Research on the E-commerce of Agricultural Products in Sichuan Province

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ABSTRACT: *A detailed investigation on the production, processing and sales of Sichuan agricultural products was made. Issues like how to bring into full play the regional advantages of Sichuan agricultural products and how to promote the advantageous resource allocation and competitiveness of agricultural products in market economy were also probed. Suggestions and schemes for the e-commerce service system of Sichuan agricultural products were proposed through the analysis framework of fuzzy comprehensive evaluation method and improved D&M model.*

Categories and Subject Descriptors:
I.5 [PATTERN RECOGNITION] Fuzzy set **K.4.4 Electronic Commerce**

General Terms:
E -Commerce, Fuzzy network

Keywords: Agricultural Products, E – commerce, Logistics Information Platform

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1. Introduction

Sichuan, a major agricultural and populous province in China, occupies a favorable position in the national market of food, oil, pigs, Chinese herbal medicine, silk, fruit, etc. However, the farmers' income suffers a slow growth with changes of the supply-demand in the national agricultural products market, and Sichuan agriculture faces a severe situation because of such limits as "*green barriers*" and "*technical barriers*" in the international market [1].

7 areas, where agricultural production is relatively concentrated, were selected including Hanyuan, Shimian, Chongzhou, Pengzhou, Dujiangyan, Shifang, Mianzhu, and a detailed survey on the agricultural production scale and the operating condition in those areas was made; the agricultural products cost from production to transportation as well as other operation links were found to be very high. In addition, though these regions cover the main agricultural products sales markets in Sichuan province, the transportation costs are high, thus exerting an unfavorable influence on the marketing and distribution of agricultural products. More than 30% of the agricultural product marketing and distribution links have no relatively stable channel, resulting in big fluctuations of the market sales share with instable profit each year. Owing to the weak competitive power of Sichuan agricultural products in the market, it becomes an urgent task to seek an effective scheme in a relatively short period of time so that a way for the development of Sichuan agricultural products can be worked out.

As an advanced kind of business model, e-commerce promotes the transformation of the world economy. Researches on the e-commerce of agricultural products have attracted the attention of many scholars both inside and outside China. However, most of them focused on the e-commerce of agricultural products in the developed areas, which relied on the existing information platform as well as well-developed logistic and marketing modes. There are few relevant researches concerning Sichuan province which is characterized by scattering and mountainous production regions of agricultural products. Based on the production status of agricultural products in Sichuan province, this paper undertakes to analyze the difficulties of introducing e-commerce and its

implementation approaches. Consequently, new schemes are proposed to improve agricultural production and circulation, increase the market information and solve the common problems such as high cost, small market range, multi-links and backward market function [2] [3].

2. Evaluation Model

E-commerce of agricultural products could not be accomplished in one step, especially for the small and scattered agricultural production. In the process of establishing e-commerce, targeted vulnerabilities should be found out, divided and conquered. But, how can e-commerce be introduced into Sichuan agricultural production? What could be the weak points in the agricultural production, processing and marketing? All of these require a comprehensive understanding and a scientific evaluation of the whole process from production to marketing of Sichuan agricultural products.

As early as 1992, Delone & Mclean put forward an advanced information system effectiveness model (D&M Model) to evaluate the success of the information system. After years of revision and research together with many scholars' suggestions, an improved D&M model was proposed in 2003, which is suitable for the assessment of e-commerce implementation. Two measure dimensions, the service quality and the net interest, were added to the improved model, and six variables in the e-commerce environment, namely, the system quality, information quality, service quality, application, user satisfaction, net income were redefined. Thus, a more effective evaluation model was created.[4] At present, most researchers still follow the index system and method of Delone & Mclean Model research about the implementation of e-commerce, as is shown by figure 1.

