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Job Displacement or Job Transformation? The Meaning, Consequences, and Sources of Technical Job Insecurity - Postprint

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Abstract

Amidst the digital transformation of Chinese enterprises, effectively alleviating and addressing employees' job insecurity is crucial for building harmonious and stable labor relations. Traditional research on job insecurity has extensively explored the sources and effects of job insecurity, but has overlooked the important context of the rapid development and application of artificial intelligence technology in current organizational management practice and research. This paper innovatively proposes the concept of technology-induced job insecurity in the context of artificial intelligence to reflect the job insecurity perceived by individuals resulting from the development and application of artificial intelligence technology. This paper has three research objectives: First, to explore the connotation and dimensional structure of technology-induced job insecurity, intending to extract two dimensions: job replacement insecurity and job transformation insecurity; Second, to examine the impact of technology-induced job insecurity on employees' work outcomes and career outcomes; Third, to investigate the sources of technology-induced job insecurity. This paper can not only enrich the conceptual and theoretical research on job insecurity in the context of artificial intelligence, but also provide practical insights for establishing harmonious and stable labor relations and enhancing employees' work well-being amidst the digital transformation of Chinese enterprises.

Full Text

Preamble

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Conceptual Framework

Job Replacement or Job Transformation? The Definition, Consequences, and Sources of Technology-Driven Job Insecurity

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Abstract: As Chinese enterprises undergo digital transformation, effectively alleviating and addressing employee job insecurity is crucial for building harmonious and stable labor relations. Traditional job insecurity research has extensively examined the antecedents and consequences of job insecurity, yet it has largely overlooked the rapid development and application of artificial intelligence (AI) technology—a critical context in contemporary organizational management practice and research. This study innovatively proposes the concept of technology-driven job insecurity to reflect individuals' perceived job insecurity resulting from AI technology development and application. The study pursues three objectives: First, to explore the definition and dimensional structure of technology-driven job insecurity, identifying job replacement insecurity and job transformation insecurity as its two core dimensions. Second, to examine the effects of technology-driven job insecurity on employee work outcomes and career outcomes. Third, to investigate the sources of technology-driven job insecurity. This research not only enriches conceptual and theoretical work on job insecurity in the AI context but also provides practical insights for establishing harmonious labor relations and enhancing employee well-being during Chinese enterprises' digital transformation.

Keywords: technology-driven job insecurity, artificial intelligence technology, job replacement, job transformation

Classification Codes: B849; C93

1. Problem Statement

Driven by big data, cloud computing, the Internet of Things, and AI technology, a new wave of technological transformation is underway, with the digital economy elevated to a national strategy. Chinese enterprises are accelerating their digital transformation, and employees face the impact of digital technologies. AI technologies, represented by machine learning and algorithms, can automate not only simple transactional tasks but also affect complex cognitive work (Davenport & Kirby, 2016; Huang & Rust, 2018). The impact of AI on human work has extended from operational positions to marketing, technical,

and management roles, and from production floors to marketing, finance, R&D, and human resource departments (Daugherty & Wilson, 2018). For instance, Vanke Group's digital employee "Cui Xiaopan" processes various accounts receivable reminders and work anomaly detection tasks with efficiency thousands of times greater than humans, while SPD Bank's digital employee "Xiao Pu" can communicate with customers emotionally and continuously improve service capabilities through active learning. Consequently, society has begun to focus on how AI technology will affect human work. Will human jobs be automated by machines? Will they be reshaped by AI technology? Therefore, as Chinese enterprises digitally transform, examining employees' perceptions of the continuity and stability of their work has significant practical importance.

Job insecurity research investigates individuals' perceived threats to the continuity and stability of their work in the future (De Witte, 1999; Greenhalgh & Rosenblatt, 1984), representing a hot topic in work stress and occupational health research both domestically and internationally (Jiang & Lavaysse, 2018; Lee et al., 2018; Hu Sanman, 2007). According to its definition, job insecurity reflects individuals' concerns about potentially losing their current job or valuable job features such as challenging tasks and promotion opportunities (Greenhalgh & Rosenblatt, 1984; Hellgren et al., 1999). Although previous studies have examined organizational and individual antecedents of job insecurity and its effects on employee well-being, work attitudes, and behaviors (Jiang et al., 2021; Lee et al., 2018; Shoss, 2017), they have paid insufficient attention to the context of AI technology development and application—a crucial backdrop in current organizational management practice and research (Luo Wenhao et al., 2022). AI technology poses a significant threat to the continuity and stability of employees' current work (Daugherty & Wilson, 2018; Davenport & Kirby, 2016), yet theoretical research on job insecurity in the AI context remains scarce.

