Research on Network Marketing System Model of E-commerce Enterprise Based on Genetic Algorithm

Haijuan Zhou, Xingguang Li

College of Economics & Management Department, Hengshui University, Hengshui 053000, China.

Abstract

Necessary assessment system during the process of planning of e-commerce enterprise for network marketing planning is the foundation for measuring the feasibility of marketing planning of the enterprise. But the assessment system for marketing strategy feasibility is imperfect, resulting in that marketing strategies of most e-commerce enterprises have the problem of docking with network environment. Therefore, this research found the breakthrough of building of network marketing system model of e-commerce enterprise based on genetic algorithm, designed to strengthen the feasibility of network marketing planning of enterprise.

Keywords: E-commerce, Genetic Algorithm, Marketing System, Theoretical Model.

1. RESEARCH BACKGROUND

1.1 Literature review

With Development of computer electronic information technology promoted the derivation of network technology and modern logistics technology and in new development route of vigorous promotion of Internet plus in China, modern e-commerce occupied mainstream market consumption indeed (Xia and Liu, 2017). However, modern enterprises have heavy loss in short term because of lack of management experience and network marketing modes during the process of blindly flocking in O2O and P2P network platform market (Bai and Wang, 2017). To eliminate the risk of network marketing, it is particularly important to further research theoretical model of network marketing system of e-commerce enterprise. Most studies focus on providing precision marketing strategies by increasing information acquisition and some studies propose the parallel computing of probability set of network marketing by big data and cloud computing to restrain the risk of marketing planning (Ji and Zhou, 2017). But support dimension of such marketing models for modern enterprises is limited to expansion of marketing channel or increase in sales base and they do not eliminate the risk after enterprises adopt e-commerce modes.

1.2 Research purpose

To improve the precision of e-commerce marketing strategy and reduce the risk of bad marketing plan meanwhile, this research designed the theoretical model of enterprise e-commerce network marketing system based on genetic algorithm to improve the security and economic benefit of network marketing of modern enterprises through utilization of quantitative transaction information base on this basis, assessment of the transaction exposure and prediction of marketing end meanwhile (Li and Zhao, 2017). Traditional genetic algorithm is assessment system based on tree structure and can carry out small-scale capability fitting in prediction efficiency, so calculation basis for extraction of network marketing risk information is relatively perfect (Li et al., 2017). Optimization scheme of building genetic algorithm in e-commerce behavior is final result combining model optimization configuration. It can be widely applied in network marketing planning of modern enterprises because it has better risk assessment effect in improving recommended credit line. But this model has lower convergence and its computational complexity goes against active response of modern enterprises. Therefore, this research integrated new operational model into traditional genetic algorithm, thus extracting the quantitative standard for trust recommendation of merchants in e-commerce platform and accelerating the feasibility of overall marketing strategies of modern enterprises under network environment.
2. Formation mechanism of realization of e-commerce platform operation management with genetic algorithm

2.1 Theoretical framework of genetic algorithm

Genetic algorithm is the laws of evolution in the biology, accords with genetic mechanism of survival of the fittest, explores random search methods in evolutionary process, and thus forms the optimum expected conclusion. Its main characteristic is direct operation of structure objects, without the requirements of derivation and continuation, so this algorithm is more reliable and objective in catching of objective information or arithmetic mode (Jiang and Tao, 2017). Meanwhile such algorithm has internal implicit parallelism and more perfect ability of global optimization and can parse the fitness of current marketing method by assessment of recent marketing strategy when it is applied to assessing whether network marketing mode has higher fitness. Furthermore, genetic algorithm is an optimization model designed based on genetic fission, and network marketing mode also faces massive referential theoretical paradigm under changing environment during the marketing process. Summarizing the law of market development or whether marketing planning can receive good feedback information from market in a certain period by genetic algorithm is the greatest advantage of genetic arithmetic. Genetic algorithm usually uses probabilistic optimization method, and this method can automatically obtain and guide the search space of optimization results and adaptively adjust search direction, without definite limits and rules of human intervention. Genetic algorithm can abandon the subjective tendency of marketing management staff, thus describing more objective market dynamic information and market response after integration of marketing decision (Wang and Li, 2015). Hence, these advantages of genetic algorithm can optimize the feasibility of marketing strategies, feed back the optimization results of expected market information, and draw the analogy of adaptation dimensionality during the process of information collection, thus supporting the building of theoretical model of overall network marketing planning.

