Cost Optimization in Sports Organizations Through Human-Centric Service Using an Artificial Neural Network

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Abstract

Human resource management mode describes the established style of management used by sports organizations to oversee the conduct of their own Sports employees throughout their businesses' long-term operations. Sports institutions need optimization and improvement in human resource development and management as society evolves to maintain or increase its market share and social competitiveness. Institutional success often hinges on how well they foster and direct their people resources. Human resource economic management is an improved human resource development and management model that has evolved alongside other sports institutions and the advancement of knowledge under human-centric service. In this context, learning how best to maximize the cost-effectiveness of institutional human resource management is a topic of significant importance in human-centric service. First, this work proposes a series of optimization measures for the economic management mode of human resources in sports institutions from different aspects. Second, this work proposes an IFWA-ELM algorithm for evaluating human resource economic management models in sports institutions. Specifically, this work uses the Cauchy mutation operator to replace the Gaussian mutation operator, uses the elite random selection strategy to replace the original selection strategy, introduces the difference mutation operator and the reverse learning operator to propose IFWA. Then use IFWA to optimize the ELM's input weights and hidden layer thresholds to establish the IFWA-ELM algorithm. Third, this work conducts systematic experiments to verify the superiority of the optimization measures and the IFWA-ELM algorithm.

Keywords: Human Resources Economic Management; Sports Institution; Artificial Neural Network: Sports Employees

1. Introduction

The practice of human resources itself is mainly through the measurement and matching of human resources output of enterprises and management to determine common ground, which mainly involves the restraint mechanism, performance appraisal, compensation and benefits, and recruitment and selection. In the current national development, human resource development and management has become the primary issue. It is understood that the personnel composition of sports institutions mainly includes: administrative personnel, technical personnel, labor personnel, etc. In the production process, the main task of sports institutions is to serve the society and promote the healthy development of the country. Therefore, the staff of sports institutions need to be higher than other ordinary people in terms of cultural quality, professional quality and political concept. Among them, the importance of human resource development and management is obvious. With the continuous optimization and development of human resource development and management model, since the emergence of human resource economic management model, it has been applied in many enterprises, and the effect is good (Mustafa & Trevor, 2022). However, due to the backwardness of human resource development and managerial thinking in most institutions, they have not played a role in human resource economic management. It can be seen that optimizing the human resource economic management model of sports institutions is very important in the current development of sports institutions (Busari et al., 2019; Carmeli & Schaubroeck, 2005; Ciobanu & Androniceanu, 2018; Coccia & Rolfo,

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2013; Pynes, 2008).

With the continuous development and optimization of society, the development and management of human resources in institutions plays a very important role and position in the development of institutions. The main reason why human resource development and management occupies such a high role and status in the development of institutions is that excellent economic management of human resources can effectively improve the overall economic benefits and work effectiveness of institutions. The rational use of human resources economic management tools is not only conducive to the long-term development of enterprises, but also can effectively reduce the economic investment of enterprises and improve the economic benefits of institutions. In the process of optimizing the economic management mode of human resources in sports institutions, in order to ensure the effectiveness of human resources development and management, it is first necessary to develop economic management tools for human resources in sports institutions. And then to ensure the optimization of human resources economic management mode, and promote the development and progress of enterprises. Through effective human resource economic management tools, it can help institutions to form a group of high-level and high-quality work teams in a short period of time. Professional training is also provided for this group of personnel, while strengthening the ability of the economic management team, while streamlining the staff of the enterprise. Human resource economic management tools can optimize the work system and management mechanism of sports institutions, thereby improving the operating efficiency of sports institutions to a large extent and promoting the development and progress of the business (Bratton et al., 2021; Coccia, 2014; Lin et al., 2020; Ridder & McCandless, 2010; Zaugg et al., 2001).

