Article

# Application of green human resource management and biomechanical strategies in employee eco-friendly behavior promotion in biotechnology enterprises based on computer-assisted decision-making system

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**Abstract:** Inspired by biomechanics, the behavior of employees within an enterprise bears resemblance to the mechanical properties of biological structures, which plays a crucial role in the achievement of an enterprise's green development. Just as the proper coordination of biological components in biomechanics is essential for efficient functioning, effective human-resource management can stimulate employees' enthusiasm to participate, thereby influencing the development of the organization. The questionnaire for this study was developed for data collection based on a questionnaire developed by a biotechnology Y company established in 1991 as the main respondent. The collected data were analyzed using tools such as Statistical Package for the Social Sciences (SPSS), Analysis of Moment Structures (AMOS), and computer-assisted decision-making system for descriptive statistical analysis, testing of reliability and validity, and regression analysis. The relationship between green human resource management and employees' eco-friendly behaviors was examined, and the mediating role of psychological contract was tested. Drawing an analogy from biomechanics, where forces and structures interact in complex ways, the relationship between green human-resource management and employee behavior is also complex. The results of the study showed that green human resource management explained 33.7% of the variance in employee eco-friendly behavior and that there was a significant positive effect of green human resource management on employee eco-friendly behavior ($|\beta| = 0.615$, $p < 0.001$). In the context of biomechanics-inspired thinking, this positive effect can be seen as a beneficial force promoting the "structural stability" of the enterprise's green development. Meanwhile, the psychological contract played a partial mediating role in this process, accounting for 44.47% of the total effect. The results of this study can provide an important basis for enterprises to implement green human resource management practices and promote eco-friendly behaviors among employees. Similar to how biomechanical principles guide the design of efficient biological systems, these results can guide enterprises to build a more sustainable and "biomechanically-optimized" human-resource management model for green development.

**Keywords:** assisted decision-making system; green human resource management; employee eco-friendly behavior; psychological contract; biomechanical strategies

## 1. Introduction

Green mountains are golden mountains, a good ecological environment is not only a natural resource, but also a socio-economic resource, but in recent years, environmental pollution is a frequent and increasingly serious problem, which has aroused social concern [1,2]. The "13th Five-Year Plan" contains the concept of green

development, promotes the formation of green production and lifestyle as the main goal, and advocates green and low-carbon travel and lifestyle, which reflects that China attaches great importance to the protection of the ecological environment [3,4]. In this context, enterprises should vigorously advocate the concept of green development while pursuing their own interests, not only focusing on economic development, but also paying attention to the protection of the environment [5,6].

Employee green behavior refers to the behavior of employees in the work process to protect the ecological environment and minimize its negative impacts, such as reducing behaviors that damage the environment [7,8]. Employee green behavior can improve work performance, corporate environmental performance and green innovation performance, and achieve the goal of sustainable development of enterprises [9,10]. In order to achieve this goal, enterprises will formulate relevant environmental measures and environmental policies, and employee participation is necessary to promote and implement green measures [11,12]. One of the most important factors for companies to achieve sustainable development and environmental innovation management is their employees.

"Green Human Resource Management (HRM)" is defined as the integration between traditional HRM and environmental policies and objectives, which is a new concept and new concept developed along with the increasing concern of enterprises for environmental protection, requiring enterprises to realize green sustainable development in the whole process of human resource management, such as recruitment, training, performance, development, etc., with the purpose of make employees understand, value, and practice environmentally friendly green behaviors [13–15]. With the extensive attention of scholars, green HRM has gradually evolved as an independent field. Green HRM is an incentive mechanism that conveys an organization's environmental philosophy, changes employees' work attitudes, and enhances their work performance. The implementation of this management strategy has a far-reaching impact, which can not only motivate employees to pay more active attention to environmental protection issues, but also significantly enhance their ability to practice environmental protection, so that they can better transform environmental protection concepts into practical actions [16,17]. More importantly, this strategy provides a valuable practical platform for employees to explore, learn and grow in practice, further promoting the in-depth development of environmental protection work. It can be said that the implementation of this management strategy not only helps to enhance employees' environmental literacy, but also helps to promote the sustainable development of the whole organization [18,19].

Research related to green human resources is mainly based on human resource management theory, person-organization fit theory, and the mainstream instrumental methods used are mainly cross-sectional studies, structural equation modeling, and other social practice research tools and methods. Chaudhary, R, combining cross-sectional research design methodology and hierarchical regression analysis methodology, reveals that green human resource management (GHRM) can be used to predict employees' task-related and resource-based green behaviors, where organizational identification reinforces this prediction [20]. Dumont et al. elaborated on the kernel and role of green HRM and supported a conceptual model integrating the influence of psychological green climate and personal green values based on HRM

and psychological climate related studies and in an analytical study, elucidated that green HRM promotes green behaviors of employees on and off the job [21]. Ababneh empirically examined how employee participation in environmental agreements plays a role in the relationship between green human resource management and individual green behaviors, based on the analysis of the person-organization fit theory, pointed out that the degree of employee dedication plays a certain mediating role between the two, and also emphasized that the degree of interaction between individuals in the organization has a positive effect on promoting employee participation in environmental agreements [22]. Darvishmotevali et al. proposed a structural equation modeling to conduct a study on the causal relationship between green HRM, pro-environmental performance (P-EP) of employees, environmental awareness and servant leadership, and validity and reliability tests were conducted using intelligent Partial Least Squares (PLS), and the results of the study showed that green HRM acted on proactive P-EP through the environmental awareness element, but not on task-related P-EP [23]. Zhang et al. conducted a related study based on data related to a cross-sectional survey of Chinese firms and a proposed technology acceptance model and found that strategies such as employee education and training, employee empowerment, and manager involvement positively influence the occurrence of green behaviors within and outside of the employee's position [24].

Scholars have tried to explore the underlying logical mechanisms of employees' green behaviors from the perspectives of corporate strategy, leadership and management, as well as from the perspective of the employees themselves, and have made certain efforts to promote corporate green development strategy and employees' green behaviors. Norton et al. examined the employees' work data and carried out relevant analyses, pointing out that the perception of corporate environmental strategy and the green psychological atmosphere promote the occurrence of employees' green behaviors, which provides an important reference for the management of green employee behaviors in organizations [25]. Li et al. analyzed how green intrinsic and extrinsic motivation affects employees' green creativity based on structural equation modeling, and found that green transformational leadership creates green intrinsic motivation for employees' green production behaviors and promotes green creativity [26]. Based on the interaction between individuals and organizations, Jia et al. investigated the mechanism of green creativity, and through empirical research analysis, it was found that transformational leadership enhances employees' passion for green behaviors through green human resource management strategies, which in turn promotes the generation of green creativity among employees [27].

The focus of this paper is to investigate the mechanism of action between green human resource management and employees' eco-friendly behavior in biotechnology enterprises. Combined with the work attributes of the employees in the enterprise, the psychological contract is added as a mediating variable. Based on the social exchange theory and the individual-environment matching theory, a theoretical model about the relationship between the two variables is constructed, and the proposed hypotheses are tested with the help of SPSS, AMOS, and the computer-aided decision-making system to ensure the validity of the questionnaire data through the reliability test, and the hypothesis test of the main hypotheses in the study through the regression analysis,

and finally, based on the results of the research Propose green human resource management strategies for biotechnology companies.

