Research Article

Correspondence Model of Human Resource Management and Marketing Based on Genetic Algorithm

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In order to realize the optimal allocation of human resources and avoid the waste or relative shortage of human resources, human resources and marketing based on the genetic algorithm are combined together and a combined evaluation management model is established in this study. By constructing a weight vector to represent the evaluation performance of different evaluation models for talent evaluation, the combination problem of multiple evaluation models is transformed into an optimization problem of weights. Based on the evaluation accuracy, the fitness function is designed, the weight vector is optimized by the genetic algorithm, and the individual selection strategy is designed to avoid falling into local optimization. The validity of the model and algorithm is verified by a numerical example, and the calculation results show that the proposed method can gradually improve the average working ability of employed employees by reasonably controlling the number of employment at different periods and the number of dismissals, and the average working ability of employees can be improved by 41%, thus realizing the optimization of human resources for the project.

1. Introduction

Human resource management (referred to as HRM), the upgrading of personnel management, refers to the effective use of relevant human resources inside and outside the organization through recruitment, selection, training, compensation, and other management forms under the guidance of economics and humanistic thinking. It is a general term for a series of activities to meet the needs of the current and future development of the organization, and to ensure the realization of the organization's goals and the maximization of member development. In the era of knowledge economy, human resources have gradually become an important competitive factor after natural resources and capital. The research on human resource management theories and methods has been deepened, and the development and management of human resources have been comprehensively carried out, including human resource costs, value and quality analysis, talent forecast,

allocation, and planning. [1]. Among them, human resource evaluation is an important link and basic work. With the intensification of competition and the continuous in-depth application of artificial intelligence technology, experts and scholars have established a series of evaluation technologies and models for different application environments, as shown in Figure 1. Statistical investigation and analysis, AHP, neural network, expert system, fuzzy logic, gray system, and other methods are used to improve management efficiency and enhance the competitiveness of the organization. From the perspective of managers who can manage human resources, it is not easy to find that there are many uncertainties in the management process. Especially compared with the traditional humanized management, the modern humanized management follows the general pattern of the times. We use scientific management to give full play to people's potential, improve efficiency, and maximize goals [2]. It is the whole process of predicting the human resource needs of an organization and making a manpower demand
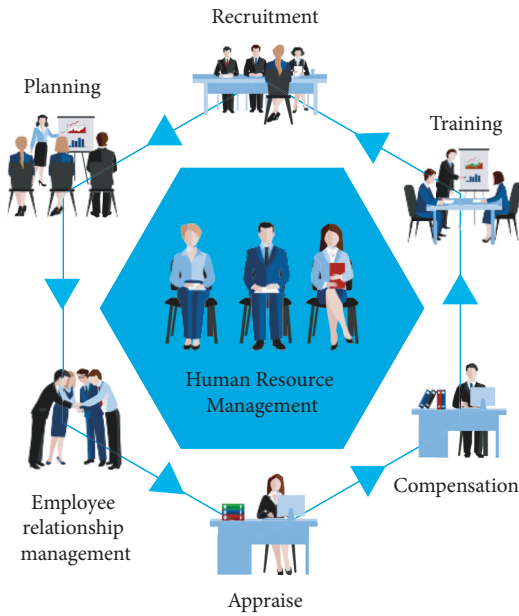
Figure 1: Human resource model.

plan, recruiting and selecting personnel and conducting effective organization, evaluating performance and paying compensation and conducting effective incentives, and combining organizational and individual needs for effective development in order to achieve optimal organizational performance. It is also an important position in the company. Previous human resource management experience may fall short of expectations, and a mathematical model based on multiple assessments is an indicator of future management performance improvement. Human management algorithms include the following: ant colony algorithm, decision tree algorithm, and genetic algorithm. But this process is based on static analysis of simulated HR data. In the face of difficult data and variable heterogeneity of business processes, the efficient operation of human resources cannot be achieved using the same algorithms. Talent evaluation is a multiobjective and multiattribute comprehensive evaluation. Various factors influence and restrict each other. Different evaluation models and methods have different adaptability. Talent assessment is "the activity of measuring and evaluating people's basic quality and performance through a series of scientific means and methods," and it is applied in the fields of enterprise management such as organizational development and talent management. The specific object of talent evaluation is not an abstract person, but the inherent quality and performance of a person who exists as an individual. The essence of human resource portfolio assessment in this study is as follows: we construct a comprehensive model based on various observation data to obtain a comprehensive assessment of each talent. The index system and weighted score are the commonly used methods [3]. However, in actual work, each indicator and its weight cannot be dynamically adjusted, and the preset indicator system and weight cannot reflect the best combination model for each individual under different circumstances. Therefore, it is

necessary to construct a dynamic combination model that can adaptively search for appropriate combination weights, thereby improving the accuracy of evaluation. In this study, a combined testing model based on the genetic algorithm is proposed to improve the accuracy of testing, and experiments are designed to test the performance of model construction.

2. Literature Review

Chen et al. believe that the traditional human resource management model is based on job analysis, which can play a role in a simple management model, but with the development of the times, human resource management has been endowed with more functions. With attributes, the traditional model has been unable to provide a sustainable guarantee for human resource management in the new situation. At present, the limitations of the human resource management model based on the job analysis model widely used by enterprises have gradually become prominent [4]. In order to adapt to the modern enterprise human resource management model and the enterprise's demand for talents, through continuous research and exploration by Emiroglu and Uyaroglu et al., a new type of competency model emerges as the times require, which fully and closely combines human resources and organizational relationships to the quality requirements of the employees of the enterprise as the composition of the model, through a series of qualities required by human resource managers, modeling by a combination of various factors, to develop a set of competency models suitable for different enterprises [5]. Martowibowo and Kemala Damanik put forward different concepts of internal marketing in the research process of service marketing. With the continuous development and innovation of internal marketing practice and theory, the meaning of internal marketing is also constantly evolving, becoming richer and more perfect [6]. Chen stated that the evolution of the meaning of internal marketing has mainly gone through the following three stages: in the first stage, internal marketing is defined from the viewpoint that employees are customers. Its main point of view is to regard employees as internal customers, emphasizing employee motivation and employee satisfaction [7]. Manita et al. believe that since employees are the key factor in improving service quality, in order to improve service quality, companies need to motivate and satisfy employees, and treating employees as customers is an effective way to improve employee satisfaction [8]. Nayana et al. first advocated that enterprises should treat employees as customers and believed that employees are an important market for service enterprises. The second stage is the customer-oriented internal marketing concept. Internal marketing means that the service company must effectively train and motivate the staff and all auxiliary service personnel who are in direct contact with customers, so that they can work together to provide customers with satisfactory services. For a company that consistently delivers high-quality service, marketers must get everyone in the company to execute a customer-focused strategy. In the research on internal marketing, some
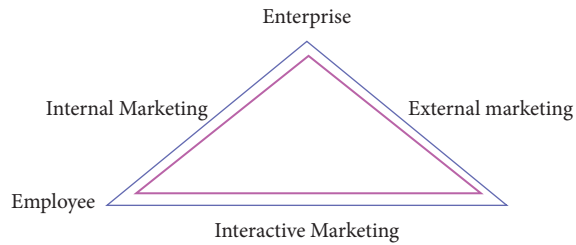
Enterprise

