Risk Management for Housing Projects Undertaken by Private Land Developers

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Abstract
Pakistan with population of 186 million faces a shortage of 8 to 10 million housing units. There has been considerable expansion in private sector for bridging the existing gap. However, this sector is exposed to numerous risks that if not taken care of, may lead to disaster. The objective of this research is to develop a risk management framework for projects undertaken by private developers. The risks encountered on projects by private developers are identified and prioritized and then their corresponding mitigation measures are established. The influence of one risk on other risks is identified. Twenty-seven (27) identified risks are categorized at country level, market level and project level risks. Top 3 identified risks are corruption, inflation and interest rate, and cost overrun. Mitigation shows that most measures selected for this study are within effective to exceptionally effective range. Identifying the influence of one risk on other risk segregates the influencing risks. This concludes that those influencing risks if mitigated effectively would help in overcoming the remaining influenced risk. Finally, a risk management framework is discussed for projects undertaken by private developers based on the significance of risks and effectiveness of mitigation measures coupled with trends highlighted in risk influence matrix.

Keywords
Construction Industry, Private Developers, Risk, Mitigation Measures, Risk Management Framework

1. Introduction

Construction industry is vital in the development of economy of a country. It provides basis for growth related to other sectors of economy. Risks and uncertainties inherent in the construction

industry are more than other industry (Zavadskas et al., 2010a). Risk handling and its proportionate handling dictates the probability of success of a project (Paslawski, 2013). Nonetheless, risk management is not done properly and most projects do not achieve time and cost objectives (Shevchenko et al., 2008), as a reason of which the key stakeholders of the project including the public suffer (Zavadskas et al., 2012, 2010b). Despite importance, managing risks remain a challenge for construction industry practitioners (Kapliński, 2009a). Research carried out by Choudhry and Iqbal (2013) on the identification of risk management system in the construction industry in Pakistan indicates that industry lacks knowledge of advanced risk management techniques, formal risk management system, and lacks in joint risk management framework.

Real estate development by private developers has seen a boom in the country in the last decade. Private developers have undertaken mega projects which are exposed to greater amount of risk. In the country, research has been undertaken to identify risk management practices in construction industry (Choudhry and Iqbal, 2013). Nonetheless, little research is done related to development of a framework for risk management for projects undertaken by private developers in the country. The aim of this research is to bridge this gap so as to develop a risk management framework based upon input with regards to risk and mitigation measures against those risks. Following objectives are kept for this research:

a. Identify and prioritize major risks encountered on housing sector projects undertaken by private developers;
b. Identify and rank corresponding mitigation measures for these risks;
c. Identify the influence of identified risks on each other.

2. Past Studies

Risks are associated with unpredictable events whose occurrence may happen in future with an uncertain outcome but it has the potential to affect the objective in some way. Project risk management is a process in which risk management planning, identification of risk, analysis, planning and monitoring of responses and control on the project is achieved through a systematic approach (Loosemore et al., 2006; Markmann et al., 2013). Joint risk management is crucial towards the success of any project. Implementation of joint risk management techniques by all the stakeholders involved in a project are extremely important for achieving project objective and to ensure that risk management include perspective of all stakeholders (Loosemore et al., 2006). Risk management in projects aims to reduce the probability and consequences of adverse incidents and at the same time increase the probability and consequence of incidents which are positive to the project outcome (American National Standard, 2004).

Risk categories vary according to the type of the project or its nature. Another way of categorizing risks is on hierarchical bases. On hierarchical bases, risks are categorized in three broad bases: country level risks, market level risks, and project level risks (Wang et al., 2004). Management of risk is a formal and iterative process which continues throughout the project to have optimum control on risk **(**Simmons, 2002). According to American National Standard (2004), RMP consists of five stages. Project risks have been analyzed by Abbasianjahromi and Rajaie (2012). Different researchers have recommended various methods for analysis of risks, few are: RAMCAP (Risk Analysis and Management for Critical Asset Protection) by introducing new parameters that affect risk value (White et al., 2016); based on intelligent agents (Smeureanu et al., 2012); based on fuzzy TOPSIS bid/no-bid model (Ravanshadnia, Rajaie, 2013); Fuzzy synthetic model (Abdul-Rahman et al., 2013) and in fuzzy environment, applying TOPSIS-F method (Tamošaitienė et al., 2013).

Researchers have highlighted the importance of considering aspects of risk management processes like the beginning of risk situation, recognize and distribute processes (Jaskowski and Sobotka, 2012; Li et al., 2013; Hanna et al., 2013), examine evidence (Zavadskas et al., 2010a, 2010b), examine the flexibility of outcomes (Jaskowski and Sobotka, 2012; Kapliński, 2008), risk charge and assessment (El-Sayegh, 2007; Ke et al., 2012; Markmann et al., 2013; Skinner et al., 2014), treatment, function or process of risk (Zavadskas et al., 2010a; Kapliński, 2009b, 2013), and observing and informing about risks allied with any activity (Xianbo et al., 2014). The exchange and interest rate risks should be undertaken by the owner (Jaskowski and Sobotka, 2012; Hanna et al., 2013). Conflict-solving among entities has been analyzed by Šostak and Makutėnienė (2013).

