Prioritizing the Risk based on its impact for Redevelopment projects using AHP & TOPSIS

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Abstract: In most cities of developing countries, old buildings always tend to undergo redevelopment. Such as buildings which are in dilapidated condition or uneconomic to repair or tenants are in a need of more usable floor area. Because of various constraints and considerations, this process of projects of building redevelopment is quite complex. If a proper and time bound process is not followed, or if the risks, uncertainties and challenges are not handled properly, even a seemingly simple project can fail, thereby causing great anguish and hardship to the stakeholders. Sometimes this may lead to prolonged litigation. The risk associated with these type of projects have multi criteria so needs to identify by the Multi criteria Decision Making (MCDM) methods. The major risk concern in the redevelopment projects are Planning risk, Construction risk & legal risk etc. In this paper the identification of risks in the redevelopment project are stated and prioritizing of the risk based on it's impact through a questionnaire survey is given. Total 49 nos. of Criterias were identified which are associated with the redevelopment projects on both stakeholder. The criteria divided into the 5 major groups. These criteria are analyzed by Analytic Hierarchy Process (AHP) & Technique for Order Preference by Similarity to Ideal Solution (TOPSIS).

Keywords: **Redevelopment projects, Risk in redevelopment projects, Analytic Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)**

I. INTRODUCTION

Redevelopment implies re-utilizing and improving land in your neighborhood or city by including or restoring structures, making increasingly attractive properties. Frequently the term is utilized when something revolting or old fashioned is crushed to clear a path for the new. Redevelopment essentially implies destruction of the old and existing structure and supplanting it with another structure having new measurements and space. The reasons are numerous for experience to redevelopment, for example, dread of breakdown because of haggard state of structures, uneconomic to fix or need of more territory or enhancements or assets or mix of more than one of reasons.

With redevelopment projects certain risk connected and this risk needs to identify and mitigate with a suitable mitigating method. This risk is held on the both stakeholder of the project. But however the risk on the society member side is much more than the risk on the developer side. By identify and analyze the risk the project can meet the success.

There are many criteria attached with the risk in this type of project. Many criteria includes the risk and sub risk which are related to the redevelopment projects. Due to presence of the multi criteria this risk need to identify by Multi Criteria Decision Making (MCDM) methods. Multiple criteria decision making (MCDM) refers to making decisions in the presence of multiple, usually conflicting criteria. The redevelopment projects have the data which is apply on the some of the method of the MCDM. On the Redevelopment projects the method used are 1) analytic hierarchy process (AHP) 2) Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) 3) Simple Additive Weighting (SAW).

This paper presents different risks which are associated with the redevelopment projects. Further through a questionnaire survey, this paper presents prioritization of that risks based on their impact is given with both method Analytic Hierarchy Process (AHP) & Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). These risks are divided in 5 major groups like 1) Management risk 2) Planning risk 3) Construction risk 4) Political and Legal risk 5) Other risk.

II. RESEARCH METHODOLOGY

Different literatures related to this research are reviewed, and in order to understand redevelopment projects and risk associated with it.

There are several methods of collecting data. Important ones are: observation method, interview method, through questionnaires, through schedules. In this research, the collected data is through questionnaires. This method of data collection is quite popular, particular in case of big inquiries. In this method a questionnaire is sent to persons concern with a request to answer the question and return the questionnaires.

Based on discussion with expert the following criteria are used to make the questionnaire. A questionnaire consists of a number of questions printed or typed in a definite order on a form about the general information about the respondent including name, experience and other basic project details. VADODARA

Table 1 & 2 shows the different Risks associated with redevelopment projects on both stakeholder.

Table 1: Risk on society member side

Risk on society member side:		
a) Management risk:	**b) Planning risk:**	**c) Construction risk:**
Improper tendering process	Developer give small area than promised	Delay in project
Lack of unity among members	Risk of improper valuation	Rent is not paid according to schedule
Absenceness of member when required	Incompetence of PMC hired	Below quality construction
Members not aware of then right	Builder not transparent, reliable & trustworthy	Changes the design without concern of member
Members do not appoint legal experts to analyse the contract	Increase in maintenance	Rent changed which is pre-decided
Corrupt management committee		
d) Political & legal risk:	**e) Other risk:**	
Illegal construction done by builder	Dispute between partners of developer	
Dispute between developer & society	Lack of organization & coordination	
All legal formalities not observed by society	Improper construction working methods	
One flat sold twice to different party	Builder stuck by financial crises & stop work	

