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Research Article

Enterprise Human Resource Allocation Optimization Model Based on Improved Particle Swarm Optimization Algorithm

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With the development of the market economy, the competition for talents among enterprises has attracted more and more attention. Therefore, in recent years, enterprises have paid more and more attention to the optimal allocation of human resources. Aiming at the problem of human resources allocation in the process of enterprise management, this research establishes a corresponding mathematical model and solves the optimal allocation model of human resources based on particle swarm optimization algorithm. The calculation amount of the model is obviously reduced in the application process, the optimal solution is more ideal, and good results are achieved. However, the genetic algorithm itself has certain limitations, and the selection of initial chromosomes and the design of genetic operators put forward higher requirements. Starting from operability, based on system analysis and quantitative evaluation method, this paper establishes a model of human resources optimal allocation, provides a quantitative management method for optimal allocation of human resources, and designs an improved particle swarm optimization algorithm to solve this problem. The numerical simulation results show the effectiveness of the algorithm.

1. Introduction

Throughout the enterprise human resource management staff working ability, it is not difficult to find that there are many uncertainty factors in the process of management, especially compared with traditional human resource management, modern human resource management conforms to the trend of the development of the times, uses scientific management methods, gives full play to human potential, improves work efficiency, and maximizes the completion of organizational goals and tasks [1]. The traditional human resource management method based on experience can no longer meet the objective needs, and the mathematical model based on quantitative analysis is the direction of future management development. Common human resource management algorithms include ant colony algorithm [2], decision tree algorithm [3, 4], and genetic algorithm [5]. However, these methods are static computational analysis based on simulated human resource performance data. Faced with the complex and changeable data heterogeneity of enterprise employment, using a single algorithm has been unable to meet the effective operation of human resources.

This method not only gives full play to the objectivity of genetic algorithm in quantitative analysis but also highlights the organizational ability of multistage strategy to affect the multiproject employment of employees in enterprises under the condition that enterprises pursue the maximum employment benefit [6–8].

Human resource allocation is one of the core elements of project management. Colleges and universities are the important concentration of high-end human resources, and scientific research projects are the key means of talent training and knowledge innovation. The input-output ratio is too high, the conversion rate of scientific and technological achievements is low, and the quality of transformation is not high [9].

Human resource scheduling in software projects mainly refers to the assignment of employees to each activity in the project, which needs to meet the available resource constraint and precedence constraint between activities [10]. At present, the scheduling optimization problem of human resources in software development is usually a single objective optimization problem, which lacks consideration of multiobjective optimization. For example, only the shortest project duration or the lowest project cost is studied, and there are few literatures on multiobjective optimization. In fact, software enterprises often hope to achieve the optimal management in several dimensions as far as possible, such as under the condition of fixed project duration, as far as possible to reduce the development cost, and development costs under controllable conditions, as far as possible to shorten the duration of the project. Therefore, the research of multiobjective optimization in software development has practical significance [11].

Faced with increasingly fierce competition and rising labor costs, multiskilled human resource strategy has been widely applied in manufacturing, processing industry, and foreign construction enterprises [12, 13]. The project effectiveness of multiskill strategy is effectively evaluated in the actual project analysis model, and its benefits include increasing employee income, reducing the rate of new employee employment, avoiding employee idleness and slack, improving technical innovation ability, improving productivity, and improving employee job satisfaction. In this context, the full and reasonable use of multiskilled employees in software enterprises will also be an important issue that enterprises face, so scientific scheduling of multiskilled employees has practical significance [14].

The theoretical research on multiobjective and multiskill human resource scheduling in software enterprises has not been reported yet. For large-scale scheduling problems, swarm intelligence algorithm can obtain the approximate optimal solution. The main purpose of this paper is to study the multiobjective, multiskill, and multiobjective multiskill human resource scheduling problems in software development enterprises under the guidance of human resource management and related theories and put forward the corresponding mathematical model and apply swarm intelligence algorithm to solve such problems. In this way, software development companies can efficiently and reasonably manage multiskilled human resources, achieve multiobjective optimization of management, and promote better development of enterprises [15–17].