## 2. Background to the study—Company Y profile

### 2.1. Y company profile

Founded in 1991, Y is a high-tech enterprise based on bio-industry and applying modern biotechnology, which is dedicated to the production of special bio-pharmaceuticals, new bio-enzyme preparations, anti-plant extracts and functional feed additives. Y has accumulated rich technological resources in the process of development, and formed a unique advantage of technological innovation. The company owns 11 core technologies and has mastered many innovative core technologies, such as compound enzyme synergistic technology, genetic engineering technology, bioengineering technology, enzyme engineering technology, etc. It also owns more than 150 invention patents, which have laid a solid foundation for the company's rapid growth and sustainable development.

In order to practice the concept that green water and green mountains are golden silver mountains and realize the green development of the enterprise, Company Y has set up a sustainable development department since 2008, which is mainly responsible for the company's environmental protection-related work. Over the years, it has been vigorously promoting the low-carbon economy and exploring the operation mode of low energy consumption, low pollution and low emission. At the same time, in the context of the era of green development, the company's eco-sustainable development plan to clarify the decline in comprehensive energy consumption, chemical oxygen demand emissions decline in the refinement of the target, the implementation of energy-saving projects, and strengthen the whole process of sewage monitoring and management. y company to actively enhance the level of production technology and management, to improve the efficiency of resource and energy utilization, and to fulfill the corporate social responsibility at the same time, to play the role of the industry as a model for the industry, to contribute to the industry's Green development of the industry continues to contribute its due strength. In this context, the overall quality of the company's employees, the concept of green development, and proactive green behavior are particularly important.

### 2.2. Green HRM in company Y

In order to gain an in-depth understanding of the practice of green HRM in Company Y, this study searched for a large amount of archival materials and chose the interview method, conducting one-on-one semi-structured interviews with the director of the Human Resources Department, the director of the Sustainability Department, and the employee representatives of Company Y.

The questions in this interview did not involve occupationally sensitive topics, so the answers given by the interviewees were considered to have a certain degree of credibility and research value, and the semi-structured interviews were the main channel through which this study obtained information related to the practice of green human resource management in Company Y. This study mainly focuses on green

recruitment and selection, green training, green performance management and evaluation, green compensation and benefits, green employee participation and other green supportive policies to understand the current status of green HRM practices in Company Y. Based on the interviews, the green HRM practices in Company Y are summarized as shown in **Table 1**. The Human Resources Department of Company Y adheres to the company's policy of "conserving energy and resources, and reducing the number of employees". The Human Resources Department of Company Y adheres to the company's principle of "saving energy and resources and reducing pollution emissions", and the company has set up 10 departments and implemented flat management to optimize the allocation of human resources, reduce operating costs and improve work efficiency. The company has a sustainable development department, which mainly focuses on the company's environmental management.

**Table 1.** Green human resource management practices of company Y.

| Dimensionality | Green human resource management practice | Company practices perceived by employees |
|---|---|---|
| Green recruitment selection | 1. Set up the sustainable development department, responsible for the daily comprehensive supervision and management of the company's environment, safety and health, and recruit professionals related to environmental protection.<br>2. Promote the company's green concept in daily recruitment publicity, in order to attract candidates who match the company's values. | The company attaches great importance to green environmental protection, and it is safer to work in such an environment. |
| Green training | 1. Organize training for all employees at the company level, including: company rules, systems and corporate culture.<br>2. The Sustainable development department takes the lead in training production and technical departments on environmental protection knowledge.<br>3. Carry out job training within the production department, and the team leader provides on-site operation guidance. | The company provides a lot of environmental protection training in production, to enhance the specific skills of individuals. |
| Green performance management and evaluation | 1. The Human Resources Department sets performance indicators for the sustainable development department and conducts assessment.<br>2. The Sustainable development department supervises and evaluates the production Department and Technology Department's daily operation and environment-related indicators, and the Human Resources Department conducts assessment according to the evaluation. | 1. We implement high environmental standards that are ahead of local government requirements.<br><br>2. The products we produce are excellent, and the food safety is in the leading position in the industry. |
| Green pay and benefits | Energy conservation and emission reduction research project award. | The daily work is actively oriented towards environmental protection. |
| Green employee participation | A special team inspects and scores restaurants daily | The environment is transparent and very reassuring. |
| Other green supportive policies | We will encourage research on energy conservation and environmental protection technologies | Proud of the company's forward-looking work confidence. |

## 3. Rationale and research hypotheses

### 3.1. Rationale

#### 3.1.1. Green human resources management

With the concept of sustainable development, the important role of employees on the effectiveness of the organization's environmental management was found in the

study of corporate social responsibility and environmental protection, and then the research perspective shifted to human resources, giving rise to the concept of sustainable human resource management. Sustainable human resource management (GHRM) is defined as human resource management that meets the current needs of society and business without jeopardizing their future [28]. Summarizing the research and characteristics of sustainable human resource management, green human resource management can be defined as the integration of green concepts into human resource management, which can win a competitive advantage for enterprises, and the implementation of green human resource management, which can safeguard and promote the realization of green strategic goals of enterprises, and provide green value for society.

### 3.1.2. Employee eco-friendly behavior

Eco-friendly behavior involves more conceptual terms, including environmental behavior, pro-environmental behavior, environmental protection behavior, environmentally friendly organization citizenship behavior, etc [29]. It can also be referred to as green behavior, the names are different but express basically the same meaning. The introduction of eco-friendly behaviors into the workplace has developed into employee eco-friendly behaviors. That is, employees make behaviors in the workplace that benefit the environment, or reduce environmental damage. According to the classification of the intention of employee eco-friendly behavior, employee eco-friendly behavior can be divided into task-based employee eco-friendly behavior, as well as active employee eco-friendly behavior.

(1) Task-based employee eco-friendly behavior

It refers to the green behaviors related to work regulations and task requirements, usually related to the organization's green goals, policies and regulations.

(2) Active Employee Eco-friendly Behavior

It refers to the green behaviors generated by employees voluntarily and autonomously, which are not related to the requirements of work tasks, rewards and punishments, and often exceed the degree of environmental friendliness required by their work tasks and the expectations of the organization.

### 3.1.3. Psychological contract

Psychological contract is defined as a series of subjective beliefs about what employees and organizations should give or get to each other that are not explicitly stipulated and are formed on the premise of economic contract. The content of the psychological contract contains two aspects of organizational responsibility and employee responsibility, organizational responsibility mainly includes providing employees with fair labor compensation, promotion, training, career development, friendly working environment and job security, etc. [30]. Employee responsibility mainly includes loyalty to the organization, following the organization's arrangements, safeguarding the interests of the organization, and working overtime for continuous work.

Meanwhile, with the development of global competition and technological innovation, the paternalistic relationship between the organization and employees in the past is gradually transformed into an equal relationship that participates in social exchanges, and the content of the psychological contract has undergone significant

changes, and the requirements for flexibility, job enrichment, and growth are taking up more and more weight in the psychological contract, and the contents that were very important in the past are gradually disappearing or decreasing in importance.

