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Abstract. China is a large agricultural country, yet the development environment of E-business in China is not mature. E-Commerce of agricultural products is a revolutionary change of traditional agricultural economy. This paper focuses on agricultural products' electronic commerce in China. Firstly, the paper describes the current situation of electronic commerce. Afterwards, the paper uses Fuzzy Analytic Hierarchy Process (AHP) to analyze the factors hindering agricultural products' electronic commerce in China. Finally, it puts forward the countermeasures to promote the development of agricultural products' e-commerce.

Keywords: Agricultural products, electronic commerce (EC), Fuzzy Analytic Hierarchy Process (AHP).

1 Introduction

Research of agricultural products in electronic commerce (EC) can be dated back to 1970s in the United States. Then much attention comes from Japan, Netherland, etc [1]. China is a large agricultural country, yet the development environment of E-business in China is not mature. E-Commerce of agricultural products is not a simple substitution of traditional distribution way. It is a revolutionary change of traditional agricultural economy since agricultural products in E-Commerce need the electronic commerce system through producing, processing and selling. Moreover, information infrastructure, supporting facilities and talents are the key factors influencing agricultural products' E-Commerce.

2 Background of Agricultural Products' E-Commerce in China

The application of internet technology gives agricultural circulation a new life. Contrary to the traditional face-to-face trading in the agricultural products market, agricultural products' E-Commerce can integrate all kinds of resources. In recent

years, some agricultural e-commerce platforms are emerging in China, e.g. Shouguang county, Shandong province has set up E-Commerce service platform of vegetable future transaction, auction and exchange online. Shanghai Nongxin E-Commerce Co. Ltd. is operating a high-quality-agricultural-product ordering platform providing the door-to-door service for customer [2]. Nowadays the ministry of agriculture tries to help more and more peasants to utilize such advanced technology, e.g. website of Chinese agricultural information net, "one-stop-trade" and "online-exhibition-hall", to expand their market and increase their incomes.

3 Factors Influencing Agricultural Products' E–Commerce

There are many factors hindering e-commerce of agricultural products, but major factors is still on the debate [3]. With the development of network economy, E-commerce gradually turns to be significant trading patterns in the modern society. In order to mature such pattern, effective measures should be taken as soon as possible. Furthermore, the key factors should be found. Then use Fuzzy Analytic Hierarchy Process (AHP) to determine the influence of factors related to agricultural e-commerce.

3.1 Introduction of Fuzzy AHP

AHP proposed by American professor T·L·Saaty in 1980s is an evaluation and decision making method with qualitative and quantitative analysis. Fuzzy AHP based on AHP and the fuzzy method comprehensively analyzes every element in the system to find the best scheme. By fuzzy AHP the values to a 0-1 range are used instead of 1-9 nine evaluation methods to establish decision matrix [4]. The basic process is as follows:

(1) Firstly, draw analytic hierarchy chart based on the decision object.

Objective level——decisions among several plans

Criteria level——factors in decision making processing.

Scheme level——several alternatives

(2) Secondly, grade the scores.

According to the importance of each factor in criteria level with decision-making requirement, the weight vector is obtained:

$W=(w_1, w_2, \ldots w_5)$. $W_i \geq 0$, and $\sum_{i=1}^{s} W_i = 1$.

If $W_i=0$, it means that failure to take the factor into consideration in some situation.

Then, evaluation system can be established to make a comparison among chosen plans with every factor in criteria level.

Scoring vector of factor *i* in several alternatives can be achieved by making points within { 0, 1 } .

$P_i = (P_{i1}, P_{i2}, \ldots, P_{in}), i = 1,2,\ldots,s$.

P_i as Row *i* of a matrix to get an s × n matrix P and weight vector W as a 1 × s matrix. The scoring vector and weight vector can be called fuzzy sets in Fuzzy Mathematics, matrix is called Fuzzy Matrix.

(3) Thirdly, calculate the product of W and P to matrix multiplication. The result is a 1×n matrix A.

$$a_i = w_1 P_{1i} + w_2 P_{2i} + ... + w_s P_{si} = \sum_k^s w_k P_{ki}, i = 1,2,...n.$$

a_i is the final evaluation of Scheme *i* under the impact of factors *S*.

(4) Finally, carry out a strategic choice to the vector in the matrix A.

