Developing Fairness Rules for Talent Intelligence Management System

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Abstract

Talent management is an important business strategy, but inherently expensive due to the unique, subjective, and developing nature of each talent. Applying artificial intelligence (AI) to analyze large-scale data, talent intelligence management system (TIMS) is intended to address the talent management problems of organizations. While TIMS has greatly improved the efficiency of talent management, especially in the processes of talent selection and matching, high-potential talent discovery and talent turnover prediction, it also brings new challenges. Ethical issues, such as how to maintain fairness when designing and using TIMS, are typical examples. Through the Delphi study in a leading global AI company, this paper proposes eight fairness rules to avoid fairness risks when designing TIMS.

1. Introduction

With the rapid development of the Internet technology, companies face increasing challenges in talent management. The National Bureau of Economic Research (2019) points that US companies spend nearly $72 billion on various talent acquisition services each year, and the global number is likely to be three times larger [1]. In addition, the high turnover rate has further increased the cost of talent management. High employee turnover also brings potential risks such as business secret leaks, stressful employees, and labor disputes [2]. Traditional talent management practices are inefficient to address these issues due to two main reasons. Firstly, the talent management practices are based on the previous management experience, but rarely bring the changes in the external market environment into consideration [3]. Secondly, talent management decisions are usually based on one-sided data obtained from supervisors [4]. Such data is limited and cannot capture the uniqueness of each employee. Thus, repeated decisions are often made to address different problems.

Using artificial intelligence, TIMS has the potential to outperform traditional talent management practices: 1) it can develop scientific application analysis methods for different problems; 2) it can provide intelligent advice based on large scale data collected by TIMS; 3) it can provide predictive analysis for talents, which allows the managers to take preventive actions in advance [5]. However, since artificial intelligence is based on machine algorithms and past data, any bias in the algorithms and/or the data can be erroneously reinforced and lead to serious problems in talent management. Indeed, Amazon was forced to kill its AI recruiting system because the system discriminated against women [6]. Since the system is trained on a pool of resumes that dominated by men, it accordingly favored men over women. Gender discrimination is not the only problem. There are other problems, such as privacy violations, rationality and transparency of the algorithm and ethical dilemmas of machine algorithms, which affect the fairness of TIMS [7]. Thus, how to design a fair TIMS becomes an urgent problem to be solved.

This paper represents an initial effort to address this urgent problem. Specifically, the following two research questions are explored:

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1) What are the fairness risks caused by the major features of a TIMS?

2) What are rules that can be used to guide the fairness design of TIMS?

We conduct a Delphi study to answer the two research questions. Experts in a global leading AI company participated in this study. We conducted three rounds of research to form a unified opinion. The results indicate that the six fairness rules proposed by previous literatures cannot completely cover the fairness issues in an AI environment. Two new sets of rules, namely interactivity rules and explanation rules, emerge from the study. Interactivity rules emphasize two-way communication between TIMS and human in order to reduce the degree of information asymmetry. Explanation rules focus on system interpretability, i.e., providing feedback and interpretation of the recommended decisions.

Important theoretical and practical contributions can be generated from this study. We enrich the knowledge of design science and propose a framework for managing AI system's fairness risks. In addition, system designers can apply the fairness rules developed in this paper to TIMS's design; company managers can use these rules to develop talent management strategy to improve the efficiency of talent management; policy makers can use these rules to provide ethics guidelines for AI's use in talent management.

2. Literature review

2.1 Organizational justice theory

Organizational justice theory (OJT) is dedicated to perceived fairness in employment relationship, which has been the research focus of management and organization field for many years [8]. Scholars have discussed the issue of how many dimensions of justice exist in fairness perception. Some researchers focus on one dimension (overall fairness perception), two dimensions (distributive justice and procedural justice), three dimensions (plus interactional justice on the first two types), and four dimensions (interactional justice is subdivided into interpersonal justice and informational justice) [9]. Among them, the most comprehensive classification is to divide organizational justice into four dimensions that are detailed below.

(1) Distributive justice. Distributive justice refers to individual's fairness perception of the decision outcomes and distribution of resources. The most common distributive justice is equity and equality. Equity means people should get rewards that are relatively consistent with their input [10]. Equality means that everyone should have equal opportunities to accept outcomes, and needs refer to the needy individual consider it to be fair when special needs are met [11].