Internal Marketing   External marketing

Employee

Interactive Marketing

Figure 2: Service marketing triangle.

scholars realize that only focusing on the internal market will lead to "marketing myopia," and point out that the purpose of internal marketing is to cultivate employees' customer orientation and service awareness to achieve customer satisfaction, and internal marketing is to serve external marketing, so as to organically link internal marketing and external marketing [9]. Xing and Zhang believe that in interactive marketing, frontline employees can not only influence consumers' current and future purchasing behavior through direct contact with customers, but also conduct marketing activities to consumers to increase the market share of enterprises. It is not enough for enterprises to make employees complete their own work, but also to motivate employees, so that they have a customer-oriented concept and a sense of active sales, and become part-time marketers. In the third stage, internal marketing is a tool to promote corporate strategy implementation and change management [10]. Samanta et al. found in their research that internal marketing has the function of multifunctional integration and reduces resistance to organizational change, and proposed that internal marketing should be used as a management tool to achieve organizational strategic goals [11]. Al-Amin et al. pointed out the role of internal marketing in integrating HR functions and marketing [12]. Indian and Bhatia believe that internal marketing is a planned effort to overcome organizational change obstacles and guide and integrate employees to effectively implement company strategies [13]. Internal marketing is a process of continuously sharing information with employees and recognizing their contributions. This continuous process is the basis for building a healthy corporate culture in which employees follow the philosophy of "I am for everyone, everyone is for the customer." Continuous internal marketing is also the cornerstone of building a world-class company.

3. Methods

3.1. Introduction to Human Resource Management and Marketing. In the process of research on service marketing, someone proposed the service marketing triangle theory, as shown in Figure 2. This theory believes that service marketing is composed of three parts, namely, external marketing, interactive marketing, and internal marketing, and the three must be closely coordinated to achieve the effective design and smooth delivery of services to build loyal customer relationships [14]. Among them, external marketing is a variety of activities in which enterprises make service-related commitments to customers, including service

products, service pricing, service channels, service integration and communication, service processes, service personnel, and tangible display. Through external marketing, the company indicates to the customer that the company will provide the customer with a specific service product at a certain price and through a certain distribution channel. These commitments set the customer's expectations. Interactive cooperative marketing is an original new marketing model, referred to as ICM. Interactive marketing refers to the skills of employees in serving customers. Interactive marketing is a process in which service personnel and customers interact and interact with each other in the process of contact. In interactive marketing, employees become marketers and are required to have service awareness and active sales awareness, to provide customers with high-quality services, to fulfill their promises to customers, and to maintain long-term relationships with customers. Whether employees can fulfill their promises depends on their willingness and ability to serve [15]. In order to enable employees to establish correct concepts and have the necessary skills to provide customers with corresponding services to fulfill the company's commitment, companies must conduct internal marketing to employees. The service marketing triangle theory shows that internal marketing is a prerequisite for the success of external marketing and interactive marketing, and reveals that enterprises should conduct internal marketing before external marketing.

A professor of a business school proposed the service profit chain theory, showing a concise and incomparably clear method to increase the profit of service enterprises. As shown in Figure 3, the service profit chain shows that if the enterprise can provide employees with good internal service quality, employee satisfaction will increase, employees who are satisfied with the enterprise will provide more service value to customers, the increase in service value will win more customer satisfaction, and improved customer loyalty will ultimately increase corporate profits and enhance corporate profitability [16]. In short, the service profit chain shows that employee satisfaction will bring more satisfied customers and ultimately more profits to the enterprise. This has been confirmed by the practice of some foreign enterprises. Financial services benefit from the idea of proposing the idea that business value and trust are increased by improving customer satisfaction and efficiency, and that customer satisfaction and loyalty are increased through service value and service value from customers. Design and supply are based on employee satisfaction and professionalism, which are determined by the quality of the company's internal services to its employees [17]. The service profit chain can be vividly understood as a link between "profitability, customer loyalty, employee satisfaction, and loyalty and productivity. It is a closed chain of circular action, in which the implementation quality of each link is the same." It will directly affect the subsequent links, and the ultimate goal is to make the enterprise profitable. Internal marketing can satisfy employees by improving the quality of internal services, and ultimately achieve corporate profit growth and capacity enhancement through a series of transmission mechanisms. The theory reveals that employees are the key
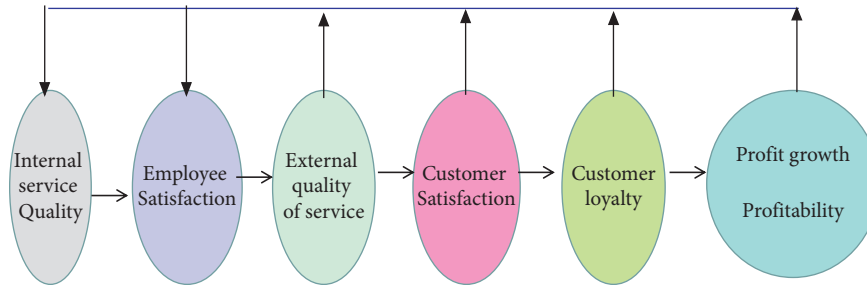
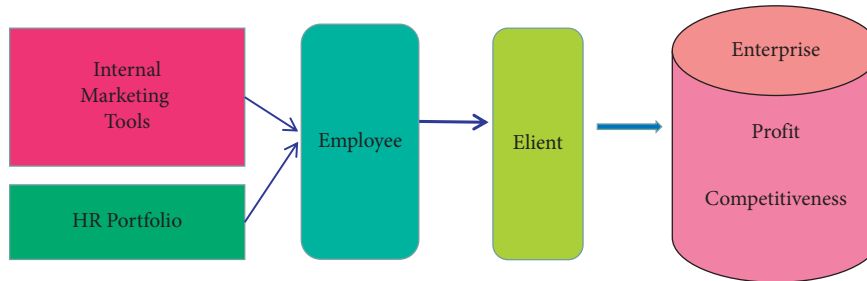FIGURE 3: Service profit chain.

FIGURE 4: Integration model of internal marketing and human resource management.

for enterprises to increase profits and enhance their profitability. In order to improve employee satisfaction, it is necessary for enterprises to carry out internal marketing.