Most investment group projects do not exist in isolation but are divided into several subprojects or carried out at the same time with other projects. In the above complex environment, enterprises face many problems in human resource allocation. Resources need to be shared among different projects, so the resource conflicts between projects are serious, resulting in the uneven capacity of human resources [18]. In the case of high project uncertainty and serious resource conflict, the company's project may not be carried out smoothly, which is easy to cause the decline of corporate reputation, corporate image damage, and thus lose customers. Since the investment of other resources is relatively stable and human resources are its main constraint, how to effectively dispatch human resources in the complex environment of multiple projects is an urgent problem to be solved [19].

At present, there are certain studies on human resource scheduling at home and abroad. For example, some foreign scholars published a research article on the mathematical model construction of the minimum project cost through the optimization of resource allocation and the application of genetic algorithm in solving the problem in the multiproject environment. Some scholars have established algorithm models by using queuing theory. In China, some scholars put forward the method of variant dynamic programming. By analyzing the importance of different projects, this method can be used to manage human resource allocation of multiple projects. In order to alleviate the conflict between supply and demand of human resource sharing among multiple projects, some scholars put forward specific quantitative management methods and established a human resource sharing equilibrium model using genetic algorithm. However, the methods studied at home and abroad generally adopt the search technology to solve the scheduling optimization problem through the use of heuristic algorithm, while the use of superheuristic algorithm is relatively rare [20]. According to the different finite rules to obtain the corresponding resource scheduling scheme, the results obtained by different heuristic methods are very different, so this paper proposes a multiproject human resource scheduling and optimization research based on ant colony algorithm and then further establishes the feasible solution to ensure the optimality of the solution [21].

The research contributions of the paper are as follows:

(1) Aiming at the problem of human resources allocation in the process of enterprise management, this research establishes a corresponding mathematical model and solves the optimal allocation model of human resources based on particle swarm optimization algorithm

(2) Starting from operability, based on system analysis and quantitative evaluation methods, this paper establishes a model for the optimal allocation of human resources, which provides a quantitative management method for the optimal allocation of human resources

(3) An improved particle swarm optimization algorithm is designed to solve this problem

2. Related Work

2.1. Model Construction. The execution process of enterprise projects is divided into multiple periods according to time. No employees can be hired before each task starts, and all employees must be dismissed after the task is completed. Employees can be hired and dismissed at the beginning of each period without consuming project time and cost. For any given task, the upper limit of the number of employees employed in each period is only related to the upper limit of the compensation that the enterprise can offer in that period and is not limited by the total amount of human resources that can be employed in the labor market. Each task can be performed and only by hired employees.

Enterprise managers can inspect the working ability of employees in each period according to the needs of the project, decide whether to retain or dismiss them, and finally achieve the purpose of gradually improving the average working ability of employees through the continuous updating of human resources. The following assumptions should be established before modeling:

(1) Each hired employee can only engage in one task, and the probability distribution of employees' working ability between different tasks is independent of each other and subject to uniform distribution

(2) The ability of employees to work on the term of employment does not change over time. According to the above assumptions, the stochastic optimization model parameters of the employment plan are established on the premise of completing the project on time and aiming at minimizing the total employee salary cost

Human resource scheduling refers to the reasonable arrangement of project activity time and human resources in the process of project development, also known as staff scheduling, scheduling, labor arrangement, etc. Human resource scheduling usually takes into account the dependencies between the activities in the project, the duration of the activities, and the relevant human resources needed to execute the activities. The result of a schedule usually contains the start time of each activity and the people assigned to it.

Domestic research on human resource scheduling is still in its infancy. Kennedy and Eberhart [11] proposed dynamic overflow routing strategy to solve the problem of multiskill human resource scheduling in call center. Goyal et al. [12] studied the scheduling of flight personnel with genetic algorithm. Stutzle and Dorigo [13] proposed to use ant colony algorithm to solve the scheduling problem of olympic-featured commuter lines and put forward an improved model. Buyya and Murshed [14] studied the problem of bank customer service system. Jeyarani et al. [15] studied the scheduling problem of multiskilled service personnel in multisystem service center. Generally speaking, the theoretical research on personnel scheduling in China is not deep enough, especially in swarm intelligence optimization algorithm.

