Dynamic Allocation Method of Incentive Pool for Financial Management Teaching Innovation Team Based on Data Mining

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***Abstract*—In order to reasonably allocate the amount of incentive pool and promote the unity of members of the financial management teaching innovation team, a dynamic allocation method of incentive pool for the financial management teaching innovation team based on data mining is proposed. This method constructs the incentive pool allocation index system by analyzing the principles of risk and income correlation, income and contribution consistency, individual and overall profit consistency, as well as the actual contribution of the financial management teaching innovation team, members' efforts and other factors that affect the allocation of incentive pool. After determining the index weight, the maximum entropy model is used to establish the incentive pool function of the financial management teaching innovation team project. The incentive pool scale decision model is established according to the prospect theory. After outputting the scale of the financial management teaching innovation team's incentive pool using the construction model, the incentive pool model of the financial management teaching innovation team is obtained. Based on the asymmetric Nash negotiation model, the allocation model for the incentive pool model of the financial management teaching innovation team is established, the improved artificial colony algorithm in the data mining algorithm is used to solve the model, and the dynamic allocation result of the incentive pool of the financial management teaching innovation team is obtained. The experiment shows that this method can effectively calculate the size of the incentive pool and allocate the incentive pool. The members of the financial management teaching innovation team have a high degree of satisfaction with the allocation result of the incentive pool, with allocation satisfaction consistently fluctuating around 96%.**

Keywords—Data mining; financial management; teaching innovation team; incentive pool; dynamic allocation; artificial colony

I. Introduction

Financial personnel need to predict risks in advance and conduct effective control in time [1, 2]. The incentive pool is an incentive mechanism that takes part of the project income to motivate team members, retain core members and stimulate members to engage in work actively [3]. In the financial management teaching innovation team, the innovation input, actual contribution, and effort level of all participants change with the actual situation of the project [4]. A single profit distribution scheme is easy to lead to the unfair distribution of surplus target costs [5], which affects the internal harmony of the financial management teaching innovation team, and even leads to team breakdown. Therefore, scientific and reasonable dynamic allocation of incentive pool [6] is an effective means to improve the stability and enthusiasm of the financial management teaching innovation team. Now many scholars are studying the dynamic allocation method of incentive pools.

Study [7] proposed a transaction incentive mechanism for the V2G market, considering dynamic loss aversion. This method considered the incentive margin and liquidated damages when allocating incentives and proposed a minimum incentive strategy. This incentive pool allocation method needs to deduct a certain amount of incentive margin. Therefore, team members have a small number of funds in the incentive pool, which has a poor incentive effect. Research [8] proposed a dynamic incentive mechanism in mobile group intelligence perception. This method allocated the incentive pool based on the contribution degree of team members by evaluating the contribution degree of team members. However, this method is ineffective in evaluating team members' contribution degree, so its allocation effect is not good. Wu Z. et al. proposed an unbalanced fund allocation method, which only distributed the unbalanced funds in the team incentive pool. When the amount in the team incentive pool is large, and the unbalanced funds cannot be divided, it cannot complete the allocation of the incentive pool. In [9] authors proposed the reconstruction method of fund allocation standard based on the extended energy model. This method used the expansion energy synthesis model to calculate the premium value of the incentive pool project funds. It allocated the funds in the incentive pool according to the premium value. However, in the application process of this method, due to the iterative influence of the expansion energy synthesis model, its calculation of the capital premium value of the incentive pool project is not accurate enough, resulting in its poor final application effect. The authors in [10] proposed a matching method for the working capital of the supply chain incentive pool. This method used a dynamic discount decision to allocate the incentive pool capital by calculating the working capital's operating cycle and cycle income. However, this method is affected by the long operating cycle of the capital, resulting in the insufficient balance of the allocation of the incentive pool capital.

In response to the problems in the above research, team members are unable to complete the allocation of incentive pool funds due to the small amount of funds allocated in the incentive pool, which has a poor incentive effect. When the amount of funds in the team incentive pool is large and unbalanced funds cannot be divided, the allocation of incentive pool funds is not balanced enough. This article studies the use of data mining methods to solve the problem. Utilize data mining techniques to analyze data related to team members' contributions, performance, and motivational effects, and establish appropriate models to evaluate the value and potential of team members. This can more accurately determine the amount of incentive funds that each member should receive, in order to improve the effectiveness of incentives. Data mining based methods can help identify imbalances among team members and optimize the allocation of incentive pool funds. By considering factors such as member contributions, performance, and overall team goals, data mining algorithms can be used to optimize fund allocation, making it more balanced and fair. Data mining technology can analyze historical data and make predictions, helping to predict the potential and performance of future team members. Based on these prediction results, the allocation of funds in the incentive pool can be dynamically adjusted to adapt to changes in team members and achieve better incentive effects and balance. Data mining technology can provide personalized incentive strategies based on the characteristics and needs of team members. By mining and analyzing the data of members, incentive plans suitable for their personal characteristics and goals can be designed for each member to improve their participation and job satisfaction.

Data mining [11, 12] refers to the non-trivial process of revealing hidden, previously unknown and potentially valuable information from a large amount of data in the database. Data mining [13] is a decision support process, which is mainly based on artificial intelligence, machine learning, pattern recognition, statistical database, visualization technology, etc., which can make a highly automated analysis of enterprise data, inductive reasoning, mining out potential patterns, and helping decision-makers adjust market strategies, to reduce risks, and make correct decisions. Data mining is a technology to find rules from a large amount of data by analyzing each data. It involves three steps: data preparation, rule finding and rule representation. Data mining tasks include association analysis, cluster analysis [14], classification analysis, anomaly analysis, specific group analysis and evolution analysis. The research purpose of dynamic allocation of incentive pool for financial management teaching innovation teams is to explore an effective incentive mechanism to stimulate teachers' enthusiasm and creativity in financial management teaching innovation. This study aims to establish a mechanism that can dynamically allocate incentive resources based on teachers' contributions and performance, in order to improve teachers' job satisfaction, teaching quality, and teaching innovation level. By dynamically allocating incentive pools, teachers can be given corresponding rewards and incentive measures based on their performance and contribution in financial management teaching innovation. This can motivate teachers to actively participate in teaching innovation activities, improve teaching effectiveness and students' learning experience. Here, based on data mining technology, this paper proposes a dynamic allocation method of incentive pool for financial management teaching innovation teams based on data mining to improve the dynamic allocation effect of incentive pool. The framework and main content of this study are as follows:

1) *Clarify* the basic principles for constructing incentive pool allocation models.