When enterprises carry out internal marketing activities, there are mainly two types of internal marketing tools used: first, the use of similar marketing tools. That is to say, the company regards employees as internal customers, and uses a set of marketing techniques and means for external customers as internal marketing tools [18]. Internal marketing is to apply the concepts, technologies, and methods of external marketing to the internal management process of the enterprise. In particular, when using similar marketing tools in internal marketing, the company first conducts market research on internal employees, then uses STP strategy to conduct market segmentation and internal positioning of all employees, and then uses a marketing mix to meet different internal target markets, which needs to satisfy employees. The second is to use human resource management tools [19]. Human resource management tools include enterprise organizational structure design, job analysis and evaluation, job description template, competency model, human resource planning, personnel recruitment management, training operation management, salary performance management, employee handbook, etc. When such tools are used in internal marketing, companies empower their employees and empower them by hiring the right people, training, motivating, and empowering those people, and providing the equipment, and technical and managerial support needed in employee service delivery. The enterprise fulfills its commitment to provide high quality service. Based on these two types of internal marketing tools, the theory of service profit chain, and the content and means of human resource management, an integrated model of internal marketing and human resource management is constructed, as shown in Figure 4.

As shown in Figure 4, the model illustrates that through the use of effective internal marketing tools, companies can improve employee satisfaction, loyalty, and productivity, which in turn can enhance customer satisfaction and loyalty, which ultimately leads to increased corporate profits and corporate profits' enhanced profitability. In the integration model of internal marketing and human resource management, internal marketing tools include quasimarketing tools and human resource management tools. It combines the advantages of marketing-like tools and human resource management tools, and integrates the two tools to better achieve the goal of employee satisfaction [20]. When carrying out internal marketing, companies first use market research and STP strategies in similar marketing tools, and then formulate corresponding human resource combinations for different internal markets, that is, design different trainings according to the needs and preferences of various employee groups, a mix of human resources such as projects, incentives, empowerment, and communication. Since this human resource combination is formulated on the basis of market research and market segmentation, and fully considers the different needs and preferences of employees, the effective implementation of this combination can better meet the needs of employees. Therefore, similar to marketing tools and human resources the integrated use of management tools makes it easier for employees to be satisfied [21].

3.2. Overview of Genetic Algorithm Use. The genetic algorithm (GA) is designed and proposed according to the evolutionary laws of organisms in nature. It is a computational model that simulates the natural selection and genetic mechanism of Darwin's theory of biological evolution. The genetic algorithm is an important part of global equation research and can be obtained during the research process. By

targeting the genetics of the study, the research process can be modified to obtain the best solution. The genetic algorithm has two characteristics:

(1) *Group Search.* Genetic algorithms simulate the learning process of a population consisting of a sequence of individuals, where each individual represents a possible solution in the search space. Starting from an initialized group, through random search process, crossover, and mutation operations, individuals are evolved, and the group gradually evolves to an optimized area in the search space to obtain the optimal solution [22].

(2) *Information Exchange between Individuals.* The crossover operation represents the social information interaction within the group, and the mutation operation introduces new individuals into the group, that is, introduces a new feasible solution, and maintains the diversity of information in the group, so as not to be trapped in local optimization.

Therefore, it is an effective way to apply the genetic algorithm, through the self-adaptive learning process and parallel processing, to deal with the human resource evaluation problem with less computational cost.

Assuming that there are K evaluation models, the result of the k-th evaluation model is a vector $E_K = \{e_{1k}, e_{2k}, \ldots, e_{Nk}\}$, e_{ik} is the evaluation value of the evaluation model for a certain talent, and N is the number of all personnel to be evaluated.

In the traditional evaluation system, since there is only one evaluation model, talents can be sorted according to the evaluation value. However, it is difficult to guarantee the objectivity and reliability of the evaluation results [23]. Under the condition of the coexistence of multiple evaluation models, since the results produced by the multiple evaluation models are different or even in conflict with each other, effective synthesis is required to obtain the final evaluation result. Therefore, let $W_k = \{w_{1k}, w_{2k}, \ldots, w_{Nk}\}$ be the weight vector of the first evaluation model, and w_{ik} represents the evaluation performance of the k th evaluation model for talent i. The larger the value, the better the evaluation model is at predicting the i-th talent. That is, the talent is more suitable for evaluation using this model, and the conditions are as shown in the following equation:

$$\sum_{k=1}^{K} w_{ik} = 1, \tag{1}$$

$W = \{W_1, W_2, \ldots, W_K\}$ is the combination of each weight vector. In order to obtain the final evaluation value o_i for talent i, the measurement value of each evaluation model can be synthesized by the following equation:

$$o_i(W) = \sum_{k=1}^{K} w_{ik} e_{ik}. \tag{2}$$

Therefore, the combined assessment problem can be described as a two-layer network, as shown in Figure 5.
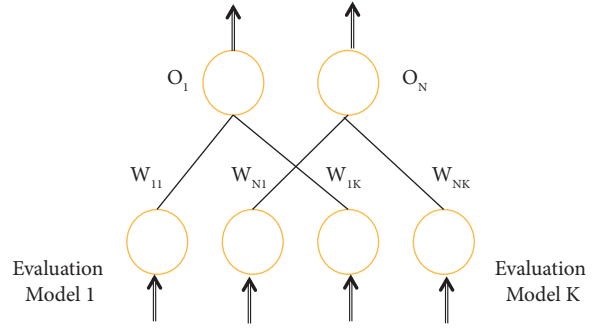

FIGURE 5: Structure of the combined evaluation model.

The input layer has $K \times N$ nodes, including the result vectors of each evaluation model. The output layer has N nodes, which represent N evaluation results, respectively, and are used to represent the comprehensive evaluation results of talents. Then, under the condition that the performance of each evaluation model is certain, the connection weight of the network becomes a factor that affects the accuracy of the final classification result. Thus, the combination problem of multiassessment models is transformed into the optimization problem of connection weights [24]. The genetic algorithm is an optimization method that applies the statistical search algorithm on the basis of the biological evolution process and is often used in the optimization of system parameters. In a genetic algorithm, the problem is encoded into strings called chromosomes, the solutions are called humans, and the authors are called citizens. Since the genetic algorithm cannot directly deal with the parameters of the problem space, the problem to be solved must be expressed as chromosomes or individuals in the genetic space through coding. This conversion operation is called encoding. Populations are constantly evolving, and better and better solutions will gradually emerge according to the principle of survival of the fittest. Here, the combination $W = \{w_{11}, w_{21}, \ldots, w_{N1}, w_{12}, w_{22}, \ldots, w_{N2}, \ldots, w_{1K}, w_{2K}, \ldots, w_{NK}\}$ of each weight vector becomes the problem to be solved. An initial value can be set, or the first public can be created with heavy equipment obtained from offline work, and then repeated, each iteration creating a new one whose performance is measured by physical activity, recent residents. Through rotation and transformation, individuals with disabilities are selected from the current population for development [25]. The fitness function is an evaluation function, which is used to analyze the performance of an individual and evaluate whether it can make better predictions. The current individual W is used to combine various evaluation models. Then, the final evaluation result is consistent with the actual score value. It indicates the accuracy of its evaluation, which is the basis for evaluating the applicability of the current individual W. We construct the accuracy function $f(W, x)$, as shown in the following equation:

$$f(W) \begin{cases} 1, & \text{If assessed correctly,} \\ \dfrac{o(W)}{\sum_{i=1}^{N} o_i(W)}, & \text{Otherwise.} \end{cases} \tag{3}$$
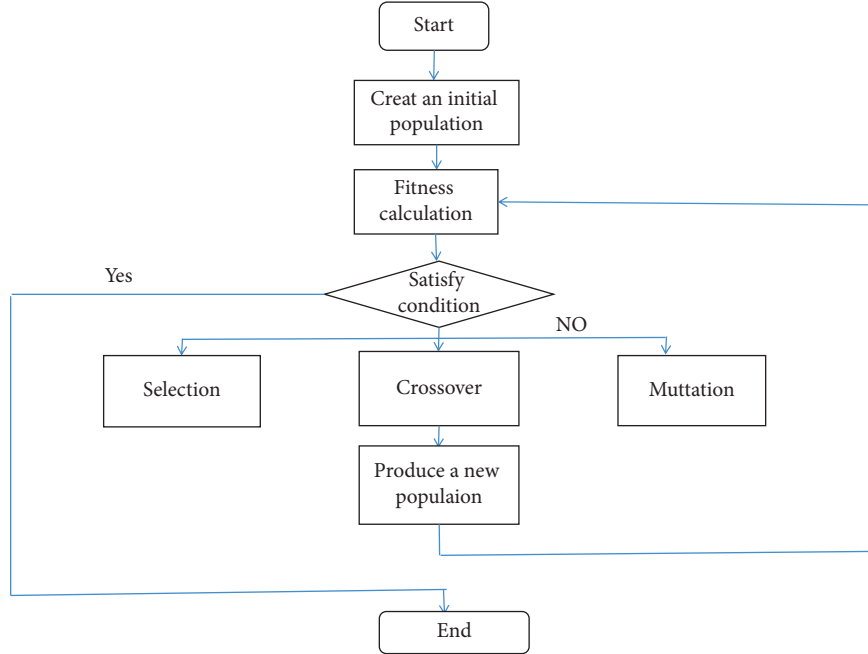
FIGURE 6: Flowchart of GA optimization methods.

In the formula, $o_i(W)$ represents the comprehensive measure of the current talent i score when the weight value is W; $o(W)$ is the true score of the talent. Therefore, a training set is needed, that is, the evaluation historical data that have been actually verified. Obviously, the larger the $f(W)$ is, the higher the prediction accuracy is [26]. The accuracy function represents the accuracy of a talent evaluation. When there are multiple talents, the accuracy of its prediction needs to be further analyzed to represent the fitness of the individual W, thus representing the performance of the combined evaluation model, as shown in the following equation:

$$\text{fitness}(W) = \frac{\sum\limits_{x \in C} f(W)}{|C|}. \tag{4}$$

In the formula, C is the training set; $|C|$ is the number of elements in the training set.

Based on health, individuals are selected from the current population to create the next generation. The outcome model is used to select individuals, and the outcome of each selected person is shown as follows:

$$p(W) = \frac{\text{fitness}(W)}{\sum_{i=1}^{M} \text{fitness}(W_i)}, \tag{5}$$

where M is the number of individuals in the population. Since the sum of the fitness of the population is constant, the greater the fitness of an individual, the greater the probability of it being selected. Figure 6 shows the flowchart of the genetic algorithm optimization method.

3.3. Theoretical Basis of Personnel Demand Forecast.
Exponential smoothing, also known as exponential smoothing, is the critical time of the estimation method and is a special weighted moving average estimation method pioneered by centrifugal smoothing. Exponential smoothing uses weights from historical data to estimate future outcomes over a period of time. Exponential smoothing, consistent with full-time and moving averages, focuses on the effect of long-term values on a time series of future estimates. The larger the weight, the larger the weight ratio, which is equal to 1, because the weight coefficient follows the exponential law and has the function of exponential smoothing, which is called exponential smoothing. According to the different exponential smoothing methods, it can be divided into the following: first exponential smoothing method, second exponential smoothing method, and third exponential smoothing method; first exponential smoothing method is suitable for time series and linear right, and third exponential smoothing method is suitable for the second exponential smoothing method. The time series of the first polynomial order changes.

3.3.1. First Exponential Model.
Let the time series be $X_t, t = 1, 2, \ldots, n$; we use S to represent the exponential smoothing value, α is the smoothing coefficient $0 < \alpha < 1$, the first exponential smoothing value in the t period is recorded as $S_t^{(1)}$, and the formula for calculating the first exponential smoothing value is shown as follows:

$$S_t^{(1)} = \alpha X_1 + (1 - \alpha)S_{t-1}^{(1)}. \tag{6}$$

3.3.2. Quadratic Exponential Model.
The secondary exponential smoothing value of the t period is denoted as $S_t^{(2)}$, and the calculation formula of the secondary exponential smoothing value is shown as follows:

$$S_t^{(2)} = \alpha S_t^{(1)} + (1 - \alpha)S_{t-1}^{(2)}, \tag{7}$$

$\widehat{X}_{t+T}$ represents the forecast value with the forecast period T starting from time t, and the mathematical model of the quadratic exponential smoothing method forecast is shown as follows:

$$\widehat{X}_{t+T} = a_t + b_t T. \tag{8}$$

The calculation formulas of parameters a_t and b_t are shown as follows:

$$a_t = 2S_t^{(1)} - S_t^{(2)}, \tag{9}$$

$$b_t = \frac{\alpha}{1 - \alpha}\left(S_t^{(1)} - S_t^{(2)}\right). \tag{10}$$

3.3.3. Triple Exponential Model.

When the changes in the time series show a quadratic parabolic trend, the triple exponential smoothing method is required. The triple exponential smoothing method is to perform another smoothing on the basis of the secondary smoothing, $S_t^{(3)}$ is the value of the third exponential smoothing, and the calculation formula is shown in as follows:

$$S_t^{(3)} = \alpha S_t^{(2)} + (1 - \alpha)S_{t-1}^{(3)}, \tag{11}$$

$\widehat{X}_{t+T}$ represents the predicted value with the prediction period T starting from time t, and the mathematical model of the triple exponential smoothing method is shown as follows:

$$\widehat{X}_{t+T} = a + bT + cT^2. \tag{12}$$

The calculation formulas of parameters a_t, b_t, and c_t are shown as follows:

$$a_t = 3S_t^{(1)} - 3S_t^{(2)} + S_t^{(3)}, \tag{13}$$

$$b_t = \frac{\alpha}{2(1-\alpha)^2}\left((6 - 5\alpha)S_t^{(1)} - 2(5 - 4\alpha)S_t^{(2)} + (4 - 3\alpha)S_t^{(3)}\right), \tag{14}$$

$$c_t = \frac{\alpha^2}{2(1-\alpha)^2}\left(S_t^{(1)} - 2S_t^{(2)} + S_t^{(3)}\right). \tag{15}$$

