The Impact of Enterprise Organizational Culture on Employee Engagement in Prosocial Activities: Based on Structural Equation Model and Artificial Intelligence Algorithm Model

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Abstract. This study combines theories from psychology and artificial intelligence algorithms to explore how employees' psychology and behavior influence their engagement in social welfare activities. Through a questionnaire survey of 300 employees in companies, it was found that a supportive organizational culture has a significant positive impact on employees' engagement in social welfare activities. Cognitive empathy has a complete mediating effect in this association, while a bureaucratic organizational culture has a moderating effect. Furthermore, this research utilizes the artificial intelligence algorithm which is the *XGBoost* algorithm, to perform additional analysis on the influence of demographic variables and questionnaire items on employees' involvement in social welfare initiatives. The training set consists of 80% of the data, which is used to build the algorithm model. The remaining 20% of the data is then used for prediction. The results demonstrate a predictive accuracy rate of 95%. Furthermore, the XGBoost algorithm can analyze the questionnaire items and demographic variables to determine the importance ranking of their impact on employees' social welfare activities. This allows us to timely predict and adjust employees' social welfare activities based on the importance of these factors.

Keywords: Artificial Intelligence Algorithms, XGBoost, Cognitive empathy, Participation in prosocial activities

1   Introduction

Previous research on the factors affecting prosocial behavior has focused on personality traits [1] emotions [2] and biological factors [3] at the individual level; At the organizational level, more attention is paid to human factors (such as colleagues and leaders) and work factors (such as job design and performance) [4], while less emphasis is placed on exploring the role of organizational culture factors. However,

in reality, organizational culture, as a more macro atmosphere and social context [5], is likely to have a far greater impact on employees' prosocial behavior than specific individuals and events. Therefore, exploring the influence and mechanism of organizational culture (including supportive culture and bureaucratic culture; [6]) on employees' prosocial activities has important theoretical and practical value.

In the actual organizational environment of enterprises, there is more coexistence and interaction between multiple subcultures. Previous studies have frequently cited three cultural dimensions: supportive culture, bureaucratic culture, and innovative culture [6]. Supportive organizational culture focuses on cultivating a spirit of collaboration and mutual assistance, creating a trusting and relaxed work atmosphere. This allows employees to care about their colleagues, participate in collective activities, conserve company resources, and makes interpersonal harmony and other organizational citizenship behaviors more likely to occur. Bureaucratic organizational culture is rule-oriented, with clear hierarchy and strict operation process control, and interpersonal behaviors such as mutual assistance and communication rarely occur due to their minor significance. Behaviors such as compliance with internal and external regulations and improving company image occur more frequently because they conform to the corporate culture orientation and management needs.

Organizational culture, as a shared cognition formed within the corporate collective, influences employees' behavior within the organization, and it also generates spillover effects on their families and society at large [7]. The culture not only impacts employees' prosocial behavior, manifesting as organizational citizenship behavior within the enterprise, but also extends its influence to activities at the social level. This transition is the result of more essential and internalized psychological processes at work. According to previous studies, in an organization with a strong supportive atmosphere, employees also have a higher level of empathy [8, 9]. Meanwhile, empathy is significantly positively correlated with prosocial behavior [10], cognitive empathy [11], which is the foundation for the occurrence of individual prosocial behavior [12].

On the other hand, the bureaucratic organizational culture, which coexists with the supportive organizational culture, is characterized by being cautious, controllable, directive, and each performing its own duties in the process [13]. This study explores the impact of organizational culture on employee prosocial activities, and further analyzes the mediating and moderating effects of cognitive empathy and bureaucratic organizational culture.

