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Application of artificial intelligence in enterprise human resource management and employee performance evaluation

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Abstract: With the rapid development of Artificial Intelligence (AI) technology, significant breakthroughs have been made in its application in many fields. Especially, in the field of enterprise human resource management and employee performance evaluation, AI has demonstrated its powerful ability to optimise and improve performance. This study explores the application of AI in enterprise human resource management and how to use AI to evaluate employee performance. The research includes analysing and comparing existing AI-driven human resource management models, evaluating how AI can help improve employee performance and leadership styles, and designing and developing human resource management computer systems for enterprise employees. Through empirical research and case analysis, this study proposes a new AI-optimised employee performance evaluation model and explores its application and effect in practice. In general, the application of AI can improve the efficiency and accuracy of enterprise human resource management, and provide new possibilities for employee performance evaluation. At present, artificial intelligence technology has been widely used in various fields of daily life, especially in corporate human resource management, providing better support for the development of enterprises.

Keywords: artificial intelligence; enterprise human resource management; employee performance evaluation; AI-optimised human resource model.

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1 Introduction

With the rapid development of science and technology, Artificial Intelligence (AI) has become an important force driving innovation and economic development in the 21st century. The application of artificial intelligence has penetrated many industries and fields, including human resource management and employee performance evaluation. Through the elimination of prejudice, data aggregation, continuous monitoring, predictive insights, customisation of metrics and administrative work automation, Artificial Intelligence (AI) improves employee performance assessments. However, to preserve confidence and solve privacy and bias issues, ethical and open use is essential. Traditional human resource management and employee performance evaluation methods face many challenges when dealing with large-scale data and complex scenarios, and the application of artificial intelligence technology can effectively solve these problems. HR has undergone a revolution thanks to Artificial Intelligence (AI), which has improved talent acquisition, automated administrative processes, enabled data-driven decision-making, detected unconscious prejudice and helped with strategic workforce planning. In such an environment, human resource managers must look far, identify the real value of human resource management, strengthen their advantages over artificial intelligence and actively respond to the challenges brought by artificial intelligence.

Artificial intelligence is an important branch of computer science, that originated from Alan Turing's explorations, was officially born at the Dartmouth Institute in 1956 and is now ranked among the three most cutting-edge technologies in the world. In recent years, the application of artificial intelligence in enterprise management has become increasingly common. Data quality, privacy, security, cost limitations, talent shortages, change management, regulatory compliance, scalability, ethical concerns, ROI uncertainty and so on are just a few of the difficulties that come with implementing AI in enterprise management. Careful preparation and funding are necessary for successful implementation. From simple data

analysis and prediction to complex decision-making, artificial intelligence is playing an increasingly important role. The competition between enterprises is not only the competition of product quality but also the competition of management level. One of the most important is the competition in human resources because resource management has direct or indirect links with all departments of the enterprise. Especially in human resource management, artificial intelligence can help enterprises more effectively carry out tasks such as recruitment, employee training, benefit planning, and employee performance evaluation. The goal of Strategic Human Resource Management (SHRM) is to ensure that an organisation's staff is trained and motivated by integrating HR practices with its purpose and vision through talent acquisition, development, performance management, succession planning and legal compliance. For example, companies can use artificial intelligence technology for semantic analysis and sentiment analysis to more accurately understand the needs and emotional states of employees, and to develop a more rational human resources strategy. Employees must have a broad skill set, including digital literacy, flexibility, cultural competency and risk management, to be competitive and innovative in the face of the fast changes in the market and society. However, although the application of AI in human resource management and employee performance evaluation has achieved some results, it is still an area full of challenges and opportunities. First, current research has not yet fully revealed the full potential of AI applications in these fields, and many innovative application scenarios have yet to be developed and explored. Secondly, how to effectively integrate artificial intelligence into the existing human resource management and employee performance evaluation system, as well as how to deal with the resulting ethical and privacy issues, are important issues that current researchers need to face. Therefore, this study aims to explore and study the application of artificial intelligence in enterprise human resource management and employee performance evaluation, hoping to provide valuable theoretical and technical support for practice through scientific research methods.

With the rapid development of science and technology today, AI technology has been widely used in various fields, including the medical field and enterprise human resource management. In the medical field, AI has begun to play an important role in cancer research and precision medicine. For example, Bhinder et al. (2021) argued that AI can help scientists better understand and diagnose cancer, leading to personalised cancer treatments. Shimizu and Nakayama (2020) also pointed out that AI can provide new perspectives on oncology research and treatment. At the same time, AI technology has also played an important role in enterprise human resource management. As Jiaping (2022) pointed out, AI technology can be used to optimise corporate human resource management models. Similarly, Sun (2022) also proposed that human resource management in enterprises can be optimised through the use of machine learning techniques. Wang et al. (2021) used AI technology to design and develop a human resource management computer system for enterprise employees. Although the application of AI in these fields has achieved remarkable results, relatively little research has been done on the evaluation of employee performance and the leadership style of leaders. In the medical field, e.g., Souza et al. (2019) studied the performance of nurses in telemedicine. In the field of business management, Castillo et al. (2021) studied self-assessment and evaluation of leadership styles among nursing leaders. In addition, Ditzian et al. (2015) investigated how performance diagnostic checklists could be used to assess employee performance problems in centralised autism treatment facilities. To sum up, the application of artificial intelligence in the medical field and business management has achieved remarkable results. However, the research on employee performance evaluation and leadership style evaluation still needs to be further explored and deepened.

