

# INSTITUTIONAL ENVIRONMENT AND INSTITUTIONAL LOGICS IN CONSTRUCTION SAFETY MANAGEMENT: THE CASE OF CLIMATIC HEAT STRESS ON SITE

Yunyan Andrea Jia<sup>1</sup>, Steve Rowlinson<sup>2</sup>, Mengnan Xu<sup>3</sup> and Baizhan Li<sup>4</sup>

<sup>1</sup> *Department of Construction Management, School of Built Environment, Curtin University, GPO Box U1987, Perth, WA, 6845, Australia*

<sup>2</sup> *Department of Real Estate and Construction, the University of Hong Kong, Pokfulam, Hong Kong*

<sup>3 and 4</sup> *Faculty of Urban Construction and Environment Engineering, Chongqing University, China*

Although climatic heat stress can be fully brought under control and prevented from causing short-term or long-term damage to the human body in laboratory experiments, the expected effect of interventions are however often lost in the practice on construction site as frontline personnel are driven by conflicting institutional logics in their specific institutional environment. The paper presents a comparative study between Hong Kong and Mainland China in the case of climatic heat stress management on construction sites. Specifically, we look into how societal culture as institutional logics leads workers and managers to their pragmatic or normative behaviours that deviate from the expected outcome of safety management. Two competing institutional logics in construction safety management are identified and discussed, i.e., production logic and prevention logic. Comparative analysis of the Chinese samples under two different institutional environments identifies two distinct society-level cultural logics that shape personal strategies of reconciling safety and production goals, i.e., Confucianism logic and Chinese pragmatism logic. Their implications on construction safety management are further discussed.

Keywords: construction safety, institutional intervention, institutional environment, institutional logics, production logic, prevention logic.

## INTRODUCTION

The behavioural approach has been widely applied in construction safety management to promote safe behaviour among workers (Jiang *et al.*, 2014; Lingard and Rowlinson, 1998). Their effect, however, is not as expected either because the basic management infrastructure is absent or, the institutions do not effectively lead to safe behaviours. The gap between formal institutions and their desired behaviours is rooted in the science-application dichotomy which results in a paradox that OHS guidelines have to be developed through scientific experiment in simplified 'ideal' settings to be valid, yet they are expected to achieve effectiveness in complex workplace situations. In the case of heat illness in summer in construction site, experimentally developed heat stress guidelines have defined environmental thresholds and suggested engineering and work-rest regimens associated with the thresholds. They are however often found dysfunctional or economically unrealistic in the industrial workplace. In a construction site where the thermal environments vary with spatial characteristics and

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<sup>1</sup> yunyanbright@gmail.com

change with daily weather conditions and time of the day, numerous risk-mitigation decisions are instantly made by the frontline staff who are busy with production tasks. Our aim of this study is to explore how the institutional interventions, in this case the heat stress management guidelines, are processed on site and why they are not generating the designated effect of mitigating the climatic risk.

Referring to the Loughborough ConAC framework (Haslam *et al.*, 2005), heat stress is an attribute of the workplace located at the immediate circumstance of construction accident causality. Its effective control lies with the shaping factors, such as work scheduling, which is further constrained by the originating influences at upper stream of the supply chain, such as project management or economic climate (Table 1).

Table 1. A summary of the Loughborough ConAC framework (Haslam *et al.*, 2005)

Immediate accident circumstances		Shaping factors	Originating influences	
			Proximal	Distal
1. Workplace	Layout/space; lighting/noise; hot/cold/wet; local hazards	Site constraints; work scheduling; house keeping	Permanent works design; project management; construction processes; health and safety culture; risk management	Client requirements; economic climate; construction education
2. Work team	Actions; behaviour; capabilities; communication	Attitudes/motivations; knowledge/skills; supervision; health/fatigue		
3. Material	Suitability; usability; condition	Design specification; supply/availability		
4. Equipment				

Building on this concept, Rowlinson and Jia (forthcoming) analysed causality of heat illness incidents from an institutional perspective and identified factors at individual, job, team, project, organization, industry, society and ecosystem levels around stakeholder’s roles. Institutions are defined as socially constructed laws, structures, rules, regulations, cultures, norms, routines, cognitive frames and established practices that explicitly or implicitly govern individual and organisational decision making behaviours. This definition recognises the regulating effect of implicit principles of behaviours and provides a finer granularity for the study of construction safety in contrast to the rules-compliance approach. The resulted institutional model connects safety risks on construction site to multiple levels of institutions and informs stakeholders at upper stream of the supply chain on possible safety consequences of their decisions, thus leading to opportunities of making effective influence on the improvement of construction site safety.