2) *Analyze* the factors that affect the allocation of incentive pools, and construct an incentive pool allocation indicator system and determine the indicator weights.

3) *On* the basis of clarifying the relevant principles, the paper constructs the incentive pool function of financial management teaching innovation team based on the maximum entropy model, and designs the Decision model of incentive pool size based on the prospect theory.

4) *Implement* the financial management teaching innovation team incentive pool allocation decision based on data mining from three aspects: constructing objective functions, calculating constraint conditions, and constructing models.

5) *The* effectiveness of the proposed method was verified through experimental analysis.

II. Dynamic Allocation Method of Incentive Pool for Financial Management Teaching Innovation Team

A. *Basic Principles for the Construction of the Incentive Pool Allocation Model*

First of all, the distribution of the incentive pool of financial management teaching innovation team is still the distribution of project profits in essence, which still needs to follow the general principles of the enterprise profit distribution model; secondly, according to the cause of formation of incentive pool and its distribution function, its distribution principle has a particularity. By summarizing the allocation scheme proposed by scholars and the practical experience of foreign financial management teaching innovation team projects, the allocation of incentive pool for financial management teaching innovation team projects should follow the following basic principles:

1) *Principles related to risks and benefits:* The potential profits and losses of all participants in the financial management teaching innovation team should be related to the real risks they bear [15].

2) *The principle of consistency between income and contribution:* The actual contribution of the financial management teaching innovation team and the contribution of each participant to the project are positively correlated with the profits obtained.

3) *The principle of consistency between individual and overall profits:* Whether the participants of the financial management teaching innovation team are profitable should be consistent with whether the project is profitable as a whole. The result of profit distribution can only lead to common profits or common losses, not profits of one party and losses of the other.

4) The principle of limited liability for financial management teaching innovation team participants: The potential losses of the members of the financial management teaching innovation team should be capped at the normal profits of each participant, the company's indirect costs and the share of profits, and the owner should bear the risks in excess.

5) 100% sharing principle: The members of the financial management teaching innovation team have 100% right to share the excess profits of the project. The above principles link the interests of participants with the interests of the project and encourage participants' behaviour to develop in a direction conducive to the project's overall profitability [16]. This paper will select indicators based on the above principles.

B. Analysis of Factors Affecting Incentive Pool Allocation

Based on the analysis of the characteristics of incentive pool allocation, this paper uses the all-factor method to comprehensively evaluate the contribution of the participants of the financial management teaching innovation team to the project surplus target cost from five aspects of the actual contribution, effort, risk and dynamic factors of the financial management teaching innovation team, combined with the design of specific indicators.

1) The actual contribution of the financial management teaching innovation team: The actual contribution of the financial management teaching innovation team is mainly reflected in the role of the internal members in the project profits. Drawing on the four major control objectives of enterprise project management, the financial management teaching innovation team members' completion of the part of the project they are responsible for is measured from the four aspects of quality, progress, safety and profit, reflecting the distribution principle of "distribution according to work" [17].

2) The degree of effort of the financial management teaching innovation team members: The effective cooperation and active innovation of the financial management teaching innovation team are the source of creating excess profits. The distribution system that only pays attention to the results without considering the efforts of the financial management teaching innovation team members is difficult to motivate the members of the financial management teaching innovation team to participate in project management and technical innovation actively. Therefore, this paper evaluates the efforts of enterprises from the perspective of project management and innovative activities.

3) The financial management teaching innovation team bears risks: The principle of "risk sharing and profit sharing" in the enterprise operation mode determines that the profit distribution mode should match the risks borne by the financial management teaching innovation team members. This paper sets three secondary indicators, namely, the degree of awareness, the control cost and the reduction of losses, from the perspective of risk control, to evaluate the contribution of the risk factors borne by the participants to the excess profits.

4) Dynamic factors: Enterprise projects usually have large investments and long cycles. When allocating excess profits, we should consider the spillover effect of the financial management teaching innovation team's investment income and special resource investment on the project.

C. Determination of Incentive Pool Allocation Index System and Index Weight

Based on the analysis of the factors affecting the allocation of the incentive pool in the financial management teaching innovation team, the indicator system and weight are determined. Firstly, 17 second-level indicators are refined according to the four first-level indicators of the financial management teaching innovation team's actual contribution, degree of effort, risk-taking and dynamic factors, and a consultation letter is sent to five scholars for indicator screening opinions; after three rounds, the indicators tend to be consistent, and then a consultation letter on the weight of indicators is issued. Both stages of consultation require respondents to evaluate their own judgment and familiarity and empower experts with the basis of their judgment and familiarity with the financial management teaching innovation team project through the analytic hierarchy process: knowledge of relevant references and cases (1), the experience of similar projects (0.75), theoretical analysis (0.5), personal intuition (0.25); Very familiar (1), familiar (0.75), average (0.5), not familiar (0.25). The calculated credibility of this consultation is 0.81; the Familiarity coefficient is 0.75; The overall authority level is 0.78, and the result is relatively reliable. The final indicator system and indicator weight are shown in Table I.

According to the indicator system in Table I, it can evaluate the contribution of team members to the incentive pool fund during the implementation of the financial management teaching innovation team project. The scores of the members of the financial management teaching innovation team project in the evaluation system in Table I are normalized and recorded as l_{ij} , then the evaluation of the financial management teaching innovation team members' profit contribution is as follows (1):

$$B = \sum_{i=1}^{n} \sum_{j=1}^{n} \xi_i \xi_{ij} l_{ij} \tag{1}$$

In equation (1), B represents the profit contribution evaluation of the members of the financial management teaching innovation team; ξ_i is the weight of the first-level indicator; ξ_{ij} is the weight of the first-level indicator.