The objectives of this study mainly include the following aspects. First, this study aims to reveal the current situation and development trend of the application of artificial intelligence in enterprise human resource management and employee performance evaluation (Johansson and Herranen, 2019). Through in-depth research, this paper aims to provide a comprehensive view of existing applications in this area, including successful applications, existing problems and potential challenges. Secondly, this study plans to design and implement a questionnaire to understand the specific situation of the application of artificial intelligence in human resource management and employee performance evaluation, as well as the effects brought by artificial intelligence. Finally, based on the results of the survey, this study expects to build and verify an application model of artificial intelligence in enterprise human resource management and employee performance evaluation. The construction of this model will be based on the combination of theory and practice, hoping to provide a new and effective management and evaluation tool for enterprises.

The significance of this study lies in: first, academic significance. This study will broaden the application research of artificial intelligence in the field of enterprise management, and make important contributions to theoretical development and knowledge construction. The findings of this study may also provide a theoretical basis and empirical reference for future research in related fields. Second, practical significance. The empirical analysis and model construction provided by this study can provide enterprises with effective human resource management and employee performance evaluation tools, help enterprises improve efficiency, optimise resource allocation and promote business development. At the same time, for policymakers, the results of this study will also help them better understand the application of AI in business management, to formulate more effective policies and measures to promote its healthy development.

This research aims to explore the application of AI in enterprise human resource management and employee performance evaluation, covering the following main aspects: First, in-depth analysis of existing AI-driven human resource management models and applications, as well as related research on how AI improves employee performance and leadership style. Second, evaluate and compare the benefits of AI in all aspects of human resource management, including recruitment, employee development, benefits and performance

management. To locate people who suit the requirements and culture of the organisation, performance management helps to connect talent acquisition strategies with organisational goals by defining expectations, identifying skill gaps, providing feedback and directing data-driven decision-making. Further, we will conduct empirical research on the AI-optimised employee performance evaluation model and explore its application and effect in different types of enterprises. Finally, we will try to design and develop a human resource management computer system for enterprise employees, using AI technology to optimise its function and efficiency. Through the above research, we hope to deepen the understanding of the application of AI in enterprise human resource management and employee performance evaluation and improve the efficiency of enterprise human resource management and employee performance.

2 Development and application of artificial intelligence

2.1 Development history of artificial intelligence

The concept of artificial intelligence has been around since the 1950s, but it is only in recent decades, with the improvement of computer hardware capabilities and the advent of big data, that the development of artificial intelligence has entered a new phase.

The development of artificial intelligence can be roughly divided into four stages:

- *Stage 1, the initial phase (1950 to 1970s)*: During this period, AI research focused on rule-based systems, such as early expert systems. These systems are usually controlled by pre-set rules and procedures and have no real 'learning' ability (Seibert et al., 2021).
- *Stage 2, the machine Learning phase (1980 to 1990s)*: In this phase, researchers began to try to make machines learn from data, rather than relying solely on preset rules. This is also an important turning point in the history of artificial intelligence, marking the beginning of the development of artificial intelligence towards true autonomous learning and reasoning (Hashimoto et al., 2020).
- *Stage 3, Deep Learning (early 2000s to present)*: Deep learning is a type of machine learning that uses so-called neural network models to handle more complex tasks such as image and speech recognition. In 2012, breakthroughs in deep learning took artificial intelligence to a new level (Elemento et al., 2021; Noorbakhsh-Sabet et al., 2019).
- *Stage 4, strong artificial intelligence stage (future)*: Strong artificial intelligence refers to machines with human intelligence level, which is the ultimate goal of artificial intelligence development, but it has not yet been reached. The complexity of human intelligence, which includes cognitive skills like thinking, creativity and ethics, makes the aim of Artificial General Intelligence (AGI) difficult to achieve. It's an ambitious and unpredictable endeavour with challenges related to safety, control measures, constant learning, and contextual knowledge. Strong AI can not only perform complex computational tasks, but also understand and generate language, think creatively and even understand and express emotions (Niu et al., 2020; Hamamoto, 2021). Owing to the resource constraints, such as expensive expenses, a lack of technical experience, poor data quality, difficult integration processes and regulatory compliance, small businesses frequently have difficulty using AI. Businesses should look for low-cost solutions, enlist outside assistance, fund staff training and progressively adopt AI to get beyond these challenges.

The rapid development of artificial intelligence has led to its wide application in various industries, including autonomous driving, medical diagnosis, financial analysis and business management. Especially in the field of enterprise management, the application of artificial intelligence has developed from primary automated processing to advanced decision analysis and prediction and has continuously promoted the innovation of enterprise management models.

