

CONCEPTUAL FRAMEWORK FOR RISK PROPENSITY, RISK PERCEPTION, AND RISK BEHAVIOUR OF CONSTRUCTION PROJECT MANAGERS

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Although a number of quantitative risk management measures and methods have been developed, the risk decision-making behaviour of construction project managers still needs to be further considered. Taking the characteristics of construction projects into consideration, this research put forward an integrated framework from the perspective of construction project managers and proposes 11 general hypotheses, putting risk propensity and risk perception in central roles. Individual differences, including demographic traits, personality differences, and knowledge and experience are identified as factors affecting risk propensity of construction project managers. Risk perception, on the other hand, is mainly influenced by magnitude or probability of potential gain or loss, problem framing, and culture influence. Questionnaires were distributed and multiple hierarchy regressions were employed to test 2 of the 11 hypotheses. The results confirm that extraversion positively influences risk propensity while agreeableness negatively does. Besides, risk propensity has a negative influence on risk perception of construction project managers. Propositions derived not only shed light on guidance for future research on the risk behaviour of construction project managers, but also provide decision-making support through a better understanding of the factors affecting risk behaviour. More empirical tests of the proposed hypotheses should be conducted in future researches.

Keywords: construction project manager, risk decision-making, risk perception, risk propensity.

INTRODUCTION

A construction project is plagued with various risks and uncertainty due to its complex and dynamic nature. Risk management as well as the quality of risk decisions thus plays a critical role during the implementation of construction projects. As an overall planner, controller, and coordinator of a project, the construction project manager must ensure the requirements of completion on time, within budget and required quality standards (Rwelamila, 1994). A project manager is the main decision maker of the project, taking the major responsibility of the risk assessment and management. Risk decision-making behaviour of the project manager thus is critical to the project success. A better understanding of risk behaviour of decision-makers can contribute to risk management programs in project organizations.

Previous research has developed various methods to study the risk decision-making, including expected profit and loss value decision method, the Bayesian decision

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method, the Markov decision method, etc (Wang and Yuan, 2011). However, quantitative studies about risk decision-making (e.g. mathematical programming, economic models) have both practical and theoretical limitations (Lin and Chen, 2004) for they rarely focused on the characteristics or behaviours of decision-makers. It is stated that decision-makers perceive risk differently when faced with various situations, the reasons of which refer to early experience, education background, personal beliefs, and culture (Alexopoulos *et al.*, 2009). Therefore, when it comes to risk behaviour of decision-makers, the subjective factors influencing the way project managers make decision cannot be ignored. Risk decisions during the implementation of construction projects are not only based on the rational evaluations of the likelihood and magnitude of risks, but also rely on the personal traits of the project manager.

A mediated model of the determinants of risk decision-making was proposed by Sitkin and Pablo, indicating that risk propensity and risk perception of the decision-maker are the main variables influencing risk decision-making behaviour (Sitkin and Pablo, 1992; Sitkin and Weingart, 1995). Meanwhile, organizational (Thomas *et al.*, 1993), personal and project characteristics (Müller *et al.*, 2009) are contextual factors which may produce impacts on manager's decision-making. Most of the research on risk propensity, risk perception, or risk behaviour is based on the theory of behavioural decision, generally from the domain of psychology. Little attention was given to factors influencing decision-makers' risk propensity or risk behaviours in construction projects (Wang and Yuan, 2011). Thus, this research tends to find out the critical factors affecting project managers' risk decision-making behaviours. Based on the literature and hypotheses, the purpose of this research is to build up a conceptual model about the relationship among various antecedents, risk propensity, and risk perception of project manager, which also takes the effects of project attributes into considerations.

THEORETICAL BACKGROUND

Risk Propensity

Risk propensity, also conceptualized as an individual's risk-taking tendency, is defined as an individual's current tendency to take or avoid risks and considered as an individual trait which can change over time as a result of experience (Sitkin and Pablo, 1992; Sitkin and Weingart, 1995). An individual's willingness to take or avoid risks may have a significant impact on his decision-making under conditions of risk and uncertainty (Keil *et al.*, 2000). Important decisions take place under conditions of incomplete information, thus it is impossible for project managers to gather all the information and take all risks into consideration to make the wise decisions. In such situations, the decision-makers' risk propensity may play an important role.