2.2. Optimization Model. In investment company, usually to project management as an organizational strategy, ensure project quality to enhance customer satisfaction, improve the company's image has played a very important role, and the project quality can be indirectly measured through human resource level; the higher the level of human resources, project quality may be higher, so, in the rest of the affecting factors under the condition of not changing, the problem of optimal project quality can be transformed into the problem of optimal human resource skill level of all project allocation of the company. The company's human resource scheduling needs to ensure that the project duration is in line with the project, and the configuration scheme is determined under the condition that the project cost remains unchanged, so as to optimize the quality of different projects and improve the company's earnings.

A large number of studies have shown that, under the complex background of multiple projects in the company, the work performance of employees not only depends on the technical level of employees but also depends on work motivation, work attitude, values, and other factors [7]. Competence is not the only determinant of performance but must be combined with motivation considerations to play a role in performance. Therefore, an important way to improve employee performance is to improve employee competency. Employee competency can be used to measure employee behaviors, which can reflect the knowledge, values, and work attitude of employees and can be used to judge whether employees are high performance or average performance.

The traditional man-hour system can be calculated by the ratio of the actual man-hour to the standard man-hour. If the man-hour coefficient exceeds 1, it is considered that the management is backward. If the man-hour coefficient is 1, it is considered standard. If the man-hour coefficient is less than 1, it is considered that there is an advanced management mode [8]. In order to reflect the impact of employee competency level on performance, the probability of the above man-hour coefficient is optimized. In view of the estimation of the man-hour coefficient of employees in different projects and tasks, the paper optimizes it from the perspective of resource scheduling. The man-hour coefficient is described by the ratio of the value generated by an employee performing a task to the value of the task plan, so as to measure the competency of the employee performing the task. The standard man-hour coefficient is set as 1. The value of this ratio is evaluated to help managers realize human resource scheduling.

Before the implementation of human resource management information system, the company mainly has the following problems in human resource management:

(1) The efficiency of human resource management is low. Before the implementation of the system, most of the company's human resource management work is completed by hand; only the use of office and other basic office software, document sorting, and archiving is completely the storage of original text materials

(2) The system of human resource management is not sound and perfect. The company lacks a unified human resource management system matching the enterprise development strategy. Most of the human resources department is still engaged in the traditional personnel management work, does not have the knowledge and skills required to perform the human resources management function, and does not master the management theory and method of modern human resources management. I do not know much about the working principles, methods and skills of staff recruitment, training, performance management, salary management, and staff career

development and career planning, which seriously restrict the company's human resource management functions and make it difficult for human resources to create greater value for the company

(3) Human resource management lacks scientific planning. In terms of human resources, the company has no scientific planning and can only go step by step and always in a dynamic situation. It is precisely because of the lack of scientific planning of human resources that the recruitment and training of employees are not planned, which leads to a great randomness in human resource management and indirectly affects the company's production and operation activities

(4) The incentive mechanism for employees lacks scientific nature. Companies mainly rely on increasing wages and giving bonuses to stimulate employees, and the performance appraisal of employees is often just a formality, which lacks scientific fairness and is not connected with the distribution system, so the results of performance appraisal do not become the direct basis for salary distribution, job changes, and rewards and punishments

(5) The training and development of employees are not standardized. The prejob training for new employees is insufficient, and the work is not standardized. Meanwhile, the successful experience of the company cannot be summarized in time to find out a set of procedures and methods suitable for the training and development of employees. When providing training, employees' personal interests and interests should not be well combined with the business needs of the enterprise, so as to achieve a win-win situation for both employees and the company

It can be seen from the above problems that the enterprise urgently needs to improve the human resource management system through the construction of information system.

