Design of Interactive Cultural Brand Marketing System Based on Cloud Service Platform

Ziwei Pan*

College of Arts, Zhuhai College of Science and Technology, China
panziweiyun@163.com

Abstract

Changes in the marketing environment and consumer behavior are the driving force for the development of online marketing. Although traditional marketing communication still exists, it has been unable to adapt to the marketing needs of modern cultural brands. On this basis, this paper combines the cloud service platform to design an interactive cultural brand marketing system. In view of the problems of improper task scheduling and resource waste in cloud platform resource scheduling in actual situations, a dynamic resource scheduling optimization model under the cloud platform environment is established, and fuzzy evaluation rules are designed. Moreover, through problem analysis, based on the reinforcement learning algorithm, this paper proposes a deep reinforcement learning resource scheduling algorithm based on tabu search, and combines the algorithm to design the functional module of the marketing system. On this basis, this paper designs an experiment to verify the performance of this interactive cultural brand marketing system. The research results prove that the marketing system constructed in this paper has certain reliability.

Keywords: Cloud service platform, Interactive culture, Brand marketing, System design

1 Introduction

With the development of information technology, especially the development of communication technology, the Internet has promoted the formation of a new type of media with a wider radiation area and stronger interaction. It is no longer limited to the one-way communication of traditional media such as radio and television, but can conduct real-time interactive communication and contact with media recipients. Correspondingly, the new thing of network marketing has also emerged. Internet marketing is a form of direct marketing. It is the product of the combination of corporate marketing practices, modern information communication technology, and computer network technology. ICTs is a larger name for Information Technology (IT), which encompasses all communications technologies and the internet, wireless communications, smart phones, workstations, programming, software, multimedia, social media, and other multimedia apps and data. Software and operating systems are examples, as are web-based knowledge and services such as remote learning, as well as cellphones as well as other telecommunications products. Moreover, it refers to the general term for various marketing activities carried out by enterprises using electronic information technology and computer networks as media and means, including network research, network new product development, network promotion, network distribution, and network services [1].

Internet marketing is an integral part of the overall marketing strategy, and is carried out to achieve the overall business objectives of the enterprise, and it refers to various activities that use the Internet as the basic means to create an online business environment. It can be seen that the essence of online marketing is to create an online business environment. This online business environment refers to the environment related to the development of online business activities inside and outside the enterprise, including the website itself, customers, network service providers, partners, suppliers, sellers, and the network environment of related industries. The construction of the online business environment is mainly through the establishment of a website with marketing as the main purpose, and on this basis, the website is promoted through some specific strategies, so as to establish and expand the relationship with other websites and with users. Its main purpose is to enhance the brand image, enhance customer relations, improve customer service, open up online sales channels and ultimately expand sales for the company [2].

The traditional two-layer structure has many defects. One is that it is a single server and is centered on a local area network, so it is difficult to expand to large enterprise WANs. A wide area network commonly referred to as WAN is really a huge collection of servers that is just not controlled by a single place. Through a WAN operator, WANs can permit connectivity, sharing of information, and so much more among endpoints all over the globe. WANs are large supply and also have a great capacity for interconnecting a big number of devices over a broad region. They make it easier to share regional assets. Uplinks are used to link Computers and MANs to the Web [21]. Second, limited by the supplier, the upgrade and maintenance of the program must be re-developed and extended by the supplier. Third, the combination and integration capabilities of software and hardware are limited. It presents a thick client on the software, and the user must install a specific client application on the client. Moreover, the business logic of the enterprise is written in the client application, which is difficult to maintain. The program upgrade requires each client to install a new client application. At the same time, for program developers, the reusability of program modules is poor, and each module is

*Corresponding Author: Ziwei Pan; E-mail: panziweiyun@163.com
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relatively independent. Fourth, the client/server model is difficult to manage a large number of clients [3].

The cloud computing notion indicates that end users can have remote access to a wide range of services. Cloud computing services can be grouped into three categories: infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) (SaaS). All materials required for deploying applications and maintenance of private clouds depending on virtualization from prominent manufacturers are included in network infrastructure solutions provider. These systems' combined researchers reveal all phases of the cloud services and program development process, with an emphasis on self-situations that include complicated business applications management [23].

Based on the above analysis, based on the cloud service platform, this paper constructs an interactive cultural brand marketing system based on the cloud platform to provide theories for subsequent interactive cultural brand marketing.

2 Related Work

Cloud platform is a comprehensive service platform based on distributed and parallel processing. It provides service models based on resource sharing, virtual storage, and efficient computing for many different users, and it builds a multi-user, multi-service functional application-level sharing model based on grid computing, parallel computing and other technologies [4]. Cloud computing features include distributed, high scalability, and on-demand services. At present, cloud platforms are used in many fields, Among the many cloud service platforms, the general-purpose cloud service platform has been applied to multiple platforms [5]. In the cloud service platform in the application field, such as in the fields of government affairs, science and education, and enterprise management [6].

Through the resource management mode, cloud computing allocates and manages the server resources of the cloud center, divides multiple network resource sharing spaces [7], and realizes the access, allocation and utilization of central resources by creating a virtualization mode. Typical products such as the United States' Open Stack cloud platform [8] provide a Linux series deployment environment. The domestic Alibaba Cloud also provides application resources for enterprises, including various operating systems and database platforms. The cloud service framework completes processing and computing capabilities through each node assigned. These computing nodes can be analyzed on demand. If there is a problem with a node, the node can be deleted through the computer center. If the efficiency in processing calculations is not enough to support the computing needs, the expansion of computing power can be achieved by adding computing nodes [9].

Many fields of advertising work with marketing strategy. The goal of brand marketing is to build a commodity which will captivate the consumer and take the business to the next level. Marketing is divided into two types: brand building and direct reaction marketing. Marketing plans or tactics are at the heart of establishing brand value. Marketing efforts can aid in enhancing the customer experience and establishing the appropriate brand reputation. Goods, prices, and channel of distribution can all be woven into marketing efforts. Integrate advertising information with ease to track and understand better how people engage with your company, from advertising campaigns to reward programs to browsing the website or app [24]. By effectively separating your consumers, creating unique communities, and personalizing material at volume, you can build more compelling, user recommendations that boost engagement and generate profitability.