This paper considers three dimensions of the psychological contract, including the transactional dimension, the developmental dimension, and the relational dimension.

(1) Transactional dimension

Organizational responsibility mainly refers to the provision of financial benefits and material conditions for employees, including fair salaries, benefits packages, performance pay, and basic working conditions and environmental security. Employee responsibility includes employees' compliance with rules and regulations and industry norms, providing work effectiveness for the organization, and completing work tasks.

(2) Development Dimension

The organization and employees take responsibility for each other's development. The organization's responsibility includes providing employees with promotion space, learning and training, long-lasting job security, challenging work and autonomy. Employee responsibilities include putting in more efforts to continuously improve their skills, supporting organizational decision-making, providing reasonable suggestions, and serving for a long period of time.

(3) Relationship Dimension

Organizational responsibility includes caring and respecting employees, providing social contact and interpersonal relationship support, good working atmosphere, organizational culture, etc. Employee responsibility includes integrating into the organization, establishing positive emotional ties, being loyal to the organization, and having a sense of cooperation and teamwork.

## 3.2. Research hypotheses

Based on the main content of this study and combing the existing literature, the psychological contract is introduced as a mediating variable in the process of studying the mechanism of influencing green human resource management on employees' eco-friendly behavior. Based on the study and analysis of existing theories, the following hypotheses are proposed.

### 3.2.1. The impact of green human resource management and employees' eco-friendly behavior

With the increasing severity of global environmental problems, more and more organizations are focusing on sustainable development and green issues. Against this background, eco-friendly behaviors have become an important organizational behavior, including energy conservation, waste reduction, and promotion of green products. When employees are aware of the green human resource management implemented by the organization, they will consciously adjust their work attitudes and behaviors according to the requirements. It also shows that when an organization adds greening to its HRM policy, its employees will also feel and show behaviors that are in line with the organization's green policy. Employee eco-friendly behavior not only reduces environmental pollution, but also increases the organization's sense of social

responsibility and credibility, thus enhancing the organization's sustainable competitiveness.

The green human resource management of an organization can influence the employee eco-friendly behaviors of its employees from the following aspects:

First, when selecting talents, the green concept of the enterprise will be integrated into the talent selection, and the integration of the green concept of the enterprise into the talent selection will help to enhance the green consciousness of the enterprise.

Secondly, green operation and operation design, green training aiming at improving employees' knowledge and skill ability are all important links to motivate employees to produce green. By incentivizing the environmental performance of the enterprise, it can make the employees better participate in the green practice of the enterprise, thus promoting the eco-friendly behavior of the employees.

Third, for employees' excellent performance in green aspects, appropriate praise and rewards should be given and some benefits in green aspects should be provided to the employees. Such positive incentives can effectively increase the degree of employees' recognition of green human resource management in the organization, and can continuously and effectively maintain or even increase the eco-friendly behaviors of the employees in the future work.

Fourth, when green human resource management is not just about management, but encourages employees to join in the management process, employees in the process of management, they will adjust their own behavior, and organizational goals in step with the increase of more eco-friendly behaviors.

Based on the above research, the first hypothesis is proposed:

H1, the positive effect of green human resource management on employees' eco-friendly behavior is significant.

### 3.2.2. The mediating role of the psychological contract

Psychological contract refers to the confidence and ability of employees in green work, reflecting their subjective initiative and motivation to participate in green actions and practices. Employees' green psychological contract has a positive impact on the green actions and sustainable development of an organization. When employees believe that they have the competence and confidence required for green actions, they are more willing to actively participate in the green actions of the enterprise and consider green responsibility as their own, thus promoting green actions and sustainable development of the enterprise. This is in line with the prediction that the enhancement of the psychological contract will promote eco-friendly behaviors among employees.

Under the current global green awareness rising and the promotion of sustainable development concept, more and more enterprises begin to pay attention to environmental protection and sustainable development, and the green psychological contract of employees becomes an important part in the development of green economy of enterprises. Green human resource management can enhance the psychological contract of employees. These policies and measures include, but are not limited to, the provision of green knowledge and skills training, the establishment of green awareness guidance and incentives, the development of green goals and

performance appraisal. Social psychology states that people's beliefs and attitudes have a significant impact on their behavior.

Based on this, this study proposes the following hypotheses:

H2, psychological contract plays a partial mediating effect in the process of green human resource management influencing employees' eco-friendly behavior.

### 3.3. Research models

Based on social exchange theory and individual-environmental matching theory, this study investigates the influence mechanism between green human resource management (GHRM) and employee eco-friendly behavior (EEFB) by establishing a moderated mediation model the research model is shown in **Figure 1**. Where GHRM is the independent variable and EEFB is the dependent variable. Also from the research model, it can be seen that the independent variable GHRM is mediated by the psychological contract (PC) in addition to having a direct effect on employee green behavior.
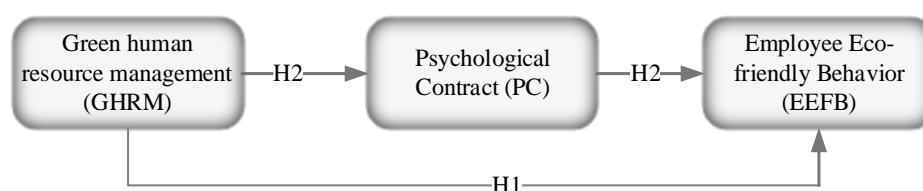


**Figure 1.** Research model.

## 4. Data analysis and hypothesis testing

### 4.1. Study design and sample selection

This study focuses on the impact of green human resource management of biotechnology enterprises on employees' eco-friendly behaviors in computer-aided decision-making system, so the target of the investigation is enterprise Y, which is on the road of low-carbon development, and this study is conducted by the management and employees in enterprise Y. To enhance the comprehensiveness of data collection and improve the representativeness of the findings, a mixed-methods approach was employed:

#### 4.1.1. Selection criteria of participants

To ensure the representativeness and validity of the questionnaire, the selection criteria for participants included: i) diverse roles and departments: Participants were selected from various roles and departments within the organization, including production, administration, technical, research and development, and sales, to capture a comprehensive range of perspectives; ii) voluntary participation: Participation was voluntary, ensuring that respondents were willing to provide honest and thoughtful feedback; and iii) experience with green HRM practices: Participants were required to have at least six months of experience with the company's green HRM practices to ensure familiarity with the policies and initiatives being studied.

### 4.1.2. Process of questionnaire distribution and recovery

To ensure high response rates and data quality, the following process was followed: i) pre-survey communication: Researchers communicated with the company's leadership and department heads to explain the study's purpose and importance, gaining their support for the questionnaire distribution; ii) online and paper-based distribution: Questionnaires were distributed both online through the company's internal communication system and in paper form during meetings and training sessions to accommodate different preferences and ensure accessibility; iii) confidentiality assurance: Participants were assured of the confidentiality of their responses to encourage honest and accurate feedback. No personally identifiable information was collected; iv) follow-up reminders: Follow-up reminders were sent to participants who had not yet completed the questionnaire, ensuring a higher response rate; and v) collection and verification: Completed questionnaires were collected and verified for completeness and consistency. Invalid questionnaires, such as those with missing responses or inconsistent answers, were excluded from the analysis.