Conventional psychological research methods rely on tools such as statistics and experiments, utilizing structural equation modeling to explore internal psychological principles and relationships among variables. However, these methods face challenges in quantitatively measuring the degree of mutual influence among factors and yielding robust prediction outcomes. Among various artificial intelligence algorithms, XGBoost (eXtreme Gradient Boosting) has gained increasing popularity and achieved success in Kaggle competitions. The core idea of the XGBoost (eXtreme Gradient Boosting) algorithm is to build a powerful predictive model by ensembling multiple weak learners, typically decision trees. It has been optimized and improved upon the original Gradient Boosting algorithm.. This ensemble learning technique, which integrates

multiple decision trees' outcomes, effectively captures logical relationships within the data and enhances prediction accuracy. Furthermore, it is worth noting that this paper has amassed over 3300 citations (according to Google Scholar, March 2, 2024)[14]. XGBoost's performance and accuracy have been extensively tested and validated in various real-world applications. For instance, it has been successfully applied in sentiment analysis [15], which involves analyzing and understanding emotions, opinions, and attitudes expressed in text data. XGBoost has demonstrated its capability to effectively classify and analyze sentiment, allowing for a deeper understanding of people's reactions and opinions.

Additionally, XGBoost has also been utilized in depression prediction [16], aiding in the early identification and prediction of depressive symptoms or disorders. By leveraging its advanced algorithms and ensemble learning techniques, XGBoost can analyze various factors and indicators to provide accurate predictions regarding an individual's risk or likelihood of experiencing depression.These practical implementations highlight the robustness and versatility of XGBoost as an efficient tool in diverse domains, showcasing its ability to tackle complex problems and deliver reliable results.

2   Research Methods

2.1   Sample

This study employed a questionnaire survey method, utilizing an online questionnaire data platform to distribute surveys and collect data nationwide. The survey targeted employees from various industry organizations, resulting in a total of 300 valid responses.

2.2   Measurements

Supportive Organizational Culture: The measurement of supportive organizational culture was developed based on the organizational culture scale from [13] adapted by [17]. A total of 5 items. The Cronbach's α value for the items in this study was 0.64.Furthermore, the study demonstrates good structural validity（$\chi^2/df = 1.48$, RMSEA = 0.03, CFI = 0.94, NFI = 0.89, IFI = 0.95）。

Bureaucratic Organizational Culture: Combining the bureaucratic organizational culture dimension from the corporate culture scale by [17] and the uncertainty avoidance scale [18] more aligned with organizational context, a set of 6 items was measured on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree). The Cronbach's α value for the items in this study was 0.80.Furthermore, the study demonstrates good structural validity（$\chi^2/df = 2.13$, RMSEA = 0.05, CFI = 0.96, NFI = 0.92, IFI = 0.96）。

Cognitive Empathy: A synthesis of the perspective-taking dimension from the Chinese version of the Interpersonal Reactivity Index-C [19] and the revisions to the Chinese version of the Questionnaire of Cognitive and Affective Empathy by [20]

was undertaken. Finally, a set of 4 items was measured. The Cronbach's α value for the items in this study was 0.63.Furthermore, the study demonstrates good structural validity (χ^2/df = 2.12, RMSEA = 0.05, CFI = 0.96, NFI = 0.92, IFI = 0.96).

Employee Participation in Prosocial Activities: Adapting from the self-assessment scale developed by [21] for Chinese participation in prosocial behaviors, a total of 7 items were measured. The Cronbach's α value for the items in this study was 0.87.Furthermore, the study demonstrates good structural validity (χ^2/df = 2.03, RMSEA = 0.05, CFI = 0.97, NFI = 0.93, IFI = 0.95).

Control Variables: In previous research, organizational fairness [22], and power motivation [23] have been found to be correlated with prosocial behavior. Therefore, this study controlled for employees' sense of organizational fairness and power motivation.

Organizational Fairness: Based on the translation of the organizational fairness scale items from [24] by [25], responses were measured on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree).

Power Motivation: Referring to [25] Chinese translation of [26] Power Motive Scale, a total of 3 items were measured. The Cronbach's α value for the items in this study was 0.66.

