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The Research on Marketing Efficiency of WeChat Mall Enterprises Based on DEA Method

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ABSTRACT

As the attention and utilization gradually focus on WeChat marketing advantages, the development of WeChat mall enterprises has received much concern. The characteristics of WeChat malls, such as flexible personalized settings, high sociality and strong closure and so on, have great practical significance to measure and evaluate the marketing efficiency of WeChat mall enterprises. First of all, by constructing a BISP marketing system from the aspects of Brand, Interface, Service and Price, this paper established an input-output system that based on DEA model for evaluating marketing efficiency of WeChat mall enterprises. Secondly, we compared the effective decision making units with the super efficiency DEA model. Finally,we analyzed input redundancy and output deficiency situation. The research shows that the overall marketing efficiency of WeChat mall enterprises is on the low side, and rather big differences are existing among different WeChat mall enterprises. To effectively enhance the marketing efficiency, WeChat mall enterprises should improve marketing investment structure and find suitable marketing schemes according to their own characteristics and advantages. So these enterprises will obtain greater benefits and promote economic development.

Keywords: WeChat mall, data envelopment analysis, super efficiency, marketing efficiency.

INTRODUCTION

Chinese mobile internet market has been booming since 2013. Most of the traditional internet enterprises and computer e-commerce industries are gradually transforming to mobile e-commerce. In recent five years, WeChat has 800 million registered users since it launched in January 21th, 2011 and WeChat Official Accounts have reached to 100 million. According to Tencent's second-quarter results released in August 2015, the combination of WeChat has 600 million monthly active users nowadays. As a social communication trading platform, WeChat uses the strong relationship as core and has a strong social function and the huge active user group, and more and more small companies and individuals, even medium and large enterprises took the WeChat mall as a new distribution channel, at the same time, it brings new hope to these small and medium-sized sellers in Taobao who are experiencing difficulties[30]. However, concerns of consumers have driven increased by emerging concepts such as "acquaintance" marketing and mobile consumption, but they still can't compare with the strength of the e-commerce giants[22]. Based on the fixed input costs, WeChat mall enterprises are urged to find the most effective marketing strategy or combination to obtain the biggest benefit. How to choose the marketing strategies to minimum cost and maximize profit for online mall enterprises? We consider that as WeChat mall enterprises (the seller), how to choose reasonable marketing strategy to improve sales is a question that necessary but difficult to achieve and it is the key to promote WeChat e-commerce development rapidly.

In WeChat malls operation process, there are many influential factors that involved in all aspects of the WeChat mall enterprises' marketing and even included intangible indicators, such as satisfaction. Regression and correlation model of the general effect may not effective enough. At the same time, a large number of studies have found that the efficiency frontier is quite robust in DEA model[26], it has become a hot topic that using DEA method to evaluate and analysis enterprises' marketing efficiency in the field of efficiency evaluation in recent years[4][12][21][29][31]. So the enterprises' marketing strategy choice problem compare to typical performance evaluation, building the marketing efficiency of input and output index system based on the DEA model to evaluate WeChat mall enterprises marketing efficiency, which has certain research

value and strong practical significance. At the same time, to avoid the traditional DEA model errors that can't make further comparison for more effective decision making units simultaneously, this context further compares the effective decision making units by using the super efficiency model. By analyzing input redundancy and output deficiency situation, we make the enterprises understand the improvement direction, which will help to choose a more effective marketing strategy.

LITERATURE REVIEW

This study contributes to the current literature of performance and efficiency evaluation with DEA method in the following ways. Since WeChat mall opened in March 2014, the attention has increased from all walks of life in recent years. The presence of WeChat malls makes WeChat from a instant messaging application turn into another media follow microblog quickly, it has become an excellent marketing tool for transforming users, enhancing users' viscosity, triggering users' behavior, maintaining good relationship with users and promoting the brand value[33]. It has been more related researches about WeChat malls, including the functions, characteristics, advantages, development and problems and even the research as new marketing mode[11][22][30], but few existing studies have explored marketing efficiency of WeChat mall enterprises as a whole. In addition, some studies have been conducted to explore and improve the problems based on the analysis of the current situation of network marketing[15][32]. According to the research, most studies considered the problems from the perspective of marketing strategy aim for each strategy (such as, price strategy, brand strategy) of the corresponding model to seek for the optimal solution under the strategy[16][17][23]. Some studies also researched the problems from the perspective of competition between different sellers, by introducing the game theory model, studied the channel strategy selection problems[9][13][14], but the optimal solution is only derived by theories, a mall seller in reality need to consider increasing the attraction of the commodity information, is it through the lower price or put more efforts? Or through money for using malls promotional products to promote, or strengthen the service quality of network customer service to attract repeat customers? The sellers don't need an evaluation tool to evaluate various options that compare with other sellers are more relative effective instead of complex models. Therefore, based on existing research evaluate WeChat mall enterprises marketing efficiency, this context provides a marketing efficiency evaluation method that based on relative efficiency, so the sellers can improve marketing strategies that make the right investment decisions.

