor x^k_{ij} of X^k is an integer and diagonal factor of each answer matrix X^k and is set at 0. It can then calculate the average matrix $n \times n$ *A* of the R experts. The formula for calculation is as follows:

$$a_{ij} = \frac{1}{R} \sum_{k=1}^R x^k_{ij} \tag{3}$$

The average matrix $A=a_{ij}$ can be also called a direct relational matrix. *A* represents the initial relational influence of one factor to the others. In addition, in accordance with the causal relationship of each pair of factors, a direct relationship graphic can be drawn.

(2) The calculation of standardized direct relational matrix: a standardized direct relational matrix *D* is drawn from the average matrix *A*, and the formula is:

$$s = \max \left(\max_{1 \leq i \leq n} \sum_{j=1}^n a_{ij}, \max_{1 \leq j \leq n} \sum_{i=1}^n a_{ij} \right) \tag{4}$$

Then $D = \frac{A}{s}$ (5)

In matrix *A*, the sum of each line *j* represents the total direct

influence of *i* on other factors. $\max_{1 \leq i \leq n} \sum_{j=1}^n a_{ij}$ indicates the total direct influence of the factor, which has the greatest influence on others. Meanwhile, the sum of each row *i* represents the total direct

influence of *i*, $\max_{1 \leq j \leq n} \sum_{i=1}^n a_{ij}$ indicating the greatest direct influence of the influenced factor. *S* represents the upper value, which is the larger one. The matrix *D* is drawn through differentiating each factor in *A* by *s*. The value of each factor d_{ij} in matrix *D* is between 0 and 0.99.

(3)The calculation of total relational matrix: the indirect influence of each question factor keeps decreasing with the increase of power.

For example, $D^2, D^3, \dots, D^\infty$, the convergent answer is confirmed as a reversed matrix, which is similar to a Markov chain

matrix, $\lim_{R \rightarrow \infty} D^R = [0]_{n \times n}$ and $\lim_{R \rightarrow \infty} (I + D + D^2 + D^3 + \dots + D^R) = (I - D)^{-1}$, in which 0 is $n \times n$ zero matrix, while *I* is $n \times n$ unit matrix, and the total relational matrix *T* is $n \times n$ matrix. The definition is:

$$T = \lim_{R \rightarrow \infty} (D + D^2 + D^3 + \dots + D^R) = D(I - D)^{-1} \tag{6}$$

(4) Drawing the causal graphic: $T = [t_{ij}] \quad t_{ij} = 1, 2, \dots, n$ is the factor of the total relational matrix *T*, the sum of the lines and that of the rows are represented by r_i and c_j . The definition is:

$$r_i = \left(\sum_{j=1}^n t_{ij} \right)_{n \times 1} \tag{7}$$

$$c_j = \left(\sum_{i=1}^n t_{ij} \right)_{1 \times n} \tag{8}$$

r_i represents the total direct or indirect influence of *i* on other factors; c_j as a result of *j*, represents the sum of influence by other factors. ($r_i + c_j$) is called prominence, representing the total level of influence and being influenced through this factor. It can indicate

the prominence of the factors in the questions; ($r_i - c_j$) and is called relation. If the result is a positive value after subtraction, this means the factor is inclined to be cause-oriented; if it is a negative value, the factor is inclined to be influence-oriented. The causal

graphic is drawn with ($r_i + c_j, r_i - c_j$) as the ordered pair, ($r_i + c_j$) as the X-axis and ($r_i - c_j$) as the Y-axis. Therefore, the causal graphic can simplify complicated causal relationships into a simple structure so as to explore in depth problems and provide solutions. Furthermore, with the help of this graphic, decision makers can make appropriate decisions based on the cause-oriented or influence-oriented factors.

DANP

Yang et al. (2008) pointed out that in the super matrix of ANP, the

method of standardization treatment is to assume that each dimension has the same weight. The method of integrating DEMATEL and ANP was instigated to solve this problem, and the empirical results show that this method is more consistent with real application.

This method is divided into the following steps:

(1) Establishing an unweighted supermatrix: obtaining the influential relation matrix of total significance of criteria from DEMATEL, each influence level of criterion is considered as a standardization, the formula is as follows (Equation 9):

$$T_E = \begin{matrix} & \begin{matrix} B_1 \\ E_{11} \\ E_{12} \\ \vdots \\ E_{1m_1} \\ E_{21} \\ E_{22} \\ \vdots \\ E_{2m_2} \\ \vdots \\ E_{n1} \\ E_{n2} \\ \vdots \\ E_{nm_n} \end{matrix} & \begin{matrix} B_1 & B_2 & \dots & B_n \\ E_{11} \dots E_{1m_1} & E_{21} \dots E_{2m_2} & \dots & E_{n1} \dots E_{nm_n} \end{matrix} \\ \begin{matrix} B_1 \\ E_{11} \\ E_{12} \\ \vdots \\ E_{1m_1} \\ E_{21} \\ E_{22} \\ \vdots \\ E_{2m_2} \\ \vdots \\ E_{n1} \\ E_{n2} \\ \vdots \\ E_{nm_n} \end{matrix} & \begin{bmatrix} T^{11}_E & T^{12}_E & \dots & T^{1n}_E \\ T^{21}_E & T^{22}_E & \dots & T^{2n}_E \\ \vdots & \vdots & \ddots & \vdots \\ T^{n1}_E & T^{n2}_E & \dots & T^{nn}_E \end{bmatrix} \end{matrix} \tag{9}$$

After the standardization of the influence matrix of total significance

of criteria T_E , we can obtain T_E^α , and the result is shown in Equations 10.

$$T_E^\alpha = \begin{matrix} & \begin{matrix} B_1 \\ E_{11} \\ E_{12} \\ \vdots \\ E_{1m_1} \\ E_{21} \\ E_{22} \\ \vdots \\ E_{2m_2} \\ \vdots \\ E_{n1} \\ E_{n2} \\ \vdots \\ E_{nm_n} \end{matrix} & \begin{matrix} B_1 & B_2 & \dots & B_n \\ E_{11} \dots E_{1m_1} & E_{21} \dots E_{2m_2} & \dots & E_{n1} \dots E_{nm_n} \end{matrix} \\ \begin{matrix} B_1 \\ E_{11} \\ E_{12} \\ \vdots \\ E_{1m_1} \\ E_{21} \\ E_{22} \\ \vdots \\ E_{2m_2} \\ \vdots \\ E_{n1} \\ E_{n2} \\ \vdots \\ E_{nm_n} \end{matrix} & \begin{bmatrix} T^{\alpha 11}_E & T^{\alpha 12}_E & \dots & T^{\alpha 1n}_E \\ T^{\alpha 21}_E & T^{\alpha 22}_E & \dots & T^{\alpha 2n}_E \\ \vdots & \vdots & \ddots & \vdots \\ T^{\alpha n1}_E & T^{\alpha n2}_E & \dots & T^{\alpha nn}_E \end{bmatrix} \end{matrix} \tag{10}$$

In which, the method of $T_E^{\alpha 11}$ standardization is shown in Equations

9 and 10. The other $T_E^{\alpha mn}$ can be calculated with the method mentioned earlier.

$$d_i^{11} = \sum_{j=1}^{m_1} t_{ij}^{11}, \quad i, j = 1, 2, \dots, m_1 \tag{11}$$

$$T_E^{\alpha 11} = \begin{bmatrix} t_{11}^{11}/d_1^{11} & \dots & t_{1j}^{11}/d_1^{11} & \dots & t_{1m_1}^{11}/d_1^{11} \\ \vdots & & \vdots & & \vdots \\ t_{i1}^{11}/d_i^{11} & \dots & t_{ij}^{11}/d_i^{11} & \dots & t_{im_1}^{11}/d_i^{11} \\ \vdots & & \vdots & & \vdots \\ t_{m_1 1}^{11}/d_{m_1}^{11} & \dots & t_{m_1 j}^{11}/d_{m_1}^{11} & \dots & t_{m_1 m_1}^{11}/d_{m_1}^{11} \end{bmatrix} = \begin{bmatrix} t_{11}^{\alpha 11} & \dots & t_{1j}^{\alpha 11} & \dots & t_{1m_1}^{\alpha 11} \\ \vdots & & \vdots & & \vdots \\ t_{i1}^{\alpha 11} & \dots & t_{ij}^{\alpha 11} & \dots & t_{im_1}^{\alpha 11} \\ \vdots & & \vdots & & \vdots \\ t_{m_1 1}^{\alpha 11} & \dots & t_{m_1 j}^{\alpha 11} & \dots & t_{m_1 m_1}^{\alpha 11} \end{bmatrix} \tag{12}$$