Risk propensity is considered to be a situational-specific variable, indicating that a decision-maker's risk propensity differs in various situations (Keil *et al.*, 2000). There is plenty of research on risk propensity of executives (Brockhaus, 1980; MacCrimmon and Wehrung, 1990; Wiseman and Gomez-Mejia, 1998). However, there is limited research conducted in the construction domain, except for a few studies, such as Han *et al* (2005) studied the risk attitude of contractors when making bid/no bid decision of international projects. Wang and Yuan (2011) also identified the critical factors affecting contractors' risk attitudes in construction projects. This research aims to study the risk propensity from the perspective of project managers in the construction context.

Risk Perception

Risk perception refers to “a decision maker’s assessment of the risk inherent in a situation” (Sitkin and Pablo, 1992). As an inherent part of the decision-making process, risk perception could be understood as an individual’s assessment of risk. It means that when individuals are faced with identical situations, some consider the situation to be very risky, while others believe it is with low risks. There is a high chance that decision-makers who perceive low level of risk might take risky actions even if they are risk averse. Forlani and Mullins (2000) put forward a framework which indicates risk perception of entrepreneurs, venture characteristics, various contextual effects, and individual traits play key roles in entrepreneurs’ decisions to enter new ventures.

Risk perceptions of various individuals may differ due to certain types of cognitive biases lead people to perceive different levels of risk (Simon, Houghton, and Aquino, 2000). According to Simon *et al.* (2000), cognitive biases can directly influence risk perception, which further produces impacts on the decision of individuals to start a venture. There are a certain number cognitive biases types, for instance, overconfidence, covariation and control, availability, representativeness, multi-stage evaluation, and so on (Simon *et al.*, 2000).

HYPOTHESES AND CONCEPTUAL MODEL

Sitkin and Pablo (1992) put forward a reformulated model integrating the determinants of risk behaviour and argued the mediating mechanisms of risk propensity and risk perception. Thus, individual characteristics, such as risk preferences, inertia, and history of prior outcomes of risk decision-making, affects risk behaviour indirectly through the impact on the decision-makers’ risk propensity. On the other hand, organizational and problem characteristics, including cultural risk values, organizational control systems, problem familiarity, problem framing (Kahneman and Tversky, 1979), affect risk behaviour only by influencing what is perceived (risk perception). Based on the three aspects, namely individual, problem-related, and organizational characteristics, the following sections aim to find out the effects of key variables on the project managers’ risk propensity and risk perception in construction projects.

Hypothesis 1: Higher levels of risk propensity of construction project managers lead to riskier risk decision-making behaviour.

Hypothesis 2: Construction project managers’ risk behaviour is negatively associated with their levels of risk perception.

Factors Influencing Risk Propensity

Demographic traits

Upper echelons theory put forward that the executives’ personalities greatly influence their interpretations of the situations they face and, in turn, affect their choices or decisions (Hambrick, 2007; Hambrick and Mason, 1984). The demographic characteristics of executives can be used as valid, albeit incomplete and imprecise, proxies of executives’ cognitive frames (Hambrick, 2007). The demographic traits of project managers are thus associated to their way of making risk decisions.

As for age, young males or females take more risks than older males or females, based on which it is proposed and then verified that risk propensity will be inversely related to age (Nicholson *et al.*, 2005). As for gender, women are found to be more risk

averse than men when facing gambling situations. It is also assumed that female project managers are less risk taking.

Lots of studies have been conducted to explore the magnitude of relative risk aversion or risk taking, but there is little consensus and few generalizations to be concluded from the existing literature (Halek and Eisenhauer, 2001). Therefore, this research tries to explore the relationship between demographic traits and risk propensity of project managers in the construction context.

Hypothesis 3: Risk propensity of construction project managers is negatively related to age. Meanwhile, female project managers tend to be more risk averse compared to male managers.

Personality

Personality traits are predictable characteristics of individual behaviour which can explain differences in actions of people in similar situations (Koe Hwee Nga and Shamuganathan, 2010). This research mainly uses the conception of the Big Five model, namely extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience.

