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BARRIERS AND FACILITATORS OF PROMOTING WORK-RELATED INJURY INSURANCE IN THE CONSTRUCTION INDUSTRY: LESSONS FROM CHINA

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Abstract. Work-related injury insurance (WRII) is essential for protecting workers' rights and enhancing workplace safety, yet its promotion in construction faces challenges. This study investigates WRII adoption barriers and facilitators in China's construction sector using a mixed-methods approach. Semi-structured interviews with 14 industry experts were conducted, followed by thematic analysis to identify key barriers. An analytic hierarchy process was then applied to prioritize these barriers. The findings reveal six main barriers: (1) cumbersome claim process, (2) incomplete law and regulation system, (3) weak right-protection awareness of construction workers, (4) weak legal consciousness of contractors, (5) unreasonable compensation treatment and fund management, and (6) difficulties in employment relationship identification. To address these challenges, the study proposes five targeted measures: (1) simplifying the claim process, (2) promulgating authoritative and detailed laws and regulations, (3) strengthening supervision and law enforcement, (4) strengthening advocacy, and (5) improving insurance compensation and fund management. These findings offer practical guidance for policymakers to enhance WRII effectiveness in China's construction industry and provide insights applicable to other developing countries. Despite limitations related to expert judgment and sector focus, the study offers valuable recommendations for future research on cross-industry comparisons and digital solutions for WRII.

Keywords: construction workers, work-related injury insurance, China, barrier and facilitators, qualitative research, AHP.

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1. Introduction

The construction industry is globally recognized as one of the most hazardous sectors due to its dynamic and complex working environments (Cheng et al., 2023a). Construction workers are frequently exposed to various safety risks such as working at heights, heavy machinery operation, exposure to hazardous materials, unpredictable weather conditions, non-standard electrical environment, and over workload, etc. (Cheng et al., 2023a; Xu et al., 2021). These factors contribute to 3–5 times higher rates of workplace injuries and fatalities compared to other industries (Cheng et al., 2022). For instance, in China alone, the construction industry accounted for 904 deaths and thousands of injuries in 2019 according to the Ministry of Housing and Urban-Rural Development (MHURD). The elevated risk of work-related injuries not only threatens workers' health and safety but also creates substantial financial challenges for them and their families. Accidents often result in significant medical bills, prolonged rehabilitation periods, and lost income during recovery, thus severely impacting their quality of life, which could even drive them into poverty. Moreover, work-related injuries in the construction industry also have broader social implications, including increased healthcare costs, higher social security expenditures, and reduced workforce productivity, which collectively pose challenges to economic stability and social well-being (Ma et al., 2019).

The high-risk nature of the construction industry underscores the crucial importance of work-related injury insurance (WRII) (Begasse de Dhaem et al., 2024; Dethlefsen et al., 2022). WRII is a form of social insurance specifically

designed to protect workers from the financial hardships resulting from occupational injuries and illnesses. It provides coverage for medical expenses, rehabilitation costs, and compensation for lost wages during recovery periods (Sears et al., 2019). This safety net ensures that injured workers can access essential healthcare and rehabilitative services without placing additional financial strain on themselves or their families. Beyond assisting individual workers, WRII strengthens workforce morale and retention by fostering job security and satisfaction, which promotes a committed workforce that supports industry stability and development. At the societal level, WRII promotes social stability and reflects a shared commitment to worker welfare by offering direct support to workers and their families in times of need, contributing to a more resilient and inclusive society. Recognizing the impotant role of WRII, especially in high-risk industries like construction, more than 100 countries, including Germany, the United States, South Korea, and Australia, have established their comprehensive WRII systems (Lee et al., 2012; Lillie et al., 2025; Prang et al., 2016; Wirth et al., 2019). These systems are typically characterized by compulsory participation, employer-funded premiums, and government oversight, ensuring that workers receive adequate compensation and support in the event of work-related injuries.

China's WRII system began in 1951 and has since evolved through extensive legislation and enforcement. By 2021, it covered 282.87 million people, achieving 37.89% policy coverage nationwide. In addition, China made particular efforts to promote WRII in the construction industry. New official guidelines were introduced to clarify WRII payment and compensation for construction workers, implementing measures like project-based coverage and shifting the burden of proof to employers. However, significant issues remain. WRII coverage in construction is still much lower than in other industries (Zhao et al., 2025), with only about 30% of workers covered as many employers avoid WRII costs despite legal requirements. Injured workers often face delays and insufficient compensation, with some relying on informal agreements with contractors to secure financial support. In fact, these challenges are also faced by many developing coutries worldwide (Banerjee et al., 2024).

Given these challenges, there is a pressing need to investigate the barriers that hinder the promotion of WRII in the construction industry and to identify facilitators that could enhance its effectiveness, as the persistently low coverage rates and recurring implementation issues indicate that existing measures have not adequately addressed the unique challenges faced by this sector. Despite the progress of WRII systems globally and in China, significant research gaps remain in understanding how WRII implementation challenges manifest within high-risk sectors such as construction, particularly in developing country contexts. Prior studies have primarily examined WRII through the lens of institutional design, fiscal sustainability, and legislative reform (Safe Work Australia, 2023; Ghorpade et al., 2024; Jamal et al., 2022), providing valuable insights into macro-level arrangements. However, sector-specific challenges, such as those posed by informal employment, multi-tier subcontracting, and frequent labor mobility in the construction industry, remain underexplored (Ma et al., 2019). Existing empirical work has touched upon some of these issues (Cheng et al., 2023d), but few studies have systematically identified and prioritized the institutional and practical barriers to WRII adoption in this context. Moreover, the interaction of regulatory constraints, cognitive limitations, and organizational fragmentation in China's construction sector has not been examined using an integrated analytical framework (Cheng et al., 2023d; Sun & Liu, 2014; Yang et al., 2024b). These gaps hinder the development of context-sensitive strategies for promoting WRII coverage among vulnerable worker populations.

Therefore, the research problem addressed in this paper is: What are the key barriers preventing the effective promotion of work-related injury insurance in China's construction industry, and what facilitators can be proposed to overcome these barriers? To address this research problem, two objectives of this study are: 1) to identify and analyze the key practical barriers hindering the promotion of WRII in China's construction industry; 2) to develop targeted facilitators to address these barriers and enhance the effectiveness of WRII implementation. To achieve these objectives, this study employs a mixed-methods approach. First, qualitative data were collected through semi-structured interviews with 14 stakeholders involved in WRII implementation. Thematic analysis was then conducted to identify key institutional and practical barriers, as well as potential facilitating measures. Subsequently, the Analytic Hierarchy Process (AHP) was applied to evaluate and prioritize the identified barriers through expert pairwise comparisons, providing a structured basis for developing targeted responses.

This study is significant both academically and in engineering practice. Theoretically, it addresses a critical gap by extending institutional theory to the context of WRII adoption in the high-risk construction sector, an area often overlooked despite evident challenges. By examining how regulatory, normative, and cognitive barriers impact WRII implementation, the study moves beyond the conventional focus on policy compliance, highlighting the complex interplay between legal, social, and organizational factors. This approach not only broadens the application of institutional theory to social insurance systems but also reveals context-specific obstacles to effective WRII promotion, offering insights into both universal and region-specific challenges. Practically, this study moves beyond descriptive analysis by developing a targeted framework to prioritize the identified barriers, addressing the practical gap in guiding WRII implementation. By systematically ranking these barriers, the study offers policymakers a clear, evidence-based roadmap for enhancing WRII coverage. The proposed measures provide concrete, context-sensitive solutions that can be directly

applied in the construction sector in China and potentially adapted to other developing regions, thereby fostering a safer work environment by addressing the underlying regulatory, social, and organizational factors that hinder effective WRII implementation.

2. Literature review

Conducting a systematic literature review ensures that the research topic and methodology are well-grounded and scientifically justified (Bhutto et al., 2021). To provide a comprehensive understanding of the research problem, this literature review systematically examines the theoretical background, global practices, and WRII implementation challenges, particularly in China's construction sector. By integrating theoretical insights, global comparisons, and critical evaluations of existing studies, it highlights the key research gaps, laying the foundation for this study's focus on addressing sector-specific challenges in WRII adoption.

2.1. Theoretical background and global development of WRII

WRII is a cornerstone of modern social security frameworks, designed to provide economic and rehabilitative support to workers who suffer from occupational injuries or illnesses. The theoretical foundation of WRII rests on several key concepts within social welfare and insurance theory, primarily focusing on risk-sharing, income redistribution, and social protection (Williams, 1991). As a risk-sharing mechanism, WRII redistributes the economic burden of occupational injuries from individuals to a collective pool funded by employers, employees, and government, thus enhancing workers' financial security and mitigating individual economic impacts. Furthermore, WRII plays an essential role in income redistribution, especially in high-risk industries, by providing injured workers with financial compensation, thereby reducing income inequality caused by occupational hazards and promoting greater social equity (Anderson et al., 2022). In terms of social protection, WRII offers not only economic compensation but also rehabilitation services that facilitate injured workers' reintegration into the workforce, thus contributing to labor market stability.