Cloud computing provides terminal customers with a billing model based on traffic, on time, and other methods. This model can be applied to the sales of some cloud service platforms [10]. The cloud service platform provides a basic storage platform for the big data platform. Unlike structured data, it can provide some unstructured database storage platforms. The cloud service platform uses HDFS (distributed file system) to achieve mass storage, and data storage selects databases such as HBase [11]. The database storage used by cloud storage is an unstructured storage technology, which uses distributed files (HDFS) as cloud storage files, which has high fault tolerance. HDFS can be used in a variety of heterogeneous storage services, reducing the storage cost of system data and the cost of daily operation and maintenance [12]. HDFS can support the high throughput of system data and can be used in scenarios where massive data is accessed concurrently [13]. HDFS-based data storage has high reliability. When the system storage is damaged, the system can complete the data service normally. When the file storage cannot meet the demand, it needs to be realized by expanding the file storage method, so the system file storage is easy to expand And expansion [14].

The cloud computing database adopts Hbase, and its data storage has high reliability, real-time and scalability [15]. In addition to providing SQL statement-based writing to complete data statistical analysis, it also provides related tools for data mining, data extraction, etc., which can achieve data filtering and screening according to conditions, and the processed data can be updated to the original database. Database records can be changed in batches [16].

The cloud computing resource pool uses virtualization technology to build a data service virtualization platform model. The cloud computing resource pool centralizes hardware and software resources, allocates resource pools, etc., and its centralized monitoring and management system. Fully support the development of the business platform. Establish a hybrid cloud platform that integrates cloud host, cloud desktop, and cloud storage business [17].

3 Grid Multi-objective Service Composition Algorithm based on Variable Neighborhood Search

FAGEA is a fast adaptive grid multi-objective service composition algorithm based on variable neighborhood search. The multi-objective optimization approach generates a number of essential alternatives and includes a visual tool that allows the user to visualize and compare options. As a result, the user can select the option that offers the optimal trade-off. Unlike similar systems, this multi-workflow scheme uses policy decisions as input parameters in the optimization procedure. In this way, QoS considerations can be incorporated into the compositional strategic planning [26]. Its purpose is to quickly find the Pareto frontier of multi-objective service composition in the cloud platform and support

decision makers according to their subjective preferences. In multi-objective optimization problems, the idea of Pareto fronted, or group of optimum solution in the universe of optimization problem, refers to a set of answers that are non-dominated to one another yet different from the rest of the answers in the search area. The optimal criteria universe's border contains all Pareto optimal locations. Programs frequently produce answers that aren't Pareto optimum but meet additional requirements, making them ideal in real world applications [28]. Find the most optimal Pareto solution. The optimal solution is generated by the Pareto front. Generally, the performance of multi-objective optimization can be measured by measuring whether the distribution of the Pareto front is uniform and widely distributed.

Since the grid itself can intuitively show the distance between different points in the grid and the distribution of points, the concept of spatial grid is introduced in FAGEA to divide the individual space, where the grid is used to determine the object The location in the target space. When a new population is generated, the location and size of the grid will also be adjusted accordingly. The purpose is to enable the updated grid to contain the entire population [18].

The grid environment is shown in Figure 1.

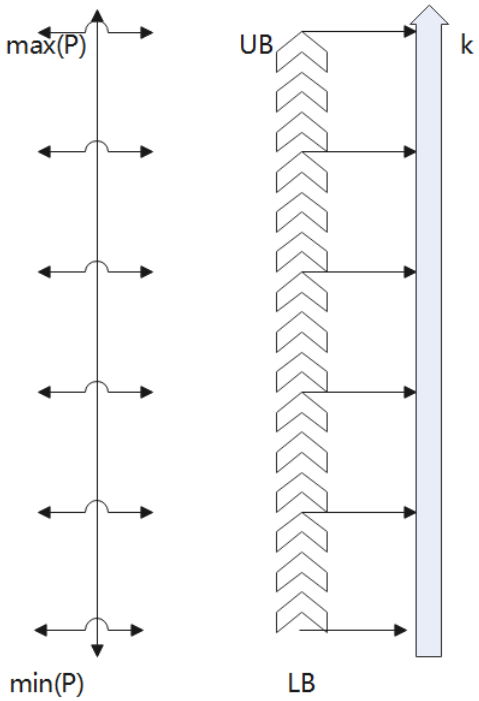

Figure 1. Grid environment

Single resource service request task, which could be performed by engaging an only resource provider, and multi-resource change requests task, which can be done by contacting numerous resources providers in a specific order in embedded environments, notably in a grid system. The system will search for resource services that really are suitable for the required properties of an SRSRTask and selects the best one to perform it. In addition to viewing for all qualifying resource services by each subproblem in an MRSRTask, the system chooses one prospective resources provider by each subproblem. The program then creates a new composites resources services and chooses the best composites resources services path from all of the options to accomplish the work with the supplied multi-objective [30].

In order for the grid environment to be adaptively constructed, it is first necessary to determine the upper and lower boundaries of the target grid to be optimized. The upper and lower boundaries of the grid of the kth target to be optimized are defined as:

$$UB_k = \max_k(p) + \eta \frac{\left(\max_k(p) - \min_k(p)\right)}{div} \tag{1}$$

$$LB_k = \min_k(p) - \eta \frac{\left(\max_k(p) - \min_k(p)\right)}{div} \tag{2}$$

Among them, $\max_k(p)$ and $\min_k(p)$ are respectively the maximum and minimum values of the k-th target to be optimized, and div is the number of divided target spaces in this dimension. η is the grid scaling factor, which affects the scaling of the upper and lower bounds of the grid, and it can be expressed as [19].:

$$\eta = \begin{cases} \frac{1}{2} & div < 10 \\ 2 & div \geq 10 \end{cases} \tag{3}$$

Grid Scale Factor is a measure of deformation on a projection grid at a certain position. The scale factors are the factors used it to compute true elliptic lengths instead of distances on the projection ground, instead of cartography scaling.

The effect of the above formula is that the upper and lower bounds of the grid space will be reduced when the div is larger,

but the existence of the parameter η will reduce the extent of the reduction. Similarly, when the div is smaller, the individual crowding in the grid will decrease. Therefore, it is necessary to expand the boundary to find surrounding individuals to increase the degree of congestion in the grid. However, due to the existence of the parameter η, the extent of the expansion limit will not be too drastic to a certain extent.

Correspondingly, the original M-dimensional target space will be divided into div_M subspaces. Therefore, the width of the subspace in the Kth target can be expressed as [20].:

$$W_k = \frac{UB_k - LB_k}{div} \tag{4}$$

Since the grid position can be represented by the upper and lower bounds of the grid space, the grid position in the Kth target can be expressed as:

$$G_k(x) = \left\lfloor \frac{F_k(x) - LB_k}{W_k} \right\rfloor \tag{5}$$

Among them, $\lfloor \cdot \rfloor$ is a round-down function, $G_k(x)$ is the grid coordinate of a single x in the k-th target, and $F_k(x)$ is the actual target value in the k-th target. The round down function takes a value that has been reduced downward to a specified number of decimal places. The procedure for round decimal is now almost comparable to the technique used during rounded entire integers.