2.2 Application of artificial intelligence in enterprise management

In business management, the application of artificial intelligence is expanding at an unprecedented speed and scope (Keskinbora and Güven, 2020). In the two key areas of human resource management and employee performance evaluation, the application of artificial intelligence technology has great value for improving efficiency, improving accuracy, optimising decision-making and enhancing predictability. Through automation, data analysis, and predictive analytics, AI technology enhances efficiency, accuracy and decision-making while simplifying processes, allocating resources optimally and guaranteeing continuous monitoring.

In human resource management, artificial intelligence has been widely used in the following aspects:

- *First, recruitment and selection*: AI can be used to screen resumes, predict candidates' performance, and help conduct interviews. AI improves human resource management through customisation, global talent access, reduced bias, enhanced applicant matching and automated screening. For example, certain AI systems can automatically identify and recommend candidates most likely to succeed by learning from historical recruitment data.
- *Second, staff training and development*: AI can personalise the design and push of employees' learning content, helping them improve their skills more effectively. At the same time, AI can also predict the development trajectory of employees and provide support for talent echelon construction.

- *Third, employee welfare and satisfaction evaluation*: AI uses sentiment analysis, emotion detection, and natural language processing to examine behavioural data and employee feedback. It predicts patterns, provides tailored suggestions, keeps an eye on data sources, and guarantees compliance and privacy. By analysing employee feedback and behavioural data, AI can identify employee needs and satisfaction, helping companies optimise benefits policies and improve employee satisfaction.

Performance appraisal, as an important part of performance management, is a comprehensive assessment of the work performance of employees in the past period, according to the corresponding indicators, and based on the assessment results, guide the future performance. Although AI is having a transformational effect on all of these industries, it's crucial to remember that the way it is used will rely on the particular requirements and objectives of each one. Performance management's usage of AI is always changing, and as technology develops and businesses look into new avenues, so are the applications that AI may have. In terms of employee performance measurement, AI also shows great potential:

- *First, performance forecasting*: By learning from historical performance data, AI can predict the future performance of employees, providing a reference for performance management.
- *Second, performance evaluation*: While traditional performance evaluations often rely on subjective judgments, AI can help assess employee performance more fairly and accurately. For example, by analysing employees' work data, AI can objectively assess the quality and efficiency of their work. Conventional techniques for evaluating employee performance involve drawbacks such as subjectivity, time commitment, and data scarcity. To solve these problems and make sure that workers are recognised for their efforts in varied and multicultural settings, organisations are implementing flexible, data-driven and ongoing feedback techniques.
- *Third, performance feedback*: AI can also automatically generate performance feedback to help employees understand their strengths and points for improvement.

When introducing some talents, enterprises often hope to recruit some talents that match the enterprise goals, and performance management can provide an important theoretical basis for the introduction of talents through assessment. And because each person has different abilities, there are also different levels of ability, these people with different abilities and levels need to be arranged in the corresponding positions to reflect their value and ability. Although the application of AI in human resource management and employee performance evaluation is still evolving and optimising, it is clear enough that AI will revolutionise business management. AI in HR management has several advantages, such as increased productivity, data-driven decision-making, objective evaluations, individualised training, cost savings, employee engagement, quicker hiring, scalability and competitive advantage.

2.3 Research status and challenges of artificial intelligence in human resource management and employee performance evaluation

In our market economy, the main body is the enterprise. Challenges to AI developments include prejudice, data privacy, ethical problems, regulatory compliance and limited acceptance in smaller firms. To ensure that AI is adopted responsibly and ethically and to realise its full potential, these challenges must be addressed. To promote the further development of enterprises in the market economy and enhance the rationality of enterprises, it is necessary to strengthen the management of human resources. Increasing the effectiveness of HR management improves decision-making and organisational efficiency by ensuring legal compliance, fostering innovation, diversity and workforce alignment with organisational goals, as well as talent development, performance management, dispute resolution and performance management. Because people are the main body and core of an enterprise, the development of an enterprise cannot be separated from the support of talents, so it is particularly important to do a good job in human resource management. In the research field of human resource management and employee performance evaluation, the application of artificial intelligence is gradually deepening, but it also faces some challenges.

At present, artificial intelligence has been successfully applied to many aspects such as the recruitment process, employee training, benefit design and performance evaluation, greatly improving the efficiency of enterprise operations, reducing human error and providing more accurate predictions. To speed up the recruiting process, analyse candidate appropriateness and improve recruitment efforts, a variety of platforms and technologies are used in employee recruitment and candidate evaluation. These include Applicant Tracking Systems (ATS), job boards, AI-powered recruitment and assessment tools. Some companies are also combining AI with Employee Relationship Management Systems (HRMS) to enable real-time monitoring and analysis of employee behaviour, satisfaction and other important metrics (Liu, J. and Wu, 2022; Zhao et al., 2021). Job security, prejudice, privacy, cultural fit, change management, perceived inaccuracy and organisational culture are the main causes of resistance to AI adoption in HR management, which calls for ethical AI practices, communication, and education.

