Decision Tree-Based Human Resources Forecasting and Enterprise Project Management COVID-19 Impact and Enterprise Response

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Abstract: Under the impact of the COVID-19 epidemic, it has had an enormous impact on Chinese high-tech enterprises. Based on the practical application of SIASUN's project management and human resources, this paper discusses a series of solutions by studying the current situation of SIASUN's project management system and the problems existing in the actual needs of employees. Scientific project management and human resource concept will promote the project's development. This paper expounds on project management and human resources universality and timeliness. To achieve technological innovation of project management and human resources, production capacity innovation, and management system innovation to improve the core competitiveness of enterprises in the large national market environment. Finally, under the impact of COVID-19, this paper expounds on some problems of project management and human resources in high-tech enterprises. This paper analyses the problems of project management and human resources and gives a systematic solution. The decision tree model is used to predict employee turnover and ensure the smooth progress of the project. Enterprises need to complete more projects in a limited time, ensure the success rate of projects and the effective use of resources, reduce production costs, and significantly improve sales and market share.

Keywords: Project Management, Decision Tree, Human Resources, High-Tech Enterprises.

1 INTRODUCTION

With the development of the economy and the change in environment, the increasingly fierce global competition, the increasing diversity and uncertainty of product types, and user needs, the competition between enterprises has gradually turned into the competition between project management and human resources [4, 8]. Under the impact of COVID-19, the traditional project management and human resources problems increasingly exposed their inherent two defects: first, the project management and human resources problems needed to be more comprehensive, simple, and less advanced technologies and methods were used [1] Not only did the cost of project management and human resources remain high, but also the slow progress of the project led to project failure. Second, project management and human resource management are

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independent, which increases the overall management cost of the project and human resource management and reduces its overall competitive advantage. Therefore, management and human resource issues are essential to meet enterprises' needs, safeguard enterprises' interests, and constantly improve project management's safety for management control in all aspects of the project.

Under the impact of the COVID-19 epidemic, the international situation is grim [9]. Although various countries are opening up one after another, the epidemic's effect continues [2, 6, 10]. Some enterprises, in some aspects of the operation of the thought, only stay in the project, and human resource management, on the surface of understanding, can only be from a few elements, profound multi-level management knowledge. How to combine human resource management and project management organically has become the main problem to be solved in project design and human resource management. From the perspective of an enterprise, the employee turnover rate is an issue that must be paid attention to by the enterprise. Various factors affect employee turnover (salary, travel, work environment satisfaction, work engagement, overtime, promotion, salary increase ratio, etc.) and the corresponding records of whether an employee has resigned. This paper will establish a decision tree model to predict the employee's likelihood to leave from the factors that affect employee resignation and whether or not the employee resigns to increase the project success rate. Each sample has a set of attributes and a classification result. That is, the classification result is known. The decision tree can obtain by learning these samples, giving the correct classification and regression for the new data.

2 PROJECT MANAGEMENT THEORY

As a unique feature of R&D projects, project management has a crucial impact on human resource management [3]. In a project-oriented organization, management support plays a leading role [7]. In project management, the project usually needs to improve at taking care of employees because of the project's progress. The demand for profits and the response to customer needs often precede employee benefits. Employees in the project often direct feedback on the project's negative impact because their wages and benefits cannot be satisfied. The pressure of the project directly affects employees, and employees' expectations cannot be met, which also affects the project. Human resource management uses salary dispersion, training, career promotion, and communication to regulate the interaction of organizational management.

2.1 Universality and Clarity

The project and human resource management links include purchase, production, material management, marketing, logistics customer demand, capital flow, information flow, inventory cost, employee recruitment, and employee training [5]. Figure 1 shows the main management elements of the project management life cycle. For a long time, the study of project management was mainly carried out at the general academic research level rather than guiding the practice of enterprises. Project and human resource management in high-tech enterprises have universality and clarity. The concept of project management is: comprehensively and effectively manage information flow, capital flow, and logistics, including planning, coordination, organization, and control.