According to the improved D & M model, the six measuring aspects are as follows: system quality can be measured by its applicability, reliability and response time; information quality can usually be evaluated by integrity, individuality, relevance, comprehensibility and safety, etc; service quality, one of the factors for e-commerce, is particularly important, and it is usually quantified by the degree of the users' needs, satisfaction, response efficiency, etc; applications can be measured by the goal of use, users browse mode in the system, the accessibility to the website and the trading number, etc. The users' satisfaction is a kind of feeling, the measurement of which has certain fuzziness itself, and usually covers the whole process of customers' usage of the system. The index is measured by the customer survey, the proportion of loyal customers, the website revisit rate, and the repurchase rate; net income is the immediate factor for the success of e-business, and it is reflected through cost savings, market expansion, time saving, product searching and cost reduction. [5]

3. Evaluation Methods

There are many theories and applications of the modern comprehensive evaluation method. According to the principle of evaluation purpose matching method as well as the statistical data, the fuzzy comprehensive evaluation method was chosen. Based on the fuzzy mathematics, fuzzy comprehensive evaluation method applied the principle of fuzzy relation synthesis to quantify some uncertain factors, and then made a comprehensive evaluation via multiple factors. It is widely used because of its good evaluation effect in handling complex problems with multi-factors and at multi-levels. [6]

3.1 Evaluation Factors and Levels

According to the improved D&M model and the decomposition of the six specific measurement items, a questionnaire on the features of agricultural production in Sichuan was designed and employed in those above-mentioned seven areas. Fifteen important agricultural production bases were selected from each area and a survey was carried out among 36 agricultural products processing enterprises with a total number of 7502 people involved, among whom 1052 were mainly production workers, 525 technicians, 565 in management, and 5360 other ordinary employees. Each questionnaire was distributed to the main production workers, staff of senior management, technicians, staff of general management and other employees. A total number of 229 questionnaires were issued and 229 were returned. The questionnaire focused on product production, processing and sale [7].

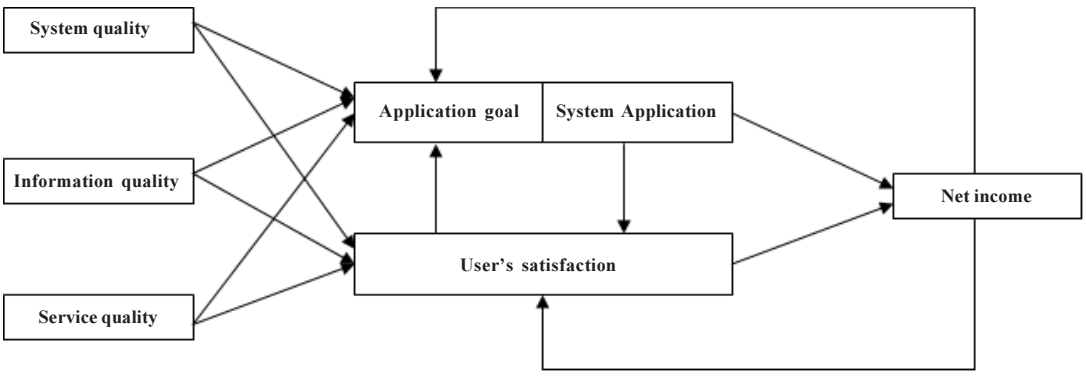

Figure 1. The improved D & M model

The first level index	The second level index
Agricultural products production	Production managers' ability of e-commerce U1
	Files construction of agricultural products production information U2
	Cost control plan for the concentrated production U3
Agricultural products processing	Enterprise managers' ability of e-commerce U4
	Construction of e-commerce system in the agricultural products processing U5
	Competitiveness U6
Agricultural products sales	Information communication in sales channel U7
	Logistics cost control U8
	Service quality U9

Table 1. Evaluation index for agricultural e-commerce implementation through D&M model

Note: this table only contains the secondary indexes owing to the limited space and the tertiary indexes are not listed. The evaluation items and weightings were concluded through related research data and analysis of the questionnaire. The evaluation matrixes of the secondary indexes were concluded through analysis of all the data collected.