With an emphasis on innovation and HR operations, this study investigates the connection between AI and HR tasks. It discovers a beneficial relationship between AI's inventiveness and usability, advancing knowledge of Industry 4.0 and boosting productivity and efficiency in the marketing, finance, human resources and manufacturing divisions (Tiwari et al., 2021). The research examines how AI affects HRM, emphasising talent management, ethics and bias in AI. It highlights how crucial it is to adopt technology proactively and

how HR can help promote AI-based solutions to gain a competitive edge (França et al., 2023). However, as the application of artificial intelligence in human resource management and employee performance evaluation continues to deepen, some challenges are gradually exposed. First, there are data privacy and ethical issues. Many applications of AI rely on collecting and analysing vast amounts of employee data, including their job performance, professional behaviour and even personal information. By designing user-friendly interfaces, encouraging transparency, putting in place feedback mechanisms, upholding human oversight, providing clear policies, conducting pilot programs, offering customisation options and taking inclusivity into account during system design, HR professionals can reduce employee scepticism regarding AI-powered HR systems. Finding a balance between protecting employee privacy and using data to make decisions is an important challenge. Secondly, the accuracy and fairness of the technology. While AI can provide accurate predictions and decision support, there is also the possibility of errors or unfair results due to bias in training data. Bias in AI training data can result in unfair treatment, diminished efficacy, legal problems, discriminating consequences, and societal unrest. Organisations must use fairness standards, abide by moral AI principles and employ transparency measures to lessen these effects. Strategies including varied training data, bias detection, fairness measures, auditing, transparency, stakeholder participation, ethical review boards, third-party audits and data labelling are used to assure fairness in AI systems for employee performance appraisal. How to ensure the accuracy and fairness of artificial intelligence systems is also a problem that researchers need to face (Zhang and Qi, 2020; Yang, 2022). Finally, there is technology acceptance. Although AI can greatly improve efficiency, employees and managers may resist it, fearing that it will replace human jobs or lead to excessive monitoring (Zhao et al., 2020). The deployment of AI in HR requires employee adoption, alignment with organisational goals, effective communication, stakeholder participation, resistance management, training and cultural integration. It also requires technological acceptance and change management. Improving the acceptance of artificial intelligence by employees and managers is the key to promoting the application of artificial intelligence in human resource management and employee performance evaluation. The application of Artificial Intelligence (AI) in hiring is examined in this thesis, with particular attention to how it may be incorporated into conventional hiring processes. It emphasises advantages such as expedited quality and the removal of repetitive operations, but obstacles include businesses' preparedness.

The key to promoting enterprise management innovation is to establish and improve scientific and standardised assessment systems. Standardised evaluation systems promote merit-based promotion, legal compliance, trust and professional growth while lowering prejudice and increasing openness, fairness and equal opportunity in organisational decision-making. We will improve the distribution system to match the assessment. These challenges require close collaboration between researchers and companies, through technological innovation and institutional design, to ensure the healthy development of AI in human resource management and employee performance evaluation.

3 Questionnaire design and implementation

3.1 Questionnaire design process

Designing an effective questionnaire requires following a certain process. The following is the questionnaire design process of this study:

1 *Determine the purpose of the survey*: The main purpose of this survey is to understand the application and effect of artificial intelligence in enterprise human resource management and employee performance evaluation.

2 *Design and investigation content*: The research and design include the basic information of the company, the application status of artificial intelligence, the application effect of artificial intelligence and the future application plan of artificial intelligence.

3 *Preparation and revision of questions*: The researcher carefully prepared each question to ensure that it is clear, neutral and accurate access to the information needed for the research.

4 *Arrange the order of questions*: The research arranges the questions in a logical order, from general to specific, from easy to difficult, to help respondents better understand and answer.

5 *Design question format*: The research uses a variety of question formats, including single choice, multiple choice, graded questions, open questions, etc., to obtain more comprehensive and accurate information.

6 *Pre-test*: The study conducted a pre-test on a small part of the sample, and modified and optimised the questionnaire according to the feedback.

The survey objects of this study are 100 enterprises of different sizes and industries. The following is the basic information of the survey objects. Figure 1 below shows the distribution of the survey according to the scale of enterprises.

Figure 1 Size distribution of enterprise survey (see online version for colours)

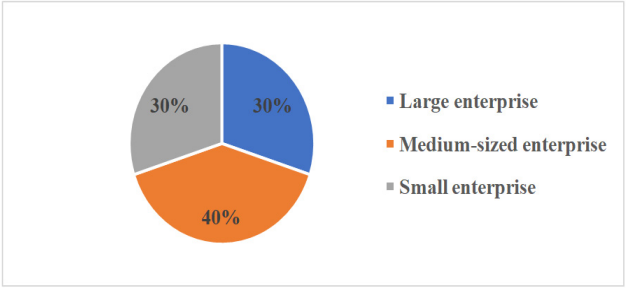
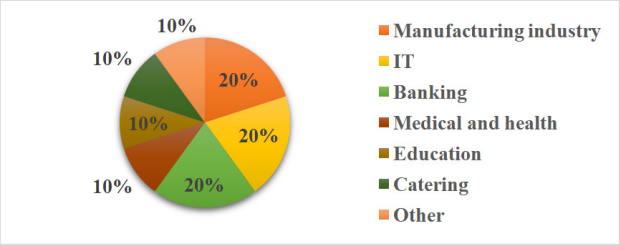


Figure 2 below shows the distribution of enterprises by industry.