In this study, the employee participation in prosocial behavior was divided into three groups based on the average score of the original scale. Specifically, there are: (1) low employee participation in prosocial activities; (2) medium employee participation in prosocial activities; and (3) high employee participation in prosocial activities. In this study, the random sampling function from the SKlearn library was employed to randomly partition the data. Specifically, 80% of the data was randomly selected as the training set, while the remaining 20% was assigned as the test set. This random partitioning ensures that both sets are representative of the overall dataset and allows for unbiased evaluation of the model's performance on unseen data. In order to timely predict the employee participation in prosocial behavior, this study used demographic variables, supportive organizational culture, bureaucratic organizational culture, cognitive empathy, organizational justice, and power motivation as independent variables, and used the XGBoost algorithm to build a model to predict employee participation in prosocial activities.

3   Data Analysis and Results

3.1   Traditional data analysis

Descriptive Statistics and Correlation Analysis
The means, standard deviations, and correlation coefficients for each variable are presented in Table 1.

Table 1. Descriptive Statistics and Correlation Analysis of Main Study Variables

Variable	1	2	3	4	5	6	7	8	9	10
1.Gender										

Variable	1	2	3	4	5	6	7	8	9	10
2.Age	-0.04									
3.Edu	0.16**	0.06								
4. SC	-0.08	0.02	-0.05							
5. CE	-0.05	0.05	0.07	0.55**						
6. BC	-0.07	-0.01	0	-0.17**	-0.1					
7. DF	-0.13*	0.08	0.07	0.57**	0.33**	-0.06				
8. PF	-0.02	0.01	0.05	0.58**	0.41**	-0.11	0.24**			
9. PM	-0.13*	-0.04	0	0.21**	0.11	0.14*	0.13*	0.24*		
10.PSB	-0.09	0.05	0.1	0.40**	0.30**	-0.19**	0.35**	0.31**	0.19**	
M	-	2.47	3.23	4.35	4.23	3.64	4.19	4.31	3.46	3.02
SD	-	0.65	0.49	0.45	0.54	0.74	0.68	0.74	0.78	0.81

Note: SC stands for supportive organizational culture, CE stands for cognitive empathy, BC stands for bureaucratic organizational culture, DF stands for distribution fairness, PF stands for procedure fairness, PM stands for power motivation, PSB stands for Employee participation in prosocial activities; * denotes $p<0.05$, ** denotes $p<0.01$.

From Table 1, it is evident that Supportive Organizational Culture is significantly positively correlated with Employee Participation in Prosocial Activities (r = 0.40, p < 0.01). Cognitive Empathy is significantly positively correlated with Supportive Organizational Culture (r = 0.55, p < 0.01) and Employee Participation in Prosocial Activities (r = 0.30, p < 0.01). Bureaucratic Organizational Culture is significantly negatively correlated with Employee Participation in prosocial Activities (r = -0.19, p < 0.01).

Structural Equation Modeling

Following Hayes' Bootstrap method [27], the study's moderated mediation hypotheses will be tested. The analysis results showed that the moderating mediating effects of bureaucratic organizational culture and cognitive empathy were established in the influence of supportive organizational culture on employee participation in prosocial activities (see Figure 1).
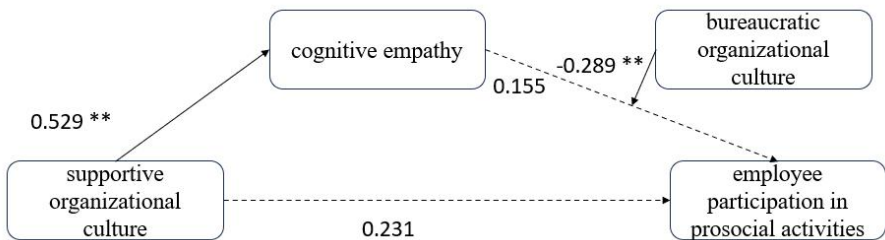
Fig. 1. Results of the Moderated Mediation Model

Note: The figures in the diagram are reported as unstandardized coefficients. Solid lines represent significant path coefficients, while dashed lines represent non-significant path coefficients. For simplicity, path coefficients of control variables have been omitted. * indicate p < 0.05, ** indicates p < 0.01.

