International Journal of u- and e- Service, Science and Technology
Vol.9, No. 7 (2016), pp.187-196
http://dx.doi.org/10.14257/ijunesst.2016.9.7.19

Research on the Evaluation of E-Commerce Logistics in the Cloud Computing Environment

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Abstract

Cloud computing has the advantages of low cost, large scale, general and scalable. In all areas of the social life and the economic life, the cloud computing is widely used. And the emergence of the cloud computing is another revolution in the information society. With the rapid development of e-commerce, the combination of e-commerce and cloud computing has been proved to be a win-win combination. But, there still are many problems of the e-commerce in the cloud computing environment, especially in logistics. In this paper, we establish the e-commerce logistics evaluation system in the cloud computing. And we use the e-commerce logistics evaluation method to evaluate the logistics in the cloud computing based on the improved entropy method. Finally, the experiments show that the proposed method can be effectively applied to the evaluation of e-commerce logistics in the cloud environment and the evaluation results are objective and effective.

Keywords: *Cloud computing, E-commerce, Logistics*

1. Introduction

Since Google proposed the concept of the cloud computing in 2007, this concept had been accepted by the majority of scholars all over the world and this concept had been greatly developed. E-commerce was constantly filled with our lives as a new industry. The emergence of the cloud computing improved the development of electronic commerce to a new level. The e-commerce logistics under the cloud computing can solve problems of the high cost, slow speed and service quality in the current logistics effectively. And this change promoted the development of electronic commerce.

Research on cloud computing has been a hot research topic. Acklesh Prasada, Peter Greena and Jon Healesb researched on the governance structures for the cloud computing services [1]. The author thought that the organizations would need to have appropriate governance structures and policies in place to manage the cloud computing services. The subsequent decisions from these governance structures would ensure the effective management of the cloud computing services. And they suggested four governance structures for managing the cloud computing services a chief cloud officer, a cloud management committee, a cloud service facilitation centre, and a cloud relationship centre. Guido L. Geerts and Daniel E. O'Leary presented an architecture for integrating cloud computing and enterprise systems based on the Resource-Event-Agent (REA) model. The public/private approach used in RosettaNet provided the conceptual basis to capture information used in the cloud and by users of the cloud locally in their own systems [2]. Marcelo Antonio Marotta etc. thought that an appropriate management of

ISSN: 2005-4246 IJUNESST

mobile cloud computing environment is necessary as the network is a key factor in the integration of mobile devices into the cloud [3]. This management must take into account 2 main points of view: the administrator and the end user view. The author introduced a management model and architecture for mobile cloud computing, exploiting both objective and subjective perspectives. Humphrey M. Sabi , Faith-Michael E. Uzoka, Kehbuma Langmia and Felix N. Njeh thought that cloud computing was a pervasive computing model that had radically changed the payment method of computer infrastructure and services. But, little research attention had been paid on adoption and usage of cloud computing at educational establishments and how contextual factors could influence diffusion and adoption of cloud computing [4]. So, the author proposed a model that took account of contextual, economic, and technological influences in the perception. Feng Dengguo *etc.*, research on the security of cloud computing. The author believed that cloud computing brought great challenges for the realization of user information security and privacy protection of assets. The author pointed out that the popularization and application of cloud computing was the challenge and development opportunity in the field of information security in recent years. And the cloud computing would lead to an important technological change in the field of information security [5]. Feng Dengguo researched on the key technologies of distributed storage in cloud computing environment. At first, the author introduced and compared the advantages and disadvantages of the typical data center network structure; secondly, introduced and compared the current commonly used two kind of distributed storage fault-tolerant technology; third, introduced the typical distribution of stored energy saving technology, and analyzed the advantages and disadvantages of each technology. Finally, the author pointed out the main challenges of the current technology and the direction of the next research. [6]. Huang Lanqiu researched and constructed a theoretical model based on the competitive intelligence service of cloud computing business through prototype implementation and case study [7]. In addition, many scholars had also conducted a study of cloud computing [8-13].