There are still certain problems affecting the development of the current application of the human resources economic management model in sports institutions. From the perspective of the human resource development and management model of the previous institutions, the most obvious problem is that the allocation of resources is extremely unreasonable. In a business unit, there is always a gap between the level of leaders and sports employees so far, which in turn affects the communication and exchanges between the two, resulting in staff even having more advanced concepts and technologies. However, in the actual application process, it can only be carried out according to the instructions of the leader (Abrudan et al., 2015; Audenaert et al., 2019; Aycan, 2005; Ghafoor et al., 2020; Hasan et al., 2019). For a long time in the past, institutions still use the traditional and outdated management mode in human resource development and management mode. With the continuous development and progress of society, the traditional human resource development and management model can no longer meet the development needs of current institutions. Because the traditional human resource development and management model lacks a fair, complete and reasonable employment mechanism, and the promotion of professional titles needs to be arranged and determined by the organization, sports employees lack personal innovation in the daily work process (Gomes et al., 2019). In addition, in the traditional human resource development and management model, the nepotism relationship is relatively strong, which leads to the failure of resource integration and allocation of human resources in sports institutions, and the phenomenon of talent waste is very serious. The development and management of human resources in sports institutions is a relatively long and slow process, so in the process of investment, the cycle is relatively long and the actual effect is relatively slow. It needs to carry out long-term planning, and through continuous updating and improvement, to achieve the optimization of human resource development and management. However, in most sports institutions, there is a general lack of long-term and continuous human resource development and training systems, resulting in an imperfect human resource economic management system (Abrudan et al., 2015; Abu-Doleh & Weir, 2007; Duan et al., 2018; Hau-siu Chow, 2004; Moghimi & Ghafari, 2015).

2. Related Work

The literature (Kipkebut, 2010). fully absorbs the mature human resource management theories of western developed countries, creatively starts from the actual development situation, and puts forward the human resource management theory suitable for the national

conditions. The common feature of these theories is to make full use of the characteristics of human resource management, to better adapt to the operating laws and characteristics of government agencies and other sports organizations, and to pursue the realization of sports goals. Literature (Burton et al., 2019). believes that people-oriented is the core content of modern human resource management, and it is necessary to propose specific goals from different perspectives, and gradually establish a systematic covering organization system and human resource management mechanism. Literature (Morillo-Flores et al., 2020) believes that the political and vertical management of business departments have similarities. The human resource management of the sports institution system is based on two factors. It is necessary to work hard to improve the incentive mechanism. It is necessary to adhere to spiritual encouragement and consider material rewards. It is necessary to carry out both individual rewards and organizational rewards. Literature (Moore & Jennings, 2017) (Moore et al., 2017)believes that for the personnel of grass-roots institutions, they are limited by the civil servant management system and have a narrow career advancement channel. In the incentive system, there is a lack of incentives for sports employees at the job level, and a scientific and reasonable selection mechanism has not been established. The development prospects of sports employees in sports institutions are also an important factor affecting the effectiveness of personnel management. From a single level, in the civil service system, the most obvious and effective incentive is to build a good career promotion platform for cadres in sports institutions. Therefore, the establishment of scientific, rational, clear and precise incentive means is the proper meaning of effective cadre management. Literature (Ehnert, 2014). believes that when a certain behavior of the examinee has a significant positive or negative impact on the performance of the organization, this behavior can be called a key event. The above point of view emphasizes that in the daily management of cadres in sports institutions, the main factors that can affect the operation of sports organizations and the enthusiasm of cadres in sports institutions are controllable. As long as the relationship between the elements can be coordinated and dealt with at ordinary times, the human resource management of the institution system can be carried out scientifically and reasonably.

Literature (Ikeanyibe, 2009). made a detailed analysis of the existing problems in the recruitment of sports institutions, conducted a general research on the recruitment cases of sports institutions, summarized the practices in the process of open recruitment, and put forward corresponding reform ideas. Literature (Aycan et al., 2000). believes that there is a big debate on whether professional positions should be tested for sports subjects or administrative professional ability. Junior professional and technical positions should directly conduct professional knowledge and skills examinations. For high-level and in-demand talents, it is more appropriate to take direct assessment methods. In literature (Tepayakul & Rinthaisong, 2018), in the research and study of enterprise training management system, enterprise groups were investigated from the aspects of training resource policy, budget, training time, priority, and training reasons. It concluded that the existing enterprise groups generally attach importance to training work and include training budgets in budget expenses, but there is a large gap in the industry. Literature (Allui & Sahni, 2016). believes that the training of sports institutions obviously lags behind the training of enterprises, and it pays attention to the training form rather than the implementation of the training content. Many institutions do not have special training departments, training personnel, training funds and training systems. The arrangement of training courses for training objects by institutions is not systematic and continuous, and the training is blind and random. Literature (Yong et al., 2020). believes that personnel in sports institutions need to improve vocational skills through training, and institutions should provide sports employees with necessary re-learning opportunities. The training of sports institutions should strengthen the pertinence of training work, carry out training demand analysis, and establish a hierarchical training system. Literature (Al Marhoobi & Tarik, 2018). proposes that the design and implementation of incentive mechanism is the focus of human resource management after the restructuring of sports institutions, and flexibility and pertinence should be fully considered in the design. In the implementation, it is necessary to balance various incentive methods, choose the correct incentive time, and

