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A Legislative Perspective on Construction Safety in China, against the Backdrop of an Industry-wide Labor Shortage[■]

ABSTRACT

In the context of the ongoing labor shortage in China's construction industry, this chapter examines how the defective domestic legislation related to construction safety worsens the situation, and also, in the legislative dimension, what reformative measures are likely to bring about fundamental improvements. Three levels of description in this chapter show, respectively, the impracticability of the main construction safety rules, the malfunctions of the Labor Contract Law and the regulations about work-related injury insurance, and the undermining of the responsibility system. While it would be difficult to construct a more efficient legal framework right away, immediate efforts can be made to address specific tough issues that are key to ameliorating China's construction safety performance and to decelerating the outflow of the construction workforce. This chapter identifies five reformative measures that should be taken: generalizing an IT system platform for construction labor management, strengthening the combination of liabilities and incentives to guide hesitant building enterprises, exploring the likelihood of absorbing migrant construction workers into unions, guaranteeing workers easy access to post-accident remedies, and promoting the role of NGOs.

Key Words: Construction Safety; China; Legislation; Labor Shortage

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1 BACKGROUND: A TRICKY SITUATION FOR CHINA'S CONSTRUCTION INDUSTRY

Since the implementation of the Tenth Five-year Plan for National Economic and Social Development, the construction industry has thrived in China (China AEC Industry Summit 2015). The corresponding gross output value exceeded ¥ 11 trillion in 2011, accounting for approximately a quarter of China's GDP for that year (National Bureau of Statistics 2012). However, behind this fascinating achievement is a nationwide shortage of construction workers. The fast-rising labor costs threaten the long-term prosperity of the whole industry.

This seems unusual for one of the most recognized surplus labor economies in the world, but the truth is that construction workers have become very sought after in mainland China in recent years. Developers¹¹ and building enterprises have to pay increasingly high prices to attract skilled manpower (See *South China Morning Post*, September 15, 2014). According to the data available on the China Engineering Cost Network, the national average daily wage for each of 18 types of Chinese construction worker ascended steeply from Q4 2011 to Q1 2014 (see the comparison between these two quarters in Chart 1). In a few cities, for example Changsha (Chart 2) and Guangzhou (Chart 3), the average daily earnings of all kinds of construction workers grew by more than 100 percent during this period.

There are many reasons behind the situation. To start with, the continuing currency inflation and soaring price level force all professions and trades to increase wages in order to satisfy laborers' basic living needs, especially in the construction industry, where workers are generally unfairly paid (China Engineering Cost Association, 2012). Secondly, China's urban-rural dualistic economic structure has been changing dramatically. Some economists believe that this fastest-growing country in the world is getting close to the so-called 'Lewis turning point' (e.g. Das and N'Diaye, 2013a; Knight et al., 2010). Thus, a few industries that have relied heavily on cheap rural migrant labor to grow face a shrinking workforce, such as construction, manufacturing, and services. Moreover, the serious problem of the aging population accelerates the exhaustion of the 'demographic dividend' in China (Das and N'Diaye, 2013b). Lastly, it is well known in China that the working conditions in the construction industry are dreadful. Construction jobs have been almost synonymous with severe wage arrears, round-the-clock working, and a high incidence of injuries and fatalities, so the appeal is conspicuously weaker than that of other professions, in particular when the competition in the labor market is becoming less stiff (Dai, 2013).

11 'Developers' refer to real estate developers, who are the original owners of commercial buildings.

Focusing on the last reason listed above, some labor lawyers raise that the ongoing supply-demand imbalance in the construction labor market provides a golden opportunity to stimulate radical improvements in the overall situation of Chinese construction workers (see *China Real Estate Business*, April 2, 2012). Agreeing with this perception, the chapter takes stock of how construction safety might be alleviated to reduce the domestic antipathy to construction jobs.

Different from previous studies that concentrate on the defeat of building enterprises in managing construction safety (e.g., Tam et al., 2003), ineffective government regulation (e.g., Wang¹, 2015), historical and social reasons (e.g., Yan, 2005), and the characteristics of China's informal employment and rural migrant workers (e.g., Swider, 2015), this chapter reflects on the multidimensional problems with the national legislation. On this basis, it raises new possibilities about the legislative changes that should be made to improve China's construction safety. These measures may play a decisive part in slowing down the outflow of workers – new-generation rural migrant workers in particular – from the labor pool of the construction industry.

2 MAJOR DEFECTS OF THE CHINESE LEGISLATION IN TERMS OF CONSTRUCTION SAFETY

At the beginning of this century, construction accidents and fatalities happened in their thousands every year in China (see table 1). After a decade of inadequate improvement the situation remains grim (see table 2).¹² As indicated by the aforementioned studies, a collection of particular national conditions have combined to result in the high incidence of construction accidents. However, from a legislative standpoint, it is more reasonable to say that China lacks legal institutions suited to the national conditions.

Above all, China has established an elementary legislative framework related to construction safety, but the specific regulations and technical codes that serve as criteria for behavior and bases for regulation are far from complete, significantly decreasing the effectiveness of the law (Zhang et al., 2003). In the meantime, Chinese labor legislation has by and large made few efforts to assist the 36 million rural migrant workers engaged in the con-

12 Because the data are incomplete, table 2 just shows the number of nationwide construction accidents and fatalities taking place in the first half of five consecutive years from 2011 to 2015. Simultaneously, it is important to note that China's central system for registering occupational accidents is very unsound (Wang and Fang 2007:9), thus, the actual numbers of construction accidents and deaths are likely much greater than the registered numbers.

struction industry,¹³ who are left outside the formal employment structure and are accordingly excluded from *de facto* labor protection. Furthermore, the system for legal responsibility is seriously flawed, and hence cannot play a proper role in eradicating the malpractice and illegalities that are regarded as the cause of most domestic construction accidents.

What follows is a detailed depiction of how these legislative defects have militated against the Chinese progress in improving construction safety. Several notable initiatives launched in 2014 are given special attention, because they demonstrate the policymakers' increasing awareness that measures must be taken to enhance construction safety, but these ultimately failed to spark sweeping transformations as had been expected.

2.1 Impractical Rules

As the most significant laws containing work safety rules, the Labor Law (2009 Amendment)¹⁴, Construction Law (2011 Amendment)¹⁵, and Work Safety Law (2014 Amendment)¹⁶ offer inadequate down-to-earth guidelines for the management of construction safety.

To be specific, in the Labor Law there are only a small number of sketchy clauses concerning occupational safety in all professions (in Articles 52-57). For example, "employers shall establish and perfect the system for labor safety and sanitation" (Article 52), "labor safety and sanitation facilities shall meet State-fixed standards" (Article 53), and "laborers should strictly follow rules on safe operation" (Article 56). The practicability of these provisions is questionable.