To understand how institutions influences organisational and individual behaviour, the concept of institutional logics opens the insight into the inquiry of the cognitive base of the constitution of institutions. Institutional logic is “*a set of material practices and symbolic constructions*” (Friedland and Alford, 1991, p. 248). This definition implies that institutional logics are composed of concrete activities, sensemaking of the activities and communication of the sensemaking. At society level, institutional logics are the central logics of institutional orders of a society, which, subject to further elaboration by organizations and individuals, generate its organising principles. Friedland and Alford suggested five logics of the central institutions in a modern Western society: the logic of capitalism which is accumulation and commodification of human activities; the logic of state which is rationalisation and regulation of human activity through bureaucracy and hierarchy; the logic of democracy which is

participation and institutional control over government (Pettit, 2008); the logic of family which is motivation of human activity by unconditional loyalty to an in-group; and the logic of religion or science which is “*truth and the symbolic construction of reality*” (Friedland and Alford, 1991, p. 248). Institutional logics are historical. Players are bounded by the institutional logics at a particular historical stage; meanwhile they construct and change institutional logics.

In the following sessions we present a comparative study between two systems of one country, Chongqing municipality in Mainland China and Hong Kong, on the effect of heat stress management guidelines as a safety intervention on construction sites. Owing to the same ethnic origin and the special governing structure between Hong Kong and Mainland China, some researcher proposed the Hong Kong system as a model for China’s reform toward a cleaner and more efficient institutional environment (e.g. Manion, 2004). However, an investigation of the institutional logics beneath these two societies by this study will demonstrate that effective improvement cannot be achieved by simplistic imposition of a “*better*” institutional structure or, even a successful experience of another society.]

## **METHODOLOGY**

The study takes a grounded theory approach as an overarching methodology. We developed a compacted daily data collection protocol integrating an array of methods for a 360-degree recording of thermal environment of workplace, work activities and their physiological impact and their organizations. The data were then content analysed, sorted and categorised through memos and constant reflections of the researchers. The HK study was a research project commissioned by the HK Construction Industry Council with an aim of developing a heat stress guidelines for the construction industry. As an outcome of the study the new guidelines has been issued and used in construction contracts by major clients (CIC, 2013). Based on the experience, the study was replicated in Chongqing. Details of the data collection methods have been reported in separate papers (Jia *et al.*, forthcoming; Rowlinson and Jia, 2014).

## **RESULTS**

Both Hong Kong and Chongqing fall into the regions of sub-tropical climate with summer ranges from May to August. The difference is that Hong Kong climate is oceanic while Chongqing climate is inland, which means the summer of Hong Kong is more humid with higher wind speed while the summer of Chongqing has a higher range of air temperature. Data in the HK study were 216 workers (90.7% are Chinese) and 96 managers from 26 construction sites (c.f. Jia *et al.*, forthcoming); in the CQ study were six workers and nine managers from two construction sites. The HK workers sample included 34 trades, while the CQ sample included three trades, including two plasterers, two concreters and two formworkers.

### **Work routines and incentive structures**

Incentive structures in the HK construction sites were differentiated between company-based workers and project-based workers. The former were less paid, had longer working hours but a better job security; whilst the latter had higher workload within a fixed range of working hours and poor job security but were better paid. In the CQ study a clear difference was observed between local and migrant workers. The two plasterers in Site A were local workers, working for 22 to 25 days a month, having the autonomy of choosing their days off. The carpenters and the concreters

were migrant workers in Site B lived in dormitories on site, performing daily work without weekends or public holidays. The carpenters were paid by a lump sum payment for certain volume of work. As a result they often worked voluntarily overtime. The concreters were paid by daily wage. As a result their job was characterised by long working hours, which, in an extreme case, they worked continuously for 48 hours.

### **Attempt of institutional interventions**

In the CQ study, two existing heat stress management guidelines were relevant to the work on construction site. A regional guidelines was issued by Chongqing Municipality in 2007 (Document No. 205, 2007), defining a hot weather day as the forecasted daily maximum temperature above 37°C, and suggesting three levels of administrative interventions based on (35-37°C preparation; 37-40°C controlled work; and  $\geq 40^\circ\text{C}$  stop outdoor work). At the national level of China, a heat stress management guidelines was issued in 2012 (Document No. 89, 2012) as an update of a primitive draft guidelines existed since 1960. The national guidelines recognised heat stroke as industry injury and made clear that employers are accountable for a safe working environment and specified a similar threshold system to the CQ guidelines. There are three other national guidelines identical to ISO 7243 and ACGIH TLVs but are not applicable to outdoor construction work.