So far, FAGEA has completed the adaptive construction of the grid space for an optimization target. If there are other optimization goals, the space construction process will start again. Obviously, FAGEA is dynamically adaptive when constructing the grid space, and can adjust the size of the grid in real time.

In order to make the population update develop in the optimal direction, and make the individuals evenly distributed and diversified along the obtained trade-off surface. Three grid-based standards are introduced to assign individual fitness values, namely grid ranking, grid crowding distance, and grid coordinate point distance. Ranking grids are matrices in which questions are required to evaluate or score objects in order of importance. This topic includes some confirmation features for guaranteeing that each item in a grid is assigned a distinct classification rank. The concentration of remedies encircling a remedy is estimated using the crowding maximum distance of the that way to solve. The average gap between adjacent neighboring remedies determines a system provides crowding distance value. Among them, GR and GCPD standards are used to assess individual convergence, and GCD standards are related to the diversity of individuals in the population.

GR is a convergence estimator that can be ranked according to individual grid positions. For each individual, GR is defined as the sum of its grid coordinates in each target [22].:

$$GR(x) = \sum_{k=1}^{M} G_k(x) \tag{6}$$

Among them, $G_k(x)$ is the grid coordinates of the individual x of the k-th optimization target, and M is the total number of targets to be optimized.

GCD is a density estimator that can consider the distribution of the solution neighborhood based on the density estimation. It can be expressed as:

$$GCD(x) = \sum_{y \in N(x)} \left(M - GD(x,y)\right) \tag{7}$$

Among them, $N(x)$ is a set of neighborhood solutions.

GCPD is the normalized Euclidean distance between the individual and the ideal point. Each quadratic difference among characteristics or individuals is divided by the total of squared differences or confidence interval to obtain normalization Euclidean distance. It is used to deal with the special case of the same GR and GCD, which can be expressed as:

$$GCPD(x) = \sqrt{\sum_{k=1}^{M} \left(\frac{\left(F_k(x) - \left(LB_k + G_k(x) \cdot W_k\right)\right)}{W_k} \right)^2} \tag{8}$$

Among them, $F_k(x)$ is the true value of the individual x of the kth target. Obviously, the smaller the value of GCPD, the better.

Unlike GrEA, FAGEA's individual optimal selection mechanism uses an improved form of the roulette selection algorithm. The basic idea is to make an individual's fitness level have a certain proportional relationship with the probability of being selected. In addition, this paper also adds a certain probability for random selection to ensure that the process of selecting the population has a certain exploratory and robustness. First, the fitness value $f(i = 1,2,\cdots,M)$ of each individual in the population is calculated, where M is the population size. Then, the probability of the individual inheriting to the next generation population is calculated, and the calculation method is [25].:

$$P(x_i) = \frac{f(x_i)}{\sum_{j=1}^{N} f(x_j)} \tag{9}$$

The cumulative probability of each individual is calculated by the following formula.

$$q_i = \sum_{j=1}^{i} p(x_j) \tag{10}$$

Finally, whether a uniformly distributed pseudo-random number r generated in the $[0, 1+\delta]$ interval is less than $q_i + \delta$ is judged. If $r < \delta$, an individual is randomly selected. If $r < q_i + \delta$, then the i-th individual is selected as a member of the next-generation population, otherwise, the k-th individual is selected to make $q_{k-1} + \delta < r < q_k + \delta$.The above steps are repeated until M times.

(4) Global optimal selection mechanism based on variable neighborhood search strategy

FAGEA uses the three fitness standards of GR, GCD and GCPD to compare individuals to select individuals. The priority of the importance of these three standards is $GR > GCD > GCPD$, and the main basis is the GR standard. In addition, the concept of grid dominance and grid difference is introduced.

We define the grid dominance as $x, y \in P, x \prec grid^y$, and it is equivalent to:

$$\forall i \in (1,2,\cdots,M): G_i(x) \le G_i(y) \wedge \exists j \in (1,2,\cdots,M); G_i(x) < G_i(y) \tag{11}$$

Among them, $x \prec grid^y$ means that the individual x is not dominated by the individual y grid. M is the number of optimization targets, p is the population that needs to be optimized, the grid environment is composed of population p, and $G_i(x)$ is the grid coordinates of individual x in the i-th target.

The element grid difference between individual x and individual y is defined as [27].:

$$GD(x,y) = \sum_{k=1}^{M} |G_k(x) - G_k(y)| \tag{12}$$

Among them, $x, y \in p$ The grid difference is affected by the number of grid divisions. When the number of grid divisions is larger, the grid unit grid is smaller

In order to quickly find the global optimal frontier, first find all the Pareto frontiers that have been sorted according to the fast non-dominated sorting method. After storing the sorted frontier set, judge and maintain the diversity of Pareto solution set according to the grid difference.

In order to ensure the timeliness of dynamic resource scheduling during the operation of the cloud platform, avoid the inefficient use of resources, and ensure the user's cost-effective experience, this article takes the average completion time of tasks in the scheduling process, the average resource utilization rate, and the average operating cost-effective ratio as the target, Establish an optimization model. Considering that users want to obtain processed workpieces quickly and cost-effectively, they hope that the utilization rate of the operating platform will increase.

The calculation method of the scheduling optimization objective function in this paper is shown in the following formula [29].:

$$Obj = \{\min(ACT), \max(ARU), \max(ACR)\} \tag{13}$$

Among them, ACT is the average completion time of tasks in the scheduling process, ARU is the average resource utilization rate, and ACR is the average operating cost ratio.

For the convenience of presentation, this paper virtualizes all cloud platform resources (such as capabilities, material storage capabilities, logistics capabilities, etc.) into computable units. The whole system consists of three parts: user demand side, side and cloud platform scheduler.