In the Construction Law, the basic law for the construction industry, a whole chapter with 16 articles (Articles 36-51) constructs only a few pragmatic norms for conduct. Many of the formulations cannot be implemented as they are too vague and are expressed in terms of principles, and no further explanations or supporting provisions are provided. For instance, Article 36 stipulates that a system should be established and perfected in order to enable the masses to participate in accident prevention and safety management, but how to set up such a system is not mentioned. According to Article 47, workers are entitled to propose improvement schemes for programs and working conditions that may cause harm to health,

13 Some 45 million people work in China's construction industry, so rural migrant workers account for 80 percent of these. See http://www.mohrss.gov.cn/gsbxs/GSBXSgongzuodongtai/201501/t20150130_150792.htm (accessed 12 March 2016).

14 《中华人民共和国劳动法（2009修正）》（*Zhonghua Renmin Gongheguo Laodongfa (2009 Xiuzheng)*).

15 《中华人民共和国建筑法（2011修正）》（*Zhonghua Renmin Gongheguo Jianzhufa (2011 Xiuzheng)*).

16 《中华人民共和国安全生产法（2014修正）》（*Zhonghua Renmin Gongheguo Anquan Shengchanfa (2014Xiuzheng)*).

and have the right to criticize, inform against and accuse management of actions endangering their health and safety. However, this provision comes to naught as well, since it virtually repeats the Article 56(2) of the Labor Law while failing to elaborate on the relevant procedures (including which government department should receive the complaints) and assigning no social resources or assistance to vulnerable workers. In the Chinese context, the millions of migrant construction workers are by no means capable of making suggestions and bringing accusations, due to the averagely poor educational background and inferior position in the labor market. Hence, the foregoing provisions are particularly empty for them.

The 2014 Work Safety Law reinforces the original version of its 2002 predecessor in many ways. By defining the rights to safety at work and the obligations of employers, workers, inspectors and government officials much better, it overcomes the roughness of the Labor Law and the Construction Law. Nevertheless, in relation to the administration of construction safety, it still has notable limitations. As the principal law for a number of high-risk industries, one can understand that it should not lay particular stress on a certain sector. However, some 'one-size-fits-all' provisions are hard to implement in the construction industry, which requires concrete regulations addressing its peculiarities. Additionally, some clauses of the 2014 Work Safety Law direct people to other specific laws, rules, or standards that need to be made by different legislatures or government departments. This is especially problematic for the Chinese construction industry, because the legislation in this field is rather laggard and undeveloped. Last but not least, although the 2014 Work Safety Law is much more detailed than the Labor Law or the Construction Law, it continues with the prescriptive approach that describes 'means' instead of 'ends' and tries to standardize work processes by applying prescriptive rules and procedures backed up by compliance monitoring and by timely sanctions for non-compliance (Zhang et al., 2003). Nonetheless, it is impossible for prescriptive regulations to embrace all construction hazards. Such hazards emerge in an endless stream because of continuous technical innovation and the development of material. Moreover, with more than 40 million construction workers,¹⁷ countless building and labor companies, and the large economic gaps between different regions, China desperately lacks the human and material resources to uphold the prescriptive approach to regulating construction safety problems. These limitations all reduce the practicability of the 2014 Work Safety Law in the construction field.

17 *Idem.*

2.2 The Labor Contract Law¹⁸ and the Impact on Construction Safety

2.2.1 The Malfunctioning of the Labor Contract Law in the Construction Industry

Enacted in 2007, the Labor Contract Law is considered a landmark in labor market governance in China. Nonetheless, the enforcement of this law has not improved the number of rural migrant workers who sign labor contracts with employers. Data collected by the National Bureau of Statistics from 2009 to 2016 suggest that for the whole labor market the percentage of rural migrant workers with written contracts has remained below 45% and has declined considerably overall (42.8% in 2009 vs. 35.1% in 2016).¹⁹ In the years 2009, 2011 and 2012, when data for specific industries are available, the construction sector always had the highest proportion (some 75%) of rural migrant workers that had not entered into a labor contract with the employer.²⁰

In theory, the Labor Contract Law develops the relevant rules of the Labor Law, and strengthens the rights of the employed (who, of course, include the approximately 290 million²¹ rural migrant workers) to written labor contracts. But what did not change was the legislative indifference to the real difficulties of the uneducated rural migrant workers in understanding and defending their own rights.

In the general provisions of the Labor Contract Law, Article 3 highlights that a labor contract should be concluded in accordance with the principles of lawfulness, fairness, equality, free will, negotiation for agreement and good faith. Articles 4, 5, and 6 emphasize the crucial role of labor unions or employee representatives in determining rules and important events in relation to remuneration, working time, health and safety at work, etc. In the special provisions (Articles 51-56) on the conclusion and implementation of collective labor contracts, the irreplaceable position of different levels of unions is again underlined.

These provisions can hardly benefit migrant construction workers in reality, although they are aimed at making up for the inferiority of workers in signing a labor contract with the mighty employer. The fundamental reason is that since a sequence of 'reforms' of the employment system in

18 《中华人民共和国劳动合同法（2012修正）》（*Zhonghua Renmin Gongheguo Laodong Hetongfa (2012 Xiuzheng)*).

19 See the monitoring surveys of NBSC on nationwide migrant workers, available at: <http://www.stats.gov.cn/was5/web/search?channelid=288041&andsen=%E5%86%9C%E6%B0%91%E5%B7%A5%E7%9B%91%E6%B5%8B%E8%B0%83%E6%9F%A5%E6%8A%A5%E5%91%8A> (accessed 5 February 2016).

20 *Idem.*

21 *Idem.*

the construction industry in the 1980s,²² unlawful contract awards, multi-layer subcontracting, contracting-out and affiliating have been prevalent in China's construction works. These illegal actions may occur separately or simultaneously. To be specific, developers may award the main building contract illicitly, derailing the entire operation from the start. At the implementation stage, the substantive construction work is not fulfilled by the head contractor²³, but is contracted out, or split into parts and subcontracted to several small building enterprises, labor service companies or labor contractors, most of whom are unqualified and are only nominally affiliated to authorized companies. Through 4-6 times of subcontracting, it is the lowest level of labor contractors that take charge of worker recruitment and management, based on such social ties as friendship, kinship, or coming from the same town. Problems arise here: 1) most poorly-educated migrant construction workers know nothing about labor contracts or the Labor Contract Law; for the minority who have heard about labor contracts, it is too complicated to figure out the other contracting party (Yizhuanyiwa Migrant Workers Culture Development Center, 2013). 2) A shocking secret is hidden in the foregoing illegal actions: the unclear relationships actually enable developers, building enterprises and labor companies to escape