Wang Xiaobo researched the logistics distribution center location model and evaluation method in the electronic commerce environment [14]. The author used the heuristic algorithm to solve the logistics distribution center location model in e-commerce environment. And the author put forward a comprehensive evaluation method which was combined with the quantitative heuristic algorithm and qualitative and comprehensive evaluation method. Luo Rui researched on the performance evaluation of fresh agricultural products cold chain logistics under the background of electronic commerce [15]. The author thought that the development of fresh agricultural product logistics lacked a scientific and objective evaluation index system. Therefore, the author combined the e-commerce platform and the fresh agricultural products and proposed the new evaluation indexes. These indexes could reflect the comprehensive situation of the fresh agricultural products logistics in the context of e-commerce. Zhang Xiaoyuan researched on the perceived services quality in e-commerce logistics [16]. The author establishes the B2C e-commerce logistics perceived service quality model. And, the author evaluated the logistics service quality by the example of Jingdong Mall. In addition, many scholars had conducted a study on the evaluation of E - commerce logistics [17-22].

We can see that there are many researches on cloud computing and e-commerce logistics. But, few scholars have studied the evaluation of e-commerce logistics in the cloud computing environment. So, it is very necessary to study the evaluation of e-commerce logistics in cloud computing environment. This paper is structured as follows. The first part is the introduction. The second part is the e-commerce logistics distribution in cloud computing environment. The third part is the establishment of e-commerce logistics evaluation system in cloud computing environment. The fourth part is the basic algorithm. The fifth part is the e-commerce logistics evaluation method in the cloud

computing environment based on entropy method. The sixth part is the experiment and the seventh part is the conclusion.

2. The E-Commerce Logistics Distribution In Cloud Computing Environment

Cloud computing is a new model based on the current business needs and technical feasibility. Cloud computing does not refer to a specific technology or standards, but a concept. With the development of the Internet, cloud computing technology and infrastructure have matured.

Electronic commerce logistics distribution is a kind of logistics service mode which appears in order to meet the new model of the commodity electronic trading pattern. E-commerce cannot be separated from the network and e-commerce logistics and distribution also need to be provided support by network. As the bottleneck of electronic commerce, logistics and distribution need the new technology and method urgently to make a breakthrough to make full use of the advantages of convenient and fast of electronic commerce. With the development of e-commerce and Internet, not only the information industry has a huge demand for cloud computing, e-commerce also requires cloud computing technology for mobile e-commerce technology support. There are 6 goals in e-commerce logistics, including high time efficiency, wide scope, flexibility, low cost, personalized service and high-quality.

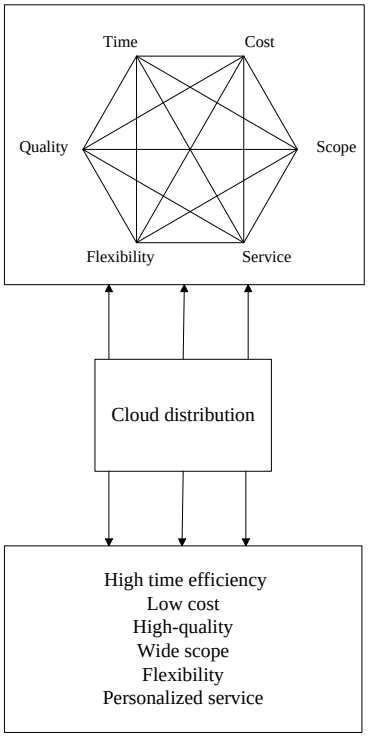

Figure 1. The Demand of Electronic Commerce on the Target Layer of Cloud Distribution

From the point of view of logistics and distribution, cloud computing can link many nodes of logistics. Based on the existing information, we can analyze the existing information, get the links that can be optimized to improve the efficiency of logistics. Cloud computing makes the development of information technology from digital, networked to the direction of intelligent.

Generally speaking, the electronic commerce logistics distribution process based on the cloud computing is shown below.