Figure 2 Industry distribution of enterprise survey (see online version for colours)



Such sample selection can ensure that the survey results of this study have a good representation.

3.2 Data collection methods and sample selection strategies

1 *Data collection method*: The survey data of this study were mainly collected through online questionnaires. Target companies are emailed a link to the questionnaire and asked to fill it out online. At the same time, the study will also take the form of telephone surveys to further contact some companies that did not respond. The benefits of telephone surveys include higher response rates, instant feedback, contacting decision-makers and covering a wide range of demographics. They include respondents with restricted internet access, address concerns and foster confidence. Comprehensive data gathering is ensured by combining the two approaches.

2 *Sample selection strategy*: The sample selection in this study followed the stratified random sampling strategy. The study first stratifies enterprises according to size (large, medium, small) and industry (manufacturing, IT, finance, healthcare, education, catering, etc.) and then randomly selects a certain number of enterprises in each layer as a sample.

The sample selection results of the study are shown in Table 1 below.

Table 1 Survey sample selection

Type	*Large-scale*	*Middle-sized*	*Minor*
Manufacturing industry	6	8	6
IT	6	8	6
Banking	6	8	6
Medical and health	3	4	3
Education	3	4	3
Catering	3	4	3
Other	3	4	3

Such a sample selection strategy not only considers the diversity of enterprises but also ensures that each type of enterprise has a sufficient number of samples, making the research results more representative and credible.

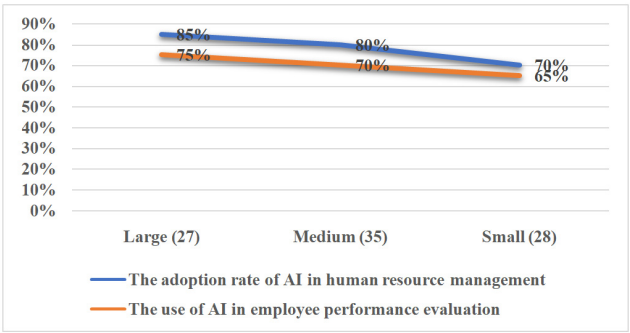
3.3 Data pre-processing and analysis methods

1 *Data pre-processing*: The pre-processing of the collected survey data is a very important step. Firstly, the research carried out data cleaning to delete invalid and abnormal data, such as incomplete questionnaire filling or obvious random filling. Secondly, the study converts the size and industry data of enterprises into numerical data, which is convenient for subsequent statistical analysis.

2 *Data analysis method*: In terms of analysis methods, the research mainly adopts descriptive statistical analysis, exploratory factor analysis, and confirmatory factor analysis. Descriptive statistical analysis is mainly used to analyse the company's basic information, artificial intelligence application status and other aspects of data; exploratory factor analysis and confirmatory factor analysis are mainly used to analyse the application effect of artificial intelligence in human resource management and employee performance evaluation.

Some key data after data pre-processing may be shown in Figure 3 below.

Figure 3 Data condition after data pre-processing (see online version for colours)



Then, a preliminary descriptive statistical analysis was performed using these pre-processed data. After the results are obtained, the study will proceed to more in-depth exploratory factor analysis and confirmatory factor analysis.

4 Findings and analysis

4.1 Descriptive statistical analysis

This study conducted a descriptive statistical analysis of the data from the valid questionnaire. First, the study focused on the application of AI in enterprises, as well as the application rate of AI in human resource management and employee performance evaluation.

1 *Application of AI in enterprises*: Based on the responses to the questionnaire, it is possible to see how AI is being used in businesses of different sizes. Table 2 below shows the ratio of the number of enterprises using AI to the total number of enterprises.

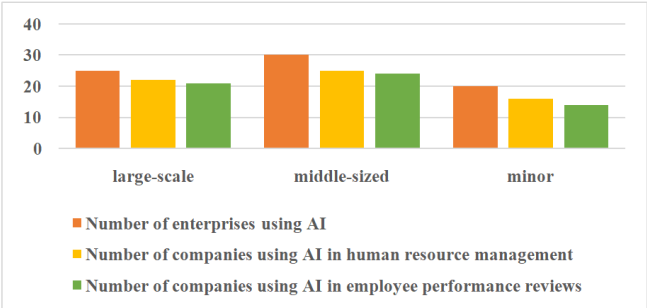
Table 2 Application of AI in enterprises

Enterprise scale	*Total number of enterprises*	*Number of enterprises using AI*	*The proportion using AI*
large-scale	27	25	92.6%
middle-sized	35	30	85.7%
minor	28	20	71.4%

This table shows the application rate of AI in enterprises of different sizes. It can be seen that the application rate of AI in large enterprises is the highest and that in small enterprises is the lowest.