Specifically, the indirect effect of Supportive Organizational Culture on Employee Participation in Prosocial Activities through Cognitive Empathy is significant, since the confidence interval excludes zero (Effect = -0.153, SE = 0.076, 95% CI = [-0.314, -0.017]). This suggests that Cognitive Empathy mediates the relationship between Supportive Organizational Culture and Employee Participation in Prosocial Activities. Furthermore, after controlling for the mediating variable of Cognitive Empathy, the direct impact of Supportive Organizational Culture, as the independent variable, on Employee Participation in Prosocial Activities, the dependent variable, is not significant at the average level of Bureaucratic Organizational Culture. The confidence interval includes zero (Effect = 0.231, SE = 0.144, p = 0.110, 95% CI = [-0.053, 0.515]). Based on the significant analysis results mentioned above regarding the indirect effect of cognitive empathy, it can be concluded that cognitive empathy fully mediates the relationship between supportive organizational culture and employee participation in prosocial activities.

Simultaneously, Bureaucratic Organizational Culture exerts a significant negative moderating effect in the relationship between Cognitive Empathy and Employee Participation in Prosocial Activities (Coeff = -0.289, SE = 0.121, p = 0.017, 95% CI = [-0.527, -0.052]).

The moderating effect of Bureaucratic Organizational Culture are shown in Fig. 2.
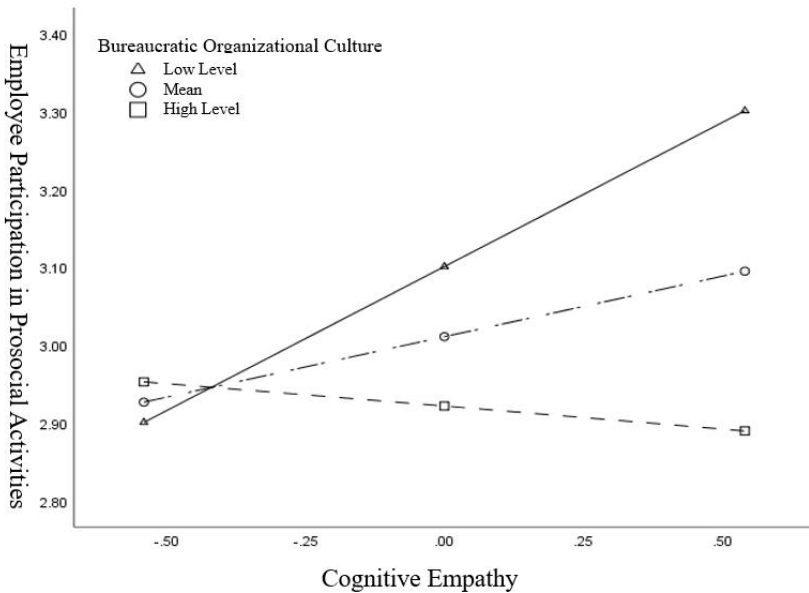
Fig. 2. Moderating Effect of Bureaucratic Organizational Culture on the Relationship between Cognitive Empathy and Employee Participation in Prosocial Activities

From the above figure, it can be observed that at lower levels of bureaucratic organizational culture, the positive influence of cognitive empathy on employee participation in prosocial activities is significant (Effect = 0.370, p = 0.005). As the level of bureaucratic organizational culture increases, the impact of cognitive empathy on employee participation in prosocial activities gradually weakens until it disappears (Effect = -0.059, p = 0.641).

3.2   XGBoost algorithm model

The demographic variables included: occupation, age , gender, job, and educational attainment. The questionnaire consisted of supportive organizational culture, bureaucratic organizational culture, cognitive empathy, organizational justice, and power motivation. The dependent variable was employee participation in prosocial activities. In the original algorithm model, we converted all the data into numerical variables and then used XGBoost to build the algorithm model.

Model Parameter Freezing

In the construction of XGBoost models, the objective and scoring are set to reg:squarederror and neg_mean_squared_error, respectively, because the dependent variable is a continuous variable. This means that the mean squared error is used as the objective function and evaluation metric. The booster uses the commonly used gbtree, which predicts by iteratively training a series of decision trees. This decision tree-based model can handle a variety of data types and has strong fitting and expressive capabilities.