3. Algorithm Design

3.1. Particle Swarm Optimization. The PSO algorithm assumes that N particles form a community in a D-dimensional target search space, where the i-th particle is represented as a D-dimensional vector $X_i = (x_{i1}, x_{i2}, \cdots, x_{iD})$, $i = 1, 2, \cdots, N$. In finding these two optimal values, the particle updates its velocity and position according to the following formulas:

$$v_{id} = w * v_{id} + c_1 r_1 (p_{id} - x_{id}) + c_2 r_2 \left(p_{gd} - x_{id}\right), \tag{1}$$

$$x_{id} = x_{id} + v_{id}. \tag{2}$$

3.2. Firefly Algorithm. From the mathematical perspective, the optimization mechanism of firefly algorithm is described as follows:

Definition 1. The relative fluorescence brightness of fireflies is

$$I = I_0 \times e^{-\gamma r_{ij}}. \tag{3}$$

Definition 2. Firefly attraction is

$$\beta = \beta_0 \times e^{-\gamma r_{ij}^2}. \tag{4}$$

In which, b is the maximum attraction, that is, the attraction at the light source $(r = 0)$; R_{ij} means the same as above.

Definition 3. The updated position of firefly I being attracted to firefly J is determined by formula (3):

$$x_i = x_i + \beta \times \left(x_j - x_i\right) + \alpha \left(\text{rand} - \frac{1}{2}\right). \tag{5}$$

3.3. PSO and GSO Hybrid Optimization Algorithm. In view of the shortcomings of PSO algorithm, which is prone to local optimization and slow convergence, the population is divided into several subgroups after updating the speed, and then, the updating strategy of the worst particle in the firefly algorithm is applied to the subgroups to update the particles, and the auxiliary particles jump out of the local optimal and accelerate convergence. An iteration of the algorithm is as follows.

(a) Generate the next generation population Z, calculate the adaptive value, and update P and Pg by using Equations (1) and (2)

(b) The particles in population Z are sorted according to the adaptive value, and the molecular population is divided according to formula (3) to determine the best value and range value in the subgroup

(c) For $j = l$: m

(d) For $j = l$: NT

(e) For each subpopulation, the particles are updated according to formulas (4) and (5)

(f) Calculate and sort the fitness values of each particle in subpopulation Mi, and update the excellent value, range value, and P in time. And P

(g) End

(h) End

(i) After all subpopulations are iterated, remix and go to Step (a)

Where NT is the iteration times of subgroup.

Here, in the ethnic groups, the iterative process using only the son of local optimum and did not use the global optimal information P, this is not only to reduce the influence of the global extremum for ethnic evolution, enhance local optimization ability of the algorithm, and can avoid the particle population gather toward global extreme value and improve the population diversity.

In view of the imprecise objective function of the existing allocation model, the decision preference coefficient is added into the economic benefit function to enhance the accuracy of the allocation model.

3.4. Objective Function. Under the guidance of the idea of sustainable development, the optimal allocation of social, economic, and environmental benefits is chosen.

$$f(X) = \text{opt}\{f_1(X), f_2(X), f_3(X)\}. \tag{6}$$

In which, $f_1(x)$, $f_2(x)$, and $f_3(x)$ are corresponding objective functions of society, economy, and environment, respectively.

(1) Social benefits

The ultimate goal of the objective function $F_1(X)$ is to make every user unit or individual be utilized, that is, to achieve the minimum loss of resources.

$$f_1(X)\left\{\sum_{a=1}^{A}\sum_{b=1}^{B}\sum_{c=1}^{C}\left[D_{abc} - \left(\sum_{i=1}^{I} x_{abc}^{i} + \sum_{j=1}^{J} x_{abc}^{j} + \sum_{k=}^{K} x_{abc}^{k}\right)\right]\right\}. \tag{7}$$

In which, D_{abc} is the demand of industry C in region A and department B.

