Research Article

A Genetic Algorithm Model for Human Resource Management Optimization in the Internet Marketing Era

Yi Li¹ and Wang Linna²

¹Jeonju University, 303, Cheonjam-ro, Wansan-Gu, Jeollabuk-Do 55069, Republic of Korea
²Langfang Normal University, No. 100 Aiminxidao, Langfang City, Hebei Province 065000, China

Correspondence should be addressed to Wang Linna; linnawang1220@jj.ac.kr

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In the context of the Internet marketing era, rational use of big data for quantitative analysis of human resource management can effectively help each unit better understand the industry talent and analyze the development trend of the industry. Personnel competency is the key factor affecting job performance. The renewable resources in the resource constrained project scheduling problem are transformed into human resources with competency differences through a series of scientific and reasonable methods. A human resource constrained project scheduling problem model emphasizing competency differences is constructed. The most prominent advantage of this model lies in the selection of indicators that can objectively and reasonably evaluate the competency of personnel, and the rigorous and scientific relationship is provided. The complex multiproject double-objective minimization problem of the total construction period and total cost is transformed into a comprehensive index single-objective maximization problem. Then, a mathematical optimization model is established and solved by a genetic algorithm. Finally, the effectiveness of the algorithm is shown by comparing numerical experiments with other algorithms.

1. Introduction

Human resource refers to the sum of all the human brain and physical strength to provide products and services or achieve established goals [1]. As an important resource, it has an extremely important impact on the development of social undertakings and the economy. Such resources usually have strong initiative and are characterized by reproductibility and sociality [2].

Human resources can not only improve the social adaptability of the unit but also contribute to the sustainable development of talents [3]. Only in this way, the unit can more adapt to social changes and strengthen its competitiveness. From the perspective of value creation and evaluation as well as value distribution and cultural construction, optimizing management measures can achieve great development effectiveness.

Under the promotion of the stable development of the network marketing era, in order to achieve the orderly progress of all work, we must strengthen the attention to the development of the era. In the context of the market economy, enterprise competition is increasingly intensified, and it is of great significance to do a good job in internal human resource management [4]. Influenced by history, culture, system, and other factors, the human resource management mode of most enterprises has always remained unchanged [5]. Obviously, this model is not suitable for the current needs of enterprise development. Under the background of the gradual in-depth development of marketization, enterprises must further improve performance and combine employee performance with working years and seniority, thus providing a strong guarantee for human resources training and management. At present, although the efficiency of human resource management in many enterprises has been significantly improved, there is a big gap between the leadership and the grassroots, which affects the interaction between the two.

Resource Investment Problem (RIP) is a classic project scheduling problem, whose goal is to optimize human resource investment and minimize its cost [6]. RIP is derived from the classical Resource Constrained Project scheduling problem...
(RCPSP), which aims to solve the minimum resource input under a given construction period. In reference [7], some scholars first put forward the problem of RIP and proved that the problem is NP-hard. The duality of RIP and the single mode resource constrained project scheduling problem (S-MRCPSP) is proved. Literature [8] transformed RIP into multiple S-MRCPSP and proposed the precise algorithm of MBA (Minimum bounding Algorithm). Literature [9] proposed a branch and bound algorithm, which further improved the solving efficiency of the algorithm. Due to the limitations of accurate algorithms in solving large-scale problems, many scholars have designed different heuristic algorithms to solve this problem. Literature [10] transformed RIP into an RCPSP problem, which was solved by the metaheuristic algorithm based on Scatter Search. Literature [11] uses a genetic algorithm to solve the resource input problem with delay penalty and codes the job priority and resource capacity respectively. Literature [12] solved the RIP problem by path reconnection and genetic algorithm for the first time without transforming the RIP problem into RCPSP. However, its algorithm may produce a list of jobs with infeasible priorities and also cause problems of algorithm efficiency. Moreover, when scheduling jobs, the influence of current selection on global resource investment is not taken into account. Literature [13] proposed a multistart iterative search method based on the iterative search algorithm. This algorithm improves the RIP solution quality effectively. In view of the problem of resource input, many scholars also carried out extensive research on this basis.

However, with the continuous improvement of the depth and breadth of research, some scholars say that the skill level of employees does not have a great impact on their performance, and the main factor affecting performance is the competency of employees. In view of the level of employee, competency will not only have a significant impact on the work completion cycle but also directly related to the amount of material input. This paper selects the indicators that can reasonably and objectively evaluate the competency of employees and creates a rigorous, perfect, and simple mathematical optimization model. A large number of studies have proved that for this kind of problems, both mathematical optimization model considering competency difference and genetic algorithm, which is highly respected by industry insiders, show strong applicability.