Model Parameter Grid Search

In the design of model hyperparameters, we used the GridSearchCV method of sklearn.model_selection to perform grid search. The parameter list of our XGBOOST model is as follows: param_grid = {'max_depth': [10, 20, 30], 'learning_rate': [0.1, 0.05, 0.01], 'n_estimators': [80, 100, 200, 300, 400], 'subsample': [0.6, 0.7, 0.8], 'colsample_bytree': [0.6, 0.7, 0.8], 'min_child_weight': [0.2, 0.3, 0.4], 'eta': [0.0001, 0.0005, 0.001]}. After all grid training, we finally got best_params as: {'colsample_bytree': 0.7, 'eta': 0.0001, 'learning_rate': 0.1, 'max_depth': 20, 'min_child_weight': 0.2, 'n_estimators': 100, 'subsample': 0.7}.

Model Results

We evaluated the predictions of y using the mean_squared_error method, and the RMSE value was 0.043. Due to the limited interpretability of continuous variables with mean_squared_error, we further categorized the original dependent variable into three groups: the low engagement group, the medium engagement group, and the high engagement group in social welfare activities. In this study, values below 1.571 were classified as the low engagement group, values above 2.428 were classified as the high engagement group, and others were classified as the medium engagement group.

After training the model, the accuracy of predictions on the test set was 95%. Out of a total of 60 predictions, 57 were correct. The Table.2 shows theconfusion matrix of predicted results and actual results. However, there were three instances where the model made prediction errors.: one instance where the actual engagement level was low but predicted as medium, and one instance where the actual engagement level was medium but predicted as high. However, the model accurately predicted all instances of the high engagement group.

Table 2. Confusion Matrix of Predicted Results

	Predicted Low	Predicted Medium	Predicted High
True Low	20	1	0
True Medium	0	21	2
True High	0	0	16

Feature Importance

This study employed Shapley values toquantify the importance of different influencing factors. Shapley values were proposed by Nobel laureate Lloyd Shapley in 1953 and are primarily used to measure the relative contributions of various predictor variables to the outcome variable. They are an important reference indicator for the results of machine learning [28]. The top ten importance items which is shown in the fig.3. are as follows:

Q19_1: The compensation I receive in the unit is fair, with the shapley value of 0.210;

Q7_2: The organization I work for is relatively conservative and usually follows established procedures, with the shapley value of 0.091;

Q18_3: I like to manage others, with the shapley value of 0.082;

Q4 Gender: Male and female, with the shapley value of 0.045;

Q7_10: The organization I work for treats employees with an equal attitude, with the shapley value of 0.043;

Q8_3: Before making a decision, I try to see each person's position from the argument, with the shapley value of f 0.0428;

Q18_2: I hope my thoughts can influence others, with the shapley value of 0.040;

Q7_11: The organization I work for often encourages employee morale and rewards in various ways,with the shapley value of 0.033;

Q5: Age, with the shapley value of 0.032;

Q7_4: Leaders in the organization I work for often speak to employees in a commanding tone, with the shapley value of 0.032.
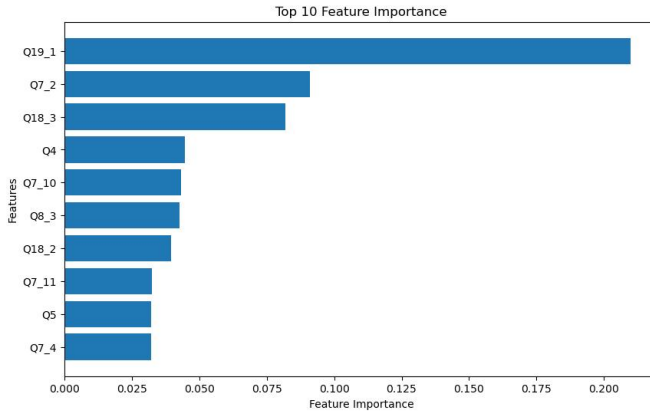
Fig. 3. Feature Importance Top 10