(2) Procedural justice. Procedural justice refers to fairness perception in the decision-making process [12]. Procedural justice can be understood as the degree to what extent rules are satisfied or violated during procedural decision making. When a procedure is perceived to be consistent, representative, and unbiased, individuals feel fair even if the outcome is unfavorable.

(3) Interpersonal justice. Interpersonal justice is an integral part of interactional justice [13]. Interpersonal justice refers to giving others dignity and respect in interactions. People believe that they should be treated well, and if not, they feel unfair. Interpersonal treatment mainly reflects individuals experience in decision-making process, which reflects the politeness and appropriateness of questions [14].

(4) Informational justice. Informational justice is another integral part of interactional justice [15]. Information justice refers to fairness perception as to whether a decision maker actually provides sufficient justification for decision making. When managers explain the reasons in detail on how a decision is made, people believe that they are an important part of the organization.

2.2 Fairness perception for traditional talent management system

Previous researches on the fairness perception for traditional talent management system were mostly based on organizational justice theory [16,17,20]. Previous researches have two limitations. First, most researches focus on the selection process [11]. In fact, many dimensions of fairness perception can be applied to other talent management processes [17]. In addition, most subsequent studies did not fully assess the dimensions. Even when considering multiple dimensions of fairness perception, there is no fairness rules guidance for these dimensions [18].

By examining relevant literature on organization justice theory, we identify six

fairness rules: consistency rule, representative rule, bias suppression rule, accuracy rule, correctability rule and ethicality rule [19]. Gilliland (1993) and Greenberg (1986) proposed a number of dimensions based on the six rules [11, 20]. The most typical 10 dimensions of fairness rules were derived from researches on allocation decisions, management equity, performance evaluation, recruitment fairness and interactive justice norms [21]. The relationship among traditional fairness rules and organizational justice theory are summarized in Table 1.

Table 1 Relationship among traditional fairness rules and organizational justice theory

Dimensions of organizational justice theory	Traditional fairness rules	Contents of traditional fairness rules	Description of contents
Distributive justice; Procedural justice	Accuracy rule	Job-relatedness	Job relatedness refers to the extent to which decision content is relevant to the job situation or appears to be relevant [18].
Interpersonal justice (human to human interaction)	Representative rule	Opportunity to perform	If decision recipients have the opportunity to express themselves during decision making, they will perceive more fair [22].
Procedural justice	Correctability rule	Reconsideration opportunity	Reconsideration opportunity refers to the opportunity to allow challenging and modifying decisions [20,23,24].
Distributive justice	Consistency rule	Consistency	Consistency must ensure that decision procedure is consistent form people to people [21,22,24].
Informational justice	No corresponding rules	Feedback	Feedback refers to the interpretation and feedback of the decision results [25].
Distributive justice	Bias suppression rule	Interpersonal effectiveness	Interpersonal effectiveness refers to the extent that participants are treated with gentleness and politeness during the decision-making process [25].
Interpersonal justice	No corresponding rules	Two-way communication	Two-way communication refers to the opportunity for members affected by decision-making to provide opinions and consider their views [25].
Procedural justice	Ethicality rule	Ease of fraud	Ease of fraud refers to the difficulty of fraud in the decision-making process [26].
Procedural justice; Interpersonal justice (human to human interaction)	Ethicality rule	Invasion of privacy	Invasion of privacy refers to the degree of invasion of personal privacy in the decision-making process [27].
Procedural justice; Interpersonal justice (human to human interaction)	Bias suppression rule	Propriety of questions	Question propriety includes illegitimate questions and prejudicial statements during decision-making [11].
Procedural justice; Interpersonal justice (human to human interaction)	Ethicality rule	Honesty	Honesty refers to decision makers' correctness, sincerity, and believability during decision process [14].

Notes. Feedback and two-way communication have no corresponding rules.

The six fairness rules provided us a good research direction, but the six rules cannot fully cover the organizational justice theory [19]. As can be seen in Table 1, feedback and two-way communication have no corresponding rules. In addition, the six rules only explained three dimensions of organizational justice theory, which were distribution justice, procedural justice and interpersonal justice (human to human interaction).