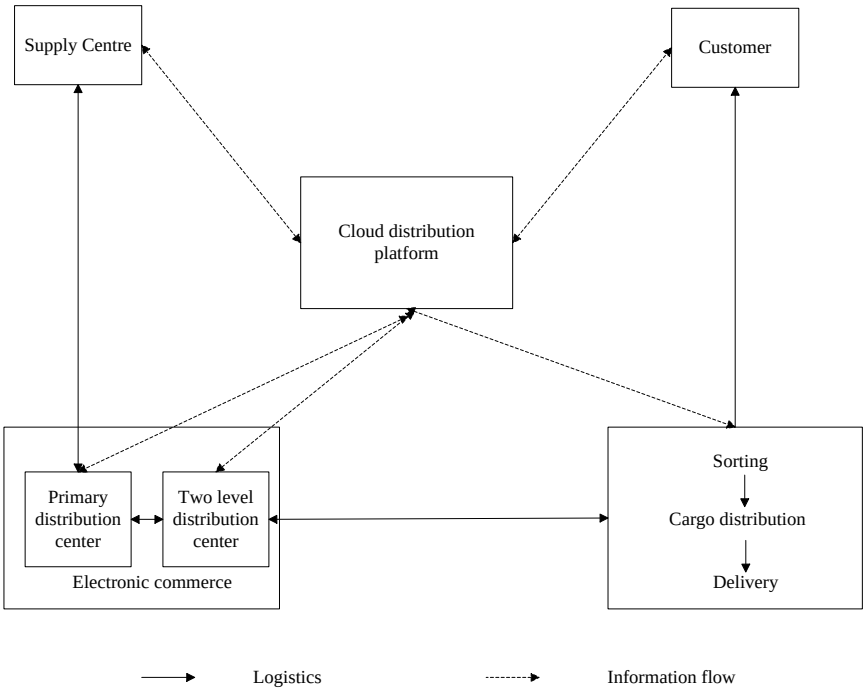

Figure 2. E-Commerce Logistics Distribution Platform in Cloud Computing Environment

From the above picture, we can see that the core of the e-commerce logistics distribution platform in cloud computing environment is the cloud distribution platform. The information flow of each node must go through cloud distribution platform, and the message is delivered by cloud distribution platform.

3. The Establishment of E-Commerce Logistics Evaluation System Under the Cloud Computing Environment

In the second section, we already know that the e-commerce has six targets. They are high timeless (T), wide scope (S), the flexible (F), low cost (C), the personalized service (P) and the high quality (Q). Based on the literature reading, social investigation, expert analysis and technical analysis, this paper establishes the e-commerce logistics evaluation system combined with the characteristics under the cloud computing environment. These characteristics are the dynamic of the customer demand, the bigger information flow and the quick speed.

Table 1. The E-Commerce Logistics Evaluation System Under the Cloud Computing Environment

E-commerce logistics evaluation system under the cloud computing environment	Timeless	Order response time
		Data transmission time
		Logistics delivery time
		Business preparation time
	Economic	Distribution cost
		Cloud computing provider service
		Daily operating expense

	Service	Distribution diversity
		Individual service
		Dot coverage
	Emergency	Parcel lost
		Data lost
		Data error
		Other emergencies
	Cloud computing provider service	reliability
		compatibility
		continuity
	Information security under cloud computing environment	Customer information security
		Data transmission security
		Data storage security

4. The Basic Algorithm

In this paper, we propose the e-commerce logistics evaluation method under the cloud computing environment which is based on the entropy method. In the fourth part, we introduce the entropy method. The steps of the entropy method are as follows.

Firstly, we establish the evaluation matrix. We assume that there is m evaluated objects and n evaluated questions. According to the sample observation data of the evaluation object, we can get the initial evaluation matrix

$$R' = (r'_{ij})_{m \times n} \tag{1}$$

Where, r'_{ij} is the status value for the i object in the j index.

The second step is the data standardization. The dimension, dimensional unit and the orientation of the index in the evaluation system may exist the differences. Therefore, when we evaluate the system, we need to deal with the data and make the data standardization. Then we get the standard state matrix

$$R = (r_{ij})_{m \times n} \tag{2}$$

The standardization formula is as follows.

$$r_{ij} = \begin{cases} \dfrac{r'_{ij} - \min\limits_i (r'_{ij})}{\max\limits_i (r'_{ij}) - \min\limits_i (r'_{ij})} & \max\limits_i (r'_{ij}) \neq \min\limits_i (r'_{ij}) \\ 1 & \max\limits_i (r'_{ij}) = \min\limits_i (r'_{ij}) \end{cases} \tag{3}$$

Where, r_{ij} is the state value for the i object in the j index. $\min\limits_i (r'_{ij})$ is the minimum state for the j index. $\max\limits_i (r'_{ij})$ is the maximum state for the j index.

The third step is to deal with the data normalization. We normalize the data and get the normalized matrix

$$(\theta_{ij})_{m \times n} \tag{4}$$

The normalized formula is as follows.

$$\theta_{ij} = r_{ij} \Big/ \sum_{i=1}^{m} r_{ij} (0 \leq \theta_{ij} \leq 1) \tag{5}$$

The fourth step is to calculate the entropy value for the j index. The formula is as follows.

$$H_j = -k\sum_{i=1}^{m}\theta_{ij} In\theta_{ij},\ j = 1,2,\cdots,n(k = 1/Inm) \tag{6}$$

The fifth step is to calculate the coefficient variance for the j index. The formula is as follows.

$$g_j = 1 - H_j, i = 1,2,\cdots,n \tag{7}$$

The sixth step is to calculate the combination weights. We adopt the coefficient variance of the entropy method to correct the weights of the AHP method. And we get the optimized weight combination.