use a reasonable incentive depth to mobilize sports employees' sense of identity and participation in reform and incentives. Literature (Nura, 2014). pointed out that backward concept, weak ability and lack of assessment system are the main problems existing in human resource management in sports institutions. Literature (Matei & Camelia, 2016). proposed that when the level of organizational support of sports employees in sports institutions is high, the higher the salary satisfaction, the relationship between leaders and members and the opportunity for career development, the higher the work results of sports employees will be.

3. Method

First, this work proposes a series of optimization measures for the economic management mode of human resources in institutions from different aspects. Second, this work proposes an IFWA-ELM algorithm for the evaluation of human resource economic management models in sports institutions. Specifically, this work uses the Cauchy mutation operator to replace the Gaussian mutation operator, uses the elite random selection strategy to replace the original selection strategy, introduces the difference mutation operator and the reverse learning operator to propose IFWA. Then use IFWA to optimize the input weights and hidden layer thresholds of the ELM to establish the IFWA-ELM algorithm. Third, this work conducts systematic experiments to verify the superiority of the optimization measures and the IFWA-ELM algorithm.

3.1 Optimizing Measures of Human Resource Economic Management Mode

This work proposes a series of optimization measures for the economic management mode of human resources in institutions. First, optimize the management concept. Thoughts determine behavior, ideas determine ways and means. In the traditional human resource management of sports institutions, the management concept is relatively outdated, which has a restrictive effect on the improvement of sports institution management. Therefore, in order to optimize the economic management mode of human resources in institutions, it is first necessary to change the management concept. This requires managers to keep up with the pace of social development, cultivate their own sense of innovation, and keep abreast of market trends and the latest management concepts of human resources. And use more advanced management ideas and management methods to guide the human resources management within the unit. In human resource management, it is necessary to always put sports employees at the core of management work, and pay close attention to the current situation, actual needs and long-term development needs of sports employees, so as to make management more humanized. In the process of allocating positions, it is necessary to comprehensively consider the work ability of sports employees. In addition, institutions should implement democratic management and people-oriented thinking in place, and encourage sports employees to express their opinions when making some decisions. In order to enhance employees' sense of identity with the institution and enhance their execution, this is an important measure to promote the smooth development of human resource management.

Second, continuously optimize the recruitment model. Recruitment is a key step to supplement talents for institutions, and the effect of recruitment directly affects the quality of personnel and the level of human resource management in institutions. Optimizing the recruitment model can improve human resource management and provide a driving force for the development of human resource management. Based on the analysis of recruitment patterns, managers should scientifically formulate recruitment plans based on the development of human resources in the market, and use internal promotion and external recruitment flexibly. Mobilize the enthusiasm of sports employees through internal promotion, enhance sports employees' sense of identity, responsibility and belonging, and bring more fresh blood to the unit through external recruitment. In external recruitment, institutions should take a variety of ways to continuously expand their own channels for recruiting talents. It is worth noting that at present, sports institutions adopt the contract appointment system, which can provide a comprehensive understanding of the applicant's ability to handle affairs, professional knowledge, etc., and can achieve merit-based admission. In talent selection, it is necessary to carry out talent screening in strict accordance with regulations, and treat all applicants equally.

Third, optimize the method of talent training. In order to achieve long-term and stable development, institutions must

have high-quality talents to join them, and they also need to do a good job in talent training. This requires staff to pay close attention to talent selection and training, formulate scientific and reasonable talent training programs, optimize talent training methods in the direction of job requirements in institutions, and ensure that staff in various positions can meet the requirements of the corresponding positions. At the same time, institutions also need to pay attention to the methods of talent training in other advanced units, learn from and learn from their own conditions, and strive to comprehensively improve the overall quality of sports employees. In optimizing talent training, it is necessary to apply the economic management model of human resources and truly implement various talent training plans. At the same time, in the process of cultivating talents, institutions can make use of their own human resources. In this way, the work skills and knowledge reserves of sports employees can be improved, which is the only way for institutions to create high-quality talents.