Globally, WRII systems vary significantly across countries. Developed countries generally adopt mandatory WRII systems that incorporate preventive and rehabilitative services, thereby extending WRII's function beyond compensation to include proactive measures like safety training and accident prevention programs (Lippel, 2012). For instance, Germany's WRII system covers a broad range of services, including safety improvements and rehabilitation, effectively reducing workplace accidents (Philipsen, 2009). Similarly, countries like South Korea and Australia have implemented comprehensive WRII models that ensure workers receive both immediate financial assistance and longer-term rehabilitation support following occupational injuries (Safe Work Australia, 2023; Lee et al., 2012).

In contrast, the situation is notably different in developing countries, where WRII adoption and implementation face persistent challenges. Developing countries often struggle with low WRII coverage rates and implementation challenges due to limited regulatory enforcement, economic constraints, and administrative capacity (Freeman, 2010). In such countries, construction workers frequently lack sufficient injury insurance, resulting in significant financial hardship following workplace accidents (Singh & Chudasama, 2020). While some developing countries have sought to emulate successful WRII models from developed countries, obstacles such as funding shortages and limited worker awareness continue to impede effective WRII implementation (Ghorpade et al., 2024; Jamal et al., 2022).

Therefore, despite the proven effectiveness of WRII systems in many developed countries, the widespread adoption of WRII in developing countries remains problematic, especially in high-risk industries like construction (Zobeiri et al., 2022). The significant gap between developed and developing regions highlights the need for context-specific approaches that address economic constraints, regulatory limitations, and social dynamics unique to these environments. Existing research often lacks a comprehensive analysis of how these multifaceted barriers interact, particularly in rapidly developing economies. Addressing this gap is essential to formulating more effective WRII policies and ensuring equitable protection for vulnerable workers.

2.2. WRII system in China

China started to establish its WRII scheme in 1951 by issuing the Labour Insurance Regulations. After that, China's central government launched a series of laws and regulations in succession (Table 1) (Wang, 2022), thus forming a basically complete WRII system. Local governments in China as well attach great importance to WRII promotion. Local administrative regulations about work-related injury insurance at different levels have been gradually established throughout the country, further improving China's WRII legislation system. In addition to legislation, China has also made great efforts in law enforcement, legislation, and infrastructure development to further promote WRII and enhance public workplace safety (Zhang et al., 2023). Thanks to the efforts of China's central and local governments, the implementation of WRII in China has achieved certain milestones. In recent years, the number of insureds and percentage of policy cover continues to grow; the fund scale continues expanding; the management and service mechanism is increasingly perfect. Statistics from the Ministry of Human Resources and Social Security (MHRSS) show that by the end of 2021, the number of insureds of WRII in China reached 282.87 million with an increase of 92.77 million over 2012 (48.80%), achieving the percentage of policy cover of 37.89%. 2.06 million people received compensation from WRII in 2021. The annual income and expenditure of the WRII fund were 95.2 and 99 billion Yuan in 2021, with a cumulative balance of 141.1 billion yuan.

Table 1. Main laws and regulations about WRII in China

Year	Name	Department	Highlights
1951	Labor Insurance Regulations	Government Administration Council	It, for the first time, stipulates that employers should pay insurance for workers' work-related injury compensation, health care, maternity, and old-age care.
1996	The Trial Procedures for Industrial Injury Insurance for Enterprise Employees	Ministry of Labor	It, for the first time, combines the three main tasks of WRII: prevention, rehabilitation, and compensation.
2003 (revised in 2010)	WRII Regulations	Ministry of Human Resources and Social Security	It clarifies the rights and obligations of employers and employees, which explains critical issues including insurance fund collection and management, work-related injury certification, verification of the degree of physical disability, compensation treatment, etc. It is the essential basis for the implementation of WRII in China.
2003 (revised in 2010)	Measures for the Determination of Work-related Injuries	Ministry of Human Resources and Social Security	It is a particular provision of the work-related injury certification process and standards.
2010	Social Insurance Law	Standing Committee of the National People's Congress	It stipulates the rights of employees to various social insurance besides WRII. It is also the highest level in China's legislation system of WRII.
2013	Opinions on Several Issues concerning the Implementation of WRII Regulations	Ministry of Human Resources and Social Security	It provides a detailed explanation of the practical problems encountered in implementing the WRII Regulations.
2014	Judicial Provisions of the Supreme People's Court on Several Issues concerning Hearing Administrative Cases of WRII	Supreme People's Court	It provides the judicial basis for the court to deal with WRII-related disputes.
2016	Opinions on Several Issues concerning Implementation of WRII Regulations (No. 2)	Ministry of Human Resources and Social Security	It further makes a detailed supplementary explanation of the practical problems not addressed by WRII Regulations and Opinions on Several Issues concerning the Implementation of WRII Regulations.

In addition, China made particular efforts to promote WRII in the construction industry (Zhang, 2015). For example, the MHRSS, the MHURD, the State Administration of Work Safety, and the All-China Federation of Trade Union jointly released the "Opinions on Several Issues concerning Further Improving WRII in the Construction Industry" in 2017, which further explain payment and compensation of WRII of construction workers in details. A series of innovative measures have been implemented considering the nature of the construction industry, such as buying WRII according to construction projects, the burden of proof belonging to employers, etc.

Despite the advancements in China's WRII practices, there are still many problems when implemented in the construction industry (Ma et al., 2019). On the one hand, the percentage of WRII cover of construction workers is much lower than other industries, even though it is considered the most dangerous. Many employers are still unwilling to provide WRII for construction workers to reduce project costs though it is illegal. Only about 30% of China's construction workers were covered by work injury insurance in 2014 (Ran & Zhao, 2023; Sun, 2019). On the other hand, when workplace accidents happen, the rights of construction workers cannot be well protected by the WRII. Many injured construction workers cannot receive enough compensation from WRII in time. Sometimes, insured injured workers have to resort to private negotiations with contractors for informal compensation (Sun & Liu, 2014; Yang et al., 2024b). This mismatch between policy intentions and practical implementation underscores the need for more tailored strategies to enhance WRII adoption, particularly in high-risk sectors like construction. Addressing the economic and social barriers that hinder effective WRII coverage is essential to improving worker protection and promoting safer work environments.

2.3. Influence factors of the effectiveness of WRII promotion

Factors influencing the effectiveness of WRII promotion are complex and multifaceted, encompassing economic, legal, and social dimensions (Carrin & James, 2005). Economically, the costs associated with WRII premiums and compensation payments often deter employers, especially in high-risk industries like construction, from fully implementing coverage, which limits overall WRII effectiveness. The clarity and enforceability of WRII regulations akso play a crucial role (Han et al., 2014). Unclear or weakly enforced policies reduce employers' compliance and workers' confidence in the system (Casamatta et al., 2000). Additionally, workers' awareness of their rights and the level of advocacy from labor organizations significantly affect WRII uptake (Huang & Han, 2022). Job characteristics, such as high turnover rates and ambiguous employment relationships,

also affect the promotion of WRII (Lillie et al., 2025). Workers with limited knowledge of insurance benefits are less likely to demand coverage, while strong union advocacy has been shown to enhance WRII compliance. Despite recent government efforts to expand coverage, these economic, legal, and social barriers continue to challenge its full implementation.

Addressing these barriers is essential for improving WRII outcomes and ensuring broader and more effective coverage across high-risk sectors. However, existing studies on the factors influencing WRII promotion are often fragmented, focusing on isolated aspects rather than providing a comprehensive and systematic analysis. This fragmented approach limits the understanding of how different factors collectively impact WRII adoption, particularly within high-risk industries like construction. Therefore, there is a clear need for research that systematically identifies and categorizes the key barriers, offering a more integrated perspective to support targeted policy interventions. Filling this gap will help develop more practical solutions tailored to the construction sector's unique challenges.

2.4. Research gaps, motivation, and innovations

Despite extensive research on WRII systems globally and in China, notable research gaps remain evident. Existing literature predominantly emphasizes general policy frameworks, legislative developments, or isolated influencing factors, while systematic analyses of practical implementation barriers within specific high-risk sectors, particularly construction, are insufficient. Moreover, research rarely addresses the distinct economic, legal, and social barriers prevalent in developing-country contexts, where informal employment, multi-layered subcontracting, and high worker turnover pose significant challenges, as exemplified by China's construction industry.

Motivated by these gaps, this study systematically identifies and analyzes the specific economic, legal, and social obstacles impeding effective WRII promotion in China's construction industry. Utilizing a mixed-methods approach that integrates qualitative thematic analysis and quantitative AHP, this research aims to provide a comprehensive and prioritized understanding of these barriers to facilitate targeted interventions.

The innovations of this study include: (1) moving beyond fragmented analyses by offering a systematic, integrated framework specifically tailored to construction-sector barriers; (2) applying a rigorous mixed-methods approach that enhances the reliability and applicability of the results; and (3) clearly prioritizing identified barriers to deliver actionable policy insights, thereby directly contributing to enhanced WRII effectiveness and improved worker protection strategies in China and comparable developing contexts.

