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QUALITATIVE ANALYSIS OF INTERNAL AND EXTERNAL RISKS FOR READY MIX CONCRETE PLANTS – A CASE STUDY APPROACH

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Abstract
Ready Mix Concrete (RMC) industry is continuously growing all over the world and India is not an exception to it. Like other industries, RMC industry is also exposed to multidimensional risks from all directions. These risks must be addressed properly so that RMC industry shall gain credibility, confidence of the customers and shall have expected profit margins. The risk sources pertaining to RMC industry are internal as well as external. This paper proposes a simple yet effective procedure for qualitative analysis of risks having internal and external sources related to Ready Mix Concrete (RMC) plants. Once the risks are qualitatively analyzed, the appropriate response strategies can be adopted to treat these risks.

Key Words *– Risk, Multidimensional, RMC,*

INTRODUCTION
Ready Mix Concrete (RMC) is a "Concrete delivered at site or into purchaser's vehicle in the plastic condition and requiring no further treatment before being placed in a position in which it is to be set and hardened" (IS 4926-2001). Ready Mix concrete is environmental friendly. Its manufacturing is not messy and time consuming. It can be provided as per the customer's requirements for specifications and quality. Storing materials at site for manufacturing concrete is not required at project sites.
In India, use and demand of RMC is growing rapidly in civil and construction business. Globalization has given a boost to many infrastructure projects in India. Many companies are foraying in RMC business because it has a huge potential. Anticipating huge potential for RMC, many organized and unorganized players are foraying in this area.
RMC industry is exposed to various risks in India. Risk Management at RMC plant is not given adequate importance the way it is given in European countries, where operation managers at RMC Plant manage risks at production plant and delivery sites (www.learn4good.com) The risk causes of any projects can be categorized into internal and external (Zia,H.1995). With this approach, the risks related to RMC plants can be categorized broadly into internal and external risks.
Proposed paper is focused on qualitative analysis approach for internal and external risks to which RMC plants in India are exposed. Qualitative analysis of risks shall help management of RMC plant to decide upon appropriate response strategies to achieve objectives of RMC business.

RISK MANAGEMENT APPROACH
Risk Management is a major feature of the management of large engineering projects to reduce uncertainties and to achieve project success. The risk management approach aims to identify and assess risks in order to enable the risks to be understood clearly and managed effectively David Hilson,2002. It is a critical part of project management as 'unmanaged or unmitigated risks are one of the primary causes of project failure' (Lyons and Skitmore, 2004). Failure to perform effective risk management can cause projects to exceed budget, fall behind schedule, miss critical performance targets, or exhibit any combinations of these troubles (*Carbone and Tippett* 2004). A number of variations of risk management approach have been proposed by different authors and researchers, that in general includes identification, classification and analysis of risks.
Risk identification deals with identification of potential risks affecting the project objectives. Various tools and techniques like Brainstorming, Cause – Effect Diagram, Decision Tree, Delphi Technique, Interviews etc.are used for risk identification. Classification of risks helps in deciding which category of risks is to be focused more for

analysis and risk response. Authors like Baldwin (1971), Mason (1973), Ashley (1981) and, Johnson and Rood (1977), have given different classifications of risks according to their own perception.
The analysis of risks could be qualitative and quantitative. Qualitative risk analysis includes deciding upon the probability of occurrence of a particular risk and tits consequences to find out the exposure of that particular risk. It is a very is rapid and cost effective method to analyze the risks. It results in a list of potential risks that shall have substantial influence on project objectives in terms of cost, time, quality, safety, health and performance. Risk quantification and analysis of quantified risks can be a step further, if needed, using suitable techniques. Some of the techniques used to analyze risks qualitatively and quantitatively are Probability and impact Grid, Fault tree analysis, Event tree analysis, Sensitivity analysis, Simulation, Decision Tree analysis, Expected value Method, Analytical Hierarchy Process.
Appropriate response strategies can be decided after qualitatively analyzing the risks. PMBOK (2004) has given four response strategies as Risk Avoidance, Risk Transfer, Risk Mitigation and Risk Acceptance.. Appropriate response strategies are selected and implemented for the selected potential risks and are to be monitored continuously. Selection of effective risk response strategies shall reduce the effect of risks on project objectives.

QUALITATIVE ANALYSIS OF RISKS – AN APPROACH PRESENTED IN PROPOSED STUDY

In the proposed study, risk is considered as a future event which has an adverse effect on the objectives of company running RMC plant and for which possible outcomes can be predicted on the basis of probability. This study considerers risk management as a process having sub- processes like Risk identification, Risk Classification, Risk analysis and Risk response management. In order to identify internal as well as external risks, and to classify them in different categories, interviews of plant managers and other key personnel at RMC plants run by different companies in different location in were conducted. Outcome of this exercise is presented in (Table 1).Table 3 represents categorization of potential risks obtained after qualitative risk analysis.