According to the interrelationship of groups, the standardization of the influence matrix of total significance of criteria can be filled up and form a supermatrix, as shown in Equation 13:

$$W = \begin{matrix} & \begin{matrix} B_1 \\ E_{11} \\ E_{12} \\ \vdots \\ E_{1m_1} \\ E_{21} \\ E_{22} \\ \vdots \\ E_{2m_2} \\ \vdots \\ E_{n1} \\ E_{n2} \\ \vdots \\ E_{nm_n} \end{matrix} & \begin{matrix} B_1 & B_2 & \dots & B_n \\ E_{11} \dots E_{1m_1} & E_{21} \dots E_{2m_2} & \dots & E_{n1} \dots E_{nm_n} \end{matrix} \\ \begin{matrix} B_1 \\ E_{11} \\ E_{12} \\ \vdots \\ E_{1m_1} \\ E_{21} \\ E_{22} \\ \vdots \\ E_{2m_2} \\ \vdots \\ E_{n1} \\ E_{n2} \\ \vdots \\ E_{nm_n} \end{matrix} & \begin{bmatrix} W^{11} & W^{12} & \dots & W^{1n} \\ W^{21} & W^{22} & \dots & W^{2n} \\ \vdots & \vdots & \ddots & \vdots \\ W^{n1} & W^{n2} & \dots & W^{nn} \end{bmatrix} \end{matrix} \tag{13}$$

Then, according to $T_E^{\alpha 11}$, W^{11} is transformed, as shown in Equations 14:

$$W^{11} = [T_E^{\alpha 11}]^{-1} = \begin{bmatrix} t_{11}^{\alpha 11} & \dots & t_{1j}^{\alpha 11} & \dots & t_{1m_1}^{\alpha 11} \\ \vdots & & \vdots & & \vdots \\ t_{i1}^{\alpha 11} & \dots & t_{ij}^{\alpha 11} & \dots & t_{im_1}^{\alpha 11} \\ \vdots & & \vdots & & \vdots \\ t_{n1}^{\alpha 11} & \dots & t_{nj}^{\alpha 11} & \dots & t_{nm_1}^{\alpha 11} \end{bmatrix} \tag{14}$$

(2) Obtaining a weighted supermatrix: the influence matrix of total significance of dimensions is shown in Equation 15, with the influence level of each dimension as a standardization.

$$T_B = \begin{bmatrix} t_B^{11} & \dots & t_B^{1j} & \dots & t_B^{1n} \\ \vdots & & \vdots & & \vdots \\ t_B^{i1} & \dots & t_B^{ij} & \dots & t_B^{in} \\ \vdots & & \vdots & & \vdots \\ t_B^{n1} & \dots & t_B^{nj} & \dots & t_B^{nn} \end{bmatrix} \tag{15}$$

After the standardization of the influence matrix of total significance

of dimensions T_B , we can obtain T_B^α , and the result is shown as follows:

$$d_i = \sum_{j=1}^n t_{ij}, \quad i, j = 1, 2, \dots, n \tag{16}$$

$$T_B^\alpha = \begin{bmatrix} t_B^{11}/d_1 & \dots & t_B^{1j}/d_1 & \dots & t_B^{1n}/d_1 \\ \vdots & & \vdots & & \vdots \\ t_B^{i1}/d_i & \dots & t_B^{ij}/d_i & \dots & t_B^{in}/d_i \\ \vdots & & \vdots & & \vdots \\ t_B^{n1}/d_n & \dots & t_B^{nj}/d_n & \dots & t_B^{nn}/d_n \end{bmatrix} = \begin{bmatrix} t_B^{\alpha 11} & \dots & t_B^{\alpha 1j} & \dots & t_B^{\alpha 1n} \\ \vdots & & \vdots & & \vdots \\ t_B^{\alpha i1} & \dots & t_B^{\alpha ij} & \dots & t_B^{\alpha in} \\ \vdots & & \vdots & & \vdots \\ t_B^{\alpha n1} & \dots & t_B^{\alpha nj} & \dots & t_B^{\alpha nn} \end{bmatrix} \tag{17}$$

the standardization of influence matrix of total significance of

dimensions T_B^α into the unweighted matrix were then completed and form a supermatrix, as shown in Equation 18:

$$W^* = \begin{bmatrix} t_B^{a11} \times W^{11} & t_B^{a21} \times W^{12} & \dots & \dots & t_B^{an1} \times W^{1n} \\ t_B^{a12} \times W^{21} & t_B^{a22} \times W^{22} & \vdots & \vdots & \vdots \\ \vdots & \dots & t_B^{aji} \times W^{jj} & \dots & t_B^{ani} \times W^{ni} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ t_B^{aln} \times W^{n1} & t_B^{a2n} \times W^{n2} & \dots & \dots & t_B^{ann} \times W^{nn} \end{bmatrix} \quad (18)$$

In order to obtain the limit supermatrix, the weighted matrix was multiplied many times and the limit super-matrix was obtained. The authors can then calculate the weight of each assessment criterion.

$$\lim_{h \rightarrow \infty} W^h$$

Where W stands for limit supermatrix and h stands for any number.

VIKOR ranking method

Opricovic and Tzeng (2004) suggested that a VIKOR should be used for the order of plans so that different distance conceptions can be considered. As for Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), when several plans drop at the diagonal line, the assessment values are the same, but the actual plans are different from the distance of the ideal solution. So, with some compromise, a TOPSIS can be used to find out the plan which is closest to the ideal solution. The main executive steps are described as follows.

(1) Finding out the ideal solution and non-ideal solution: Confirm the best and worst value of each assessment criterion so as to calculate the difference between the ideal solution and non-ideal solution of each plan. This can be calculated from Equations 16 and

17. f_i^* is the ideal solution of i , and f_i^- is the non-ideal solution of i . If all the criteria of a plan achieve ideal solutions, this means that all the criteria achieve the best effect, namely the aspired level.

$$f_i^* = \max_j f_{ij} ; j = 1, 2, \dots, n \quad (19)$$

$$f_i^- = \min_j f_{ij} ; j = 1, 2, \dots, n \quad (20)$$

(2) The calculation of distance: The authors can adopt Equations 18 and 19 to calculate the distance of each plan and criterion.

S_k Means the ratio of distance of plan K and the ideal solution.
 R_k Means the ratio of distance of plan K and the non-ideal solution.

w_i Is the weight of each criterion based on DEMATEL with ANP.
 f_{ij} Is the performance of each criterion through the collected questionnaires.

$$S_k = \sum_{i=1}^n w_i (f_i^* - f_{ik}) / (f_i^* - f_i^-) \quad (21)$$

$$R_k = \max_i [(f_i^* - f_{ik}) / (f_i^* - f_i^-)] \quad (22)$$

(3) Calculating the comprehensive index: In order to ascertain the plan order, Equation 20 was used to calculate the comprehensive index Q_k . The closer it is to 0, the closer will it be to the ideal solution. This is made as the basis of plan order.

$$S^* = \min_k S_k, \quad S^- = \max_k S_k, \quad R^* = \min_k R_k, \quad R^- = \max_k R_k,$$

the value of $\min_k S_k$ represents the maximum group effect, and the value of $\max_k R_k$ represents the minimum individual regret. V

Means strategic weight. If V is larger, more people will prefer the majority's decision. Conversely, they may prefer the minimum objection. Generally, $V=0.5$, which can be adjusted according to the need.

