Research on Digital Marketing Strategy of Telecommunication Service Based on Computer Complex Network Model

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Abstract. With the emergence of the 2G, 3G, 4G, 5G, the business volume of telecom enterprises has grown rapidly, and at the same time, because services are lagging behind actual demand, they are also facing the risk of losing customers. This paper studies the close relationship between the complex network model and the digital marketing of telecom enterprises by using computer, and analyzes the customers of telecom business and puts forward the corresponding strategy of digital marketing.

Keywords: Computer, Complex Network, Telecommunications Services, Marketing

1. Introduction

Network marketing is a new marketing method, facing the new competitive environment due to various external factors. Enterprises must track consumer consumption behavior in the implementation of network marketing in order to obtain a sustained competitive advantage. There is a very close relationship between consumption behavior patterns and complex network system structure. If a single individual in a consumer network is regarded as a node, and the information flow between individuals indicates that there is a side connection, which constitutes a typical complex network structure. Therefore, the defined social consumption network is a complex network [1]. Network filled with information flow of advertising information, price information, commodity evaluation information, etc. A large number of empirical studies in the past have revealed that social networks like this have small-world characteristics that high agglomeration, short distance, that is, small-world network or scale-free network, and the information flow and its emerging results show a high degree of unpredictability.

In summary, group dynamics behavior on complex networks with information flow is one of the manifestations of various network behaviors. Therefore, complex network theory provides a new paradigm for market diffusion behavior research on consumer networks.

Local products with geographical location, shelf life and other conditions limit, in the network promotion cannot blindly put into the market, the analysis of its market diffusion behavior is crucial. According to the change of market share in different periods and the complex non-linear relationship between enterprises input, to reflect their own specific life cycle.

2. Computer-based complex network model
2.1. Basic model

The local product has the specific target consumer group, the individual of this group has the similar consumption preference, the product information transmission between groups is also relatively frequent, such target consumer group and the commodity information flow between them constitute the target consumer network of the market \( G(u,v) \).

\[

v(G) = \{v_1, v_2, v_3, \ldots, v_n\}
\]  \hspace{1cm} (1)

Here the \( v_i \) \( (i=1,2,\ldots,N) \) is the node or consumption node of the network, representing the consumer or enterprise, \( N \) representing the capacity of the network, representing the size of the target consumer market [2].

\[

(\text{u, v}) \in e(G)
\]  \hspace{1cm} (2)

And the intensity of the information flow between the consumer nodes is measured by the number of times \( P \) the commodity information is transmitted or obtained between the nodes.

\[

L = 1/P
\]  \hspace{1cm} (3)

Indicating that the greater the intensity of information flow between node \( u \) and \( v \), the more frequent the acquisition or transmission of information, the smaller the distance between the two consumption nodes, the more conducive to the formation of similar consumption preferences.

Thus, according to the consumer preference, the local product network promotion initial network marketing point is positioned on its neighbor node.

2.2. Related metrics for networks

(1) The average path length of the network. The path length between node \( u \) and \( v \) in the consumer network model is \( L_{av} = 1/P_{uv} \). For the shortest length of all paths connecting the two nodes, they are usually called geodesic lengths between nodes, and the longest length of all geodesic networks is called the diameter of the network.

\[

D = \max \{L_{av}\}
\]  \hspace{1cm} (4)

It can be used to measure the information coverage of the target consumption network, the small diameter network, and the high efficiency of information dissemination. The average length of the network can be further defined by averaging the path length of all nodes in the network:

\[

A = \frac{1}{N(N-1)} \sum L_{av} = \frac{1}{N(N-1)} \sum P_{uv}
\]  \hspace{1cm} (5)

These two statistics are used to measure the degree of possible consumer preference convergence between any two nodes in the network. The smaller the distance between the two statistics, the shorter the distance, the more frequent the transmission of information flow between nodes, the greater the possibility of consumer preference convergence and the higher the intensity of market diffusion [3].

(2) The clustering coefficients of network nodes. Each node in the network is connected to other nodes through a connection between nodes. The number of bars of the connection is called the degree of the node. Consider a node with a degree of \( k \), which is connected side by side with \( k \) other different nodes in the network [4]. If the \( k \) nodes are completely connected to each other, it constitutes a local complete graph with \( k(k-1)/2 \) connections between nodes, whereas in fact there is only \( E_k \) connection, so the clustering coefficient of this node is obtained.

\[

C_i = \frac{2E_i}{k(k-1)}
\]  \hspace{1cm} (6)

At the same time, there is the average value of the clustering coefficient of the whole network:

\[

C = \frac{1}{N} \sum C_i
\]  \hspace{1cm} (7)
The clustering coefficient and its average value reflect that the network with high aggregation degree of nodes in the network often has high efficiency of information flow and high frequency of information dissemination. It is very necessary to investigate the clustering coefficient of the target consumer group network before the local product is put on the market. The same advertising input acts on the target consumer group network with different clustering coefficient size. As a result, online advertising choice in high click rate websites or associations, posts, Weibo and other advertising benefits will be higher.