The real-time user needs of the cloud platform can be written as a user demand matrix. We assume that at time t, a total of n user requirements $\{D_1, D_2, \cdots, D_n\}$ are generated on the user demand side, among which $t = \{1,2,\cdots,L\}$ .It is worth noting that each user requirement contains k kinds of resources $\{R_1, R_2, \cdots, R_k\}$. Demand Matrix is a global leader in AI-powered Techno graphics and Intention Analytics for B2B marketers looking to reach the fundamental stage in identifying and targeting the correct customers depending on their tendency to invest in a specific technology. Specifically, the user demand matrix is as follows:

$$d_{n,k} = \begin{bmatrix} d_{1,1} & d_{1,2} & \cdots & d_{1,k} \\ d_{2,1} & d_{2,2} & \cdots & d_{2,k} \\ \vdots & \vdots & \cdots & \vdots \\ d_{n,1} & d_{n,2} & \cdots & d_{n,k} \end{bmatrix} \tag{14}$$

Among them, $d_{n,k}$ represents the demand vector of the kth resource of the nth user.

In order to simplify the problem, this paper assumes that the resource requirements of all tasks are known when they arrive. Among them, the task arrival time, task due time, and user D_i's location are a_i, b_i, and (x_{D_i}, y_{D_i}), respectively.

In addition, the real-time resource status of the cloud platform can be written as a status matrix. The control remains effective for any angular position since the state matrix and control results are refreshed every minute and suited to the present system circumstances. At time t, there are m running $\{F_1, F_2, \cdots, F_m\}$, and the state matrix is as follows:

$$f_{m,k} = \begin{bmatrix} f_{1,1} & f_{1,2} & \cdots & f_{1,k} \\ f_{2,1} & f_{2,2} & \cdots & f_{2,k} \\ \vdots & \vdots & \cdots & \vdots \\ f_{m,1} & f_{m,2} & \cdots & f_{m,k} \end{bmatrix} \tag{15}$$

Among them, $f_{m,k}$ is the real-time status of the m-th k-th resource. m is a fixed value, which means that all tasks are executed only in m during the entire operating cycle. In contact with reality, this paper believes that each capacity is much larger than a single demand task, so it can accommodate multiple running tasks at the same time. In addition, the cost and location of F_j are c_j and (x_{F_j}, y_{F_j}), respectively.

In the task and resource scheduling process, the cloud platform scheduler selects one or more demand tasks from the demand pool for scheduling at the same time in each time step. Among them, user demand and production capacity remain unchanged. It is worth noting that when there are enough resources to ensure that no resource preemption occurs during the scheduling process, each selected requirement should be executed so that the task can be completed without causing any resource fragmentation. If all resources cannot meet the needs of the current task, the task will enter the waiting queue. In addition, if at time, the sum of the selected m capabilities is less than the sum of n user requests for any resource type, the task is frozen at the current time, and the resources at the current time step will be re-allocated so that All planned tasks can be completed in the job.

(1) ACT optimization sub-model

When the arrival time a_i and the due time b_i of the i-th task are given, the ideal duration e can be expressed as:

$$e=\sum_{i=1}^{n}(b_i-a_i) \tag{16}$$

Among them, n is the total number of tasks in a job sequence.

It is worth noting that delay is inevitable. Therefore, this paper considers the possibility of emergencies. For example, if the progress of the task will be delayed due to a machine failure, the machine delay of the i-th task is g_i .In addition, in the later stage of scheduling, since a certain processing task may be saturated, the newly arrived task cannot continue to be scheduled and needs to wait. This paper also defines the waiting delay of the i-th task as o_i . The i-th position delay between users is:

$$q_i=\alpha\left(\left(x_{F_j}-x_{D_i}\right)^2+\left(y_{F_j}-y_{D_i}\right)^2\right)^{\frac{1}{2}} \tag{17}$$

Therefore, the total delay v can be expressed as:

$$v=\sum_{i=1}^{n}\left(g_i+o_i+\alpha\left(\left(x_{F_j}-x_{D_i}\right)^2+\left(y_{F_j}-y_{D_i}\right)^2\right)^{\frac{1}{2}}\right) \tag{18}$$

Among them, the parameter α is the time coefficient, expressed as an integer, x_{F_j} and y_{F_j} are the values on the x-axis and y-axis of the j-th position, respectively, and x_{D_i} and y_{D_i} are the values on the x-axis and y-axis of the i-th specific demand position, respectively.

When considering both the delay and the ideal duration, the average task completion time can be expressed as:

$$ACT=\frac{1}{n}\sum_{i=1}^{n}\left(b_i-a_i+g_i+o_i+\alpha\left(\left(x_{F_j}-x_{D_i}\right)^2+\left(y_{F_j}-y_{D_i}\right)^2\right)^{\frac{1}{2}}\right) \tag{19}$$

Among them, b_i is the expiration time of the i-th task, a_i is the arrival time of the i-th task, g_i is the machine delay of the i-th task, o_i is the waiting delay of the i-th task.

(2)ARU optimized sub-model

The effective resource utilization of the cloud platform can avoid unnecessary waste of resources in the entire resource scheduling process. This paper defines the action taken by the scheduler as A_i^t in the i-th learning round at time t. Then, the average resource utilization rate is:

$$ARU=\frac{1}{K}\sum_{k=1}^{K}\frac{\sum_{t=0}^{L}d_i^{t,m,k}\cdot\arg\max\left(A_i^t\right)}{f_i^{t,m,k}} \tag{20}$$

Among them, $d_i^{t,m,k}$ is the task of the Kth demand type at time , A_i^t is the vector of the action space that generates random probabilities, $f_i^{t,m,k}$ is the operating capacity of the kth resource type of the m-th node at time t; K is the upper limit of the number of resource types.

In each round of learning, sum up the resources required by all tasks in the selected action value, and calculate the sum value with the selected resource. The obtained value is in the range of 0 to 1 and finally all the values are summed up again Get the average resource utilization value of this article on average. It is worth noting that all task requirements should be within the upper limit of ability. If the sum of the tasks in the selected action space exceeds the upper limit, a reselection action will be performed.

(3) ACR optimization sub-model

In the task, another operational indicator worth considering by the user is the average cost-effective ratio of the task. The gross value is estimated by the change in the endpoints to get a cost-effectiveness ratio. A cost-effectiveness study can assist discover areas where resources can be redirected to accomplish more. It highlights not just the value of redistributing resources between inefficient to treatment options, but also the value of supports up from less expense toward more cost-effective initiatives. While ensuring the completion of tasks in a short time and high resource utilization, users usually also hope that the operating services they purchase have a certain price-performance ratio. Therefore, this article also established a model about the average operating cost-effective ratio, which is calculated as follows:

$$ACR=\frac{PERF}{C}\times 100\% \tag{21}$$

Among them, PERF is the quantified product performance, and C is the operating cost. Generally, the average operating cost ratio is composed of two parts, namely operating costs and quantified product performance. C is given by:

$$C=\frac{1}{n}\sum_{i=1}^{n}\left(c_i+\beta\left(\left(x_{F_j}-x_{D_i}\right)^2+\left(y_{F_j}-y_{D_i}\right)^2\right)^{\frac{1}{2}}\right) \tag{22}$$

Among them, the parameter β is the distance cost coefficient, which represents the degree to which distance affects the price, and c_i is the cost of operation. It is worth noting that the above formula shows the average task cost of a work sequence.