$$Q_k = v(S_k - S^*) / (S^- - S^*) + (1-v)(R_k - R^*) / (R^- - R^*) \quad (23)$$

EMPIRICAL RESULT ANALYSIS

The empirical analysis of criterion applicability

This study adopted the convergent gray zone test to undertake a questionnaire survey on 10 scholars and 5 senior managers who were from the fields of e-commerce, property management and quality management. Subsequently, the data from the questionnaires were analyzed. Two different methods were used for the analysis process and the results testing, which were not removing extreme value (5:2/7:4). Finally, an observation was made for the differences in the analysis results. Table 1 shows the result of the assessment criteria with the method of not deleting extreme value. It indicates that the testing result of fulfilment, compensation and contact was a negative value, which means that the gray zone was larger than the average geometric range. So even though the cross point of the double-triangle fuzzy number can be calculated, it cannot represent the special consensus value. Table 2 is the result of the assessment criteria with the method of deleting extreme value (5:2). It indicates that the Z' of all criteria were below 0 or equivalent to 0, meaning that there was no gray zone. Hence, the geometric mean of double-triangle fuzzy number can be used to calculate the arithmetic average as the special consensus value. The result showed that after the deletion of extreme value, the gray zone can be reduced in order to find out the specialists' consensus value. Table 3 is the result of the assessment criteria with the method of deleting extreme value (7:4). It indicates that if the ratio of deleting extreme value is over large, the testing result will tend to be in between, and then the results have little difference from the majority's decision. To sum up, this study adopted the ratio of 5:2. As there were 15 samples, the highest and lowest of the three extreme values were directly deleted. It was assumed

Table 1. The result of assessment criteria with the method of non-deleting extreme value.

Assessment criterion	minC ⁱ		maxO ⁱ		Geometric mean		Gray zone	Range	Testing value	Consensus value
	min	max	min	max	C _M ⁱ	O _M ⁱ	Z ⁱ	M ⁱ	M ⁱ -Z ⁱ	G ⁱ
Efficiency	5	10	8	10	7.189	9.504	2	2.315	0.315	8.697
Systematic availability	5	10	8	10	6.631	9.026	2	2.395	0.395	8.467
Fulfillment	2	10	5	10	6.635	9.211	5	2.576	-2.424	-
Privacy	5	10	8	10	7.603	9.647	2	2.044	0.044	8.815
Responsiveness	1	9	7	10	5.923	8.829	2	2.906	0.906	7.746
Compensation	1	10	5	10	5.907	8.612	5	2.705	-2.295	-
Contact	3	10	7	10	6.328	8.750	3	2.422	-0.578	-
							(α-cut) = 6.0	Number of criteria = 4		

- Represents Z>M, gray zone is over large, no common value.

Table 2. The result of assessment criteria with the method of deleting extreme value (5:2).

Assessment criterion	minC ⁱ		maxO ⁱ		Geometric mean		Gray zone	Range	Testing value	Consensus value
	min	max	min	max	C _M ⁱ	O _M ⁱ	Z ⁱ	M ⁱ	M ⁱ -Z ⁱ	G ⁱ
Efficiency	7	8	9	10	7.211	9.769	-1	2.558	3.558	8.490
Systematic availability	5	8	8	10	6.676	9.081	0	2.405	2.405	7.879
Fulfillment	6	8	9	10	7.302	9.769	-1	2.467	3.467	8.536
Privacy	7	9	9	10	7.753	9.884	0	2.131	2.131	8.819
Responsiveness	6	7	8	9	6.425	8.883	-1	2.458	3.458	7.654
Compensation	6	8	9	10	6.968	9.322	-1	2.354	3.354	8.145
Contact	6	7	8	9	6.536	8.883	-1	2.347	3.347	7.710
							(α-cut) = 6.0	Number of criteria = 7		

Zi≤0 means no gray zone, Gi is the mean of geometric mean.

Table 3. The result of assessment criteria with the method of deleting extreme value (7:4).

Assessment criterion	minC ⁱ		maxO ⁱ		Geometric mean		Gray zone	Range	Testing value	Consensus value
	min	max	min	max	C _M ⁱ	O _M ⁱ	Z ⁱ	M ⁱ	M ⁱ -Z ⁱ	G ⁱ
Efficiency	7	8	9	10	7.135	9.851	-1	2.716	3.716	8.493
Systematic availability	5	8	8	10	6.78	9.12	0	2.340	2.340	7.950
Fulfillment	7	8	9	10	7.412	9.851	-1	2.439	3.439	8.632
Privacy	7	8	10	10	7.701	10	-2	2.299	4.299	8.851
Responsiveness	6	7	9	9	6.41	9	-2	2.590	4.590	7.705
Compensation	6	8	9	10	6.979	9.275	-1	2.296	3.296	8.127
Contact	6	7	9	9	6.552	9	-2	2.448	4.448	7.776
							(α-cut) = 6.0	Number of criteria = 7		

If the ratio of deleting extreme value is over large, the testing results will tend to be in between.

that α-cut is 6.0. As the specialists' consensus value of all criteria was above 7.5, all the criteria were selected.

Based on the analysis of the collected questionnaires given to the experts, it was suggested that the e-SQ assessment criteria have a high-level application to house

rental websites. Therefore, they can perfectly be considered as the criteria of an e-SQ assessment of house rental websites (Figure 2).

Using the Fuzzy Delphi method, the specialists' consensus value can be calculated through a double-

Table 4. The influence level of the criteria.

	D_i	R_j	D_i+R_j	D_i-R_j
Efficiency	5.616	5.642	11.258(1)	-0.026(4)
Systematic availability	5.608	5.590	11.198(2)	0.018(3)
Fulfillment	5.603	5.479	11.082(3)	0.124(1)
Privacy	4.856	4.920	9.776(7)	-0.064(7)
Responsiveness	5.253	5.314	10.567(5)	-0.062(6)
Compensation	5.140	5.077	10.217(6)	0.062(2)
Contact	5.413	5.467	10.880(4)	-0.054(5)

Table 5. Limit matrix.

Limited	Efficiency	Systematic availability	Fulfillment	Privacy	Responsiveness	Compensation	Contact
Efficiency	0.132	0.132	0.132	0.132	0.132	0.132	0.132
Systematic availability	0.131	0.131	0.131	0.131	0.131	0.131	0.131
Fulfillment	0.129	0.129	0.129	0.129	0.129	0.129	0.129
Privacy	0.115	0.115	0.115	0.115	0.115	0.115	0.115
Responsiveness	0.165	0.165	0.165	0.165	0.165	0.165	0.165
Compensation	0.158	0.158	0.158	0.158	0.158	0.158	0.158
Contact	0.170	0.170	0.170	0.170	0.170	0.170	0.170

Table 6. Total performance assessment scale.

Dimension/criterion	Original weight	Total weight	www.591.com.tw		www.twhouses.com.tw		www.tmm.org.tw	
			Performance	Difference	Performance	Difference	Performance	Difference
Key dimension	0.507		3.542	0.292	3.232	0.354	3.303	0.339
Efficiency	0.261	0.132(4)	3.733	0.253	3.200	0.360	3.267	0.347
Systematic availability	0.259	0.131(5)	3.667	0.267	3.267	0.347	3.333	0.333
Fulfillment	0.253	0.129(6)	3.467	0.307	3.200	0.360	3.400	0.320
Privacy	0.227	0.115(7)	3.267	0.347	3.267	0.347	3.200	0.360
Restored dimension	0.493		3.223	0.355	3.158	0.368	3.379	0.324
Responsiveness	0.335	0.165(2)	3.200	0.360	3.133	0.373	3.400	0.320
Compensation	0.320	0.158(3)	3.200	0.360	3.067	0.387	3.333	0.333
Contact	0.344	0.170(1)	3.267	0.347	3.267	0.347	3.400	0.320
Total performance value			3.385(1)		3.196(3)		3.340(2)	
Average difference				0.323(1)		0.361(3)		0.332(2)

Table 7. The order of modification.