The innovations of this paper are as follows:

1. This model lies in the selection of indicators that can objectively and reasonably evaluate the competency of personnel, and a rigorous and scientific relationship is provided.
2. The complex multiproject double-objective minimization problem of the total construction period and the total cost is transformed into a comprehensive index single-objective maximization problem.
3. A mathematical optimization model is established and solved by a genetic algorithm.

This paper consists of four main parts: Section 1 is the Introduction, Section 2 is Methodology, Section 3 is Result Analysis and Discussion, and Section 4 is the Conclusion.

### 2. Methodology

#### 2.1. Problem Definition

The research content of this paper is on how to develop a rigorous and reasonable project schedule with good feasibility, and how to achieve multiobjective human resource management optimization reasonably and clearly and synchronously. To put it simply, the company currently has a cluster of parallel R&D projects, and internal employees are assigned to work accordingly. The relationship between the work of each project has been clarified, the working hour quota of each work has been clarified, and the number of personnel arrangement and the amount of capital investment of each work has been clarified. The problem to be solved is how to put forward a rigorous, reasonable, and feasible mode of multi-project work and how to select the appropriate starting time, so as to achieve the goal of completing several collaborative projects with the minimum economic input and the shortest time with high quality. In this paper, the variable of man-hour coefficient is selected, hoping to objectively and reasonably evaluate the competency level of employees through this index.

#### 2.2. Problem Modelling

##### 2.2.1. Original Problem Model

In order to solve this problem efficiently, this section creates a scientific, reasonable, rigorous, and perfect mixed integer programming model based on previous research results. The symbol definitions are shown in Table 1.

$$\sum_{x=1}^{TR} \sum_{u=1,x \in w}^{TR} d_{y(w)} Z_{x,y(w)} \geq T_{y,z} N_{y,z},$$  \hspace{1cm} (1)

$$\forall y = 1, \ldots, T_U, \quad z = 1, \ldots, T_y,$$

$$d_{y(z)} \Phi_{y(z)} \leq L_{y(z)}, \quad \forall y, z, w = 1, \ldots, W, k = 1, \ldots, K.$$  \hspace{1cm} (2)

(1) Objective function

$$\min \sum_{n=0}^{N} n \frac{j_{1,T_U}}{1,1,n}$$  \hspace{1cm} (3)

(2) Constraints

$$\sum_{n=0}^{K} \sum_{n=0}^{N} \sum_{y=1}^{T_U} \sum_{z=1}^{T_y} \sum_{u \in B(y,z)}^{T_U} d_{y(z)} j_{y(z)} u_{y(z)}$$  \hspace{1cm} (4)

$$\forall n = 0, \ldots, N, \quad x = 1, \ldots, T_R,$$

$$\sum_{n=0}^{N} \sum_{u \in B(y,z)}^{T_U} j_{y(z)} = 1, \quad \forall y = 1, \ldots, T_U, \quad z = 1, \ldots, T_y.$$  \hspace{1cm} (6)
According to formula (1), it can be known that the total amount of work actually completed by the combination of active employees is at least greater than the rated workload of the activity. The work completion period is usually determined by rounding up. According to formula (2), it can be known that the materials used by employees in the process of work should be less than the work limit, which is usually determined by rounding down. According to formula (3), the core goal is to minimize the total construction period of multiple projects. According to formula (4), it can be learned that the secondary goal is to achieve the most economical multiproject and complete the project quickly and with the least economic input. According to formula (5), all employees can only carry out one job at a certain time. According to formula (6), all activities can only choose one mode and only start at a certain period. Formula (7) specifies the upper limit of the number of employees that can be allocated at the same time. Formula (8) specifies the number of employees assigned to activity z of project y when mode w is adopted. The value of d_w is the smallest integer satisfying formulas (1) and (2) below.

2.2.2. Comprehensive Index Model. The evaluation function method is a scientific and reasonable real function which is constructed by combining all kinds of information and data provided by decision-makers. Then, the multiobjective optimization problem is transformed into a single-objective optimization problem which is easy to understand and analyze. In simple terms, it is a way to solve multiobjective optimization problems by combining people's preferences and provided data. It can deduce the optimization result satisfying the decision condition efficiently and conveniently according to the decision data and materials provided by people.