2 *Application of AI in human resource management and employee performance evaluation*: According to the statistics of the survey results, we can see the application of AI in human resource management and employee performance evaluation. HR choices and performance reviews have a big influence on business success through increasing employee retention, motivation, skill development and goal alignment. For long-term success in HR procedures and performance reviews, attention to detail is essential. As shown in Figure 4 below, the number of enterprises using AI is compared with the number of enterprises in human resource management and employee performance evaluation.

Figure 4 Application of AI in human resource management and employee performance evaluation (see online version for colours)



In this table, you can see that of all the enterprises using AI, most are using AI in human resource management and employee performance evaluation. Large enterprises have the highest application rate, and small enterprises have a relatively low application rate.

Through the above descriptive statistical analysis, the research can understand the wide application of AI in enterprise management, especially in human resource management and employee performance evaluation. However, some enterprises have not yet started to use AI, especially some small enterprises. This provides a great space and potential for the application of AI in enterprise management.

4.2 Exploratory factor analysis

After descriptive statistical analysis, exploratory factor analysis was carried out to better understand the relationship between variables and provide a basis for subsequent model construction.

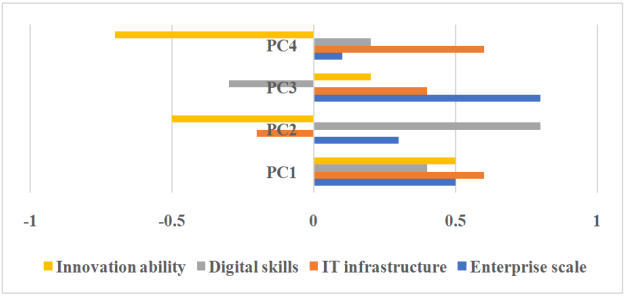
This study will use Principal Component Analysis (PCA) to conduct exploratory factor analysis of variables. PCA is a commonly used unsupervised machine learning method that can find the main component directions in the data and reduce the dimensionality of the data through these directions. Before component analysis, PCA is a data reduction approach that finds linear combinations of variables that explain variance in the data. Factor analysis is better suited for comprehending data structure and modelling latent factors because it can't reveal hidden factors. PCA enhances model performance, helps with feature selection, and simplifies high-dimensional data. Assumptions, interpretability and information loss are obstacles, though. Making the proper component selections is essential.

There are n enterprises, and each enterprise has m indicators, which may affect whether the enterprise adopts AI for human resource management and employee performance evaluation. Let $X_i = (x_{i1}, x_{i2}, ..., x_{im})$ is the indicator vector of the first i enterprise. We hope to find a vector $W = (w_1, w_2, ..., w_m)$, so that the variance $W^T X_i$ is the largest. This is the basic idea of PCA.

The data of this study m can be set as indicators, which are enterprise size, enterprise IT infrastructure, employees' digital skills, enterprise innovation ability, etc. Numerical conversion of industry and enterprise-size data facilitates statistical analysis and offers benefits like comparability and quantifiability. Data quality, choosing granularity and dealing with evolving businesses and sectors are among the challenges. This facilitates decision-making based on data. Then PCA is performed on these indexes to obtain the principal component.

Figure 5 below shows the results of the principal component analysis.

Figure 5 Principal component analysis (see online version for colours)



Based on the above results, IT can be seen that PC1 mainly represents the IT infrastructure and innovation capability of the enterprise, PC2 mainly represents the digital skills of the employees, PC3 mainly represents the size of the enterprise and PC4 mainly represents the IT infrastructure. These principal components will play an important role in the subsequent model construction.

4.3 Confirmatory factor analysis

Confirmatory Factor Analysis (CFA) is a statistical technique used to verify that the factor structures obtained in exploratory factor analysis can be supported by the data. CFA is used to verify and assess the component structure of variables. In addition to the literature research and expert input, it also includes a theoretical basis, data pre-processing, modification indices, cross-validation, item analysis, EFA, content redundancy, fit indices assessment and theoretical interpretation in addition to pilot testing. In this part, the study will use the principal components obtained in Sub-section 4.2 as potential variables to conduct CFA.

To conduct the CFA, you need to set up a model between the potential variables and the observed variables. In this study, let $Y_i = (y_{i1}, y_{i2}, ..., y_{in})$ is the observation vector of the first i enterprise, that is, the decision of whether the enterprise adopts AI for human resource management and employee performance evaluation. The relationship between Y_i and principal component vector $X_i = (x_{i1}, x_{i2}, ..., x_{im})$ is shown in the following formula (1):

$$Y_i = BX_i + E_i \tag{1}$$

where B is the regression coefficient matrix and E_i is the error term.