Only a handful of studies have examined job insecurity in the AI context, investigating its antecedents (e.g., employee AI technology awareness, Brougham & Haar, 2020; Lingmont & Alexiou, 2020; occupational replacement risk, Dengler & Gundert, 2021; robot exposure, Yam et al., 2022) and its effects on burnout, work behavior, and career competence development (Koo et al., 2021; Yam et al., 2022; Chen Wenjing et al., 2020). Unfortunately, these studies focus on overall job insecurity rather than job insecurity specifically caused by AI technology development and application, hindering researchers from deeply revealing the phenomenon of job insecurity in the AI context and preventing organizations from implementing targeted measures to alleviate employees' negative work experiences triggered by technological change. What aspects of job insecurity do employees perceive due to AI technology development and application? What are their unique consequences? What are their unique sources?

The primary objective of this study is to define job insecurity in the AI context by proposing the concept of technology-driven job insecurity and examining its dimensional structure. We define technology-driven job insecurity as the threat to the continuity and stability of work that individuals perceive due to

AI technology development and application. Given that AI technology may automate human work (replacement) or reshape human work (transformation), we identify job replacement insecurity and job transformation insecurity as the two core dimensions of technology-driven job insecurity. Our second objective is to reveal the effects of technology-driven job insecurity on employee work and career outcomes. Our third objective is to explore the sources of technology-driven job insecurity.

By clarifying the definition and dimensional structure of technology-driven job insecurity, revealing its consequences, and identifying its sources, this study builds a systematic theoretical framework for technology-driven job insecurity with both theoretical and practical significance. Theoretically, it innovatively proposes the concept of technology-driven job insecurity and distinguishes between job replacement and job transformation insecurity, deepening conceptual research on job insecurity in the AI context. Second, by examining the consequences and sources of technology-driven job insecurity, this study advances theoretical research on job insecurity in the AI context and reveals previously overlooked phenomena. Practically, it provides insights for effectively managing the consequences of technology-driven job insecurity and offers guidance for addressing employees' negative work experiences triggered by technological change.

2. Literature Review

2.1 Traditional Job Insecurity Research

2.1.1 Concept and Dimensionality of Job Insecurity Table 1 presents definitions of job insecurity by domestic and international scholars. While definitions vary, job insecurity has three key characteristics. First, job insecurity is a subjective perception—different employees may experience different levels of job insecurity in the same objective environment. Second, job insecurity reflects future expectations of job loss rather than actual loss. Third, job insecurity concerns employees' feelings about their current employing organization and job. Regarding dimensionality, some scholars have focused on overall job insecurity (Greenhalgh & Rosenblatt, 1984), while others have distinguished different dimensions, such as quantitative versus qualitative job insecurity (Hellgren et al., 1999), cognitive versus affective job insecurity (Huang et al., 2010), and job-focused versus person-focused job insecurity (Ma Bing et al., 2022).

2.1.2 Theoretical Perspectives on Job Insecurity Research In traditional contexts, researchers have primarily used cognitive appraisal theory, conservation of resources theory, social exchange theory, and social identity theory to examine the antecedents and consequences of job insecurity (Figure 1 [Figure 1: see original paper]). Overall, existing research has focused more on consequences than antecedents.

Cognitive Appraisal Theory. Cognitive appraisal theory (Lazarus & Folk-

man, 1984) posits that whether individuals perceive objective situations as affecting their well-being and whether they have adequate resources to cope jointly determine their cognitive appraisal and coping strategies. According to this theory, negative organizational contextual factors (e.g., poor organizational performance, Debus et al., 2014; frequent organizational change, Çalışkan & Özkoç, 2020) trigger job insecurity. Employees who are sensitive to negative stimuli or lack coping resources (e.g., high negative affectivity, external locus of control, Debus et al., 2014) not only experience higher overall job insecurity but also react more strongly to negative situations or stimuli. Additionally, job insecurity triggers negative appraisals, thereby damaging employees' positive work attitudes, behaviors, and well-being (Debus et al., 2012; Vander Elst et al., 2014).

Conservation of Resources Theory. Conservation of resources theory (Hobfoll et al., 2018) suggests that individuals strive to maintain and conserve existing resources and use them to acquire new resources. Actual resource loss and threats of resource loss elicit stress responses and prompt individuals to take action to protect resources. Moreover, resource gain and loss operate in a spiral pattern—individuals with abundant resources tend to gain more, while those lacking resources or facing resource loss threats tend to experience further losses. According to this theory, employees with fewer resources or in a state of resource loss are more likely to experience job insecurity (Jiang et al., 2021; Vander Elst et al., 2018). Simultaneously, job insecurity represents a threat of resource loss, leading to stress reactions and reducing job satisfaction, affective commitment, and work engagement (Jiang & Lavaysse, 2018; Jiang & Probst, 2017; Sender et al., 2017).