3. Research methods

This study adopts an exploratory sequential mixed-methods design combining qualitative and quantitative analyses grounded in a case study of China. The choice of a mixed-methods approach is grounded in the need to capture both the nuanced, context-specific insights from qualitative data and the objective prioritization of factors through quantitative analysis. Mixed-methods designs are increasingly employed in social science research to address complex phenomena that cannot be fully understood through a single methodological lens (Halevi Hochwald et al., 2023; Hendren et al., 2023; Van Looy, 2021). This approach is particularly suitable to comprehensively investigate the barriers and facilitators influencing the promotion of WRII in the construction industry. The construction industry is a high-risk sector with intricate social, legal, and economic dynamics. Understanding the barriers to WRII promotion requires not only identifying the key challenges but also prioritizing them to inform targeted interventions. A purely qualitative approach might offer rich, descriptive insights but lacks the ability to quantify the relative importance of each barrier. Conversely, a purely quantitative method might overlook the nuanced contextual factors. Therefore, a mixed-methods approach is ideal, as it combines the depth of qualitative inquiry with the rigor of quantitative analysis.

The research is structured in three stages, which are data collection, qualitative analysis, and quantitative validation, each serving a distinct purpose in building a comprehensive understanding of the issue (Figure 1). In the first stage, data were gathered through semi-structured interviews to capture diverse stakeholder perspectives on WRII implementation. This stage aimed to collect rich, experience-based insights into real-world challenges and enabling factors. In the second stage, a thematic analysis was conducted to systematically identify and interpret key institutional and practical factors. This qualitative step

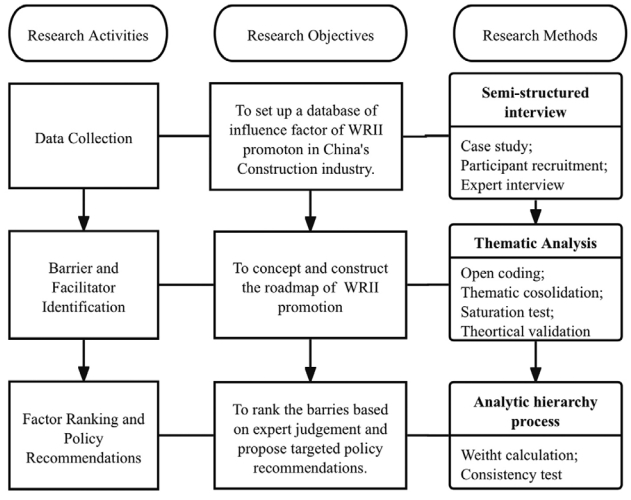

Figure 1. Research design based on a mixed-methods approach

allowed for the development of a structured framework grounded in stakeholder experiences. In the third stage, the Analytic Hierarchy Process (AHP) was applied to validate and prioritize the identified barriers. This stage transformed qualitative findings into a quantitative decision model, enabling the identification of high-priority obstacles for targeted policy intervention.

3.1. Case study

A case study approach was adopted in this research due to its suitability for examining complex, context-dependent phenomena within their real-life settings (Noor, 2008; Priya, 2021). As a qualitative research strategy that integrates multiple sources of information (Bao & Lu, 2020), the case study method enables researchers to gain a holistic understanding of dynamic institutional processes (Burnard, 2024), particularly when boundaries between the phenomenon and its context are blurred (Bao et al., 2020). Given that the promotion of WRII involves interrelated legal, administrative, and behavioral components that vary by context, the case study approach provides the necessary depth and flexibility to uncover the barriers and facilitators embedded in a specific national system, thereby making the study more referential and possibly generalizable to other regions globally.

China was selected as the case study setting for three main reasons (Cheng et al., 2023d; Yang et al., 2024a). First, construction is a cornerstone of China's national economy, and the country holds a leading position in the global construction market. Since 2009, the construction sector has consistently contributed more than 6.5% to China's GDP. In 2021, the total output value of China's construction industry reached 29.3 trillion yuan, marking an 11.04% increase from the previous year and ranking first worldwide. Additionally, China's trade volume in construction services reached 40.27 billion US dollars in 2021, again leading globally. These industry characteristics make China's construction sector an ideal reference for drawing conclusions that may also be relevant to other countries. Second, the Chinese government has introduced several initiatives to promote WRII in recent years, achieving some progress while still facing challenges. By examining China's experiences, this study aims to identify key barriers and facilitators that can guide future WRII development. Finally, as the largest developing country, China provides a model that could be especially insightful for other developing nations. Lessons from China's WRII practices could offer valuable guidance for similar efforts in construction industries globally, especially in regions with comparable economic conditions.

3.2. Data collection: semi-structured interview

Semi-structured interviews were employed as the primary data collection method to gather in-depth insights from diverse stakeholders on WRII promotion in China's construction industry. This qualitative approach combines structured questioning with flexibility, allowing for a comprehensive exploration of complex issues while maintaining consistency (Adeoye-Olatunde & Olenik, 2021; Barriball & While, 1993). The method's adaptability makes it particularly suitable for this study, as it facilitates the collection of nuanced perspectives from respondents with varied professional backgrounds (Cheng et al., 2023c; Stanitsas et al., 2021). By enabling follow-up questions, semi-structured interviews allow for deeper exploration of emergent themes that more rigid methods like structured interviews may overlook.

The purposive sampling strategy focused on individuals with substantial experience related to WRII, ensuring role diversity and expertise representation. The selection of qualified interviewees generally followed two criteria. Firstly, they should have an in-depth understanding of the WRII promotion in China's construction industry and, therefore, are expected to be able to provide insights on this topic. This means selected interviewees should have rich related work experience. Secondly, their roles should

Table 2. Profiles of interviewees

No.	Roles	Work experience
1	An associate professor in construction management	6 years
2	A lawyer specializing in labor disputes	12 years
3	A section chief of the department of the WRII of the Labor and Social Security Bureau	11 years
4	A professor in laws	14 years
5	A construction manager (mainly building engineering projects)	8 years
6	An officer of the State Bureau of Safe Production Supervision and Administration	7 years
7	A construction manager (mainly railway engineering projects)	5 years
8	A judge of the provincial court	9 years
9	A construction manager (mainly civil engineering projects)	6 years
10	An associate professor in laws	7 years
11	An officer of the Provincial Department of housing and urban-rural development	6 years
12	An officer of the Human Resource Office of a construction company	5 years
13	An on-site construction engineer	9 years
14	A consultant in an insurance company	7 years

be diverse enough to cover different phases of WRII promotion to obtain a more comprehensive understanding. The WRII promotion in China's construction industry involves various stakeholders from governments, industries, and academia. Therefore, this study should include all related stakeholders. Table 2 lists the details of the interviewees.

The interview protocol was designed to guide discussions while allowing flexibility to probe emerging themes. Core questions addressed responsibility for medical expenses, common WRII practices, key barriers, and potential strategies for WRII enhancement. Participants were asked to respond to four questions regarding WRII promotion:

1. Who will afford construction workers' medical bills when work-related injuries occur in construction projects in China?
2. What are the usual practices of construction enterprises in China in providing construction workers WRII? Are they enough?
3. What are the barriers to implementing workers' WRII in China's construction industry?
4. Could you please suggest any facilitators to promote WRII in China's construction industry further?

Before the interviews, ethical issues associated with participating in the research were considered. These include obtaining participants' full consent for answering interview questions, ensuring the confidentiality and anonymity of research data, and seeking permission to audio-record the interviews. Semi-structured interviews were conducted through video calls in Chinese. Each interview lasted about 30 min and was audio-recorded and fully transcribed. An interview transcript was sent to each Interviewee, enabling them to confirm the findings and thus ensuring the content validity of the study. The qualitative data obtained through semi-structured interviews formed the foundation for thematic analysis and informed the identification of key barriers and facilitators in WRII promotion.

3.3. Qualitative research: thematic analysis

Thematic analysis is a qualitative research method used to systematically identify, analyze, and interpret patterns within data (Franz & Roberts, 2022). It provides a structured approach to uncovering insights from qualitative information, making it particularly suitable for examining complex social phenomena (Opoku et al., 2022). This method enables researchers to distill qualitative data into meaningful themes, facilitating a comprehensive understanding of participants' experiences and perspectives (Govender et al., 2025). Its flexibility allows for nuanced interpretation, which is essential when examining diverse stakeholder views on WRII promotion.

Following the completion of the 14 interview transcripts, an in-depth thematic analysis was conducted to explore the barriers and facilitators of WRII promotion in China's construction industry. This study followed the thematic analysis process outlined by Zainal and Barlas (2022). Initially, all transcripts were thoroughly read to ensure familiarity with the content. Open coding was then performed line by line, generating preliminary codes that represented fundamental aspects of WRII-related barriers and facilitators. At this stage, a wide range of codes was created to capture diverse insights. Subsequently, the codes were carefully reviewed, refined, and grouped into overarching themes. This iterative process involved merging similar codes, discarding irrelevant ones, and ensuring that the themes accurately reflected the data. The analysis continued until data saturation was achieved, indicated by the absence of new themes emerging from the transcripts. To enhance reliability, only themes mentioned by at least three interviewees were retained. Finally, the themes were triangulated with existing literature to reinforce the validity of the findings, ensuring that the identified barriers and facilitators were grounded in both empirical data and theoretical context.