Table 2: Risk on developer side

Risk on developer side		
a) Risk due to society management committee:	**b) Planning risk:**	**c) Construction risk:**
Corruption in management committee	Non saleability of newly generated house	Non availability of labour, material & machinery
Members may be interested for gaining more money	Select wrong type of development	Construction cost overruns
Non resident owner demand high price on property	Changes in project cost	Delay in completion time
Old documents can not be traceable	Escalation in rent	Quality risk
Delay in possession from occupants	Rules changed by regulatory authority	Damage to surrounding properties
Change in society members expectations	Delay in approvals from authorities	
Choices of new units		
d) Legal & political risk:	**e) Other risk:**	
Corruption in government agency	Damaged to surrounding	
Violation of byelaws & Acts	Recession in real estate	
Advocate Units/ land title related issue	Cast related risk	
Loan related NOC's issue		

III. DATA ANALYSIS AND RESULT

The Questionnaire form is distributed to the both stakeholders which are associated with redevelopment projects 1) Society member 2) Developer among the redevelopment sites in Ahmedabad city. Total 64 responses were taken in which 20 respondent from the developer side and 44 respondent form society member side.

It is important to identify the degree to how much the respondents agree or disagree on the severity of these causes based on their own experience and knowledge. The data Analysis is done with the help of AHP & TOPSIS concept over the qualitative data that is converted to a quantitative form. The data collected from experts were analyzed using Microsoft Excel sheet. Final data obtained after analysis will help to prepare a risk factors and prioritization of various risk factors affecting the redevelopment projects.

1) Data analysis by **AHP** Method: In AHP Method the prioritization is done by finding the local and global weight of criteria and sub criteria.

Local Weight: It represents the relative weights of the nodes within a group of siblings with respect to their parent node.

Global Weight: It is obtained by the multiplying the local weights of the siblings by their parent's global weight. The sum of all criteria's Global weight must be equal to 1.

For example: If criteria and sub criteria's local weights are known.

For sub criteria: Corruption in Management Committee

Global Weight = Risk due to Society Management Committee * Corruption in Management Committee

= 1 * 0.106 = 0.106

For sub criteria: Members may be Interested for Gaining More Money

Global Weight = Risk due to Society Management Committee * Corruption in Management Committee

= 1 * 0.227 = 0.227

For sub criteria: Non Resident Owner Demand High Price on Property

Global Weight = Risk due to Society Management Committee * Non Resident Owner Demand High Price on Property

= 1 * 0.053 = 0.053

For sub criteria: Old Documents cannot be Traceable

Global Weight = Risk due to Society Management Committee * Old Documents cannot be Traceable

= 1 * 0.094 = 0.094

And so on,

Table 3 shows the Local weight and Global Weight of the above example

Table 3: Local weight and Global Weight of the criteria

Criteria	Local weight	Sub Criteria	Local Weight	Global Weight
Risk due to society management committee	1	Corruption in management committee	0.106	0.106
		Members may be interested for gaining more money	0.227	0.227
		Non resident owner demand high price on property	0.053	0.053
		Old documents can not be traceable	0.094	0.094
		Delay in possession from occupants	0.162	0.162
		Change in society members expectations	0.244	0.244
		Choice of units	0.115	0.115
Total				**1**

Global Weights of the criteria for each respondent was calculated by Eigenvector method of AHP. Aggregation of all global weights was done by Arithmetic Mean Method (AMM).

Final global weights of each Risk categories and factors are calculated and the analysis is done on both stakeholder is given in following Table 4 and 5.