(2) Economic benefit objective function

The goal of $F_2(x)$ is to maximize the economic benefits driven by enterprises as a whole and to increase the decision preference coefficient $JABC$ according to the decision theory.

$$f_2(X) = \max\left\{\sum_{a=1}^{A}\sum_{b=1}^{B}\sum_{c=1}^{C}\left[\sum_{i=1}^{I}\left(e_{abc}^{i} - v_{abc}^{i}\right)x_{abc}^{i}\alpha_{abc}^{i} + \sum_{j=1}^{J}\left(e_{abc}^{j} - v_{abc}^{j}\right)x_{abc}^{j}\alpha_{abc}^{j}\right]\right\}. \tag{8}$$

(3) Objective function of environmental benefits

$F_3(X)$ is to minimize the loss caused by human resources.

$$f_3(X) = \left\{\sum_{a=1}^{A}\sum_{b=1}^{B}\sum_{c=1}^{C}\sum_{l=1}^{L} 0.01 d_{abc}^{l} p_{abc}^{l}\left(\sum_{i=1}^{I} x_{ic} + \sum_{j=1}^{J} x_{jc} + \sum_{k=1}^{K} x_{kc}\right)\right\}. \tag{9}$$

In which, D_{ABC} is the loss of sewage discharged by sector B and industry C in region A.

3.5. Constraints. The human resource constraint function constructed by us is as follows:

$$\begin{gathered}\sum_{a=1}^{A}\sum_{b=1}^{B}\sum_{c=1}^{C}\left[\left(\sum_{i=1}^{I} x_{abc}^{i} + \sum_{j=1}^{J} x_{abc}^{j} + \sum_{k=}^{K} x_{abc}^{k}\right)\right] \le W, \\ D_{\min} \le \sum_{i=1}^{I} x_{abc}^{i} + \sum_{j=1}^{J} x_{abc}^{j} + \sum_{k=}^{K} x_{abc}^{k} \le D_{\max}, \\ x_{abc}^{i} \ge 0\,;\, x_{abc}^{j} \ge 0\,;\, x_{abc}^{k} \ge 0\,;\, D_{abc} \ge 0.\end{gathered} \tag{10}$$

4. Experimental Results and Analysis

Assume that the project undertaken by an enterprise contains four tasks that can be completed in parallel, and the main parameters of each task are shown in Table 1. For each task, the working ability of employees is evenly distributed. The upper limit of probability density function is $e_{\max} \in [0.8, 0.9]$ and the lower limit is $e_{\min} \in [0.2, 0.4]$. The project parameters are shown in Table 1.

The above model is used to solve the problem. Firstly, the whole project was divided into four periods, each period of one month, and a stochastic optimization model of the problem was established. In order to reflect the optimization characteristics of the model, three scenarios are set up for comparative analysis based on the different length of firing interval. The details are as follows: In all scenarios, the interval of hiring new employees is one month; that is, new employees can be hired at the beginning of each period. The method proposed above is applied to solve the three scenarios, respectively, and the calculation results are shown in Table 2.

In scenario 2, the interval of employee dismissal is 2 months, so the employee can only be dismissed once during the implementation of the project, that is, at the beginning of the third period. The changes of average working ability of employees in different periods are shown in Table 3.

The calculation results show that the project execution duration of scenario 1 is 4 months, so employees will be reduced during the task execution. In task 3, 157 people/d of work will not be completed on schedule. If the remaining workload is outsourced, the total cost of the project is 920,000 yuan. It can be seen from scenario 1 in Table 3 that the average working ability of employees in different periods has not changed. The dismissal interval of case 2 is 2 months, so the dismissal of current employees starts at the third time point, so that task 3 can be started at the third time period, which reduces the workload by 41 compared to the case where task 3 cannot be completed l/ d. The total cost of the project exceeds the situation by 120,000 yuan. The average working ability of the employees in task 2 in time period 3 increased from 0.55 people/d in time period 2 to 0.63 people/d. In scenario 3, the firing interval was shorter, so task 1, task 3, and task 4 were fired once, respectively, and task 2 was fired twice. As a result of the increased frequency of dismissal, the average work ability of employees has been significantly improved over time, which enables all tasks to be completed within the time limit. The total cost of

Table 1: Main parameters of the project task no. task time.

Task number	Task time/month	Total workload	Employee monthly salary	The minimum number of people	The cost of outsourcing
1	2	738	4000	7	800
2	3	1085	3500	5	700
3	4	615	3000	6	600
4	4	685	500	8	900

Table 2: Result calculation tasks for 3 scenarios.