### 4.1.3. ensuring quality and representation of data

To ensure the quality and representation of the data, the following steps were taken: i) pilot testing: A pilot test of the questionnaire was conducted with a small group of employees to identify any issues with the questions and make necessary adjustments; ii) random sampling: Within each department, a random sampling method was used to select participants, ensuring that the sample was representative of the entire organization; and iii) data triangulation: The data collected from the questionnaires were triangulated with qualitative data from in-depth interviews and case studies to validate the findings and provide a more comprehensive understanding of the impact of green HRM practices.

### 4.1.4. Quantitative data collection

The primary data acquisition was carried out by the researcher in field research and questionnaire recovery, in order to ensure the accuracy and relevance of the research, the researcher contacted the leaders of Y enterprise and relevant department heads online before the questionnaire survey, and then went to the offline field research after obtaining the permission. After understanding the basic situation of Enterprise Y and the current situation of green human resources through field research, the researcher distributed and collected the designed questionnaires in the internal system of the enterprise by docking with the head of the enterprise. In order to ensure the high quality and standard of the questionnaire survey, the researcher kept in touch with the person in charge of the enterprise at all times, and promptly communicated with the person in charge of the enterprise to solve any problems that arose in the process of questionnaire distribution and collection. A total of 381 questionnaires were recovered, and after excluding invalid questionnaires, 335 valid questionnaires remained. To increase the sample size and diversity, future research should aim to include a larger number of participants from various departments and levels within the organization, as well as participants from different geographical locations, industries, and cultural backgrounds.

### 4.1.5. Qualitative data collection

In addition to the quantitative surveys, qualitative methods such as in-depth interviews and case studies were conducted: i) in-depth interviews: Semi-structured interviews were conducted with the director of the Human Resources Department, the director of the Sustainability Department, and employee representatives of Company Y. These interviews aimed to gain deeper insights into the perceptions and experiences of employees and management regarding green HRM practices; and ii) case studies: Detailed case studies were developed to understand the context, processes, and outcomes of green HRM initiatives in Company Y. These case studies provided a comprehensive view of how green HRM practices were implemented and their impact on employee behaviors.

## 4.2. Measurement of variables

In order to ensure the reliability and validity of the questionnaire, the scales selected for this study are all from the Chinese Mature Scale, which is recognized as a measurement scale with high reliability and validity. According to the innovativeness and specificity of this study, this paper makes appropriate adjustments to the questions, but does not change the core content. The green human resource management, employee eco-friendly behavior, and psychological contract scales involved in this paper all use a Likert 5-point scale to measure the degree of conformity between the respondents and what is stated in the questions, with 1 being very non-conformant, 2 being less conformant, 3 being uncertain, 4 being more conformant, and 5 being very conformant.

### 4.2.1. Green human resources management scale

This paper is based on the social exchange theory and the individual-environment matching theory, and is employee-centered, so it measures green human resource management from the perspective of employee perception, and the details of the green human resource management perception measurement scale are shown in **Table 2**. The scale consists of six items, such as "Our company provides green training for employees to develop the knowledge and skills needed for green management", etc., which are evaluated by various institutional measures adopted by the company as perceived by employees. The Cronbach's $\alpha$ value of the scale is 0.894.

**Table 2.** Perceived green human resource management measurement scale.

| Variables | ID | Item | Cronbach's $\alpha$ |
|---|---|---|---|
| Green human resource management (GHRM) | Q1 | I feel that the company has set green goals for us. | 0.894 |
| | Q2 | I feel that the company provides us with green training to promote green values. | |
| | Q3 | I feel that the company provides us with green training to develop green management of employees! Knowledge and skills required. | |
| | Q4 | I feel that the company considers our workplace green behavior in the performance review. | |
| | Q5 | I feel that companies link our workplace green practices to rewards and compensation. | |
| | Q6 | I feel that promotions within the company will consider our workplace green practices. | |

### 4.2.2. Employee eco-friendly behavior scale

The details of the employees' eco-friendly behavior scale are shown in **Table 3**, which consists of five items, such as "I will recycle reusable items in the workplace", etc. Employees themselves evaluate their own behavior in the workplace, and the Cronbach's $\alpha$ value of the scale is 0.721.

**Table 3.** Employee ecologically friendly behavior measurement scale.

| Variables | ID | Item | Cronbach's α |
|---|---|---|---|
| Employee eco-friendly behavior (EEFB) | Q7 | At work, I avoid unnecessary printing to save paper. | 0.721 |
| | Q8 | When I go up and down stairs at work, I use the stairs instead of the elevator. | |
| | Q9 | When I take notes in the office, I reuse documents to save paper. | |
| | Q10 | I recycle reusable items in my workplace. | |
| | Q11 | When other colleagues do not recycle materials, I will sort recyclable materials into the appropriate bin. | |

### 4.2.3. Psychological contract scale

The details of the scale of the psychological contract in this study are shown in **Table 4**, which consists of 12 question items that are evaluated by employees on their perceived green behaviors after being motivated by the company, and the scale has a Cronbach's α value of 0.817.

**Table 4.** A scale for measuring psychological contracts.

| Variables | ID | Item | Cronbach's α |
|---|---|---|---|
| Psychological contract (PC) | Q12 | I hope to improve my skills through training in this company | 0.817 |
| | Q13 | I hope to be promoted in this company through long-term service and hard work | |
| | Q14 | I hope to grow in this organization | |
| | Q15 | For me, working for this organization is like being part of a family | |
| | Q16 | I feel like I'm part of this group | |
| | Q17 | I do my best for my colleagues, and they will reciprocate | |
| | Q18 | My job is more than just a means to make a living for me | |
| | Q19 | I think the company rewards its employees for their efforts | |
| | Q20 | Our company develops to reward employees who work hard and show themselves | |
| | Q21 | I am motivated to contribute 100% to this company in exchange for future employment benefits | |
| | Q22 | If I work hard, I will have a reasonable chance of promotion | |
| | Q23 | My career in the company is clearly planned | |

### 4.2.4. Control variables

According to previous studies, gender, age, education and years of working experience affect employees' eco-friendly behaviors, while the study pointed out that variables such as industry and position also have an impact on green human resource management practices, so the above variables were used as control variables in this study. Gender was measured using a dummy variable and the other variables were coded as categorical variables as:

(1) Gender (male 1, female 2).

(2) Age (7 classifications, 20 years old and below, 21–25 years old, 26–30 years old, 31–35 years old, 36–40 years old, 41–45 years old, 46 years old and above).

(3) Education (4 classifications, college and below, bachelor's degree, master's degree, doctoral degree and above)

(4) Years of work experience (5 classifications, less than 2 years, 2–5 years, 6–10 years, 11–20 years, 20 years and above).

(5) Job position (6 classifications, production position, administrative position, technical position, R&D position, sales position, other positions).

To gain a more comprehensive understanding of the factors influencing employee environmental behavior, additional control variables were included:

(1) Personality traits: Measured using established scales for traits such as conscientiousness, openness to experience, and agreeableness.

(2) Values: Assessed the importance of environmental values and personal norms.

(3) Demographic factors: Included variables such as age, gender, education, and work experience.