	Weight	D_i+R_j	D_i-R_j	Quadrant	Kano	Order of modification
Efficiency	0.132(4)	11.258(1)	-0.026(4)	IV	M	(3)
Systematic availability	0.131(5)	11.198(2)	0.018(3)	I	M	(2)
Fulfillment	0.129(6)	11.082(3)	0.124(1)	I	M	(1)
Privacy	0.115(7)	9.776(7)	-0.064(7)	III	M	(7)
Responsiveness	0.165(2)	10.567(5)	-0.062(6)	III	M	(6)
Compensation	0.158(3)	10.217(6)	0.062(2)	II	O	(5)
Contact	0.170(1)	10.880(4)	-0.054(5)	IV	O	(4)

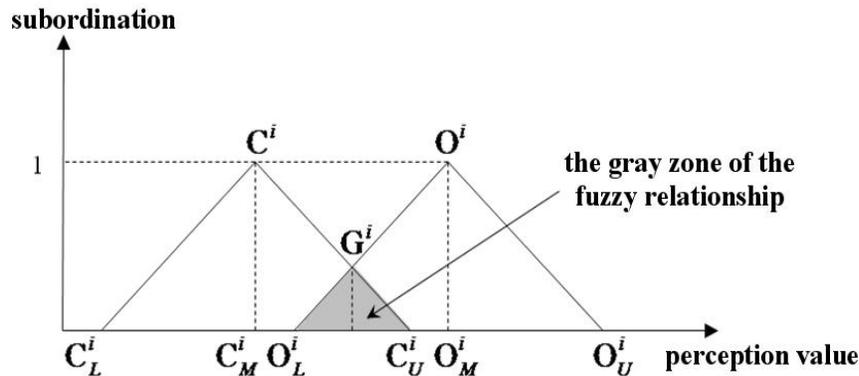


Figure 1. Double-triangle fuzzy number of the most pessimistic perception and the most optimistic perception [Parasuraman et al., 1988].

triangle fuzzy number and it can be tested whether it is convergent or not by the convergent gray zone test. The simple deletion method of this study was proposed with reference to the grading method of Federation Internationale de Natation (FINA) water-jumping rules. In addition, by way of deleting the 7-judge system (7:4), which has an over large ratio of extreme values, the simple deletion method adopted an appropriate 5-judge system (5:2) as the deleting ratio of extreme values, thereby helping to reduce the gray zone and making the specialists' consensus value easier to be convergent (Figure 1).

The empirical research on the order of causal weighting

The questionnaire of this study was conducted during May 2010 with 15 experts as the participants, including 3 scholars of management and 12 senior managers with rich internet marketing experience. Figure 4 indicates that each dimension and criterion of the e-SQ of the house rental websites has, to some extent, a relation with the others and has self-feedback. The criterion with the strongest influence was fulfillment (0.124), then compensation (0.062), and the third was systematic availability (0.0180). The criterion with the highest level of being influenced was privacy (-0.064), then responsiveness (-0.062), and the third one was contact (-0.054). In addition, the influence of key dimension on resorted dimension is 0.004.

After a DEMATAL was used to calculate the relational influence of dimensions and criteria of the e-SQ of house rental websites, using a DEMATEL with an ANP, the former matrix of the originally total relational influence was used to figure out the underlying dynamic relational influence of significance in order to replace the criterion significance degree represented by that of the ANP. This can be regarded as the weight of the e-SQ assessment

of house rental websites. The calculated result showed that the criterion significance degree (in order) was contact (0.170), responsiveness (0.165), compensation (0.158), efficiency (0.132), systematic availability (0.131), fulfillment (0.129) and privacy (0.115).

By multiplying the weight (drawn from the DEMATEL with the ANP) with the satisfaction degree of the e-SQ of house rental websites drawn from the collected questionnaires (5-point Likert scale), the performance value of each assessment plan was calculated. A VIKOR was then adopted to calculate the total performance value and the average difference of the comprehensive index. The highest total performance value was 5, a higher value represents a better e-SQ. The lowest average difference was 0, a lower value representing that the e-SQ was closer to the aspired level.

Figure 3 indicated that, for the e-SQ assessment plan of house rental websites, the order of its total performance value was as follows: www.591.com.tw (3.385), www.tmm.org.tw (3.340) and www.twhouses.com.tw (3.196). Meanwhile, the order of average difference was www.591.com.tw (0.323), www.tmm.org.tw (0.332) and www.twhouses.com.tw (0.361). In terms of the different distances of VIKOR, it was indicated that the order of the e-SQ of the house rental websites was in order, www.591.com.tw (1), www.tmm.org.tw (2), and www.twhouses.com.tw (3).

Figure 4 shows that although compensation may have quite a high level of influence on the minority of criteria, it is never the key to the problems. Therefore, it is not necessary to be modified first (ranking No.5). This is totally different from the result of the DEMATEL (without the introduction of the traditional Kano causal graphic) in which the factor (ranking No.2) needs to be modified first. As for the rest of the criteria, after excluding compensation, their order of modification had no change, and neither did the criteria in each quadrant have any difference from $M > O > A > I$, as proposed by Matzler et al. (1996).

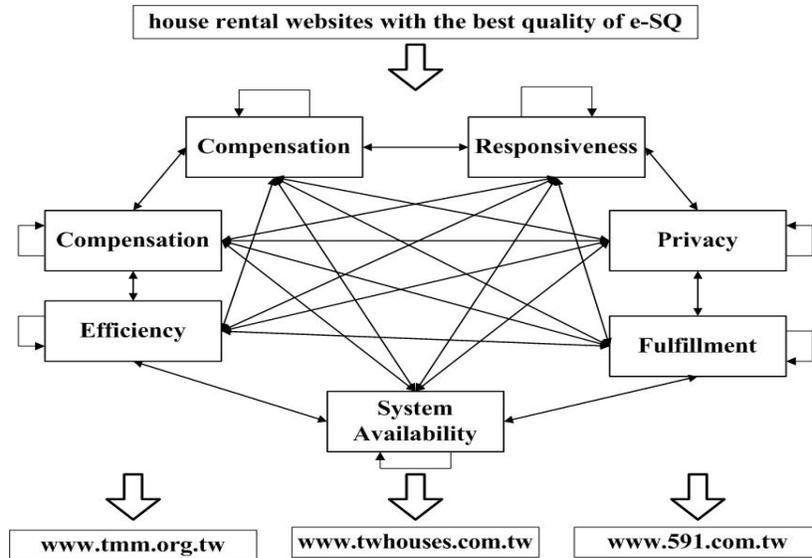


Figure 2. The e-SQ assessment framework of house rental websites.

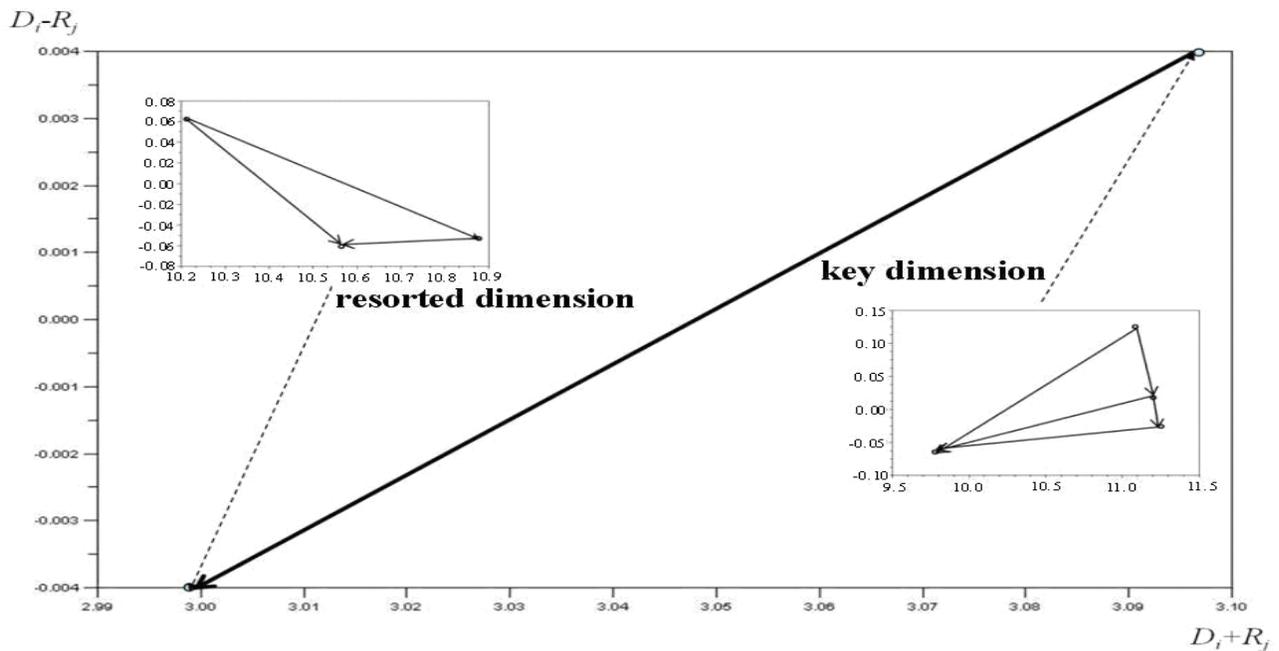


Figure 3. Causal graphic; data is organized from this study.