22 Before 1980, Chinese rural migrant construction workers were fairly well protected, and received the same wages and benefits as urban workers, because all construction projects were planned and managed by the government. In 1980, to stimulate the vitality of the brand-new market economy, the State Council introduced a project-contracting system to the construction industry by enacting the 《建筑安装工程包工合同条例》 *Jianzhu Anzhuang Gongcheng Baogong Hetong Tiaoli* (Regulations on Contracts of Construction Installation Engineering). In September 1984, another piece of legislation passed by the State Council – 《关于改革建筑业和基本建设管理体制若干问题的暂行规定》 *Guanyu Gaige Jianzhuhe he Jiben Jianshe Guanli Tizhi Ruoganweni de Zanxing Guiding* (Interim Provisions on Several Issues concerning the Reform of the Construction Industry and the Basic Construction Management System) – clearly stipulated that state-owned building enterprises should gradually replace permanent employment with contract-based employment, and that in the near future only a small number of technical experts could be employed permanently. However, the household registration (the so-called 'hukou' in Chinese) and social security institutions were not prepared for this dramatic change and enterprises therefore blatantly took advantage of these institutional deficiencies and treated migrant construction workers in a discriminatory way. In November of the same year, the Ministry of Construction and the National Planning Commission jointly issued 《建设工程招标投标暂行规定》 *Jianshe Gongcheng Zhaobiao Toubiao Zanxing Guiding* (Interim Provisions on the Tendering and Bidding on Construction Projects), further encouraging contractors to lower their bidding prices. In consequence, countless private labor contractors and unauthorized labor companies that focused on finding rural migrant workers emerged, and the practices of exploiting inferior migrant workers and carving up interests, in the forms of contracting-out, affiliating and multi-layer subcontracting, started spreading widely in the construction industry.

23 A 'head contractor' is a building enterprise that signs the main building contract with the developer.

regulatory governance, not to prepay labor costs,²⁴ and to shift various risks to construction workers who are at the end of the chain of interests. 3) The great informality of employment and the cognitive limitations of rural migrant workers work against the solidarity of workers and certainly work against the formation of strong unions that would be capable of helping workers to conclude a fair labor contract with the employer.

Enterprises that are qualified to sign labor contracts have no direct or apparent employment relationship with workers, whereas labor contractors that directly recruit and manage workers are not eligible to conclude labor contracts with workers. For the sake of addressing this dilemma, regulations that identify who is capable of recruiting construction workers and who is obliged to sign labor contracts with workers in different situations should have been made for the construction industry.

2.2.2 The Impact on Construction Safety

The low proportion of workers with labor contracts in the construction industry stores up trouble for construction safety. First of all, many employers force rural migrant workers to work extremely long hours due to the absence of labor contracts. According to the latest official data in the national monitoring survey of 2009, the average working hours in the construction sector is 59.4 hours per week (National Bureau of Statistics 2010), far beyond the general limit of 44 hours set by the Labor Law. The research of Zhang (2014) about the association between fatigue and construction safety shows that the error rate increases significantly as soon as construction workers feel slightly fatigued, and as they feel further fatigue the hazard perception and motor control starts to fail; workers are unconscious of most of the errors because the sensory ability is impaired.

Secondly, the unstable contract-free relationship between building enterprises and rural migrant workers gives rise to a high level of labor mobility in the construction industry. Given that the workers will move to another construction project promptly after finishing the first one, many building enterprises wriggle out of investing in professional safety training and facilities, even though they have an obligation to do so. In other words, the temporary connection with workers gives building enterprises little promise of long-term return for human resources investment, which fundamentally discourages any real expenditure on safety training. In consequence, many construction sites adopt simple and one-sided rules to deter risky behaviors, such as heavy fines for smoking and for not wearing a helmet. The importance of construction safety and the relevant skills

24 Workers' basic accommodation is usually offered by private labor contractors, who do not pay wages until they themselves are paid by the higher layers of subcontractors after the construction work is finished. This means that a default on payment at any step will give rise to wage arrears, which is not the focus of this chapter but is another huge challenge for labor protection in China's construction industry.

and knowledge are rarely imparted in ways that rural migrant workers can understand. For the workers, it is not clear why trivial things like ‘smoking’ and ‘forgetting to wear a helmet’ matter, and the unpersuasive penalties are more like shackles of the last freedom.

2.3 Legislation on Work-Related Injury Insurance May Worsen the Predicament

In addition to the above impact on construction safety, the scarcity of contract-based employment relationships in the construction industry has an unfavorable interaction with the legislation on work safety insurance. In the light of the Regulation on Work-Related Injury Insurance²⁵ issued by the State Council in 2003 and revised in 2010, work-related injury insurance is the basic mechanism to ensure that workers injured in occupational accidents can obtain medical care and economic compensation, and to promote the prevention of work-related injuries and occupational recovery (Article 1). The insurance funds are deposited into a designated financial account and used to pay work-related injury insurance benefits, work ability appraisal fees, fees for publicity, and training with respect to the prevention of work-related injury (Article 12). Bearing in mind the great significance of these provisions, the Ministry of Labor and Social Security – one of the predecessors of today’s Ministry of Human Resources and Social Security (MOHRSS) – issued the Notification of Doing Well the Work about Migrant Construction Workers’ Participation in Work-related Injury Insurance (2006)²⁶. It required that local construction administrative departments should only award a safety production license to building enterprises (head contractors) that have paid work-related injury insurance premiums for all their construction workers. However, as already mentioned, the head contractors do not directly employ or contract with construction workers. For the purpose of getting the production licenses quickly, some head contractors fabricate a roll call of workers and then buy insurance for non-existent people, while the real workers who are informally employed by unauthorized private labor contractors to work on the construction projects are not covered by occupational insurance (Li 2013).

With a view to addressing the above frauds and irregularities, the Social Insurance Law²⁷ enacted in 2010 prescribes that employers who do not pay work-related injury insurance premiums must pay insurance benefits and compensation to injured workers or bereaved families following work-related accidents. If an employer fails to pay these costs, the work-related

25 《工伤保险条例》(Gongshang Baoxian Tiaoli).

26 《关于做好建筑施工企业农民工参加工伤保险有关工作的通知》(Guanyu Zuohao Jianzhu Shigong Qiye Nongmingong Canjia Gongshang Baoxian Youguan Gongzuo de Tongzhi). See http://www.mohrss.gov.cn/gkml/xxgk/201407/t20140717_136115.htm (accessed 27 Jan 2016).

27 《中华人民共和国社会保险法》(Zhonghua Renmin Gongheguo Shehui Baoxianfa).

insurance fund must advance the payment and then pursue the debt from the employer (Article 41). This means that the building enterprises or labor companies that actually use the laborers cannot evade paying either work-related insurance premiums or benefits. Nonetheless, the problem remains. Injured workers or bereaved families must prove the existence of labor relationship with these enterprises when applying for ‘work-related injury ascertainment’ (Article 18 of the Regulation on Work-Related Injury Insurance), which is the prerequisite for obtaining compensation and insurance benefits. So, we are taken back to the start – the ‘missing’ labor contract. What can be used as proof of the employment relationship except a labor contract? How can rural migrant workers who do not even realize the importance of a labor contract be aware that they must collect other evidence in advance? Most crucially, building enterprises, labor companies, and labor contractors may all take a share of the illegal profits made from exploiting rural migrant workers. Would they leave evidence behind? Once these queries have begun to be deliberated over, one will probably decide that the road ahead for injured construction workers is rather long and dim.