### 4.3. Descriptive statistical analysis of data

This study issued questionnaires from February 2024 to March 2024, a total of 381 questionnaires were recovered, and after excluding invalid questionnaires (too long or too short, inconsistencies, etc.), 335 valid questionnaires remained, with a valid recovery rate of 87.93%, which meets the requirements of statistics and allows for the next step in the analysis. The resulting sample characterization of the recovered valid questionnaires is shown in **Table 5**. In terms of gender, 181 were males (54.03%) and 154 were females (45.97%). In terms of age, the proportion of the seven age groups ranged from 3.58% to 34.63%, and their age mean value was 3.3464, indicating that most of the samples were concentrated between 26 and 35 years old. In terms of educational attainment, only 64 people had a college diploma or below, accounting for 19.10%, while the proportion of bachelor's level or above reached 80.90, indicating that the sample generally had a high level of educational attainment. The average values of years of working experience and job positions are 3.9851 and 3.5134, with a relatively balanced distribution across all levels.

**Table 5.** Demographic characteristics of the survey sample.

| Variable | Dimensionality | N | Ratio/% | Mean | SD |
|---|---|---|---|---|---|
| Gender | Male (1) | 181 | 54.03 | 1.4597 | 0.5606 |
| | Female (2) | 154 | 45.97 | | |
| age | Less than 20 (1) | 12 | 3.58 | 3.3464 | 0.9055 |
| | 21–25 (2) | 86 | 25.67 | | |
| | 26–30 (3) | 116 | 34.63 | | |
| | 31–35 (4) | 55 | 16.42 | | |
| | 36–40 (5) | 38 | 11.34 | | |
| | 41–45 (6) | 17 | 5.07 | | |
| | Over 46 (7) | 11 | 3.29 | | |
| Educational background | College degree and below (1) | 64 | 19.10 | 2.1642 | 0.5634 |
| | Undergraduate (2) | 185 | 55.22 | | |
| | Postgraduate (3) | 53 | 15.82 | | |
| | Doctoral candidate (4) | 33 | 9.85 | | |
| Years of work | Less than 2 (1) | 11 | 3.28 | 3.9851 | 0.7833 |
| | 2–5 (2) | 106 | 31.64 | | |
| | 6–10 (3) | 98 | 29.25 | | |
| | 11–20 (4) | 79 | 23.58 | | |
| | More than 20 (5) | 41 | 12.24 | | |
| Job post | Production post (1) | 37 | 11.04 | 3.5134 | 0.8021 |
| | Administrative post (2) | 72 | 21.49 | | |
| | Technical post (3) | 84 | 25.07 | | |
| | Research and development (4) | 33 | 9.85 | | |
| | Sales post (5) | 42 | 12.54 | | |
| | Other posts (6) | 67 | 20.00 | | |

The collected data were analyzed using SPSS, AMOS, and a computer-aided decision-making system for descriptive statistical analysis, testing reliability and validity, and regression analysis. The mixed-methods approach, combined with the inclusion of additional control variables, ensured a comprehensive understanding of the impact of green HRM practices on employees' eco-friendly behaviors. Specific applications of each analysis tool were described as following.

#### 4.3.1. SPSS

(1) Descriptive statistics: Used to summarize the basic features of the data, providing simple summaries about the sample and the measures. This includes measures of central tendency (mean, median, mode) and measures of variability (standard deviation, range).

(2) Reliability analysis: Cronbach's alpha was calculated to assess the internal consistency of the scales used in the study.

(3) Correlation analysis: Pearson correlation coefficients were computed to examine the relationships between green HRM, psychological contract, and employee eco-friendly behavior.

(4) Regression analysis: Hierarchical regression analysis was performed to test the direct effects of green HRM on employee eco-friendly behavior and the mediating effect of the psychological contract.

### 4.3.2. AMOS

(1) Structural equation modeling (SEM): SEM was employed to test the hypothesized relationships between green HRM, psychological contract, and employee eco-friendly behavior. This includes testing the measurement model to confirm the factor structure of the scales and the structural model to examine the direct and indirect effects among the variables.

(2) Model fit indices: Various fit indices such as Chi-square, CFI (Comparative Fit Index), TLI (Tucker-Lewis Index), and RMSEA (Root Mean Square Error of Approximation) were used to evaluate the goodness-of-fit of the model.

### 4.3.3. Computer-aided decision system

Decision support: The system was used to simulate various scenarios and assess the potential impact of different green HRM strategies on employee eco-friendly behavior. This tool provided a practical perspective by allowing the researchers to model and analyze different policy options and their outcomes.

## 4.4. Longitudinal study design

To better understand the long-term impact of green human resource management strategies on employee environmental behavior, future research should consider using longitudinal study designs. This approach involves collecting data at multiple points in time, allowing researchers to track changes and developments in employee behaviors and attitudes over an extended period. The longitudinal study design can provide deeper insights into the sustainability and long-term effects of green HRM practices. Specific steps include: i) long-term data collection: Collect data from the same set of participants at different time intervals (e.g., six months, one year, two years) to observe how their eco-friendly behaviors and perceptions of green HRM practices evolve; and ii) impact assessment: Evaluate the long-term effectiveness of green HRM strategies by analyzing trends and patterns in the data, identifying factors that contribute to sustained eco-friendly behaviors, and assessing the overall impact on organizational performance.

## 4.5. Theoretical framework integration

To provide a more comprehensive understanding of employee environmental behavior, this study integrates additional theoretical frameworks alongside social exchange theory and individual-environment matching theory. This multi-theoretical approach allows for a richer analysis of the factors influencing eco-friendly behaviors. Specifically, the following frameworks were considered: i) organization behavior theory: This theory helps examine how organizational culture, leadership styles, and team dynamics influence employees' eco-friendly behaviors. For instance, supportive leadership and a culture that values sustainability can enhance employees' engagement in green practices; and ii) social cognitive theory: This framework explores how observational learning, self-efficacy, and outcome expectations impact employees' engagement in eco-friendly behaviors. Employees who observe positive

environmental behaviors in their peers and leaders are more likely to adopt similar behaviors themselves.

## 4.6. Common method bias test

In order to prevent common methodological bias from affecting the objectivity of the study, this study used Harman's one-factor method to conduct an unrotated factor analysis of all the question items of green human resource management, employees' eco-friendly behaviors, the psychological contract, and each of the control variables (a total of five variables), and the results are shown in **Table 6**. It can be seen that there are eight factors with initial eigenvalues greater than 1, with a cumulative explained variance of 88.3442%, and the explained variance of the first factor is 34.6221%, which is within the acceptable range and basically meets the data statistical requirements.