Task number	Scenario 1		Scenario 2		Scenario 3	
	The workload	The total cost	The workload	The total cost	The workload	The total cost
1	56	92	30	94	27	85
2	116		98		183	
3	157		116		102	
4	90		101		96	

Table 3: The relationship between average working ability and time of employees in various scenarios.

Period of time	Scenario 1				Scenario 2				Scenario 3			
	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
Time 1	0.6	0.55			0.6	0.55			0.6	0.56		
Time 2	0.6	0.56			0.6	0.55			0.68	0.62		
Time 3	0.55			0.65		0.63	0.5	0.65		0.79	0.5	0.65
Time 4			0.5	0.65			5	0.65			0.54	0.71

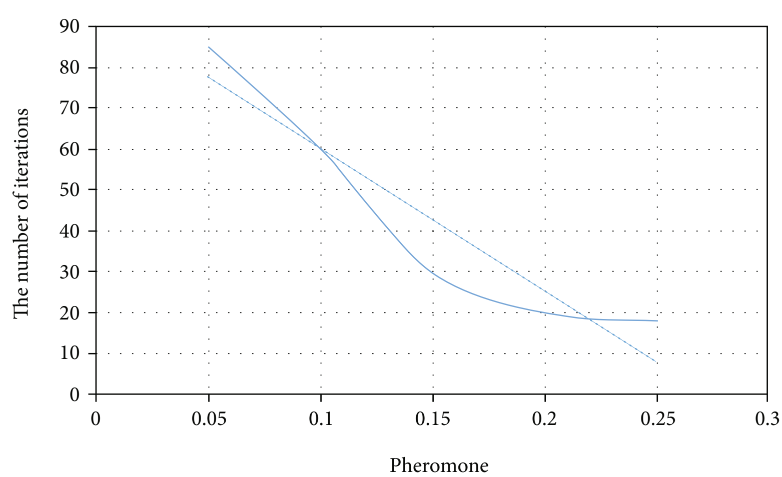

Figure 1: Pheromone value results.

the project was reduced to 850,000 yuan and 90,000 yuan less than scenario 2, and the average working ability of employees in all tasks showed an upward trend. Among them, the average working ability of employees in task 2 is the most obvious improvement, which increases from 0.56 people/d in time period 1 to 0.79 people/d in time period 3, with an increase of 41%.

The parameter setting results of the ant colony algorithm adopted in this study have a great influence on the results of human resource scheduling. The simulation experiment was conducted to analyze the value of pheromone volatility intensity of important parameters in the ant colony algorithm, and the results are described in Figure 1.

As can be seen from Figure 1, the higher the volatile intensity of pheromone is, the faster the convergence speed of the algorithm will be; the lower the volatile intensity of pheromone is, the results obtained will weaken the pheromone and have a negative impact on the optimization efficiency of the algorithm. In this study, 0.18 is selected.

As can be seen from Figure 2, the method proposed in this paper has better advantages. Under the same conditions, the method in this paper obtains higher rewards and is more