Conclusions and suggestions

(1) Exploring the criteria of the e-SQ assessment questionnaire of house rental website: According to the organized literature of this study and the confirmation of FDM, the e-SQ scale, as proposed by ZPM [43], had a high level of application to the e-SQ assessment of house rental websites. Therefore, it was regarded as the criteria for the assessment of questionnaire of this study.

(2) Analyzing the relational influence of the e-SQ criteria of house rental websites: In accordance with the DEMATEL, this study suggested that key dimensions have a great influence on resorted dimensions, indicating that when there is something wrong with key dimensions, the restored dimensions will be influenced. Conversely, if key dimensions have nothing wrong, the restored dimensions are useless. For instance, if house rental websites work very well, the tenants naturally have no

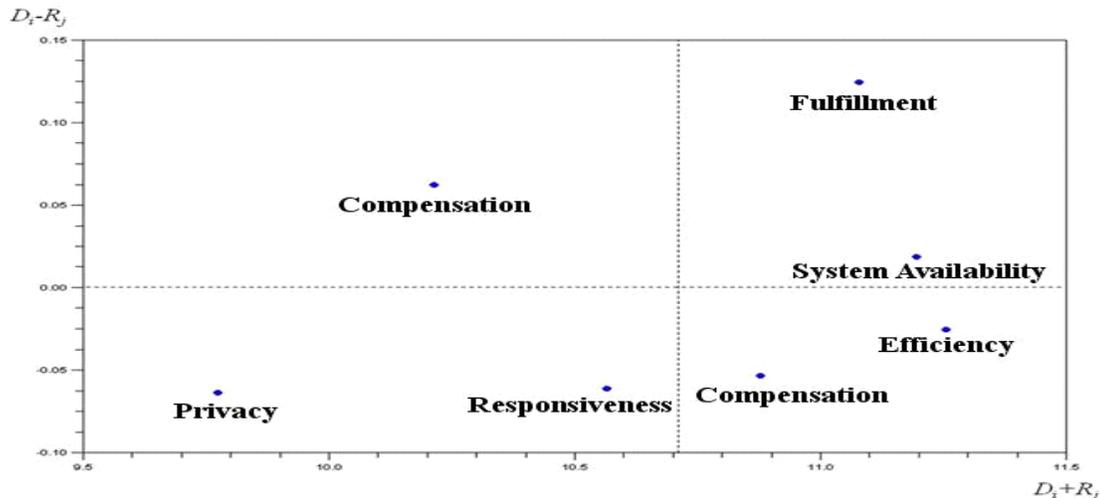


Figure 4. Kano causal graphic.

complaints.

(3) Research on the significance degree of the e-SQ criteria of house rental websites: Based on the calculation of the DEMATEL with the ANP, this study concluded that contact (0.170), responsiveness (0.165) and compensation (0.158) were the most significant criteria. Interestingly, they all belong to restored dimensions. Therefore, it is obvious that when key dimensions have problems, the quality of the restored dimensions would greatly affect whether customers felt good about the e-SQ.

(4) Exploring the performance of the e-SQ assessment plan for house rental websites: This study used www.591.com.tw, www.twhouses.com.tw and www.tmm.org.tw for the e-SQ assessment plan for house rental websites. Through the order of VIKOR, it showed that www.591.com.tw ranked No.1 in terms of the house rental website e-SQ assessment plan. In the second place was www.tmm.org.tw, and in third was www.twhouses.com.tw. This indicated that the success of www.591.com.tw was not only due to the large quantity of advertisements, but also owing to the contribution of the high level of e-SQ.

Furthermore, this study introduced the concept of aspired level so as to improve the assessment quality. The purpose is to avoid the misconception of picking one bad apple from a basket of bad apples. The Kano causal graphic showed that, although compensation may have quite a high level of influence on the minority of criteria, it was never the key to the problems (Figure 3).

Therefore, it is not necessary to be modified first (ranking No.5). This was totally different from the result of the DEMATEL (without the introduction of the traditional Kano causal graphic) where the factor (ranking No.2) needs to be modified first. It implied that when house rental websites have something wrong, high quality compensation can not only maintain consumer

confidence, but also achieve a good reputation, showing that the website can deal well with a consumer's problem.

However, compensation, after all, is a kind of remedy. If the resources of firms can be appropriately used for fulfillment with the highest level of modification, which enhances the capabilities of fulfilling customers' needs, or into the systematic availability (ranked NO.2), which can strengthen the system workload and correctly maintain the updating of information, then the e-SQ of house rental websites can be greatly improved.

There will then be fewer mistakes, compensation will be reduced and the resources of firms will be safeguarded.

In conclusion, when compared with the DEMATEL graphic, the Kano graphic can present a more authentic world and provide more precise information concerning decision making, thereby helping decision-makers to make more appropriate decisions. Therefore, it contributes to the research results.

Limitation and suggestions

The participants of the questionnaire were experts and scholars with practical experience in related fields, not the actual ordinary consumers. Therefore, the research results can only be used for reference and cannot be applied to the research on consumer behaviour and satisfaction. Therefore, it is suggested that more questionnaires be distributed to extend this study.

The dimensions and criteria of this study were a simplified version of the e-SQ scale, not the full version. Therefore, the research results can only be used for a rough reference instead of an in-depth reference on decision making. It is suggested that, in a further study, large quantities of questionnaires should be used with an e-SQ scale of the full version or with some modifications.

In addition, researchers should observe whether the criteria in each quadrant have any differences from $M > O > A > I$, as proposed by Matzler et al. (1996), in order to make advance contributions to this research.

Conflict of interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Perceptions of entrepreneurship education by engineering students of Modibbo Adama University of Technology, Yola, Nigeria

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There has been emphasis on the study of entrepreneurship in tertiary institutions in Nigeria for both management and non-management students like those undergoing engineering programmes. While much work has been done to assess the relationship between the teaching of entrepreneurship and entrepreneurship intentions of recipients, very few studies have been carried out – especially in the Nigerian context – on the perceptions of technically-inclined students to the teaching of entrepreneurship. This study sought to find out the perceptions of engineering students of one university in Nigeria to the teaching of entrepreneurship education (EE). Perception of EE was defined in terms of perceived need for EE, Perceived relevance of curriculum, and Perceived competence of EE lecturers. A census was carried out on the 141 final year engineering students and data were descriptively analyzed using mean and standard deviation, and inferentially, using multiple regression analysis. The study shows that EE was positively perceived across all dimensions. The study further shows a strong positive relationship between perception of EE and entrepreneurial intentions. The study concluded that building a positive perception of EE among students is fundamental to achieving its primary objective

Key words: Entrepreneurship education, perceived curriculum, perceived competence of lecturers, perceived role of university, engineering students, entrepreneurial intentions.