2.3 Fairness perception for talent intelligence management system (TIMS)

2.3.1 Talent intelligence management system. Talent intelligence management system (TIMS) is an AI-based system. The digital innovation and advancement of TIMS have produced a range of talent identification and assessment tools [28]. Intelligent recruitment system can help organizations find the right people and automatically match candidates to the right job [29]. Intelligent talent development /turnover

prediction system can predict talent career development route and turnover probability, which can provide reference for employee retention [30]. High-potential talent discovery system explores and discovers talents through talent circles and more talent activities [31]. More and more TIMSs are serving talent management, greatly improving the efficiency of talent management. However, the fairness issues of TIMS in talent management are appearing. The fairness issue is a matter of general concern, so it is necessary to construct a theoretical framework to avoid fairness risks.

2.3.2 Fairness rules for TIMS. The six rules proposed by scholars are a general statement of the fairness perception of traditional talent management processes, but AI technology has changed these processes. Especially when used to evaluate the fairness perception of TIMS, these rules may not be fully covered the four dimensions of organizational justice. Table 1 indicates that these six rules only explain the first three dimensions of organizational justice theory, and there is no rule for information justice. At the same time, the application of TIMS is no longer a human-to-human interaction, but now it becomes a machine-to-human interaction. Therefore, interpersonal justice should consider the fairness perception of machine-to-human interaction. Based on the guidance of these two dimensions we revise the existing six rules and add two new rules: interactivity rule and explanation rule. In order to verify the validity of the fairness rules, we conducted a Delphi study.

3. The Delphi Study

Delphi study tries to get consensus from a group of experts through a controlled repetitive process, which avoids direct confrontation between experts [33]. The experts participated in this Delphi study come from a leading high-tech company, which is mainly engaged in search engine services. There are about 40000 employees in this company. The employees span various professional fields, including information system, business management and human resource management. The large number and diversity of employees impose great challenges on talent management. The company has set up a Talent Intelligence Center to solve the problem of talent management. Since 2016, the company has gradually developed a talent intelligence management system (TIMS). Based on AI technology, this system provides a complete set of intelligent talent management tools, transforming the traditional talent management process to a data-driven process. As an early adopter of TIMS, this company provides a good research site for this study. We invited 10 experts in Talent Intelligence Center to participate in the Delphi study, which contain 3 human resources managers, 4 system developers and 3 researchers in the field of human resource management and IS. They have extensive experience in designing and using TIMS. Thus, they can provide a relatively complete item pool of TIMS.

We follow the standard process to conduct the Delphi study in three phases [32]. In the first phase, each of the ten experts brainstormed at least ten AI features of TIMS. A total of thirty-four features of TIMS were proposed. In this phase, many repeated features have been deleted and similar features merged. In the second phase, each expert selected at least ten features that they considered important in affecting the fairness perception in talent management from the list generated from the first phase. This process reduced the number of AI features to twenty-five items. In the last phase, the experts classified different features into the fairness rules.

3.1 Transcripts of interviews

In addition to the Delphi study, we conducted face-to-face interviews with these 10 experts. The interviews mainly focused on exploring the following questions: (1) What is the usage scenario of each feature of TIMS? (2) Why do you think that this feature will violate the corresponding fairness rules when it is actually applied? (3) Which fairness rule should be followed in the implementation of TIMS in different talent management stages? There is no strict answer order, and the interviewees can choose to answer all or part of the questions. Transcripts of interviews are shown in Table 2.

Table 2 Transcripts of interviews

AI features of TIMS	Quotes of interviews
Intelligent video interview	"Intelligent video interview is mainly used in recruitment interview process, which mainly affects the fairness of recruitment. Intelligent recruitment system can simulate real interview scenarios, and