2.2 Operational pattern of genetic algorithm

Feedback information of terminal customers shall be completely collected during the process of network marketing, which is the objective index that supports the selection of marketing mode of enterprises. The enterprises should select the preferential marketing plans made after assessment of mass information, so the optimal marketing scheme is assumed to be the maximum of the function during the selection process and the maximum is the expected best marketing effect of marketing planning, namely, product dump and maximum return (Su and Song, 2016). Meanwhile set the minimum of the function to describe the peak contrast of marketing planning, namely, overstocking of all products and the minimum return that the enterprises can accept. Set X as marketing decision variable in plan model described by the sequence, parse constraint conditions in objective function and plan the subset of constraint conditions within U fundamental spatial category. When constraint conditions meet the parsing results, X is deemed as highly feasible marketing planning, and R can represent all set factors that do not meet constraint conditions and is deemed as set of feasible solutions.

As a search heuristic algorithm used for optimum scheme in the field of computer science artificial intelligence, evolutionary algorithm advantage of genetic algorithm is particularly obvious (Wang et al., 2015). This heuristic computing method can solve the natural selection rule when marketing planning scheme selects optimization measures, thus supporting the enterprises to make the most accurate marketing scheme and improve the feasibility and fitness of marketing planning under network environment. Law of marketing, very similar to biological phenomena, can also select preferential reference variables during inheritance, mutation, natural selection and other processes, thus supporting the convergence effect of genetic algorithm when the fitness function reaches the expectation and providing the enterprises with reliable global optimal scheme.

2.3 Genetic algorithm process structure

Basic operation process of genetic algorithm consists of three parts, namely, initialization, individual assessment, selection operation, crossover operation and mutation operation. Genetic operations are based on analogue simulation of biogenic inheritance (Gong and Chai, 2015). After forming initial group in genetic algorithm, genetic operations are to carry out derivation operation of individuals in the group to realize the survival of the fittest. Genetic operations can further parse problems at the time of searching feasible marketing strategies and approach the optimal parse result during the process of optimizations of generations. Figure 1 shows the network marketing planning process structure based on genetic algorithm.
Firstly, initial process is the best solution of setting of evolutionary algebra counter \( t=0 \), when the maximum evolutionary algebra \( T \) reached random \( M \) independent sample and can be as individual initial group \( P(0) \), used to describe the market environment, enterprise environment, enterprise’s operating costs, expectation of marketing scheme and other initial values before marketing strategies are implemented under network environment.

Secondly, complete the fitness adjustment through individual assessment, select the individual fitness of each network marketing scheme from the group \( P(t) \), as projections before collection of market feedback information, used as the indexes of later assessment of feasibility of marketing schemes.

Thirdly, need to further select the operation mechanism and apply selection operator to \( P(t) \) group. The selection is to directly pass optimized individual to next generation or use the crossover genetic model to hasten the next generation of optimization conclusion of new individual marketing scheme (Sun and Ma, 2014). Building the group fitness based on selection operation can clearly assess whether all planning schemes have high fitness, if no marketing scheme reaches the predicted index, select the genetic results in new generation of derived conclusions as new round of assessment foundation.