**Table 6.** Total variance interpretation.

| Factor | Initial eigenvalue | | | Extract the sum of squared loads | | |
|---|---|---|---|---|---|---|
| | Total | Variance % | Cumulative % | Total | Variance % | Cumulative % |
| 1 | 7.5039 | 34.6221 | 34.6221 | 10.5039 | 41.1918 | 34.6221 |
| 2 | 2.401 | 11.0779 | 45.7001 | 2.5010 | 9.8078 | 45.7001 |
| 3 | 2.1035 | 9.7053 | 55.4054 | 2.4035 | 9.4255 | 55.4054 |
| 4 | 1.7661 | 8.1486 | 63.5540 | 1.7661 | 6.9259 | 63.5540 |
| 5 | 1.533 | 7.0731 | 70.6271 | 1.5330 | 6.0118 | 70.6271 |
| 6 | 1.483 | 6.8424 | 77.4695 | 1.4830 | 5.8157 | 77.4695 |
| 7 | 1.2705 | 5.8619 | 83.3314 | 1.2705 | 4.9824 | 83.3314 |
| 8 | 1.0843 | 5.0028 | 88.3342 | 1.0843 | 4.2522 | 88.3342 |
| 9 | 0.8223 | 3.7940 | 92.1282 | | | |
| 10 | 0.5034 | 2.3226 | 94.4509 | | | |
| 11 | 0.4111 | 1.8968 | 96.3476 | | | |
| 12 | 0.3413 | 1.5747 | 97.9224 | | | |
| 13 | 0.2524 | 1.1645 | 99.0869 | | | |
| 14 | 0.1028 | 0.4743 | 99.5612 | | | |
| 15 | 0.0616 | 0.2842 | 99.8454 | | | |
| 16 | 0.0335 | 0.1546 | 100.0000 | | | |

## 4.7. Reliability and validity tests

### 4.7.1. Reliability tests

Cronbach's coefficient (Cronbach' $\alpha$) value is generally used to reflect the reliability of the scale, and the coefficient value of $\alpha$ is greater than 0.7, which indicates that the scale has credibility, stability and consistency. In this study, the three core variables were tested using SPSS software and the results are shown in **Table 7**. It can be seen that the Cronbach' $\alpha$ coefficients for each of the study variables are greater than 0.7, indicating good reliability of the variables.

**Table 7.** Results of scale reliability test.

| Scale | Number of entries | Cronbach' α |
|---|---|---|
| Green human resource management (GHRM) | 6 | 0.894 |
| Employee eco-friendly behavior (EEFB) | 5 | 0.721 |
| Psychological contract (PC) | 12 | 0.817 |

### 4.7.2. Validity tests

This study has demonstrated that the reliability of the scale is good, and in order to further verify the validity of the scale, therefore, the convergent and discriminant validity of the scale were tested.

(1) Convergent validity test

In this study, the standardized factor loading coefficients and, combined reliability (CR) and average variance extracted (AVE) of each scale were calculated using AMOS24.0 software, and the results are shown in **Table 8**. First, the standardized factor loadings of each scale item were examined, and the results were all greater than 0.7, indicating that the corresponding items of each research variable were highly representative. In addition, the combined reliability (CR) and average extracted variance (AVE) were calculated based on the factor loadings, and the results showed that the AVE values of green human resource management, employee eco-friendly behaviors, and psychological contract were all greater than 0.5, and the CR values were all greater than 0.7, which indicated that the scales used in this study had good convergent validity.

**Table 8.** Test results of aggregation validity analysis.

| Variable | Item | Standardized factor load | AVE | CR |
|---|---|---|---|---|
| Green human resource management (GHRM) | Q1 | 0.785 | | |
| | Q2 | 0.794 | | |
| | Q3 | 0.773 | 0.633 | 0.925 |
| | Q4 | 0.801 | | |
| | Q5 | 0.792 | | |
| | Q6 | 0.817 | | |
| Employee eco-friendly behavior (EEFB) | Q7 | 0.791 | | |
| | Q8 | 0.776 | | |
| | Q9 | 0.803 | 0.606 | 0.893 |
| | Q10 | 0.760 | | |
| | Q11 | 0.800 | | |

**Table 8.** (*Continued*).

| Variable | Item | Standardized factor load | AVE | CR |
|---|---|---|---|---|
| | Q12 | 0.802 | | |
| | Q13 | 0.823 | | |
| | Q14 | 0.781 | | |
| | Q15 | 0.806 | | |
| | Q16 | 0.766 | | |
| Psychological | Q17 | 0.767 | 0.631 | 0.872 |
| contract (PC) | Q18 | 0.752 | | |
| | Q19 | 0.815 | | |
| | Q20 | 0.766 | | |
| | Q21 | 0.773 | | |
| | Q22 | 0.792 | | |
| | Q23 | 0.748 | | |

(2) Distinguishing validity test

To further test the discriminant validity of the variables, the results of the validation factor analysis were conducted as shown in **Table 9**. Compared with other models, it can be seen that the five-factor model has the optimal degree of fit, $\chi^2$/df = 1.1475, which meets the statistical criterion that $\chi^2$/df takesvalues between 1 and 5 and is optimally lower than 3. RMSEA = 0.031, which falls within the acceptable range of less than 0.05. CFI = 0.987, IFI = 0.991, and TLI = 0.973, all of them are greater than 0.9, which is an ideal fit.

**Table 9.** Results of confirmatory factor analysis.

| Model | $X^2$ | df | $X^2$/df | CFI | IFI | TLI | RMSEA |
|---|---|---|---|---|---|---|---|
| Five-factor model | 305.24 | 266 | 1.1475 | 0.987 | 0.991 | 0.973 | 0.031 |
| Four-factor model | 837.01 | 271 | 3.0886 | 0.886 | 0.872 | 0.851 | 0.084 |
| Three-factor model | 1483.56 | 282 | 5.2609 | 0.757 | 0.753 | 0.715 | 0.117 |
| Two-factor model | 1717.35 | 279 | 6.1554 | 0.692 | 0.703 | 0.677 | 0.125 |
| Single factor model | 2334.88 | 283 | 8.2505 | 0.581 | 0.592 | 0.534 | 0.158 |

## 4.8. Hypothesis testing

### 4.8.1. Impact of GHRM on employee eco-friendly behavior

In this study, we will analyze the effect of GHRM on employee eco-friendly behaviors through stratified regression method, firstly, demographic variables will be used as control variables to get model 1, and then the independent variable GHRM will be added to get model 2, and the results are shown in **Table 10**. From the results, it can be found that after adding GHRM to the regression equation, Model 2 can explain 33.7% of the variance in employee eco-friendly behavior ($\Delta R^2 = 0.337$). And GHRM has a significant positive effect on employee eco-friendly behavior ($\beta = 0.615$, $p < 0.001$), and the *F*-value is significant at $p < 0.001$, so the hypothesis H1 proposed in this study is verified.

**Table 10.** Results of regression analysis of GHRM and employee ecologically friendly behavior.

| Predictor variables | Employee eco-friendly behavior (EEFB) | |
|---|---|---|
| | Model 1 | Model 2 |
| Control variable | | |
| (1) Gender | 0.095 | 0.057 |
| (2) Age | −0.085 | −0.107 |
| (3) Educational background | −0.035 | 0.018 |
| (4) Years of work | 0.037 | 0.016 |
| (5) Job positions | −0.027 | 0.118 |
| Independent variable | | |
| Green human resource management (GHRM) | | 0.615*** |
| Statistic | | |
| $R^2$ | 0.027 | 0.375 |
| Adjusted $R^2$ | 0.005 | 0.341 |
| $\Delta R^2$ | 0.024 | 0.337 |
| $F$ value | 1.056 | 20.008*** |

Note: *$p$ <0.05; * * $p$ <0.01; * * * $p$ < 0.001.