Table 4: Overall Local Weight and Global Weight on Developer side

Sr. No.	Criteria	Local Weight	Sub Criteria	Local Weight	Global Weight	Rank
1	Risk due to society management committee	0.256	Corruption in management committee	0.106	0.027	19
		0.256	Members may be interested for gaining more money	0.227	0.058	6
		0.256	Non resident owner demand high price on property	0.053	0.014	25
		0.256	Old documents can not be traceable	0.094	0.024	20
		0.256	Delay in possession from occupants	0.162	0.041	11
		0.256	**Change in society members expectations**	0.244	0.062	**4**
		0.256	Choice of units	0.115	0.029	17
2	Planning risk	0.283	Non salability of newly generated house	0.136	0.038	13
		0.283	Select wrong type of development	0.181	0.051	7
		0.283	Changes in project cost	0.110	0.031	16
		0.283	**Rules changed by regulatory authority**	0.264	0.075	**1**
		0.283	**Delay in approvals form authorities**	0.211	0.060	**5**
		0.283	Escalation in rent	0.101	0.029	18
3	Construction risk	0.182	Non availability of labour, material & machinery	0.217	0.039	12
		0.182	Construction cost overruns	0.230	0.042	10
		0.182	**Delay in completion time**	0.347	0.063	**3**
		0.182	Quality risk	0.104	0.019	23
		0.182	Damage to surrounding properties	0.103	0.019	24
4	Legal & Political risk	0.172	Corruption in government agency	0.278	0.048	8
		0.172	Violation of byelaws & acts	0.111	0.019	22
		0.172	Land title related issue	0.198	0.034	15
		0.172	**Loan related NOC's issue**	0.413	0.071	**2**
5	Other risk	0.101	Recession in real estate	0.349	0.035	14
		0.101	Cast related issue	0.461	0.047	9
		0.101	Damaged to surrounding	0.190	0.019	21

Table 5: Overall Local Weight and Global Weight on Society Member side

Sr. No.	Criteria	Local Weight	Sub Criteria	Local Weight	Global Weight	Rank
1	Management Risk	0.137	Improper tendering process	0.057	0.008	24
		0.137	Lack of unity among members	0.139	0.019	20

		0.137	Absenceness of member when required	0.088	0.012	23
		0.137	Members not aware of their right	0.145	0.020	19
		0.137	Member do not appoint legal experts to analyze the contract	0.213	0.029	13
		0.137	**Corrupt management committee**	0.353	0.048	**4**
2	Planning Risk	0.232	Developer give small area than promised	0.155	0.036	9
		0.232	Risk of improper valuation	0.147	0.034	11
		0.232	Incompetence of PMC hired	0.190	0.044	7
		0.232	**Builder not transparent, reliable & trustworthy**	0.431	0.100	**1**
		0.232	Increase in maintenance	0.079	0.018	21
3	Construction Risk	0.178	Delay in project	0.154	0.028	14
		0.178	**Rent is not paid according to schedule**	0.268	0.048	**5**
		0.178	**Below quality construction**	0.323	0.057	**2**
		0.178	Change the design without concern of member	0.121	0.022	17
		0.178	Rent changed which is pre-decided	0.126	0.022	16
4	Legal & Political Risk	0.141	Illegal construction done by builder	0.149	0.021	18
		0.141	Dispute between developers & society	0.304	0.043	8
		0.141	**All legal formalities not observed by society**	0.372	0.052	**3**
		0.141	One flat sold twice to different party	0.175	0.025	15
5	Other Risk	0.129	Dispute between partners of developer	0.264	0.034	12
		0.129	Lack of organization & coordination	0.114	0.015	22
		0.129	Improper construction working method	0.277	0.036	10
		0.129	Builder stuck by financial crises & stop work	0.344	0.044	6

2) Data analysis by **TOPSIS** Method: In TOPSIS Method the prioritization is done by finding Relative Closeness (Ci) of criteria and sub criteria.
Final Relative Closeness (Ci) of each Risk categories and factors are calculated and the analysis is done on both stakeholder is given in following Table 6 and 7.

Table 6: Overall Ranking and Relative Closeness (Ci) of Developer's Respondents

Rank	Relative Closeness (Ci*)	Respondents	Rank	Relative Closeness (Ci*)	Respondents
1	0.649430	R20	11	0.382013	R17
2	0.456622	R5	12	0.372721	R11
3	0.426299	R4	13	0.369707	R1
4	0.424479	R20	14	0.354714	R19
5	0.418636	R18	15	0.340982	R13
6	0.418152	R3	16	0.327603	R8

7	0.410212	R15	17	0.326821	R9
8	0.399814	R10	18	0.299593	R12
9	0.386634	R7	19	0.240560	R6
10	0.385530	R16	20	0.239996	R14