TABLE I. PROJECT INCENTIVE POOL INDEX SYSTEM OF FINANCIAL MANAGEMENT TEACHING INNOVATION TEAM

Influencing factor layer	Primary index	Secondary indicators
Actual contribution	Quality contribution (0.1)	Project quality qualification rate (0.4)
		Number of quality accidents (0.6)
	Progress contribution (0.1)	Progress contribution rate (0.5)
		Return and shutdown frequency (0.5)
	Profit contribution (0.2)	Profit contribution rate (0.5)
		Profit loss rate (0.5)
	Safety contribution (0.1)	Accident loss (0.7)
		Accident frequency (0.3)
Effort	Project management (0.15)	Project management plan (0.6)
		Decision cycle (0.4)
	Innovation investment (0.05)	Professional training rate (0.5)
		New technology (0.5)
Risk factor	Risk compensation (0.2)	Cooperation risk (0.3)
		Capability risk (0.3)
		Investment risk (0.4)
Dynamic factors	Input resources (0.1)	Capital investment (0.8)

D. Construction of Project Incentive Pool Model for Financial Management Teaching Innovation Team

The construction of the incentive pool has played a very good role in risk sharing and incentive compensation under the financial management teaching innovation team model. However, the size of the incentive pool, that is, the amount of funds invested in the incentive pool, has become the key issue of subsequent research and the prerequisite for allocating the incentive pool. If the number of incentive pools is too high, it may cause the enterprise to exceed the project's budget range and cannot save costs on the premise of encouraging all participants. If the number is too low, it will weaken the role of the incentive pool, make the setting role of the incentive pool not obvious, and cannot bring power to the financial management teaching innovation team to maximize the project benefits and save costs, and also make the tense relationship between the members of the financial management teaching innovation team. It brings difficulties to the subsequent research on the allocation of incentive pools [18], so how to determine the size of the incentive pool is very important for maximizing project benefits.

The project incentive pool model of the financial management teaching innovation team consists of three parts, namely C1, C2 and C3, as shown in Fig. 1.

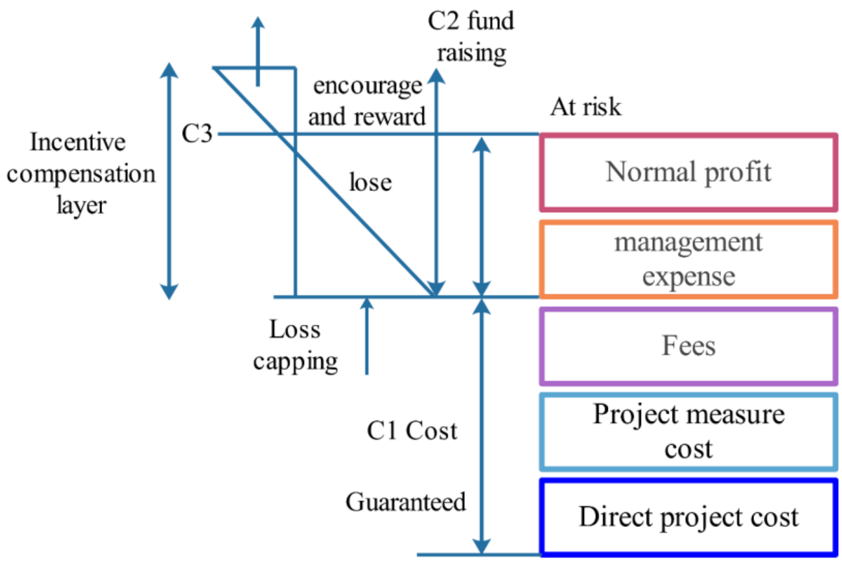

Fig. 1. Project incentive pool model of financial management teaching innovation team.

According to the division of enterprise project costs, the C1 layer is the first part, which is the project cost, including the direct project cost, project measure cost and regulation cost of the project. The cost of this part is guaranteed, and these costs are placed at the first level because the project partner will never let his direct project cost and site management cost bear the risk. The C2 level is the second part, which is the project remuneration, including the project management fee and normal profits. Because this part may suffer losses, if any, it will be borne by all financial management teaching innovation team members, so this part is reflected in the risk sharing. The C3 layer is the third part, that is, the compensation layer for project risk incentives, including the loss value for failing to reach the target and the bonus for exceeding the target. The amount of this part of rewards or punishment mainly depends on the final actual output of the project. If the benefit exceeds the expected target, it will be rewarded, and if it is lower than the expected target, it will be punished. Here we introduce two keywords, target cost (TOC) and actual cost (AOC). TOC represents the project target cost agreed upon by all participants at the initial design stage [19]. AOC refers to the actual total cost after the completion of the project, which is equal to the actual direct project cost plus the project measure cost and regulation fee. There are four cases to analyze the model:

1) If the target cost is equal to the actual cost, the incentive compensation level is equal to the initial incentive value, the project is completed as scheduled, and there is no loss or surplus. The financial management teaching innovation team members can be rewarded as expected.

2) If the target cost is less than the actual cost, but the target cost plus the initial incentive value is greater than the actual cost, the incentive compensation level is equal to the initial incentive value minus (actual cost - target cost), the project loss, cost overrun, and the members of financial management teaching innovation team jointly bear the loss.

3) If the target cost is greater than the actual cost, the incentive compensation level is equal to the target cost minus the final cost and plus the initial incentive value so that the project gains benefits, reduces costs, saves expenses, and members of the financial management teaching innovation team can get corresponding benefits.

4) If the target cost plus initial incentive value is less than the actual cost, there is no incentive compensation; that is, the incentive compensation level is equal to 0.