Furthermore, the Regulation on Work-Related Injury Insurance (Article 17) sets a one-year limit for injured workers or their relatives, bereaved families, or unions to apply for work-related injury ascertainment if the employer fails to do so within 30 days after the day on which the accident occurs. This provision overlooks the fact that one year may be too short to allow migrant construction workers to get ready. Sometimes, the treatment period exceeds one year, and in addition there is the time spent in getting acquainted with the relevant procedures, collecting evidence, seeking legal aid, and resorting to labor relationship arbitration and litigation. As explained by the labor lawyer Mr. Tong Lihua, the dean of Beijing Zhicheng Legal Aid and Research Center (mentioned later), it takes around three years and nine months, or six years and seven months when there are extensions, to go through all the procedures for obtaining a due legal remedy.²⁸

On account of these obstacles, most injured workers opt out of the legal route and accept the inappropriately low compensation offered by the employer ‘behind closed doors’. In this sense, law breakers win in the end, which virtually brings about more circumventions of the law.

In order to break the current vicious circle, the MOHRSS, the Ministry of Housing and Urban-Rural Development (MOHURD), the State Administration of Work Safety (SAWS), and the All-China Federation of Trade Unions (ACFTU) jointly issued an Opinion on Further Improving the Work on Work-related Injury Insurance in the Construction Industry²⁹ (hereafter

28 See <http://www.chinasafety.ac.cn/main/xwzx/aqyw/2013-12-10/6374.html> (accessed 2 February 2016).

29 《关于进一步做好建筑业工伤保险工作的意见》(Guanyu Jinyibu Zuohao Jianzhuyegongshang Baoxian Gongzuo de Yijian). See http://www.mohrss.gov.cn/SYrlzyhshbzb/ldbk/shehuibaozhang/gongshang/201501/t20150105_148141.htm (accessed 15 August 2017).

referred to as the 'Opinion') in late 2014. This central administrative document puts forward a string of measures to enforce the universal coverage of work-related insurance for construction workers.

The first pioneering move is to instruct head contractors to insure workers who are not formally employed, based on the construction projects rather than labor contracts. The aim is to deal with the high degree of labor mobility in the construction industry. The Opinion also emphasizes that the cost of insurance premiums should be calculated as an independent expenditure and should not be counted as a part of the bidding price. Before starting the construction project, the head contractor should pay the one-off insurance premiums and put all the safety measures in place; failing this, the construction permit must not be awarded. Simultaneously, the Opinion makes an appreciable effort to assist injured construction workers in applying for work-related injury ascertainment and for compensation: 1) aside from a labor contract (the primary evidence of the employment relationship), the roster, wage payment proofs, work cards, attendance records, recruitment registration, and testimony of other workers should be counted as effective evidence for the factual labor relationship; 2) the procedures for work-related injury ascertainment should be simplified and shortened to make the relief more efficacious; and 3) if the owners (developers) of construction projects, head contractors, or subcontractors who are qualified to employ workers give out subcontracts to unauthorized organizations or individuals, they should jointly bear the liability for compensation for the losses of injured workers or bereaved families. Finally, the Opinion re-emphasizes the significant role of unions, proposes schemes for policy propaganda and training among rural migrant workers, and urges building enterprises to give a true and prompt account of construction accidents.

Still, it is doubtful whether the Opinion has revolutionary implications. Issued by departments of the central government, it has a certain binding force. However, it cannot accomplish much in circumstances where higher levels of legislation demonstrate little sympathy for the plight of construction workers. Moreover, what the Opinion provides is not so much refined rules as preliminary proposals, and these will exert actual influence only when there is layer-by-layer local legislation to develop concrete provisions. The reality is that after the issuance of the Opinion, most provincial and municipal authorities only specified the minimum proportion of building enterprises' work-related injury insurance costs to total construction costs, and transcribed the other parts of the Opinion into local administrative documents. In another word, local legislatures have scarcely improved the enforceability of the Opinion. Furthermore, the lack of overall solutions to boost the coverage of work-related injury insurance among rural migrant workers erodes the Opinion's momentum. Unions remain feeble since there are no sophisticated measures to make them powerful, and developers and head contractors are unlikely to make massive changes when there are no explicit punishments for deliberately hindering workers' quest for insurance benefits.

2.4 The Undermining of the Responsibility System

Under the current legal framework, responsibilities for construction safety are mainly imposed on developers and head contractors. However, under the veil of subcontracting, contracting-out and nominal affiliating, these responsibilities are often shifted to the labor companies or private labor contractors who actually control the behavior of workers on construction sites. These lowest-level ‘exploiters’ are unlikely to pay for the costly training, equipment and facilities that are necessary for reducing the precariousness faced by workers. In such cases, the responsibility system is undermined to a large degree.

Here, an underlying question is worth contemplating: why do illegal contract awards, multi-layer subcontracting, contracting-out, and affiliating keep flourishing in practice? The deep-seated reason still lies in the defective legislation. According to a disclosure by a MOHURD spokesman, around 40 percent of catastrophic construction accidents nationwide are bound up with unlawful contract awards, multi-layer subcontracting, contracting-out and affiliating.³⁰ However, there have been few systematic measures aimed at reducing these offenses, and pronounced legislative deficiencies are found in the following aspects.

- 1) The concepts of ‘illegal contract award’, ‘subcontracting’, ‘contracting-out’ and ‘affiliating’ have never been defined explicitly in the important pieces of construction legislation, although they have been banned for so long. In addition, without paying any regard to the many different forms in which they are found in practice, the laws and administrative regulations in relation to construction attempt to encapsulate varied cases in simplistic provisions. Consequently, the implementation of the law is thwarted. In 2014, the MOHURD defined these offenses and listed their typical forms for the first time in the Measures for the Administration of the Diagnosis, Investigation and Handling of Illegal Contract Award, Subcontracting and other Unlawful Actions (for Trial Implementation)³¹ (hereafter referred to as the ‘2014 Measures’). Nevertheless, interim legislation like this made by the MOHURD should not be used to interpret indefinite concepts in laws and administrative regulations, whose ambiguity can only be removed by legislative actions of the (Standing Committee of the) National People’s Congress and of the State Council.
- 2) As the legal liabilities for the foregoing offenses and for regulators’ dereliction of duty have been either unclear or irrationally light, the importance of construction safety has been belittled. In order to deal

30 http://www.mohurd.gov.cn/zxydt/201409/t20140929_219193.html (accessed 3 March 2016).