3.4. Quantitative analysis: Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) is a structured multicriteria decision-making method that facilitates the quantitative prioritization of factors by decomposing a complex problem into a hierarchy of more easily comprehended sub-problems (Pant et al., 2022). Through pairwise comparisons and the calculation of priority weights, AHP systematically quantifies subjective judgments, making it particularly useful when decision criteria are qualitative or not directly measurable. AHP is widely applied in construction management research to rank factors based on expert opinions (Aksüt & Eren, 2023; Cheng et al., 2023b), providing a robust framework for decision analysis.

This study applied AHP to quantitatively validate and prioritize the key barriers to WRII promotion identified through thematic analysis. Considering the multifaceted and subjective nature of WRII barriers, AHP is particularly suitable for this research context as it provides a structured approach to integrate expert judgments while simultaneously ensuring consistency through rigorous checks. In this study, the AHP process involved 14 experts who had previously participated in semi-structured interviews. These experts conducted pairwise comparisons of the identified barriers, rating each barrier's relative importance on a scale from 1 (equally important) to 9 (extremely more important). The pairwise comparison matrix was constructed based on these judgments, and the priority weights were calculated to rank the barriers. To ensure the reliability of the results, a consistency ratio (CR) was computed, with a CR value below 0.1 considered acceptable. In cases where inconsistency was detected, experts were asked to reassess their evaluations to improve consistency.

The results of AHP quantitatively highlighted the most significant barriers to WRII promotion, providing a clear hierarchy of factors. This quantitative analysis, when integrated with qualitative insights from thematic analysis, offers a comprehensive understanding of the primary challenges in WRII adoption, informing targeted interventions and policy recommendations.

4. Results of qualitative research

Through an in-depth thematic analysis of the 14 interview transcripts, six barriers preventing the promotion of WRII in China's construction industry were identified, and five targeted facilitators were proposed accordingly. The final thematic map is presented in Figure 2. Each barrier and facilitator is detailed separately below.

4.1. Barriers preventing WRII promotion

4.1.1. B1: Difficulties in employment relationship identification

According to the "Regulation on WRII", employment relationship identification is a prerequisite for work-related injury certification. Only after the employment relationship is confirmed, could researchers then further determine whether an injury is work-related. However, China's construction industry has the characteristics of short construction periods, large personnel turnover, and weak awareness of workers' rights protection. Many construction workers work without official labor contracts. Injured construction workers often cannot provide valid evidence of employment relationships when safety accidents occur. It is sometimes difficult for the labor and social security department to verify the employment relationship. Difficulties in employment relationship identification give some illegal contractors a leg up on shirking their responsibility.

Interviewee 5 explained that: "Due to the short construction period for construction workers, especially the construction period of only a few months in northern China, construction enterprises and workers generally do not sign labor contracts but just verbally agree on the amount of salary. This brings inconvenience in employment relationship identification during work-related injury certification".

Interviewee 3 added that: "Even though the labor and social security department will help construction workers without contracts to investigate and verify the existence of employment, the process is sometimes difficult due to a lack of solid evidence and takes a long time".

As echoed by Interviewee 2: "Since it is challenging to identify employment relationships for construction workers without official labor contracts, some construction enterprises that do not pay workers' WRII often refuse to bear the responsibility for the injury by denying labor relations".

In addition, subcontracting is common in China's construction industry, which further increases difficulties in employment relationship identification during work-related injury certification.

As explained by Interviewee 11: "Construction enterprises often subcontract much of the work to other subcontractors. Some of these small sub-contractors even lack corresponding qualifications. The employment relationship

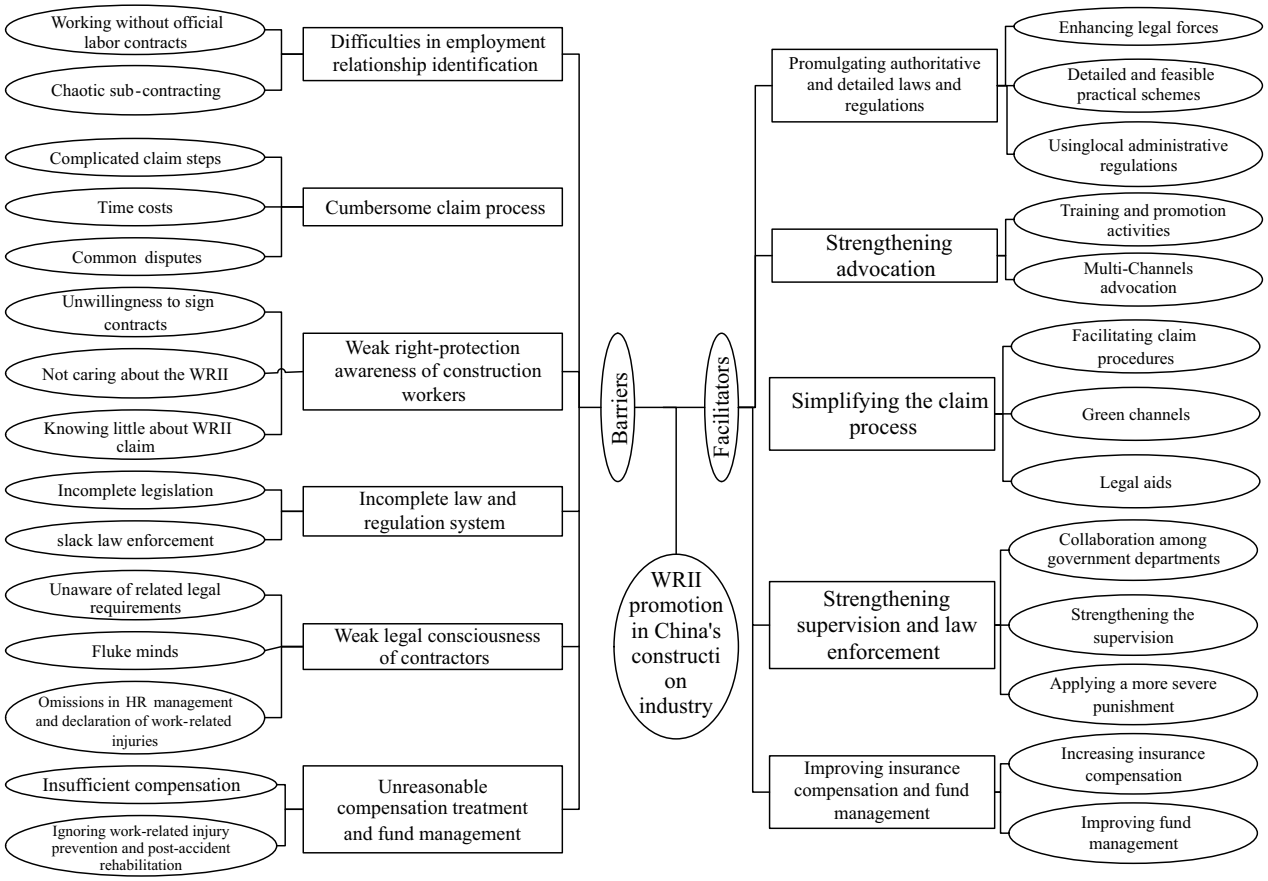

Figure 2. Thematic coding map of barriers and facilitators of WRII promotion in China's construction industry

is unclear between workers, sub-contractors, and construction enterprises. Therefore, when paying workers' WRII or work-related injuries occur, sub-contractors and construction enterprises are likely to pass the buck to each other".

In summary, due to the nature of China's construction industry, it is often difficult to validate the employment relationship identification in the liability issue, which provides an excuse for employers not to provide WRII for their construction workers and to deny compensation when work-related injuries occur. This finding resonates with past studies pinpointing the barrier to employment relationship identification for construction workers. For example, Liao and Chiang (2022) found that non-standard employment construction workers face inferior job security and protection like WRII. Wu (2014) also highlights the obstacles to further promoting WRII in China's construction industry caused by employment relationship identification for construction workers. Ran and Zhao (2023) also pointed out that ambiguous employment relationships complicate the protection of employees' rights when occupational accidents occur.

4.1.2. B2: Cumbersome claim process

The claim process of WRII usually consists of three steps: work-related injury certification, verification of the degree of physical disability, and compensation payment. When work-related injuries occur, injured workers must submit the required materials for work-related injury certification to the local labor and social security department. When workers are disabled due to work-related injuries, verification of the degree of physical disability is also required. The compensation will be paid after the cumbersome process, which usually takes time. Due to the high time cost of WRII claims, many injured construction workers, especially those desperate for money to pay for medical and living expenses, have to settle the case out of court, even though they will receive much less compensation in this case.

According to Interviewee 7: "The claim process usually takes several months to one year. If unexpected circumstances occur in the process, such as difficulties in employment relationship identification, labor arbitration or even litigation may be required, which will cost much more time".

Interviewee 14 added: "Sometimes injured workers are not satisfied with the outcome of the WRII claim, and they will file an administrative review. This will significantly increase the required time of the WRII claim process".