Social Exchange Theory. Social exchange theory (Cropanzano & Mitchell, 2005; Zou Wenchong et al., 2012) posits that in social exchange relationships, if one party benefits from another, it is obligated to reciprocate to maintain a positive exchange relationship; conversely, if harmed, it will retaliate to preserve equity. Psychological contract theory represents a typical social exchange perspective. On one hand, job security constitutes part of the psychological contract between employees and organizations. Perceived psychological contract breach reduces employees' sense of control over their work environment, causing them to experience job insecurity (Keim et al., 2014). On the other hand, when employees experience job insecurity, they tend to perceive that the organization has violated the reciprocal relationship, feel emotional exhaustion, reduce job satisfaction and affective commitment, and engage in counterproductive work behaviors that harm organizational interests (De Cuyper & De Witte, 2006; Huang et al., 2017; Piccoli & De Witte, 2015).

Social Identity Theory. According to social identity theory (Ashforth & Mael, 1989), threats to individuals' social identity trigger negative consequences such as negative emotions, reduced group identification, and decreased work performance. Existing research shows that job insecurity threatens employees' organizational identity (Piccoli et al., 2017; Song Jing et al., 2018) and their iden-

tity as employed individuals (Selenko et al., 2017), reducing work performance, organizational citizenship behavior, and well-being. Additionally, low-quality leader-member exchange relationships reduce employees' perceived insider status, leading to job insecurity (Wang et al., 2019).

Self-Determination Theory. Self-determination theory (Ryan & Deci, 2000) posits that work environments satisfying needs for autonomy, competence, and relatedness enhance work motivation and positive work behaviors. Research based on this theory has examined how job insecurity affects work behavior. Job insecurity, especially developmental job insecurity, threatens employees' needs for autonomy, competence, and relatedness, reducing organizational citizenship behavior, creativity, and innovative behavior (Montani et al., 2021; Stynen et al., 2015) while increasing counterproductive work behavior (Van den Broeck et al., 2014).

Spillover and Crossover Effects. Spillover effects refer to the mutual permeation of work and family experiences, reflecting intra-individual influence processes across roles (Bolger et al., 1989). Crossover effects refer to how individuals' emotional experiences affect those around them, reflecting inter-individual influence processes (Westman, 2001). As a work stressor, job insecurity causes tension, anxiety, and other negative emotions that may spill over into family life and even affect family members. Research finds that fathers' job insecurity leads to financial anxiety, which in turn causes children's financial anxiety (Lim & Sng, 2006), while parents' job insecurity affects their parenting behaviors (Lim & Loo, 2003).

2.2 Job Changes and Job Insecurity in the AI Context

2.2.1 Job Changes in the AI Context AI technology uses machines to perform cognitive, recognition, and analytical functions, including artificial neural networks, machine learning, algorithms, and natural language processing. Unlike previous technologies, AI can automate not only simple transactional tasks but also affect complex cognitive work (Davenport & Kirby, 2016; Huang & Rust, 2018; Li Lei et al., 2021). Scholars hold different views on how AI will affect human work.

Scholars advocating the AI automation perspective argue that AI will ultimately replace human work by automating various tasks (Tschang & Almirall, 2021). Huang and Rust (2018) proposed a job replacement theory to predict AI's impact on human work, distinguishing four intelligence types—mechanical, analytical, intuitive, and empathetic—and noting that these types increase in difficulty for machines. AI technology first automates tasks requiring “lower” intelligence types and then upgrades to “higher” intelligence types, eventually completely replacing humans. Frey and Osborne (2017) estimated the risk of replacement for 702 occupations based on U.S. labor market data, finding that approximately 47% of U.S. jobs face potential disappearance due to computerization in the next 10-20 years. Arntz et al. (2016) assessed task automation levels and found that

across 21 OECD countries, an average of 9% of jobs have high automation risk, ranging from 6% in South Korea to 12% in Austria. Zhou et al. (2020) estimated AI technology's replacement rates for different occupations in China's labor market, finding that by 2049, 278 million workers will be replaced by AI technology.

Scholars advocating the AI augmentation perspective argue that AI will automate non-core work tasks, assist humans in completing core tasks, and ultimately achieve human-machine collaboration and complementary advantages (Daugherty & Wilson, 2018). Chui et al. (2015) noted that AI technology will reshape human work, enabling humans to work more efficiently and freeing them from repetitive, mechanized tasks to engage in more complex, creative work. For example, marketers use AI technology to obtain potential customer information and identify cross-selling and upselling opportunities to improve sales efficiency. Malik et al. (2022) found that AI technology application in human resource management promoted personalized employee experiences, increased job satisfaction and organizational commitment, reduced withdrawal tendencies, and enhanced HR management effectiveness. Upadhyay and Khandelwal (2018) noted that applying AI technology to recruitment can improve efficiency and reduce costs. As AI automates tedious resume screening tasks, recruiters have more time to focus on strategic issues and long-term planning.