3.2 Hierarchical Comprehensive Evaluation

$U = \{u1, u2, \ldots\ldots, um\}$, are the nine factors depicting the evaluated object (namely, evaluation index);

$V = \{v1, v2, \ldots\ldots, vn\}$, are the different states depicting each factor (namely, evaluation level: 5 grades from void, weak, ordinary, good to excellent);

A general evaluation data collection was constructed by evaluating the above m factors respectively according to the stipulated n levels, and an evaluation matrix R by $m \times n$ was constituted.

$$R = (r_{ij})_{m \times n} \begin{bmatrix} r_{11} & r_{12} & \ldots. & r_{1n} \\ r_{21} & r_{22} & \ldots. & r_{2n} \\ \ldots. & \ldots. & \ldots. & \ldots. \\ r_{m1} & r_{m2} & \ldots. & r_{mn} \end{bmatrix}$$

Evaluation model: $R = A \circ R$

(A refers to the weighting for each evaluation index, the mean value of which was obtained through gathering the data of the questionnaire, and evaluation matrix R was finally constituted.)

Evaluation model was used to calculate separately the index for the production, processing and sales of agricultural products so as to obtain the value of the comparative matrix B:

The managers' ability of e-commerce $B1$:

$$B_1 = A_1 \circ R_1 = (0.15, 0.1, 0.15, 0.15, 0.15, 0.15, 0.15)$$

$$\begin{pmatrix} 0 & 0.1 & 0.5 & 0.3 & 0.1 \\ 0.03 & 0.1 & 0.4 & 0.37 & 0.1 \\ 0.3 & 0.3 & 0.3 & 0.06 & 0.04 \\ 0 & 0.2 & 0.4 & 0.3 & 0.1 \\ 0.3 & 0.6 & 0.06 & 0.04 & 0 \\ 0.3 & 0.3 & 0.3 & 0.1 & 0 \\ 0.2 & 0.5 & 0.2 & 0.1 & 0 \end{pmatrix}$$

B1=(0.168, 0.31, 0.304, 0.172, 0.046)

Similarly, the agricultural products processing B2 was calculated:

B2 = (0.29, 0.28, 0.68, 0.09, 0.02)

Cost control plan for the concentrated production B3:

B3= (0.039, 0.318, 0.4165, 0.19, 0.0365)

The managers' ability of e-commerce B4:

B4 = (0.09, 0.178, 0.308, 0.3, 0.124)

The ability to construct E-commerce system in the agricultural products processing B5:

B5 = (0, 0.1055, 0.318, 0.393, 0.1835)

The competitiveness of agricultural products processing enterprises B6:

B6 = (0.045, 0.09, 0.203, 0.304, 0.358)

The ability to establish agricultural products sales channels B7:

B7 = (0.172, 0.231, 0.349, 0.162, 0.116)

Cost control ability of the logistics B8:

B8 = (0.1848, 0.3498, 0.3267, 0.1056, 0.0231)

Service quality of the agricultural products sales B9:

B9 = (0.0105, 0.252, 0.3525, 0.2825, 0.1015)

The 5 evaluation levels (void, weak, ordinary, good, excellent) were marked respectively with the number from 1 to 5 and each evaluation data were converted proportionally to get the final comprehensive evaluation data for the operating conditions of the production, processing and sale at the first level index: 2.9633, 3.6126, 2.8329. The comprehensive evaluation data at the secondary index are as follows: production (2.618, 3.35, 2.867), processing (3.19, 3.6545, 3.84) and sale (2.909, 2.4024, 3.2095).

4. Conclusion

4.1 Data Analysis

From the above calculation results, it can be seen that the respective indexes of agricultural production, processing and sales are 2.9633, 3.6126, 2.8329 respectively, which shows that the sales are the weakest followed by the production. When the sales were analyzed, three major factors, namely, sales channels, logistics costs and service quality were considered. The calculation indexes of the three are 2.909, 2.4024, 3.2095 respectively, from which it can be seen that the logistics are a great loss in the marketing followed by the weak ability to analyze and investigate the optimal sales market. This can directly affect the income of the farmers in the product production. According to the calculation data above, the producers' ability to participate in e-commerce, build the file of agricultural production information, and centralize production and control cost was analyzed. The calculation indexes of the three are 2.618, 3.35 and 2.867 respectively from which it can be seen that producers have the weakest capacity for e-commerce, and they are severely lacking in the consciousness and ability to make use of the e-commerce so as to obtain information for production decisions and consequently solve production problems.