	combine semantics analysis and image analysis." [System developer & researcher in IS] "In the video interview, the machine communicates with the interviewer, and the two-way communication may violate the Interactivity rule. At the same time, intelligent video interview may have certain risks of cheating. For example, the partners who do not appear in the video lens can provide answers, that is, there is a certain ease of fraud, so the Ethicality rule may be violated." [Human resources manager] "I don't think intelligent video interviews can lead to cheating. The interview process will limit the repetition and time of the answers. It will examine the interviewer's reaction of speed and ability. It is actually a certain restriction on possible cheating behavior." [System developer& researchers]
Person-job fit	"Person-job fit is the highlight feature of intelligent recruitment system. It mainly focuses on the service derived from the fit problems between talents and jobs encountered in the recruitment process. This feature measures the degree of job relatedness." [Human resources managers] "Person-job fit needs to assess the candidates' information and match the job requirements. However, the accuracy of the assessment and matching may lead to fairness issues."[System developer & researcher]
Intelligent interviewer assessment and fit	"Intelligent interviewer assessment and fit is based on the evaluation criteria of past interviewers evaluation data. The main concern is the consistency of evaluation criteria."[Human resources managers & researcher]
Intelligent performance forecast	"Intelligent performance forecasting is to predict employee performance and may lead to the consistency concern of assessment in TIMS."[System developer] "I think intelligent performance forecast is very relevant to job relatedness."[Human resources manager] "If we compare consistency and job relatedness, I think intelligent performance forecast may violate consistency in terms of fairness."[Other human resources manager & researcher]
Intelligent risk forecast	"Intelligent risk forecast mainly predicts organizational risks based on risk prediction indicators, such as predicting organizational stability and organizational management risk."[Human resources manager] "If the final risk prediction results can provide explanatory feedback, I think it will be more fairness."[System developer & researcher]
High-potential talent identification	"This feature is to identify those talents with promotion potential. The identification of high- potential talents is an important part of employee development plan and it is also a significant factor in determining the quality of talent pool within the enterprise."[Human resources managers] "Enterprises need to accurately identify and select high-potential employees, but what kind of employees are high-potential talents? I think the consistency of identification standards is an important factor affecting employees' fairness perception."[Researcher & human resources managers]
Business core analysis	"This feature uses social network to analyze the position of each employee in the overall business line. To make each employee feel fair, this feature should use consistent analytical metrics."[System developer & researcher]
New star index evaluation	"The feature assesses whether an employee after internship will grow into a high–potential talent in the future. An evaluation score is given mainly based on the performance of his internship period and social network data."[Human resources manager] "For a person who is not a long-time employee, the decision criteria needs to be discussed whether he is a high-potential talent or not by observing his performance during internship."[Researcher]
Intelligent grade benchmark	"Intelligent grade benchmarking is used to guide job setup and resource allocation by comparing the skills and responsibilities of job position in different companies."[Human resources manager] "For the results of intelligent grade benchmarking, the system should allocate resources according to the consistency standard for each job position."[System developer]
Intelligent salary forecast	"Intelligent salary forecast is first described by employees' self-expression, and then matched with the job requirements to achieve salary forecasting."[System developer] "Intelligent salary forecast is based on employees' self- recommendation, which is an important factor in representing employees' ability to get corresponding salary. Intelligent systems should give more opportunities to perform, so that employees feel more fairness."[Human resources manager & researcher]
Turnover forecast	"Turnover forecast can predict which employee will leave and which employee is looking for other job. Company can find the employees' resignation intention in time and adopt retention strategy."[System developer] "Turnover forecast should provide feedback where the employees may be dissatisfied. And the interpretation of the results of the turnover forecast. These reflect the fairness of TIMS."[Human resources manager]
Intelligent collaborative office	"Intelligent collaborative office is mainly used for inter-organization office, issuing job notifications and collaborative teamwork. It ensures a clear organizational structure and improves collaboration efficiency." [System developer & researcher] "This feature focuses on collaboration and interaction between employees. If this process is biased, it will be considered unfair."[Human resources manager]
Organizational	"This feature is mainly used to predict organizational innovation performance. It is closely related to