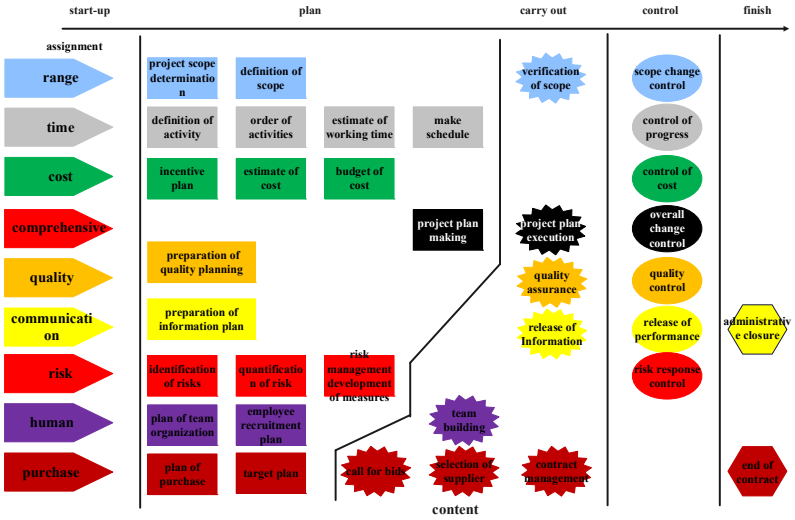

Figure 1: Main management elements of the project management lifecycle.

The control of the project management system involved in the project and human resource management theory aims to enable enterprises to achieve customer products and optimize the control of existing processes. Among them, optimizing the total cost is particularly important because the cost is the essential element for an enterprise to survive. The project and human resource management theories not only emphasize the concept and methods of the comprehensive management model but also organically combine all aspects of the project and human resource management, which can achieve the highest efficiency of project management. Enterprises must find the correct positioning. If an enterprise does the project behind closed doors, it is difficult to cover all aspects of the project, eventually leading to project delay or even project failure. Because of this, project and human resource management teach managers to integrate resources and monitor projects using rational and scientific management methods.

2.2 Timeliness and Rigor

High-tech enterprises use advanced project and human resource management theory to organize their enterprises. In the whole enterprise management process, timeliness and rigor are very important for the decision-makers and managers of enterprises. The traditional management mode has many shortcomings, such as poor confidentiality, low efficiency, and high cost. A long time will produce a large number of documents and data, which has brought many difficulties to the project's implementation and maintenance. Because of this, high-tech enterprises must establish a complete project and human resources management system. This paper focuses on the design and implementation of Siasun's project and human resource management.

Because of the timeliness and rigor of project management, high-tech enterprises in many industries and regions have been widely recognized and developed. For any project task in the process of execution, there are specific start and end times. Therefore, the implementation goal and time have been made clear before the project implementation. Resource sharing in the

information age has been popularized and widely implemented in high-tech enterprises. In order to ensure the accuracy and rigor of project and human resource management information, the effective implementation of information resource sharing in each link to achieve timely, accurate, and comprehensive protection of project and human resource management information.

3 DECISION TREE BASED HUMAN RESOURCES FORECASTING

The factors influencing the prediction of human resource demand are as follows: (1) the enterprise's production and operation tasks and its demand for human resources in a certain period in the future. (2) The expected employee turnover rate and job vacancy size. (3) The influence of the improvement of production technology and the change of organizational management mode on demand for human resources. (4) The influence of an enterprise's decision to improve product or service quality or enter a new market on human resource demand. (5) Constraints of enterprise's financial resources on human resource demand. This paper studies the decision tree training and testing of expected employee turnover.