31 《建筑工程施工转包违法分包等违法行为认定查处管理办法（试行）》(*Jianzhu Gongcheng Shigong Zhuanbao Weifa Fenbao deng Weifa Xingwei Rending Chachu Guanli Banfa (Shixing)*). Available at: http://www.mohurd.gov.cn/zcfg/jsbwj_0/jsbwjjzsc/201409/t20140904_218909.html (accessed 7 February 2016).

with the hollowness of the liability clauses in the Construction Law, in the Regulation on the Quality Management of Construction Projects, and in the Administrative Regulations on the Work Safety of Construction Projects³², the 2014 Measures lay down specific standards of administrative fines for different situations and adopt a variety of sanctions, such as suspending construction projects until the failures are rectified, revoking or down-grading an enterprise's qualifications, ceasing to disburse funds (for state-funded projects), and so forth. While this is a step towards defining the penalties for illegal contract awards, subcontracting, contracting-out and affiliating, the 2014 Measures have not established a sound accountability system for eliminating these chronic and stubborn 'ills' of the construction industry. As departmental rules, the 2014 Measures have temporarily filled the gap in terms of the administrative liabilities for the above illegal actions, but the corresponding criminal liabilities and civil liabilities based on tort law and employment law are of comparable significance and need framing simultaneously. Furthermore, since the influence of malpractice has been underestimated, the 2014 Measures fail to address the liabilities of regulators. It is actually a simple truth that lax regulation by government has the potential to subvert the effectiveness of the strictest liability clauses designed to deter illegal actions of the monitored entities.

- 3) The MOHURD has set quite high thresholds for building enterprises to enter the construction market. A great many unqualified building/labor companies and private labor contractors survive by 'rent-seeking', namely reaching a trade-off between money and nominal affiliation. A number of certificated enterprises make a profit from renting out the qualifications, and ineligible organizations or individuals undertake construction work in the name of those who lend out the qualifications. A comparison between the 2001 and 2014 versions of the Grade Standards of Construction Enterprise Qualifications suggests a slight trend towards looser qualification requirements for domestic construction companies. However, the new standards continue to emphasize the financial and material condition (net asset value, highest contract amount, personnel, and technical equipment) of a company, while not touching upon the safety record, safety management level, or competency to deal with construction hazards.³³ This is a deficient way of controlling building enterprises and relevant individuals' access to the construction market. On the one hand, when OSH performance is not a criterion for qualification assessment, certificated companies need not fear that permitting a nominal affiliation may discredit their own safety records. 'Rent-seeking' is more likely to take place. In the meantime,

32 《建设工程安全生产管理条例》(*Jianshe Gongcheng Anquan Shengchan Guanli Tiaoli*).

33 See <http://economics.hnsci.net/sites/economics.hnws.cn/files/economics/pdf/2-root/2.1.7.pdf> and <http://www.mohurd.gov.cn/wjfb/201411/W020141231012846.pdf> (accessed 2 March 2016).

some building businesses in fact have the ability to manage construction risks, but they are totally blocked out of the construction market by the high financial thresholds. To stay within this market, they cannot but join the 'rent-seekers'.

3 NEW-GENERATION MIGRANT WORKERS ARE FLEEING THE DANGEROUS CONSTRUCTION INDUSTRY: LEGISLATIVE POSSIBILITIES AND CHALLENGES

The concept of 'New-Generation Migrant Workers' was proposed by China's No.1 Central Document for 2010,³⁴ referring to rural migrant workers born after 1980 and aged over 16. A report by ACFTU (2010) estimates that this population amounted to 100 million people as of 2010, accounting for more than 60 percent of all rural migrant workers.

In the building industry, the older generation of migrant workers is becoming physically inactive and demonstrating a tendency to return to rural areas in the near future. The inclinations of the new-generation migrant workers towards job selection will therefore have a strong influence on the labor supply for the construction sector. The fact is that only 9.8 percent of the new-generation migrant workers opt to work in the construction industry, as opposed to 27.8 percent of the older generation (see Table 3). Even though the average wages for all kinds of construction work have been growing, the new-generation migrant workers show a fading interest in it, and gradually drift into the manufacturing and service sectors (National Bureau of Statistic 2011).

Indeed, unfavorable factors, such as long working hours, low wages and instability, exist in non-construction sectors as well (National Bureau of Statistic 2011). The unwillingness of new-generation migrant workers to do construction work is not derived from a shortage of hardworking spirit among them, but from the pursuit of a comparatively safe and decent working environment. The National Bureau of Statistics (2011) discloses that the coverage of social insurance among new-generation migrant workers is quite low in all sectors, but those engaged in the construction industry feel particularly unsafe in every way. Confronted with diverse deadly hazards, only 5.2 percent of the new-generation construction workers are covered by medical insurance, and 16.1 percent by work-related injury insurance. These proportions are even lower than those of the new-generation migrant workers covered by medical and work-related injury insurance in most of the less precarious sectors (see table 4). Moreover, depressingly few of the new-generation construction workers are covered by endowment insurance and unemployment insurance (see table 4). In short, it is the disrespect for life that scares the new-generation migrant workers away from the construction industry.

34 See http://english.agri.gov.cn/hottopics/cpc/201301/t20130115_9543.htm (accessed 14 March 2016).

Whether the safety assurance system for construction work can be appreciably improved in short order will have a determining influence on future trends in the industry-wide labor shortage. This section digs into what would be feasible and effective in the legislative dimension, and puts forward the following five possibilities that would probably make a major difference.

3.1 Mandating an Real-Name IT System for Construction Labor Management

The rather random and informal relationship between workers and employers is the root cause of the poor safety records and most of the other labor protection problems on China's construction sites. Nothing is more urgent than taking measures to regularize the employment status of building workers and transform the whole of the labor management system in the construction industry.

For a long time the employment status of construction workers has been supervised based on the reports by building enterprises. Then the regulatory authorities establish and maintain dossiers manually. The technological backwardness of this approach leaves clear space for intentional falsification and concealment. With a view to accessing real information about construction employment more effectively, a few provincial governments, such as Beijing, Tianjin, Shanghai, Chongqing, Shannxi, and Hebei, have been voluntarily experimenting with their respective information systems in recent years, establishing an alliance between the internet and other modern technologies (such as Radio-Frequency Identification Technology). Chart 4 displays the typical model for these systems. In short, the regulatory authorities, building enterprises, and construction workers are the main users of the information platform, and they all contribute to the establishment of a central database that embraces complete information about individuals and building enterprises. Laborers who intend to do construction work are first of all issued with an 'all-in-one information card'. Their real name, picture, date of birth, registered place of domicile, ID number, skill level, training history, physical condition, and union membership are input into the card with the help of governmental aid workers. After the construction workers have been employed, the head contractors, authorized subcontractors or labor companies must add information about the labor contract and social security status of the worker to the card. The specialized software installed in the project division obtains and uploads the on-site records of the labor services. As all the messages eventually flow into the central database, the regulators and social security agencies are able to learn, analyze and manage them comprehensively in order to improve administrative effectiveness (see Wang², 2015; Wang, 2009).

By applying the network platforms, the aforementioned provinces and municipalities have basically achieved the unified management of information about construction labor services within their territories. This has

huge potential to suppress informal employment and noncompliance with obligations concerning the conclusion of labor contracts, payment of wages, training, safety protection, and work-related injury insurance.

This chapter proposes that central legislative instruments make immediate efforts to spread the advanced way of administering construction employment across the country, and that the systems of all the provinces are interconnected to form a national database. With a universally valid information card, a construction laborer would be less likely to be exploited by anonymous organizations that work outside the legal employment rules, since work-related movements and working conditions would be continuously tracked. The regulatory authorities could also prevent untrained, poorly equipped or uninsured workers from entering construction sites. If any accidents did happen, rescues and investigations would become more efficient.