2.2.2 Job Insecurity in the AI Context A few scholars have examined employees' perceived threats of AI technology to work continuity and stability, exploring antecedents and effects of job insecurity in the AI context. Regarding antecedents, Lingmont and Alexiou (2020) examined the effect of AI technology awareness on job insecurity and the moderating roles of organizational learning culture and organizational authority culture. They found that AI technology awareness increases job insecurity, organizational authority culture strengthens this relationship, and organizational learning culture has no effect. Brougham and Haar (2020) also found that AI technology awareness causes job insecurity, though employees with more job alternatives can better cope with its negative effects. However, Brougham and Haar (2018) found that AI technology awareness does not affect job insecurity. Additionally, Dengler and Gundert (2021) found that occupational replacement risk increases cognitive job insecurity but not affective job insecurity. Nam (2019) found that interpersonal interaction requirements reduce job insecurity, while professional knowledge requirements, creativity requirements, and task repetitiveness have no effect. Yam et al. (2022) found that robot exposure increases job insecurity, leading to employee exhaustion and interpersonal deviance. Regarding consequences, Chen Wenjing et al. (2022) examined the effect of job insecurity on career competence development in the AI context, finding a U-shaped relationship between quantitative job insecurity and career competence development and a positive relationship between qualitative job insecurity and career competence development. Occupational replacement risk strengthens the U-shaped effect of quantitative job insecurity and mitigates the positive relationship between qualitative job inse-

curity and career competence development.

2.3 Challenges in AI Context Job Insecurity Research

Concept and Dimensionality of Job Insecurity. AI technology affects work continuity and stability in multiple ways. On one hand, AI automation may cause job loss (Roos & Shroff, 2017; Qiu Yue & He Qin, 2020). For example, self-checkout systems cause cashier unemployment. On the other hand, AI augmentation may force job transformation (Roos & Shroff, 2017; Qiu Yue & He Qin, 2020). For example, AI technology reshapes HR specialists' work to focus more on decision-making, strategy, and interpersonal communication tasks. Traditional job insecurity research has distinguished quantitative versus qualitative job insecurity (Hellgren et al., 1999), cognitive versus affective job insecurity (Huang et al., 2010), and job-focused versus person-focused job insecurity (Ma Bing et al., 2022). However, these dimensional structures cannot effectively capture the threats to work continuity and stability that individuals perceive due to AI technology development and application—namely, jobs being replaced by intelligent automation or transformed by intelligent augmentation. Therefore, researchers must specifically examine the concept and dimensional structure of job insecurity in the AI context.

Consequences of Job Insecurity. Traditional job insecurity primarily reflects employees' subjective perceptions of being replaced by others in their current job, whereas AI context job insecurity mainly reflects employees' perceptions of being replaced by technology or being unable to adapt to technology. Research shows that being replaced by others more easily threatens self-worth, while being replaced by technology more easily raises concerns about future economic prospects (Granulo et al., 2019). Consequently, AI-triggered job insecurity may affect employees differently than traditional job insecurity. Moreover, since AI technology can lead to both intelligent automation and intelligent augmentation, and employees have different psychological reactions to these two modes (Einola & Khoreva, 2023), job insecurity under these two modes may also differentially affect employees. Therefore, researchers must specifically reveal the consequences of job insecurity in the AI context and the differential effects of its dimensions.

Sources of Job Insecurity. Traditional job insecurity research has primarily examined organizational contextual factors (e.g., organizational communication, change, performance) and individual factors (e.g., demographics, emotional traits, self-evaluation traits) as antecedents (Lee et al., 2018; Jiang et al., 2021). AI context job insecurity mainly stems from job changes triggered by AI technology. Current job characteristics largely determine the degree and type of change work will undergo in the AI context and the degree and type of job insecurity employees will experience (Dengler & Gundert, 2021; Nam, 2019). Simultaneously, technology-related personal characteristics such as AI technology awareness likely influence whether employees perceive AI technology's impact on work and whether they experience job insecurity (Brougham

& Haar, 2020; Lingmont & Alexiou, 2020). Therefore, researchers must reveal unique antecedents of job insecurity in the AI context, such as current job characteristics and technology-related personal characteristics.