innovation forecast	nature of work and job performance."[System developer] "The accuracy of prediction is an important factor affecting fairness perception."[Researcher]
Organizational stability prediction	"Organizational stability not only provides feedback on the status of employees entering or leaving the organization, but also feedback on the overall activity of the organization."[System developer & researcher] "The system will give a score of organizational stability, but the interpretation of the final result is the issue we care about. For example, which aspects of the organization have instability factors and we should promote or eliminate what bad things happen."[Human resources manager]
Organizational culture assessment	"The organizational culture assessment is mainly used to compare the differences between the enterprise and the whole industry, and to measure the adaptability of corporate culture and long-term development strategy."[Human resources manager] "However, whether the evaluation criteria of organizational culture adapts to the unique cultural background is still uncertain, and there may be industry bias in the systematic evaluation."[Researcher]
Organizational health analysis	"Organizational health refers to the effectiveness and maturity in the organization's operation process. Specifically, it refers to the efficiency of organizational business development and the integrity of organizational construction."[Human resources manager] "Organizational health analysis requires the organization of internal and external privacy information in order to obtain accurate analysis results, so this feature may invade privacy."[System developer & researcher]
Organizational public opinion discovery	"Organizational public opinion analysis is aimed at the focus events or topics related to organizational interests, grasping the development trend, conducting in-depth thinking processing and analysis, and formulating corresponding countermeasures."[Human resources manager & system developer &] "The media is developing rapidly, the speed of information fermentation is also very fast. The company needs to grasp the event sensation information in time, and provide feedback and explanation of the sensation. In this case, the system will be considered more reliable and guarantee healthy development." [Researcher]
Organizational importance assessment	"This feature mainly assesses the importance of a department in the company's business, but whether the criteria are appropriate is also a question worthy of further study."[Human resources manager]
Employee retention cost estimate	"Employee retention cost estimate is an assessment of the replacement cost of job position, which has significant reference for employee turnover and job setting."[System developer & researcher& human resources managers] "The feature needs to comprehensively examine the substitutability of employee positions and nature of work for evaluation. The accuracy of assessment has an important impact on fairness perception."[System developer]
Employee retention strategy generation	"This feature can generate some recommendations for employee retention based on the results of employee retention cost estimate. It forms a specific retention policy according to employees' basic information, which may infringe on personal privacy."[System developer & human resources manager]
Personalized training	"Personalized training uses some auxiliary intelligent systems to provide staff training channels, such as accurately recommending employee training content, timely replenishing business knowledge for employees, and ultimately giving employees personalized training evaluation."[System developer] "Personalized training is a personalized evaluation feature for different employees. I think that if the system gives more personalized opportunities to perform, I will feel more fairness to the final training results."[Researcher]
Talent portrait	"Talent portrait score the qualities that candidates demonstrates, such as educational experience, work experience, professional skills and personality traits. Of course, this is mainly based on the candidates' self-expression, so the system should provide candidates with sufficient opportunities to perform, thus they feel fair in the evaluation process."[Human resources managers & system developer]
Intelligent humanistic care	"Intelligent humanistic care is a general term for some features of TIMS that pay attention to the physical and mental health of employees. Common psychological counseling and support, friend recommendation, employee welfare counseling, etc."[System developer] "The mutual understanding, communication and support between enterprises and employees can increase the happiness of employees. This feature directly reflects the fairness treatment of interpersonal communication and care."[Human resources manager & researcher]
Work status monitoring	"This feature can actually be called agile performance management. It is mainly to dynamically monitor the employees' work and performance realization process."[System developer] "However, due to the detection of employees' work status information, employees may have a sense of being monitored and feel their privacy has been violated."[Researcher & human resources manager]
High-potential talent development path prediction	"This feature is used to predict the development path of high-potential talents, such as job promotion and career change. However, the development path is not constant. With the subsequent performance of high-potential talents, the development path can be modified and changed. Obviously this is what a fair and intelligent talent management system should have."[System developer & researcher]

3.2 Results of the Delphi study

After all experts' opinions have been unified, we used agreement level to test the consensus level between experts. Agreement level refers to a consistent statement of agreement or disagreement, most of which are usually defined above 50 percent [34]. We removed the features categories that have a agreement level below 50%, and sorted the top ranked rules that experts considered to be the most consistent or easiest to violate.

Table 3 Classification results of the Delphi study

Fairness rules	AI features	Agreement level (percent)
Consistency rule	Intelligent interviewer assessment and fit	80
	Intelligent performance forecast	90
	High-potential talent identification	100
	Business core analysis	90
	Intelligent grade benchmark	100
Representative rule	Intelligent salary forecast	80
	Personalized training	100
	Talent portrait	90
Bias suppression rule	Intelligent collaborative office	90
	New star index evaluation	80
	Organizational culture assessment	80
	Organizational importance assessment	90
Accuracy rule	Person-job fit	90
	Organizational innovation forecast	80
	Employee retention cost estimate	80
Correctability rule	High-potential talent development path prediction	80
Ethicality rule	Employee retention strategy generation	70
	Work status monitoring	90
	Organization health analysis	80
Interactivity rule	Intelligent video interview	70
	Intelligent humanistic care	70
Explanation rule	Intelligent risk forecast	70
	Turnover forecast	80
	Organizational stability prediction	90
	Organizational public opinion discovery	90

4. Findings from the Delphi study

We summarize the new fairness rules of TIMS and corresponding contents in Table 4.