The major challenge in putting in place the information system under discussion lies in ensuring that potential construction laborers know of the system and actively seek protection. The new-generation migrant workers are, on average, better educated than the older generation and are more familiar with the internet and other electronic media. This probably facilitates their acquaintance with and the utilization of the all-in-one information card and other relevant components. However, the bad news is that it has been found that, at present, the new-generation migrant workers use the internet and other modern media mainly for entertainment, and rarely for learning technical knowledge, labor legislation, policy changes, or industry trends (Mei, 2012; He, 2015). Thus, if the real-name information platform for construction labor management is brought into play, the government should publicize this in various ways and at the same time do its utmost to improve the media literacy of construction workers.

3.2 A Two-Pronged Strategy to Guide Building Enterprises

Building enterprises may be aware that there is no more effective way to cope with the industry-wide labor crisis than by reforming the existing employment mechanism and business model in the construction sector and fundamentally improving working conditions, in particular the OSH level. Nonetheless, few are willing to spearhead forgoing reforms, since any individual endeavor is no more than 'a drop in the ocean' when divorced from the common efforts of the industry overall. More importantly, taking part in a 'race to the top' seems very unrewarding for enterprises that are incapable of bearing the temporarily increased costs. The point advanced here is that a two-pronged strategy should be adopted by construction legislation to spur the revolution in construction businesses.

Stronger deterrents must be introduced, so as to raise the costs of breaking the law at all levels. Firstly, records indicating how well building enterprises maintain on-site safety and comply with other labor protection obligations ought to be made one of the criteria for grading business

qualifications, granting the entitlement to bid for projects, and awarding construction permits. It is worth mentioning that the standards for evaluating safety records should be result-oriented. Building enterprises must reduce the incidence of accidents and fatalities, or they will be disqualified at the first stage. This also means that building enterprises should minimize the influence of uncontrollable factors, and stop conniving with illegitimate subcontractors or unauthorized labor contractors. Secondly, it is time to use major legislative instruments, instead of tentative regulations, to construct a complete responsibility system that intensively and comprehensively addresses the civil, administrative and criminal responsibilities of different offenders whose actions cause damage or pose a threat to construction safety (e.g. those who manage building enterprises, workers, on-site safety supervisors, administrative officials, and so forth).

On the other hand, central and local legislation should provide a series of incentives to ensure the survival of building enterprises that desire to ameliorate their own safety performance. Firstly, building enterprises that actively carry out safety-promotion policies ought to be granted certain forms of recompense, such as tax preferences, bonus points in the qualification assessment, and priority in bidding. Secondly, the government should be obliged to allocate or collect special funds in order to support enterprise investment in OSH training, facilities and equipment. Thirdly, local administrative departments shoulder the responsibility of helping building enterprises set up long-term cooperative relationships with trustworthy training agencies and safety equipment suppliers that offer excellent services or products but charge reasonably, with a view to reducing the economic burden borne by building enterprises. Alternatively, local governments could utilize the power to integrate available resources and provide uniform training and safety equipment based on cost-sharing principles, benefiting building enterprises indirectly.

3.3 Creating Adaptable Unions

It has been a Gordian knot that unions are absent or fail to play a proper part in the construction industry in China. In striving for fair labor contracts, shorter working hours, and proper payment of wages, and in accusing of actions that expose workers to high risk, unions should undoubtedly have exerted an irreplaceable influence and given the strongest backing to construction workers. However, as discussed earlier, the very high mobility and the cognitive limitations of Chinese rural migrant workers have broken up the foundation needed for traditional unions to take root and grow (Zhao 2011). Unionism may adapt to this situation and come into play only by innovating in the organizational structure and operating model.

In July 2015, the Grassroots Organization Department of ACFTU gave suggestions for promoting the establishment of unions in building and labor enterprises, from which five constructive ideas can be extracted. Firstly, no matter whether construction workers are employed by legitimate

subcontractors or labor companies, and regardless of whether the employment is contract-based or not, head contractors should spare no efforts to assure every worker of access to union membership. Secondly, allowing for the fact that migrant construction workers almost all live where they work, construction sites should be the main ‘battlefield’ of unions. Unions belonging to the head contractor’s special project division can function on behalf of the unions of subcontractors and labor companies, or associated grassroots unions can be established so as to carry out project-based union activities. Thirdly, within the territory of a county, associated unions can be set up for several different construction projects in order to facilitate the management of local unions and the selection of chairmen from ‘socialized union officials’³⁵ recommended by the superior unions. Fourthly, branches of ACFTU should solicit the support of local administrative authorities to help unions solve financial problems. Developers ought to lay down in the contracting agreements that contractors need to reserve sufficient funding for union activities, as required by the Trade Union Law, and that the spending on project-based unionism must be independent of other parts of union expenditure. Lastly, more up-to-date and adaptable means should be introduced to cope with the high labor mobility and to make it easier for migrant construction workers to join and transfer between unions. For instance, a ‘green passage’ could be opened in local job markets to offer union-related services; union officials could preach about unionism on construction sites or by mobile phone applications; and union members could surely be managed more effectively if the real-name IT system discussed previously was in place (Wang and Sun 2015).

The Grassroots Organization Department of ACFTU puts forward the above solutions based upon its experience in dealing with local unions. The attempt to structure project-based unionism in the construction industry is obvious, by defining the responsibilities of relevant parties, ensuring the funds for union activities, and developing various means of absorbing migrant workers into unions. Central and local legislatures should examine the effectiveness and feasibility of these proposals straight away in pilot areas, and host hearings and seminars to collect the opinions of union experts, social activists, building enterprises, and representatives of migrant construction workers. Only in this way can effective legislation be made to address the low union density in the construction sector.

3.4 Making Procedures for Post-Accident Remedies ‘Worker-Friendly’

It has been difficult for millions of Chinese building workers to receive post-accident legal remedies, due to the insurmountable procedural barriers. Previous analyses of the legislation on work-related injury insurance show

35 Socialized union officials are employed by local branches of ACFTU as full-time experts who are devoted to pushing forward with the establishment and expansion of unions in domestic private enterprises and non-public economic and social organizations.

that the improper time limits and lengthy judicial proceedings discourage most injured workers and bereaved families from requesting confirmation of the labor relationship, applying for injury ascertainment, and claiming insurance benefits. Indeed, victims of construction accidents face similar problems in claiming compensation, employer-paid medical treatment, job placement assistance and disability (death) subsidies. This is a vital reason why the new-generation migrant construction workers demonstrate no stronger preference to the older generation workers for seeking legal remedies (Huang and Xing, 2012). In most instances, they would rather reach a private settlement with the employer or resort to political power by a group petition (Huang and Xing, 2012).