Based on the above analysis, this paper uses the maximum entropy model and prospect theory to determine the size of the incentive pool.

a) Construction of incentive pool function of financial management teaching innovation team based on maximum entropy model: The maximum entropy theory was put forward by Jaynes in 1957, which is one of the data mining algorithms. The maximum entropy theory is a mining algorithm that, under the premise of a certain number of probability distributions, the maximum probability expression of other location distributions is reached when the entropy value of the whole population is maximum, and the maximum entropy value is obtained to obtain the optimal results. The maximum entropy objective function is shown in equation (2):

$$h(x_i) = -B\int_{x_1}^{x_2} f_x(x)\ln f_x(x)dx \tag{2}$$

In equation (2), x_i represents the i-th state value; $h(x_i)$ is the maximum entropy objective function; $f_x(x)$ is the probability density function of the variable x; x_2 and x_2 represent the upper and lower limits of the maximum differential entropy.

The constraint conditions for setting equation (2) are as follows:

$$h(x_i)\int_{-\infty}^{+\infty} f_x(x)dx = 1 \tag{3}$$

$$\int_{x_1}^{x_2} f_x(x)F_i(x)dx = \varepsilon_i \tag{4}$$

In the above equation, $F_i(x)$ is a distribution function of a random variable x, which represents a prior condition before solving the maximum unknown distribution probability of x; ε_i is a set of constants.

According to the characteristics of the project delivery model of the financial management teaching innovation team, it is assumed that the utility value of the financial management teaching innovation team can be approximated as the sum of the utility values of all members. The random variable x can represent the utility of each member. The function of the size of the incentive pool of the financial management teaching innovation team is $x_n(sca)$, and the proportion of the incentive pool to the utility fluctuates within the range of 0-1. sca is the size of the incentive pool, $n=1,2,\cdots$ is the number of members in the financial management teaching innovation team, $h(x_i)$ is the entropy value of any member of the financial management teaching innovation team to maximize it. $x_n(sca)$ is substituted into the above model, and the size function of the incentive pool model of each member's utility financial management teaching innovation team is taken as a random variable to obtain the relationship function that best conforms to the random probability density distribution. In this paper, several Lagrange multipliers, such as $a_0, a_1, \cdots, a_i$, are introduced to form a new Lagrange function by combining the constraint function and the objective function. The extreme value of the original function is obtained by solving the stationary point. The incentive pool model of financial management teaching innovation team can be expressed as equation (5)

$$G(X) = -\int_0^1 f_{x_n}\left[x_n(sca)\right]\ln f_{x_n}\left[x_n(sca)\right] + h(x_i)\sum_{i=1}^{k} F_i(\varepsilon_i, f_{x_n}\left[x_n(sca)\right])dx\sum_{i=1}^{k} a_i dx \quad (5)$$

In equation (5), $G(X)$ represents the incentive pool model of the financial management teaching innovation team, and $k = 1, 2, \cdots$ represents the different roles of members in the financial management teaching innovation team project.

To calculate the differential at both ends of the above equation and assign the initial value to 0, the functional relationship between the utility of the financial management teaching innovation team's members and the size of the incentive pool can be obtained as equation (6):

$$x_n(sca) = G(X)\int_0^1 x_n f_{x_n}\left[x_n(sca)\right]dn \quad (6)$$

b) Incentive pool size decision model based on prospect theory: Prospect theory is a psychological concept that studies the criteria for people making decisions from a psychological perspective. This theory believes that the estimation of events with different probabilities is different. After this paper uses the maximum entropy model to obtain the functional relationship between the utility of each participant in the IPD project and the size of the incentive pool, the best scheme of the size of the incentive pool can be solved by applying the prospect theory, introducing the value function and the weight function. Its specific mathematical expression is:

$$U(x, p) = x_n(sca)\sum_{i=1}^{k} w(p_i)\sum_{i=1}^{k} V(\pi_i) \quad (7)$$

$$w(p_i) = \begin{cases} p^r \cdot \dfrac{1}{\left[p^r + (1-p)^r\right]^{\frac{1}{r}}}, \text{earn profit} \\ q^\delta \cdot \dfrac{1}{\left[q^\delta + (1-q)^\delta\right]^{\frac{1}{\delta}}}, \text{damage} \end{cases} \quad (8)$$

$$V(\pi_i) = \begin{cases} \pi_i^\alpha & \pi_i > 0 \\ -\tau(-\pi_i)^\beta & \pi_i < 0 \end{cases} \quad (9)$$

In the above equation, $U(x, p)$ represents the overall value of the incentive pool, and $i = 1, 2, 3\cdots$ represents the possible future, $w(p_i)$ represents the weight function of the foreground i ; $V(\pi_i)$ represents the value function of the prospect i . α and β represent the risk attitude coefficient of the members of the financial management teaching innovation team, τ represents the loss aversion coefficient of each participant, and r and δ represent the adjustment coefficient of the weight. Assuming there are two prospects u' and u'', under the prospect u', the financial management teaching innovation team successfully completes the project and gains profits. Under prospect u'' , the project is incomplete, and all financial management teaching innovation team members lose. Then the decision model of the size of the incentive pool is shown in equation (10):

$$\max U = U(x, p)\sum_{i=1}^{k}\frac{p^r\left[u'_i(sca)\right]\alpha}{\left[p^r + (1-p)^r\right]^{\frac{1}{r}}} + \tau\sum_{i=1}^{k}\frac{q^\delta\left[u''_i(sca)\right]\beta}{\left[q^\delta + (1-q)^\delta\right]^{\frac{1}{\delta}}} \quad (10)$$

In equation (10), $Max \;\; U$ represents the decision model of the size of the incentive pool.