3. Digital marketing complex network of telecommunications enterprises

Enterprise marketing network exists in a business environment determined by market characteristics and operating conditions. Each node in the network has its own goal and behavior. The network structure is different from existing complex network models but not non-scale or small world. There are more dense correlation edges between nodes and nodes in a certain regional market range, while the density between regions is relatively low. Therefore, this paper regards the community structure of "node-to-node with more dense correlation edge" as a local world. Because of the competition in enterprise marketing network, the growth rate of node degree and intensity is not only related to the age of the node, but also to the fitness of the node. For enterprises, adaptation is to be able to deal with the competitive pressure effectively, to keep up with the development of technology, to respond to the needs of customers quickly, to make reliable decisions quickly through accurate prediction of customer needs, so as to shorten the order period and improve the level of customer service as far as possible. In the enterprise marketing network, new nodes are constantly added to the marketing network, and there are also nodes in the original marketing network leaving the network for various reasons. At the same time, the relatively low density connection between local marketing network and local marketing network is regarded as the connection between local world and local world [5]. Because each node in the enterprise marketing network has its own different identity and influence in the market, it is described in different positions. Based on this definition, the correlation degree of establishing connection possibility between two nodes is evaluated. Location parameters are used to measure the degree of proximity between the node and other nodes in the network. In addition, the importance of different nodes and different marketing channels in the marketing network is different, so the weight of nodes and edges should be considered in the construction of enterprise marketing network evolution model, and the construction of weighted network can provide a more comprehensive description of the evolution characteristics of the actual enterprise marketing complex network. The node strength integrates all the information of the degree of the node and the edge weight value connected to the node. In general, the stronger the node is, the more important it is in the network. The average node strength of the network can reflect the frequency of establishing connections between nodes and the degree of closeness of connection relationship. In general, the greater the average node is and the more strength of the network and the closer the relationship between nodes in the network. Complex network model evolution for digital marketing of telecom enterprises is shown in figure 1(a) (b) (c).

![Node degree](image-url)
4. Research on telecommunication customer classification and digital marketing strategy

China Telecom began to develop from the traditional telephone voice communication service to the integrated information service communication in recent years, and the types R benefits of the service are abundant, and the service group is becoming larger and larger [6]. The following is the current stage of the introduction of telecommunications customers, for the follow-up research to make a cushion. According to the nature of customers, telecommunications customers can be government-enterprise customers, private customer two categories. Government and enterprise customers include organizations such as governments, enterprises and other groups with telecom operator products, and private customers include family customers and individual customers. According to consumer spending, telecom customers can be further subdivided into high-end customers and ordinary customers.

4.1. Government and enterprise customer classification

High-end government and enterprise customers include operators, financial securities, party, government and military, tourism and hotel, trade, science, education, culture and health, manufacturing and retail. Ordinary government and enterprise customers mainly refer to those small and medium-sized enterprises and other organizations, the number is very large, the purchase behavior is very complex, the difference in the demand of ordinary government and enterprise customers in different industries is not obvious, it is difficult to subdivide it.

4.2. Private clients

Private clients include family and individual clients. In the growth and development of China Telecom, family customers have been playing a fundamental role. With the promotion of information
construction in China and the increasing demand for communication, the scale of family customers is becoming larger and larger [7]. According to the needs of the family, family customers can be divided into two groups: voice and integrated information service, broadband access and integrated information service demand. Individual customers mainly refer to mobile users such as PHS users and mobile phone users, and also include some mobile users who use IP phones and public phones, but because the latter has less data and is difficult to count, it is agreed that the individual customers in the text refer to mobile users. Before the third reorganization, China Unicom was the only full-service operator in China's telecommunications industry, while China Telecom and China Netcom could only operate fixed-line services, while China Mobile could only operate mobile services. Due to the restriction of business scope, the main customer base of fixed network operators is government and enterprise customers and family customers, and the proportion of individual customers is less; the main customer base of mobile operators is individual customers, and the proportion of government and enterprise customers and family customers is less.

5. Conclusion

The digital marketing of telecom business should follow the market diffusion dynamics characteristics of the target consumer network, attach importance to the important role of the clustering coefficient and average channel length of consumers in the network in the initial stage of market diffusion. Based on the analysis of customer behavior, the computer complex network model is used to develop strategies for guiding customers and planning for customers, as well as guiding new market trends.

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