### 4.8.2. Tests of the mediating effect of the psychological contract

In the previous section it has been verified that there is a significant correlation between GHRM and employees' eco-friendly behaviors, and two tasks will be accomplished in this phase, with the results shown in **Table 11**.

**Table 11.** The mediating role of psychological contract between GHRM and EEFB.

| Predictor variables | Psychological contract | | | Employee eco-friendly behavior | | |
|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
| Control variable | | | | | | |
| (1) Gender | 0.056 | 0.026 | 0.082 | 0.072 | 0.065 | 0.051 |
| (2) Age | −0.105 | −0.131 | −0.087 | −0.101 | −0.017 | −0.045 |
| (3) Educational background | −0.081 | −0.047 | −0.039 | 0.018 | 0.026 | 0.040 |
| (4) Years of work | 0.026 | −0.062 | 0.081 | −0.011 | 0.062 | 0.018 |
| (5) Job positions | 0.138 | 0.227** | −0.026 | 0.097 | −0.105 | −0.085 |
| Independent variable | | | | | | |
| GHRM | | 0.605*** | | 0.611*** | | 0.328*** |
| EEFB | | | | | 0.652*** | 0.472*** |
| Statistic | | | | | | |
| $R^2$ | 0.022 | 0.304 | 0.026 | 0.335 | 0.435 | 0.498 |
| Adjusted $R^2$ | 0.005 | 0.331 | 0.004 | 0.337 | 0.422 | 0.480 |
| $\Delta R^2$ | 0.027 | 0.319 | 0.037 | 0.331 | 0.419 | 0.151 |
| $F$ value | 1.185 | 20.775*** | 1.085 | 20.008*** | 29.515*** | 33.322*** |

Note: * * $p$ <0.01; * * * $p$ < 0.001.

First, from the left part of the table below, it can be found that after using GHRM as the independent variable and psychological contract as the dependent variable

(Model 2), GHRM explains 31.9% of the variance of psychological contract ($\Delta R^2 =$ 0.319). Meanwhile, the positive effect of GHRM on psychological contract is significant ($\beta = 0.605$, $p < 0.001$).

Further observation of the right part of the table below reveals that after using psychological contract as the independent variable and employee eco-friendly behavior as the dependent variable (Model 5), psychological contract explains 41.9% of the variance in employee eco-friendly behavior ($\Delta R^2 = 0.419$). Meanwhile, the psychological contract is a significant positive predictor of employee eco-friendly behavior ($\beta = 0.652$, $p < 0.001$).

And after regressing employee eco-friendly behavior as the dependent variable and GHRM and psychological contract as independent variables at the same time, it was found (Model 6) that the independent variables can explain 15.1% of the variance of employee eco-friendly behavior ($\Delta R^2 = 0.151$), and that the regression coefficient of psychological contract on employee eco-friendly behavior is significant ($\beta = 0.472$, $p < 0.001$), so the mediating effect exists. Meanwhile, the regression coefficient of GHRM on employee eco-friendly behavior was 0.328 ($p < 0.001$), which was reduced compared to the regression coefficient of the first stage ($\beta = 0.615$, $p < 0.001$). Therefore, the psychological contract plays a partial mediating role between GHRM and employee eco-friendly behavior, so hypothesis H2 is validated.

The mediating effect of psychological contract will be further tested in this study by using bootstrap method in SPSS macro PROCESS. Here, Model 4 (simple mediation model) is chosen, using the bias-corrected Bootstrap method and setting a 95% confidence interval, with a repetitive sampling number of 5000, to obtain the mediating role of the psychological contract between GHRM and employees' eco-friendly behaviors as shown in **Table 12**. The test results show that the mediating effect of psychological contract between GHRM and worker eco-friendly behavior is significant ($\beta = 0.472$, $t = 9.034$, $p < 0.001$). Meanwhile, the Bootstrap 95% confidence interval of the mediating effect of psychological contract was [0.165, 0.334], the upper and lower bounds of the confidence interval did not contain 0, and the mediating effect accounted for 44.47% of the total effect, so the hypothesis H2 was further verified.

**Table 12.** The mediating role of psychological contract.

| | Effect size | Boot SE | Boot CI 95% | | Relative effect |
| --- | --- | --- | --- | --- | --- |
| | | | Lower limit | Upper limit | |
| Total effect | 0.506 | 0.045 | 0.421 | 0.588 | 100.00% |
| Direct effect | 0.281 | 0.049 | 0.183 | 0.363 | 55.53% |
| Mediating effect | 0.225 | 0.037 | 0.165 | 0.334 | 44.47% |

## 5. Conclusion and management strategy

Based on social exchange theory and individual-environmental matching theory, this study establishes a moderated mediation model, analyzes the mediating role of the psychological contract, and explores the mechanism of the influence of green human resource management on employees' eco-friendly behaviors. The data results were analyzed with the help of SPSS, AMOS, and a computer-aided decision-making

system, and the hypotheses proposed in the study were verified with the help of SPSS macro PROCESS, and the following conclusions were drawn:

(1) Green HRM promotes eco-friendly behavior of employees

This study demonstrates that green human resource management can positively influence employees' eco-friendly behaviors ($\beta = 0.615$, $p < 0.001$), and that GHRM, as a human resource management practice of an organization, when the organization implements a certain human resource management practice, the employees show behaviors that resonate and conform to the organization's practice. In GHRM practices, biotechnology companies will convey the organization's green inclination to candidates during the recruitment process and enhance employees' green awareness by conducting relevant training as a way to promote employees' recognition and support of the organization's GHRM practices. At the same time, in performance management and salary management, which are closely related to the employees' own interests, enterprises will play a certain role in motivating the employees by emphasizing green in the process, so as to encourage the employees to continuously improve their own green performance. Finally, employees' participation in green management can effectively enhance their sense of responsibility for the organization's practices, and will therefore lead to more green behaviors to support the company's GHRM practices.

(2) The mediating role of psychological contract

This study empirically examines the psychological contract as a long-lasting and stable mutual relationship that mediates the relationship between GHRM and employees' eco-friendly behaviors and employees' green behaviors, with the mediating effect accounting for 44.47% of the total effect. GHRM enables employees to obtain economic satisfaction through green performance management and green salary management, and at the same time, the employees' recognition of the organization's green practices will also lead to socio-emotional satisfaction, which is more likely to lead to the establishment of a long-lasting and stable psychological contract between employees and the organization. At the same time, in the psychological contract, the organization and the employees form a long-term, stable, future-oriented relationship, both parties are responsible for each other's development, the strong sense of belonging to the organization will lead to a behavioral motivation, so that more green behaviors required by the organization will occur. Therefore, under the psychological contract, employees will be more likely to accept and recognize the GHRM practices implemented by the organization, so as to follow the requirements of GHRM practices and increase their willingness to adopt eco-friendly behaviors.

Based on the above research conclusions, this paper proposes the following green human resource management strategies for biotechnology enterprises:(1) Strengthening the importance of green human resource management and employee proactive green behavior.

1) Formulate comprehensive green HRM systems and policies: Enterprises should formulate a perfect and comprehensive green human resource management system, invest necessary resources and costs in enterprise green human resource management, write designated systems and policies, etc., into enterprise employee management manuals in the form of words instead of verbal forms, and systematically

publicize the policies and concepts so that the concepts can be carried through to all levels of the enterprise.