INTRODUCTION

Faced with the increasing rate of unemployment among graduates and its attendant socioeconomic problems, the Federal Government of Nigeria, through the Federal Ministry of Education, in the mid-1980s, introduced entrepreneurial education into the curriculum of tertiary institutions in the country. It was the thinking of government that the teaching of entrepreneurship will

equip students with skills, attitude, and knowledge necessary for self-employment generation and management. Entrepreneurship Education (EE) has been defined as the type of education geared toward producing self-employed or self-reliant person (Onu, 2008). Diaz-Casero et al. (2012) defined entrepreneurial intention as “idea of creating a company, planning to have

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one's own business, dedication of time and energy." This is a state of mind that students wish to create a business of their own upon graduating from university.

In the Modibbo Adama University of Technology (MAUTECH), Yola, Nigeria, entrepreneurship education is thought as, "Entrepreneurship Development" (ED). Osemeka (2012: 256) defines entrepreneurship development as "...the process of enhancing entrepreneurial skills and knowledge through structural training and institutional building programme." In this paper, EE and ED shall be used interchangeably as they imply the same thing. At MAUTECH, ED is a compulsory course at the final level of the undergraduate programme, not only to business students but also to those in non-business and technical fields like engineering. The compulsory involvement of engineering students in EE is seen by educational policy makers as an effective strategy to harmonize their technical capabilities with strong business creation ability.

Despite the emphasis on EE for technically-biased students like engineering undergraduates, very few studies have been carried out – especially in the Nigerian context - to assess how the recipients perceive this programme, and also how these perceptions influence intentions to go into entrepreneurship on graduation. Previous researchers have focused on either the linkage between ED and entrepreneurial intention or on how specific traits like, locus of control, prior business experience, self-efficacy, creativity, etc., related to readiness to go into entrepreneurship. The statement of the problem can be stated thus; what are the perceptions of engineering students in MAUTECH to EE? The objectives of the study are, therefore, to: (1) examine engineering students perceptions of EE with respect to its need, the relevance and adequacy of EE curriculum and course content, and competence of EE lecturers, and (2) Assess the relationship between perception of EE and entrepreneurial intentions of engineering students. Perception of EE is defined in terms of: (1) need for EE; (2) relevance and adequacy of curriculum and course contents; and, (3) competence of EE lecturers.

Research questions and hypotheses

Research questions

1. What are students' perception of EE with respect to EE its need in tertiary institutions?
2. What are engineering students' perceptions of EE curriculum and course content?
3. What are engineering students' perceptions of EE Lecturers?
4. What is the relationship between perceptions of EE and entrepreneurial intentions of engineering students?
5. How do socio-demographic variables moderate the relationship between perception of EE and entrepreneurial intentions of engineering students?

Research hypotheses

The two null hypotheses for this study were:

Hypothesis one: There is no significant relationship between engineering students' perception of EE and their entrepreneurial intentions

Hypothesis two: Socio-demographic factors do not significantly moderate the relationship between engineering students' perceptions of EE and their entrepreneurial intentions.

LITERATURE REVIEW

Perceived need for entrepreneurial education

Entrepreneurial education is offered at both the undergraduate and post-graduate levels in universities in Nigeria. The objectives at the undergraduate level are to create awareness among students and stimulate their interests in entrepreneurship (Abbas, 2013). The course is expected, among others, to make students appreciate the risks and rewards associated with business creation and ownership. It is hoped that the course will change students' mindsets and attitudes towards entrepreneurship as well as helping in "developing entrepreneurial traits...and provide the necessary networking support..." (Agbim et al., 2013: 37). Some studies show that students perceived EE as an important and relevant course (Akpan and Etor, 2013; Akinboye and Pihie, 2014; Ramlan and Ngah, 2012). Studies by Hosseini et al. (2011) and Abbas (2013) show that EE positively changed students' perceptions of and attitudes toward entrepreneurship.

Perceived relevance of curriculum and course contents

The appropriateness of the curriculum and course contents is a challenging issue in EE, and the success of the programme lies on getting this aspect right. Zegeye (2013) argues that this problem arises owing to inability to harmonize the viewpoints of the major stakeholders in EE: educators, students, programmers, and evaluators. The students, for example, come from diverse educational background and orientations. What and how to teach them are fundamental questions that need to be asked and pragmatically answered if students interests and skills acquisition in entrepreneurship are to be met. Adejola and Olufumilayo (2009), Ramlan and Ngah (2012) identified curriculum and course contents as critical to achieving the course outcomes. Ozaralli and Rivenburgh (2016) identified the theory-based approach to EE and the non-involvement of practical entrepreneurs as responsible for low interest and poor perception of entrepreneurship among university students in Malaysia.

Table 1. Reliability coefficients of variables measures.

S/n	Dimensions	No of items	No of cases	Cronbach's Alpha
1	Perceived need for Entrepreneurial education	10	99	.525
2	Perceived relevance of curriculum and course content	7	99	.656
3	Perceived competence of EE lecturer	6	99	.553
4	Perceived entrepreneurial intentions	6	99	.656

This finding was corroborated by other studies (Kontio, 2010; Ramlan and Ngah, 2012; Zegeye, 2013).

Perceived competence of entrepreneurial education lecturers

Those who teach entrepreneurship in universities have significant role in influencing students' attitudes to and perceptions of EE (Gustafsson-Pesonen, 2008; Akinboye and Pihie, 2014). However, studies show that students have low perceptions of existing teaching methods in positively influencing their interests in entrepreneurship (Ramlan and Ngah, 2012). This has been blamed on the dysfunctional approach to EE by lecturers handling the course. This was the position of Yasin et al. (2011:200) who observed that "lecturers lacked relevant entrepreneurial skills, knowledge or training and teaching approaches were inappropriate." This finding was collaborated by later study (Abbas, 2013).

Entrepreneurial intentions

The goal of EE is to create entrepreneurial intentions among the recipients. Entrepreneurial intention refers to "an individual's personal desire to create a new firm or a new value driver within existing organizations" (Wu and Wu, 2008). Entrepreneurial intention is seen as the first step in new business creation. ED, it is argued, will develop students' interests in and create positive perception of entrepreneurship (Agbim et al., 2013). Students will be equipped with the skills to translate their interests into business formation at some stage after completion of their undergraduate programmes.

METHODS

Population of the study and census

EE is a compulsory course for all final year undergraduate students in MAUTECH, including those of the School of Engineering and Engineering Technology (SEET). The numbers of registered final year students in each of the engineering departments for the 2014/2015 academic session were as follows: Agricultural Engineering (19), Chemical Engineering (32), Civil Engineering (33), Electrical/ Electronic Engineering (54), and Mechanical Engineering (13). Given the relatively small size of the population – 141 – the researcher decided to carry out a census.

Instrumentation

The instrument for data collection in this study was an "Entrepreneurship Perception Questionnaire." The questionnaire consisted of five sections: A, B, C, D, and E. Section A which measured "Perceived Need for Entrepreneurship Education," was based on a previous study (Adediran and Onifade, 2013). The remaining sections were developed by the researcher. Section B measured "Perception of Curriculum and Course Contents," Section C measured "Perception of ED lecturers," Section D measured Perceived Entrepreneurial Intention," and Section E measured the socio-demographic characteristics of engineering students. Section A to Section D was based on a 5-point Likert Scale which ranged from 'Strongly Disagree (scaled as one point) to Strongly Agree (scaled as five points). Multiple choice questions were developed to measure socio-demographic factors.

One hundred and twenty four copies of questionnaire were distributed to final year engineering students of MAUTECH during an EE class and were to be returned the next day. Only 112 copies of the questionnaire were returned and of this number, 12 were wrongly completed and therefore discarded. The 99 correctly completed and usable copies of questionnaire represented a response rate of 88.39 percent.

Tools for data analysis

The socio-demographic variables of respondents were frequency and percentage. The first three research questions were analyzed using another descriptive statistical tool – mean and standard deviation. In analyzing these research questions, the decision cut-off mean was 2.50. Means scores above that the cut off mark were adjudged positively perceived (Agreed), while mean scores below were adjudged negatively perceived (Disagreed). The two hypotheses were tested using multiple regression analysis. In analyzing the research questions the decision cut-off mean was 2.50 (for a 5-point Likert Scale). Mean score above the cut-off were adjudged "Agree" and mean score below were adjudged "Disagree." The Scientific Package for Social Sciences (SPSS) version 14 was used in analyzing all data.