3.1 An Overview of Human Resource Demand Forecasting

In order to ensure the smooth progress of the project, it is necessary to forecast employee turnover. The corresponding record of whether an employee has resigned is used to improve the data. The data set is divided into training sets and test sets. Training stage: Construct a tree from a training set (special features from the heel node and how to carry out feature segmentation). Test stage: Walk from top to bottom according to the constructed tree model. Once the decision tree is constructed, the task of classification or prediction is effortless and only needs to walk once. Then the difficulty lies in how to construct a tree. Therefore, the generation of a decision tree mainly consists of the following two steps: 1. Node splitting: Generally, when the attributes represented by a node cannot be judged, the node will be divided into two child nodes (if it is not a binary tree, it will be divided into n child nodes). The permutation candidate threshold conditions are compared, and the candidate condition with the lowest entropy is selected as the parent node for tree generation; 2. Threshold determination: Select an appropriate threshold to minimize the classification error rate. In order to ensure the smooth progress of the project, it is necessary to forecast employee turnover. The corresponding record of whether an employee has resigned is used to improve the data. The data set is divided into training sets and test sets. If the decision tree depends on the mathematical calculation method, it can achieve more ideal results. The mathematical expression is as follows:

$$(x, y) = (x_1, x_2, x_3 \dots, x_k, y) \tag{1}$$

The relevant variable y indicates that we are trying to understand, classify, or more general results. Other variables, $x_1, x_2, x_3 \dots, x_k$, etc., help us achieve our goals.

3.2 Decision Tree Training and Testing

1. Information entropy:

The classification standard used by ID3 is information gain($Entropy$), which represents the degree to which the uncertainty of the sample set is reduced when the information of feature A is known. Information entropy of data set:

$$Entropy = H(D) = -sum[p(x_i) * log_2(P(x_i)] = -\sum_{k=1}^{K} \frac{|C_k|}{|D|} \log_2 \frac{|C_k|}{|D|} \tag{2}$$

Where C_k refers to the subset of samples belonging to class k in set D. Therefore, when the information entropy is at its maximum of 1, the classification effect is the worst; when the information entropy is at its minimum of 0, it is the state of complete classification. Because entropy equals zero is the ideal state, and in practice, entropy is between zero and one. For a feature A, the conditional entropy $H(D \mid A)$ of dataset D is:

$$\begin{aligned} H(D \mid A) &= \sum_{i=1}^{n} \frac{|D_i|}{|D|} H(D_i) \\ &= -\sum_{i=1}^{n} \frac{|D_i|}{|D|} \left(\sum_{k=1}^{K} \frac{|D_{ik}|}{|D_i|} log_2 \frac{|D_{ik}|}{|D_i|} \right) \end{aligned} \tag{3}$$

Where D_i represents the sample subset of the i-th value of feature A in D, D_{ik} stands for D_i and is a subset of samples belonging to class k.

2. Information gain:

Information gain=information entropy - conditional entropy:

$$Gain\ (D, A) = H(D) - H(D \mid A) \tag{4}$$

The greater the information gain is, the more significant the purity improvement obtained by using feature A to divide. The classification of training data can reach 0 error rate, but because the new data is different from the training data, the error rate increases in the face of the new data. The decision tree is to obtain the statistical information of the data by analyzing the training data rather than being tailored to the training data.

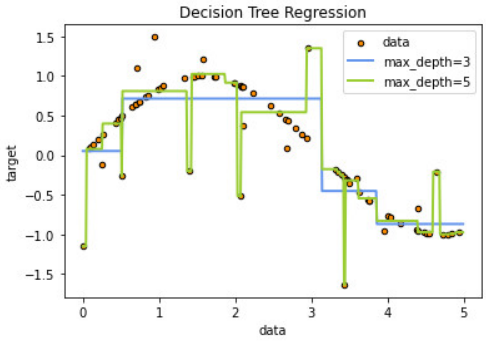

Figure 2: Decision tree prediction.

Therefore, in order to avoid too fine segmentation, C4.5 improves ID3. In C4.5, the optimization term should be divided by the cost of too-fine segmentation, called the information gain rate. If the segmentation is too fine, the information gain rate will decrease. Other than that, the principles are the same as ID3. Figure 2 shows that the turnover rate of frequent business trips is the highest, and the number of research departments accounts for the most significant proportion. However, the turnover of personnel in the sales department is higher, and the turnover rate is higher. The turnover rate of men and single employees is relatively high. Respect for employees is the most fundamental principle if enterprises want to retain talent.