In order to quantitatively evaluate the services of different tasks, this paper uses fuzzy theory to evaluate the operational services in the cloud platform scheduling process. The evaluation level is divided into 5 types: very high performance (VH), high performance (H), normal performance (N), low performance (L) and very low performance (VL).In addition, this paper uses defuzzification processing for fuzzy operational service levels, and the specific method is to map the fuzzy evaluation results to fuzzy triangle numbers. Then, the membership function of the quantified product performance can be expressed as:

$$PERF(x)=\begin{cases}\dfrac{x-l}{m-l} & x\in[l,m]\\ \dfrac{u-x}{u-m} & x\in[m,u]\\ 0 & otherwise\end{cases} \tag{23}$$

Among them, l and u are the upper and lower limits of the fuzzy number of product performance, and m is the most likely value. Figure 2 intuitively shows the distribution of five triangular fuzzy levels.

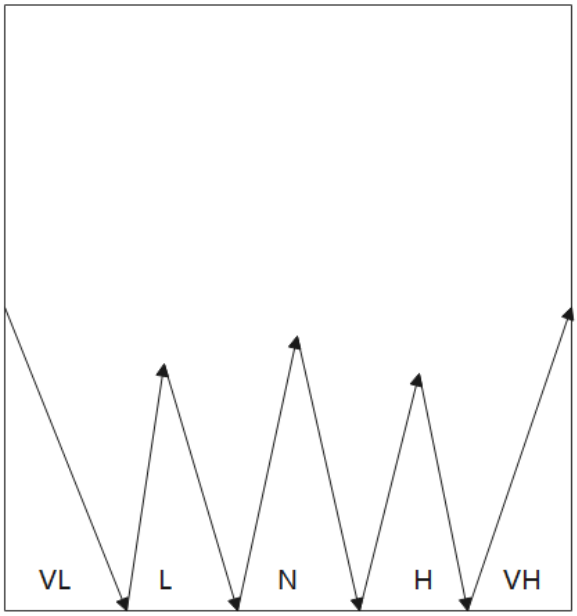

Figure 2. Distribution of five triangular fuzzy levels

At this point, the optimization target model DRSOM is established.

4 Interactive Cultural Brand Marketing System based on Cloud Service Platform

The interactive integrated marketing management system based on the cloud service platform includes two parts: managers manage the system in the background and customers browse and participate in marketing activities on the front-end web pages. Others such as payment authentication systems do not belong to the scope of this system.

Participants are the roles played by things that directly interact with the system. According to the previous system requirements, the following participants can be determined in the scope of the system's responsibilities: ordinary viewers, members, content managers, marketers, and system administrators. According to the identity and operation of the participants, ordinary viewers and members can be generalized to customers, and content managers, marketers, and system administrators can be generalized to managers.

After defining the participants, according to the previous system requirements, the use case diagram shown in Figure 3 can be obtained.

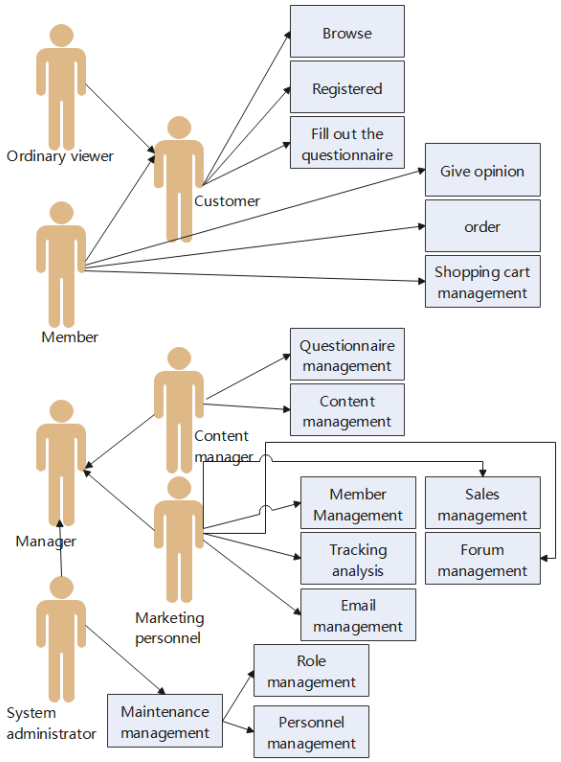

Figure 3. Use case diagram of interactive cultural brand marketing system based on cloud service platform

The functional architecture of the platform is shown in Figure 4.