Fourth, implement the post responsibility system. Human resources are managed by people, and the purpose of human resources management is to manage sports employees and positions within the unit. In the specific management, the post responsibility system can be implemented, and the work content and post responsibilities of each staff member can be clarified, so that the employees can work in an orderly and smooth manner. This requires the staff to have a comprehensive understanding of the characteristics, responsibilities and specific requirements of each position in the unit. And according to the actual situation, reasonable allocation of human resources. After clarifying the responsibilities of the sports employees, the staff should also require the sports employees to actively carry out innovations in work modes and work methods, and continuously improve the quality of work.

Fifth, further optimize the incentive mechanism. The incentive mechanism is an important starting point to mobilize the enthusiasm of sports employees. When establishing an incentive mechanism, institutions need to grasp the principles of transparency, openness, fairness and justice. Under the new situation, in the human resource management of sports institutions, it is necessary to properly apply reward and punishment measures, and to encourage employees with outstanding performance. At the same time, reasonable rewards and punishments can also improve the lazy atmosphere within the unit and build a positive working atmosphere. Among the reward and punishment measures, the commonly used incentives include material rewards, economic rewards, honor incentives, etc. These methods have their effects, but they are not a panacea. At the same time, in the incentive methods used, the proportion of spiritual incentives should be increased.

3.2 Fireworks Algorithm

The behavior of fireworks exploding in the air is abstracted into a mathematical model, and then a fireworks algorithm is proposed. The location information stored for each firework is equivalent to a set of solutions, and a new solution is generated by simulating the way the firework explodes. In the first iteration of the fireworks algorithm, the initial fireworks are randomly generated. Secondly, the explosion operations are performed on these initial fireworks to generate explosion sparks, and a number of these fireworks are randomly selected for Gaussian mutation operation to generate mutation sparks. Finally, some fireworks are selected from the set of fireworks and sparks through the selection strategy as the initial fireworks for the next iteration. This iterates successively until the set stopping condition is met.

The fireworks algorithm can solve the optimal solution of complex optimization problems. The flow of the algorithm is shown in Fig. 1. The smaller the fitness value corresponding to the initial firework in the firework algorithm is, the smaller the calculated explosion amplitude of the firework is, and the more explosion sparks are generated. Conversely, the larger the explosion amplitude, the smaller the number of explosion sparks generated.

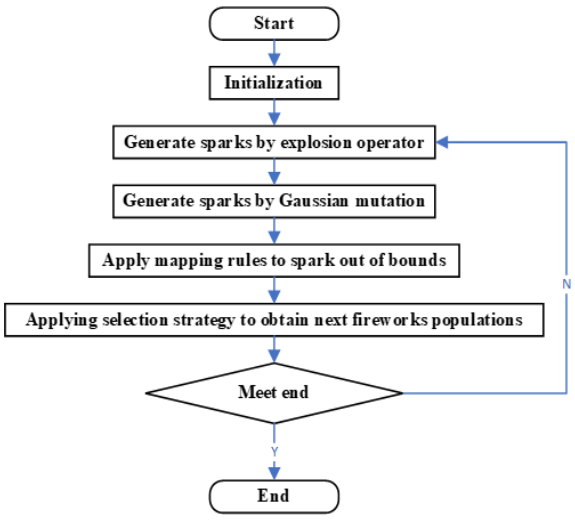

Fig. 1. FWA pipeline.

The fireworks algorithm generates a variety of different sparks through the explosion operator to achieve the diversity of individuals, which provides strong support for searching for the global optimal point. Different from the general population intelligence optimization algorithm that directly sets the population size, the individual size of each generation of the fireworks algorithm is uncertain. However, in order to avoid too many individuals in each generation in the firework algorithm, the number of sparks generated by each initial firework explosion is limited by the explosion intensity.

$$S_i = m\frac{\max(f(x_i))-f(x_i)+\varepsilon}{\sum_i \max(f(x_i))-f(x_i)+\varepsilon} \quad (1)$$

In the early stage of the algorithm, the fitness value of each firework is too large, and the calculated number of sparks is close to the maximum value. In the later stage of the algorithm, the fitness of each firework differs little from each other, and the number of sparks calculated by the formula will be close to a lower constant value. At this time, the optimal individual cannot generate enough sparks, which greatly wastes computing resources. To limit the number of sparks produced by firework explosions within a reasonable range, set a limit on the number of sparks produced for each firework.

$$\hat{s}_i = \begin{cases} rand(am), & S < am \\ rand(bm), & S < bm \\ rand(S_i), & others \end{cases} \quad (2)$$