At present, except the DEA method, there are some other methods about effectiveness of evaluation, such as Analytic Hierarchy Process (AHP)[10], Fuzzy Comprehensive Evaluation (FCE)[28], Principal Component Analysis (PCA)[24] and Artificial Neural Network (ANN)[25]. However, Analytic Hierarchy Process has less quantitative data and more qualitative elements, and it is difficult to convince when index statistics are too much to determine the weight, and the data statistical magnitude is heavy. Fuzzy Comprehensive Evaluation evaluates based on the subjective information, the subjectivity is stronger to determine the index weight vector. Artificial Neural Network overcomes the defects of the subjective given for index weight, the evaluation results are more accurate compared with the Fuzzy Comprehensive Evaluation, but it needs bigger sample data (the local minimization problem) and it has slower speed of network convergence, sometimes it even affects the evaluation efficiency. In addition, Principal Component Analysis to evaluate ranks comprehensive based on principal component scores, not from the perspective of resources input and efficiency output to evaluate relative effectiveness. These methods are limited to a single output, by contrast, the DEA method can deal with multiple inputs and multiple outputs, and especially multiple outputs capacity has an absolute advantage. What's more, DEA method not only can judge whether the correspondent decision making units are on the efficient production frontier or not by using linear programming, but also can obtain useful management information. It is a method not only to evaluate the relative effectiveness, but also to guide and improve weak validity or inefficiency, so it can provide information in production and management for organizer and managers. As a result, it is superior and more widely useful than other methods (including statistical method). So this context evaluated marketing efficiency of WeChat mall enterprises by building a DEA-based input and output index system on the existing research results, and further compared the effective decision making units with the super efficiency model. Finally we analyzed input redundancy and output deficiency, to improve the method and marketing efficiency.

DEA EVALUATION MODEL

In 1978, Data Envelopment Analysis (DEA) method was put forward by the famous operations researcher A.Charnes, W.W.Cooper and E.Rhodes. DEA method is a multi-objective decision method based on the concept of relative efficiency and a method of combined quantitative and qualitative methods that consider the effect of qualitative factors which quantitative model unable to determine, even it can seek for the optimal index weight distribution for each evaluation objects[7][19][20]. The model adapts different analytic requirements under various situations, including the CCR model, BCC model and SBM model, etc.

The DEA model can be regarded as a method of dealing with multi-objective decision problem that has multiple inputs (outputs as small as possible) and multiple outputs (input as larger as possible)[7][19][20]. It is certificated that DEA validity is equal to pareto that efficient solution of correlative multi-objective programming problem (or non dominated solution). Data envelopment analysis (DEA) can be seen as a kind of new method for statistical analysis. It estimated production frontier surface effectively according to a set of input-output observations[1][2]. Estimating the efficient production frontier in economics and econometrics usually use statistical regression and other statistical methods, these methods to estimate the production function show Inefficiency function instead of the actual frontier, because these estimations get results by confusing effective decision unit with the effective decision units[3][18]. This article will use the CCR model and super efficiency DEA model, to measure and evaluate WeChat mall enterprises marketing efficiency, the form of specific mathematical model as shown below:

The CCR model mathematical form as follows:

$$\min \theta = V_{D_1}$$

$$s.t. \begin{cases} \sum_{j=1}^{n} X_j \lambda_j + s^- = \theta X_0 \\ \sum_{j=1}^{n} Y_j \lambda_j + s^+ = Y_0 \\ \lambda_j \geq 0, j = 1,2,...,n, s^+ \geq 0, s^- \geq 0 \end{cases} \quad (1)$$