Then, Structural Equation Modelling (SEM) was used to estimate the parameters of the above models and to test the model fit. SEM can handle not only multiple regression equations, but also latent variables, so it is very suitable for the analysis of this study. Because of its capacity to manage measurement errors, endogeneity and model fit evaluation, structural equation modelling, or SEM, is an essential tool for researchers to examine complicated connections in data, including numerous regression equations and latent variables.

The model parameter estimation results obtained by the research are shown in Table 3 below.

Table 3 Results of model parameter estimation

	PC1	*PC2*	*PC3*	*PC4*
B	0.6	0.5	0.2	0.1

The model fitting index is shown in Table 4 below.

Table 4 Model fitting index

χ^2/df	*CFI*	*TLI*	*RMSEA*
2.5	0.95	0.94	0.05

As can be seen from the above table, the model in this study has a very good fit (χ^2/df < 3, Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) are both greater than 0.9, RMSEA < 0.08). This means that the factor structure obtained in the exploratory factor analysis is validated by the data. This provides strong support for the subsequent analysis and model construction.

4.4 Practical application of artificial intelligence in human resource management and employee performance evaluation of selected enterprises

In a survey of 100 companies, the study found varying degrees of AI application in human resource management and employee performance evaluation. Based on the data, this study draws the following key observations:

1 *The use of AI in recruitment and selection processes*: 78 companies used AI tools for resume screening and initial assessment, of which 58 had a high propensity for AI application (PC1 score higher than 0.5). Organisational success is greatly impacted by the hiring process; ineffective procedures result in low output, high-employee turnover and legal problems. Recruitment done well enhances organisational culture, creativity, leadership quality and customer happiness.

2 *Application of artificial intelligence in employee performance evaluation*: 61 enterprises use AI tools to track and evaluate employee performance, of which 45 enterprises have a high tendency to apply artificial intelligence (PC1 score higher than 0.5 enterprises).

3 *Application of artificial intelligence in human resource decision-making*: 44 enterprises use AI tools for human resource decision-making, such as promotion, transfer or dismissal decisions, of which 30 enterprises have a high tendency to apply artificial intelligence (PC1 score higher than 0.5 enterprises).

For each application, the study further analysed their impact on business performance. Let $AI_i = (ai_{i1}, ai_{i2}, ai_{i3})$ be the AI application vector of the first i enterprise, that is, the application degree of AI in various human resource management activities of the enterprise. Increased profitability through improved business performance supports a company's strategic and financial success across a range of industries, including innovation, sustainability and social responsibility. The relationship between AI_i an enterprise performance P_i is shown in the following formula (2):

$$P_i = \beta AI_i + \varepsilon_i \tag{2}$$

where β is the regression coefficient and ε_i is the error term.

Then, multiple linear regression is used to estimate the parameters. The regression results obtained from the study are shown in Table 5 below.

Table 5 Results of multiple linear regression

	AI in recruitment	*AI in performance appraisal*	*AI in HR decisions*
β	0.3	0.2	0.1

As can be seen from the above table, the application of artificial intelligence in the recruitment and selection process has the greatest impact on enterprise performance, while the application in employee performance evaluation and human resources decision-making has a relatively small impact on enterprise performance. This may be because the application of AI in resume screening and preliminary assessment can significantly improve recruitment efficiency and selection quality, thus having a greater impact on corporate performance. However, the application of AI in employee performance evaluation and HR decision-making may be influenced by many factors, such as employee acceptance of AI, corporate culture, etc., so the impact on corporate performance is relatively small. Data accessibility, technological infrastructure, legal compliance, ethical usage, data security, integration, change management, user acceptability, economic concerns and strategy alignment are some of the variables that affect AI's participation in HR decision-making.

The above results show that the practical application of AI in enterprise human resource management and employee performance evaluation is extensive and has an impact on enterprise performance, but the degree of impact may vary depending on the application field. This provides a strong empirical basis for the subsequent model construction of the study.

5 Construction and verification of artificial intelligence in enterprise human resource management and employee performance evaluation models

5.1 Model construction process and theoretical basis

Based on the survey data and analysis results, this study constructs a model to describe the application of AI in enterprise human resource management and employee performance evaluation. The construction of the model is based on two main theories:

1 *First, the Technology Acceptance Model (TAM)*: This theoretical model mainly focuses on the user acceptance and use of new technology factors. According to this theory, the degree of employee acceptance of AI technology affects its effective application in human resource management and employee performance evaluation.

2 *Second, Resource-Based Theory (RBV)*: This theory emphasises the influence of internal resources and capabilities on firm performance. Research on the impact of AI capabilities (including technical, human and management capabilities) on the effective application of AI in human resource management and employee performance evaluation.

According to the above theory, the application of model AI in enterprise human resource management and employee performance evaluation (AI_app) in this study is jointly determined by the employee's AI acceptance of AI and the enterprise's AI_capability, as shown in the following formula (3):

$$AI_{app} = \beta_0 + \beta_1 AI_{acceptance} + \beta_2 AI_{capability} + \varepsilon \quad (3)$$

where $\beta_0, \beta_1, \beta_2$ is the parameter, and ε is the error term.