After obtaining this value, it is also necessary to calculate the explosion range of each firework, that is, the explosion radius.

$$A_i = \hat{A}_i\frac{\max(f(x_i))-f(x_i)+\varepsilon}{\sum_i \max(f(x_i))-f(x_i)+\varepsilon} \quad (3)$$

In the fireworks algorithm, the operation that actually generates the explosion spark is the displacement operation, and the displacement of the corresponding dimension of the fireworks to be exploded simulates the process of the real fireworks exploding in the night sky to generate sparks.

$$\Delta x_i^k = x_i^k + rand(0, A_i) \quad (4)$$

Similar to the common intelligent optimization algorithm to achieve population diversity through mutation, the fireworks algorithm enhances diversity through mutation operators, reducing the probability of premature maturity and falling into local optimal solutions.

$$x_i^k = g x_i^k \quad (5)$$

The sparks generated may exceed the feasible range, and it would be wasteful to discard these individuals directly. Therefore, in order to effectively utilize the generated individuals beyond the feasible domain, the Fireworks algorithm maps them into the feasible domain.

$$x_i^k = x_{min} + \left|x_i^k\right| \%(x_{max} - x_{min}) \quad (6)$$

The fireworks algorithm first selects the optimal individual from the set of initial fireworks, explosion sparks and Gaussian variation sparks, and then uses the roulette method to select the remaining individuals. The selected individuals are the initial fireworks for the next iteration, and the remaining unselected individuals will be discarded directly.

3.3 Improved Fireworks Algorithm and IFWA-ELM

In the original fireworks algorithm, the selection method of roulette is used to select some fireworks from the set of initial fireworks, explosion sparks and mutation sparks as the initial fireworks for the next iteration. This selection strategy based on the Euclidean distance metric needs to calculate the Euclidean distance between any two bodies of all individuals, so the original fireworks algorithm consumes a lot of time. Moreover, it will directly abandon the selected individuals, which will also cause a waste of computing resources. In view of the above shortcomings of the original fireworks algorithm, this section proposes an improvement method. First, replace the original Gaussian mutation operator with the Cauchy mutation operator. Second, differential mutation and reverse learning strategies are added to solve the resource waste caused by the roulette wheel selection strategy. At the same time, the elite random selection strategy is used to replace the roulette selection strategy of the original algorithm.

First, it is improved based on the Cauchy mutation operator (CMO). The Cauchy mutation operator based on the Cauchy distribution is:

$$x_i^k = x_i^k(cauchy(0,1) + 1) \quad (7)$$

The Cauchy distribution is long and flat in the shape of the Gaussian distribution in the transverse axis, and the process of approximating the coincidence with the axis is relatively gentle. The Cauchy mutation operator has a greater probability to generate new individuals with greater differences, so the Cauchy mutation operator is stronger than the Gaussian mutation operator in terms of perturbation ability and enhancement of population diversity. Therefore, the Cauchy mutation is introduced

into the target position update formula, and the disturbance ability of the Cauchy operator is exerted, so that the global optimization performance of the algorithm is improved, and there is a greater probability to find the global optimal point.

Second, it is improved based on the difference mutation operator (DMO). This paper chooses to use the DE/best/2 strategy to form the differential mutation operator. When mutating, the differential evolution algorithm uses real-valued parameter vectors and treats them as a population.

$$x_{i,G+1} = x_{best,G} + F(x_{r_1,G} - x_{r_2,G} + x_{r_3,G} - x_{r_4,G}) \quad (8)$$

This paper chooses to use the DE/best/2 strategy to form the differential mutation operator. When mutating, the differential evolution algorithm uses real-valued parameter vectors and treats them as a population.

Third, it is improved based on the reverse learning operator (RLO). Reverse learning is an effective method to increase the optimization ability of an optimization algorithm. Reverse learning is to calculate its reverse solution while solving, which will increase the diversity of solutions and accelerate the convergence speed of the optimization algorithm. Calculate the reverse learning population position as:

$$x'_{ij} = x_{max,j} + x_{min,j} - x_{i,j} \quad (9)$$

The reverse learning strategy operator has strong global exploration ability, and is used to perform mutation operation on 50% of the individuals in the set K after the fitness value is sorted to generate K/2 new individuals.