Extraversion trait is manifested by sociable, outgoing, positive attitude and assertive characteristics (Ciavarella *et al.*, 2004), which creates a positive drive to risk-taking propensity and need for achievement. Agreeableness trait concerns the ability to foster social consensus in order to maintain mutual trust (Llewellyn and Wilson, 2003). Overly agreeable personality may result in compromising to gain acceptance and lower risk-taking propensity (Koe and Shamuganathan, 2010). Conscientiousness is related to an individual's meticulousness, responsibility, industriousness, which may promote their dependability at work (Ciavarella *et al.*, 2004). Emotional stability represents individual differences in adjustment. Individuals who are more emotional stable can be characterized as self-confident, clam, and relaxed (H. Zhao and Seibert, 2006). Openness to experience is a personality dimension which indicates that individuals tend to seek new experience and explore novel ideas (H. Zhao and Seibert, 2006). Individuals who are high on the dimension of openness tend to be versatile, imaginative, and often face challenges and display creativity (Llewellyn and Wilson, 2003). It thus can be regarded as a cognitive stimulus for risk seeking, chartered as acceptance of experimentation, tolerance of the uncertainty, change and innovation.

Much research has examined the relationship among personality trait, risk propensity, and entrepreneurial status (Miner and Raju, 2004; Nicholson *et al.*, 2005). The relationship between risk propensity and big-five model personality is however controversial (H. Zhao and Seibert, 2006). Limited research has been conducted to explore the relationship between personality and project managers' risk propensity. Thus it is necessary to test the relationship in the construction industry.

Hypothesis 4: Extraversion and openness to experience are positively related to project managers' risk propensity, while agreeableness, conscientiousness, and emotional stability are inversely associated with risk propensity.

Knowledge and experience

Knowledge mainly refers to professional knowledge of project managers. Professional knowledge, and scope of knowledge all play significant roles in influencing contractors' risk attitudes in the Chinese construction industry (Wang and Yuan, 2011). Thus, it is also considered to be important for the project manager, as the main individual who is responsible for the whole construction project, to have a good

knowledge of all work in projects. Project managers with adequate knowledge are likely to be more confident in his decision-making, thus becoming more risk taking.

Hypothesis 5: The risk propensity of construction project managers is consistent with their professional knowledge.

Experience section mainly considers project managers' engineering experience and social experience. It is noted that people tend to fear risk involved in an activity which they are not familiar with. As an individual's experience of problems or tasks increase, he is willing to accept higher levels of risk (Richards *et al.*, 1996). In the construction context, before a person becomes a project manager, there is high probability that he has gained 5-10 years of experience working in the construction sites. Adequate engineering and social experience are thus the foundation of project managers' decision-making and make them feel confident in the construction field.

Hypothesis 6: As construction project managers obtain more and more engineering and social experience over time, this will influence their risk propensity.

Factors Influencing Risk Perception

Risk propensity and risk preference

Risk propensity may influence the relative salience of threat or opportunity under certain situations and thus cause biased risk perception (Brockhaus, 1980; Sitkin and Weingart, 1995). A risk-averse decision maker tends to weight negative outcomes more heavily than positive outcomes and overestimate the probability of loss, leading to a heightened perception of risk. Conversely, a risk-seeking decision maker is likely to weight positive opportunities more heavily and overestimate the probability of gain. Scholars also confirmed risk attitude as a prominent explanatory role in shaping risk perception (Sjöberg, 2000).

Hypothesis 7: The higher a construction project manager's risk propensity, the lower the level of perceived situational risk.

Magnitude or probability of potential gain or loss

Risk is conceptualized as a function of probability (likelihood) and magnitude or regarded as the combination of the probability of desirable events and the magnitude of loss associated with such events (McNamara and Bromiley, 1999). People's risk perception is based more on risk magnitude than on probability, meaning that the magnitude of potential loss is a more influential factor in shaping risk perception (Keil *et al.*, 2000). A popular managerial perspective of risk taking behaviour argued that managers consider risk not as a probability distribution but as the size of potential loss from certain decision (March and Shapira, 1987).

Hypothesis 8: The magnitude and probability of potential gain or loss both influence the construction project managers' risk perception and within different situations the role of magnitude and probability may change.

Problem framing

Problem framing, which refers to whether a problem is framed in positive or negative terms (Sitkin and Weingart, 1995). Prospect theory stated the opinion that positively framed situations resulted in risk averse decisions (Kahneman and Tversky, 1979). However, it should be noted that research also showed positively framed problems foster risk taking because they can draw more attention to the opportunities (March and Shapira, 1987). Emphasizes on the potential losses would heighten the salience of risk, while stressing the potential gains is related to a lower level of perceived risk.

Thus, there exist differences about the relationship of problem framing and risk perception. New research should be considered in the context of construction.

Hypothesis 9: Construction project managers in positively framed situations will perceive lower risk than negatively framed situations.

Culture influence

Researchers have argued that cultural theory is an important explanatory scheme for understanding risk perception (Sjöberg, 2000). Cultural norms and values play an indispensable role in shaping people’s risk perception (Alexopoulos *et al.*, 2009).

