Business to Consumer E-commerce on the Basis of Multi-attribute Intelligent Grey Target Decision Model

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Abstract—Business to consumers (B to C) e-commerce is welcomed by more and more consumers. Multi-attribute intelligent grey target decision model is introduced into e-commerce benefits analysis of consumers' preference for business to consumer website. To research their purchase decision in B to C website, website design, safety payment, website information are regarded as an effect measure for benefit type objective and online price is regarded as an effect measure for cost type objective. Meanwhile, website function is regarded as an effect measure for moderate type objective. These effect measures are transferred to uniform effect measure and the matrix of synthetic effect measures can calculated by zero value in grey target. Next, in the sample of three websites which is used by consumers widely, an order is given by an interval number and one in three websites is the most welcome. B to C in e-commerce model which is made by multi-attribute intelligent grey target decision provides an important reference for enterprises or electronic emporium to optimize website as well as promote website for the increase in the number of online consumers along with improvement business performance in e-commerce.

Index Terms—Multi-attribute grey target decision, Multi-objective, Business to Consumer e-commerce, Website, Effect measure

I. INTRODUCTION

A. Multi-attribute Intelligent Grey Target Decision Model

Luo Dang (2013) point out that multi-attribute intelligent grey target decision model is one of main method in grey systematic theories. The decision model usually is used by solution of technological assessment and project selection. [1] Liu Sifeng, Yuan Wenfeng, Sheng Keqin (2010) claimed that four kinds of uniform effect measures of the effect measure for benefit type objective, the effect measure for cost type objective, the lower effect measure for moderate type, and the upper effect measure for moderate type are formed in view of different decision objective of benefit type, cost type, and moderate type. The decision objectives with different meaning, different dimension, and / or different nature can be transferred to uniform effect measure. By the uniform effect measure, it is simple to get a matrix of synthetic effect measures. Then an order is given by comparison in all kinds of decisions of grey target. [2]

B. Business to Consumer E-commerce

B to C means a model of business to commerce e-commerce. In recent years, B to C e-commerce is developing in China, and it has been closely associated with people life because more and more consumers choose B to C website to buy products. Enterprises make use of electronic emporiums which provide network infrastructures, payment platform, security platform, management platform for them. Thus enterprise can do business with consumers on website with a form of an efficient and low cost. [3]

Nowadays, with the sharp increase in a number of electronic emporiums, consumers have more choice for electronic emporiums and are particular about electronic emporiums. Consumers usually choose some good e-commerce websites for online shopping and B to C website of which they think the best is used by consumers on priority. However, how to choose a good B to C website is key segment in e-commerce. There are many indicators in decision problem of B to C website because the online consumers consider several factors, such as, website design, website function, website information, and other services in B to C website.
website. The website not only provided helpful information, but also save consumers’ time. [6]

B. Multi-attribute intelligent grey target decision model

In the first step: Event set, A = {a₁, a₂, ..., aₙ}, and countermeasure set, B = {b₁, b₂, ..., bₘ}, are build decision set S = {sᵢ = (aᵢ, bⱼ) | aᵢ ∈ A, bⱼ ∈ B}.

In the second step: Target decision is solved when k = 1, 2, ..., S.

In the third step: Every target decision weight is obtained, η₁, η₂, ..., ηₘ.

In the fourth step: In terms of target, k = 1, 2, ..., s, the matrix for the corresponding target effect sample is obtained.

\[ U^{(k)} = \left( u_{ij}^{(k)} \right) = \begin{bmatrix} u_{11}^{(k)} & u_{12}^{(k)} & \cdots & u_{1n}^{(k)} \\ u_{21}^{(k)} & u_{22}^{(k)} & \cdots & u_{2n}^{(k)} \\ \vdots & \vdots & \ddots & \vdots \\ u_{m1}^{(k)} & u_{m2}^{(k)} & \cdots & u_{mn}^{(k)} \end{bmatrix} \]

(1)

In the fifth step: Assumption for zero point of target effect is to do next step;

In the sixth step: The matrix of the uniform effect measure for object in K is solved;

\[ R^{(k)} = \left( r_{ij}^{(k)} \right) = \begin{bmatrix} r_{11}^{(k)} & r_{12}^{(k)} & \cdots & r_{1n}^{(k)} \\ r_{21}^{(k)} & r_{22}^{(k)} & \cdots & r_{2n}^{(k)} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1}^{(k)} & r_{m2}^{(k)} & \cdots & r_{mn}^{(k)} \end{bmatrix} \]

(2)

In the seven step: according to

\[ r_{ij} = \sum_{k=1}^{s} \eta_{(k)} \cdot r_{ij}^{(k)} \]

a matrix of synthetic effect measures is solved.

\[ R = \left( r_{ij} \right) = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix} \]

(3)

In the eighth step:

\[ \max_{1 \leq j \leq n} \{ r_{ij} \} = r_{i0j} \]

(4)

\[ \max_{1 \leq i \leq m} \{ r_{ij} \} = r_{i0j} \]

(5)

\[ \max_{1 \leq i \leq m, 1 \leq j \leq n} \{ r_{ij} \} = r_{00j} \]

(6)

III B TO C E-COMMERCE ON THE BASIS OF MULTI-ATTRIBUTE INTELLIGENT GREY TARGET DECISION MODEL

The decision of consumers online shopping is related to business volume on B to C website, but consumers is impacted on a lot of factors when they do choice. So decision is complex process with uncertain feature. To solution the problem, multi-attribute intelligent grey target decision model is introduced into the B to C e-commerce. The application is the following step.