3. Conceptual Framework

3.1 Research Objectives and Framework

This study focuses on job insecurity in the AI context, proposing the concept of technology-driven job insecurity. It first explores the definition and dimensional structure of technology-driven job insecurity, then examines its effects and sources. Specifically, the study has three objectives: (1) To clarify the definition of technology-driven job insecurity and analyze its dimensional structure by integrating job insecurity research and AI context job change research, identifying job replacement insecurity and job transformation insecurity as the two core dimensions; (2) To examine the effects of technology-driven job insecurity on employee work and career outcomes and the mediating mechanisms and boundary conditions of these effects based on signaling theory; (3) To explore how current job characteristics and employees' technology-related personal characteristics affect technology-driven job insecurity based on cognitive appraisal theory, as well as their joint effects. Corresponding to these objectives, the study comprises three sub-studies, with the overall framework shown in Figure 2 [Figure 2: see original paper].

3.2 Study 1: Definition and Dimensionality of Technology-Driven Job Insecurity

The core questions of this study are: What is the definition of technology-driven job insecurity in the AI context? What are its basic dimensions? Although previous studies have examined antecedents (e.g., employee AI technology awareness) and consequences (e.g., burnout, work behavior, career competence development) of job insecurity in the AI context (Koo et al., 2021; Yam et al., 2022; Chen Wenjing et al., 2020), they have not focused on job insecurity specifically caused by AI technology development and application. To more precisely reveal the phenomenon of job insecurity in the AI context, this study proposes the concept of technology-driven job insecurity, defining it as the threat to the continuity and stability of work that individuals perceive due to AI technology development and application. Based on this definition, this study first uses qualitative methods to identify the core dimensions of technology-driven job insecurity and then develops measurement instruments.

First, regarding core dimensions, this study will conduct in-depth interviews to comprehensively understand how AI technology affects individuals' perceptions of work continuity and stability in management practice. Based on literature review, AI technology affects human work in two primary modes: (1) Intelligent automation, where AI automates core human work tasks, ultimately replacing humans with machines (e.g., self-checkout systems replacing cashiers); (2)

Intelligent augmentation, where AI automates non-core tasks, enabling close human-machine collaboration to complete core tasks (e.g., AI automating resume screening to assist HR specialists in decision-making and strategic planning). Both modes threaten work continuity and stability, leading employees to perceive technology-driven job insecurity, but the specific content differs. Intelligent automation tends to cause employees to worry about losing their current jobs due to machine replacement (job replacement insecurity), while intelligent augmentation tends to cause employees to worry about changes in important job features such as work content, work modes, and skill requirements (job transformation insecurity). Therefore, this study posits that in the AI context, technology-driven job insecurity has two core dimensions: job replacement insecurity and job transformation insecurity.

Second, regarding measurement instruments, building on the above research and previous job insecurity measures (Ashford et al., 1989; Hellgren et al., 1999), this study will develop a technology-driven job insecurity scale with high reliability and validity and conduct empirical testing. Sample items for job replacement insecurity include: “Due to AI technology development and application, I worry that machines may replace humans and cause unemployment in the future” and “Due to AI technology development and application, I worry that machines may replace humans and cause me to be fired.” Sample items for job transformation insecurity include: “Due to AI technology development and application, I worry that the skill requirements of my current job may change” and “Due to AI technology development and application, I worry that the work mode of my current job may change.”

3.3 Study 2: Effects of Technology-Driven Job Insecurity

Study 1 clarified the definition of technology-driven job insecurity and distinguished between job replacement and job transformation insecurity. Building on this, Study 2 examines the effects of technology-driven job insecurity on employees and reveals the differential impacts of its dimensions. The core question is: How do different dimensions of technology-driven job insecurity affect employee work and career outcomes? What are the mediating mechanisms and boundary conditions?

Signaling theory (Spence, 2002) posits that information between individuals and larger entities (often unobservable) is asymmetric. Lacking sufficient information, individuals seek and interpret signals from entities to make judgments and decisions (Taj, 2016). Employees’ experiences in their current work serve as important signals reflecting career prospects (Chang & Busser, 2020). Based on signaling theory, this study argues that technology-driven job insecurity affects employee work and career outcomes by influencing their perceptions of career futures (occupational future time perspective). The strength of these effects depends on whether organizations implement human resource management practices that promote organizational-employee collaborative development (i.e., developmental HR practices). The research model is shown in Figure 3 [Figure

3: see original paper].