3.3.4. Smooth Coefficient.

The smoothing coefficient is a coefficient related to the exponential smoothing method, and the value of the exponential smoothing coefficient is very important. The smoothing constant determines the level of smoothing and how quickly it responds to the difference between the predicted value and the actual result. When the exponential smoothing method is used for trend forecasting, the value of the smoothing coefficient α needs to be reasonably determined. The determination of the α value can be obtained according to the empirical judgment method. For example, when the time series shows a relatively stable horizontal trend, a smaller α value is selected, so that the forecast values of each period have a similar impact on the forecast results; when the time series fluctuates, however, when the long-term trend does not change much, a slightly larger α value can be selected; when the time series greatly fluctuates, the long-term trend greatly changes, it shows an obvious and rapid upward or downward trend, and a larger α value should be selected to avoid and improve the sensitivity of predictive models.

However, according to the empirical method, there are certain limitations. In most cases, the α value is not easy to judge. For the sake of accuracy, different α values need to be used for trial calculation. According to the actual situation, the minimum error of the most recent periods is generally considered as the criterion. Error analysis indicators generally use the standard deviation of error (SDE) and mean relative error (MAPE), as shown in the following formulas:

$$SDE = \frac{1}{n-1}\left[\sum_{i=1}^{n}\left(X_i - \widehat{X}_i\right)^2\right], \tag{16}$$

$$MAPE = \frac{1}{n}\left[\sum_{i=1}^{n}\left|\frac{X_i - \widehat{X}_i}{X_i}\right|\right]. \tag{17}$$

The advantage of the exponential smoothing method for forecasting is that it can carry out the self-weight correction and monitoring model for the forecast error generated by each operation, so it can effectively judge the impact of each traffic cycle on future traffic.

3.4. Human Resource Management and Marketing Data Survey.

We take a call center as an example to study human resource management and marketing. In order to reduce the heavy investment in labor costs, call center systems generally tend to operate at a high utilization rate. However, high utilization is not safe for call centers with heavy system load, because if the actual arrival traffic slightly exceeds the forecast value, it may generate a long call queue, which will increase the customer abandonment rate. The increasing queuing queue will increase the average delay time of customers in the waiting process, which in turn will increase the customer abandonment rate. Efficiency has important implications [27]. Traffic forecasting refers to the estimation and expectation of the traffic that may appear in the future network by analyzing the historical data statistics of the telecommunication network traffic or related factors. Traffic forecasting is not a simple task; it is inseparable from the customer analysis and business type analysis of the call center. The call center traffic has the following characteristics:

(1) When the service level increases, the utilization rate of the operator decreases.

To improve service levels, call centers need more operators to answer customer questions in a timely manner, so the workload of each operator will be reduced. It is foreseeable that when the service level increases by one percentage point, the utilization rate of man-hours will decrease accordingly. These two
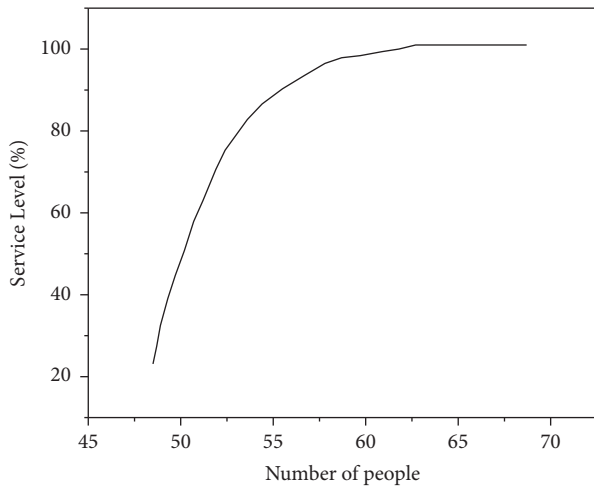
Figure 7: The relationship between the number of operators and service level.

Figure 8: Graph of incoming calls from January 1, 2021, to October 31, 2021.

indicators are negatively correlated in the call center management system.

(2) When the number of operators increases, the average answering speed and trunk load decrease.

When the number of call center operators increases, calls waiting to be answered are answered as quickly as possible, so the average speed of answering decreases, and thus, the time of the trunk is occupied. These three indicators are also negatively correlated in the call center management system.

(3) The law of diminishing returns is as follows:

When the service level of a call center is low, adding operators will have a significant effect on improving the service level. But as service levels continue to rise, the effect of increasing the number of operators will become less and less effective, to zero. When the traffic volume per unit time is 0.2 calls l s and the average service duration is 240 s, the relationship between the number of operators and the service level is shown in Figure 7.

(i) Traffic volume is affected by special events. Under normal circumstances, the traffic volume shows a regular trend of change. The historical traffic data automatically imported through the CTI system interface can be used as the basis for future traffic forecasting. However, the traffic volume is also affected by special events. Events that have an impact on traffic volume can be divided into two categories; one refers to regular events such as weekends and billing days at the beginning of the month and the end of the month; the other refers to special events such as promotional activities, holidays, system upgrades, and system failures.

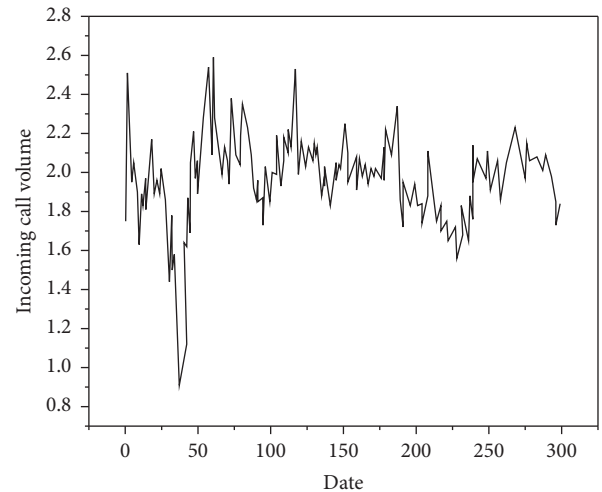The change trend of traffic volume is closely related to the work and living habits of call center customers. The traffic volume changes with time and has the relevant characteristics of time series. Therefore, the traffic volume corresponding to different times can be called traffic time. From the long-term change trend of traffic time series, it can be intuitively seen that there is a certain period of traffic time series. When establishing a traffic time-series prediction model, it is necessary to consider the periodic characteristics of the sequence. The following is the analysis of historical traffic volume laws that change over time.