Hofstede's (1980) way of cultural division is accepted. Uncertainty avoidance is often related to high levels of aversion to risk. Americans and northern Europeans are highly convinced that they can control events, while East Asian cultural groups tend to hold the view that events are complex, which are affected by various factors and are inevitably less controllable (Nisbett and Masuda, 2003).

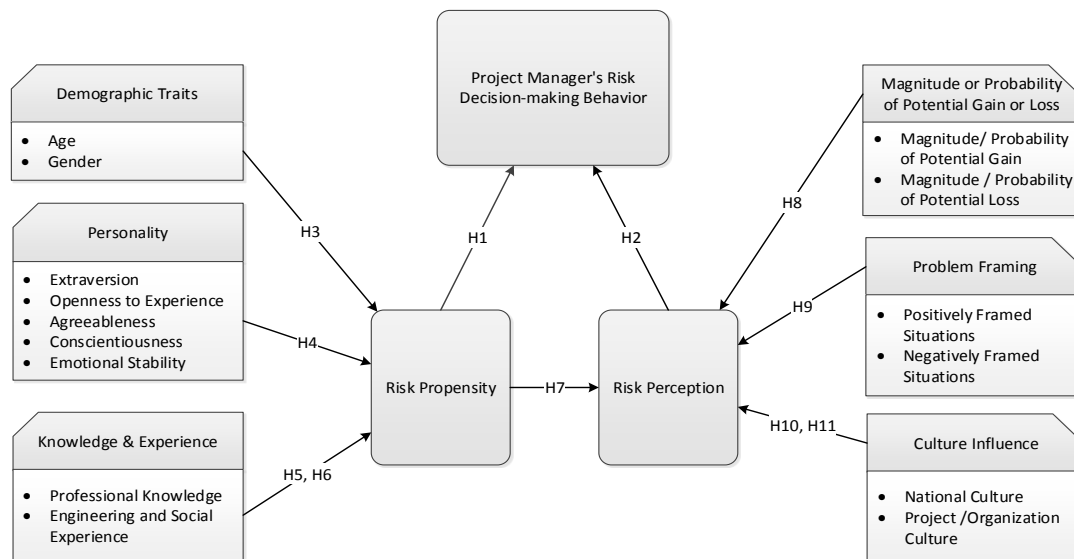
Cultural risk value is defined as organizational tendency to prefer certainty versus uncertainty and risk avoiding versus risk taking (Douglas and Wildavsky, 1983). Thus, the cultural risk value of a project, which indicates or reflects broader attitudes toward uncertainty and risk, may provide important guidelines for project managers when they make risk decisions. Specifically speaking, being in the risk-seeking culture, the project manager is likely to be influenced by the project culture and make risk-seeking decisions, even though he might tends to be risk averse naturally.

Hypothesis 10: National culture in different countries is likely to influence the way people perceive risk.

Hypothesis 11: Project culture or organization culture affect construction project managers’ risk perception. To be specific, project managers in construction projects or organizations with higher risk-seeking cultural values tend to take more risks.

Based on the existing theory and empirical findings of previous research, this research proposes a conceptual model of the relationship among individual differences of the project manager, project or organizational attributes, culture influence, risk propensity, risk perception, and risk decision-making behaviour. Figure 1 shows the integrating framework of this research with 11 hypotheses in total.

Figure 1: Conceptual model related to project managers’ risk behaviour



HYPOTHESES TESTS

To partly verify the validity of the proposed conceptual model, this research chose part of the hypotheses to conduct an empirical test. H4 and H7 will be tested, and questionnaires were distributed to gather data in this research.

Sample

All the formal respondents were project managers from Chinese construction industry, whose privacy were highly protected. 150 questionnaires were sent by e-mail to the construction project managers, and 114 replies were received, making the response rate 76%. After the completeness analysis, 48 effective questionnaires were finally employed, making the effective rate 42.1%. The sample size is not that large because it might be more difficult to gather data from construction project managers only, as the number of project managers is markedly less than general employees.

Measures

The Big Five personalities

Gosling *et al.* (2003) developed a simple Ten Item Personality Inventory (TIPI) based on previous complex scales, and tested the reliability and validity of TIPI. Scholars have translated TIPI into Chinese, and the reliability and structural validity are all acceptable. This research uses TIPI to measure project managers' personalities.