First, technology-driven job insecurity affects occupational future time perspective (focus on limitations and focus on opportunities). Occupational future time perspective reflects individuals' perceptions of their future careers (Zacher & Frese, 2009). This study focuses on two dimensions: focus on limitations (perceived constraints and restrictions in future careers) and focus on opportunities (perceived goals, choices, and possibilities in future careers) (Rudolph et al., 2018; Zacher & Frese, 2009). As an experience in current work, technology-driven job insecurity is an important signal conveying career prospect information (Chang & Busser, 2020). Specifically, job replacement insecurity not only means employees must expend resources to cope with career discontinuity and instability (limitations) but also signals that current jobs lack development prospects and opportunities. Job transformation insecurity, while also requiring personal resource investment to cope with uncertainty (limitations), signals that adjusting work modes, updating skills, and improving competence can create more choices and possibilities in future careers (opportunities). Therefore, this study posits that job replacement insecurity is positively related to focus on limitations and negatively related to focus on opportunities, while job transformation insecurity is positively related to both focus on limitations and focus on opportunities.

Second, occupational future time perspective affects employee work and career outcomes. When employees focus on limitations, they concentrate on losses and negative outcomes (Zacher & Frese, 2009), triggering avoidance tendencies that prevent full work engagement, inhibit work performance and proactive career behaviors, and reduce career satisfaction (Zacher & Rudolph, 2021). When employees focus on opportunities, they concentrate on achievable goals and opportunities (Zacher & Frese, 2009), triggering approach tendencies that motivate full work engagement, better performance, proactive career management, and increased career satisfaction (Zacher & Rudolph, 2021). This study posits that focus on limitations is negatively related to work engagement, work performance, proactive career behavior, and career satisfaction, while focus on opportunities is positively related to these outcomes.

Third, occupational future time perspective mediates the effects of technology-driven job insecurity on work and career outcomes. Job replacement and job transformation insecurity differentially affect occupational future time perspective, which in turn differentially affects work engagement, performance, proactive career behavior, and career satisfaction. This study posits that job replacement insecurity indirectly and negatively affects these outcomes through both focus on limitations and focus on opportunities, while job transformation insecurity indirectly and negatively affects them through focus on limitations but indirectly and positively affects them through focus on opportunities.

Fourth, developmental HR practices moderate these relationships. Developmental HR practices treat employees as organizational partners and promote employee potential development and career growth through diverse training,

developmental assessment, job design, and communication feedback, thereby achieving mutual organizational and employee development (Tang Chunyong et al., 2021). Like technology-driven job insecurity, these practices are important signals conveying career prospect information (Rodrigues et al., 2020). Specifically, developmental HR practices not only develop employee potential and competence to increase perceived career opportunities but also provide resources to help employees cope with career uncertainty, reducing perceived career limitations. Therefore, developmental HR practices provide information consistent with job transformation insecurity's signals about career opportunities but inconsistent with both job replacement and job transformation insecurity's signals about career limitations. Signal consistency strengthens signal effects, while inconsistency creates confusion and weakens effects (Connelly et al., 2011; Ho & Kong, 2015). Consequently, developmental HR practices strengthen the positive relationship between job transformation insecurity and focus on opportunities, weaken the positive relationships between both types of insecurity and focus on limitations, and weaken the negative relationship between job replacement insecurity and focus on opportunities.

Since technology-driven job insecurity affects work and career outcomes through occupational future time perspective, and developmental HR practices moderate the relationships between technology-driven job insecurity and occupational future time perspective, developmental HR practices also moderate the indirect effects of technology-driven job insecurity on outcomes. This study posits that developmental HR practices weaken the negative indirect effects of both job replacement and job transformation insecurity on outcomes through focus on limitations, weaken the negative indirect effect of job replacement insecurity through focus on opportunities, and strengthen the positive indirect effect of job transformation insecurity through focus on opportunities.

3.4 Study 3: Sources of Technology-Driven Job Insecurity

To deeply understand job insecurity in the AI context and build a complete theoretical framework, researchers must not only reveal its unique consequences but also identify its unique sources. Since Study 2 shows that job replacement and job transformation insecurity differentially affect employees, identifying their differential antecedents can also guide managerial interventions. Study 3 extends Study 2 by exploring the sources of technology-driven job insecurity.

AI technology development and application affects nearly all jobs, but the degree and mode of impact vary. AI technology typically automates iterative and information-processing tasks while assisting humans in completing complex problem-solving tasks (Daugherty & Wilson, 2018). Therefore, current job characteristics largely determine how AI will affect work. Additionally, whether employees recognize AI's impact and how they evaluate it may also affect their job insecurity (Brougham & Haar, 2020; Lingmont & Alexiou, 2020). This study examines the effects of job characteristics and technology-related personal characteristics on technology-driven job insecurity. The core questions are: Do

employees' current job characteristics affect their perceived technology-driven job insecurity? What are the mechanisms? Which employees are more likely to perceive technology-driven job insecurity? Do job and personal characteristics jointly affect technology-driven job insecurity?