Set the constraint conditions of the decision model for the size of the incentive pool as equation (11):

$$s.t.\begin{cases} \int_0^0 f_{u'}\left[u'(sca)\right]du' = 1 \\ \int_0^0 f_{u'}\left[u'(sca)\right]F_i\left[u'(sca)\right]du' = \varepsilon_i(sca) \end{cases} \quad (11)$$

E. Construction of Incentive Pool Allocation Model Based on Asymmetric Nash Negotiation Model

1) Principle of asymmetric Nash negotiation model: The last section mainly introduced the method to determine the size of the incentive pool of the financial management teaching innovation team. After having an incentive pool of appropriate size, the project participants implemented and completed the entire financial management teaching innovation team project according to their scope of rights and responsibilities and achieved the expected results. However, the rational allocation of funds in the incentive pool will enable all parties to have sufficient motivation to work hard to achieve the project objectives without being jealous because of the excessive distribution of other parties [20], which is the main consideration of the members of the financial management teaching innovation team after the completion of the project implementation. This paper then proposes a mathematical model of an incentive pool allocation system based on the asymmetric Nash negotiation model, which is based on the risk preference and risk decision-making weight of the financial management, teaching innovation team members in the project implementation process to solve this problem quantitatively. The Nash negotiation model is a mathematical model for finding a Nash equilibrium solution. This equilibrium solution makes the strategy adopted by each player to other players optimal. The equilibrium solution was put forward and improved by Nash during his PhD study (1950, 1951). Before that, there was only a cooperative game in the simple game theory, and the game hypothesis that all parties in the game participated in cooperation made the game theory not develop rapidly. With Nash putting forward the concept of a non-cooperative game and providing a method to find an equilibrium solution that can satisfy all parties, the non-cooperative game problem that can have more extensive application space has been developed and improved in the long run. In the research process in recent years, with the deepening of the research on Nash negotiation theory, there are two game forms, symmetrical game and asymmetric game [21], and different optimal strategy sets can be obtained according to the Nash negotiation model. The mathematical expression of the asymmetric Nash negotiation model is shown in equation (12):

$$C=\max U\prod_{i\in n}\left[x_i\omega_i-g_i\omega_i\right] \tag{12}$$

In equation (12); $n=1,2,\cdots$ refers to the participants in the negotiation; x_i represents the result of the negotiation, and g_i represents the starting point of the negotiation; ω_i is the weight coefficient of negotiator i.

Set the constraints of the asymmetric Nash negotiation model, as shown in equation (13):

$$s.t.\begin{cases} x_i\geq g_i \\ x_i\in\Omega \\ \sum_{i=1}^{n}\omega_i=1 \end{cases} \tag{13}$$

In equation (13), Ω represents the project negotiation domain.

2) Construction of incentive pool's allocation objective function of financial management teaching innovation team: Based on the above asymmetric Nash negotiation principle, the objective function of incentive pool allocation for financial management teaching innovation teams is established. When the financial management teaching innovation team members participate in the project, each member's position is different, and the role of undertaking the project and the number of resources is different. It should be more suitable for the asymmetric Nash negotiation model [22]. The Nash equilibrium solution obtained with the goal of maximizing each member and taking the project's own conditions as constraints is the most reasonable allocation proportion of the incentive pool of the financial management teaching innovation team. The objective function of incentive pool allocation for the financial management teaching innovation team is shown in equation (14):

$$D=\max C\prod_{k\in n}\left[c_k\omega_k-g_k\omega_k\right] \tag{14}$$

In equation (14), c_k represents the utility value of each member considering risk sharing; g_k refers to the utility value when no agreement is reached, and the difference between the first two items is the increase in the interests of each participant minus the risk cost; ω_k refers to the decision-making weight of the project participants in the risk sharing process.

3) Calculation of constraint conditions of incentive pool allocation objective function

a) Calculation of individual utility and group utility: According to the assumption of individual utility, this paper assumes that the members of the financial management teaching innovation team are in line with the mean-variance expected utility function [23]; that is, their individual utility function can be expressed as equation (15):

$$c_k=E(x_k)-0.5H_k\sigma^2(x_k) \tag{15}$$

In equation (15), $E(x_k)$ represents the utility expectation of each participant, $\sigma(x_k)$ is the utility variance value of each participant, H_k represents the absolute risk aversion coefficient of each participant.

ζ_k represents the distribution proportion of the financial management teaching innovation team members in the incentive pool. The group utility of the members of the financial management teaching innovation team can be expressed as equation (16):

$$\sum_{k=1}^{n}c_k=E(x_X)-(0.5\sum_{k=1}^{n}H_k\zeta_k^2)\sigma^2(x_X) \tag{16}$$

In equation (16), $E(x_X)$ represents the utility expectation of the financial management teaching innovation team; $\sigma(x_X)$ represents the utility variance of the financial management teaching innovation team.

b) Absolute risk aversion coefficient setting: The concept of the risk aversion coefficient [24] was first developed in finance, investment and other fields. When the risk aversion coefficient is greater than 0, it indicates that the evaluated person is risk averse; that is to say, the existence of risk does not affect their decision-making. When the risk aversion coefficient is greater, the evaluated person's risk aversion degree is also higher; when the risk aversion coefficient is 0, the evaluated people are said to be risk-neutral. They do not care about the variance of the utility they can achieve but only about the expected utility they can achieve. Such people are theoretical model people that do not exist in reality; when the risk aversion coefficient is less than 0, the assessed can be defined as risk preference. The smaller the risk aversion coefficient is, the more risk they chase. For the financial management teaching innovation team, the different positions of the members in the project, the different workloads they undertake, and the different levels of development of their enterprises lead to different ways of evaluating their risk aversion. This paper adopts the definition standard of risk aversion coefficient in the US investment and wealth management industry. The value is between 2 and 6; that is, the greater the value of H_k is, the more risk-averse the financial management teaching innovation team is, and the smaller the value of H_k is, the more risk-averse the financial management teaching innovation team is.