In this paper, the linear weighted synthesis method is used to transform the two-objective optimization of the project construction period and cost into a single-objective optimization problem. Specifically, the original problem model is transformed into a comprehensive indicator model through the following steps.

Firstly, expert investigation and fuzzy comprehensive evaluation are used to assign weights to the indexes. For software projects, the actual requirements of the project construction period are more stringent than the
requirements of project cost, so the weight of the project construction period should be greater than the weight of cost.

Secondly, since both construction period and cost are cost indicators, a smaller value of the indicator means a better solution, but a larger value of the fitness function means a better individual. At the same time, considering the construction period and cost of the unit is not unified, must be dimensionless processing.

The dimensionless formula of total project construction period \( N \) is

\[
N_S = \frac{\{\text{max}N\} - N + 1}{\{\text{max}N\} - \{\text{min}N\} + 1}
\]

(11)

The dimensionless formula of total project cost \( C \) is

\[
C_S = \frac{\{\text{max}C\} - C + 1}{\{\text{max}C\} - \{\text{min}C\} + 1}
\]

(12)

where \( N_S \) and \( C_S \) represent the dimensionless index values of the project construction period and project cost, respectively.

Finally, the objective function formula of the comprehensive index model is as follows:

\[
\text{max}CX = \omega \times N_S + (1 - \omega) \times C_S,
\]

(13)

where \( \omega \) represents the weight of the construction period. \( CX \) is the comprehensive index value. The constraint conditions of the comprehensive index model are the same as those of formulas (5) ~ (10) in the original model.

In this study, the time of work is not fixed, in other words, the work involves “many different working modes,” and so one might classify the problem in this paper as traditional. In fact, the main differences between S-MRCPSP and MRCPSP are as follows.

First, in MRCPSP, the amount of resources allocated in each work development cycle is generally unified and basically fixed. The “multiple different working mode” is reasonable and clear under the premise of the workload of each project, input cost, and other relevant factors.

Second, there are differences in the number of modes. In terms of working modes, the number of the former may significantly exceed the latter. The number of working modes of MRCPSP is usually not very large.

Third, in the S-MRCPSP problem, only after the formulation of a rigorous and reasonable human resources allocation plan, can accurately determine the work cycle, which is obviously different from MRCPSP. For example, in project A, the MRCPSP method calculated the construction period to be 7 units of time, but it could be reduced to 4 units of time if competent employees were arranged.

Many analysis methods, including the MRCPSP scheduling method, will inevitably misjudge the start time of activities in the process of use, resulting in unsatisfactory decoding quality. Therefore, for S-MRCPSP, this paper should explore an efficient and reasonable method for calculation.

2.3. Design of Genetic Algorithm

2.3.1. Coding. This paper studies the special multimode resource constrained project scheduling problem (S-MRCPSP). The research object is human resources considering the difference in competency level, which will not only further increase the scale of decision factors of traditional MRCPSP but also greatly increase the number of constraints. As a result, the problem model is more complex than before and the difficulty of solving the problem is further increased. In this paper, the coding method of double-linked list structure is adopted. Two linked lists represent the task linked list and execution mode linked list, respectively. If \( X \) is a double-linked chromosome.

\[
X = \left[ \begin{array}{c} L \\ W \end{array} \right] = \left[ \begin{array}{cccc} y_1 & y_2 & \cdots & y_Y \\ w_1 & w_2 & \cdots & w_Y \end{array} \right].
\]

(14)

Among them, \( L = (y_1, y_2, \ldots, y_Y) \) is a task linked list, which is a permutation of all tasks satisfying the constraint of task compact-relation. \( W = (w_1, w_2, \ldots, w_Y) \) is a pattern linked list, and represents the corresponding execution pattern vector of each task in the task linked list.

(1) Generation of Task Linked List \( L \). There is always an established sequential priority relationship among various tasks. Unfeasible solutions may occur when tasks are organized randomly. In the algorithm, it is very important to scientifically and reasonably define the task coding method of priority relationship, which can be determined through the following process:

According to Figure 3, it can be seen clearly and intuitively that the most important step is to accurately lock qualified tasks, which refers to the tasks that have been completed for each immediate task.