The super efficiency DEA model mathematical form as follows:

$$\min[\theta - \varepsilon(\sum_{i=1}^{s} s_i^- + \sum_{r=1}^{s} s_i^+)]$$

$$s.t. \begin{cases} \sum_{\substack{j=1 \\ j \neq k}}^{n} X_{ij} \lambda_j + s_i^+ \leq \theta X_0 \\ \sum_{\substack{j=1 \\ j \neq k}}^{n} Y_j \lambda_j - s_r^+ = Y_0 \\ \lambda_j \geq 0, j = 1,2,...,n, s_r^- \geq 0 \end{cases} \quad (2)$$

CCR model is a kind of ideal efficiency research methods that mainly used to research the relative efficiency of decision making units with multiple inputs and multiple outputs and can also study decision making unit scale and technical efficiency. To consider it from production function perspective, this model is used to study with multiple inputs, especially with multiple

outputs "manufacturing" and as the "scale" and "technical efficiency" of the ideal and effective method[5][6]. And super efficiency DEA model is based on the CCR model to determine more accurate comprehensive efficiency value of DEA[8]. As choice of WeChat malls under the same conditions is limited, so the context applies the super efficiency DEA to calculate the effective decision making units' related efficiency value, in order to solve the problem that decision making units is less.

For WeChat mall enterprises, the economic meaning of DEA efficiency: when $\theta = 1$, $s^+ = 0$, $s^- = 0$, then the WeChat mall enterprises have DEA effective. Namely in the case of the current input, the output obtained relative optimal among n DMU; When $\theta = 1, s^+ \neq 0$ or $s^- \neq 0$, then the WeChat mall enterprises has weak DEA effective, means that to adjust one or more input index of the enterprises, the DEA relative efficiency still keeps relative optimal; When $\theta < 1$, the WeChat mall enterprises show that DEA is invalid. Namely the WeChat mall neither reached technology effectively nor reached in scale, which need to increase or decrease input indexes by slack variable to reach the relative optimal.

<p align="center">RESEARCH METHODOLOGY</p>

Selection of DMU

WeChat mall is an e-commerce system researched and developed based on WeChat, and it is also a shopping system that is the integration of a traditional internet, mobile e-commerce, WeChat, EasyChat. As a new trading platform compared with the traditional marketing, WeChat malls have many different choices for users in various respects about marketing strategy and cannot use traditional 4C (customer, cost, convenience, and communication) model to evaluate, also the study of network marketing tools haven't known as the standard model. Therefore, by reading a lot of literature and expert interviews and so on, understanding and analyzing present situation of WeChat mall enterprises marketing strategy, the WeChat malls' marketing strategies are summarized as interface strategy, price strategy, brand strategy, channel strategy, customer service strategy, product strategy and promotion strategy and so on. This context integrates the current existing marketing theory, such as 4C, 4P (Product, Price, Place and Promotion), 4I (Interesting, Interests, Interaction and Individuality) and 4R (Relationship、Relevancy、Reward and Reaction)[27], according to the consumer experience perspective, BISP marketing system is constructed. As shown in figure 1:
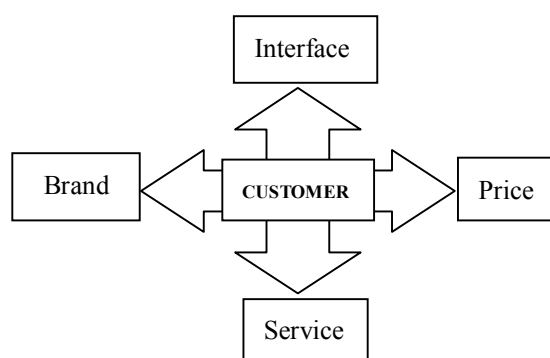

<p align="center">Figure 1. BISP marketing system</p>

Evaluation Index System and Evaluation Standard

Evaluation Index System

Interface strategy. Most mobile e-commerce are directly transplanted from computer terminal, such as Jingdong, Dangdang and some other famous e-commerce companies. It's goods, store, trade process and service tools are all done by electric business platform independently, enterprises can accomplish all commodity exhibition and trading via their cellphone, and don't need to depend on any third-party platform basically. However, WeChat malls just provide user information for enterprises, trading systems and service tools are all depend on third-party platform, and need to set up on the third-party platform. Users can see the web page which has the function of browsing that turned the original chat tools. At the same time, the page content is the medium of communication for businesses and customers. To some extent it works more than physical, a beautiful virtual store

that can express goods information well is the key to success for WeChat mall enterprises.