(ii) Monthly variation of traffic volume is as follows: Figure 8 shows the daily traffic volume of a company's call center from January 1, 2021, to October 31, 2021. The horizontal axis represents hours, and the vertical axis represents traffic volume. It can be seen from the figure that the change trend of traffic has a typical monthly cycle. Near the billing period at the beginning of the month and at the end of the month, the traffic volume is large and fluctuates in monthly units. There are some obvious abnormal points in the figure, such as February 2021. At the beginning of the month, the traffic volume dropped significantly compared with the usual one. This is due to the influence of the Spring Festival holiday. Most of the abnormal traffic curves are caused by special events. From the data analysis and research, it can be seen that the traffic volume is measured in monthly terms. It presents a regular change for the period, which is called the monthly change rule of the traffic volume.

Figure 9 shows the traffic volume change curve in hours on a certain day in June 2021. The curve in the figure represents the traffic volume change on a certain day in June, and the corresponding relationship between the curve and the date is
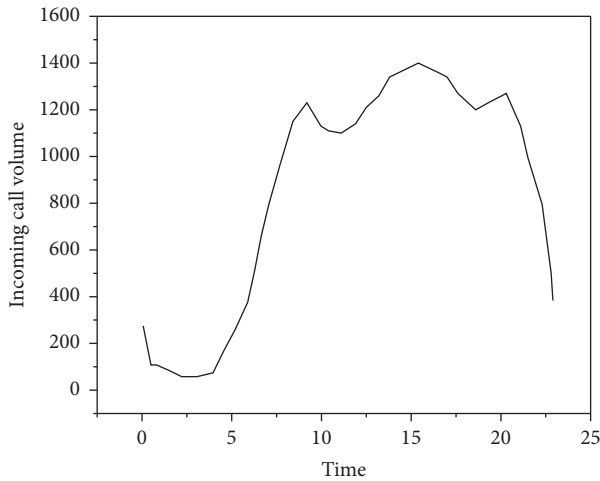
FIGURE 9: Graph of incoming calls on a certain day in June 2021.

FIGURE 10: Curve of weekly inbound call volume from January to October 2021.

shown in the subscript in the figure. It can be seen that there are two relatively fixed traffic peak periods in June. The morning traffic peak occurs around 12:00, the evening peak occurs from 18:00 to 21:00, and the traffic occurs between 0:00 and 6:00 in the morning. The volume trough, because the daily time period of the traffic volume is obvious and fixed, is called the daily change rule of the traffic volume.

Figure 10 is a graph of the change trend of in-call volume in weeks from January to October 2021. It can be seen from the figure that most of the time traffic distribution has obvious characteristics, the traffic volume on Monday is slightly more than other working days, and the traffic volume on Saturday and Sunday is relatively slightly less. It is formed by working and living habits, but other curves do not conform to this law very well, and cannot show regular changes. The change rule in weeks is relatively insignificant, but it can still be used as one of the analysis and reference bases for traffic forecasting.

To sum up, although there is randomness in the arrival of traffic, the change trend conforms to a certain law, so it is completely feasible to make a more accurate prediction.

The historical traffic volume of a company's call center studied in this research is in hours. The following is a one-month historical traffic data of a company's call center from April 15 to May 14, 2021, by the exponential smoothing method. We predict the traffic volume of each time period within 24 hours on May 15, 2021.

When using exponential smoothing method, according to the above to determine the coefficient of exponential smoothing method, the historical data of different period with different weights, using type (17) shows the average relative error of calculation in the last ten days the sum of the error of predicted value, as the final measurement standards, selection of smoothing coefficient of minimum error, with the coefficient of computing time.
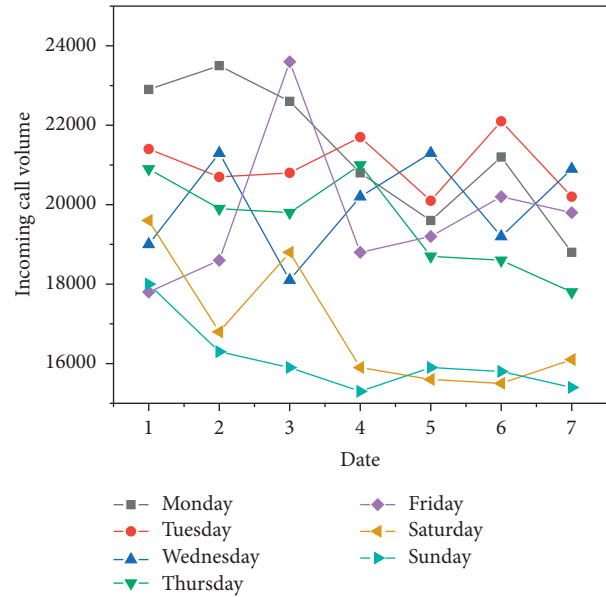
The secondary and tertiary exponential smoothing methods are used to predict the traffic volume, the traffic volume forecast value of each time period on May 15, 2021, is calculated, and the error and accuracy of the two methods are compared and analyzed. The selection of the smoothing index is based on the minimum average relative error, and the traffic volume in hours is calculated according to the quadratic and triple exponential smoothing methods, and is compared and analyzed with the actual value, as shown in Table 1 and Figure 11. Among them, the optimal smoothing coefficient 2 refers to the coefficient with the smallest average error when the quadratic exponential smoothing method is used, and the optimal smoothing coefficient 3 refers to the coefficient with the smallest average error when the triple exponential smoothing method is used.

It can be seen from Figure 12 that the change in the projected curve of the quadratic exponential smoothing path is gradual at the peak running time. In other periods, the two methods are similar to the observed values, but the average error of the quadratic exponential smoothing method is similar to that of the cubic exponential smoothing method. The exponential smoothing method is relatively small, and the change trend is more consistent with the observed value, so the second exponential smoothing method has more advantages than the third exponential smoothing method in traffic forecasting.

As shown in Figure 13, the service duration includes call-in delay, waiting time, and operator working time, which is the sum of customer delay reminder time, waiting time, actual call time, and operator finishing time. Service duration is an important part of the Erlang C queuing model. The input parameter is one of the important indicators to measure the service quality of the call center operation. It can be used to calculate the system load and the demand of personnel in each time period, and finally decide the

TABLE 1: Predicted data of the quadratic and triple exponential smoothing method.