3.2 Main Factors Affecting Agriculture Products' E-Commerce

Figure 1 shows the structure of factors affecting agriculture products' E-Commerce. The first layer-objective level is the target, i.e. the result for such analysis. The second layer-criteria level, lists some main factors by the method of Delphi, they are transaction subject, object and platform, environment. And the third layer-scheme level, respectively presents each main factor in detail, e.g. for the transaction subject, subject cognition and information quality are considered, while for the transaction object, standard, brand and industrial and commercial level are considered, and for the transaction platform, information infrastructure and classification and normalization are considered, and for social environment, logistics level, transaction security, electronic payment, social credibility are considered. Afterwards, determine the weight of these factors in layer B accounting for layer A, then calculate the weight of factors in layer C accounting for layer B. Finally, obtain the affecting scores of each factor in layer C accounting for layer A.

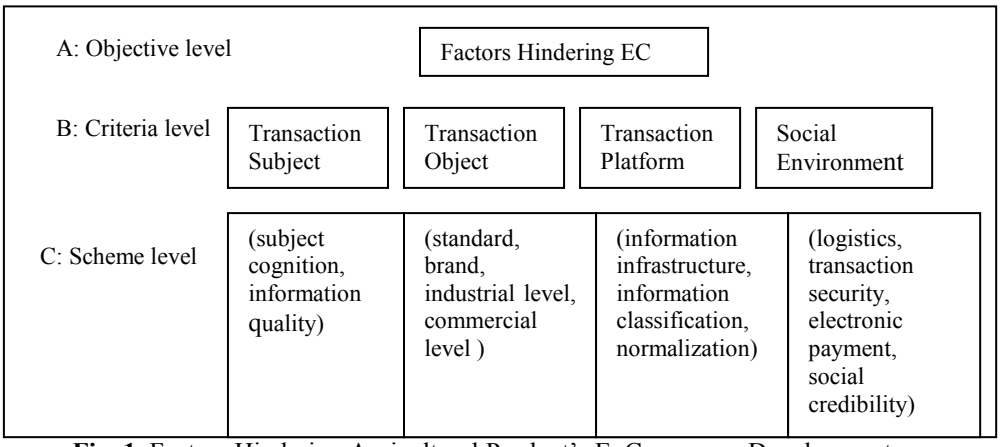

Fig. 1. Factors Hindering Agricultural Product's E–Commerce Development

Determine each factor's importance from 0 to 1 by comparison. The bigger the value is, the more important. Table 1 shows the fuzzy decision matrix [5].

Table 1. Value and Signification

Value	Signification
[0-0.1）	Compared with each other, one element is obviously less important than the other.
[0.1-0.3）	Compared with each other, one element is less important than the other.
[0.3-0.5）	Compared with each other, one element is slight unimportant than the other.
0.5	Compared with each other, elements both have the equivalent importance.
(0.5-0.7)	Compared with each other, one element is more important than the other.
[0.7-0.9）	Compared with each other, one element is greatly important than the other.
[0.9-1]	Compared with each other, one element is critically important than the other.

From the above, there are four elements in layer B:

B1= Transaction Subject

B2= Transaction Object

B3= Transaction Platform

B4= Social Environment

A decision matrix can be achieved according to the method of Delphi (see Table 2).

Table 2. Importance for elements of layer B

	B1	B2	B3	B4
B1	-	0.6	0.65	0.7
B2	0.4	-	0.6	0.65
B3	0.35	0.4	-	0.55
B4	0.3	0.35	0.45	-

$\because \mathrm{D} = \sum_{j=1}^{4} B_{ij}$, $F = \sum_{j=1}^{4}(\sum_{i=1}^{4} B_{ij})$, 且(i≠j).

$\therefore$ the weight of every element in layer B is w_i=D/F.

W_i^B = (0.325, 0.275, 0.217, 0.183).

In the same way, there are 13 elements in layer C.

C1= subject cognition

C2= information quality

C3= standard

C4= brand

C5= industrial level

C6= commercial level
C7= information infrastructure
C8= information classification
C9= normalization
C10= logistics
C11= transaction security
C12= electronic payment
C13= social credibility

Table 3, Table 4, Table 5 and Table 6 show the weights of element in layer C accounting for the element in layer B:

Table 3. Importance for elements of group CB1

	C1	C2
C1	-	0.51
C2	0.49	-

Table 4. Importance for elements of group CB2

	C3	C4	C5	C6
C3	-	0.56	0.54	0.42
C4	0.44	-	0.52	0.53
C5	0.46	0.48	-	0.49
C6	0.58	0.47	0.51	-

Table 5. Importance for elements of group C_{B3}

	C7	C8	C9
C7	-	0.60	0.56
C8	0.40	-	0.44
C9	0.44	0.56	-

Table 6. Importance for elements of group C_{B4}

	C10	C11	C12	C13
C10	-	0.70	0.65	0.60
C11	0.30	-	0.60	0.45
C12	0.35	0.40	-	0.58
C13	0.40	0.55	0.42	-

$\therefore W_C^{B_1} = (0.51, 0.49)$

$W_C^{B_2} = (0.254, 0.245, 0.235, 0.260)$

$W_C^{B_3} = (0.357, 0.260, 0.333)$

$W_C^{B_4}$ =(0.326, 0.225, 0.221, 0.225)

∵ W_i^B (i= l, 2, 3, 4) and W_k^C (k=1, 2, 3,…13).