Forth, it is improved based on the elite random selection strategy (ERS). The individual with the best fitness value is selected from the initial fireworks, explosion sparks, Cauchy mutation sparks, differential mutation operator sparks, and reverse learning operator sparks. The remaining initial fireworks are randomly selected from the set consisting of initial fireworks, explosion sparks, Cauchy mutation sparks, differential mutation operator sparks, and reverse learning operator sparks. The FWA pipeline is demonstrated in Fig. 2.

The extreme learning machine (ELM) is a fast single-hidden layer feedforward neural network training algorithm. Compared with the traditional artificial neural network, it has the advantages of simple structure, fast running speed, and easy implementation. The core principle of extreme learning machine is to transform the training process of neural network into solving linear least squares problem, and then calculate the output weight through MP generalized inverse. The only parameter that ELM needs to manually set is the number of neurons in the hidden layer.

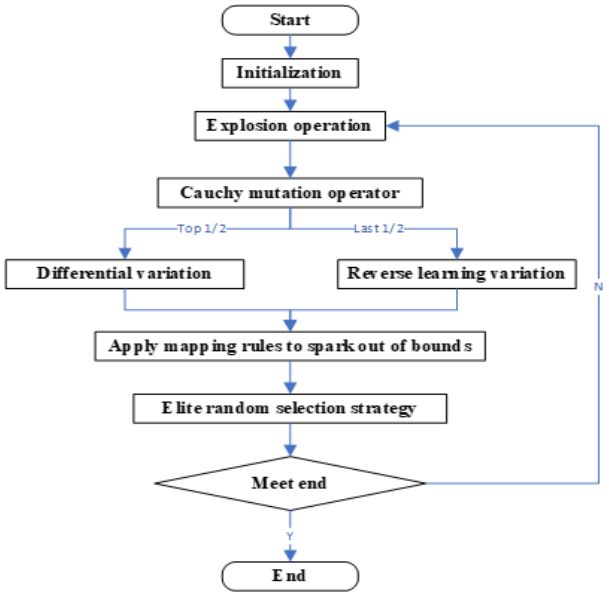

Fig. 2. IFWA pipeline.

The output weights in the network structure of ELM are calculated from the pseudo-inverse of the output matrix and the hidden layer matrix. The hidden layer matrix is obtained by bringing the input weights and hidden layer thresholds randomly generated at the beginning of the ELM into the activation function. Because they are randomly generated, the generalization ability of ELMs fluctuates greatly. Therefore, in order to reduce the influence of randomly generated input weights and hidden layer thresholds on ELM, the proposed IFWA algorithm is used to optimize the input weights and hidden layer thresholds, so that the predicted output is closer to the true value. First, the dimension of the individual fireworks of the IFWA algorithm is set equal to the sum of the number of input weights and the number of hidden layer thresholds, and the optimization range is set to [-1,1]. Second, initialize in the scope to get the original fireworks. Again, the explosion operation and the Cauchy mutation operator operation are performed. Next, calculate the fitness value of each individual, perform differential mutation on the top 50% of the individuals in the fitness value, and perform reverse learning mutation on the bottom 50% of the individuals in the fitness value ranking. Then, according to the elite random selection strategy, the original fireworks of the next iteration are selected from the set of all fireworks and sparks, and it is

judged whether the termination condition is established. If established, the optimized parameters are output directly. Otherwise, start the next iteration until the termination condition is satisfied and output the optimized parameters. The IFWA-ELM pipeline is demonstrated in Fig. 3.

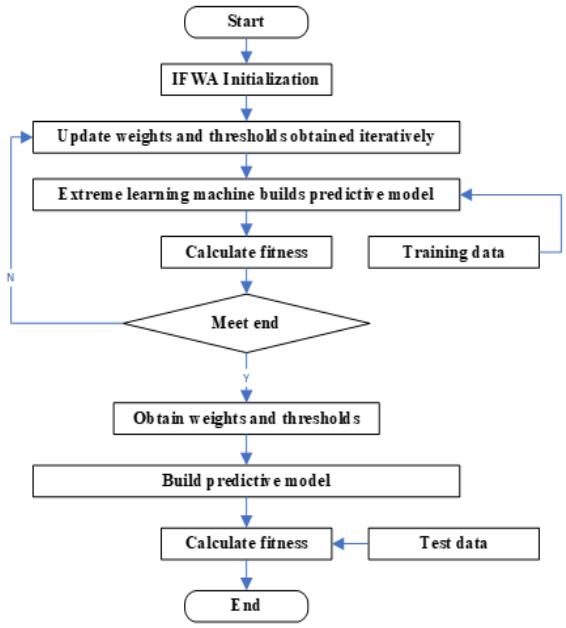

Fig. 3. IFWA-ELM pipeline.