(1) Consistency rule. Consistency rule can be understood as similar to equal distribution, which means everyone should have equal opportunities to get decision results and the decision criteria are consistent [21,23]. TIMS should be consistent with everyone during decision-making process, which is similar with consistency rule in traditional talent management process.

(2) Representative rule. Representative rule allows individuals to have opportunities to express their own characteristics or capabilities. Procedures are perceived to be more fair if individuals have opportunity to express themselves before the decision is made [22, 25].

(3) Bias suppression rule. Although TIMS is an AI-based system, it may cause bias due to different training samples. One dimension of fairness was related to "interpersonal effectiveness", which is the same as traditional bias suppression rule [14]. And another dimension of traditional bias suppression rule is "propriety of questions". However, "propriety of decision criteria" should be considered in TIMS, because "propriety of decision criteria" refers to the appropriateness of the basis for decision making, including biased standards and procedures [11].

(4) Accuracy rule. Previous accuracy rule includes "job relatedness" [26], which refers to the extent that the decision measures the content relevant to job situation or appears to be valid. In TIMS, "job relatedness" still belongs to accuracy rule, but the application scenario has changed from the traditional talent management system to TIMS.

(5) Correctability rule. Correctability rule refers to the opportunity to challenge or modify the decision-making evaluation process [20, 23]. TIMS should be fault tolerant because there may be erroneous operations and improper procedures. We can also use "reconsideration opportunity" as the dimension of correctability rule of TIMS.

(6) Ethicality rule. Both traditional talent management system and TIMS should follow ethicality rule. The first dimension is "ease of fraud". The second dimension of ethicality rule is "invasion of privacy". Arvey and Sackett (1993) indicated that the two dimensions may influence individuals' reactions to fairness [26].

(7) Interactivity rule. Two-way communication is an embodiment of interactivity, but it can occur not only between human to human but also between human to machine [34, 35, 36]. So we add interactive rule to explain "two-way communication".

(8) Explanation rule. The provision of informative feedback is cited as an important factor of information justice [35]. Feedback may be an interpretive procedural factor because it is a factor that organizations can easily improve without increasing the extra cost of system development. Therefore, we add explanation rule to indicate "feedback" of TIMS.

Table 4 New fairness rules of TIMS

New fairness rules	Contents of new fairness rules
Consistency rule	Consistency
Representative rule	Opportunity to perform
Bias suppression rule	Interpersonal effectiveness
	Propriety of decision criteria
Accuracy rule	Job-relatedness
Correctability rule	Reconsideration opportunity
Ethicality rule	Ease of fraud
	Invasion of privacy
Interactivity rule	Two-way communication
Explanation rule	Feedback

4.2 Rules distribution of TIMS's fairness design

Combined interview records, we have further understood the usage scenarios of TIMS, which provides guidance and recommendations for fairness design of TIMS at different talent management stages. Based on different factors and management procedures in talent management process, we divide talent management stages into before hiring, during hiring and after hiring [37, 38]. We map the distribution of fairness rules in different talent management stages (Figure 1).

Before hiring, talent management focuses on talent attraction and recruitment. Intelligent interviewer evaluation and fit, intelligent salary forecasting, talent portrait, person-job fit, and intelligent video interviewing are the main features used by TIMS at this stage [37]. The corresponding fairness rules are consistency rule, representative rule, accuracy rule, and interactivity rule. During hiring, talent management mainly focuses on staff placement, training and evaluation. Business core analysis, intelligent grade benchmarking, personalized training, new star index evaluation, organizational culture assessment, organizational importance assessment are the main functions used by TIMS at this stage [38,39] The corresponding fairness rules are consistency rule, representative rule, bias suppression rule. After hiring, talent management focuses on performance management, promotion and retention. Intelligent performance forecasting, high potential talent identification, intelligent collaborative office, organizational innovation forecast, employee retention cost estimation, high potential talent development path prediction, employee retention strategy generation, work status monitoring, organizational health analysis, intelligent humanistic care, intelligent risk prediction, turnover prediction, organizational stability prediction and organizational public opinion discovery are the main features of TIMS at this stage [27,39]. The corresponding fairness rules are consistency rule, bias suppression rule, accuracy rule, correctability rule, ethicality rule, interactivity rule and explanation rule.