Period	Observations	Optimal smoothing factor 2	Quadratic exponential smoothing	Mean relative error 2	Optimal smoothing factor 3	Triple exponential smoothing	Mean relative error 3
0 o'clock	365	0.1	332.22	0.023	1	156	0.1
1 o'clock	411	0.2	356.79	0.12	0.1	279.78	0.1
2 o'clock	97	0.1	114	0.079	1	100	0
3 o'clock	132	0	126	0.123	0.2	379.99	1
4 o'clock	349	0	397.67	0.089	0.3	465.12	0
5 o'clock	623	0	720	0.117	0	776.81	1
6 o'clock	798	0.3	598.91	0.113	0.1	684.89	0
7 o'clock	1034	1	1132.24	0.123	0.1	1777	0.1
8 o'clock	1058	0	1250.18	0.2	0.1	1546.76	0.1
9 o'clock	1177	0	1278.61	0.218	0.1	1443.52	0.1
10 o'clock	1288	0.1	1300	0.098	0	1323.01	0.3
11 o'clock	1358	0.2	1319.11	0.078	0.1	1433.89	0
12 o'clock	1369	0.1	1495.67	0.056	0.2	1221.51	0.1
13 o'clock	1451	1	1588.34	0.091	0.1	1589	0.1
14 o'clock	1436	1	1597.40	0.045	0	1563.21	1
15 o'clock	1479	0	1518	0.026	0.3	1479.08	0
16 o'clock	1498	0	1478.89	0.178	1	1322.6	0.1
17 o'clock	1266	0	1789.60	0.195	0.1	1345.8	0
18 o'clock	1049	0.1	1123.5	0.123	0.1	1209.5	0
19 o'clock	954	0.1	943.98	0.2	0	1092.3	1
20 o'clock	723	0.2	669.99	0.1	0	926.1	0.1
21 o'clock	651	0.2	723.12	0.028	0.2	765.22	0.3
22 o'clock	543	0	503.1	0.052	0.1	591.84	0.1
23 o'clock	425	0.1	298.7	0.071	0	335.26	1

arrangement of the call center operators in each time period. Therefore, it is very important to estimate the average service duration. It directly affects the call center call queue length and user waiting time, and has a strong correlation with organizational capacity planning issues such as personnel arrangement and recruitment training, thereby affecting the service level, quality, and user satisfaction of the call center. Figure 13 shows the change trend of the average service time of a company's call center within 24 hours of a day on April 15, 2021. It can be seen that the average service time in a day is shorter from 2:00 a.m. to 6:00 a.m., and during the peak traffic period, it is relatively long, and the changes in other time periods are relatively gentle.
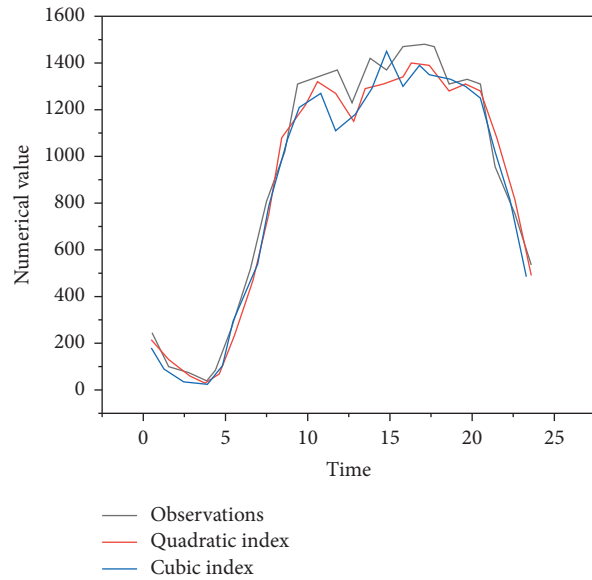
FIGURE 11: Comparison of prediction results between the second exponential smoothing method and the third exponential smoothing method.
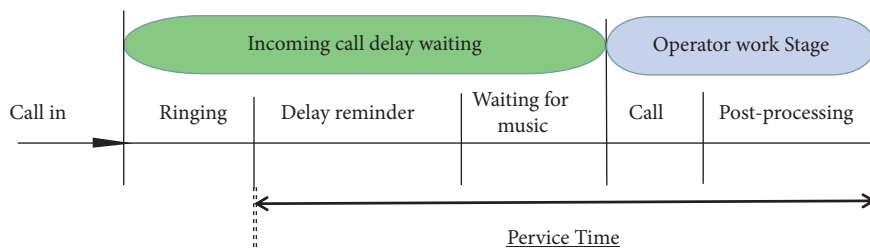

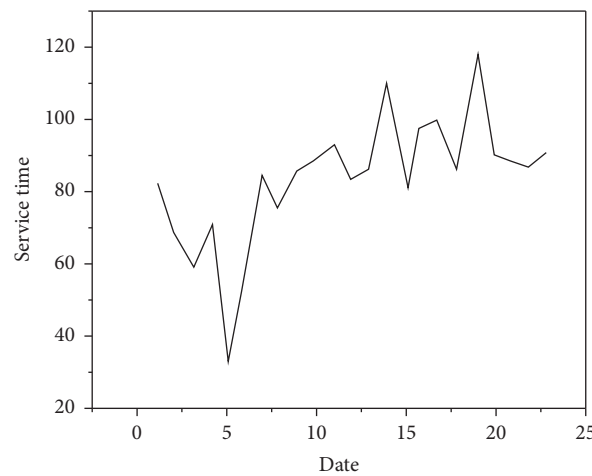FIGURE 12: Schematic diagram of the duration of a phone call.

FIGURE 13: Variation trend of service hours on April 15, 2021.

4. Results and Analysis

In the early stage of the genetic algorithm operation, the individual differences are large, and the roulette method can be used for selection. The number of offspring produced is proportional to the fitness of the parent individual. It is easy to make the population contain too many offspring of good individuals, resulting in premature maturity (premature). In the late stage of algorithm operation, the fitness of individuals gradually tends to be consistent, and the advantages of good individuals are no longer obvious when producing offspring, which makes the evolution of the entire

population stagnate, which is not conducive to obtaining better offspring. Therefore, a selection strategy needs to be designed to avoid getting stuck in local optimization [28]. The simulated annealing (simulated annealing) algorithm is a commonly used combinatorial optimization improvement method. It is a heuristic random search process based on the Monte Carlo iterative solution method. The simulated annealing algorithm is an optimization algorithm that can effectively avoid falling into a local minimum and eventually tend to the global optimal serial structure by giving the search process a time-varying probability that eventually tends to zero. We construct the individual selection strategy, as shown in the following equation:

$$P(W) = \frac{e^{\text{fitness}(W)/T}}{\sum_{W \in \text{Generation}} e^{\text{fitness}(W)/T}}, \quad (18)$$

$$T = \frac{T_0}{\log(1 + t)}. \quad (19)$$

In the formula, generation is the collection of individuals, namely, the population; T is the temperature; T_0 is the set larger initial temperature; and t is the genetic algebra. With the increase in the genetic algebra, the temperature T gradually decreases, and the fitness of the individual W is gradually stretched, so that the fitness difference of the individuals with similar fitness is enlarged, so that the advantages of the excellent individual become more obvious. A large probability is selected, which overcomes the problem of early maturity of the population.

Suppose the number of individuals in the population is 50, the crossover rate is 0.55, the mutation rate is 0.001, and the initial temperature T_0 is 100. The experimental results are shown in Figure 14.