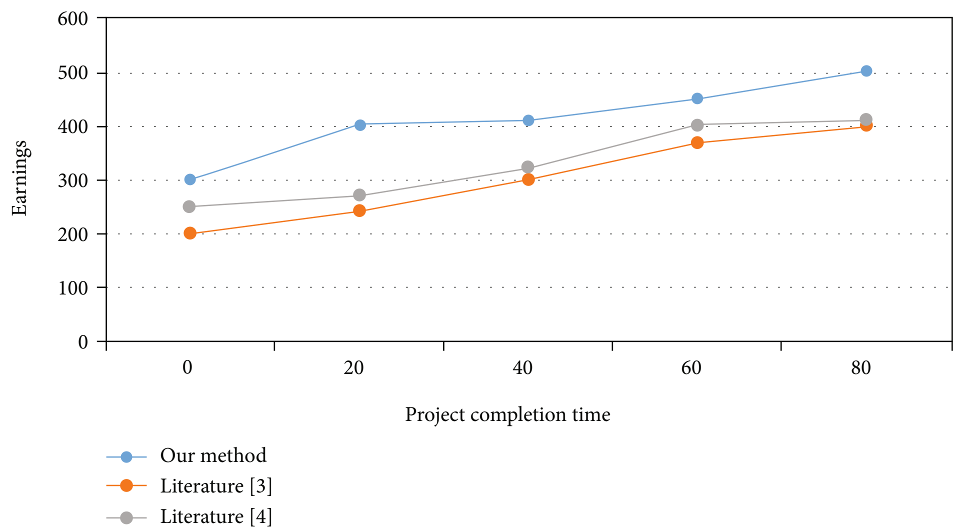

Figure 2: Comparison of scheduling results of different methods.

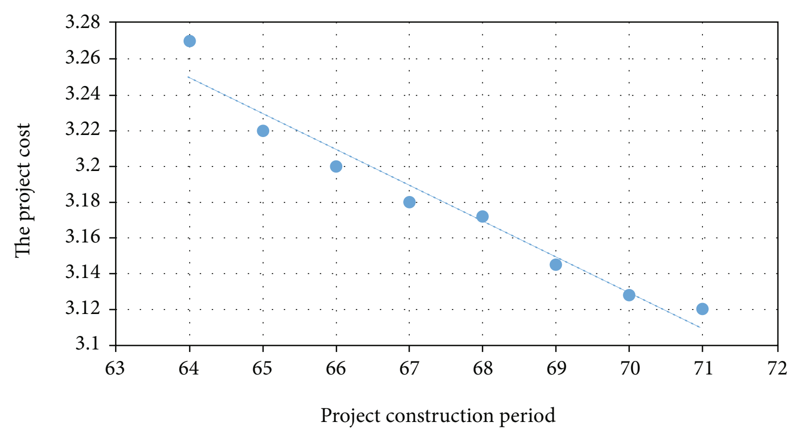

Figure 3: Pareto frontier diagram of NSGA-II/MS project duration and project cost.

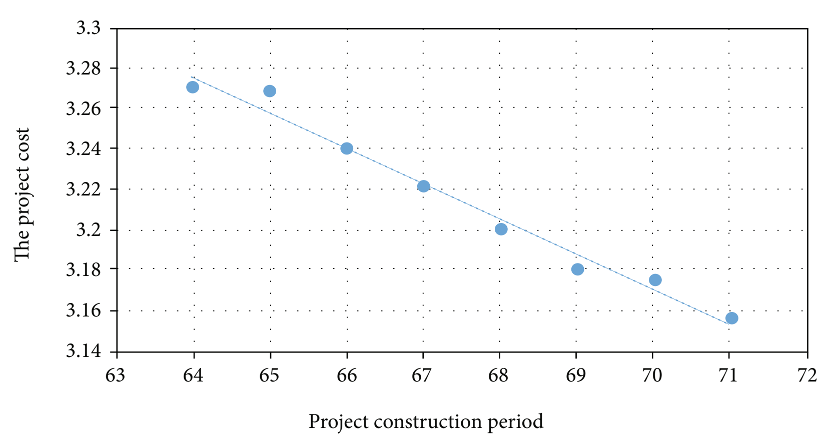

Figure 4: Pareto frontier diagram of MOPSO/MS project duration and project cost.

effective. On the basis of the above data, the method in this paper, the method in literature [3], and the method in literature [4] are used to compare the overall project revenue and the completion cycle of the project, and the results are described in Figure 2. Analysis of Figure 2 shows that the method in this paper can reduce the overall completion time of the project to 30 days, which is 18% and 15% shorter than the method in literature [3] and literature [4], and the total income is also significantly improved. The data show that the proposed method can effectively reduce the project cycle,