In Hong Kong, there were two guidelines relevant to climatic heat stress management and applicable to construction work by the time of the research. They were an initial guidelines issued by CIC (2008) and a heat risk assessment checklist published by Labour Department of the HK government (2009). The CIC 2008 guidelines specify responsibilities of stakeholders of construction project, followed by description of consequences of heat illness and recommendations of safety measures. Neither of the two guidelines adopted an environmental threshold system.

Our field study found that neither of the two guidelines was in use. In compliance with the requirement of safety management, most construction sites had a formal risks assessment procedure in place; however, climatic heat stress risk was not among the risks being assessed. As organisational initiatives, two sites were found to be trying to apply certain threshold systems, one applied the American Heat Index chart (Steadman, 1979, 1984) while another used the Canadian Humidex chart (Anderson, 1965; CSAO, 2007, 2010; Masterton and Richardson, 1979). Our field study found that the adopted threshold systems could not give a sensible indication of the local climate of HK thus had little influence on the decision making of frontline staff. Analyses of field studies found that none of the existing guidelines were well known among site based staff. In the CQ sample, 60% workers and 66.7% managers did not know the existence of the guidelines, while in the HK sample 66.7% workers and 49.4% managers are unaware of the existing guidelines. Among those who were informed of the guidelines, the HK samples received the information mainly from formal institutionalized including training, supervisor, or Internet research (as part of manager's work). In CQ, 22.2% managers reported to be informed through formal training while the rest of workers and managers get the information from public media and personal networks.

### **Effective interventions: formal vs. informal**

Effective interventions are identified through triangulation of multiple sources of data. Among the identified effective interventions, the two samples are in common in terms of shade, ventilation, drinking water, first aid and buddy system. Those that the two

samples are not in common are listed in Table 2. A clear pattern can be seen from Table 2 that the Chongqing sample relies more on informal and passive measures, while their Hong Kong counterpart identifies more with formal institutions.

*Table 2. Differences in the effective interventions identified in the two studies*

	CQ sample	HK sample
Effective interventions in difference	Air conditioned dormitory	Mechanical aids
	Toolbox talk	Training
	Ageratum Liquid (Chinese medicine)	Prohibit alcohol
		Advice workers taking necessary rest
		Remind workers on personal health
		Arrange regular breaks
		Inform supervisor of early symptom

**Norms prevail over rules: conformity vs. compliance**

A drunken worker on construction site is a safety hazard to both himself and others around, as his alertness, motor coordination and control are impaired by alcohol (Levitt and Samelson, 1993). For this reason, construction sites in both Hong Kong and China have set up formal rules to prohibiting alcohol. In relation to heat stress risk, alcohol dehydrates the body therefore increases one’s vulnerability to heat illness. For this reason, the prohibition of alcohol was specified in the Hong Kong 2008 guidelines for heat stress management. The site observation and interview data of this study found this formal institution was in most cases not practiced, indicating a norm of alcohol drinking prevails over the formal rule.

A worker in the Chongqing site indicated that he drank a bottle of beer during lunch in summer, for “cooling down the body”, and some rice wine during dinner “for health”. It was observed that drinking beer during lunch was a norm among workers. In a similar belief, a female worker in the Hong Kong site mentioned that she needed to drink some rice wine “to give me strength for this heavy work” in spite of an awareness that she would be dehydrated. Similar justification was given by a group of rebar workers for drinking beer when working in hot weather, reflecting a norm among construction workers for recharge of physical strength and a feeling of cooling down through alcohol drinking.

Rather than being seen as a violation of rules, the norm of alcohol drinking was well accepted by the frontline managers. In the Chongqing site where no formal rules of banning alcohol existed, a nondrinker manager rejected the idea of setting such a rule and gave the reason as “People like it. You can’t prohibit people’s hobby.” In the Hong Kong site where alcohol drinking was formally prohibited, a manager described the reality on site as, “The rebar trade is used to drinking alcohol, because it is their norm”.

To go even further beyond, the norm in some cases prevailed over the formal rules to ‘cause’ workers’ alcohol drinking behaviour. For example, in the Hong Kong site a plasterer working for a subcontractor openly stated that he drank alcohol over lunch. The reason he gave was “I have to drink with my boss, or he wouldn’t hire me for the next job!” In this case, the norm was internalised into a social obligation.

## Historical dimensions of market logic

Market is a societal institutional logic field that brings in values of individualism, willingness to work for gain, trading leisure for income at the margin, and victim-blaming (DiMaggio, 1994). These are jointly formed by the legislative, spatial and temporal structures of the specific societies. Two different market logics were explicated in the patterns of fatigue and the attitudes toward acclimatisation in this study.