Table1
Identification of External and External risks in RMC Plants in India

Sr No.	Description of risks	Internal	External
1	Change in Govt. and Govt. policies		✓
2	War, Riots etc.		✓
3	Interference of local Politicos		✓
4	Contractual liability (breach, third party action)	✓	
5	Inappropriate dispute redressel mechanism	✓	
6	Conflict between various agencies	✓	
7	Errors in contract price calculation	✓	
8	Misinterpretation of contract terms	✓	
9	Litigation due to claim	✓	
10	Ambiguity in specification for delivery	✓	
11	Change in scope	✓	
12	Air Pollution	✓	
13	Water Pollution	✓	
14	Noise Pollution	✓	
15	Soil Pollution	✓	
16	Environmental Litigation		✓
17	Depletion of Natural resources	✓	
18	Extreme weather conditions (cold / hot)		✓
19	Inflation		✓
20	Delay in Payment by client	✓	
21	Investment Risks	✓	
22	Interest rate change		✓
23	Force Majeure(Acts of God)		✓
24	Disease / Epidemic		✓

25	Fire		✓
26	Terrorism		✓
27	Natural Disaster		✓
28	Changes in local Tax rates		✓
29	Levy of additional taxes and duties on RMC (Entry Tax, Excise duty)		✓
30	Changes in current RMC regulations and ministry requirements		✓
31	Changes in local Tax rates		✓
32	Use of new technology	✓	
33	Lack of technical expertise / personnel	✓	
34	Internal technology system failure	✓	
35	Improper internal infrastructure	✓	
36	Improper site access	✓	
37	Ineffective control over wastage	✓	
38	Confined spaces	✓	
39	regulatory and Govt. requirements for production		✓
40	Operational performance risk	✓	
41	Extended operation hours	✓	
42	Delay during transportation		✓
43	Frequent breakdown of M/Cs, Plant etc.	✓	
44	Damage to M/Cs due to flood, accidents and during transport of concrete	✓	
45	Wrongly designed layout	✓	
46	Unskilled personnel at work	✓	
47	Risk of accidents loosing production, loosing life	✓	
48	Traffic problems		✓
49	Idle machineries	✓	
50	Technical Risks – Policies and Procedure	✓	
51	Loading wrong material	✓	
52	Oversetting of concrete	✓	
53	Non setting of concrete	✓	
54	Improper infrastructure, scaffolding and platform	✓	
55	Over utilization of plant capacity	✓	
56	Wrong working location	✓	
57	Improper errection and commissioning of Plant	✓	
58	Death/Injury to someone at site or in plant due to accident	✓	
59	High transportation cost	✓	
60	Lack of infrastructural facilities (water, roads, electricity, communication systems)	✓	
61	Use of ungraded machineries in manufacturing process	✓	
62	Delay due to accidents at site	✓	
63	Damage to roads due to transporting through heavy vehicles	✓	
64	No flow through pipes during discharge	✓	

65	Varying degree of moisture in sand	✓	
66	Improper or no calibration of water meter, weigh balance, machines and equipments	✓	
67	Errors in testing and inspection of materials.	✓	
68	Non availability of advanced testing facilities.	✓	
69	Poor quality of repairs and maintenance	✓	
70	Inaccuracy in batching, weighing, mixing	✓	
71	Inaccuracy in statistical adjustments	✓	
72	Risks of drying and loss of workability of concrete	✓	
73	Slump and sand content is not properly governed	✓	
74	Mixer not maintained in an efficient and clean condition	✓	
75	Improper moisture compensation	✓	
76	Incorrect Mix design	✓	
77	Improper specification for RMC		✓
78	Incorrect use of admixtures	✓	
79	Irregular quality monitoring	✓	
80	Inappropriate quality standards	✓	
81	Receiving raw material at site without required specifications	✓	
82	Risks related to basic properties of ready mix concrete like workability, strength, durability, segregation and homogeneity during transport	✓	
83	Not using proper checklist for quality control	✓	
84	Non availability / shortage of cement and other materials	✓	
85	Transport strike		✓
86	Vender problems (delays)		✓
87	Poor quality of materials	✓	
88	Non availability of spare parts		✓
89	Difficulties in importing equipments		✓
90	Raw material selection risk	✓	
91	Improper storage system (Dampness, no ventilation)	✓	
92	Theft at site	✓	
93	Risks associated with buying and /or hiring decisions	✓	
94	Eye, skin and respiratory tract irritation	✓	
95	Chemical burns	✓	
96	Over exertion	✓	
97	Ergonomics	✓	
98	Occupational hazards faced by truck drivers	✓	
99	Injuries at site	✓	
100	Slips, trips and falls	✓	
101	Accidents at site	✓	
102	Non functioning of fire fighting system at	✓	