There are many indicators that can measure the input of WeChat mall enterprises on interface strategy, such as, information services, platform construction, page design and maintenance of product information. The use of the third-party platform for WeChat malls, makes it possible for personalized settings and operations. And it not only provides more opportunities for the third-party service providers, but also provides more choices for consumers.

Price strategy. In the era of information explosion, consumers can know all prices of the same product from different businesses through a variety of ways, so the network marketing strategy becomes more and more important. Price strategy is a direct contest between the cost and price to guide consumers to make a choice through a lower price is a wise measurement. In addition, the competition is very fierce, the price which the businesses proposed should be modified in time, and even they develop automatic price modification system, to reduce the cost. Merchant adjusts the price according to changes in market supply and demand situation and the price is showed by the competition of businesses. Therefore, the price of the mall enterprises in terms of price strategy inputs can be mainly to markdown amplitude and price adjustment frequency to represent.

Brand strategy. In the era of rapid network development, the brand has become an important tool for the company to win the market. Brand is an invisible belief, it includes the name of the brand, packaging, brand story, reputation and style and so on. Brand is also different from customers' experience by using company's products and different practical experience of themselves. It is the invisible property of the enterprises resource and it has a certainly personality and exclusive. Brand owners can constantly gain profits by virtue of the brand, brand is unique after registering or applying for a patent, and once the purchaser recognized, it will quickly form a brand trust, deepen its specificity. Therefore, this article measures brand strategy input of the mall enterprises is divided into brand name, visual signs, brand commitment and brand personality.

Customer service strategy. Economy is following the changes of the times to change and transform. The economy that based on industrial transform into the economy that based on the center of network, the users' experience has shown more and more important economic value. Customer service has become one of the most important and commonly core measures and profit methods for many companies. In the era of e-commerce, the buyer's market has occupied a superior identity in the whole market. Processing of consume and special needs has changed gradually, the demand and shopping ideas also have shown a new trend. Customer service as a marketing strategy has played a important role to understand and meet customer needs, improve customer experience and integrity, achieve product differentiation, enhance product quality, develop new market opportunities, coordinate the common interests between customer and company, and enhance the company competitive power and so on.

The idea of network customer service strategy is: using online customer service tool FAQ page to provide related products, companies information; using email for online businesses and consumers to exchange and interact; electronic customer relationship management also has been used in some large enterprises, it will guide customers into marketing management and integrate into the group of companies. Interacting with customers to understand customers' needs and timely solve customers' demands. This idea is not unilateral, but forms a closed loop with four aspects and influences each other. As shown in figure 2:
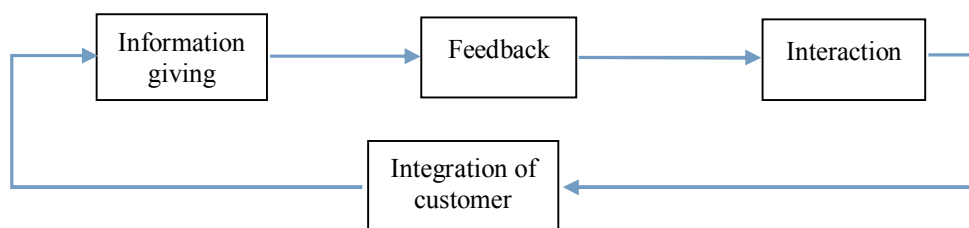

Figure 2. Network customer service strategy

Therefore, the measure of customer service strategy in the mall enterprises mainly divided into FAQ page details, community interaction, customer service system and customer resource integration.

Output variable quantities are mainly composed of browse, collection, concern and purchase and other consumer behavior data, for example, sold items in the following 3 months. Therefore, sales volume, the counts of that have been browsed and collected have become the main output variables. Combined with the characteristics of DEA method, the enterprises' marketing strategy choice problems compare with typical multiple inputs and multiple outputs performance evaluation to evaluate WeChat mall enterprises marketing efficiency and analyzing methods of improvement.