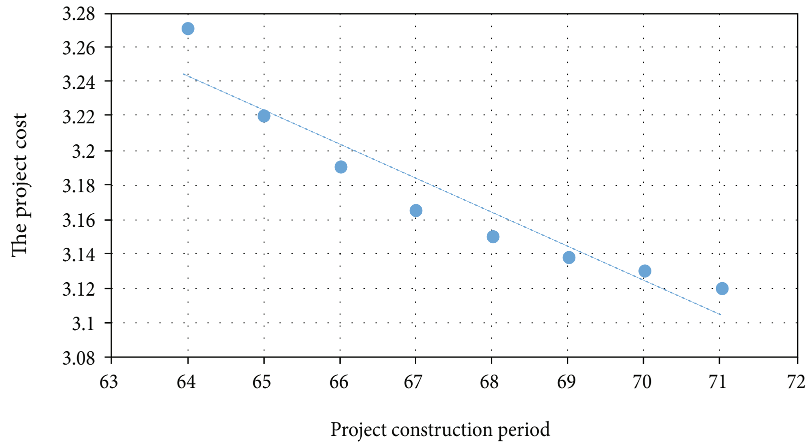

Figure 5: Pareto frontier diagram of IMOCS/MS project duration and project cost.

improve the overall income, and alleviate the human resource conflicts caused by resource constraints through scientific and reasonable human resource scheduling.

Multiobjective, NSGA-II/MS, MOPSO/MS, and IMOCS/MS were applied to solve the problem. Pm = 0.25 in NSGA-II/MS. The weight W in NSPSO/MS gradually changed from 1 to 0.4, and both C1 and C2 were 2. In IMOCS/MS, the discovery probability Pa = 0.25, the step size control variable is adaptive, and the initial value is 0.1. In order to compare and analyze the experimental results, the population size and iteration times of the three intelligent optimization algorithms are set as 50 and 200. The Pareto frontier of NSGA-II/MS project duration and project cost is shown in Figure 3, that of MOPSO/MS project duration and project cost is shown in Figure 4, and that of IMOCS/MS project duration and project cost is shown in Figure 5.

It can be seen in Figures 3–5 that the three population intelligent algorithms can achieve good results in solving this case, and the Pareto front desired by IMOCS/MS is the smoothest. The shortest project duration obtained by the three algorithms is all 64 days. Compared with NSGA-II/MS and MOPSO/MS, it is found that when the project duration is the same, the project cost obtained by NSGA-II/MS is less than or equal to MOPSO/MS. Compared with IMOCS/MS and MOPSO/MS, it was found that when the project duration was the same, the project cost required by IMOCS/MS was less than MOPSO/MS. By comparing NSGA-II/MS and IMOCS/MS, it is found that when the construction period is 64, 65, 66, 67, and 68, the project cost requested by IMOCS/MS is less than or equal to NSGA-II/MS; when the construction period is 69, 70, and 71, the project cost requested by NAGA-II/MS is less than IMOCS/MS. This shows that nAGA-II/MS and IMOCS/MS are better than MOPSO/MS in solving such problems, and NAGA-II/MS and IMOCS/MS have mutual advantages.

5. Conclusion

In order to make the establishment of mathematical model more convenient and the solution process more simple, this study made ideal assumptions on the mathematical model and on this basis to establish the corresponding model, so as to facilitate the solution. Since the establishment of mathematical model will have a great or small influence on the solution of the optimal value of the problem and even deviate from the actual situation, it is required to idealize the mathematical model as much as possible in the construction of mathematical model. For solving mathematical model, the general has many kinds of algorithms, such as on the mathematical model in this research can use the multiobjective nonlinear programming method, the multiobjective integer programming, branch and bound method, and greedy algorithm, etc., due to the design mathematical model of this study is more complex; constraint condition is more, and if use this algorithm to solve, it can make the solution more complicated and significantly increase the amount of computation (such as multiobjective integer programming algorithm or branch-and-bound method), or the optimal solution is not ideal (such as greedy algorithm). In this study, genetic algorithm is used to solve the mathematical model of human resource allocation, which can effectively avoid the above shortcomings. Moreover, the genetic algorithm itself has certain limitations, such as the selection of initial chromosomes, which puts forward higher requirements for the design of genetic operators. If the selection and design are not ideal, it may lead to local convergence or slow convergence. For different practical problems, the establishment of the corresponding mathematical model needs to be further discussed.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that he has no conflict of interest.

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