Cognitive appraisal theory (Lazarus & Folkman, 1984) posits that when individuals perceive that objective stimuli affect their well-being, they further evaluate whether the stimuli promote or harm their well-being and whether they have adequate coping resources. When stimuli promote well-being, individuals make a challenge appraisal; when they harm well-being and individuals lack adequate resources, they make a threat appraisal. Technology-driven job insecurity refers to the threat to work continuity and stability that individuals perceive due to AI technology, representing a subjective evaluation of the work situation (Yam et al., 2022). Job characteristics constitute important work situations that affect employees' cognitive appraisals and subsequently influence their work attitudes, behaviors, and well-being (Ohly & Fritz, 2010; Jiang Fubin & Wang Zhen, 2022). Based on cognitive appraisal theory, this study posits that job characteristics (information processing requirements, work complexity, and problem-solving requirements) affect employees' expectations of AI's impact on work, which in turn affects their perceived technology-driven job insecurity. Technology-related personal characteristics (AI technology awareness and technology readiness) not only directly affect perceived technology-driven job insecurity but also moderate the relationship between job characteristics and technology-driven job insecurity. The research model is shown in Figure 4 [Figure 4: see original paper].

First, job characteristics have direct effects. AI technology's distinguishing feature is its ability to replace human mental labor, affecting knowledge work. Therefore, this study examines three knowledge work characteristics: information processing requirements, work complexity, and problem-solving requirements. Jobs with high information processing requirements involve handling large amounts of data or information; high-complexity jobs require applying multiple advanced skills and have high cognitive demands; high problem-solving requirement jobs require generating innovative ideas and solutions and identifying and solving problems (Morgeson & Humphrey, 2006). Jobs with high information processing requirements, low complexity, and low problem-solving requirements are machine-suited and tend to be automated by AI, causing employees to perceive future replacement by machines and triggering threat appraisals and job replacement insecurity. Conversely, jobs with low information processing requirements, high complexity, and high problem-solving requirements are temporarily difficult to automate and require human-machine collaboration, causing changes in work modes and skill requirements that employees perceive as mismatches between current work methods/competencies and future requirements, triggering threat appraisals and job transformation insecurity. This study posits that information processing requirements are positively related to job replacement insecurity and negatively related to job transformation insecurity; work complexity is negatively related to job replacement insecurity and positively related to job transformation insecurity; and problem-solving requirements are

negatively related to job replacement insecurity and positively related to job transformation insecurity.

Second, expected intelligent automation/augmentation mediates these relationships. According to cognitive appraisal theory, cognitive appraisal begins when individuals perceive that their well-being is affected. Therefore, this study posits that objective job characteristics affect technology-driven job insecurity by influencing employees' expectations of AI's impact on work (expected intelligent automation/augmentation). Expected intelligent automation means machine replacement of humans, while expected intelligent augmentation means human-machine collaboration. Employees expect jobs with high information processing requirements, low complexity, and low problem-solving requirements to be automated by AI technology, leading to job replacement insecurity. They expect jobs with low information processing requirements, high complexity, and high problem-solving requirements to be augmented by AI technology, leading to job transformation insecurity. This study posits that information processing requirements, work complexity, and problem-solving requirements affect job replacement insecurity through expected intelligent automation and affect job transformation insecurity through expected intelligent augmentation.

Third, personal characteristics have direct effects. Personal characteristics affect how individuals perceive and appraise objective stimuli (Lazarus & Folkman, 1984). Different individuals perceive and appraise the same stimuli differently (Debus et al., 2014). Therefore, this study further examines the effects of two personal characteristics—AI technology awareness and technology readiness—on technology-driven job insecurity. AI technology awareness reflects individuals' perceptions of how AI technology will affect their work in the future (Brougham & Haar, 2018). Employees with high AI technology awareness are more conscious of AI's impact on work and thus more likely to perceive technology-driven job insecurity. This study posits that AI technology awareness is positively related to both job replacement and job transformation insecurity. Technology readiness refers to individuals' propensity to accept and use new technologies to achieve work goals (Lin & Hsieh, 2012; Parasuraman, 2000). Employees with high technology readiness view technology-induced work changes more positively and have adequate resources to cope with them, making them less likely to perceive technology-driven job insecurity. This study posits that technology readiness is negatively related to both job replacement and job transformation insecurity.