5. E-Commerce Logistics Evaluation Method Under the Cloud Computing Environment Based on the Entropy Method

In this paper, in order to evaluate better the e-commerce logistics under the cloud computing environment, we propose the e-commerce logistics evaluation method based on the entropy method. The specific steps are as follows.

Firstly, we establish the index system

$$L = \{L_1, L_2,\cdots, L_i\};(i = 1,2,\cdots,n) \tag{8}$$

L_i is the evaluated index.

Secondly, we establish the comment set

$$V = \{V_1, V_2,\cdots, V_j\};(j = 1,2,\cdots,m) \tag{9}$$

And we assign the different values for the comments in the comment set.

Thirdly, we structure the comparison matrix and normalize it.

$$a_{ij} = a_{ij}\Big/\sum_{k=1}^{n} a_{kj} \qquad (i = 1,2,\cdots,n) \tag{10}$$

Fourthly, we calculate the sum of each row for the judgment matrix A and normalize it.

$$\omega_i = \omega_i\Big/\sum_{i=1}^{n}\omega_i \qquad (i = 1,2,\cdots,n) \tag{11}$$

Fifthly, according to

$$A\omega = \lambda_{\max}\omega \tag{12}$$

We calculate the maximum characteristics and the feature vector.

Sixthly, we calculate the entropy value e_j for the j index. That is,

$$e_j = -k\sum_{i=1}^{m} p_{ij}\ln p_{ij} \tag{13}$$

Seventhly, we adjust the differential coefficient

g_j $(g_j = 1 - e_j)$

by using the entropy method. Then we adjust the weights of the AHP and get the weights.

$$w_j = wg_j \Big/ \sum_{j=1}^{n} wg_j \tag{14}$$

Eighthly, according to the following formula, we get the index weights.

$$\mu_k = \alpha w_k + (1-\alpha)\rho_k \tag{15}$$

Where, w is the objective weight which is obtained by the entropy method. ρ is the subjective weight which is obtained by the standard deviation method. α is the subjective weight proportion. $(1-\alpha)$ is the objective weight proportion. We establish the objective function.

$$\min z = \sum_{j=1}^{n} [(\mu_k - w_k)^2 - (\mu_k - \rho_k)^2] \tag{16}$$

We derivate α and make the derivative as zero. We get $\alpha = 0.5$. Therefore, the best optimal combination weights is that the objective weight proportion is 50% and the subjective weight proportion is 50%.

Therefore, the comprehensive weight is as follows.

$$\mu_k = 0.5 w_k + 0.5 \rho_k \tag{17}$$

Ninthly, we assume that the evaluation index is n. According to the comment set, we can get the n evaluation matrix L^n which is normalized. Then, we multiply the evaluated matrix for the n level index and the n level index weight. Then we obtain the $n-1$ level evaluated result $L^{n-1} = L^n \square u^n$. We make the result as the evaluated index and do the next evaluation. Finally, we can get the second level evaluated result L^2.

Tenthly, we use the

$$Q = L^2 \cdot V \tag{18}$$

to get the finally evaluated result.

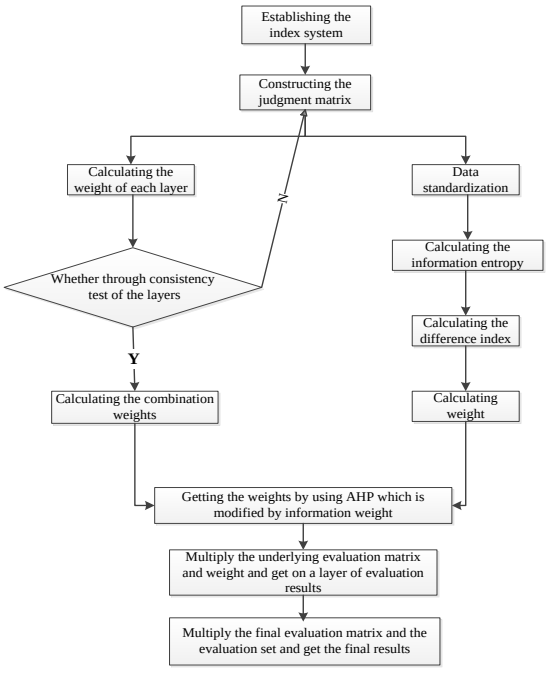

Figure 3. Entropy Method Under the Cloud Computing Environment

6. Experiment

In this paper, we study and evaluate the e-commerce logistics under the cloud computing environment. After we determine the studied object and establish the e-commerce logistics evaluation system, we obtain the weights of each index and the comprehensive weights. The results are as follows.