4) Incentive pool allocation decision model for financial management teaching innovation team based on data mining: According to the objective function and constraint conditions of the incentive pool allocation of the financial management teaching innovation team, the incentive pool allocation decision model of the financial management teaching innovation team is constructed, as shown in equation (17):

$$T = \max c_k \prod_{k=1}^{n} \left[DE(x_X)\omega_k - 0.5\sum_{k=1}^{n} H_k \zeta_k^2)\sigma\left(x_X\right)\omega_k \right] \tag{17}$$

The constraint conditions for solving the incentive pool allocation decision model of the financial management teaching innovation team are equation (18):

$$s.t.\begin{cases} x_X = \sum_{k=1}^{n} x_k \\ \sum_{k=1}^{n} \zeta_k = 1 \end{cases} \tag{18}$$

According to the constraints of equation (18), the improved artificial swarm algorithm of data mining algorithm is used to solve the incentive pool allocation decision model of the financial management teaching innovation team, that is, the numerical value of ζ_k, as a reasonable incentive pool allocation proportion, which can ensure that the members of financial management teaching innovation team can reach the Nash equilibrium solution when the project is completed.

The artificial bee colony algorithm is a bionic intelligent optimization algorithm that simulates bees searching for honey sources in space. The algorithm has fewer control parameters in the calculation process and good global convergence. The detailed steps of the incentive pool allocation decision model of the financial management teaching innovation team based on the improved artificial bee colony algorithm are as follows:

Step 1: Use equation (17) to get the solution of the incentive pool allocation decision model of all financial management teaching innovation teams, and then import it into the artificial bee colony algorithm.

Step 2: After setting the colony boundary conditions, use the incentive pool allocation decision model of the financial management teaching innovation team a_k to generate the initial colony N_p, then the position value y_{ij} of the i-th solution in the colony in the j-th dimension is as shown in equation (19):

$$y_{ij} = Ty_{j\min} + \psi y_{j\max} - \psi y_{j\min} \tag{19}$$

In equation (19), i represents the bees in N_p, that is, the solution of the incentive pool allocation decision model of the financial management teaching innovation team; $j = 1, 2, \cdots, D$ represents the dimension of the solution, D represents the total dimension, $y_{j\max}$ and $y_{j\min}$ represent the maximum and minimum fitness values of the j-th dimension respectively; ψ is a random constant.

Step 3: After calculating the position value of the solution of the incentive pool allocation decision model of all the financial management teaching innovation teams by using equation (19), sort the solution according to the size of the value, and select the solution of the incentive pool allocation decision model of the financial management teaching innovation teams corresponding to the first $\frac{N_p}{2}$ fitness as the employment bee of the bee colony. Take the hired bee as a discrete random variable and calculate its entropy, as shown in equation (20):

$$R(fit) = -y_{ij}\sum_{i=1}^{n} o_i \ln o_i \tag{20}$$

In equation (20), $R(fit)$ represents the employment bee entropy, o_i represents the probability of occurrence of the state.

According to the result of equation (20), the artificial bee colony is allowed to select the honey source following bee proportion $\dot{\alpha}$ and the optimal honey source selection probability $\dot{\beta}$ within an appropriate range, as shown in equation (21):

$$\begin{cases} \dot{\alpha} = \dfrac{R(fit)_{\max}}{R(fit)_{\max}} - R \\ \dot{\beta} = 1 - \dfrac{R(fit)_{\max}}{2R(fit)_{\max}} - R \end{cases} \tag{21}$$

In equation (21), R represents the initial entropy of the colony; fit_i represents the limit value of swarm sway.

Step 4: hire bees to update the honey source location according to equation (21).

Step 5: After the honey source location of the hired bees is updated, calculate the probability of the current status of each hired bee. According to this probability value, the hired bees search for new honey sources in their neighboring areas and greedily choose while recording the solution at this time.

Step 6: Judge whether all the employed bees in the current artificial bee colony have been allocated. If not, terminate the solution process. If yes, proceed to the next step.

Step 7: Set the number of honey source location updates ϖ . When the number of honey source location updates is lower than the time ϖ , a new honey source will be randomly generated.

Step 8: Record the optimal solution generated by the current artificial bee colony algorithm, and set the maximum iterative threshold u of the artificial bee colony algorithm. When the number of iterations reaches the maximum threshold, stop the iteration and output the current optimal solution. Otherwise, continue the iteration.

After the above steps, the artificial bee colony algorithm transmits the optimal solution of the financial management teaching innovation team's incentive pool allocation decision model. It obtains the incentive pool allocation result of the financial management teaching innovation team.

III. Experimental Analysis

Taking the financial management teaching innovation team as the experimental object, the financial management teaching innovation team is composed of 11 teachers who have innovative teaching concepts, are aggressive, are determined to reform, and are good at cooperation. The team members are from Nankai University, Shanghai University of Finance and Economics, Xi'an Jiaotong University, Jilin University, Chinese Academy of Social Sciences and other well-known universities. The professional title structure, educational background structure, age structure and academic background structure of the teaching team are reasonable. It is a high-level, highly educated, old, middle and young teachers' team with an optimized structure. The team has played an effective role in planning, organizing and coordinating the company's project promotion. It has effectively improved the company's project revenue by using the experience and wisdom of team scholars. The teaching hours and incentive amount of the 11 financial management teaching innovation team members participating in the company's projects are shown in Table II.

This article mainly adopts three methods: asymmetric Nash negotiation, data mining, and artificial bee colony algorithm when implementing dynamic allocation of incentive pools for financial management teaching innovation teams based on data mining. To ensure the effectiveness of the experiment, set the parameters of the corresponding algorithm:

- Asymmetric Nash negotiation:

Initial strategy setting: The initial strategy for each team member is [0.2, 0.3, 0.5], indicating the proportion they expect to be allocated to the incentive pool.

Objective function setting: The objective function is to maximize the average incentive value.

Game theory parameter setting: the number of participants is 3, and the strategy space is [0, 1].

- Data mining:

Dataset selection: Use a financial management teaching innovation team dataset that includes data on member contributions and performance.

Feature selection: select the performance indicators of members and participation in teaching innovation activities as the characteristics for analysis.

- Artificial bee colony algorithm:

Bee quantity setting: Set 10 bees to search for incentive pool allocation schemes.

Parameter settings: foraging distance is 2, memory factor is 0.8, and local search range is 0.2.