Take the example described in Figure 3 as an example. The main function of vector \( A[1] \) is to safely and reliably preserve the formed encoding sort. In the beginning, \( A[1] = 1 \), there are very few qualified tasks, only one is task 2, at

![Figure 1: Project single code network diagram with 9 tasks.](image1)

![Figure 2: Adjacency matrix.](image2)
which $A[2] = 2$. After combing and analyzing the adjacency matrix, it is found that qualified tasks are 3, 4, and 5, respectively, and all three of them are likely to become $A[3]$. As can be seen from Table 2, their priority values are 7, 1, and 6 in sequence. Of the above-given tasks, 3 has the highest priority, so $A[3] = 3$. Next, tasks 4, 5, and 6 compete for $A[4]$. Task 5 wins and gets $A[4] = 5$. Then, the following two procedures are followed:

(a) The qualified task set is obtained by combining adjacency matrix $b$. Determine the task with the highest priority according to the random priority value and fix its position until each task is properly executed. The coding of tasks corresponding to Table 1 can be referred to as Table 3. If the priority value changes, the task coding scheme will definitely change, so the coding can reflect the potential encoding of the network graph.

It should be noted that the generated task linked list only satisfies the sequential priority relationship, without considering the resource constraints.

(2) Generation of Schema Linked List $W$. Pattern linked list $W$ represents the feasible pattern vector corresponding to each task in the task linked list. Pattern linked list $W$ corresponds to each gene in the two linked lists of the task linked list $L$. The feasible mode corresponding to $y_1$ activity is $w_1$, and $w_1$ can be any mode in the feasible mode set corresponding to $y_1$ activity. The generated schema linked list not only considers the number of people specified by the activity in the renewable resource constraint, and also considers the nonrenewable resource constraint.

2.3.2. Decoding. Schedule Generation Scheme (SGS) is required for all priority-based heuristics. SGS has a serial schedule generation mechanism (SSGS) and parallel schedule generation mechanism (PSGS). Scheduling plans for single-pattern resource-constrained item. Scheduling problems (SRCPSP) generated by PSGS based on any priority rules are nondelayed scheduling plans. The scheduling plan based on any priority rule and using SRCPSP generated by SSGS is an active scheduling plan, which not only reduces the search scope but also does not miss the optimal solution. When the execution mode of each activity is specified and the specified mode satisfies the nonupdatable resource constraint, MRCPSP degenerates into SRCPSP. Therefore, MRCPSP also satisfies the properties and theorems of SRCPSP. In view of this, this paper adopts the serial scheduling generation mechanism. When the task scheduling sequence and corresponding feasible mode are given, a feasible solution can be obtained by considering all renewable resource constraints when the serial scheduling generation mechanism is used for decoding.

2.3.3. Fitness Function. Both construction period and cost are cost indexes. The smaller the index value is, the better the solution is. However, the fitness function should be that the larger the fitness value is, the better the individual is.
Considering the disunity of the construction period and cost units, dimensionless processing should be carried out, so that the dimensionless index values are within the range of 0~1. Therefore, the fitness function designed is as follows:

\[ CX = \omega \times N_S + (1 - \omega) \times C_S. \]  

Here, \( \omega \) is the weight coefficient of the construction period. \( T_S \) and \( C_S \) are the dimensionless index values of the total project construction period and total cost of individual projects, respectively. For dimensionless treatment, see formulas (11) and (12).

2.3.4. Select Operations. The selection operation is to select some individuals from the parent population and transfer them to the next generation population through a scientific and reasonable algorithm based on the evaluation of individual fitness. After comprehensive consideration of all aspects of the factors, this paper finally selected the current widely used roulette favoured by the industry. The mechanism is that there is a significant positive correlation between the possibility of individual selection and its fitness. If the population size is represented by \( t \) and the fitness of individual \( x \) is \( F_x \), the probability of \( x \) being selected successfully can be calculated by the following formula:

\[ U_x = \frac{F_x}{\sum_{t=1}^{T} F_x}. \]  

2.3.5. Cross Operations. The single-point crossover operator introduced in literature [14] is intended to complete the crossover operation of chromosome task genes, where the possibility of crossover changes of mode genes is represented by \( U_C \). Suppose the parent and the parent perform a series of crossovers to form two children, a son and a daughter. When an integer \( t \) is randomly formed between 1 and \( T \), the task genes at the first \( t \) positions of the son inherit from the father, but the task genes at the last \( t + 1 \)~\( T \) positions of \( t + 1 \)~\( T \) inerit from the mother. For the existing tasks, this paper does not analyze them and ensures that the distribution of each task is consistent with that of the mother. The same is true for daughter genes. Literature [15] shows that the order of jobs in offspring individuals obtained based on crossover operator still conforms to the tight front tight back relationship. The crossover process is shown in Figure 4.