Through the analysis of the experimental results in Figure 14, the following conclusions can be drawn:

(1) As the number of people being evaluated increases, the error will increase. However, the three weighted means have no obvious advantage, and their mean errors are significantly higher than the results of the combined model.

(2) The combined evaluation model based on the genetic algorithm can automatically find reasonable connection weights and form a dynamic weight combination, which has a better evaluation effect than the fixed weighted average.

(3) The increase in the number of people being evaluated means an increase in the types of talents, which leads to an increase in the error of the evaluation results. At this time, the combined evaluation model based on the genetic algorithm can adaptively obtain a new weight combination so that the average error of the evaluation can be significantly improved.

We assume that a project performed by a company has 4 tasks that can be completed at the same time, and the values of each project are shown in Table 2. For each project, the
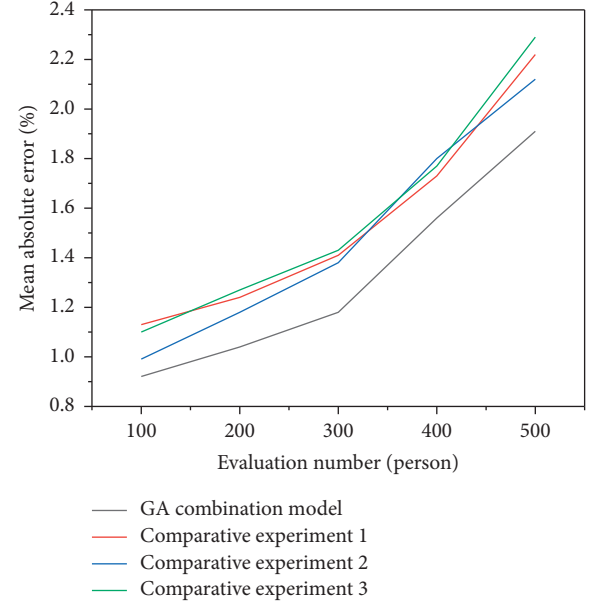

FIGURE 14: Comparison of mean absolute errors.

operational capabilities of employees follow a similar distribution, the upper limit of the probability density function is $e_1^{\max} \in [0.8, 0.9]$, the lower limit is $e_1^{\min} \in [0.2, 0.4]$, and the project parameters are shown in Table 2.

To solve this problem using the above model, first we divide the whole project into 4 cycles of 1 month each and create the best model for the situation. We set up three cases of different lengths for comparison as follows: in all cases, the onboarding period for new employees is 1 month, i.e., new employees can be onboarded at the beginning of each period. The three scenarios were solved by the method proposed above, and the calculation results are shown in Table 3.

In Scenario 2, the time to fire an employee is 2 months, so an employee can only be fired once during the work period, which is at the beginning of the third period. The average working ability changes of employees at different times are shown in Table 4.

The results show that the completion time of the project scenario is 4 months, and then, there will be layoffs during the work period. The workload of the second project is 157 people/day, and we will not complete it on time; the remaining equipment is outsourced, and the total project cost is 920,000 yuan. As can be seen from Scenario 1 in Table 4, there is no change in the average work capacity of employees at different times. In Scenario 2, the dismissal delay period is 2 months. So it is possible to remove the active worker once at the start of the 3rd period, which will start position 3 for the 3rd time, and cannot remove the functionality of task 3. Completing on time can reduce 41 people/d. Compared with scenario 1, the total project cost is also increased by 20,000 yuan. The average work capacity of 2 employees in period 3 increased from 0.55 person/day in period 2 to 0.63 person/day. Scenario 3 fires at shorter intervals, so when calculating benefits, Job 1, Job 3, and Job 4 are fired once, and Job 2 is fired twice. The average work

TABLE 2: Main parameters of the project task number task time.

Task number	Mission time (month)	Total workload (person d-1)	Employee monthly salary (yuan)	Minimum number of people	Outsourcing cost (yuan)
1	3	698	2500	6	300
2	2	552	3000	8	250
3	2	719	3500	8	280
4	4	980	4000	5	400

TABLE 3: Calculation result tasks for three scenarios.

Task number	Calculation results for scenario 1		Calculation results for scenario 2		Calculation results for scenario 3	
	Workload (person d-1)	Total cost/ten thousand	Workload (person d-1)	Total cost/ten thousand	Workload (person d-1)	Total cost/ten thousand
1	0		0		0	
2	0	100	0	98	0	83
3	210		168		110	
4	0		0		0	

TABLE 4: Relationship between average working ability and time of employees in each scenario.

Period	Scenario 1				Scenario 2				Scenario 3			
	Task 1	Task 2	Task 3	Task 4	Task 1	Task 2	Task 3	Task 4	Task 1	Task 2	Task 3	Task 4
1	0.6	0.55			0.6	0.55			0.6	0.56		
2	0.6	0.56			0.6	0.55			0.68	0.62		
3	0.55			0.65	0.63		0.5	0.65		0.79	0.5	0.65
4			0.5	0.65			0.5	0.65			0.54	0.71

capacity of employees has increased several times due to multiple posting times, which allows all tasks to be completed within the allotted time. The total cost of the project dropped to 850,000 yuan, 90,000 yuan is less than the second target, and the average working ability of various staff members showed an upward trend. Among them, the average working ability of 2 employees improved the most, from 0.56 people/day in the first stage to 0.79 people/day in the third stage, with an increase of 41%.

5. Conclusions

Portfolio assessment is an important work in human resource management. With existing assessment tools to assess human resources, the results are feasible. However, in the unified assessment of different types of teachers, the index system and weight need to be set in advance, which cannot reflect the best combination model of each individual under different circumstances, and the result has a large error. The combined evaluation model designed in this research can adaptively obtain a dynamic weight combination, thereby effectively reducing the evaluation error. In the specific implementation process, the school can scientifically design the corresponding team or job evaluation focus and index system according to the positioning and development goals, and combine the self-adaptive combined evaluation model to effectively carry out unified evaluation for different types of personnel, so as to provide basis and reference for improving performance management. It can be seen from the calculation example

that by reasonably controlling the timing and quantity of the employment and dismissal of employees, the overall working ability of the human resources of the project can be gradually improved, thereby reducing the human resource cost of the project. The frequency of employee dismissal has a significant impact on the optimization effect of the employment plan; on the premise that the time interval of newly hired employees remains unchanged, the shorter the time interval for dismissal of employees, the greater the improvement in the average work efficiency of employees. The optimization effect of human resources is more obvious. In a word, using the hierarchical genetic algorithm to optimize supply chain platform, look from the inside, can effectively coordinate the relationship between the human resource department and other departments, look from the outside can also help enterprises and realize the maximization of the interests of stakeholders for the construction of human resources in the supply chain system, improve the efficiency of companies and institutions should the human resources department with the screening has positive significance and talents.

Data Availability

The labeled dataset used to support the findings of this study is available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

Acknowledgments

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