Fourthly, crossover operation is apply the crossover operator to \( P(t) \) group, plays a core role in genetic algorithm and realizes the comparison of operation results of crossover subset (Lu and Han, 2014). Such comparison is a screening process of marketing scheme feasibility, and applying mutation operation on this base can apply mutation operator to \( P(t) \) group. Make genetic markers on all operation conclusions in this group, thus adding the tandem gene and marketing planning gene, and analyze the change mechanism and trend of market feedback information. So, \( P(t) \) group obtains the next generation of \( P(t+1) \) group after selection, crossover and mutation operations, and this result is the best solution of marketing planning and the most feasible theoretical value. Afterwards, when \( t=T \), it is deemed that the genetic process is completed, the individual with the best fitness during evolutionary process is also the marketing planning scheme output by optimal solution, and the calculation can end.

3. Genetic algorithm mode of network marketing system of e-commerce enterprise

3.1 Collection of online e-commerce consumption information and marketing feedback information

Information collection shall be carried out at the beginning of building of genetic algorithm mode of network marketing system of e-commerce enterprise and it is to provide the standard interval division of comparison reference of genetic algorithm. Standard interval shall describe two types of information, including the existing
consumption information of real products of enterprises under network environment and expected market feedback information after implementation of marketing planning, as shown in Table 1.

**Table 1** Collection of online e-commerce consumption information and marketing feedback information

<table>
<thead>
<tr>
<th>projects</th>
<th>Information collection</th>
<th>Short-term reach</th>
<th>Acceptable level of acceptance</th>
<th>Improve effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic indicators</td>
<td>Consumer information</td>
<td>50%</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>expectations</td>
<td>Marketing feedback</td>
<td>100%</td>
<td>75%</td>
<td>25%</td>
</tr>
</tbody>
</table>

3.2 Marketing information collection, processing and operational model

For the purpose of systematic assessment of optimization scheme of e-commerce marketing strategies, input information collected into statistics software for selection of big data. When selected data meet operation effect variable, collect the data sample of e-commerce transaction information with sparse and scattered point cloud data collection technology. Meanwhile preset 100% scheduled product sale quantity of e-commerce transaction without risk (Yang et al., 2012). Data time series can be expressed as \( \{x_i\} \) \( i=1,...,N \). Conduct the genetic arrangement collection according to genetic sequence \( y'(n) \) and take original sequence produced by transaction as assessment conditions, and the sequence amplitude is:

\[
\{ \delta \delta x_k(j^k) = x_k[k - x_k] \} (k \in 1,2,...,N)
\]  

(1)

After using analysis mode of adaptive regression model function, built the characteristic components of e-commerce transaction and then describe finial expression form of division of transaction data level. For example: X(0) the credible marketing planning at the N level, and marketing sequence group of X(1) X(2)....X(N) can be expressed as X(0) = \( \{x_i\} \) \( i=1,...,N \).

Use general transaction practices in e-commerce marketing link as risk sequence of assessment of marketing planning credibility \( y'(n) \), meanwhile use the optimization processing and obtain the marketing planning equilibrium point and sparse and scattered data collection sample of expected values of marketing results through cloud computing. Set the sampling variable as \( Q \) and marketing planning risk factor as exponential spectrum \( X \). So each individual \( X \) has a corresponding completely parsed basis vector and vector model is:

\[
\zeta_i(k) = (1-\omega)\zeta_i(k-1) + \varphi \zeta_i^0(1)
\]  

(2)

Give priority to combination of prior rule function through arrangement of sparse and scattered points of aforesaid marketing planning data, and obtain the best result of e-commerce transaction, and in case of marketing risk data, it can be expressed by fitting time series model in statistic information:

\[
x_n = \sigma_0 + \sum_{i=1}^{p} \sigma_i x_{n-i} + \sum_{j=0}^{q} \gamma_j \beta_{n-j}
\]  

(3)

Set \( \{\sigma\} \) as the extreme case where the mean is 0 in this formula, normal distribution of variance \( \gamma^2 \) presents the function distribution process, \( \sigma_0, \sigma_1, \sigma_2, ..., \sigma_p \) brings out possible unknown risk of e-commerce strategies, time node of this risk, or reversible characteristic decomposition coefficient. Take \( \lambda_1, \lambda_2, ..., \lambda_q \) as measuring errors of transaction data collection, thus assessing whether the theoretical value of this model is objective and reliable.