In order to cultivate the new-generation migrant workers' faith in the law and in the prospect of working in the construction industry, a whole package of initiatives aimed at improving the practicability of post-accident remedies should be put on the next legislative agenda of both central and local government. In general, strict liability ought to be imposed on building enterprises that hamper or fail to assist the application of an injured worker or the bereaved family for work-related accident ascertainment.

Moreover, for the main facts in dispute, 'a principle of presumption' should be implemented to the workers' advantage, according to which a building enterprise would bear the burden of disproving the presumed facts that were in favor of the worker's claim. This principle has been merely adopted to deal with disputes about whether an injury is work-related or not (Article 19, the Regulation on Work-Related Injury Insurance). There is certainly every reason to establish it for the investigation of other key facts too, including whether a factual employment relationship exists, whether an injured worker is legally eligible for insurance benefits, compensation, and subsidies, and so on.

In addition, founding a separate tribunal in the court system to handle labor disputes and simplifying the judicial procedures with a view to increasing the efficiency of case processing, as advocated by some Chinese scholars (e.g. Chen, 2002; Lin, 2007), would be of great significance for diminishing the costs and difficulty faced by injured workers or bereaved families in seeking judicial help.

Besides, Chinese rural migrant workers are in desperate need of a legal aid mechanism, which has only been applied in criminal litigation procedures in China. According to *2005-2015: A Ten-Year Report of Legal Aid for Rural Migrant Workers* released by the Beijing Zhicheng Legal Aid and Research Center³⁶, the Beijing Zhicheng alone offered free legal counseling to rural migrant workers in 65,201 labor disputes during the decade, involving up to 200,000 man-hours and ¥ 500 million. In all, 10,069 cases had been settled, as of 2015, and the economic losses were reduced by ¥145

36 Beijing Zhicheng Legal Aid and Research Center is one of the leading privately-run organizations for public interest in China.

million.³⁷ These figures imply the tremendous demand by Chinese rural migrant workers for a well-functioning legal aid system in the labor law field. One would imagine that most rural migrant workers would be willing to use the law as a ‘weapon’ to assert their own rights, if the labor legislation stipulated that there was free or low-cost assistance to workers who were otherwise unable to afford legal advice or access to the judicial system, and if it provided sufficient stimuli to the expansion of legal aid services in the form of duty lawyers and community legal clinics.

3.5 NGO Training and Supportive Interventions

Apart from the few non-governmental organizations (NGOs) concentrating on free legal aid for rural migrant workers (such as the Beijing Zhicheng mentioned above), another type of NGO is devoted to interventions at community level, with the aim of helping rural migrant workers to achieve decent and safe working conditions and to lead a dignified urban life. Yizhuanyiwa and Xingzai renjian are the two best-known of these. In the northern and southern suburbs of Beijing they provide OSH and legal literacy training together with various forms of community services to migrant construction workers, and in many aspects they perform functions similar to those of unions.

Take Yizhuanyiwa, for instance. This organization has been making contributions in the following areas since it was founded in 2010. Firstly, with the permission of building enterprises, the staff of Yizhuanyiwa come to construction sites and use various means to implant OSH and legal knowledge into the minds of rural migrant workers, such as by hosting themed galas, handing out safety manuals, communicating with workers face to face in the latter’s dormitories, and setting up standing offices on construction sites. Secondly, since Yizhuanyiwa’s training and intervention are more than welcome among migrant construction workers, and Yizhuanyiwa has achieved very positive outcomes, some building enterprises take the initiative of inviting Yizhuanyiwa to deliver training courses to their workers. Thirdly, making the most of their opportunities to collect first-hand data, Yizhuanyiwa teams up with academics to do empirical research and to hold periodical symposiums on OSH and employment issues in China’s construction industry. Its goal is to launch a campaign that culminates in the birth of a national code of conduct and social responsibility for building enterprises so as to fill the gap in this respect. Lastly, in view of the plight of unions in cities,³⁸ Yizhuanyiwa sends its staff to labor-exporting areas (rural areas) to establish grassroots labor organizations that collaborate with local administrative authorities to give potential migrants preliminary train-

37 See http://yzlx.pkulaw.cn/fulltext_form.aspx?Db=lawfirmarticles&Gid=1778402821&keyword=&EncodingName=&Search_Mode= (accessed 4 April 2016).

38 Urban unions cannot try their utmost to safeguard workers’ interests under political pressure to balance social stability and economic development.

ing on OSH and labor legislation. The target audience can therefore make a proper assessment of the risks of working in the construction industry and have a clear picture of their own rights, legal position, and channels for problem-solving (Guo, 2014).

The commitment by Yizhuanyiwa demonstrates the chances of NGOs acting as a fourth party in making positive changes to China's construction safety performance. Its endeavors on many occasions smooth over the difficulties confronting building enterprises, workers, and public authorities. The current problem is that, even in the capital city, this sort of NGO is terribly scarce. To be precise, Yizhuanyiwa and Xingzai renjian are the only two in the Beijing area, where all kinds of resources are much more available than in the rest parts of the country. Chinese legislators should work outside the box without a doubt, and embrace NGOs in their future strategies for addressing construction safety issues. This of course means offering them sufficient financial support, free space for self-development, and access to long-term cooperation with the authorities. It is conceivable that the multiplication of these NGOs would be conducive to breaking the logjam in the construction sector today.

4 FINAL REMARKS

Given that the recent labor shortage in China's construction sector is partly derived from the growing antipathy of potential laborers towards the serious and persistent occupational safety problems, this chapter illustrates how legislative deficiencies have exerted a negative influence in this process, and explores the solutions that could make a change in the status quo. In short, China's major pieces of legislation associated with construction safety have failed to play a due role because of the low practicability. Meanwhile, inadequate attention has been paid to the plight of millions of rural migrant workers, who are the primary construction workforce and are in the greatest need of extra legal help to realize their rights to occupational safety. In addition, there has been no comprehensive liability system to deter various violations of construction safety obligations. By elaborating on these defects embedded in China's construction safety legislation, this chapter firstly argues that future legislation could mandate a real-name IT system in all provinces and municipalities, for the purpose of regularizing the recruitment and employment practices in the construction industry. Secondly, not only a complete responsibility system and a mechanism that gives consideration to the safety records of building enterprises in qualification assessment, but also a full set of incentives, such as subsidies, tax preferences and training allowances, should be introduced. Only a two-pronged strategy can induce enterprises to participate in the reform within the sector. Thirdly, the innovative ideas raised by ACFTU about adapting the structure and operating model of unionism to China's construction industry in order to give rural migrant workers strong backing in their battle for safety rights,

deserve serious evaluation by the legislature. Fourthly, it is essential to remove the many barriers that hinder construction workers from obtaining post-accident legal remedies, so that people's confidence and interest in construction work may not continue to drop. Finally, a few NGOs have been making a silent contribution to construction safety compliance and risk management. The multiplication of these organizations, however, cries out for official recognition and support.