Two major dimensions of fatigue leading to heat illness are identified, which are sleepiness and lack of energy. Lack of energy is associated daily cardiac cycle, e.g. in the situations of long continuous work, working with an empty stomach before lunch or working immediately after lunch. Sleepiness is associated with quantity and quality of sleep. Quantity of sleep is influenced by external factors such as working hours and travelling time. The quality of sleep is influenced by workers' personal health and work-life balance. Off-work abuse of alcohol or drug influences both sleep quality and quantity. Both Hong Kong and Chongqing samples agree on the importance of continuous working time (CWT), or, lack of break, as a prominent heat risk factor. In Hong Kong, the Noise Control Ordinance (Cap 400) specifies that no construction work is allowed between 7 p.m. – 7 a.m., which leads to a compacted workload within the restricted 12 hours of the day. There was no such an equivalent legislation constraining construction working hours in Chongqing, where task were subcontracted and packaged to teams; works were mostly self-paced. The onsite accommodation enabled workers to do their work very early or very late in a day and stay in air-conditioned dormitory during the hottest hours of the day.

Apart from the influence of external institutional environment, continuous work time and quantity of sleep are also determined by workers' personal priority, which is a reflection of the societal culture. For example, the rebar team collectively determined whether they took a break or not at the beginning of a working day. Often collective decisions were made to cancel the break on Wednesday afternoon for an early off for Hong Kong's weekly horseracing event at night. In the cases of Chongqing, it was observed that although the site was facilitated with a well-equipped canteen, it was almost empty during lunch time. In contrast, the majority of workers rush to a street food court of a very poor hygiene condition outside of the construction site. When workers were asked whether their choices were based on price difference between the canteen and street food, the answer was no. Instead, the key factor that led to such decision was "*time for a nap*". To buy a set lunch in the official canteen, workers need to queue and wait, whilst the private street food court was operated in a much more efficient way. There workers threw their money into a bucket, helped themselves on choices of food, finished lunch and rush back their dormitory for a nap before starting the afternoon work. The risk of fatigue is thus minimized despite of their incredible long working hours. On this, the Chongqing workers set in their personal priority on the avoidance of fatigue, a contrast to the priorities of their Hong Kong counterparts.

Lack of acclimatization was recognized as a prominent risk in the Hong Kong sample but not in their Chongqing counterpart. A worker in the Chongqing site explained why he believed an acclimatisation protocol for newcomers was not necessary, "*It is one's own responsibility to make sure he has enough capacity to do the work he chooses to do. If he wants the high wage he has to work fast. If he cannot catch up then he has to leave.*" It is clearly a manifestation of a victim-blaming value. In contrast, in the Hong

Kong study both workers and managers agreed that “*newcomers should be given time to work slowly to adapt to heat.*” Although the acclimatization protocol was often not fully practised, it was well accepted as a necessary means for working in heat.

Societal institutional environment and its associated temporal and spatial structures constitute the different market logics in the Hong Kong and the Chongqing studies, indicating the historical dimension of institutional logics. The Chongqing sample was reasoning along a rational market logic which assumes independent and competitive individuals (Daly and Lewis, 2000) willing to work for gain and to sacrifice leisure for income. While the Hong Kong sample sees a more mature individualism that emphasizes individual autonomy and accepts of individual rights and wellbeing (Turner *et al.*, 1986). The contrast in characteristics of components that constitute the two different logics are briefly summarised in Table 3.

*Table 3. Prevailing societal logics in the two studies*

	CQ study	HK study
Prevailing societal logics	Rational market logic	Individualism
Institutional constraint	None	Noise Control Ordinance
Spatial characteristics	Mixed work and life spaces	Clear separation of work and personal life
Temporal characteristics	Stay in dormitory during hot hours; no leisure time	Continuous work; daily commute time 2-3 hours; more time for off-work activities
Individual priority	Rest	Freedom