4.2 Conclusion

According to the results of analysis and evaluation about the agricultural products, the efficiency of production, processing and sales in Sichuan province need to be improved by taking the following steps: Firstly, an independent agricultural e-commerce platform must be set up and supervised by the government. This is the best and fastest way toward e-commerce given a lack of fund and technical support shortage [8]. Secondly, with such an e-commerce platform, a strong network for agricultural product trade shall be established, which includes agricultural products demand information, price information, logistics and distribution, and the agricultural resource information, etc. The medium and long term market analysis and forecast shall be conducted by utilizing information local resources. The real-time information not only covers the regional agricultural production sales situation, but it also includes the surrounding areas, provinces and cities, and even the whole country. Thirdly, now that food safety has become the focus of attention from the current market demand of the agricultural products, a complete information and supervision system must be established in the whole process, and this becomes the key point in building the quality guarantee system of agricultural product production, processing and marketing. Consequently, the market competitiveness of agricultural products can be enhanced and favorable conditions for the integration of production, processing and sales of agricultural products can be created [9].

As is mentioned above, the sales of agricultural product are the weakest with the largest loss in logistics; therefore, the agricultural products logistics information platform of Sichuan province must be fully utilized in order to reduce logistics cost and a correct target market need to be chosen. Also, an advanced logistics information network shall be constructed so that the agricultural products logistics system can operate with real-time information. This is not only the basic condition to improve the operation efficiency of the whole system, but also the bridge and the link for operation of the logistics subsystems. Only through the optimization of logistics operation mode and information sharing mechanism as well as the integration of logistics supply chain, can the operating condition of agricultural products logistics in Sichuan province be effectively improved. At the same time, the rapid and transparent information exchange between agricultural production bases and market can be realized through a unified logistics information platform and an integrated supply chain, thus the types and the production of agricultural products can be more scientifically controlled by the producers and related departments, and a best target market can also be analyzed.

References

[1] Jingquan, Yu., Yanqiong, Li . (2009). Intra-industry Trade Empirical Analysis of Agricultural Production in Sichuan. *Journal of Southwest University of Science and Technology* (6) 62-67.

[2] Wuhu, Yan., Shuqin, Zhang. (2008).The Construction of E-commerce Mode Suitable for Chinese Agriculture. *Journal of Shanxi administration school* (22) 8-12.

[3]Xiaomei, Cheng. (2007). Agricultural E-commerce Development Research. *Journal of Northern Economy* (7) 14-17.

[4] Herong, Zhang., Xiaoling, Huang., Zhizhong,Xie. (2008). Research on Agriculture E-commerce Development Pattern in Fujian. *Agricultural Information Science*, (7) 467-472.

[5] Rongyu, Bai. (2009). Research on the Evaluations and Factors for the Successful Implementation of E-commerce. *Economic Forum*, (4) 124-126.

[6] Dong, Du., Qinghua, Pang., Yan., Wu (2008). Selected Modern Comprehensive Evaluation Methods and Cases (second edition). Beijing: Qinghua University Press, p. 34-61.

[7] Zenglei, Xi., Xianwei, Zheng., Lili, Feng (2010). Mechanism Research on the E-commerce Marketing of Agricultural Products. *Anhui Agricultural Science,* 38 (8) 4277-4278.

[8]Zhaohong, Wang. (2007). Modern Agriculture Constructs and the Fast Commercial Response Pattern Research. *Agricultural Mechanization Research* (11) 41-43.

[9] The Department of Market and Economic Information in the Ministry of Agriculture (2008). The Theory and Practice of the Traceability System Construction for the Quality and Safety of Agricultural Products. Chinese Agricultural Science and Technology Press, p. 20-24.

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