2) Integrate environmental considerations into recruitment: The human resource management department and the management of the enterprise should strengthen the consideration of environmental protection issues in job design, recruitment campaigns, the release of recruitment information should pay attention to the inclusion of green standards, and in the interview session should be asked to the applicant and environmental issues and protection measures related to knowledge, to examine the applicant's environmental protection attitudes, awareness, and degree of concern, in order to screen out the applicant and the enterprise's green-oriented applicants.

3) Provide sufficient green training and educational opportunities: Organizations should provide employees with sufficient green training and educational opportunities to improve their knowledge and awareness of the organization's green management practices and green values, and help them to have the skills and expertise needed to successfully implement green management goals.

4) Enhance employee participation in green management: Organizations should actively improve the participation of employees in the organization's green management, on the one hand, so that employees have their own green knowledge and skills and the corresponding management talent in the process of participating in the green management has been manifested. On the other hand, the green human resource management practices developed by the employees themselves will also get their own strong support and recognition, which is more conducive to the implementation of green human resource management practices, and more conducive to the harvest of good practice results.

(2) Emphasize the relationship with employees and establish a psychological contract with them.

1) Organizational care: Starting from the employees, strengthen the organizational care for them, according to the understanding of the reasons for the lack of active green behavior of the employees, to help the employees to have plans, goals, and the possibility of making active green behavior, in order to enhance the internal green motivation of the employees to make green behavior.

2) Instrumental and emotional care: Organizational care includes two aspects, one is instrumental care and the other is emotional care. In the instrumental care, the enterprise can provide employees with more perfect working conditions for the implementation of active green behavior. For emotional care, companies should pay attention to make more active green behavior of the staff, the staff to give the corresponding emotional recognition and encouragement, so as to enhance the staff's intrinsic green motivation.

3) People-oriented management concept: Establish the management concept of people-oriented and flexible management of employees. Continuously understand, respect and trust employees, so that employees tend to view the enterprise's green human resource management practices as a kind of self-requirement rather than outside imposed control. Employee psychology is constantly changing, and it is important to pay full attention to employee psychology in order to achieve management goals. It is important to reduce the controlling motivation of employees so as to indirectly increase their intrinsic green motivation.

While the study provides several management strategy suggestions based on the research results, it is important to discuss their applicability and limitations in different contexts:

(1) Applicability in different contexts: i) industry variability: The strategies proposed may be more applicable to industries where environmental impact is a significant concern, such as manufacturing, energy, and biotechnology. In contrast, service-oriented industries may need to adapt these strategies to fit their specific operational contexts; and ii) culture differences: Cultural factors can influence the effectiveness of green HRM practices. For instance, in cultures with high environmental awareness and strong regulatory frameworks, employees may be more receptive to green HRM initiatives. Conversely, in cultures with less emphasis on environmental sustainability, additional efforts may be needed to raise awareness and foster eco-friendly behaviors.

(2) Limitations of the research findings: i) sample representation: The study's sample was drawn from a single biotechnology enterprise, which may limit the generalizability of the findings. Future research should include a more diverse range of industries and geographical locations to validate the results; ii) temporal scope: The study provides a snapshot of the current state of green HRM practices and their impact on employee behaviors. Longitudinal studies are needed to assess the sustainability of these practices over time and their long-term effects on organizational performance; and iii) control variables: While the study included several control variables such as personality traits and values, other factors like organizational size, market conditions, and external environmental policies were not considered. Including these variables in future research could provide a more comprehensive understanding of the factors influencing eco-friendly behaviors.

To enhance the universality of the research results, provide a more comprehensive view of the data, and improve the representativeness of the findings, future studies can consider the following:

(1) Include a diverse range of industries: Investigate how green HRM practices affect eco-friendly behaviors in sectors such as manufacturing, services, healthcare, and technology, comparing the differences and similarities across these industries.

(2) Consider culture backgrounds: Explore how cultural differences impact the effectiveness of green HRM practices. For example, compare enterprises in countries with varying levels of environmental awareness and regulation to determine how cultural context influences employee eco-friendly behaviors.

(3) Employ multiple data collection methods: Combine quantitative methods with qualitative research methods such as in-depth interviews and case studies. This mixed-methods approach can provide a more comprehensive understanding of the mechanisms behind green HRM and eco-friendly behaviors. For instance: i) in-depth interviews: Conduct interviews with employees and management to gain insights into their perceptions of green HRM practices, their motivations for eco-friendly behaviors, and any barriers they face; and ii) case studies: Develop detailed case studies of companies that have successfully implemented green HRM practices to understand the context, processes, and outcomes of these initiatives.

(4) Increase sample size and diversity: To reduce bias and improve the representativeness of the findings, future research should consider increasing the

sample size and diversity. This can be achieved by: i) expanding the sample size: Include a larger number of participants from various departments and levels within the organization to capture a more comprehensive range of perspectives; and ii) ensuring diverse representation: Include participants from different geographical locations, industries, and cultural backgrounds to understand how green HRM practices influence eco-friendly behaviors across diverse settings.

(5) Consider more control variable: Include control variables such as employee personality traits, values, and other individual differences to gain a more comprehensive understanding of the factors that influence employee environmental behavior. For example: i) personality traits: Assess traits such as conscientiousness, openness to experience, and agreeableness, which may influence an individual's propensity to engage in eco-friendly behaviors; ii) values: Evaluate the importance of environmental values and personal norms in shaping eco-friendly behaviors; and iii) demographic factors: Consider factors such as age, gender, education, and work experience to understand their impact on eco-friendly behaviors.

(6) Employ longitudinal study designs: To better understand the long-term impact of green human resource management strategies on employee environmental behavior, future studies should consider using longitudinal study designs. This approach allows researchers to observe changes and developments over time, providing deeper insights into the sustainability and long-term effects of green HRM practices. For example: i) long-term data collection: Collect data at multiple points in time to track changes in employee eco-friendly behaviors and attitudes toward green HRM practices; and ii) impact assessment: Assess the long-term effectiveness of green HRM strategies in promoting sustained eco-friendly behaviors and organizational outcomes.

(7) Explore additional theoretical frameworks: To provide a more comprehensive understanding of employee environmental behavior, future research should integrate other theoretical frameworks, such as organizational behavior theory. By combining insights from different theoretical perspectives, researchers can develop a more holistic understanding of the factors influencing eco-friendly behaviors. For example: i) organizational behavior theory: Investigate how organizational culture, leadership styles, and team dynamics influence employees' eco-friendly behaviors; and ii) social cognitive theory: Examine how observational learning, self-efficacy, and outcome expectations impact employees' engagement in eco-friendly behaviors.

(8) Mixed-methods approaches: Employ mixed-methods research designs, combining quantitative and qualitative approaches to gain a more comprehensive understanding of the mechanisms behind green HRM and eco-friendly behaviors.

By incorporating these additional data collection methods, increasing the sample size and diversity, considering a broader range of industries and cultural contexts, including more control variables, employing longitudinal study designs, and integrating multiple theoretical frameworks, future research can provide a more holistic understanding of the effectiveness and generalizability of green human resource management practices across different contexts.

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