Table 1. The Index Weights for The E-Commerce Logistics Evaluation System Under the Cloud Computing Environment

Two level index	Three level index	weight	Comprehensive weight
Timeless	Order response time	0.231	0.238
	Data transmission time	0.118	0.120
	Logistics delivery time	0.376	0.388
	Business preparation time	0.275	0.254
Economic	Distribution cost	0.481	0.477
	Cloud computing provider service	0.332	0.324
	Daily operating expense	0.187	0.199
Service	Distribution diversity	0.297	0.301
	Individual service	0.431	0.411
	Dot coverage	0.273	0.288
Emergency	Parcel lost	0.385	0.395
	Data lost	0.268	0.261
	Data error	0.256	0.260
	Other emergencies	0.091	0.084
Cloud computing provider service	Reliability	0.405	0.411
	Compatibility	0.264	0.269
	Continuity	0.331	0.320
Information security under cloud computing environment	Customer information security	0.381	0.375
	Data transmission security	0.263	0.281
	Data storage security	0.356	0.344

After we get the index weight, we need to evaluate and score an electronic business company. And we normalize it. The evaluated level is divided into five levels. They are

$$\{Wonderful, Good, Normal, Poor, Very\ poor\}.$$

The comment set is

$$V = \{95, 85, 75, 65, 60\}.$$

We score for the order response time of the timeless and get

$$\{0.1, 0.2, 0.4, 0.3, 0\}.$$

The score of the date transmission time is

$$\{0.2, 0.2, 0.4, 0.2, 0\}.$$

The score of the logistics delivery time is

$$\{0.2, 0.3, 0.4, 0.1, 0\}.$$

The score of the business preparation time is

$$\{0, 0.3, 0.5, 0.2, 0\}.$$

Then we get the matrix.

$$L = \begin{pmatrix} 0.1 & 0.2 & 0.4 & 0.3 & 0 \\ 0.2 & 0.2 & 0.4 & 0.2 & 0 \\ 0.2 & 0.3 & 0.4 & 0.1 & 0 \\ 0 & 0.3 & 0.5 & 0.2 & 0 \end{pmatrix}$$

The weight is

$u = \{0.238, 0.120, 0.388, 0.254\}$.

According to the eleventh step, we also get

$L^2 = \{0.156, 0.383, 0.325, 0.136, 0\}$.

The final evaluated result is

$Q = L^2 \cdot V = 80.53$.

Therefore, the e-commerce logistics evaluated score under the cloud computing environment is 80.53.

7. Conclusion

At present, the combination between the cloud computing and the electronic commerce has become a trend. However, the e-commerce logistics evaluation under the cloud computing is still little. The e-commerce logistics evaluation under the cloud computing is not only to consider the logistics factor, but also the cloud computing environment. This paper propose the e-commerce logistics evaluation method under the cloud computing. This method needs little sample and makes full use of the existing information. It can reduce the human error and can get the objective e-commerce enterprise logistics results. It provides an intuitive numerical references for the e-commerce enterprise under the cloud computing. The main contents are as follows. Firstly, this paper establishes the e-commerce logistics evaluation under the cloud computing. Secondly, this paper proposes the e-commerce logistics evaluation under the cloud computing which is based on the entropy method. Thirdly, this paper applies the method to evaluate the e-commerce enterprise under the cloud computing environment. Finally, the experimental results show that the method is effective and reliable under the cloud computing environment.

Acknowledgments

This thesis is supported by the Shaanxi Provincial Education Department, the project name: Based on the RFID of the Northern Shaanxi sand control system of water saving irrigation. Project number: 2013JK1151; This thesis is supported by Yulin science and Technology Bureau, project name: Based on the research and application of agricultural products e-commerce operation service platform based on mobile Internet, the project number: 2014cxy-08-4; This thesis is supported by the Shaanxi Provincial Science and Technology Department, the project name: A study on the evaluation method and model of the coordinated development of water resources and environment economy in Yulin, the project number: 2015SF261.

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