3. Methodology

The research design of this study is cross sectional in nature. Three questionnaires were floated to the leading private developers in the country. Six organizations working across the country are selected that included Bahria Town, Defense Housing Authority (DHA), Eden Housing, Pearl City, Gulberg Greens and City Housing as being the leading private developers in the country. They are not only involved in construction of housing units but are also constructing multipurpose high rise buildings. First survey was used for risk ranking. Second survey ranked mitigation measures of already ranked risks. Influence of one risk on another was established through a risk influence matrix used in the third survey. Finally results of surveys were used to propose a risk management framework.

3.1 Measures Used

The first survey designed to identify and prioritize risks and measured two attributes of each risk. One is probability of occurrence of risk and second its consequence on the project.
Risk score 'S' was then calculated by multiplying the probability of occurrence "P" with impact factor "I" (see Eq. I).

$$S = P \times I \qquad \text{Eq. I}$$

The second survey was designed to assess the effectiveness of mitigation measures on a Likert scale of 1-5. The scale adopted for measuring effectiveness on Likert's scale is '1'- not critical and '5' - exceptionally critical. The third survey for investigating the influence of one risk on another is conducted with the help of risk influence matrixes. The intensity of influence is determined based upon percentage of respondents selecting a category. Relative importance index is used to rank the risks as used by other researchers (e.g. Kometa *et al*., 1994).

$$\text{Relative importance index (RII)} = \sum W / (A \times N) \qquad \text{Eq. II}$$

Where

W = Weighting of each factor

A = Highest value of factor, and

N = Total number of respondents.

3.2 Questionnaire Design and Content

Structure of questionnaire used for first and second survey is same as used by Wang et al. (2004) for risk management framework for construction projects in developing countries. Apart from this, additional risks identified from interviews of project managers from private developers, were included for first survey along with their corresponding mitigation measures for second survey. Eight interviews in total were carried out targeting professionals within the leading private developers such as Bahria Town and Defense Housing Authority. Based on the results of interviews, risks were segregated as significant and non-significant. Twenty-seven (27) significant risks were selected under three broad categories i.e. country level, market level, and project level for final survey and subsequent ranking. Mitigation measures are identified from structured interviews and literature. This was followed by the design of three sets of questionnaire. First questionnaire identified the effectiveness of risks based upon the probability of occurrence and its impact on project. Second questionnaire ranked mitigation measures against the already ranked risks as per the effectiveness they exhibit in overcoming or reducing the risks. Third questionnaire identified the influence of one risk on another within the same category as well as on risks from other categories.

4. Results and Analysis

4.1 Response Rate

In total, 120 questionnaires were floated for first survey, 90 for second, and 100 for third survey. Response rate for first survey was 41.7%, for second survey it was 42.2 % and for third survey response rate was 53%.

4.2 Respondent Profile

Within private developers multi facet respondents were targeted. Most of them were engineers and architects but also included financial managers, operation managers and managers for land development.

4.3 Reliability Analysis

Reliability tests for the first survey shows that in total 27 risks have a Cronbach's alpha value of 0.726. The value of Cronbach's Alpha for individual categories of country level, market level and project level risks was 0.818, 0.714 and 0.835 respectively. The results of Cronbach Alpha depict high consistency of results.

4.4 Risk Ranking - Relative Importance Index (RII)

Relative importance index (RII) is used for ranking of the risks. Table 1 shows the relative importance index (RII) of all the risks and the overall ranking of the risks. It shows that 6 out of top 10 risks are within the country level category. Market level and project level category, each has 2 risks within the top 10 category. This reflects that risks have a trickledown effect. If country level category is mitigated effectively this will have a positive effect for mitigation of market and project level risks. Top three risks are briefly discussed next.

4.4.1 Corruption

Corruption (CL5) tops the overall ranking of risks. As per transparency international report, the country is ranked 127^{th} out of 177 countries. The corruption perception index 2013 shows that the country lies within the range of highly corrupt countries with CPI score of 27 (corruption perception index 2013, transparency international).

4.4.2 Inflation and interest rate

Inflation and interest rate (ML3) is ranked the second most significant risk. The country has suffered from a high rate of inflation in the last decade. Annual inflation rates for last five years show double digit inflation (Pakistan bureau of statistics). The rapid rise in inflation during the period validates the result of this study in which inflation and interest rates are ranked second with a very high significant score.

4.4.3 Cost over runs

This is followed by cost over runs (PL1) being the third most significant risk. The major reason of cost overruns was talked out to be high inflation and frequent changes in scope (Interviews with project managers, 2014).

4.5 Ranking of Mitigation Measures

Results of the second survey give out the effectiveness of the mitigation measures and their ranking as per the effectiveness. Reliability test for mitigation measures shows a Cronbach's Alpha value of .848 for country level risk, 0.815 for market level risks and 0.827 for project level risks. Data reveals that a high percentage of mitigation measures fall within the effective and exceptionally effective (3-5) range. The list of top mitigation measure against top 5 risks is shown in Table 2.