4 PROJECT AND HUMAN RESOURCE MANAGEMENT ISSUES

4.1 Problem of Technical Requirements

For the enterprise, there will be mistakes if there are many projects, and everyone will focus on the project differently. Only by discovering the actual needs behind the project can we take timely actions before problems occur and significantly increase the efficiency of successful development. For high-tech enterprises, there are very few experienced and skilled people, so it is impossible to have such people in every link. The project management of high-tech enterprises often involves many complex and diverse technologies. In the past, it took much work for technical developers to refine the project's technical unit, summarize the technical content required by each part, draw a flow chart and arrange it for the designated personnel. Generally speaking, technical personnel will analyze where they want to go, and the project will be stalled when they encounter technical problems.

4.2 Problem of Team Structure

Under the impact of COVID-19, it is necessary to conduct a comprehensive analysis of enterprise projects and human resource management to realize the construction of efficient production system management. Typically, inexperienced project managers go by the seat of their pants when given a project assignment. Team structure refers to the composition of team members, which is the basis of team cooperation and plays an essential role in the success of projects. The project team members may come from different departments, so they must return to the original department after the project. This means the team needs more tacit understanding and needs to be reconciled as soon as possible. However, as the project progresses, new members may be added to the project, and the project's structure should be adjusted slightly, which often makes it difficult for the project executive to integrate the team structure.

4.3 Problem of Tasks Division

Under the impact of COVID-19, project management and human resources of enterprises are more prominent. Scientific project management concepts will promote the project's development, but if there are mechanical implementation and severe compliance problems in the process of project management. Employees do not express their expectations during project development because many people need to understand their abilities. Therefore, it is difficult in project development to assign tasks according to workability, give play to personal strengths, and implement responsibilities to everyone. Task allocation is more challenging to balance and

care about the ideas of project members, etc. In the whole process, project and human resource management generally use scientific management mode to make project executives more aligned with the process. Not only can it provide a complete product research and development process, but it also can provide a basis for purchasing, production, and sales. The goal of project management is success, and successful goals need to meet three criteria: business goals, cost, and schedule.

5 PROBLEM AVOIDANCE METHODS

5.1 Strengthen Risk and Quality Management

Due to the complexity of the project, the project risk resulted in many uncertain factors. The problem of project risk occurrence often has hidden risks and uncertainties because it is difficult to predict risks in all types of project links. However, preventive measures are often taken in a typical project risk control, which requires an enterprise's technology accumulation. Only good technology accumulation and problem-solving mechanisms can be more effective in prevention. Therefore, to achieve the work goal, it is necessary to divide the specific tasks so that the tasks can be carried out in parallel. By clarifying the tasks, we can determine the project team and make a good division of labor. Project risk management is a comprehensive risk management project. The goals and tasks of projects are often fuzzy boundary conditions in the development of robotics projects, often to change the specific Customer needs to adjust the program.

Based on ensuring the interests of enterprises, the higher the quality, the stronger the competitive advantage, the better the reputation, and ultimately improve the visibility and influence of enterprises. Quality management research is a solid guarantee for production projects to enter the market. Under the requirement of quality management, delivering deliverables and evaluating the quality of activities are not conducive to improving the quality of engineering projects but also to implementing remedial work plan deficiencies. Under the premise of closed-loop control and process control, the overall quality can be guaranteed. The implementation of monitoring management can significantly improve the quality and enhance the competitive advantage of enterprises in the market.