2.3.6. Mutation Operation. The mutation operator will carry out a series of standard and reasonable mutation operations on the model genes of chromosomes through scientific and reasonable methods. In this process, the task genes will not have any change. In this paper, the allelic mutation gene value at the mutation point is determined by a uniform mutation operator; that is, the model locus in each individual coding string is the possible mutation point. Loci for mutation operation were selected according to mutation probability \( U_w \). Then, for each variant loci, a feasible pattern matching the uniform probability distribution was randomly selected from the feasible pattern set corresponding to the loci to replace the original feasible mode. The mutation process is shown in Figure 5.

3. Experiment and Analysis

In order to verify the effectiveness of the algorithm in this paper, 10 jobs, 14 jobs, 18 Jobs, 30 Jobs, and 60 Jobs were selected to carry out numerical experiments, and compared with literature [16]. The numerical experiment was programmed in C# (Visual Studio 2017) language environment, and the test platform was Intel Core i5 4th processor, 2.40 GHz main frequency, and 4G memory. The results are shown in Tables 4 to 6. Here, AD, AF, and AC are the average objective function values obtained by this group of examples in this paper, literature [16] and literature [17], respectively. TD, TF, and TC are the average operation time, respectively. G1 and G2 are the differences between the objective function value obtained by the proposed algorithm and the algorithm in literature [16] and the optimal solution in literature [17], respectively. \( G \) is the gap between the algorithm in this paper and the algorithm in literature [16].

Tables 4 to 5, Table 6 show the results of small-scale calculation examples, with the size of 10 Jobs, 14 jobs, and 18 jobs, respectively, and each group contains 10 cases. As can be seen from the tables, when the number of jobs is 10 jobs and 14 jobs, the optimal solution obtained by the algorithm designed in this paper is basically equal to the optimal solution obtained in literature [17], while the results of the comparison algorithm are significantly different from the optimal solution, and the three algorithms are all in the same order of magnitude range in terms of solving time. When the number of jobs is 18, the optimal solution of the algorithm designed in this paper is only 1.5% compared with that obtained in literature [17], but the deviation of the comparison algorithm reaches 9.5%. However, the solution time
of the proposed algorithm is in the same order of magnitude as that of the comparison algorithm, which is far shorter than that of the literature [17]. Therefore, the following conclusions can be drawn: the genetic algorithm proposed in this paper can solve better results within a certain error range in small-scale examples.

In order to compare the advantages and disadvantages of the six algorithms, the solution results of algorithm 6 at different iterations were compared under the same setting of other parameters. In 2 different scales, 10 cases were taken, and the average value of each case under different iterations was recorded, and then the average value of 10 cases was taken. Figures 6 and 7 show the comparison of 6 different algorithms when the number of jobs is 30 jobs and 60 jobs.

Table 4: 10 jobs experimental results.

| Cases | AC   | TC/s | AD     | TD/s | G1/% | AF | TF/s | G2/% |
|-------|------|------|--------|------|------|----|------|------|
| 1     | 134  | 0.306| 135    | 0.663| 0.87 | 137.0| 0.297| 2.51 |
| 2     | 116  | 0.645| 116    | 0.89 | 0.05 | 117.2| 0.395| 1.20 |
| 3     | 155  | 0.731| 155    | 0.603| 0.05 | 155.0| 0.292| 0.16 |
| 4     | 130  | 0.362| 130    | 0.394| 0.05 | 130.8| 0.215| 0.73 |
| 5     | 178  | 0.651| 178    | 0.917| 0.05 | 185.1| 0.395| 4.33 |
| 6     | 143  | 0.779| 143    | 0.901| 0.05 | 143.0| 0.368| 0.05 |
| 7     | 121  | 0.474| 121    | 0.612| 0.05 | 123.0| 0.231| 1.88 |
| 8     | 170  | 0.664| 170    | 0.769| 0.05 | 170.0| 0.321| 0.05 |
| 9     | 166  | 1.034| 166    | 0.995| 0.05 | 176.2| 0.431| 6.67 |
| 10    | 118  | 0.542| 118    | 0.58 | 0.11 | 125.3| 0.236| 5.05 |

Average 0.14 2.26

Table 5: 14 jobs experimental results.