Risk propensity

The scale measuring risk propensity in this research is a 5-item scale called General Risk Propensity (GRP), employed from Hung and Tangpong (2010). This scale has also been modified and tested under Chinese context.

Risk perception

Psychological measures are usually used to measure risk perception in construction area. Respondents are asked to evaluate the probabilities for certainty risk factors. In this research, 29 risk factors were used based on the research of Zou *et al.* (2007).

Control variables

Four variables are considered as control variables, namely gender, age, working experience and education background. These individual traits might be correlated with independent variable, and would have influence on risk propensity. So they should be controlled to get the real influence of personalities on risk propensity.

Results and Analysis

The Cronbach's alpha for extraversion, agreeableness, conscientiousness, emotional stability, openness to experience and risk propensity was 0.748, 0.672, 0.663, 0.651, 0.763 and 0.824 respectively, indicating the internal consistency of the scales was acceptable. Then a confirmative factor analysis was conducted to test the structural validity of Big Five Personality Model. Results show satisfactory support for it (CMIN/DF=2.001, CFI=0.909, NNFI=0.837, GFI=0.912, RMSEA=0.100).

Multiple hierarchical regressions were applied to test the developed hypotheses. The results are shown in Table 1. The results indicate that extraversion is significantly positively related to risk propensity ($\beta=0.128$, $p<0.05$), and agreeableness is significantly negatively related to risk propensity ($\beta=-0.242$, $p<0.01$). In addition, the relationships proposed in H4 between risk propensity and openness to experience, conscientiousness, and emotional stability are not significant. This might be due to not considering different contexts. Research has implied that openness to experience and

emotional stability may positively influence risk propensity if the project gained revenue, while not to influence under loss. These results indicate that H4 is partially supported. When testing H7, the results show that risk propensity is significantly related with risk perception ($\beta=-0.252$, $p<0.001$), suggesting that H7 is supported.

Table 1: Conceptual model related to project managers' risk behaviour

Independent Variable	Risk Propensity		Risk Perception	
	Model 1	Model 2	Model 3	Model 4
Gender	-0.411*	-0.341	-0.027	-0.131
Age	-0.031	-0.025	0.005	-0.002
Educational Background	0.187	0.142	0.033	0.080
Working Experience	0.034	0.016	-0.002	0.006
Extraversion		0.128*		
Agreeableness		-0.242**		
Conscientiousness		-0.034		
Emotional Stability		0.006		
Openness to Experience		0.068		
Risk Propensity				-0.252***
R2	0.084	0.270	0.004	0.138
F	2.216	3.775***	0.100	3.083*

Notes: * $p<0.05$, ** $p<0.01$; *** $p<0.001$

CONCLUSIONS

This research mainly puts forward a conceptual model related to key factors influencing project managers' risk decision-making behaviour in the construction field and set forth a theoretical framework for examining risk behaviour. Three classes of factors influencing risk behaviour are considered, namely individual characteristics, organizational characteristics, and problem-related characteristics. 11 relative hypotheses are put forward through identifying critical factors from literature review. Individual differences, such as demographic traits, personality differences, and knowledge and experience are identified as factors affecting risk propensity of project managers. Risk perception, on the other hand, is mainly influenced by magnitude or probability of potential gain or loss, problem framing, and culture influence. 2 of the 11 hypotheses are empirically tested. The results confirm that extraversion positively influences risk propensity while agreeableness negatively does, and risk propensity has a negative influence on risk perception of construction project managers.

This research yields some new insights into project managers' risk behaviour by integrating perspectives from both risk decision-making literature and risk management theory in the construction context. Prior research often focused on the objective factors of risk and a number of quantitative measures and methods have been developed. However, apart from the objective factors, the individual characteristic of project managers also influence the way they make risk decisions. Studying the relationship between risk characteristics and risk propensity, risk

perception can help improve predictive models about risk behaviour. On the other hand, this research provides project managers a framework for thinking about their own risk propensity and risk perception and how the risk decisions are made. Top managers from the construction enterprises can take the individual differences into account when selecting appropriate project managers.

In addition, this framework is only a starting point to focus on the risk decision-making of project managers. Models or framework are in fact incomplete depictions of the empirical world. Additional work and research should provide more potential influencing factors, revisions, or even challenges to this conceptual model. As to the methods of the research in the future, qualitative method of interviewing is considered as an appropriate way to collect data. Researchers can interview the project managers to discover how they interpret situations, what are their concerns when facing particular issues or problems, how they make final decisions, etc.

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