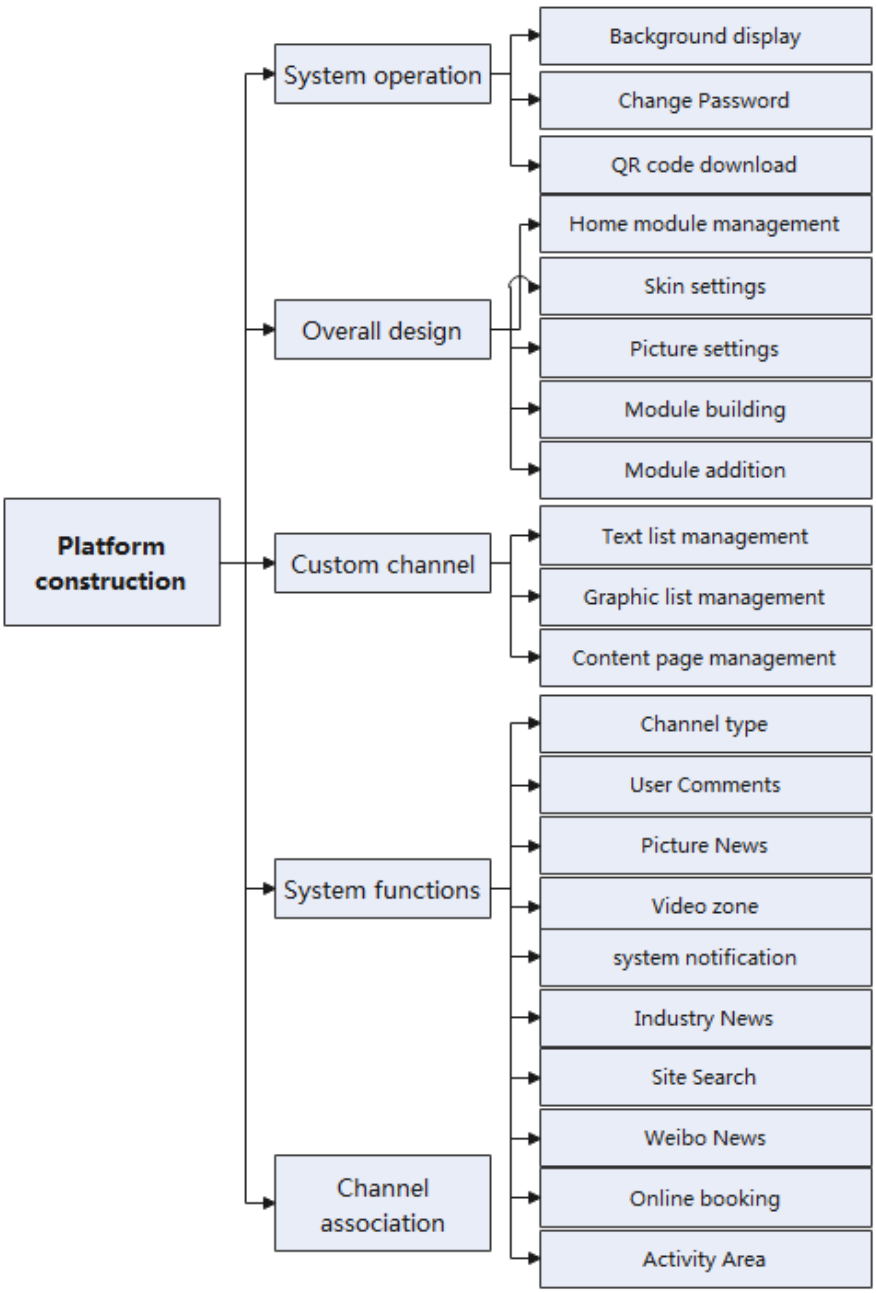

Figure 4. Functional architecture diagram of platform construction

The platform includes system operation, overall design, custom channels, system functions, and channel associations. Among them, the system operation involves background display, password modification, and QR code download. The overall design involves home page module management, skin settings, carousel picture area addition settings, module construction, and module addition. Custom channels involve text list management, graphic list management, and content page management. System functions involve channel types, user messages, photo news, video zones, system announcements, industry trends, site search, Weibo dynamics, online reservations, and event zones.

The network architecture of the interactive marketing platform is shown in Figure 5.

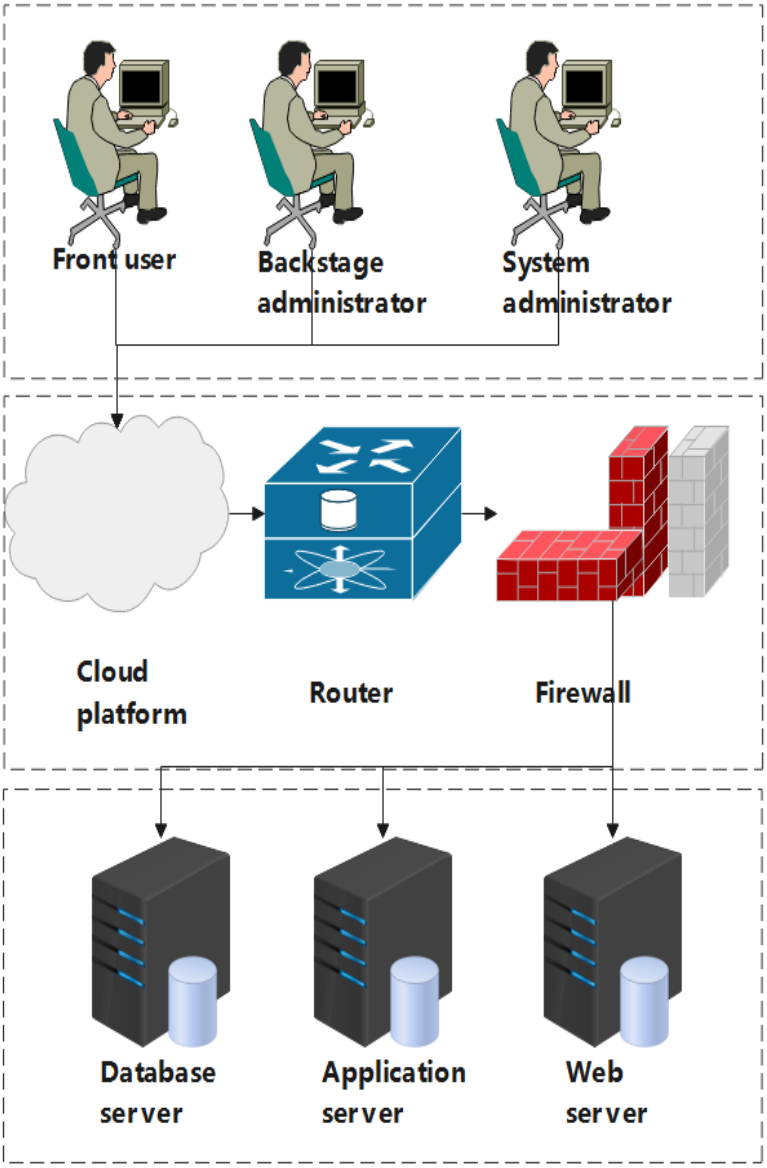

Figure 5. Platform network architecture diagram

In most cases, cloud computing equipment is housed in datacenters. As a result, today's cloud programs are built on process of developing and implementing in remote data centers interconnected by high-speed networking. Cloud networking expands virtualization technology across cloud services to offer customers with cloud and telecommunication infrastructure. Virtual routers, broadband, digital firewalls, and network protocols are all examples of network resources. Virtualization approaches allow several users to share a physical server or system. A cloud server is a virtual server that runs in a cloud computing system instead of a database hardware. It's created, stored, and distributed via the web via a cloud platform that can be viewed from anywhere. A server that hosts apps is known as a database server. An application server program defines tools for developing web apps as well as a database server in which they can run. On the front-end business page of the marketing platform, the front-end user realizes that when viewing the product details display, the product details display request is sent, and the operation method of the product management form class The product details display captures the product detail display instructions and creates the front-end business service Class, execute the product detail display database statement, and display the corresponding product detail record. The activity diagram for the realization of product details display is shown in Figure 6.