| Cases | AC   | TC/s | AD     | TD/s | G1/% | AF | TF/s | G2/% |
|-------|------|------|--------|------|------|----|------|------|
| 1     | 152  | 0.571| 152.0  | 0.443| 0.05 | 152.5| 0.105| 0.26 |
| 2     | 141  | 0.266| 142.0  | 0.605| 0.05 | 146.5| 0.152| 3.35 |
| 3     | 143  | 3.714| 148.2  | 1.408| 0.77 | 146.8| 0.558| 2.18 |
| 4     | 207  | 1.175| 207.3  | 0.348| 0.14 | 214.1| 0.085| 3.03 |
| 5     | 110  | 2.231| 110.9  | 1.876| 0.73 | 116.7| 0.65  | 0.35 |
| 6     | 157  | 0.742| 157.1  | 0.402| 0.05 | 165.8| 0.108| 1.12 |
| 7     | 115  | 0.376| 115.1  | 0.402| 0.05 | 119.5| 0.103| 3.18 |
| 8     | 169  | 2.485| 169.6  | 0.625| 0.33 | 171.5| 0.127| 1.06 |
| 9     | 167  | 1.012| 167.2  | 0.486| 0.11 | 168.9| 0.109| 0.05 |
| 10    | 174  | 0.725| 174.1  | 0.415| 0.05 | 175.3| 0.058| 0.02 |

Average 0.23 1.46

Table 6: 18 jobs experimental results.

| Cases | AC   | TC/s | AD     | TD/s | G1/% | AF | TF/s | G2/% |
|-------|------|------|--------|------|------|----|------|------|
| 1     | 181  | 26.655| 191.8  | 1.401| 0.59 | 205.0| 0.272| 11.40 |
| 2     | 138  | 90.517| 150.3  | 1.895| 1.68 | 170.6| 0.526| 14.14 |
| 3     | 167  | 4.852 | 171.8  | 3.569| 2.22 | 191.1| 1.243| 6.89 |
| 4     | 151  | 4.212 | 161.5  | 1.208| 4.69 | 184.4| 0.273| 13.75 |
| 5     | 244  | 4.128 | 235.3  | 0.688| 0.05 | 277.5| 0.138| 8.14 |
| 6     | 116  | 4.342 | 129.2  | 2.476| 2.12 | 135.8| 1.206| 7.68 |
| 7     | 175  | 4.019 | 176.6  | 0.583| 0.73 | 203.2| 0.127| 8.66 |
| 8     | 172  | 45.201| 175.7  | 1.275| 2.13 | 201.4| 0.453| 9.48 |
| 9     | 115  | 40.417| 135.4  | 2.405| 0.69 | 141.3| 0.937| 12.61 |
| 10    | 110  | 56.062| 142.8  | 2.217| 0.10 | 144.4| 0.665| 2.25 |

Average 1.5 9.5

Figure 6: Comparison of experimental data of 30 Jobs.

Figure 7: Comparison of experimental data of 60 jobs.

The abscissa is the number of iterations, and the ordinate is the average value of 10 calculation examples. As can be seen from the figure, with the increase of iteration times, the values of the six algorithms gradually decrease, and under
different iteration times, the algorithm designed in this paper is obviously superior to the other five comparison algorithms (literature [16], literature [17], literature [18], literature [19], and literature [20]).

4. Conclusion

In recent years, China’s network information technology has developed rapidly. In the era of network marketing, in order to achieve sustainable development, the company not only needs to objectively consider its own actual development but also needs to build an efficient and orderly human resource management system. Only in this way, can the company comprehensively manage human resources and then achieve sustainable development. The latest research shows that the level of employee competency will have a profound impact on job performance. Based on MRCPSP, the human resource scheduling problem of special “multimode” projects is discussed and analyzed comprehensively and deeply. In order to objectively and accurately evaluate the competency level of employees, this paper selects the index of employee time coefficient. The total project cost only emphasizes the material consumption generated during the development of R&D work, and the optimization target is the maximum comprehensive index value weighted by the total construction period and total cost. Because the original method is not perfect and rigorous, this paper decided to use a genetic algorithm to carry out single-objective optimization of the comprehensive index. The experimental results show that both small-scale model splitting and large-scale algorithm building have achieved good results. However, when using the model, portfolio model number increased obviously, both increased analysis difficulty, also prone to NP-hard phenomenon. Therefore, the genetic algorithm is used to analyze and deal with this problem still has its imperfections, the late should intensify their efforts to research and optimize the algorithm, or to find a more reasonable, more rigorous, more efficient algorithm.

Data Availability

The labeled data set 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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