An Enhanced Quality Approach for Ecommerce website using DEA

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Abstract – Today, Ecommerce is booming everywhere. Customer's satisfaction is an important issue in every Business-to-consumer website. Sometimes it is difficult to evaluate performance of website. It's on customer to visit, see or purchase any product. Entrepreneur is unaware of its nature. Here, we have adopted DEA (Data Envelopment Analysis) tool along with ANP (Analytic Network Process). DEA is used to evaluate performance of DMU's (Decision Making Units) and ANP resolves problem of interrelated inputs. Existing techniques does not analyze relevant DMU's for any e-commerce website. We have proposed scheme, Quality Analysis Using DEA and ANP of e-commerce Website (QADAE), which will analyze the websites and will results in popularity of websites to an entrepreneur. Our scheme, QADAE will contribute to the improvement of overall quality of website and promote the healthy development in e-commerce.

Keywords: data envelopment analysis (DEA), analytic network process (ANP), decision making units (DMU's).

I. INTRODUCTION

Quality of e-commerce website affects on its performance directly. With the rapid development and wide application of e-commerce, academia and business are desperately in need of an effective website evaluation technique to compare the relative merits of website which will be helpful for website construction [1]. DEA is one of the tools to evaluate the quality of e-commerce website [8]. It is a multi-factor performance measurement and improvement tool [2].

DEA is relatively new "data oriented" approach for evaluating the performance of a set of entities called DMU's which convert multiple inputs into multiple outputs. We have adopted ANP model along with DEA model to overcome problem of interrelated inputs. Proposed model will calculate inefficiencies in units and results will be used for improvement of website.

II. SYSTEM MODEL

Existing system provides a different approach to analyze a quality of e-commerce website. For this, it uses web log data of different sites, divide them into different inputs and convert it into possible output using concept of DMU's and before that, apply quality evaluation method i.e. DEA [1]. The amount of ambiguity and uncertainty, and the search time during surfing that they make out determine the effort size and, as an outcome, the cognitive cost amount [7].

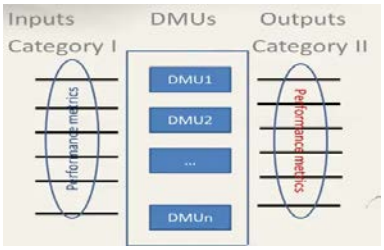

Fig. 2.1 DMU [9]

III. PREVIOUS WORK

DEA was first introduced by Charnes, Cooper, and Rhodes.

Zijuan Liu et al(2012). In this paper, DEA was adopted to evaluate the quality of E-commerce website and a quality diagnosis method was proposed based on DEA. Input oriented BCC model is used as an evaluation model.

Chuen Tse Kuah et al(2010). In this paper different DEA models are explained. DEA was first introduced by Charnes, Cooper, and Rhodes in 1978.

ZhuoFan Yang et al (2014). It compares different models CCR, BCC and KH model. Study shows that CCR and BCC model overvalues efficiency scores in contrast to KH model, which also implicitly reveals the poor coordination among business processes.

Babak Daneshvar Royendegh1 et al (2009). First, the DEA separately formulates each pair of units. In the second stage, the pair-wise evaluation matrix generated in the first

stage is utilized to fully rank the units via the ANP. They have implemented a hybrid algorithm of DEA and ANP.

LI-NA YUAN et al(2012). Here, a two stage DEA model is developed. Relative to the traditional DEA approach, two-stage DEA method has the advantage that it can not only provide the overall efficiency values of the evaluated objects, but also the values of each stage.

IV. PROPOSED METHODOLOGY

Our aim is to build a quality evaluation system which will diagnose DMU's on the basis of their efficiency. Our reference paper has built a system which uses BCC model. A BCC model is input oriented and used for evaluation purpose.

DEA BCC model is established based on input data and output data of derived from CCR [3]. In DEA, the unit of analysis is called the DMU which represents a production unit. One of the drawbacks of the traditional DEA models is the neglect of intermediate activities

Fig. 4.1 Flow diagram

First, the DEA individually formulates each pair of units. In the second stage, the pair-wise evaluation matrix generated in the first stage is utilized to fully rank the units via the ANP. DEA and the ANP both have limitations. Combined model effectively removes limitations. Our proposed system **(QADAE)** is shown as follows:

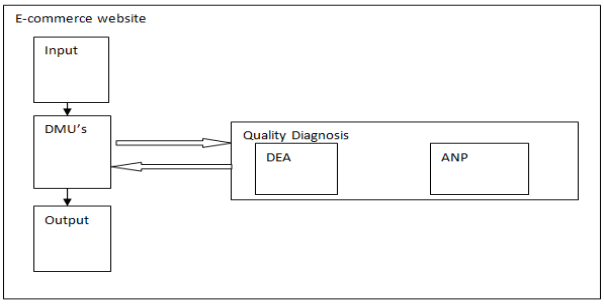

Fig. 4.2 Proposed Work

V. EVALUATION

To gain insights into the potential causes of the major website functionalities' inefficiencies, we analyzed the inefficiencies by website functionality with the metrics. The Unit Inefficiency can be computed from the DEA results. ANP is the generalization of the AHP, since it allows a network structure including dependence and feedback among the elements of a decision model. Inputs refer to measurements Calculated is the amount of effort required to build, maintain and perform the site. Output is amount of traffic the website generates. These outputs are measured as the average number of daily visits of customers and their purchases [4].Here four metrics are proposed:

1. Unit Inefficiency: Inefficiency of website functionality based on output represents how much the inefficiency due to the particular website based on functionality. It can be calculated by the following formula.
   Unit Inefficiency = s_m^-/y_s^j
2. Con.Rate1: The conversion rate from product page to Shopping cart page. It can be calculated by the following formula.
   Con.Rate1 =x_4/x_3
3. Con.Rate2: The conversion rate from Shopping cart page to Order process pages for customers. It can be calculated by the following formula.
   Con.Rate2 =X_5/X_6
4. Con.Rate3: The conversion rate from Order process pages to checkout pages for customers. It is defined below.

Con.Rate3 = X_6/X_5

Where,

Input

X_1 = Product list page
X_2 = Promotion page
X_3 = Product page
X_4 = Shopping cart page
X_5 = Order process page
X_6 = Checkout page

Output

y_1 = Basket size

After calculating all the values using above formulas we got these results shown below.

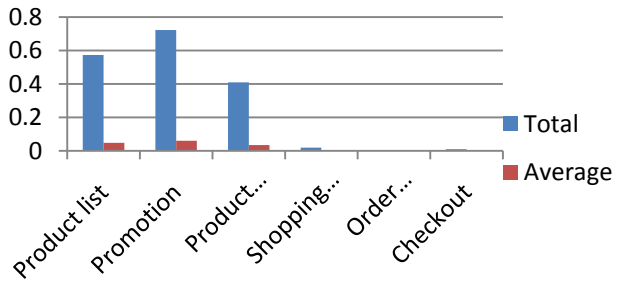

Fig. 5.1 Evaluation graph

VI. CONCLUSION

The overall performance of an e-commerce website can be gauged by this proposed technique. Implications of this study relate to a new model of a set of criteria that used to measure the efficiency of the design, usability and performance of websites. DEA is only as good as the initial selection of input and output variables.

The inputs must represent the resources consumed by the DMUs and the outputs must characterize the end results of the production by the DMUs. The ANP will analyze the websites and will results in popularity of websites to an entrepreneur. The result shows that Product list, Promotion page and Product page has great inefficiency. So focus on these attributes more. QADAE will result in overall improvement of quality of website and promote the healthy development in e-commerce.

VII. FUTURE SCOPES

Here, work done is on DMU's. DEA is used for initial selection of input and output variables. Everything is in DMU. The ANP will analyze the websites and will results in popularity of websites to an entrepreneur. It can be extended in the future work about to use advanced DEA model like hierarchical to improve performance of selection and output of system. The input should be equally categorized so that DEA will perform well.

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REFERENCES

[1] Zijuan Liu, "Diagnosing Ecommerce website quality Based on DEA," 2nd International Conference on Computer Science and Network Technology, 2012.
[2] Chuen Tse Kuah, Kuan Yew Wong, Farzad Behrouzi, "A Review on Data Envelopment Analysis (DEA)," 2010 Fourth Asia International Conference on Mathematical/Analytical Modelling and Computer Simulation, 2010.
[3] Wenli Geng, Jing Tan, "Evaluating Model for B2C E-commerce Enterprise Development Based on DEA," Advanced Science and Technology Letters Vol.53 (ISI 2014).
[4] K. Abd El-Aleem, W. F. Abd El-wahed, N. A. Ismail, F. A. Torkey, "Efficiency Evaluation of E-Commerce Websites," World Academy of Science, Engineering and Technology International Journal of Computer, Information, Systems and Control Engineering Vol:1 No:4, 2007.
[5] Babak Daneshvar Royendegh1, Serpil Erol, "A DEA – ANP hybrid Algorithm Approach to Evaluate a University¨s Performance," International Journal of Basic & Applied Sciences IJBAS-IJENS Vol:09 No:10.
[6] LI-NA YUAN, LI-NA TIAN, "A NEW DEA MODEL ON SCIENCE AND TECHNOLOGY RESOURCES OF INDUSTRIAL ENTERPRISES," Proceedings of the 2012 International Conference on Machine Learning and Cybernetics, Xian, 15-17 July, 2012.
[7] Corrado lo Storto, "Evaluating ecommerce websites cognitive efficiency: An integrative framework based on data envelopment analysis," Applied Ergonomics 44, 2013.
[8] DEA information available www.deafrontier.net.
[9] DMU image available www.google.com.