Summary above analysis that based on WeChat mall enterprises marketing strategy to determine the marketing strategy that used commonly, and we found the measure of mall enterprises input standards in each strategy, as specified in Table 1 below:

Table 1. WeChat mall enterprises marketing efficiency evaluation index system

Index	Category	Specific indicators
Input index	Interface strategy	page design
		product information
	Price strategy	markdown amplitude
		price adjustment frequency
	Brand strategy	brand name
		visual signs
		brand commitment
		brand personality
	Service strategy (customer)	FAQ page details
		community interaction
		customer service system
Output index		Sales volume
		Number of collections
		Number of good comments

Index Evaluation Standard

Through analyzing indicators of marketing strategy, we extracted its second class indicators, and through the expert scoring (except price strategy), then getting the weight of corresponding indicators, to establish a set of indicators evaluation criteria.

Price strategy mainly depends on markdown amplitude, calculation method is to firstly calculate commodity prices from different WeChat malls, sales price is taken directly from the product page. When merchant provides discount among the quantity of goods, we use discount divided the quantity of the goods, and then minus the real logistics costs. If there is a different logistics price, we use the simple average method. For example, mask price of one merchant is 699 yuan, surface mail for 5 yuan, expressage for 10 yuan, expressage with long distance for 15 yuan, the finally commodity price is 709 yuan (699+ (5+10+15) /3=709), In the end, using the highest price minus the price of calculation to obtain markdown amplitude.

Two indicators of interface strategy is the degree of rich in content and the degree of beautiful page to synthesize the evaluation, as shown in Table 2:

Table 2. Interface strategy rules in details

First class indicator	Second class indicator	Weight	Detailed grading rules
the degree of rich in content	whether integrate basic information or not	0.1	Not integrate for 0 point, integrate for 1 point
	the degree of rich in character	0.2	Less text description for 0 point, more description for 1 point
	the degree of rich in picture information	0.2	Less picture information for 0 point, the more for 2 points, general for 1 point
	the overall consistency	0.3	Mainly inspect color,background and the location of function module and so on
the degree of beautiful page	the degree of beautiful picture	0.2	Picture has the phenomenon that there is an obvious deformation, color is not harmonious, not clear, even theft online picture, for 0 point.picture is clear and nice for 2 points, general for 1 point

The measure indicators of brand strategy contain the brand name, visual signs, brand commitment and brand personality. The evaluation scale as shown in Table 3:

Table 3. Brand strategy rules in details

First class indicator	Second class indicator	Weight	Detailed grading rules
Brand name	Principle for easy to read and remember	0.1	Easy to read and remember for 1 point, otherwise for 0 point
	Principle for enlightenment and imagination	0.1	Enlightenment and imagination for 1 point, otherwise for 0 point
	Principle for strong applicability	0.2	Adapt to the market environment well for 2 points, not applicability for 0 point, general for 1 point
Visual signs	Whether to form more specific, perceptible image memory for consumers or not	0.2	Mark and bright, form knowledge memory for 2 points, not form bright image memory for 0 point, general for 1 point
Brand commitment	Whether to let consumers have feelings on products or not	0.1	Have their own brand promise,produce feelings for 1 point, otherwise for 0 point
Brand personality	Whether to form their own brand style or not	0.3	Mainly inspect the degree of the brand trust for consumers

The measure indicators of customer service strategy contain FAQ page details, community interaction, customer service system and other indicators. The evaluation scale as shown in Table 4:

Table 4. Customer service strategy rules in details

First class indicator	Second class indicator	Weight	Detailed grading rules
FAQ page details	Whether company information is clear or not	0.1	Detailed introduction for 1 point, otherwise for 0 point
	Whether product information is enrich and authority or not	0.2	Product introduction is rich and persuasive for 2 points, no introduction for 0 point, general for 1 point
Community interaction	Whether active and positive about content	0.2	Active community interaction and high response rates to post for 2 points, inactivity for 0 point, general for 1 point
	Whether community management orderly or not	0.1	Community management orderly and posting abide by the rules for 1 point, otherwise for 0 point
Customer service system	The speed of response to consumers	0.1	Response quickly for 1 point, slowly for 0 point
	The attitude to solve the problem	0.1	Good service attitude for 1 point, bad attitude for 0 point
	Competence in solving problems	0.2	Be promptly and efficiently solve the problem of consumers for 1 point, otherwise for 0 point