4   Discussion

4.1   Traditional Methods Result Discussion

Tett and Guterman's Trait Activation Theory[29] explains the relationship between personality traits and situations, where personality traits need to be awakened in trait-related situational cues. Previous research on organizational culture has focused on its impact on internal efficiency, such as job performance [30], proactive behavior [31], or dedication [32]. There is attention to how organizational culture affects prosocial behavior occurring within the organization. Literature shows that organizational culture has a significant positive impact on organizational citizenship behavior [33]. There is also research that extends the impact of organizational culture on prosocial behavior to outside the organization (such as employees participating in social welfare activities). A study based on survey data from 628 domestic ordinary employees found that organizational culture is highly correlated with employees' social-level citizenship behavior, which often occurs outside the workplace, such as participating in prosocial activities, promoting a good image of the organization, etc. [34].

The research findings revealed that a supportive organizational culture can positively influence employee engagement in prosocial activities through the mediating role of cognitive empathy. In this regard, the positive impact of a supportive organizational culture on cognitive empathy aligns with the conclusions drawn from a survey conducted by [35] among frontline healthcare workers during the pandemic. This study indicated a connection between higher scores in organizational support and an increase in empathy scores, thus corroborating the constructive role of a supportive organizational atmosphere in fostering employee empathy. Furthermore, the positive impact of cognitive empathy on employees' engagement in prosocial behavior is in line with the assumptions of the empathy-altruism hypothesis . This finding is consistent with previous research, suggesting that in the realm of prosocial behavior influenced by empathy, the utilization of cognitive

empathy, representing the dimension of perspective-taking, plays a crucial role. Higher levels of perspective-taking ability (indicating stronger cognitive empathy) are associated with a greater tendency to engage in prosocial behaviors. This could be due to the fact that cognitive empathy helps individuals understand the feelings and needs of others, thereby facilitating better coordination of actions and enhancing the efficiency of prosocial behavior, which contributes significantly to the occurrence of philanthropic activities. Moreover, as a relatively stable individual trait, empathy not only promotes prosocial behaviors within organizations, such as extra-role organizational citizenship behaviors [36], but also enhances engagement in prosocial behaviors at the societal level, such as participation in prosocial activities [37].

Furthermore, bureaucratic organizational culture not only negatively moderates the impact of empathy on employee participation in prosocial activities, but also negatively moderates the indirect effect of supportive organizational culture on employee participation in prosocial activities through empathy. This finding is consistent with the empirical results which demonstrated a negative impact of organizational structure on OCB [38]. Their study indicated that features of bureaucratic organizational culture, such as high task routineness (repetitive and monotonous work) and centralization (decision-making authority concentrated at the top, with employees relying primarily on directives from superiors), result in decreased levels of employee organizational citizenship behavior. Employees originally perceived organizational support and developed higher levels of cognitive empathy due to their presence in a supportive organizational culture, which enhanced their intrinsic motivation for engaging in prosocial behaviors. However, the coexistence of bureaucratic organizational culture with the supportive culture emphasizes positional distinctions, rulemaking, work procedures, and power regulations. As the level of bureaucratic organizational culture increases within this coexistence, employees tend to perceive higher levels of task routineness and are more inclined to strictly adhere to established procedures [39]. According to the Motivational Crowding Theory proposed, the excessive external regulations introduced by a bureaucratic organizational culture can lead to the transformation of intrinsic motivation into extrinsic motivation. This transformation weakens the supportive organizational culture's ability to promote prosocial behavior through cognitive empathy by internal motivation. As a result, employees' engagement in prosocial activities decreases, indicating a suppressive moderating effect of bureaucratic organizational culture on this relationship.