When the order details view is implemented, the front-end user can view the order details in the background business page of the marketing platform. After the order details view request is sent, the order management control class has the operation method Order details view Captures the order details view instruction , Execute the order details to view the database statement, and display the corresponding order details records. The activity diagram of the realization of order detail view is shown in Figure 7.

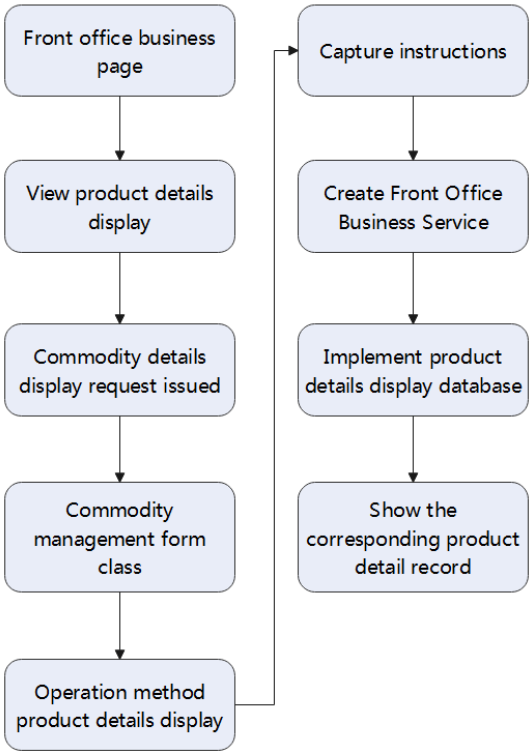

Figure 6. Activity diagram of the realization of product detail display

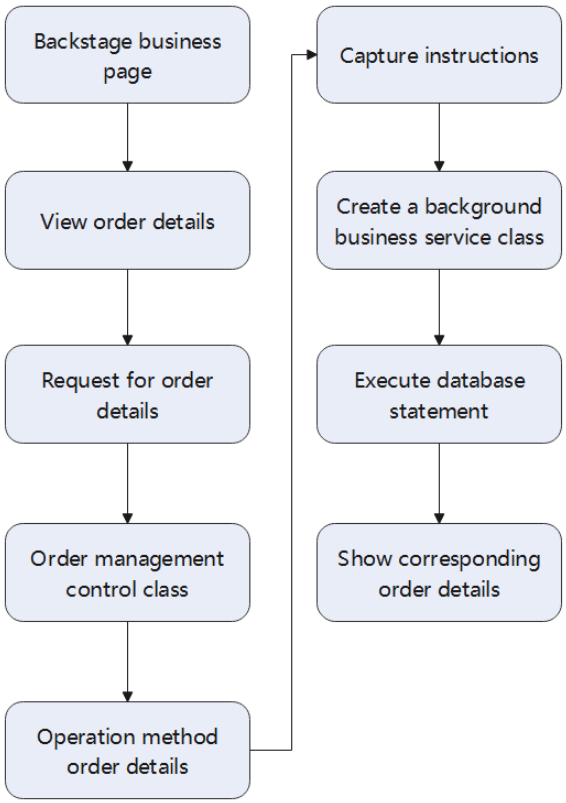

Figure 7. Activity diagram of the realization of order detail view

5 Performance Test of Interactive Cultural Brand Marketing System based on Cloud Service Platform

This paper constructs an interactive cultural brand marketing system based on the cloud service platform and verifies the performance of the system constructed in this paper based on the actual situation. In the process of system verification, this paper mainly combines two aspects of marketing system's data operation performance and marketing effect. First, the marketing data is processed. This article combines the interactive cultural brand marketing requirements to set 72 sets of data, and uses the system constructed in this paper to process the marketing data. The results are shown in Table 1 and Figure 8.

Table 1. Statistical table of evaluation of data processing effect of interactive cultural brand marketing system based on cloud service platform

No.	Data processing score	No.	Data processing score	No.	Data processing score
1	78.5	25	79.4	49	87.4
2	74.4	26	72.3	50	88.6
3	89.3	27	85.8	51	86.6
4	81.5	28	78.9	52	72.3
5	78.8	29	76.5	53	74.8
6	77.0	30	82.7	54	87.4
7	78.8	31	86.2	55	84.8
8	79.6	32	89.4	56	84.5
9	82.6	33	78.1	57	87.3
10	78.5	34	79.4	58	88.9
11	85.4	35	74.9	59	84.6
12	78.7	36	86.4	60	73.1
13	84.4	37	78.9	61	89.0
14	80.1	38	82.2	62	84.2
15	78.7	39	88.3	63	72.7
16	75.2	40	83.0	64	88.8
17	83.4	41	83.1	65	86.7
18	73.9	42	77.9	66	72.7
19	83.2	43	83.0	67	80.4
20	77.8	44	78.5	68	84.2
21	77.4	45	86.4	69	86.1
22	83.8	46	87.3	70	74.5
23	80.8	47	79.2	71	80.5
24	81.9	48	83.2	72	84.2

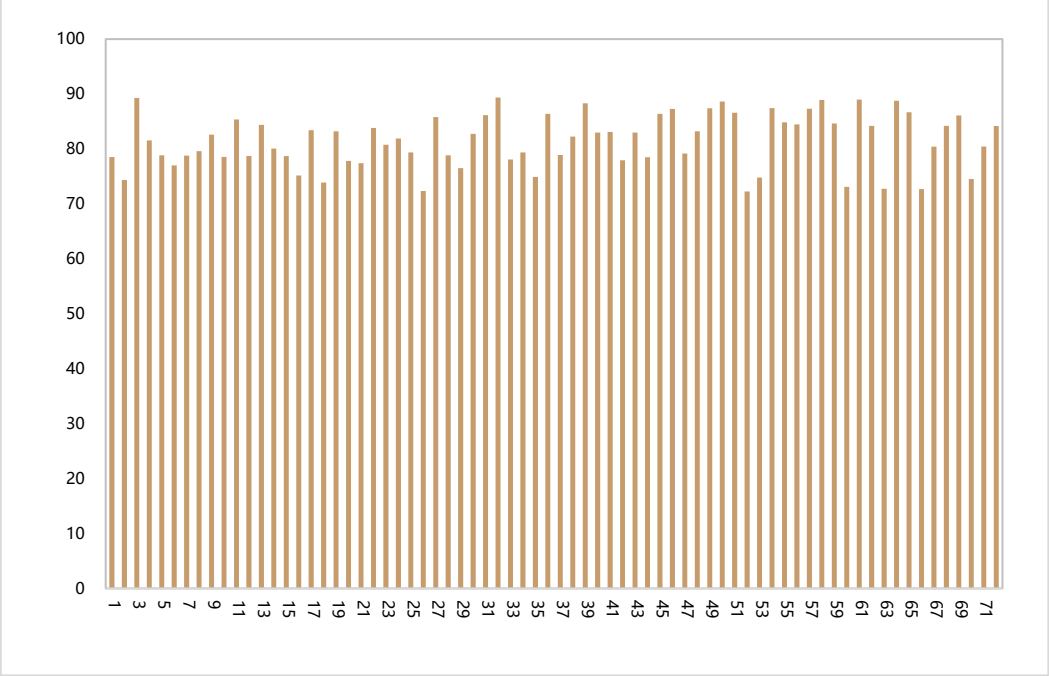

Figure 8. Statistical diagram of evaluation of data processing effect of interactive cultural brand marketing system based on cloud service platform