5.2 Incentive Management of Human Resource

For project members to carry out the project with passion and not dull, a fundamental premise is to trust the project members fully. In real life, the project manager often likes to ask questions and ask the project members to explain the project's progress to him, which will cause the employees to be deeply distrusted. Project members need to be recognized, and they should also be given some practical rewards. The results in Figure 3 show that the higher the satisfaction with the job reward provided, the higher the job satisfaction. In addition, when project managers were more satisfied with their company's work rewards, they also had higher satisfaction with their company's HRM practices. The more satisfied managers were with their job rewards, promotion opportunities, benefits packages, and total compensation packages, the higher their job satisfaction. This indicates a significant correlation between project managers' satisfaction with their company's HRM practices and their overall job satisfaction.

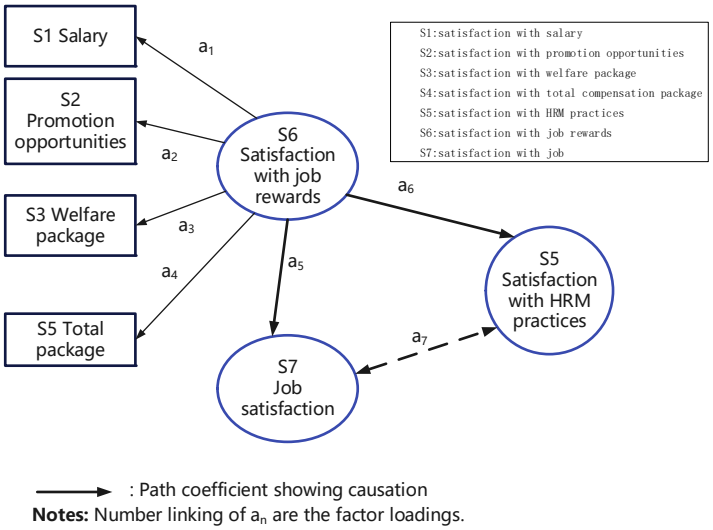

Figure 3: Relationship between satisfaction with the job,rewards and HRM practices.

Enterprises put more energy and money into the talent training and management of high-tech enterprises. The paper puts forward higher requirements for high-tech enterprises to achieve their ultimate goals. In project management, the project manager should not only motivate the project members positively but also take some harmful incentive methods to exert a little work pressure on the project members. Many successful managers are good at using this psychology of their subordinates. The potential of employees is also realized in this way.

5.3 Project control and Closure

The famous milestone plan is the classic clever method of project control. This is a goal, which is a set of activities to achieve the project goals. Assign tasks, organize team, and determine project objectives and scope. Make and review project plans, track, supervise and control the project according to the Project Plan, and ensure the smooth implementation and completion of the project according to the plan. Milestone planning aims to control the project's progress and ensure the achievement of the overall goal by establishing milestones and verifying the achievement of each milestone.

At the end of the project, the project manager should identify the success indicators of the project from multiple perspectives and self-determine whether the project is successful or not. Generally speaking, project management will consider the problem from multiple perspectives in the end stage: finance, time, quality, human resources, environment, project planning, project control, and other aspects to measure the completion of the project. Although different people have their standards for the results of the project, in the final analysis, we can be summarized as follows: (1) to achieve the project expectations; (2) to evaluate the effectiveness of the project; (3) to customer's evaluation of the use effect.

6 CONCLUSION AND PROSPECT

Under the impact of COVID-19, project and human resource management are to effectively manage the whole project process and human resource management using systematic theories and methods. Because the projects of high-tech enterprises are characterized by uncertainty, uniqueness, and urgency, it is necessary to have advanced management software and management means when managing projects and human resources. Based on the project and human resource management problems involved in the technology development process of SIASUN Company, this paper starts with the current situation, existing problems, and actual needs of management. This paper analyzes the current situation and some problems of high-tech enterprises' projects and human resource management. It can make the project more efficient based on strengthening risk management, quality management, human resource incentive, project management control, building an advanced platform, human resource early warning, strategic resource allocation, and scientific management technology. The decision tree model is used to predict employee turnover and ensure the smooth progress of the project. It is challenging to find a perfect solution to a real problem. It is of great significance to improve the speed and reasonable development of the project and human resource management for the operation efficiency of enterprises.

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