∴ The influence of each factor on electronic commerce can be found. The following conclusions are drawn:

W_C^A = (0.16575, 0.15925, 0.06985, 0.0682, 0.06545, 0.0715, 0.083979, 0.05642, 0.072261, 0.59658, 0.041175, 0.040443, 0.041724).

It is obvious that 0.596589 (C10) is the maximum, then 0.16575 (C1) and 0.15925 (C2), while 0.040443 (C12) is the minimum, following is 0.041175 (C11) and 0.041724 (C13).

Therefore, the most important factors to the development of agricultural products' e-commerce are logistics development level, subject of cognition, information quality of peasants. On the contrary, electronic payment, transaction security and social credibility make the slightest effect on agricultural e-commerce.

4 Countermeasures for the Development of Agricultural EC

4.1 Set up Effective Agriculture Product Logistics System

Owing that agricultural products varied from types and volumes, much difficulty will come up in the logistic activities, i.e. fresh-keeping, transportation, follow-up treatment [6]. Nowadays weakness of agricultural products distribution system is one of the bottlenecks in the development process of agricultural products' E-commerce in China. It is necessary to set up refrigerated-warehouses, distribution centers, etc. to accelerate the speed from the countryside to city. On the other hand, tracking and tracing system through GPS and GSI should also be introduced to help buyers and sellers monitor the whole process via network to improve the safety, reliability, accuracy of agricultural products.

4.2 Improve Rural Information Infrastructure

Although internet is available everywhere in the city, the users of internet in the countryside are so less [7]. Such unbalanced situation becomes the second obstacle for agricultural EC. It is necessary to improve rural information infrastructure in China in order to reduce the cost of gaining information for the peasants.

4.3 Implement Standardization and Brands

After accession to WTO, our exports of agricultural products often reject. No wonder that consumers prefer safety and famous agricultural products. It is eager for agricultural products to implement standardization and brands. Ministry of agriculture

in China has carried out some standards about agricultural products [8]. In addition, our agricultural products should have our own brands and register trademarks all over the world. It is useful to depend on the intellectual property rights to protect our own brands and expand our markets. If national agricultural product becomes the famous brand in the world then the buyers abroad can easily click the button "Search" and catch the related information.

4.4 Cultivate Talents in Agricultural Products' EC

Another key element for the success of agricultural products' EC is talents in this field. If millions of peasants can understand the principles of EC and are in their positions to trade via internet, agricultural products' EC will realize.

Firstly, a long-term education plan about science and technology should be made in the countryside [9]. Secondly, knowledge related to information technology and electronic commerce should be taught for the peasants. Another way is preferential policies guiding EC professional talents in the colleges to service for countryside.

4.5 Promote Industrial Management of Agriculture

The current main body in agricultural products' EC is agricultural operation enterprises since the firms could take use of their own advantages on capital and technology to improve the value of agricultural products and speed up the standardization of local agricultural production, enhance the competitiveness. Industrialized operation of agriculture is not only useful to open both international and domestic market of our agricultural products, but also can accelerate the development of rural social economy. Therefore, more and more agricultural products operating and processing enterprises should be encouraged to open to strengthen the competitiveness and raise agricultural labor employment.

4.6 Specialize E-Commerce Websites

The EC website is the network platform to develop EC, there are more than 6000 websites related to agriculture in the countryside in China [10]. However, agricultural websites in western China are fewer than in other regions. A number of websites focus on information integrating function, the payment function of website is not perfect. At present, the EC domestic websites of agricultural products are far from professional and colorful.

As a result, more agricultural enterprises and intermediary organizations should establish commercial websites. And these websites should be estimated regularly by the public and government.

5 Conclusions

Depending on the basic industry of national economy, agriculture has a bearing on the healthy and stable development for economic and society. Along with optimized structure of agricultural production and improved level of e-commerce, technology innovation could accelerate modernization and industrialization of agriculture, and provide more comprehensive prospects for agricultural e-commerce. A new generation agricultural e-commerce platform comes to the top. With the development of network economy, e-commerce gradually will turn to be significant trading patterns in the future.

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