	site		
103	Non availability /no use of safety equipments and tools at site	✓	
104	Unavailability of proper medical facilities	✓	
105	Mishandling of material at site	✓	
106	Demand – Supply Gap	✓	
107	Competition in Market		✓
108	Wrong assessment of market potential and demand estimation.	✓	
109	Problems created by nearby residents		✓
110	Public outcry with regard to activities like quarrying near plant etc		✓
111	Non productivity / performance of laborers	✓	
112	Non availability of local labor		✓
113	High Labor turnover	✓	
114	Problems by labor union		✓
115	Cultural differences		✓
116	Performance risks	✓	
117	Improper planning for various works	✓	
118	Less growth opportunities within organization	✓	
119	Discharge of concrete on ground (slurry is lost)	✓	
120	Improper mixing	✓	
121	No policy for solid waste and runoff management	✓	
122	Inappropriate disposal of sludge	✓	
123	Conveyance of waste water is not regulated properly	✓	
124	Inappropriate sewage treatment and disposal	✓	
125	Low maintenance	✓	
126	No careful planning is done for repairs and maintenance	✓	
127	No periodical check up of plant and machineries	✓	
128	Not following manufacturers recommended practice for cleaning and lubricating etc	✓	
129	Not maintaining maintenance check sheet and repair records	✓	
130	No set up for regular testing and inspection	✓	
131	Major overhauling is not done by manufacturer's representative or specialist/ experts.	✓	
132	Worn parts are not replaced on regular basis	✓	
133	Hydraulic equipment is not kept free from contamination.	✓	

Qualitative risk analysis was done using five point scales for probability and Impact. This Five po140 scale was used to get the probabilities and impact values on subjective basis (1 to 5 – standing for very low, low, medium, high and very high respectively). A high probability of very low impact and very low probability of a very high impact is not considered as a risky condition. Only when both, the probability of occurrence and the Impact are significant, the situation is considered risky (Baloi Daniel et.al; 2004). On the basis of this concept, the risk acceptance criteria was defined and decided in the proposed study (Table 2). For example, Probability of occurrence of Health risks is very high in RMC plant and Impact is also high considering the importance of human life. Hence exposure of this risk is considered very high. This risk is thus considered for the further process in risk management i.e. for risk quantification and quantitative risk analysis. Similarly, risks with low probability of occurrence and low Impact will have low exposure and thus can be excluded from further process in risk management.

Table 2
Combination of the probability and Impact for risks to be considered for Quantification

Very High Probability - Very High Impact
Very High Probability - High Impact
Very High Probability - Medium Impact
High Probability - Very High Impact
High Probability - High Impact
High Probability - Medium Impact
Medium Probability - Very High Impact
Medium Probability - High Impact
Medium Probability - Medium Impact

With the help of Probability –Impact ranges and the acceptance criteria decided upon, a screened list of risks is obtained which will actually have substantial influence on objective of a company running RMC plant. These screened risks are then assigned different sub- categories like political, environmental, legal-contractual, financial, operational, safety, repairs and maintenance, quality, procurement and storage, market and organizational risks. This list is to be taken into account to decide upon suitable response strategies (Table 3). This sub-categorization is important because management of RMC plant may be interested in deciding upon response strategy only for the risks falling under a particular category and may ignore other categories of risks for various reasons.

Table 3
Selective risks having significant impact

No.	Significant Risks	Risk Category - **Internal**	Risk Category - **External**	Risk **Sub-Category**
1.	Interference of local politicos		✓	Political
2.	Inappropriate dispute redressal mechanism	✓		Legal/Contractual
3.	Conflict between various agencies	✓		Legal/Contractual

4.	Extreme weather conditions		✓	Environmental
5.	Delay in payment by client		✓	Financial
6.	Delay during transportation		✓	Operational
7.	Wrongly designed layout	✓		Operational
8.	Accidents at site	✓		Safety
9.	Loading wrong material	✓		Operational
10.	No periodical check up of plant and machineries	✓		Repairs and Maintenance
11.	Receiving raw material at site without required specifications	✓		Quality
12.	Vendor problems(delays)		✓	Procurement and storage
13.	Unavailability of proper medical facilities	✓		Safety
14.	competition in market		✓	Market
15.	Wrong assessment and market potential and demand estimation	✓		Market
16.	Less growth opportunities within an organization	✓		Organizational

CONCLUSION

The proposed paper presents an approach for qualitative analysis of internal as well as external risks is RMC plants at various locations in India. On the basis of the information gathered, a checklist of risks is generated. Subjective ratings for both, probability of occurrence and Impact were applied to these risks in order to qualitatively analyze them. An acceptance and rejection criteria is suggested to screen the risks having significant impact on the objectives of companies running RMC plants. Thus, qualitative analysis resulted into a list of potential risks. Suitable response strategies for these screened risks can be decided upon by the management of respective RMC plant.

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