4.6 Risk Interdependencies

Risk interdependency is an extremely important consideration for developing a risk management framework. Survey results are further explained under three broad categories.

Table 1: Ranking of risks

Category of Risks	Risks	RII	Over all Rank	Risks	RII	Over all Rank
Country Level	CL#1 Approval and Permits	0.756	6	CL#8 Political instability	0.563	23
	CL#2 Change in Law	0.661	12	CL#9 Government policies	0.646	15
	CL#3 Justice Reinforcement	0.588	22	CL#10 Differences in work culture	0.690	9
	CL#4 Government influence on disputes	0.670	10	CL#11 Environmental protection:	0.594	21
	CL#5 Corruption	0.850	1	CL#12Public image	0.621	18
	CL#6Expropriation	0.515	24	CL#13 Force majeure:	0.629	17
	CL#7 Land Acquisition	0.824	4	CL#14 Fragile security Environment	0.812	5
Market Level	ML#1 Human resource	0.699	8	ML#4 Market demand	0.653	14
	ML#2 Corporate fraud by other private partners	0.511	25	ML#5 Competition	0.596	20
	ML#3 Inflation and interest rates:	0.834	2	-	-	-
Project Level	PL#1 Cost Overrun	0.828	3	PL#5 Improper quality control:	0.635	16
	PL#2 Improper design	0.610	19	PL#6 Improper project management:	0.664	11
	PL#3 Low Construction productivity	0.748	7	PL#7 Intellectual property protection	0.388	27
	PL#4 Site safety	0.482	26	PL#8 Inadequate survey for infrastructure planning and development	0.655	13

cc

Table 2: Top mitigation measure against top 5 risks

Top 5 Risks	Mitigation Measure	
	Code	Explanation
CL5- Corruption	M4	Key persons should be trained about culture and commercial dealing to cater for corrupt people.
ML 3- Inflation and interest rates	M2	Alternatives for cash payment for example rights, resource sharing should be adopted.
PL1- Cost Overrun	M3	Plan should be practical and clear, and time schedule and cost plan should be properly monitored and controlled.
CL7- Land acquisition	M3	Joint Venture (JV) should be established with state owned enterprises.
CL14- Fragile security Environment	M3	Security risk should be covered through insurance.

4.7 Country level risks

Risks influence survey was used to develop a risk influence matrix. Risk influence matrix showed that how the country level risks influence the market and project level risks. It shows the influence of country level risks within the same category of risks i.e. country level. Results reflect the percentage of respondents who indicated that occurrence of a particular risk is to influence the occurrence of other risks. For instance, if country level risk CL1 occurs than 68% of respondents indicated that there is a probability that risk CL7 will also occur and if not mitigated it will have adverse effect on the project. It can be seen from the influence matrix that risks such as CL5 influences eight other risks whereas risk CL9 influences 11 other risks. As per criticality CL5 is ranked 1 and CL9 is ranked 15 in overall risk ranking. This indicates that it is not necessary that higher ranking risks are the one which have more influences on other risks.

4.8 Market Level Risks

Risks influence matrix for market level risks shows how the market level risks influence the project level risks and also within market level risks. Risk influence matrix shows that risk ML1 has influence on ML5, PL2 and PL3. Interestingly there is no market level risk which influences any risk from country level category. This shows that mostly risks influence other risks within their own category or lower category.

4.9 Project level risk

Risk influence matrix for project level risk indicates that how PL6 clearly influence maximum

number of risks. PL6 is ranked eleventh in over all categories and third within project level category. Risk PL1 is top ranked risk within project level category. Interestingly PL1 does not influence any other risk. This again validates that it is not necessary that a higher rank risk influences more number of risks than a lower rank risk.

5. Conclusions

This research reveals multiple aspects of risk management that private developers are facing. Results indicate that risk management practices of private developers lags considerably as compared to that of global standards. Risk management techniques used by private developers in in the country are mostly subjective in nature. The results indicate corruption, inflation and interest rate, and cost overrun as the top three risks. Results indicates that out of top 10 risks, 6 lies in country level category followed by two risks each for market and project level categories. Similarly results of a comprehensive survey ranks mitigation measures. Results show that the mitigation measures selected for the study fall within effective to exceptionally effective range. This is followed by another survey to establish risk influence. Risk influence matrix depicts that it is not necessary that the most significant risk is the most influencing risk. Findings indicated that out of total 27 risks, 6 risks are most influencing risks. Five out of these 6 risks lie within country level category. These 6 risks if mitigated effectively can help in overcoming the remaining influenced risk. Finally, significance of risks and effectiveness of mitigation measures coupled with trends highlighted in risk influence matrix are used to develop a risk management framework for projects undertaken by private developers. This risk management framework is planned to be discussed in the expanded paper planned to be submitted in a reputed journal. The framework can be used as a valuable guide for project planners, engineers and managers to take a stock of their ongoing as well as future project. The risk management framework can also be utilized by other sector of construction industry as a reference for developing a framework for managing risks on their project.

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