**Logics of processing safety in production**

Distrust between employers and workers has been an obstacle for effective safety management. The latter is embedded in the reward-sanction system of the organization while the former varied in their manifestations through the two different societal cultures. In the Chongqing study, although workers identified toolbox talk as an effective intervention for disseminating heat stress prevention knowledge, they also identified it had never been practiced. Workers made sense of this non-action as “*they’d rather keep us ignorant so that they don’t have to pay for the Chinese medicine required by the guidelines.*” A different mechanism of generating distrust is seen in the Hong Kong study. Rather than complaining about the absence of safety efforts from employers, Hong Kong workers instead felt overwhelmed by the numerous safety programmes on site that cut into their time for production work by which they were paid. Workers made sense of the safety programmes as “*managers are working for their own rice bowl*”, while safety programmes in practice was not trying to achieve improvement in workers’ safety and wellbeing. The comparative analysis defined two different patterns of distrust signify two different institutional logics at the organisational level: a prevention logic and a production logic. The prevention logic in the Chongqing sample was underneath workers’ self-initiation and their personal priority of staying safe in the absence of a safety management infrastructure. In the Hong Kong sample, while the existing management system ensured a certain standard of safety, the extra effort on safety initiatives was processed in more of a symbolic sense, as extra tasks to the production work.

The differences in procession of prevention logics are further explained by the logics of societal culture that determines individual sensemaking. Liu *et al* (2010) describe

that traditional Chinese society is characterized as a high culture of the Confucianism of the gentlemen and a low culture of pragmatism among ordinary people in the field. Central to the Confucianism culture is the value of benevolence (Ren), expressed as “do not do to others what you would not have them do to you” (Analects of Confucius), which is a reversed expression of Matthew 7:12. While Chinese pragmatism is a set of values that is against any consistent values system but to achieve the material goals, often short-term, regardless of the values of the means, based on a belief that “the ends justify the means”. The Confucianism logic was expressed in a manager’s statement in the CQ study: “According to the Three Cardinal Guides, a king should be a role model of his subjects. Applying to our time, it means a cadre should be a role model to the masses; a boss should be a role model to his employees. Bosses should be caring about their workers’ wellbeing and workers will follow their example to work hard to achieve their production goals.”

In contrast, the pragmatic logic was seen in the Hong Kong study in which employers performed safety as a task of satisfying external institutional requirements while workers felt exhausted by these extra tasks they were not paid for. By this, safety is decoupled from its meaning. The constitutions of the two different prevention logics are summarized in Table 4.

Table 4. Procession of prevention logics in two different institutional contexts

	Chongqing	Hong Kong
Dominant societal culture	Confucianism	Pragmatism
What is prevention	Free from work	Another production task
What is production	In spite of safety risks	Core business
Incentive structure of prevention logic	Self-initiatives (informed by public media)	Organisational initiatives in response to external institutions and market
Structures to enable prevention logic	Onsite accommodation; flexibility of working time	PPE free area, inspection, morning brief, site nurse, posters, reminders
Safety is whose interest	Workers	Employers
Interest of the counterpart	Profit	Individual freedom
Accountable to	Personal wellbeing	External institutions
Central question	Prevention or production?	Which to prioritize?
Core issue	Contradict safety and production	Decouple safety from its meaning
How to reconcile	Benevolent leadership	Authentic leadership

## DISCUSSIONS AND CONCLUSIONS

The concepts of institutions and institutional logics help explain why certain institutional interventions generate safe behaviors in one context but not another, or for certain period of time but not effective for long. They also help predict the change of institutions and their consequential organizational and individual behaviors. While the behavioural approach emphasizes rules and compliance, Elsenbroich and Xenitidou (2012) differentiated compliance from obedience and conformity as motivations of normative behaviors. Our analysis on the alcohol drinking behavior suggests that norms as implicit institutions often have more governing power over



behaviors than the formal institutions do. On the historical dimension of market logics, Yang (1989) identifies three modes of economy in the 1980s in Mainland China: state administered economy, capitalism and an economy of *guanxi*. The first is based on under-informed bureaucracy; the second on market; the third on Confucianism kinship. Our Chongqing study, after three decades of Yang's study, finds that the mode of state administered economy has diminished in the construction sector while capitalism is dominant, which is manifested in the rational market logic embedded in both the organisations' incentive structure and the workers' blame-victim mindset.

Our comparative study suggests that in the practice of construction site, one-size-fits-all institutional interventions are either shelved or, if powerfully imposed, ending up provoking pragmatic reactions, rather than compliance, that lead to unintended outcomes. In an attempt of understanding deviated consequences of business decisions, Goh *et al* (2012) mapped out the production and the prevention dimensions that interact in a way that the organisational system as a whole drifts towards accidents, as theorised by Reason (1997). The institutional logics explicated through this study provide further insights into how individuals and organisations make sense of the ownership of safety and the obligations of mitigating safety risks. New and informal institutions are being constructed through the misinterpretation and distrust between managers and workers, or their collective blindness to certain risks bounded by their cultural contingencies, and internalised to shape behaviours. Further cross-cultural and cross-national studies are needed for validation of the explicated institutional logics in this study.

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