From the data test experiment, the system constructed in this paper can effectively process a large amount of marketing data and effectively improve the processing and sending of marketing data. On this basis, this paper further analyzes the marketing effect of the interactive cultural brand marketing system based on the cloud service platform. The marketing effect is evaluated by means of expert scoring, and the results are shown in Table 2 and Figure 9.

Table 2. Statistical table of the evaluation of the marketing effect of the interactive cultural brand marketing system based on the cloud service platform

No.	Data processing score	No.	Data processing score	No.	Data processing score
1	76.9	25	71.8	49	74.4
2	72.1	26	75.6	50	77.7
3	80.0	27	70.6	51	82.9
4	66.7	28	67.6	52	72.6
5	69.5	29	67.5	53	73.4
6	69.4	30	83.8	54	72.2
7	75.4	31	71.5	55	83.3
8	70.3	32	66.7	56	73.7
9	81.8	33	82.6	57	67.3
10	79.3	34	71.7	58	71.3
11	66.8	35	72.1	59	74.4
12	66.4	36	71.3	60	68.5
13	82.8	37	71.1	61	64.6
14	73.9	38	67.6	62	76.9
15	64.2	39	67.4	63	67.5
16	77.4	40	82.0	64	70.8
17	78.9	41	68.1	65	80.3
18	74.4	42	78.3	66	72.5
19	66.9	43	64.7	67	77.7
20	84.0	44	71.2	68	73.5
21	78.3	45	78.7	69	83.4
22	74.8	46	72.8	70	76.1
23	71.5	47	79.4	71	69.0
24	67.1	48	69.5	72	82.3

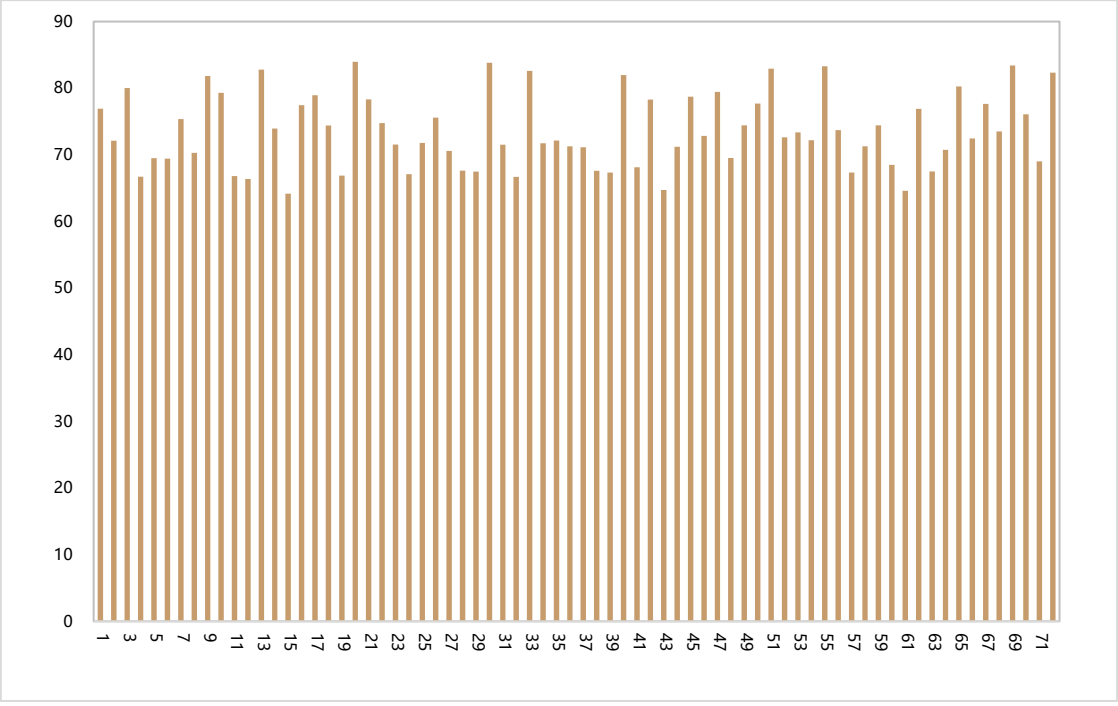

Figure 9. Statistical table of the evaluation of the marketing effect of the interactive cultural brand marketing system based on the cloud service platform

From the above statistical results, it can be seen that the interactive cultural brand marketing system based on the cloud service platform constructed in this paper has a better marketing effect.

6 Conclusion

The widespread use of the Internet has had a huge impact on the marketing communication environment of corporate culture brands. The previous marketing communication theories and methods have been unable to guide current companies to conduct efficient marketing communications in the fierce competition. The research on how to realize efficient interactive marketing communication under the Internet environment has important theoretical significance and practical application value.

Through the research on the theory and method of interactive marketing communication, this paper explains the current situation of marketing communication research and conducts empirical analysis to investigate the influence factors of marketing communication, and then builds an interactive marketing communication system model under the Internet environment. Moreover, this paper combines the results of the survey on the influence factors of marketing communication and gives a series of suggestions for enterprises to establish a marketing communication system. Finally, the performance of the system constructed in this paper is evaluated. From the research results, it can be seen that the system constructed in this paper has a certain effect.

Positioning yourselves as an autonomous trusted advisor is an important component of online advertising in the corporate technology space. As a result, high-quality content like as press releases, blog articles, and webinar are crucial for building the groundwork for bringing influencers on onboard in the future.

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Biography

Ziwei Pan is a lecturer working at Faculty of Liberal Arts in Zhuhai College of Science and Technology, China. He has a doctorate from Faculty of Business in City University of Macau.