CHARTS AND TABLES

Table 1: Registered Construction Accidents and Deaths in Mainland China from 2001 to 2005

Year	Accidents	Deaths
2001	1674	1647
2002	1948	2042
2003	2634	2788
2004	2581	2777
2005	2288	2607

Data Published by State Administration of Work Safety of China, Quoted from Wang and Fang (2007:9)

Table 2: Registered Construction Accidents and Deaths in Mainland China in the first half year of 2011-2015

Year	Accidents	Deaths
2011	282	345
2012	209	247
2013	219	283
2014	243	287
2015	168	219

Data Published by the Ministry of Housing and Urban-Rural Development of China, Available at: <http://www.mohurd.gov.cn>

Table 3: Main Industries Where Old and New Generations of Rural Migrant Workers Are Employed

Industrial Distribution (%)	Old Generation	New Generation
Manufacturing	31.5	44.4
Construction	27.8	9.8
Transportation, Storage & Postal Services	7.1	5.0
Wholesale & Retail	6.9	8.4
Accommodation & Catering	5.9	9.2
Residential Services	11.0	12.4
Other	9.8	10.8

Data from the Report of NBSC (2011)

Table 4: Coverage of Social Insurance among the New-Generation Migrant Workers in Main Industries

Industrial Sector	Work-Related Injury Insurance	Medical Insurance	Endowment Insurance	Unemployment Insurance
Manufacturing	26.9	14.5	7.8	3.9
Construction	16.1	5.2	2.4	1.3
Transportation, Storage & Postal Services	25.5	14.9	9.6	5.8
Wholesale & Retail	10.1	8.0	6.2	3.2
Accommodation & Catering	11.8	7.0	3.5	1.9
Residential Services & Other	13.7	9.0	4.2	2.4

Data from the Report of NBSC (2011)

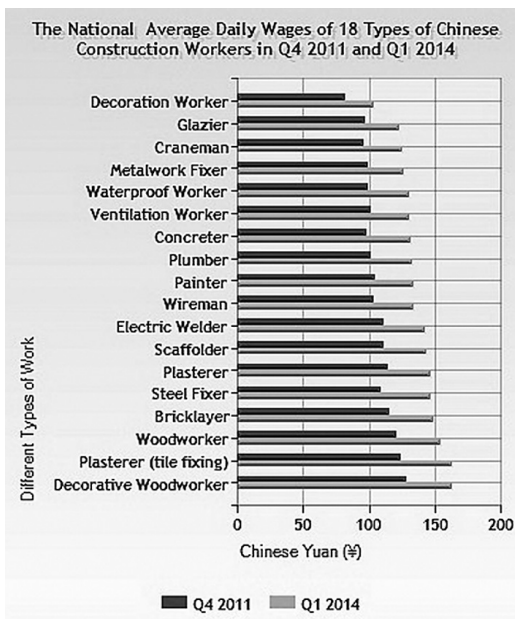


Chart 1: Data from China Engineering Cost Network [accessed March 20, 2016]

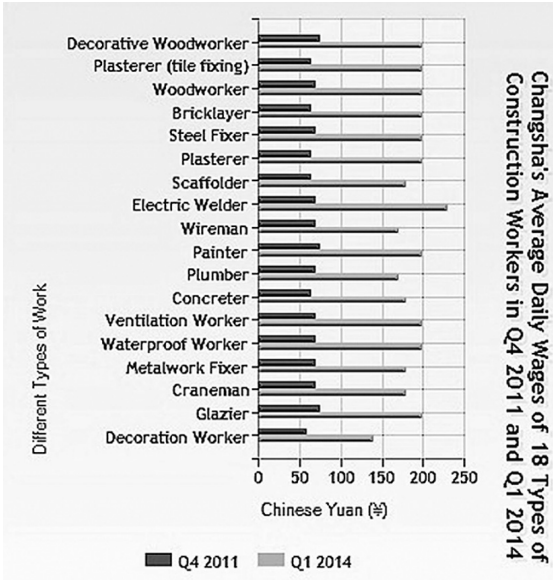


Chart 2: Data from China Engineering Cost Network

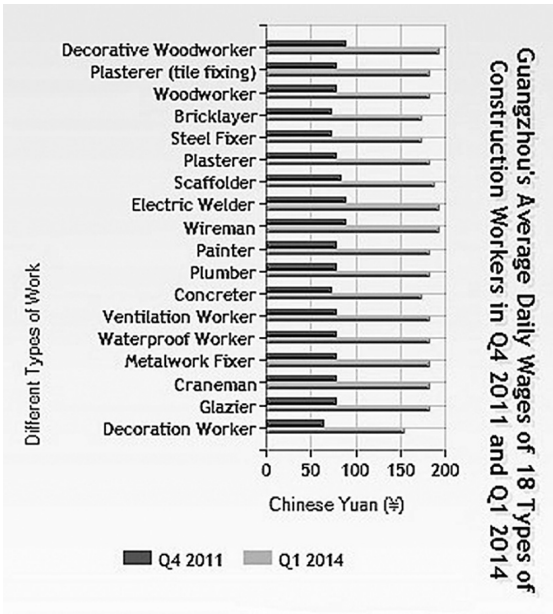


Chart 3: Data from China Engineering Cost [accessed March 20, 2016] Network [accessed March 20, 2016]

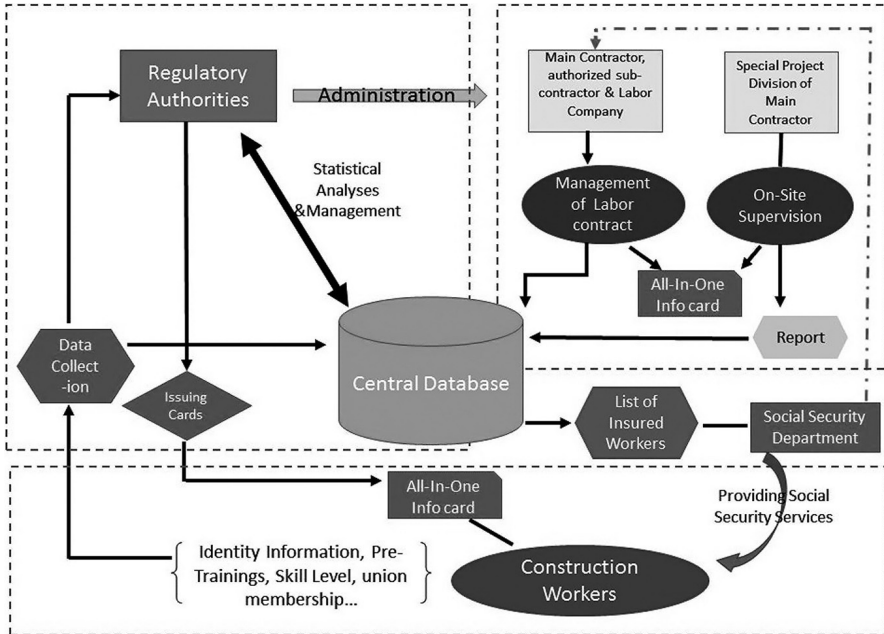


Chart 4: Source from Wang (2009)