Reliability

The Alpha Cronbach coefficient (α) was used to test the internal consistency of the items. A reliability of 0.50 was set as the criterion of acceptability for this study.

As shown in Table 1, the four variables ranged from 0.525 to 0.656, and the instrument is considered reliable as the Cronbach coefficients for each dimension was above the minimum criterion for acceptability.

RESULTS

The result of analysis of respondents' socio-demographic

Table 2. Socio-demographic characteristics of respondents.

Variable	Dimension	Frequency	Percentage
Gender	Male	94	94.9
	Female	5	5.1
	Total	99	100.0
Age (year)	18-20	0	0.0
	21-23	9	9.1
	24-26	54	54.5
	27-29	27	27.3
	30-32	5	5.1
	33+	4	4.0
	Total	99	100.0
Marital status	Single	92	92.9
	Married	7	7.1
	Separated/Divorced	0	0.0
	Widowed	0	0.0
	Total	99	100.0
Department	Agricultural Engineering (Ag. E.)	12	12.1
	Chemical Engineering (Ch. E.)	25	25.3
	Civil Engineering (Civ. E.)	13	13.1
	Electrical/Electronic Engineering (E/E E.)	41	41.4
	Mechanical Engineering (Me. E.)	8	8.1
	Total	99	100.0
Prior business experience	Never been involved in business of my own	58	58.6
	Own/have owned a business of my own	54	41.4
	Total	99	100.0
Business background of parent/guardian	Parent(s)/Guardian(s) is(are) in business	54	54.5
	Parent(s)/Guardian(s) is(are) not in business	45	45.5
	Total	99	100.0

characteristics is presented in Table 2. The result of analysis of the first research question, “what are student perceptions of EE with respect to EE its need in tertiary institutions?” is presented in Table 3.

Table 3 shows that engineering students positively perceived the need for EE. They are generally of the view that EE promotes self-reliance and self-employment, equips graduates with innovative ideas and business creation skills among others. Among the five departments, Department of Agricultural Engineering had the highest cluster mean (4.025) while Department of Mechanical Engineering had the least (3.480). All the dimensions on which perceived need for EE was measured had mean ratings above the decision cut-off mean score of 2.500. The cluster mean is 3.929, which is above the benchmark or cut-off mean score. The result suggests that engineering student perceived the need for

EE.

The results of analysis of the second research question, “What are engineering students perceptions of EE curriculum and course content?” is presented in Table 4.

Measured on a five-point Likert scale, Table 4 shows the mean scores of the first five questions on EE curriculum and course contents were all above 4.000 across the five departments. However, the sixth and seventh questions which were on students’ exposure to relevant sources of funds, and students’ practical field work respectively, each had mean score less than 4.000. Students’ exposure to relevant sources of funds had the least mean score of 3.010. Comparing the cluster mean for each department, Agricultural Engineering had the least cluster mean (3.833) while Chemical Engineering had the highest (4.078). However, the cluster mean for

Table 3. Mean score of respondents on the perceived need for entrepreneurship education.

S/n	Question	Mean score for each engineering dept.					Group mean	Std. dev.
		Ag. E.	Ch. E.	Civ. E	E./E. E.	Me. E.		
1	Entrepreneurship education is suitable for Nigeria	4.416	4.077	3.960	4.220	3.625	4.111	.946
2	Entrepreneurship education is a discipline that can promote self-reliance	4.333	4.153	4.360	4.220	4.375	4.273	.767
3	Entrepreneurship education promote self-employment among people	3.583	3.231	3.280	3.317	3.375	3.333	.845
4	Entrepreneurial education decreases unemployment among the youths	4.166	4.077	3.880	4.170	3.375	4.020	.869
5	Entrepreneurship education enhances creative and innovative ideas	4.417	4.154	4.240	4.195	4.000	4.212	.883
6	Entrepreneurship education can facilitates development of commence in rural communities	3.917	3.923	4.320	4.024	3.875	4.061	.988
7	Entrepreneurship education helps in reducing numbers of failed businesses	3.667	3.954	3.560	3.585	3.500	3.525	.993
8	Entrepreneurship education reduces poverty	3.167	3.923	3.800	3.854	3.500	3.737	.932
9	Entrepreneurship education equip graduate with business creation skills	4.250	4.385	4.320	4.244	4.375	4.293	.732
10	Entrepreneurship education helps in harnessing local resources	4.333	4.308	3.320	3.780	4.175	3.828	1.040
	Cluster	4.025	4.019	3.904	3.961	3.480	3.929	0.900

the group is 4.002 which is above the benchmark or cut-off mean score (2.500). The result suggests that engineering student positively perceived the curriculum and content of EE as being relevant and adequate.

The result of analysis of the third question "What are engineering students' perceptions of EE Lecturers?" is presented in Table 5.

Table 5 shows that the mean scores are generally high. The highest group mean score (4.748) was for the statement, "The lecturer shows much interest in teaching the course," while the least group mean score (3.980) was for the "The lecturer addressed the questions I had concerning entrepreneurship." Among the five departments, Department of Chemical Engineering had the highest cluster mean (4.398), while Department of Agricultural Engineering had the least (4.226). The group cluster mean was 4.323 which is above the benchmark or cut-off mean score (2.500). The result suggests that engineering student perceived EE lecturers to be competent.

Test of hypothesis one

Table 6 shows that the analysis of the influence of perceived need of EE on entrepreneurial intentions of engineering students of MAUTECH yielded an adjusted R-square multiple regression coefficient of 0.142. The result also shows that Analysis of Variance for the multiple regression data produced an F-ratio of 6.412 which is greater than the critical F-value of 2.68 and was significant at .05 level [F-statistic (3, 96) = 6.412 compared to $F_{0.05}(3, 96) = 2.68$]. $H_0: \mu = \mu_0$ was rejected and $H_a: \mu \neq \mu_0$ was accepted. Therefore, there is a significant relationship between engineering students' perceived EE and their entrepreneurial intentions. Ee in terms of the three variables explained 14.2 per cent of the variation in entrepreneurial intention. To find out the relative contribution of the individual variables to the prediction of the dependent variable, a test of regression weight was carried out. The result shows that the standardized regression weights (Beta) ranged from

Table 4. Mean score for respondents on the perceived relevance and adequacy of curriculum and course contents.

S/n	Question	Mean score for each engineering dept.					Group mean	Std. dev.
		Ag. E.	Ch. E.	Civ. E	E./E. E.	M. E.		
1	The time allocated for the course in the time table is adequate	4.250	4.462	4.600	4.390	4.500	4.444	.519
2	The course covers basic skills required for entrepreneurship	4.166	4.230	3.840	4.317	4.000	4.141	.742
3	The course covers how business opportunities can be identified	4.000	4.230	4.040	4.220	4.125	4.141	.821
4	Preparation of feasibility studies is contained in the course outline	4.250	4.615	4.400	4.465	4.5	4.444	.642
5	The programme encourages students to meet and share business ideas	4.250	3.846	4.200	4.073	4.125	4.101	.801
6	The course exposes students to relevant sources of funds	2.750	3.240	2.600	3.700	3.500	3.010	1.035
7	Students are encouraged to have practical experience in entrepreneurship through filed work and interaction with practicing entrepreneurs	3.167	3.923	3.800	3.854	3.500	3.737	.932
	Cluster	3.833	4.078	3.297	4.146	3.536	4.002	0.785

Table 5. Mean score for respondents on the perceived competence of entrepreneurship education lecturers.