Data Collection

There are massive open data sources on the open media platform, and the public satisfaction estimate which is developed by third party companies are emerging in an endless stream, and for the closed WeChat, we can't do anything about it at present[30]. The problem is that it has more difficult in WeChat than microblog and other media platform to evaluate marketing efficiency because of underdevelopment of the data source. Therefore, the data are collected by manual operation that focused on the designated WeChat malls and collected the relevant indicators of the malls every month. WeChat malls springed up in early 2014, it had rapid development in the 2 years, but the development is uneven in all walks of life, and WeChat malls quantity are limited that has output data, so WeChat malls can not classify to analysis by industry or other standard. We searched WeChat malls through the search function, the first ten WeChat malls that has output data are selected as the analytical samples, it is also a certain representativeness. It includes Karin Christian official mall, Jingdong shopping mall, Gome online mall, Choiskycn official mall, Zhang Shi mall, VANCL official mall, Three squirrels official mall, Suning mall, Hot mom school mall and Haier mall. With these ten WeChat malls as the research object, through the ten WeChat mall enterprises marketing efficiency evaluation results, we analyzed the existing problems and putted forward countermeasures and suggestions. Collected and concluded the data of the ten WeChat mall enterprises and got the list of the original data as shown in Table 5.

Table 5. The original data in WeChat mall

Mark	Name of enterprises	Order record	Number of good comment	Number of been collected	Original price (yuan)	Adjusted price (yuan)	Price adjustment frequency
A	Karin Christian official mall	5305	2457	3301	398	119	4（↓）
B	Jingdong shopping mall	56875	41252	8900	299	129	4（↓）

C	Gome online mall	5327	4918	87	319	165	4（↓）
D	Choiskycn official mall	1608	17	5	234	195	2（↓）
E	Zhang Shi mall	2	1	1	299	194	2（↓）
F	VANCL official mall	304	240	57	249	168	2（↓）
G	Three squirrels official mall	1209	29	1	190	99	4（↓）
H	Suning mall	25789	8812	880	224	159	4（↓）
I	Hot mom school mall	1348	477	73	219	119	2（↓）
J	Haier mall	409	330	52	159	139	1（↓）

The input and output data of the decision making unit are obtained as shown in Table 6 after disposal data. The data concluding sum of the degree of rich in content and the degree of beautiful page, sum of the degree for brand and sum of customer service satisfaction and so on are obtained according to investment strategy of the standard rules, using Likert table, and making the questionnaire that is graded by consumers, finally to calculate the weighted average.

Table 6. Input/output data of Decision making unit

DMU	y_1	y_2	y_3	x_1	x_2	x_3	x_4	x_5
A	5305	2457	3301	279	4	5	6	5
B	56875	41252	8900	170	4	6	8	6
C	5327	4918	87	154	4	3	7	1
D	1608	17	5	39	2	4	6	4
E	2	1	1	105	2	3	6	5
F	304	240	57	81	2	1	4	1
G	1209	29	1	91	4	4	8	4
H	25789	8812	880	65	4	5	8	1
I	1348	477	73	100	2	3	4	5
J	409	330	52	20	1	5	8	1

The output variables are:

Y_1 is the total sales volume;

Y_2 is number of good comments;

Y_3 is collected number.

The input variables are:

X_1 is markdown amplitude;

X_2 is price adjustment frequency nearly 6 months ;

X_3 is sum of the degree of rich in content and the degree of beautiful page;

X_4 is sum of the degree for brand;

X_5 is sum of customer service satisfaction.

Results and Analysis

According to the original data of evaluation objects, we used deap2.1 software computing DEA efficiency for evaluating objects. To effective decision unit in the traditional DEA models, we used the ems1.3 software to future calculate super efficiency values of evaluation objects, then to determine the relative ranking position. Calculated results are shown in Table 7:

Table 7. DEA validity evaluation results

DMU	Comprehensive efficiency	Pure technical efficiency	Scale efficiency	Returns to scale	Conclusion	Comprehensive super efficiency	Rating
A	0.495	0.911	0.543	irs	Invalid DEA	0.495	4
B	1	1	1	-	Valid DEA	5.809	1
C	0.627	1	0.627	irs	Invalid DEA	0.627	3
D	0.109	1	0.109	irs	Invalid DEA	0.109	5
E	0	0.857	0	irs	Invalid DEA	0	10
F	0.038	1	0.038	irs	Invalid DEA	0.038	8
G	0.038	0.648	0.059	irs	Invalid DEA	0.038	9
H	1	1	1	-	Valid DEA	2.721	2
I	0.047	1	0.047	irs	Invalid DEA	0.047	7
J	0.068	1	0.068	irs	Invalid DEA	0.068	6
$\overline{X}$	0.342	0.942	0.349				
SD	0.469	0.115	0.407				
Max	1	1	1				
Min	0	0.648	0				

Note: The comprehensive efficiency refers to the technical efficiency not considering the returns to scale ; Pure technical efficiency is the technical efficiency considering the returns to scale; Scale efficiency has consider the returns to scale and comprehensive efficiency value(EC) = pure technical efficiency value (PE)* scale efficiency value(SE). Among them, the comprehensive super efficiency value of decision making units F and G are 0.0384 and 0.0382. The result is consistent with retaining 3 decimal places, so the decision making unit F is still ranked in the front.