Fourth, personal characteristics moderate these relationships. According to cognitive appraisal theory, cognitive appraisal depends first on perceiving that well-being is affected and second on viewing the impact and having resources to cope. The translation of job characteristic information into expectations of intelligent automation/augmentation requires employees to be aware of AI's future impact on work. Employees with high AI technology awareness process job characteristic information from an AI perspective and further judge how AI will affect work, while those with low awareness do not (Brougham & Haar, 2018). Therefore,

AI technology awareness strengthens the relationships between job characteristics and expected intelligent automation/augmentation. Additionally, whether expectations translate into technology-driven job insecurity depends on employees' attitudes toward technology and their resources to cope with change and uncertainty. Employees with high technology readiness have positive attitudes toward technology and high perceived control (Lin & Hsieh, 2012; Parasuraman, 2000), making them less likely to perceive job replacement insecurity from expected automation and less likely to perceive job transformation insecurity from expected augmentation. This study posits that technology readiness weakens the positive relationships between expected intelligent automation and job replacement insecurity and between expected intelligent augmentation and job transformation insecurity.

Finally, combining these mediating and moderating effects, this study further posits that AI technology awareness and technology readiness moderate the indirect effects of job characteristics on technology-driven job insecurity through expected intelligent automation/augmentation.

4. Theoretical Contributions

This study examines job insecurity in the AI context, proposes the concept of technology-driven job insecurity, and builds a systematic theoretical framework by clarifying its definition and dimensional structure, revealing its consequences, and identifying its antecedents. The study offers three theoretical innovations.

First, it innovatively proposes the concept of technology-driven job insecurity and analyzes its dimensional structure, deepening research on job insecurity in the AI context. Previous studies have primarily examined job insecurity antecedents and consequences in traditional contexts (Jiang et al., 2021; Lee et al., 2018; Shoss, 2017). Only a few have explored job insecurity in the AI context (Brougham & Haar, 2020; Lingmont & Alexiou, 2020; Nam et al., 2019) without focusing on job insecurity specifically caused by AI technology. The concept of technology-driven job insecurity and its dimensional structure provide a foundation for subsequent research. Moreover, while previous research distinguished quantitative versus qualitative job insecurity (Hellgren et al., 1999), cognitive versus affective job insecurity (Huang et al., 2010), and job-focused versus person-focused job insecurity (Ma Bing et al., 2022), this study distinguishes job replacement versus job transformation insecurity based on AI-induced job changes, expanding job insecurity conceptualization.

Second, this study examines the effects of technology-driven job insecurity on employee work and career outcomes. Traditional job insecurity research has used cognitive appraisal, conservation of resources, social exchange, and social identity theories to examine effects on well-being, work attitudes, motivation, and behavior (Lee et al., 2018; Shoss, 2017). Based on signaling theory, this study argues that technology-driven job insecurity conveys information about career prospects, affecting employees' perceptions of their occupational future

and subsequent outcomes. This enriches theoretical perspectives on job insecurity and reveals unique consequences. Additionally, while a few AI context studies have examined effects on exhaustion, work behavior, and career competence (Koo et al., 2021; Yam et al., 2022; Chen Wenjing et al., 2020), they have not revealed underlying mechanisms. This study explores differential effects of job replacement versus job transformation insecurity and reveals mediating mechanisms and boundary conditions, providing theoretical guidance for future research.

Third, this study examines how job characteristics and personal characteristics affect technology-driven job insecurity. Traditional research has focused on organizational factors (e.g., communication, change, performance) and individual factors (e.g., demographics, emotional traits, self-evaluation traits) (Jiang et al., 2021; Lee et al., 2018). In contrast, this study examines knowledge work characteristics (information processing requirements, work complexity, problem-solving requirements) and technology-related personal characteristics (AI technology awareness, technology readiness), revealing unique antecedents. Furthermore, while previous research found that both low-skill and high-intelligence jobs generate job insecurity (Yam et al., 2022), this study argues that employees in different jobs perceive different types of technology-driven job insecurity. Specifically, employees in jobs with high information processing requirements, low complexity, and low problem-solving requirements tend to perceive job replacement insecurity, while those in jobs with low information processing requirements, high complexity, and high problem-solving requirements tend to perceive job transformation insecurity. Additionally, Nam (2019) found that professional knowledge, creativity, and task repetitiveness did not affect job insecurity in the AI context. This study argues that the same job characteristic has opposite effects on job replacement versus job transformation insecurity, with effect strength depending on personal characteristics (AI technology awareness and technology readiness). By revealing differential effects of job characteristics on the two types of insecurity and their boundary conditions, this study deepens understanding of the relationship between job characteristics and technology-driven job insecurity.

This study also has practical value. AI technology profoundly impacts human work, threatening job continuity and stability. Alleviating employees' perceived technology-driven job insecurity and helping them effectively cope with it during Chinese enterprises' digital transformation is vital for building harmonious, stable labor relations. Therefore, examining the definition, consequences, and sources of technology-driven job insecurity in the organizational behavior domain can help organizations take effective measures to enhance employee well-being and promote harmonious labor relations during technological transformation.

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