Table 7: Overall Ranking and Relative Closeness (Ci) of Developer's Respondents

Rank	Relative Closeness (Ci*)	Respondents	Rank	Relative Closeness (Ci*)	Respondents
1	0.696068	R21	23	0.477870	R2
2	0.686278	R40	24	0.476279	R29
3	0.650338	R39	25	0.470911	R12
4	0.635278	R20	26	0.461588	R10
5	0.633441	R19	27	0.460298	R31
6	0.607616	R16	28	0.457489	R30
7	0.606535	R35	29	0.456447	R15
8	0.584307	R7	30	0.443351	R24
9	0.580295	R1	31	0.442647	R44
10	0.562913	R37	32	0.439528	R11
11	0.559138	R18	33	0.432255	R8
12	0.554675	R26	34	0.428068	R13
13	0.540993	R4	35	0.414195	R25
14	0.516614	R41	36	0.413937	R34
15	0.515929	R17	37	0.410611	R38
16	0.512949	R28	38	0.397041	R36
17	0.497208	R33	39	0.380636	R3
18	0.493897	R6	40	0.369565	R43
19	0.493740	R27	41	0.355276	R32
20	0.491715	R23	42	0.302064	R5
21	0.482017	R22	43	0.296638	R14
22	0.478550	R42	44	0.239661	R9

IV. ACCORDING TO AHP METHOD

Top ten Risk which affect on redevelopment projects organized in higher to lower order impact. Table 8 shows the top ten criteria of Redevelopment projects analyzed by AHP method.

Table 8: Overall Ranking of the criteria based on AHP Method

Rank No.	On Developer side	On Society Member side
1	Rules Changed By Regulatory Authority	Builder Not Transparent, Reliable & Trustworthy
2	Loan Related NOC'S Issue	Below Quality Construction
3	Delay In Completion Time	All Legal Formalities Not Observed By Society
4	Change In Society Members Expectations	Corrupt Management Committee
5	Delay In Approvals Form Authorities	Rent Is Not Paid According To Schedule

6	Builder Stuck By Financial Crises & Stop Work	Builder Stuck By Financial Crises & Stop Work
7	Select Wrong Type Of Development	Incompetence Of PMC Hired
8	Cast Related Issue	Dispute Between Developers & Society
9	Construction Cost Overruns	Developer Give Small Area Than Promised
10	Delay In Possession From Occupants	Improper Construction Working Method

V. ACCORDING TO TOPSIS METHOD

Top ten risk which affect on redevelopment projects organized in higher to lower order impact. Table 9 shows the top ten criteria of Redevelopment projects analyzed by TOPSIS method.

Table 9: Overall Ranking of the criteria based on TOPSIS Method

Rank No.	On Developer side	On Society Member side
1	Members may be interested for gaining more money	Builder not transparent, reliable & trustworthy
2	Members do not appoint legal experts to analyse the contract	Members do not appoint legal experts to analyze the contract
3	Changes in project cost	Builder Stuck By Financial Crises & Stop Work
4	Construction cost overruns	Lack of unity among members
5	Non saleability of newly generated house	Below quality construction
6	Cast related risk	Members not Aware of their right
7	Recession in real estate	Incompetence of PMC hired
8	Delay in approvals from authorities	Corrupt management committee
9	Rules changed by regulatory authority	All legal formalities not observed by society
10	Change in society members expectation	Dispute between developer & society

VI. CONCLUSION

Based on the results of this study some conclusions are to be found as discussed below,

- The redevelopment projects are quite complex and due to that different risk are associated with the projects. The different risks are planning risk, Management risk, Execution risk, Legal and political risk etc.
- According to **AHP analysis**, Top Three Risks which affect the Redevelopment projects are:
  a) On Developer side:
     1) Rules Changed By Regulatory Authority
     2) Loan Related NOC'S Issue
     3) Delay In Completion Time
  b) On Society Member side:
     1) Builder Not Transparent, Reliable & Trustworthy
     2) Below Quality Construction
     3) All Legal Formalities Not Observed By Society
- According to **TOPSIS analysis**, Top Three Risks which affect the Redevelopment projects are:
  a) On Developer side:
     1) Members may be interested for gaining more money
     2) Members do not appoint legal experts to analyse the contract
     3) Changes in project cost
  b) On Society Member side:
     1) Builder not transparent, reliable & trustworthy
     2) Members do not appoint legal experts to analyze the contract
     3) Changes in project cost
- For successful completion of the Redevelopment projects both stakeholder need to understand this risks and take suitable mitigate measures to overcome the risks and make project successful.

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