The results of DEA validity evaluation are included in Table 7, it showed that only Jingdong Mall and Suning mall input efficiency value reached to 1, it indicated that the choice of marketing strategy input in the two malls is valid, and the other eight malls investment efficiency can't meet the frontier, are in an invalid state. The average value of the relative efficiency is only 0.342, which shows that the marketing strategy efficiency of WeChat malls are generally low. Choiskycn official mall, Zhang Shi mall, VANCL official mall, Three squirrels official mall, Hot mom school mall and Haier mall have below the average value, standard deviation is 0.469, it indicates that investment efficiency of WeChat mall marketing strategy has great differences. From the results of super efficiency data analysis show that relatively speaking, Jingdong mall and Suning mall are identified for effective decision making units in the traditional DEA model, super efficiency values of Jingdong mall is 5.809, however, super efficiency values of Suning mall is 2.721. They have reached the optimum, but the marketing efficiency of Jingdong mall is more efficient than suning mall. However, Jingdong mall, Suning mall and Haier mall all with strong brand effect, has appeared big differences, why? For WeChat malls, the brand is not the only magic weapon in marketing, interface strategy, price strategy and customer service strategy also need to reach a certain proportion of investment to get the final profit.

The comprehensive efficiency is decomposed into pure technical efficiency and scale efficiency, and we can find the reasons for inefficiency by comparing the pure technical efficiency and scale efficiency of decision making units. Pure technical

efficiency is the efficiency of the system and management level, scale efficiency can be explained that whether WeChat mall is suitable for the current scale of investment or not. Table 7 shows that the average of pure technical efficiency is 0.942 and the standard deviation is 0.115. It shows that the majority of WeChat malls' system and management efficiency level are generally high, and it is not the cause of decision making units' inefficiency. Among them, there are seven WeChat malls that the pure technical efficiency value is 7 and the lowest pure technical efficiency value is Three Squirrels official mall. It also indicated that Three squirrels official mall needs to be strengthened in system and management level. The average of scale efficiency is 0.349 and the standard deviation is 0.407. It shows that there are invalid investment scales in WeChat malls, and there is a big difference in scale efficiency among these malls. In WeChat malls that comprehensive efficiency value is less than 1, the pure technical efficiency value of Gome online mall, Choiskycn official mall, VANCL official mall, Hot mom school mall and Haier mall is equal to 1, in other words, the reasons that the five WeChat malls hadn't reach fully effective mainly are marketing investment scale inefficiency. The scale of rewards shows that WeChat malls that hadn't fully met the efficiency are in stage of the increasing scale of rewards. So we improve the marketing investment scale and investment structure in WeChat malls, to improve WeChat malls marketing investment efficiency. Obviously, compared with Jingdong mall and Suning mall, Haier mall also have a strong brand effect but fall behind caused by its marketing size. And the emerging brand WeChat malls such as Three squirrel official mall and Choiskycn official mall won the favor of consumers with the reasonable investment in marketing strategy.

Compared to ten WeChat malls with input redundancy and output deficiency, the results shown in Table 8:

Table 8. The input redundancy and output deficiency in WeChat mall

DMU	Output deficiency			Input redundancy				
	S_1^-	S_2^-	S_3^-	S_1^+	S_2^+	S_3^+	S_4^+	S_5^+
A	15789.87	12843.32	0	74.92	0.49	0.25	0	0.25
B	0	0	0	0	0	0	0	0
C	5729.62	0	653.91	67.3	1.05	0	1.46	0
D	0	679.01	96.62	0	0	0.16	0.22	0.35
E	4.39	3.64	0	0	0	0	0	0
F	60.26	24.2	0	2.02	0.05	0	0.1	0
G	0	737.72	153.04	0	0.04	0	0.09	0.04
H	0	0	0	0	0	0	0	0
I	0	500.72	137.94	0.71	0	0	0	0.09
J	45.98	0	19.2	0	0.04	0.29	0.48	0.02