A. Generalization Performance Test of Incentive Pool Decision Model

The subjects' working characteristic curve, also known as the ROC curve, is one indicator describing a model's generalization ability. A model's generalization ability is good, indicating that the model has a strong calculation ability. The generalization ability of the financial management teaching innovation team and historical decision-making model built by the method of this paper is verified in the form of a ROC curve. The test results are shown in Fig. 2.

TABLE II. Teaching Hours and Incentive Amount of Financial Management Teaching Innovation Team Members

Team member code	Teaching hours	Follow up the teaching content of the project	Expected incentive amount/10000 Yuan
1	109	Financial management	4.6
2	128	Enterprise Finance Theory	5
3	156	Cost control	10
4	98	Strategic cost management	8.5
5	69	Financial analysis	5
6	70	Financial decisions	6.5
7	90	Tax administration	9
8	115	Assets and liabilities	6.5
9	137	Profit management	4.5
10	164	Profit and loss assessment	7.8
11	103	Owner's equity	6.2

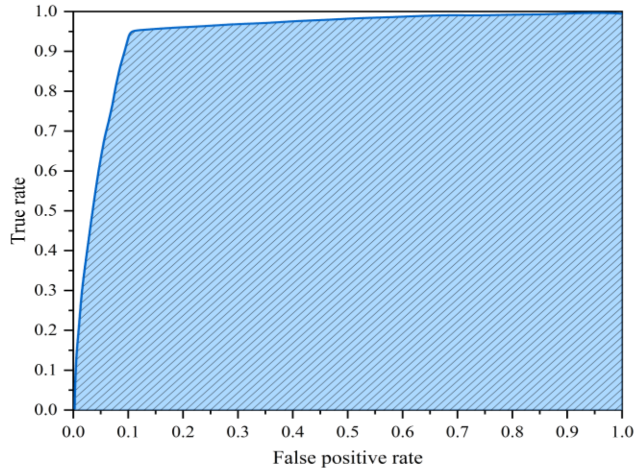

Fig. 2. Financial management teaching innovation team and historical decision-making model generalization ability.

The analysis of Fig. 2 shows that the real rate value of the ROC curve of the model in this paper can reach more than 0.96, and the maximum value of the false positive rate value is only about 0.1. In contrast, the coverage area under the ROC curve is large. The above results show that the model in this paper can effectively adapt to new measured samples in the application process, with strong adaptability, good generalization ability, and more accurate output results.

B. Ability to Build Incentive Pool Allocation Index System

The reliability and validity of the incentive pool allocation indicator system selected are taken as the measurement index to analyze the reliability and validity of the different influencing factors of the incentive pool allocation of the financial management teaching innovation team and verify the ability of the method of this paper to select the incentive pool allocation indicator system of the financial management teaching innovation team. The test results are shown in Fig. 3.

According to the analysis of Fig. 3, the reliability and validity values of different influencing factors of the incentive pool allocation of the financial management teaching innovation team are 0.94, which shows that the incentive pool allocation indicator system of the financial management teaching innovation team constructed by the method in this paper is good. The incentive pool can be reasonably allocated according to this indicator system.

C. Calculation of Incentive Pool Size of Financial Management Teaching Innovation Team

After the financial management teaching innovation team is responsible for the company's project profitability, it generates its incentive pool. It uses the method in this paper to calculate the scale of the incentive pool during the project promotion cycle. The calculation results are shown in Fig. 4.

It can be seen from the analysis of Fig. 4 that with the increase of the project cycle, the incentive pool of the financial management teaching innovation team has gradually increased, but in the process of increasing, the scale of the incentive pool has also decreased, because when the enterprise project is promoted, its internal capital liquidity is strong. There is a situation of a loan of profit funds in the project cycle. However, as the project continues to advance, the scale of the incentive pool of the financial management teaching innovation team continues to increase, which indicates that the project is profitable. The incentive amount that can be allocated to the financial management teaching innovation team members continues to increase. To sum up, the method in this paper can effectively calculate the size of the incentive pool of the financial management teaching innovation team and provide a basis for the subsequent allocation of the incentive pool.

D. Incentive Pool Allocation Results

When the enterprise project is completed, the incentive pool of the financial management teaching innovation team is allocated, and the allocation results are shown in Fig. 5.

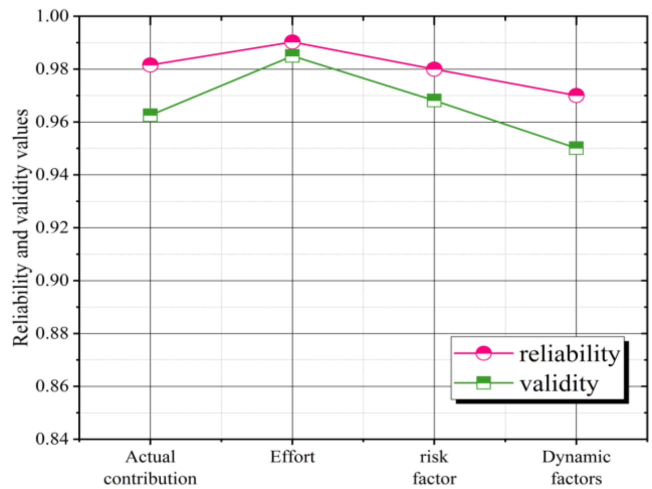

Fig. 3. Reliability and validity of incentive pool allocation indicator system.

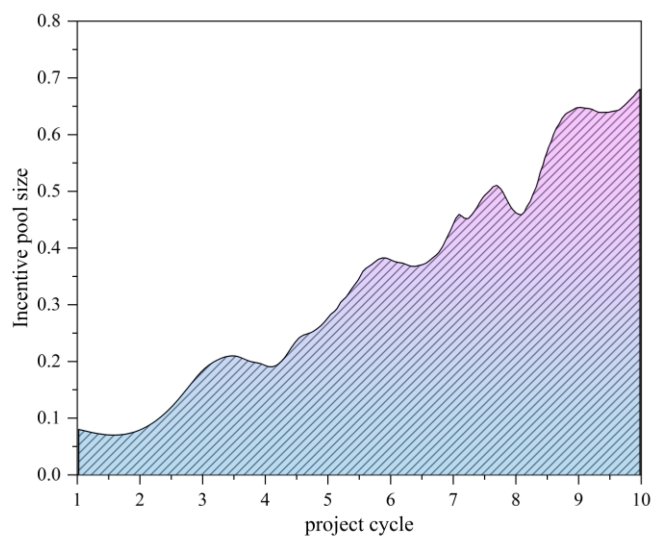

Fig. 4. Calculation results of incentive pool size under different project cycles.