Interviewee 1 added: "The registered address of the construction company is often inconsistent with the project address in China's construction industry. Claiming in different places can also increase the compensation process time of WRII claims".

Interviewee 3 further added: "Injured construction workers are often caught in the vortex flow of claims applications, work-related injury certification, labor arbitration, and judicial litigation. The marathon process usually exhausts and prohibits many people from protecting their rights with WRII. Therefore, settling the case out of court with contractors sometimes becomes the last resort".

In summary, the cumbersome claim process of WRII significantly increases injured construction workers' time cost during compensation for work-related injuries. Many injured construction workers are unwilling to afford the increased time cost, especially those who desperately need money to pay for medical and living expenses. The cumbersome claim process is therefore considered a block in WRII promotion in China's construction industry. These findings are in line with previous studies. For example, Basaula (2017) indicated that claim process speed helps to increase insurance business. Ren (2020) also highlighted the negative impacts of the cumbersome claim process on WRII promotion in China's construction industry.

4.1.3. B3: Weak right-protection awareness of construction workers

Construction workers in China usually have weak right-protection awareness. Firstly, they often ignore the importance of employment contracts in work-related injury certification. Many construction workers are not even willing to be tied down by contracts. This leaves severe risks for construction workers to protect their rights when work-related injuries occur.

Interviewee 12 explained that: "Worker turnover is exceptionally high in the construction industry. Contractors implement simple "oral management" instead of signing official employment contracts. At the same time, construction workers are sometimes willing to be free from contracts".

Secondly, many construction workers are not concerned about their insurance configuration. They usually do not know employers are obligated to provide them with WRII. Many of them are also unclear whether the employers have helped them buy WRII.

As echoed by Interviewee 9: "During my work, few construction workers take the initiative to inquire about the configuration of WRII when they enter the workforce. Most workers only care about their salaries".

Interviewee 1 added: "Even without WRII, many construction workers still work as usual. Some construction workers are even afraid that WRII may impact their income, thus averse to buying insurance".

Thirdly, when safety accidents happen, many injured construction workers do not know how to protect their rights properly and claim compensation.

Interviewee 13 explained: "Few construction workers understand the process of WRII claims. Because they worry that the claim process will be too complicated and time-consuming, many construction workers prefer to settle behind closed doors with contractors instead of claiming compensation with WRII, in order to obtain compensation as quickly as possible".

Interviewee 5 added: "Construction jobs are highly fungible. Safeguarding rights may mean losing their jobs for many construction workers. Therefore, many construction workers do not dare do".

In summary, weak right-protection awareness of construction workers gives irresponsible contractors a leg up on weaseling out of their responsibilities, thus further hindering the promotion of WRII in China's construction industry. Findings are consistent with previous studies. For instance, Wu (2019) conducted a questionnaire survey in Hangzhou, China. He found that most construction workers lack enough right-protection awareness and know little about their WRII. Similarly, Ren's (2020) survey also highlights the weak right-protection awareness of China's construction workers.

4.1.4. B4: Incomplete law and regulation system

Although China has made great efforts to the WRII-related laws and regulations system, there are still many problems. Firstly, in terms of legislation, the law and regulation system of WRII lacks the necessary top-level design. In other words, the governments do not pay enough attention to the WRII of construction workers; thus, the legislation lags behind.

As explained by interviewee 10: "The most important law and regulation related to WRII issued by the central government in China is "Regulation on WRII". In China's legislation system, it belongs to administrative regulations. Compared with laws, its constraint is weak. The force of administrative regulations issued by local governments is weaker than national laws and regulations. The weak binding force of related laws and regulations results in difficulties in enforcement".

Interviewee 4 added: "The present related laws and regulations mainly consist of insurance enrollment, fund management, work-related injury certification, and compensation payment. However, partial contents, particularly related to work-related injury certification and compensation payment, are not specific and clear enough. It is thus difficult for construction workers to protect their rights when work-related injuries happen".

Interviewee 1 further added: "The lack of efficient reward and punishment mechanisms in the current legal system is one of the main reasons why many construction managers dare to weasel out their responsibilities".

In addition to legislation, slack law enforcement also hinders WRII promotion in China's construction industry.

As explained by interviewee 2: "The WRII and work-related injuries processing in the construction industry are related to various government departments in China, such as the MHRSS, the MHURD, and the State Administration of Work Safety. There are unclear responsibilities and buck-passing among departments".

Interviewee 6 added: "Contractors' illegal cost is low. The government lacks effective management and supervision of the WRII in the construction industry. The relevant law enforcement officials usually go through the motions in the routine inspection of the construction units and do not perform their functions carefully. There is no effective punishment mechanism for illegal contractors. Even when workplace accidents happen, the government department's treatment is sometimes based on the information reported by the enterprise instead of its own investigation. Construction workers are often not treated fairly in disputes about work-related injuries".

In summary, there are still some shortcomings in the law and regulation system about WRII promotion in China's construction industry in terms of both legislation and enforcement. This barrier is also highlighted in previous studies. For example, Duan and Wang (2016) indicated laws and regulations about WRII do not have sufficient binding force. Deng and Xiang (2009) indicated that poor collaboration among various government departments results in poor enforcement of laws and regulations. Xu and Mei (2011) also highlighted shortcomings in legislation and enforcement regarding WRII promotion in China's construction industry.

4.1.5. B5: Weak legal consciousness of contractors

Even though China's central and local governments have implemented laws and regulations to promote WRII in the construction industry, many contractors with weak legal consciousness do not obey these rules to maximize economic benefits.

As echoed by Interviewee 10: "Many contractors are unaware of related legal requirements such as the labor law and Regulation on WRII. They, therefore, do not sign employment contracts and buy insurance. Some contractors understand related legal requirements but still do not sign employment contracts and buy insurance to weasel out their responsibilities and reduce project costs. Construction workers with weak right-protection awareness usually indulge in employers' delicts".

Interviewee 1 added: "Many contractors feel that safety accidents are small probability events, and thus it is unnecessary to provide WRII for construction workers. These contractors are often forced to take out workers' insurance long after a project has begun because of the requirements of construction permits".

In addition to not signing employment contracts and not buying insurance, some contractors also have many omissions in human resource management and declaration of work-related injuries, which goes against the laws and regulations.

Interviewee 6 explained that: "Many construction projects have no full-time staff to handle WRII. There are many omissions in their daily work, such as belittling workers' attendance, taking no count of the real-name system of construction managers, and not processing work-related injuries in time".

In summary, contractors with weak legal consciousness are sometimes unaware of and thus fail to obey related laws and regulations, resulting in delicts such as not buying WRII or not processing work-related injuries in time. These delicts are definitely impacting the further promotion of WRII in China's construction industry. This finding is in line with previous studies. For example, Wu (2019) indicated that contractors' weak legal consciousness makes them fail to fulfill duties about workers' WRII. Ye (2018) also highlighted the role of contractors in WRII promotion in China's construction industry.

4.1.6. B6: Unreasonable compensation treatment and fund management

The compensation treatment and fund management in China's WRII are also unreasonable. Firstly, the aggregate amount of compensation is not enough.

As explained by Interviewee 14: "Most construction workers' salaries are the primary breadwinner for their families. When they suffer work-related injuries and lose work capacities, their families may fall into financial crisis. However, the aggregate compensation amount is usually insufficient to cover all medical and living expenses".

In addition to the insufficient aggregate compensation amount, the fund management is also irrational, which is reflected by the fact that a small portion of the fund has been used for work-related injury prevention and post-accident rehabilitation.

Interviewee 3 explained that: "Although the Regulation on WRII has mentioned the importance of work-related injury prevention and post-accident rehabilitation, there are no detailed regulations. In other words, the WRII in China mainly focuses on the compensation for work-related injuries after accidents while paying little attention to work-related injury prevention and post-accident rehabilitation".

In summary, unreasonable compensation treatment and fund management sometimes make WRII fail to address work-related injury problems. This is in line with previous studies. For example, Xu and Mei (2011) indicated that the aggregate compensation amount is often insufficient to support the necessary expense of work-related injuries in the construction industry. Ren (2020) then highlighted the improper use of the WRII funds.

4.2. Facilitating measures to prompt WRII

The qualitative analysis also identified five key facilitating measures to address six main barriers to WRII promotion in China's construction industry (Figure 3). Promulgating authoritative and detailed laws and regulations (F1) targets the incomplete legal framework (B4). Strengthening advocacy (F2) addresses weak rights-protection awareness among workers (B3) and weak legal consciousness among contractors (B5). Simplifying the claims process (F3) tackles the cumbersome claims process (B2) and difficulties in employment relationship identification (B1). Strengthening supervision and law enforcement (F4) primarily addresses incomplete law and regulation system (B4), weak legal consciousness of contractors (B5), and unreasonable compensation and fund management (B6). Improving insurance compensation and fund management (F5) addresses unreasonable compensation and fund management (B6).

4.2.1. F1: Promulgating authoritative and detailed laws and regulations

As mentioned, there are still many deficiencies in legislation and system setup to further promote WRII in China's construction industry, such as insufficient legal force, some detailed problems remaining unclear and unaddressed, etc. Thus, seeking out the deficiency in legislation and perfecting the legislation system are effective ways to promote WRII in China's construction industry. The central government should enhance the legal force of related laws and regulations.