From the Table 8 can be seen, most of WeChat malls have the status of input redundancy and output deficiency. In price investment strategy, six WeChat malls that haven't fully achieved effective are redundant, especially Karin Christian official mall, Gome online mall and VANCL official mall; In page investment strategy, Karin Christian official mall, Choiskycn official mall and Haier official mall have input redundancy; In brand investment strategy, Gome online mall, Choiskycn official mall, VANCL official mall, Three squirrels official mall and Haier mall have redundancy in some degree; In customer service investment strategy, Karin Christian official mall, Choiskycn official mall, Three squirrels official mall, Haier mall and Hot mom school mall also have input redundancy. To summary, WeChat malls marketing investment elements are not so fully utilized that caused lower comprehensive marketing efficiency, marketing investment structure needs to be improved.

According to the data, we can also find that the marketing investment of most WeChat malls has output deficiency problems and needs to be further improved. Karin Christian official mall, Gome online mall and VANCL official mall should be adjusted in price strategy. Haier mall, Karin Christian official mall and Choiskycn official mall have redundant in interface strategy, it

should be adjusted investment proportion. And Haier mall, Gome online mall, Karin Christian official mall, VANCL official mall and Three squirrels official mall also need to adjust in customer service strategy, to achieve the optimal investment proportion. Among them, Haier mall and Gome online mall also need to fully use its brand strength, adjusting the structure of marketing investment, to improve output deficiency problem. Anyway, according to the empirical results, the proportion of investment of Jingdong mall and Suning mall is optimal in the price strategy, interface strategy, brand strategy and customer service strategy, and they also have obtained the certain marketing results. The other eight malls are required to improve the investment proportion in their marketing strategies according to the obtained slack variables, to improve marketing efficiency and enhance the mall sales.

CONCLUSIONS AND FUTURE WORK

This study contributes to both theory and practice. It is the very first time that DEA method is used to evaluate marketing efficiency in WeChat. All of first, we obtained the corresponding evaluation index system through the analysis of various marketing strategies of WeChat malls. We took interface strategy (page design, product information), Price strategy (markdown amplitude, price adjustment frequency), Brand strategy (brand name, visual signs, brand commitment, brand personality), Service strategy (FAQ page details, community interaction, customer service system) as input indexes, and output indexes include sales volume, number of been collected and number of good comment. By building an input-output system based on DEA model, we provide the theoretical framework to evaluate marketing efficiency of WeChat mall enterprises. Secondly we offer super efficiency model to make further comparison of the effective decision unit, and input redundancy and output deficiency were analyzed to find out the reasons restricting WeChat mall enterprises' marketing efficiency. Finally, we got the following conclusions and recommendation.

According to the final data results, our study shows that there are two WeChat mall enterprises achieved fully DEA effective, the average of comprehensive efficiency is only 0.342, which shows that the marketing strategy efficiency of WeChat malls is generally low. Standard deviation is 0.469, it shows that there are great differences in investment efficiency of WeChat malls marketing strategy. According to the comprehensive efficiency evaluation results, marketing efficiency of WeChat malls is low and the actual reason is the scale efficiency, in other words, low scale efficiency is the main factor to restrict WeChat mall enterprises marketing efficiency. The situation analysis of scale of rewards shows that WeChat mall enterprises are almost in increasing scale of revenue stage, which is correspond with the characteristics of WeChat malls, such as flexible personalized settings, high sociality and strong closure. According to above conclusions, to effectively enhance the marketing efficiency, the WeChat mall enterprises should improve marketing investment structure and find suitable marketing schemes according to their own characteristics and advantages. As a result, these enterprises will obtain greater benefits and promote economic development.

As with any study, there are several limitations that present opportunities for future research. Although our sample of ten WeChat malls is sufficiently diverse to support our results, future studies could sample a larger set of WeChat malls in order to confirm that our results hold. Second, any theories and methods are constantly developing and perfecting, so are the methods here that proposed in this paper. The indicators of our study in the evaluation system are limited to only four strategies, because some cognition limitations may cause the deviation of evaluation results. In addition, are the models effective for any network platform for evaluating marketing strategy? These problems need to do further exploration and study.

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