S/n	Question	Mean score for each engineering dept.					Group mean	Std. dev.
		Ag. E.	Ch. E	Civ. E	E./E. E.	M. E.		
1	The lecturer shows much interests in teaching the course	4.583	4.615	4.840	4.805	4.625	4.748	.437
2	The lecturer encourages students to participate in entrepreneurship-related activities	4.335	4.462	4.680	4.463	4.000	4.465	.577
3	Students are encouraged to consider starting their own business	4.000	4.462	4.280	4.098	4.500	4.212	.836
4	The course lecturer has stimulated my interest in becoming an entrepreneur	4.333	4.462	3.880	4.366	4.250	4.242	.882
5	The lecturer makes the course relevant to the real world	4.250	4.385	4.320	4.244	4.375	4.293	.731
6	The lecturer addressed the questions I had concerning entrepreneurship	3.853	4.000	4.040	3.976	4.000	3.980	.795
	Cluster	4.226	4.398	4.340	4.325	4.291	4.323	0.709

-.028 to .338 and the t-ratio from .130 to 3.047 to 6.909. The Beta weight of perceived need for EE was significant at 0.05 level, while that of Perceived relevance of Curriculum and contents and perceived competence of

EE lecturers were insignificant. The result shows that perceived need for EE made the greatest contribution (3.047) to explaining the entrepreneurial intentions of engineering students.

Table 6. The multiple regression analysis of perceived EE on entrepreneurial intentions of engineering students (N=99).

Model	Unstandardized coefficients		Standardized coefficients	T	Sig.	F	Adjusted R square
	B	Std. Error	Beta				
(Constant)	13..549	3.346		4.049	.000	6.412	.142
ENTREPRE. EDUCATION	.227	.075	.338	3.047	.003		
CURRICUL. & CONTENT	-.029	.108	-.028	-.267	.790		
LECTURER	.135	-.117	.130	.130	.251		

a Dependent variable: ENTREPRENEURIAL INTENTIONS; Sig. at .05 level.

Table 7. The moderating effect of socio-demographic variables on the relationship between perceived EE and entrepreneurial intentions of engineering students (N=99).

Model	Unstandardized coefficients		Standardized coefficients	T	Sig.	F	Adjusted R Square
	B	Std. error	Beta				
(Constant)	13.413	4.111		3.263	0.002	3.200	0.168
ENTREPRE. EDUCATION	0.207	0.078	0.308	2.646	0.010		
CURRICULU.&CONTENT	-0.008	0.110	-0.008	-0.073	0.942		
LECTURER	0.155	0.124	0.150	1.251	0.214		
GENDER	-0.473	1.246	-0.037	-0.380	0.705		
AGE	-0.572	0.344	-0.181	-1.661	0.100		
MARITAL STATUS	-0.661	1.185	-0.061	-0.558	0.578		
DEPARTMENT	0.167	0.233	0.069	0.718	0.475		
BUSINESS EXPERINCE	1.426	0.580	0.254	2.459	0.016		
PARENT*BACKGROUND	0.288	0.552	0.052	0.522	0.603		

a Dependent variable: ENTREPRENEURIAL INTENTIONS; Sig. at .05 level.

Test of hypothesis two

Table 7 shows that the analysis of perceived EE (in terms of perceived need for EE, perceived relevance of curriculum and contents, and perceived competence of EE lecturers) and socio-demographic variables (in terms of gender, age, marital status, department, business experience, and parent background) on entrepreneurial intentions of engineering students of, yielded an adjusted R-square multiple regression coefficient of .168. The Analysis of Variance for the multiple regression data produced an F-ratio of 3.200 which is greater than the critical F-value of 1.96 and was significant at .05 level [F-statistic (9, 90) = 3.200 compared to $F_{0.05}(9, 90) = 1.96$]. $H_0: \mu = \mu_0$ was rejected and $H_0: \mu \neq \mu_0$ was accepted. Therefore, socio-demographic factors significantly moderate the relationship between engineering students' perceptions of EE and their entrepreneurial intentions. To find out the relative contribution of the individual variables to the prediction of the dependent variable, a test of regression weight was carried out. The result shows that the standardized regression weights (Beta) ranged from -.008 to .308 and

the t-ratio from -.073 to 3.263. The Beta weights of two variables – perceived need for EE and prior business experience - were significant at .05 level while the other seven variables were not significant.

DISCUSSION

The three research questions - the perceived need for EE, the perceived relevance and adequacy of curriculum and course contents, and, the perceived competence of EE tutors - were measured on a five-point scale. The perceived need for EE was measured using 10 statements. Six of the statement each had group mean score above 4.000. These statements include: EE can promote self-reliance; EE can enhance creativity and innovative ideas; and, EE decreases unemployment among youths. The remaining four statements, which include: EE helps in reducing the number failed businesses; and, EE reduces poverty, each had group mean of less than 4.000. Of the five departments involved in the study, Agricultural Engineering had the highest cluster mean of 4.025, while Mechanical

engineering had the lowest with 3.480. The perceived relevance and adequacy of curriculum and course contents was measured using seven statements. Each of the five statements had a group mean above 4.000. The statements include: The course covers basic skills required for entrepreneurship; and, the course covers the preparation of feasibility studies. The two statements whose means were less than 4.000, were: The course exposes students to relevant sources of fund; and, students are involved in practical field work and interactions with practicing entrepreneurs. Of the five departments, Electrical/Electronic Engineering had the highest cluster mean of 4.146, while Agricultural Engineering had the lowest (3.833). The perceived competence of EE lecturers was measured using six statements. Five of the statements each had group mean score of above 4.000. These statements include: The lecturer shows much interests in teaching the course; the lecturer has stimulated my interests in entrepreneurship; and, the lecturer makes the course relevant to the real world. Of the five departments, Chemical Engineering had the highest cluster mean of 4.398, while Agricultural Engineering had the lowest (3.480).

The test of the first research question shows that engineering students of MAUTECH Yola, perceived the need for EE. This means that engineering students see EE as being an important aspect of their degree programme. It is the view of these students that EE will equip them with business creation skills, enable them to identify and create employment for themselves and others thereby reducing the unemployment problem in Nigeria and enhancing the country social and economic development. This finding is in consonance with previous studies (Akpan and Etor, 2013; Akinboye and Phile, 2014; Pulka et al., 2015) that students positively perceived Entrepreneurial studies for independence and business success. The study also revealed that engineering students of MAUTECH positively perceived the relevance of the curriculum and course contents. The students are of the view that the provisions in the curriculum for EE is such that will enable to acquire the basic skills and knowledge necessary not only for business opportunity identification for the ability to start and manage the business with a high probability of success. Many studies (Adejimola and Olufumilayo, 2009; Ramlan and Ngah, 2012; Adediran and Onifade, 2013) have shown that the curriculum and course contents are critical the successful implementation of EE at all level of education. A number studies have reported that EE education at the tertiary level of education help students to acquire entrepreneurial skills, which agrees with the finding of this study. There are, however some studies which reported a negative association between EE and entrepreneurial skill acquisition by students. This was blamed on the theory based-approach to the teaching of entrepreneurship income tertiary institutions. Lecturers handling EE were perceived as competent. The availability of tutors who have both the experience in

teaching EE and practical business experience have been identified as essentials in enhancing students' understanding and stimulating their interests in entrepreneurship (Abbas, 2013).

Another finding of this study was that engineering student' perceptions of EE significantly influence their entrepreneurial intentions. That is to say, the more students positively perceived the need for EE, the relevance of EE curriculum and course contents, and the competence of lecturers handling the course, the more the tendency to go into business creation upon graduation. EE help in removing grey areas which impede business creations amongst youths. The finding provides some support for the belief that attitude and interest can be influenced and positive attitude toward and interest in vocation can make one to go into that vocation. This assertion with regard to entrepreneurship is in line with the findings of Duval-Couetil et al. (2011). This finding was, however, at variance with the work of Abbas (2013) whose findings show low entrepreneurial intentions among non-business and technically inclined students. When moderated with socio-demographic variables, perceived EE also significantly influenced entrepreneurial intentions of engineering students.

CONCLUSION

Premised on the findings of this research work, the study concludes that engineering student positively perceived EE as important to graduate self-employment. They perceived the need for EE in universities in the sense that it will promote self-reliance and self-employment, equip graduates with innovative ideas and business creation skills among others. The relevance and adequacy of EE curriculum, and the quality of lecturers handling EE are strategically important to the success of the programme and were positively perceived. These enhance students' interests in EE and increase their intentions to go into self-employment after graduation.

Conflict of interests

The authors have not declared any conflict of interests.

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