In the first step: Event set, countermeasure set, and decision set are established. The consumers’ decision to choose e-commerce is an event (aᵢ). Namely Event set is A = {aᵢ}. JD, AMAZON, and DANGDANG website are selected in the research. So JD, AMAZON, DANGDAND are b₁, b₂ and b₃ in countermeasure, respectively. Countermeasure is B = {b₁, b₂, b₃}. Event set, A, and countermeasure, B, are built decision project.

S = \{sᵢ = (aᵢ, bⱼ) | aᵢ ∈ A, bⱼ ∈ B, i =1; j=1,2,3\} = \{sᵢ₁, sᵢ₂, sᵢ₃\}

In the second step: According to the interview with 180 of consumers in two times, the five target decisions for website function, online price website design, safety payment and website information. The qualitative targets are website design, safety payment, and website information is settled and consumers give a mark about the three subject. The three subjects are regarded as benefit type target in the research and the high mark which is given represents that consumers are more favorite website design, safety payment, and website information. Online price is cost type target. The lower mark in online price represents the online price is welcomed by consumers. Website function is moderate type target.

In the third step: In order to obtain target decision, questionnaire is designed and sent to consumers. According to questionnaire collected from 180 of consumers, every target and corresponding decision making index is defined.

In the fourth step: Vector for effect sample of every target is resolved.

\[ U^{(1)} = [6.5 6 6.4] \]
\[ U^{(2)} = [9.3 10.1 8.9] \]
\[ U^{(3)} = [9.5 11.5 13] \]
\[ U^{(4)} = [6.6 6.3 6.4] \]
\[ U^{(5)} = [6.5 6.8 6.2] \]

In the fifth step: The hypothesis is zero value for target effect. Website design, safety payment, website information are benefit type objective, respectively and

| Target assessment | Website function | Online price | Website design | Safety payment | Website information |
|------------------|------------------|--------------|----------------|----------------|-------------------|
| unit             | several          | Ten thousand | qualitative    | weight         |
| order            | 1                | 2            | 3              | 4              | 5                 |
| weight           | 0.15             | 0.22         | 0.18           | 0.28           | 0.17              |

TABLE I. DECISION MAKING IN TARGET SYSTEM
its zero value, \( u_{ij0} = 6 \), \( k=3,4,5 \); Online price is the zero value for cost type target. Website function is the moderate type. There are 10 functions in B to C website. At least two new functions are added to B to C website every year. So the upper limit for zero value is 12. The lower limit for zero value is 10.

In the sixth step: The matrix of the uniform effect measure is obtained by the following process. The cost type objective for website design, safety payment, and website information are regarded as qualitative value in target effect measure. The cost type objective for online price is regarded in target effect measure. Website function is regarded as moderate target. In order to obtain uniform effect measure, benefit type objective, cost type objective, and moderate objective for lower limit along with upper limit effect measure use grey correlation decision.

\[
R(1) = [1.00, 0.00, 0.80] \\
R(2) = [0.64, -0.09, 1.00] \\
R(3) = [0.75, 0.25, -0.50] \\
R(4) = [1.00, 0.50, 0.67] \\
R(5) = [0.63, 1.00, 0.25]
\]

In the seventh step: \( \sum_{k=1}^{5} \eta_k \cdot R_{ij}^{(k)} \). There is a result for matrix of synthetic effect measure.

\[
R = [r_{11}, r_{12}, r_{13}]
\]

\[
= [0.8113, 0.3350, 0.4792]
\]

In the eighth step: Result of the decision is given. \( r_{11}>0, \quad r_{12}>0, \quad r_{13}>0 \). The result indicates that JD, AMAZON, and DANGDANG website are hit in the objective effect and consumers have interested in the three B to C websites.

\[
\max_{1 \leq i, j \leq 3} \{ r_{ij} \} = r_{11} = 0.8113
\]

The result indicates 180 of consumers who are investigated prefer JD to AMAZON and DANGDANG in B to C website.

**IV Conclusion**

Introducing multi-attribute intelligent grey target decision model into B to C website is feasible by the research. The multi-attribute intelligent grey target decision can analyze these uncertain and complex reasons when consumers choose B to C website for online shopping because of its feature with multi-attribute and multi-situation. Many factors, including website design, website function, online price, safety payment, website information, have influence on consumers’ buying choice is considered as index of target. So B to C e-commerce model is practicable and feasible.

It is crucial for development of B to C e-commerce is that consumers feel satisfied with convenient operation function, reasonable price by online communication, safe payment with quick speed, attraction for website interface, and rich as well as value information.

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