As explained by Interviewee 10: "Most laws and regulations related to WRII in China are administrative regulations instead of laws, including the WRII Regulations which is the most critical basis for implementing WRII in China. The central government should improve the top-level design of the law and regulation system, raise the class of related laws and regulations, and enhance their legal force".

In addition to the legal force, some unclear details of practical problems that have not been addressed in previous laws and regulations should be further explained in future legislation.

Interviewee 4 explained: "An efficient reward and punishment mechanism for WRII in the construction industry has not been developed in China's legislation system. The governments should enact a law to punish illegal acts of employees such as not signing labor contracts, illegal subcontracting and sub-letting, and not buying WRII".

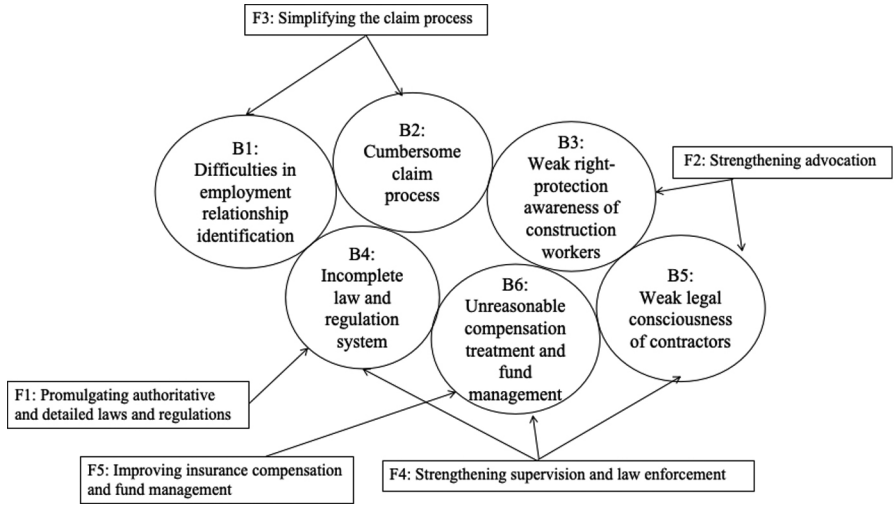

Figure 3. Facilitating measures targeted to identified barriers of WRII promotion in China's construction industry

Interviewee 11 further added: "The governments should promulgate detailed laws and regulations that the industry stakeholders can truly follow by considering the nature of China's construction industry. Such laws and regulations must contain detailed and feasible practical schemes for various stages of WRII promotion in the construction industry, including insurance enrollment, fund management, work-related injury certification, and compensation payment".

In addition, the role of local administrative regulations should also be taken maximum advantage of.

As echoed by Interviewee 10: "Local administrative regulations about construction workers' work-injured insurance at 3different levels have been gradually developed in China. In the future, local governments should continue to make full use of local administrative regulations to further promote WRII in the construction industry by combining the laws and regulations released by the central government and region-specific factors".

In summary, a perfect law and regulation system is critical for further promoting construction workers' WRII, which is also highlighted in many previous studies (Duan & Wang, 2016; Wang, 2022).

4.2.2. F2: Strengthening advocation

It is widely acknowledged by existing literature and expert interviews that weak right-protection awareness of construction workers and the legal consciousness of contractors are essential barriers to promoting WRII in China's construction industry. Strengthening advocation is expected to raise the right-protection awareness of construction workers and the legal consciousness of contractors.

As echoed by Interviewee 8: "A series of training and promotion activities of WRII enable construction workers to understand the importance of labor contracts and WRII, and how to protect their rights with the WRII when safety accidents happen".

Interviewee 6 further added: "Construction managers are often unfamiliar with the newest policy about WRII and the potential outcomes of their irregularities. Sometimes they even do not realize that they have broken the law. Thus, it is necessary to enhance policy advocacy to allow contractors to understand their responsibilities and improve their legal consciousness".

To boost the effects, the advocation campaign should cover more channels to which construction managers and workers may be exposed.

According to Interviewee 11: "Advocation campaigns should consider the characteristics of audiences. Advocation contents toward construction workers and managers should be as accessible as possible. Advocation campaigns can be conducted through multiple forms, such as vocational training, TV advertisements, publicity slogans, etc. Considering the popularity of internet short video platforms in China, advocation can also apply some short videos".

In summary, a series of advocation through multiple forms are necessary for further promotion of WRII in China's construction industry. This finding is in line with previous studies (Ren, 2020; Wu, 2019).

4.2.3. F3: Simplifying the claim process

Most China's construction workers are peasant workers with low education levels and weak right-protection awareness. When workplace accidents happen, injured construction workers have no access to seek compensation that they deserve with legal means. Therefore, it is necessary to simplify the WRII claim process and facilitate injured construction workers to protect their rights.

As echoed by Interviewee 6: "Work-related injury certification, particularly employment relationship identification, has always been problematic in construction workers' WRII claims. Therefore, reducing the required materials and procedures in work-related injury certification is essential. For employment relationship identification of injured construction workers, types of acceptable evidence should be further extended. Labor and social security departments of governments should also positively aid injured construction workers in taking evidence during work-related injury certification".

Interviewee 1 added: "Governments should set up specialized institutions and provide "green channels" of WRII claims for construction workers. Relevant government departments should prioritize WRII construction workers' claims and process the case within a limited time. A specialized labor dispute tribunal is needed for cases with large disputes to handle them efficiently. In this way, the simplified claim process and reduced time cost will encourage more construction workers to participate in WRII promotion".

Interviewee 10 further added: "Advancements in internet technologies can also aid in the simplification of WRII claims. In addition to the traditional face-to-face claim approach, the governments can also establish an online platform for WRII claims, which provides construction workers more access to protect their rights with the law means".

For construction workers with difficulties in work-related injury disputes, necessary legal aids are also important.

Interviewee 2 explained: "Governments should set up "green channels" to provide necessary legal aid for construction workers with difficulties in work-related injury disputes, such as legal consulting and compensation claims, etc., which enables them to take legal steps to protect their rights.

Interviewee 4 further added: "The necessary judicial remedy should also be provided for the parties with financial difficulties. For example, related costs such as legal fare and counsel fee should be further reduced to help construction workers who need legal aid".

In summary, difficulties in WRII claims often keep construction workers from claiming compensation and protecting their rights with law means. To further promote WRII in China's construction industry, governments must

simplify the claim process and provide construction workers with necessary aid, thus reducing potential difficulties in WRII claims. This finding is as well consistent with previous studies. For example, Luo (2019), Ren (2020), and Wang (2022) all highlighted the importance of reduction of construction workers' difficulties in WRII claims.

4.2.4. F4: Strengthening supervision and law enforcement

A sound policy system can only be truly effective if well executed. As mentioned, there are several omissions in implementing WRII in China's construction industry. Therefore, strengthening supervision and law enforcement is critical to further promote WRII. Firstly, WRII promotion is not a solitary pursuit. Instead, it requires collaboration among various government departments to ensure that the measures are implemented.

As echoed by Interviewee 6: "To address the problems in WRII implantation in China's construction industry, such as overlapping functions, the divorce between powers and responsibilities, and duplicate law enforcement, the functions and powers of related government departments including the MHRSS, the MHURD, and the State Administration of Work Safety shall be appropriately divided and clarified, thus avoiding mutually making excuses. In addition, various government departments should also achieve information sharing, joint enforcement, and mutual supervision, thus ensuring the integration and smooth completion of the whole process of WRII promotion in China's construction industry".

In addition, increasing employers' violation costs also helps to stop them from weaseling out their responsibilities. This requires not only strengthening the supervision of contractors but also applying a more severe punishment for violations.

Interviewee 4 explained that: "Governments should strengthen the security patrol, urged, inspection for common violations in the construction industry, such as illegal subcontracting and sub-letting, not signing employment contracts, not buying WRII, etc. Relevant monitoring should not be mere formalities".

Interviewee 8 added that: "The government needs to monitor violations through multiple channels. Apart from related government departments, it is vital to attract social forces to participate in the supervision work. A platform is expected to be provided for the public for violation tip-off. In addition, advanced big data technologies are also expected to contribute to monitoring violations of contractors".

Interviewee 1 further added that: "A robust accountability mechanism for contractor violations is urgently needed to promote WRII in China's construction industry further. Governments should hold the contractors involved accountable and take administrative coercive measures such as hefty fines, suspension of works, and confiscation of the relevant qualifications of the contractors".

In summary, strengthening supervision and law enforcement helps reduce contractors' fluke minds and increase their illegal costs, thus ensuring they obey related laws and regulations in employing workers and purchasing WRII. Previous studies also highlighted the importance of supervision and law enforcement in WRII promotion in China's construction industry, which validated the findings of this study (Duan & Wang, 2016; Ye, 2018).

4.2.5. F5: Improving insurance compensation and fund management

To fully use the WRII for protecting construction workers' rights, the insurance compensation and funding management of WRII should be further improved. On the one hand, the insurance compensation should be increased to guarantee medical care and living conditions for injured construction workers.