3.4 Experiment

3.3.1 Dataset

This work collects data on human resources and economic management models of sports institutions. The data set contains a total of 19,037 samples, of which 12,301 are training samples and the rest are test samples. The specific feature information of each sample is shown in Table 1, and the corresponding label is the human resource economic management model rating. Accuracy and recall are used as evaluation metrics in this work.

Table 1

The specific feature information of each sample.

Index	Item
x_1	Income generated by each employee
x_2	Length of service
x_3	Job satisfaction
x_4	Timetable and Program Matching
x_5	HR cost per employee
x_6	Collaboration and Teamwork
x_7	Mission and Vision of the Work
x_8	Pay equity

3.3.2 Comparison with Other Method

To verify the rationality of the IFWA-ELM designed in this work for the evaluation of human resource economic management models in sports institutions, this work compares it with other methods, as demonstrated in Fig. 4.

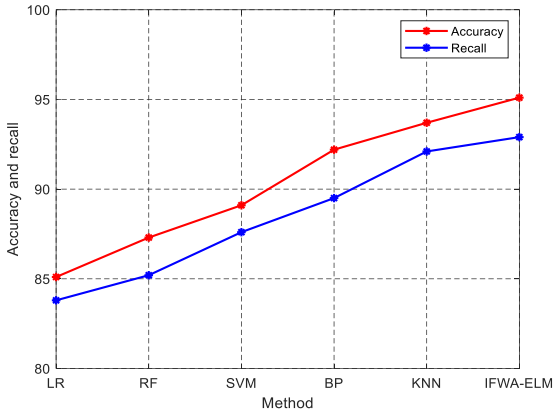

Fig. 4. Comparison with other method.

Compared with other methods, the IFWA-ELM method designed in this work can achieve the highest accuracy and recall rate and can achieve different degrees of performance improvement compared with other methods.

3.3.3 Evaluation for CMO

IFWA-ELM uses the CMO strategy to improve the traditional FWA algorithm, to verify the effectiveness of this improvement. The performances without and with CMO are compared, respectively, as demonstrated in Fig. 5.

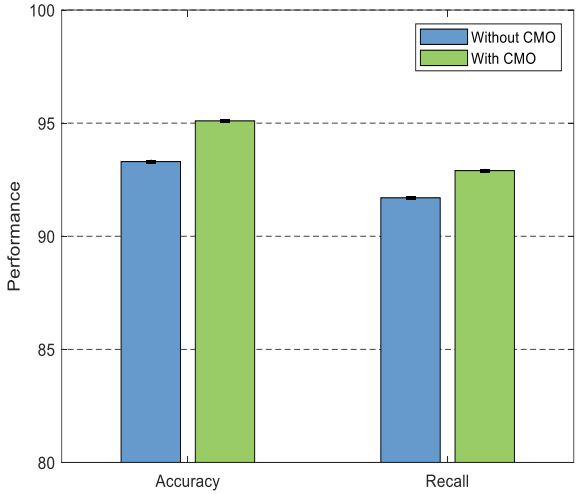

Fig. 5. Evaluation for CMO.

Compared with the performance without CMO, the accuracy and recall rate are improved by 1.8% and 1.2% respectively after using this strategy.

3.3.4 Evaluation for DMO

IFWA-ELM uses the DMO strategy to improve the traditional FWA algorithm, to verify the effectiveness of this improvement. The performances without and with DMO are compared, respectively, as demonstrated in Fig. 6.

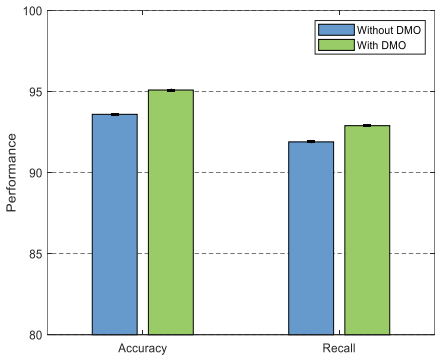

Fig. 6. Evaluation for DMO.

Compared with the performance without DMO, the accuracy and recall rate are improved by 1.5% and 1.0% respectively after using this strategy.