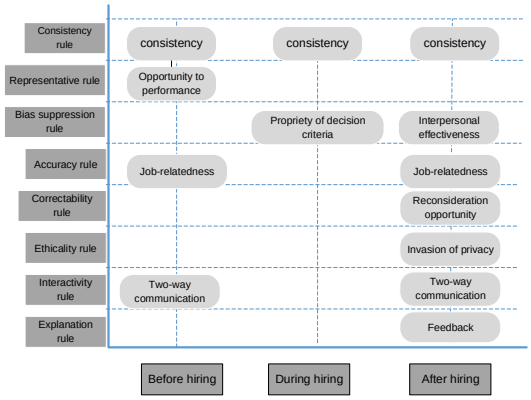

Figure 1 Rules distribution of TIMS's fairness design

5. Discussion

AI technology applied to talent management has greatly improved the efficiency of human resource management, but it also can cause corresponding fairness risks. If employees feel that they have been treated unfairly, there are huge hidden dangers for the company, such as outflow of talents and low performance. To reduce or mitigate the potential fairness risks generated from AI technology in the talent management process, this paper proposes eight fairness rules based on a Delphi study. These rules describe in detail the

employee perceived fairness risks that can be caused by the current TIMS.

Compared with the fairness rules of traditional talent management system, interactivity rule and expenditure rule are newly added. When AI is applied to the field of talent management, the HR managers should pay more attention to the human-computer interaction experience and the interpretability of the decision-making process. In particular, TIMS should not be a cold, unfeeling machine, but rather fair, gentleman and rational.

Moreover, we map the distribution of fairness rules to the talent management stages to identify the most important rules for each stage. As shown in Figure 1, the issues affected employees' fairness perception vary across the three stages of talent management. Accordingly, the set of fairness rules that TIMS should follow need to be adjusted to reflect this change. This result can be used to guide TIMS design and application at different talent management stages, which can alleviate the fairness issues of TIMS and improving employees' fairness perception.

5.1 Implications for Theory

From a theoretical perspective, this study has three contributions. First, we extend the boundaries of organizational justice theory, which was primarily developed to address fairness perceptions in human dominated talent management practices. But when artificial intelligence technology is used to automate talent management process, new fairness issues emerge. Second, we enrich the knowledge of design science and provide guidance to avoid fairness risk in AI system design. Third, we propose a theoretical framework to manage AI by developing fairness rules, which lays the ground to study the effect of AI system on organization.

5.2 Implications for Practice

As artificial intelligence technology is increasingly used by companies in human resource management, new risks and concerns emerge. How to control or mitigate these risks and concerns becomes an urgent research topic that can affect the use of AI use in the talent management process at the technical level, company level and policy level. Specifically, system designers can apply the fairness rules developed in this paper to TIMS's design; company managers can use these rules to develop talent management strategy to improve the efficiency of talent management; policy makers can use these rules to provide ethics guidelines for AI's use in talent management.

5.3 Directions for Future Studies

The fairness rules developed in this paper serve as a base to avoid fairness risks. There are many directions worth studying in the future.

(1) One of the most important future directions is to verify the validity of fairness rules developed in this paper, which are the basis for studying the effect of TIMS on organizational outcomes.

(2) Another direction related to fairness rules is the salience of these rules in different talent management stages. The fair issues vary in different talent management stages. As TIMS's features are constantly improved and new features appearing, the corresponding fairness issues are gradually increasing. Therefore, the fairness rules in different talent management stages need to be constantly revised and improved.

(3) Finally, future research should empirically verify the relationship between TIMS's fairness and organizational outcomes. According to these rules, the features of TIMS can be abstracted into management variables used in constructing management model, and the effect of TIMS's fairness on organizational outcomes can be explored through empirical research.

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