4.2   XGBoost Discussion

In the establishment of the algorithm model, we used grid search to determine the optimal solution for the hyperparameters. During the grid search process, it was observed that the number of items in the independent variables was 25 which is not exceed the independent variables item' number. As a result, the optimal solution for the max_depth parameter was found to be 20. This value was determined through the grid search, which systematically explores different combinations of hyperparameters to identify the optimal configuration for the model. The learning_rate takes the

maximum value at its value of 0.1. n_estimators takes the optimal solution of 100, indicating that 100 trees can integrate a relatively good model. The subsample is 0.7 for the optimal solution, indicating that the tree does not use the entire dataset to prevent overfitting, and colsample_bytree is also at 0.7 for the optimal solution, indicating that there is also some sampling for the independent variables to prevent overfitting.The min_child_weight is 0.2, and eta is 0.001 at the optimal solution, indicating that the newly added decision tree approximates the optimal solution with smaller weights and steps.

In terms of demographic variables, gender has the greatest impact on employee participation in philanthropic activities, with a mean score of 2.098 for males and 1.949 for females. This finding contradicts much of the previous research, which suggests that women are generally more likely than men to exhibit prosocial behavior[18]. This inconsistency may be attributed to the specific demographics of our sample, which primarily consisted of employed individuals. Age is the second demographic variable that influences participation in philanthropic activities, with mean scores of 1.965 for younger individuals and 2.176 for older individuals. The XGBOOST algorithm model is consistent with existing psychological research, indicating that as adults age, their engagement in prosocial activities increases[40]. In the questionnaire items, the item "The rewards I receive in my organization are fair" in the organizational fairness section has the greatest impact on the results. As organizational fairness increases, individuals tend to engage in more philanthropic activities. This finding aligns with previous research, which suggests that high distributive fairness promotes more prosocial behavior. Furthermore, the item in bureaucratic organizational culture that "the style of my organization is relatively conservative, and in most cases, we follow existing procedures" has not been addressed in current psychological research on procedural organizational culture. XGBOOST provides a clue as the main effect is not significant in XGBOOST. However, further analysis using the SHAP method reveals that "I dislike being the focus of attention" and "the rewards I receive in the workplace are fair" are two items with strong interaction effects. Nevertheless, this study is solely based on the patterns discovered from the data model, and its theoretical implications require further exploration in psychology. In terms of power motivation, the influence of "I enjoy managing others" on employee participation in charitable activities has been shown in previous research to have an insignificant main effect on prosocial behavior. The conclusion of this XGBOOST model aligns with that, but it also suggests an interaction effect with social presence on prosocial behavior. For this particular item, the algorithm's conclusion is consistent with the traditional findings.

The analysis through these two methods revealed that causal relationships between variables can be explored using linear regression and relevant psychological theories, leading to the finding that a supportive organizational culture positively predicts employee engagement in charitable activities. Causal research allows for a better understanding of the changes in psychological processes, although these changes primarily influence people's thinking and are difficult to directly apply in practice. On the other hand, artificial intelligence algorithms facilitate analysis and, with simpler code, we identified important independent variables affecting employee participation

in charitable activities. While the conclusions of AI algorithms may not have corresponding theoretical support, they can indicate directions for future research based on data. Additionally, AI algorithms can establish models to predict employee participation in charitable activities, enabling early identification of employees with low engagement and making adjustments accordingly.

In summary, both research methods based on linear regression and psychological theories, as well as analysis methods using artificial intelligence algorithms, have their respective advantages and applicability in studying employee engagement in charitable activities. Combining the results from both methods can provide a more comprehensive insight and guide the development of strategies to encourage employee participation in charitable activities.

5   Conclusion

This study explores the impact and mechanisms of organizational culture on employee engagement in philanthropic behavior. It found that a supportive organizational culture has a significant positive influence on employee engagement in social welfare activities, with cognitive empathy playing a fully mediating role. Additionally, a bureaucratic organizational culture not only negatively moderates the impact of cognitive empathy on employee engagement in social welfare activities but also inhibits the indirect effect of a supportive organizational culture on employee engagement through cognitive empathy. The study trained an XGBOOST model, which demonstrated a high predictive effect of the demographic variables and questionnaire items used in this study on employee engagement in philanthropic behavior, with an accuracy of 95% in the three-class classification. Further analysis revealed that demographic variables such as gender and age have a high predictive power for employee engagement in philanthropic behavior, while questionnaire items such as distributive fairness and power motivation also have a high predictive power.

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