3.3.5 Evaluation for RLO

IFWA-ELM uses the RLO strategy to improve the traditional FWA algorithm, to verify the effectiveness of this improvement. The performances without and with RLO are compared, respectively, as demonstrated in Fig. 7.

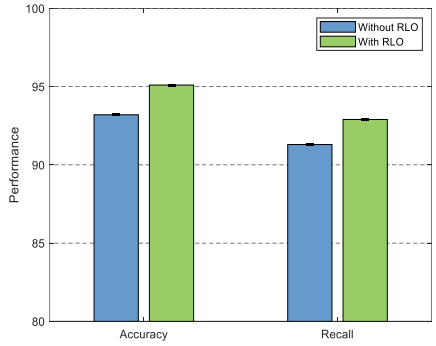

Fig. 7. Evaluation for RLO.

Compared with the performance without RLO, the accuracy and recall rate are improved by 1.9% and 1.6% respectively after using this strategy.

3.3.6 Evaluation for ERS

IFWA-ELM uses the ERS strategy to improve the traditional FWA algorithm, to verify the effectiveness of this improvement. The performances without and with ERS are compared, respectively, as demonstrated in Fig. 8.

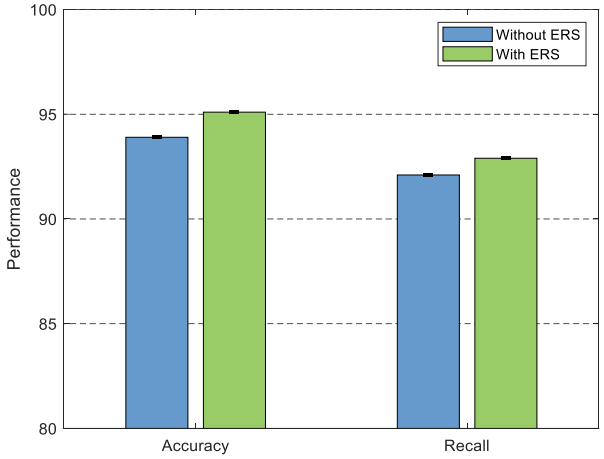

Fig. 8. Evaluation for ERS.

Compared with the performance without ERS, the accuracy and recall rate are improved by 1.2% and 0.8% respectively after using this strategy.

3.3.7 Optimizing Measure Analysis for Human Resource Economic Management

A series of optimization measures are proposed in this work for the optimization of the human resources economic management model of institutions. To verify the feasibility of these measures, this work compares the quality indicators before and after these optimization measures are used. The comparison data is demonstrated in Table 2.

Table 2

Optimizing measure analysis result.

Feature	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8
Before	78.3	82.2	85.1	83.8	86.9	89.3	87.7	90.6
After	80.1	83.7	86.3	86.9	90.5	91.7	89.6	92.1

According to the analysis of the data in the table, after using the optimization countermeasures proposed in this work, the economic management mode of human resources in institutions has been effectively improved. Different degrees of improvement can be obtained on each index, which verifies the superiority and feasibility

of the optimization strategy proposed in this work.

4. Conclusion

Human resource economic management occupies an increasingly important position in sports institutions, because excellent human resources economic management tools can effectively improve the work effectiveness and overall economic benefits of all aspects of sports institutions. If want to optimize the human resources economic management model, you must first optimize the human resources economic management tools of sports institutions. Because human resources economic management tools can help business units build a group of high-level work teams. Moreover, the use of human resources economic management tools to optimize the work system and management mechanism of sports institutions can greatly improve operational efficiency and provide continuous assistance for the progress of sports institutions. Under this background, it has become an important subject to study the optimization of the economic management mode of human resources in institutions. First, this work proposes a series of optimization measures for the economic management mode of human resources in institutions from different aspects. Second, this work proposes an IFWA-ELM algorithm for the evaluation of human resource economic management models in sports institutions. Specifically, this work uses the Cauchy mutation operator to replace the Gaussian mutation operator, uses the elite random selection strategy to replace the original selection strategy, introduces the difference mutation operator and the reverse learning operator to propose IFWA. Then use IFWA to optimize the input weights and hidden layer thresholds of the ELM to establish the IFWA-ELM algorithm. Third, this work conducts systematic experiments to verify the superiority of the optimization measures and the IFWA-ELM algorithm.

Availability of Data and Material

The datasets used during the current study are available from the corresponding author on reasonable request.

Competing Interests

The author declared that he has no conflict of interest.

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