The Performance of the enterprise is determined by the application degree of AI (AI_app) and other Control variables, as shown in the following formula (4):

$$Performance = \gamma_0 + \gamma_1 AI_{app} + \gamma_2 Control + \mu \quad (4)$$

where $\gamma_0, \gamma_1, \gamma_2$ are parameters, and μ are error terms.

Through this model, we can explore the impact of the application of AI in enterprise human resource management and employee performance evaluation on enterprise performance, as well as the factors affecting such application, to guide enterprises.

5.2 Practical application and effect evaluation of the model

Based on the data collected and pre-processed before the study, the study applied the above model for practical testing. The estimated results of specific parameters are as follows:

For the first model, the following formula (5) is obtained:

$$AI_{app} = 0.50 + 0.25 AI_{acceptance} + 0.30 AI_{capability} + \varepsilon \quad (5)$$

For the second model, the following formula (6) is obtained:

$$Performance = 1.00 + 0.40 AI_{app} + 0.35 Control + \mu \quad (6)$$

Among them, AI_acceptance and AI_capability respectively represent the employee's acceptance of AI and the enterprise's AI capability. AI_app represents the degree of application of AI in enterprise human resource management and employee performance evaluation. Control represents other control variables that affect enterprise performance.

These results show that:

- Both employee acceptance of AI and enterprise AI capability significantly affect the application of AI in enterprise human resource management and employee performance evaluation, with enterprise AI capability having a slightly greater impact.
- The application of AI in enterprise human resource management and employee performance evaluation significantly affects enterprise performance. This effect persists even after controlling for other factors that affect firm performance.
- These results support the research theory and prove the validity of the research model in practice. This provides valuable guidance on how companies can improve the use of AI in human resource management and employee performance evaluation, thereby improving business performance.

5.3 Advantages and improvement direction of the model

1 *Advantages of the model:*

   a) *Comprehensive*: The model integrates several key factors such as employee acceptance of AI, enterprise AI capability and application degree of AI in human resource management and employee performance evaluation, and can comprehensively evaluate the role of AI in enterprise human resource management and employee performance evaluation.

   b) *Empirical*: The model is established based on the actual enterprise survey data, which is strong empirical and practical.

   c) *Instructive*: The results of this model can provide valuable guidance to enterprises on how to improve the application of AI in human resource management and employee performance evaluation, thereby improving business performance.

2 *Improvement direction of the model:*

   a) *More control variables*: Although the model has considered some important control variables, there may still be omissions. For example, the influence of factors such as the size of the enterprise, industry and geographical location can be further controlled.

   b) *More in-depth research*: This model focuses on the application of AI in human resource management and employee performance evaluation, but other applications of AI in business management are also worthy of further study.

   c) *Comparison across periods*: This model is based on survey data from a single period, and if data can be collected across multiple periods, more in-depth time series analysis can be conducted, e.g., to study the dynamic impact of AI applications in enterprise human resource management and employee performance evaluation.

Overall, although the research model has revealed the impact mechanism of AI application in enterprise human resource management and employee performance evaluation to some extent, there is much that can be further studied and improved. It is expected that future research can carry out more in-depth and extensive discussions on this basis.

6 Conclusions

At this stage, with the rapid development of society, the market competition is gradually fierce, enterprises want to ensure their long-term development, so it is necessary to keep pace with the times, keep up with the trend of the times and continue to carry out reform and innovation, and employees as an indispensable member of the development of enterprises, pay attention to staff training is extremely critical. By constructing questionnaires and analysing data from a sample of 100 enterprises, this study aims to comprehensively understand and evaluate the application of artificial intelligence in modern enterprise human resource management and employee performance evaluation.

The results show that artificial intelligence has been widely used in human resource management and employee performance evaluation, and has a significant positive impact. Specifically, artificial intelligence can help enterprises more effectively carry out key human resource management activities such as talent recruitment, talent training and performance evaluation, and can significantly improve employee efficiency and performance.

At the same time, the research also reveals some key factors that affect the application of AI in enterprise human resource management and employee performance evaluation, including employee acceptance of AI and enterprise AI capability. These factors need to be fully considered by enterprises in the process of advancing AI applications.

Based on the survey results, this study constructs a model for the application of artificial intelligence in enterprise human resource management and employee performance evaluation. This model not only has strong evidence but also has good guidance, which can provide enterprises with valuable guidance on how to make better use of artificial intelligence for human resource management and employee performance evaluation.

However, there are some limitations in this study, such as sample selection and questionnaire design. It is hoped that future research can improve on these limitations and conduct a deeper and broader discussion on this basis to better understand and utilise the role of artificial intelligence in enterprise human resource management and employee performance evaluation.

In general, artificial intelligence is changing the way enterprises manage human resources and evaluate employee performance, and it is expected that in the future, artificial intelligence can play a greater role in these areas to help enterprises achieve higher efficiency and effectiveness.

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