As echoed by Interviewee 14: "The compensation of WRII should comprehensively consider various factors, such as traumatic condition, degree of physical disability, the local price of commodities, family conditions of injured construction workers, etc. The insurance compensation should be enough to support injured construction workers' medical and living expenses until they can return to work".

On the other hand, more efforts should be made to improve work-related injury prevention and post-accident rehabilitation in insurance fund management.

Interviewee 3 explained that: "Work-related injury prevention and post-accident rehabilitation are also important objectives of WRII, often ignored when implemented in China's construction industry. In the future WRII fund management, investment in work-related injury prevention and post-accident rehabilitation should be increased, such as improving workplace conditions of construction workers, developing specialized rehabilitation centers, etc.".

In summary, improving insurance compensation and fund management enables WRII to maximize the effects of protecting construction workers' rights and accelerating workplace safety in the construction industry. This is also in line with previous studies like Wu (2014) and Xu and Mei (2011).

5. Results of quantitative research

The results of the AHP analysis indicate the relative importance of various barriers to promoting WRII within China's construction industry. The calculated weights for each barrier, calculated from the pairwise comparison matrix, allow for a prioritized understanding of these barriers. Using 14 expert responses, a pairwise comparison matrix was created to evaluate each barrier's relative importance. The matrix was normalized by dividing each element by the sum of its column. The normalized matrix provides a standardized basis for calculating weights.

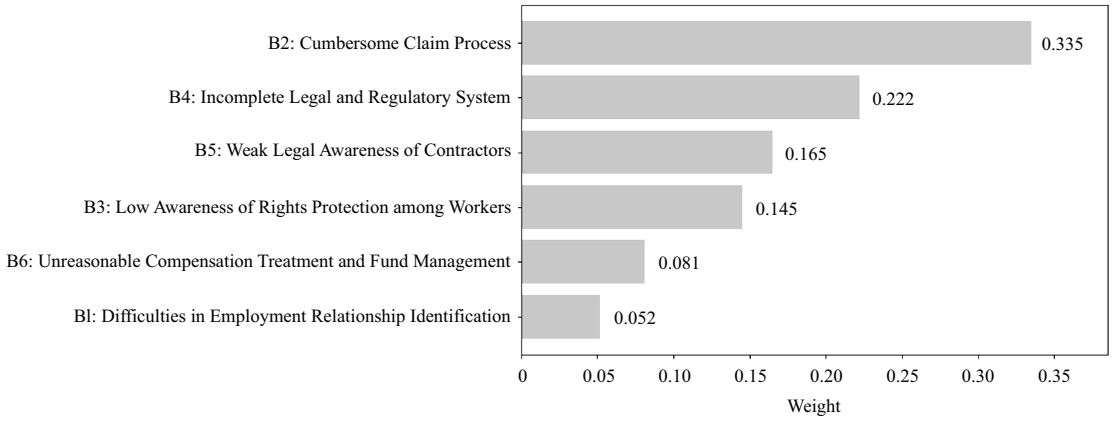

Figure 4. Relative weights of barriers to WRII promotion in China's construction industry

$$N = \begin{matrix} 0.062 & 0.067 & 0.039 & 0.070 & 0.053 & 0.029 \\ 0.125 & 0.133 & 0.348 & 0.281 & 0.263 & 0.571 \\ 0.188 & 0.044 & 0.116 & 0.070 & 0.132 & 0.286 \\ 0.125 & 0.067 & 0.232 & 0.140 & 0.395 & 0.714 \\ 0.156 & 0.067 & 0.174 & 0.046 & 0.132 & 0.429 \\ 0.313 & 0.033 & 0.058 & 0.028 & 0.044 & 0.143 \end{matrix}.$$

By averaging each row of the normalized matrix, we derived the relative weights of each barrier (Figure 4).

To validate the reliability of the expert ratings, a consistency ratio (*CR*) was calculated. The maximum eigenvalue (λ_{max}) was obtained, and the consistency index (*CI*) was calculated as follows:

$$CI = \frac{\lambda_{max} - n}{n-1} = 0.043.$$

With a random consistency index (*RI*) of 1.24 for a matrix of size six, the *CR* is calculated as:

$$CR = \frac{CI}{RI} = 0.035.$$

Since the *CR* is less than 0.1, the expert ratings exhibit acceptable consistency, supporting the reliability of the calculated weights.

6. Discussions

6.1. Theoretical validation of identified factors

Through qualitative analysis, this study identified six key barriers and five corresponding facilitating measures for promoting WRII in China's construction industry. The barriers include (1) difficulties in employment relationship identification, (2) cumbersome claim process, (3) weak right-protection awareness of construction workers, (4) incomplete law and regulation system, (5) weak legal consciousness of contractors, and (6) unreasonable compensation treatment and fund management. The facilitating measures address these barriers by (1) promulgating authoritative and detailed laws and regulations, (2) strengthening advocation, (3) simplifying the claim process, (4) strengthening supervision and law enforcement, and (5) improving insurance compensation and fund management. During thematic analysis, these identified factors have been cross-validated against existing literature to ensure reliability. In this section, we further validate the findings through the lens of institutional theory.

Institutional theory suggests that organizational and individual behavior is shaped not solely by efficiency or self-interest but also by the influence of broader social and institutional environments (Scott, 2013). External norms, rules, and shared beliefs guide actions to align with societal expectations. Institutional theory comprises three main pillars: regulatory, normative, and cognitive. The regulatory pillar includes laws and policies that clearly define acceptable boundaries of behavior. The normative pillar consists of social standards and professional ethics that provide guidance for appropriate actions. The cognitive pillar encompasses shared beliefs and understandings, which make certain behaviors appear rational and appropriate within a given context (Tu & Wu, 2021; Vadasi et al., 2020). Together, these pillars encourage alignment with societal expectations, helping organizations and individuals gain legitimacy and support.

The findings of this study align well with institutional theory, identifying significant barriers to promoting WRII in China's construction industry. First, weaknesses in the regulatory framework, such as an incomplete legal structure and complicated claims processes, suggest that the current system lacks the clarity needed to effectively support WRII. Institutional theory holds that without strong regulatory support, a system's credibility and influence are weakened, which discourages participation. This is consistent with our findings, as unclear procedures and regulations have been shown to reduce engagement with WRII. Normative barriers, including low legal awareness among contractors and limited rights awareness among workers, also present challenges. Institutional theory underscores that normative support, including a collective understanding of roles and responsibilities, is crucial for encouraging compliance. In China's construction industry, the lack of strong normative pressures means that contractors and workers may not view WRII as a necessary or expected standard. Our study reveals that many contractors lack

awareness of legal responsibilities, while workers are often uninformed about their rights, indicating insufficient normative reinforcement within the current system. Cognitive barriers, such as complex employment relationships and unclear compensation processes, further hinder WRII adoption. According to institutional theory, the cognitive dimension provides individuals and organizations with frameworks to understand and interpret institutional rules. When core aspects of WRII like compensation structures or employment relationship criteria are unclear, it creates confusion, diminishing willingness to participate. Without clear cognitive support, WRII can appear impractical or unreliable, further discouraging compliance. Thus, institutional theory offers a coherent framework for understanding these barriers and highlights the need to strengthen the regulatory, normative, and cognitive pillars to improve WRII adoption in China's construction sector.

In addition, the five proposed facilitating measures are also grounded in institutional theory, addressing critical barriers to promoting WRII. First, strengthening laws and regulations supports the regulatory pillar by establishing a solid legal foundation for WRII, reducing enforcement ambiguities, and enhancing the system's legitimacy, which in turn encourages enterprise compliance. Second, enhancing advocacy efforts aligns with the normative pillar by increasing legal awareness among contractors and workers' understanding of their rights, helping to embed WRII as an industry standard and foster a compliance culture. Additionally, simplifying the claims process supports the cognitive pillar by reducing confusion among stakeholders, increasing trust in the system, and making WRII easier to navigate and implement. Strengthened supervision and enforcement further bolster the regulatory pillar by ensuring consistent oversight and imposing penalties for non-compliance, thus reinforcing adherence as the norm. Lastly, improving compensation and fund management boosts system transparency and reliability, building greater trust in WRII. Together, these measures address WRII implementation challenges within China's construction sector, guided by the regulatory, normative, and cognitive pillars of institutional theory, providing both theoretical and practical insights for broader adoption.

In summary, using institutional theory to understand the barriers and proposed measures provides a clear approach to improving WRII adoption in China's construction industry. Strengthening regulatory, normative, and cognitive support addresses key challenges and encourages lasting and effective implementation, offering both a solid theoretical basis and practical guidance for wider application.