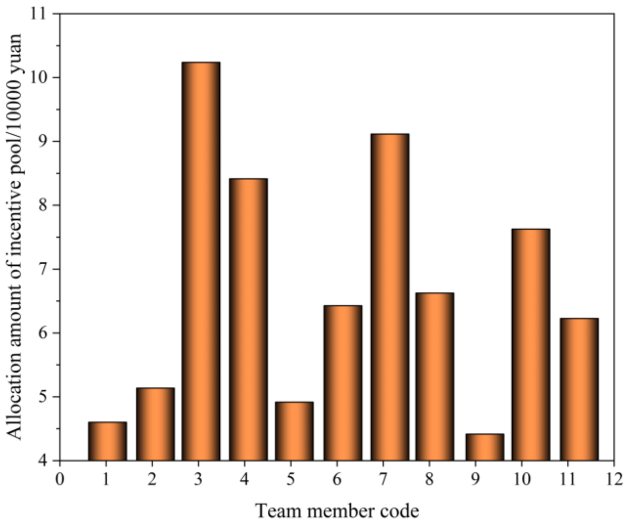

Fig. 5. Distribution results of incentive pool of financial management teaching innovation team.

It can be seen from the analysis of Fig. 5 that using the method in this paper can effectively allocate the incentive pool amount of the financial management teaching innovation team, and compared with the incentive amount of the team members in Table II, the allocation results meet the expected amount of the team members. Some team members allocate the incentive amount higher than their expected amount. The above results show that this method can effectively allocate the incentive pool of the financial management teaching innovation team. Its allocation result is more consistent with the team members and their results, with good application effect.

To further verify the allocation ability of the method in this paper to the incentive pool of the financial management teaching innovation team, it takes the satisfaction of the members of the financial management teaching innovation team with the allocation result of the incentive pool as a measure, to test the ability to allocate the amount of the incentive pool when the number of incentive pools is different. In order to make full use of the experimental results, the methods of reference [7], reference [8], reference [25], reference [9], and reference [10] are used to carry out the test. The test results are shown in Fig. 6.

It can be seen from the analysis of Fig. 6 that when the number of incentive pools allocated by the method in this paper is different, the satisfaction of the members of the financial management teaching innovation team with the allocation of incentive pools has always fluctuated around 96%, which shows that the results of the allocation of incentive pools are in line with the expected values of the members of the financial management teaching innovation team. When allocating incentive pools according to the method of reference [8], when the number of incentive pools is small, the satisfaction of team members with the allocation results is high. Still, when the number of incentive pools is large, the satisfaction of team members with the allocation results shows a downward trend. The satisfaction value of team members is lower than that of the method in researches [7], [25], [9] and [10] when allocating different rate incentive pools. The above results show that the method of this paper can not only effectively allocate an incentive pool, but also team members are satisfied with the allocation results of the incentive pool, and its application effect is good.

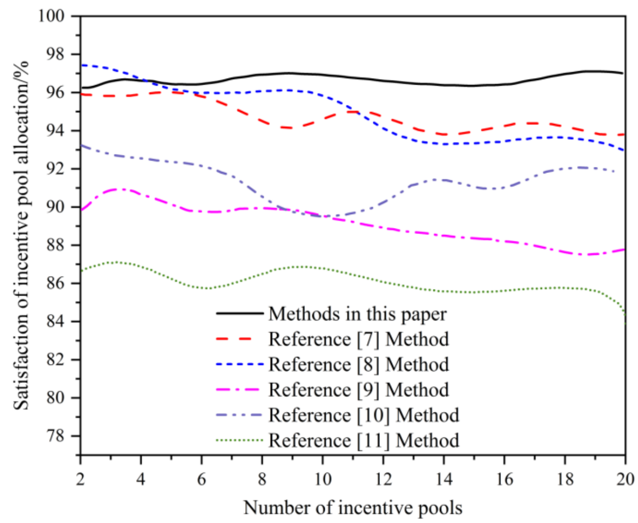

Fig. 6. Test results of satisfaction with the allocation of incentive pool of financial management teaching innovation team.

IV. Conclusion

When the amount of incentive pool is distributed unevenly, it will seriously affect team unity and lead to the poor effect of the team following up on the enterprise project. Therefore, this paper proposes a dynamic allocation method of incentive pool for financial management teaching innovation teams based on data mining. Taking the actual enterprise project and financial management teaching innovation team as the experimental object, the method in this paper has been fully verified. The verification results show that the method in this paper has a relatively significant application effect. However, the method in this paper still has some shortcomings. For example, it is difficult to determine the amount of funds in the incentive pool in the early stage of the project promotion. There are many unpredictable factors in the project promotion process. The calculation of the size of the incentive pool is usually carried out in the late stage of the project promotion. However, the calculation results of the method in this paper calculate the size of the incentive pool in each project cycle, and there is a certain deviation. Although the method of dynamically allocating incentive pools was proposed in the study, it may face some challenges in practical applications. For example, factors such as resource constraints, organizational structure, and culture may affect the actual allocation and execution of incentive pools. Therefore, when applying research results to practice, it is necessary to consider these practical feasibility issues. In the future, in the process of applying the cumulative prospect theory, according to the actual implementation of the project and the risks and changes that may be encountered, the risk prospect with more dimensions and different probability of occurrence will be set. When applying the cumulative prospect theory model, the risk prospect of the project can be judged from different angles, and the more suitable incentive pool size can be solved.

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