3.3 Calculation of recommended value of marketing planning assessment of e-commerce enterprise

Input the marketing strategy feasibility analysis data of enterprises collected in the network into the cloud storage system, establish e-commerce marketing planning expert database, extract the categories of merchants
with outstanding marketing planning in previous transactions, and conduct the information integration processing to obtain the optimal solution of the minimum sales constraint conditions of marketing planning:

$$\max_{x_{a,b,c,d}} \sum_{a \in A} \sum_{b \in B} \sum_{c \in C} \sum_{d \in D} x_{a,b,c,d} V_p$$

subject to

$$\sum_{a \in A} \sum_{b \in B} \sum_{c \in C} \sum_{d \in D} x_{a,b,c,d} R_{bw}^{kp} \leq K_b^{kp}(s), b \in B$$

(4)

Using genetic evolutionary algorithm is the evolutionary computation mode to reduce network marketing risk, and genetic evolutionary process can realize the calculation of variable Xm and maximum function value fm of network marketing risk control (Ma and Ma, 2013). After initial group is built, calculate the feasibility of marketing planning by the group fitness function, thus obtaining the priori probability density P(x0) of risk control, and the operating guideline of genetic evolution is:

$$P_j(k) = \frac{[\ell_j(k) - \ell_i(k)]\mu_j(k)}{\sum_{j \in N_i(k)} [\ell_j(k) - \ell_i(k)]\mu_j(k)}$$

(5)

Where, \(\mu_{ij}(k)\) means the crossover probability of e-commerce network marketing planning strategy. Such crossover and mutation operations during the genetic evolution process is necessary development trend of avoiding network marketing risk, and calculate the reference of risk value and obtain the risk controllable probability in group fitness (Zhuang et al, 2015). Genetic evolution result obtained after elimination of risk variable is highly feasible marketing planning. Set it as the variable reference of the i group and set the sequence of fitness function in D-dimensional space \(X_i = (x_{i1}, x_{i2}, ..., x_{iD})\), used as the function value of risk cost of corresponding network marketing planning, and design the fitness in each individual project, thus obtaining the final collection solution of the i genetic group \(P_i = (p_{i1}, p_{i2}, ..., p_{iD})\), and meanwhile obtain the recommendation value credibility after e-commerce enterprise implements network marketing planning in the control of genetic evolution, then recommend the calculation iteration situation, and the model is:

$$j \in N_i(k), N_i(k) = \{\|x_j(k) - x_i(k)\| \leq r_j(k)\}$$

(6)

4. CONCLUSION

To sum up, using genetic algorithm can objectively describe the possible risks when enterprises implement the marketing planning in network environment during the process of alternation, iteration, replication, calculation and evolution. Integrating risk mechanism is also a necessary way to measure the marketing strategy feasibility. Genetic algorithm gives the balance effect of enterprise’s expectations and market feedback information during the stage development stage rather than the equilibrium conditions of current risk factors. Hence, the enterprises shall emphasize accurate information of current and undeveloped customers and meanwhile completely collect the information of the industry for full comparison to improve the accuracy of operation results during the process of application of genetic algorithm. Applying genetic algorithm is a special way to improve the performance effect of e-commerce network marketing planning and a theoretical model only, and enterprises may also lose the ability of comprehensive assessment and subjective judgment in network marketing link if blindly relying on the final results of genetic algorithm. So, enterprises shall not only collect lots of information of customers and industrial products under network environment but also enhance their ability of subjective judgment at the time of application of genetic algorithm to optimize the network marketing scheme and realize better operation performance with the support of genetic algorithm.

ACKNOWLEDGMENTS

Hebei Education Science Research "12th Five-Year Plan" Project (1505005); Teaching Reform Project of Hengshui University in 2016(JG2016056, JG2016063).
REFERENCES

Bai D.F and Wang Y. (2017). Taobao shop marketing and promotion analysis -- taking the book online store as an example. Modern marketing (bottom 10), (09), 92-97.