6.2. Prioritization of key barriers and policy recommendations

Based on the AHP results, this section ranks the six main barriers to adopting WRII in China's construction industry, explaining how each affects WRII uptake and effectiveness. The cumbersome claims process is identified as the most significant barrier, with a weight of 33.5%. The extensive documentation and procedural requirements involved in making a WRII claim, including injury certification and disability assessments, impose a substantial burden on workers. This complexity often leads construction workers, especially those in immediate financial need and without administrative resources, to abandon formal claims processes in favor of informal agreements with employers, thus undermining the purpose of WRII. The procedural demands reduce both the accessibility and attractiveness of WRII for workers, diminishing its potential for widespread adoption. The incomplete legal and regulatory framework ranks as the second most critical barrier, with a weight of 22.2%. Gaps in the WRII regulatory system, coupled with weak enforcement mechanisms, create opportunities for some employers to avoid insurance obligations, particularly in cases where the employment relationship is ambiguous. This regulatory shortfall leaves workers vulnerable, especially those employed informally or on short-term contracts, as they may face delays or denial of rightful compensation. Without a comprehensive and enforceable legal framework, WRII fails to serve as a reliable safety net for all workers. The third-ranked barrier is limited legal consciousness among contractors (16.5% weight). Some contractors, focused on reducing costs, may view WRII as unnecessary or optional. This outlook often leads contractors to neglect their legal obligations, assuming that workplace injuries are unlikely or can be managed informally. As a result, many workers remain uninsured, and the industry lacks consistent WRII adherence, which undermines WRII's role as a universal protective measure. Following closely is the weak rights-protection awareness of construction workers is the fourth barrier, with a weight of 14.5%. Many construction workers lack adequate knowledge about WRII, including their eligibility and the protection it affords. This lack of awareness not only reduces workers' motivation to seek WRII coverage but also limits the pressure on employers to provide it. When workers are unaware of their rights, they are less likely to challenge employers or advocate for WRII benefits, resulting in lower demand and participation, which weakens WRII's overall reach and impact. Unreasonable compensation treatment and fund management ranks fifth, with a weight of 8.1%. The current WRII compensation system is often inadequate to fully cover workers' medical and living expenses following an injury. Moreover, the focus on post-incident compensation over preventative and rehabilitative support limits WRII's effectiveness in safeguarding workers' long-term well-being. The insufficient financial support discourages workers from relying on WRII as a dependable resource, reducing its perceived value and importance. Finally, difficulty in identifying employment relationships ranks sixth, with a weight of 5.2%. The construction industry's reliance on subcontracting and informal labor arrangements complicates the verification of worker-employer relationships, especially in cases lacking formal contracts. This ambiguity in employment status can impede workers' access to WRII benefits when disputes arise over who bears respon-

sibility. Consequently, the difficulty in verifying employment relationships reduces WRII's accessibility for workers who need it most, limiting its overall coverage and effectiveness. Building on the analysis of the prioritized barriers to WRII adoption in China's construction industry, it is clear that targeted policy measures are essential to address each barrier effectively.

First, simplifying the claims process is essential, given that the cumbersome claims procedure is the top barrier to WRII (Dini et al., 2019). To address this, a designated "fast track" for urgent claims should be established, especially for workers with immediate medical or financial needs, ensuring swift review and compensation. Additionally, the types of acceptable proof for claims could be broadened to include wage records or witness statements, making it easier for workers to verify employment relationships and thus streamline the process. To further increase accessibility, an online claims platform should be developed, allowing workers to submit claims and track progress digitally, reducing the time and effort required for in-person applications (Xu & Mei, 2011).

Second, promulgating authoritative and detailed laws and regulations is crucial to address the barrier of an incomplete legal framework. Raising WRII policies to a higher legal level would provide stronger protection for workers nationwide (Wang, 2022). These regulations should include clear and detailed provisions on key stages, such as insurance registration, fund management, injury certification, and compensation disbursement, to ensure they are clear and enforceable. Additionally, establishing a system of rewards and penalties would increase employer compliance. Heavier fines for violations, such as failing to provide insurance or illegal subcontracting, would strengthen adherence to WRII requirements.

For strengthening supervision and law enforcement, collaboration among government departments could help ensure comprehensive WRII implementation by allowing information-sharing and coordinated enforcement actions. A public reporting platform would enable individuals to report non-compliance, and big data analytics could support monitoring of employers' compliance. Establishing clear accountability measures, such as fines, work stoppages, and revoking the qualifications of non-compliant companies, would discourage contractors from neglecting WRII responsibilities.

In addition, strengthening advocacy can effectively address both the low awareness of rights among workers and the limited legal understanding among contractors. Multi-channel outreach efforts using television advertisements, banners, and short videos could help workers understand the benefits of WRII and the protection it offers. Regular training sessions on policies and regulations for both workers and contractors would ensure they understand current WRII requirements and their respective legal responsibilities, thereby reducing non-compliance due to lack of knowledge.

Finally, improving insurance compensation and fund management addresses the barrier of unreasonable compensation. Adjusting compensation levels to better reflect the actual medical and living expenses of injured workers, particularly those with severe or long-term injuries, would enhance the program's protective effect. Also, directing some funds toward accident prevention and rehabilitation programs, such as establishing rehabilitation centers and improving safety measures on construction sites, would support workers' recovery and reduce the likelihood of future injuries.

These recommendations, prioritized according to the significance of each barrier, aim to resolve the main obstacles to WRII adoption through streamlined processes, clear regulations, increased awareness, rigorous oversight, and fairer compensation management.

6.3. Lessons for other developing countries

Although this study is based on China's construction industry, its findings have broader implications for other developing countries with similar institutional and labor market characteristics. According to institutional theory, countries with underdeveloped legal systems, fragmented administrative structures, and high rates of informal employment often encounter comparable challenges in implementing WRII. These include weak regulatory enforcement, limited legal awareness among stakeholders, and difficulties in verifying employment relationships. Therefore, the approaches adopted in China to address these issues provide theoretically grounded and potentially transferable insights for other developing contexts.

Several practical strategies identified in this study may serve as valuable references. First, the project-based insurance enrollment model adopted in China offers a flexible solution for extending WRII coverage in industries with high labor mobility and informal employment. Second, simplifying claims procedures and establishing centralized or digitalized service platforms can reduce administrative barriers and improve access for injured workers. Third, enhancing coordination among government agencies can improve regulatory enforcement, especially in sectors characterized by subcontracting and complex employment chains. Finally, targeted awareness campaigns for both employers and workers can help foster legal compliance and strengthen the normative environment necessary for effective WRII implementation. While local adaptation is essential, these measures offer practical guidance for developing countries seeking to strengthen worker protection in high-risk industries.

6.4. Limitations and future research

This study provides valuable insights into the barriers and facilitators of WRII adoption in China's construction industry; however, several limitations should be acknowledged. First, while the AHP method enabled prioritization of barriers based on expert judgment, the results may still reflect subjective biases. Future studies could explore alternative prioritization techniques or adopt longitudinal designs to examine how the relative importance of these barriers and facilitators may shift over time and in response to policy or institutional changes.

Second, as this study focuses exclusively on China's construction sector, which is characterized by specific regulatory structures, employment patterns, and risk profiles, the generalizability of the findings may be limited. Comparative studies across industries or international contexts could help identify both common and context-specific factors that influence WRII implementation and effectiveness.

Third, while institutional factors are emphasized, this study does not fully examine the potential role of emerging technologies such as digital claims platforms, automated compliance monitoring, and data-driven supervision systems that may improve access, efficiency, and accountability in WRII systems. Future research could investigate the application, performance, and adoption challenges of such tools across different settings.

Although the findings are subject to these limitations, they offer broadly applicable insights into institutional and practical barriers to WRII implementation. Addressing the identified gaps through future research will not only strengthen the empirical basis for WRII reform but also contribute to more informed policy design and institutional innovation in high-risk labor environments.

7. Conclusions

This study explores the institutional and practical challenges in promoting WRII in China's construction industry. Employing a mixed-methods approach that integrates thematic analysis with the AHP, the research identifies and prioritizes key barriers and develops targeted policy responses. The key findings are summarized as follows:

(1) Six major barriers hinder the effective implementation of WRII that are cumbersome claim process, incomplete law and regulation system, weak right-protection awareness of construction workers, weak legal consciousness of contractors, unreasonable compensation treatment and fund management, and difficulties in employment relationship identification. Among these barriers, the cumbersome claims process was identified as the most critical, followed by gaps in the legal and regulatory system and weak legal consciousness of contractors. These issues collectively undermine the accessibility, reliability, and overall effectiveness of WRII, particularly for vulnerable construction workers.

(2) Five targeted measures were proposed to address these challenges, including simplifying the claims process, improving the legal and regulatory framework, strengthening supervision and law enforcement, enhancing stakeholder advocacy, and optimizing compensation treatment and fund management. These measures aim to reduce institutional complexity, improve legal clarity, and strengthen enforcement capacity. Together, they provide a practical foundation for enhancing the accessibility, efficiency, and credibility of WRII in high-risk sectors such as construction.

These findings directly address the research objectives by identifying key institutional and practical barriers to WRII implementation and proposing prioritized policy measures to overcome them. They also enhance theoretical understanding of how institutional and practical barriers rooted in regulatory shortcomings, normative limitations, and cognitive gaps shape WRII implementation in high-risk sectors. The proposed measures offer practical guidance for improving WRII effectiveness in China and inform similar reforms in other developing countries. Future research could assess the real-world impact of these measures, explore cross-sector and cross-country comparisons, and examine how digital technologies may further advance WRII implementation.

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