Identification, evaluation, and allotment of critical risk factors (CRFs) in real estate projects: India as a case study

MohammedShakil S. Malek[a*], Saiyed Farhana Mohibali[b] and Dhiraj Bachwani[c]

[a]F.D. (Mubin) Institute of Engineering and Technology, Bahiyal, Gandhinagar, Gujarat, India
[b]Assistant Engineer, Narmada and Water Resources, Water Supply and Kalpsar Department, SSNNL, Government of Gujarat, Chief Engineer's office, Mehsana India
[c]Assistant Professor, Civil Engineering Department, School of Technology, Indus University, Ahmedabad, India

C H R O N I C L E	A B S T R A C T
	The boom of real estate has been a motivating force for economic growth in India for the past few years. However, the Real Estate (RE) market of India is still in the embryonic phase and juvenile. In the context of the real estate projects, it is a general situation observed that such projects cannot meet the target as the Indian real estate companies are deficient in scientific management technology to confront the risks. The research paper aims to focus mainly on constraints and demurral of Risk Management (RM) in RE firms of India to investigate findings for the same in the Indian Real estate market and further focusing on RE projects of Ahmedabad. The paper is mostly founded on an overview of individuals who are straightforwardly or firmly identified with the administration and the RE business in India. The question-naire survey shall be targeted over the five prime territories of Ahmedabad. This research further high-lights to concerned identified primary critical risk factors (by Criticality Index Method) influencing the residential real estate market and then developing a framework for assessing the factors carrying out the quantitative analysis using various analytical methods of SPSS software, Factor analysis, ANOVA and Post-Hoc Test. The validation of the results has been done through a survey of experienced experts. The critical risks identified based on the questionnaire survey are modeled through the decision tree diagram.

1. Introduction

The Indian Real Estate (RE) sector has remained more prominent with the liberalization of the economy and this is because of the subsequent improvement in labor migration and business opportunities there has been an enlargement of demands for commercial and housing estates. The boom in the RE shows a vital part in the overall growth of Indian infrastructure. (Far-hana, 2015, 2017). Today, the Real Estate mirrors the customers' desires for prevalent quality with India's expanding amal-gamation with the worldwide economy. The fast-growing economy of India has focused on the significance and requirement of considering the performance of risk management. Property investment is viewed as perhaps the sharpest change as odds of misfortune are modestly unimportant. Real Estate is additionally referred to as the income creating part. The RE Sector is the highest advantageous modern part in the nation using the business openings in development or the commitment in the context of the Gross Domestic Product (GDP). Advancing towards becoming a global potential for investment India has become a goldmine for investors all over the world. Investors all over the world choose India because of its booming economy and liberalized government policies. What's more, in this manner India has become a business center driven by positive develop-ment in the Real Estate. Likewise, the Government of India's choice to allow100% outside direct venture (FDI) under the 'programmed course' in the development and advancement there has been a critical ascent in the quantity of Indian just as remote financial specialists in the reality part (Knight Frank India research, India real estate residential and office, 2015).

After the US and China, India stood at the third post in the worldwide economy. The examination gives an all-encompassing perspective on the dangers that have infiltrated in Real Estate and explores the key drivers that have led to the moderate pace of the Real Estate market.

The significance of focusing on the behavior of RM is because of the accelerated rising economy of India. This exploration features a structure of risks that have burgeoned beside the RE speculation procedure and spotlight on the Indian qualities. The objective of this research is to explore the slow pace of real estate market about the attitude of Ahmedabad people enabling the development of an equitable risk allocation framework in Ahmedabad real estate projects from the identified critical risks and to identify the projected results to enhance the forthcoming growth of RM in Ahmedabad. The research work concentrates only on the residential real estate sector and the work is concentrated in Ahmedabad city of Gujarat state which gives a picture of the Indian real estate market.

2. Literature Review

Risks and vulnerabilities happen in all RE projects extending mostly in the muddled land venture. Risks looked by the real estate projects impact each undertaking stage from the reasonable stage, venture practicality examination, structure and arranging, development and execution, and handover stage. The hazard the board forms are commonly a progressing and iterative procedure, even every land venture is extraordinary and one of a kind. The run of the mill approach of land hazard the executives will comprise of three essential advances i.e., Risk recognition and incentive evaluation; Reaction and Alleviation and more exploration towards risk. Various literatures highlight the risk factors which are further utilized for analysis i.e. High leverage risk, decentralized products/market, market downturn, interest risk, prolonged contractors strike, competition risk, site characteristics, political risks, environmental risks (Apgar, 1976), Geological conditions (Clauretie, 1988), Geographical Location risk, property type risks (Hartzell et al., 1994), property type risks, type of REIT (Cannon & Vogt, 1995), Market risks (Chen & Hobbs, 2003), Information and communication risk (Dixon, 2005), Portfolio risk, tenant concentration, asset concentration, location concentration (Blundell et al., 2005), Cash flow risk (Hoesli, 2006), Demographic risk, efficiency risk of client, urban planning risk, cultural compatibility risk, accessibility and evacuation risk (Kryvobokov, 2006), Financial risk, contractual risk, local taxes risk, cash flow risk, interest risk, delay in payments, total value of the project, immoral developers, reputation, financing strength of developers, bargaining power of the developer, laws and regulation, inexperienced developer (Ke, 2007), Fluctuation in foreign exchange, inflation risk, interest risk, defaults by contractors, labor and market price fluctuation (Ling & Lim, 2007), Insurance risk (Lin et al., 2007), Market competition, land price, material price, construction technique, social purchasing power (Jiang et al., 2007), Incomplete design risk, Inappropriateness of specification, Uncertainty of Material unavailability, Ineffective Design updating, Checklist & methodology problems, Information and communication risks, Accidents, Site condition inappropriateness risk, Faulty construction and designs, Several functionalities, Time, Rate of interest, Property type, Market liquidity, Currency conversion, Supply and demand, Debt risk (Shah, 2014; Fei & Li, 2014; Jagdishbhai. 2015), Liquidity risk (Kaiser & Clayton, 2008), Portfolio risk (Shiwang et al., 2009), Customer relationship management (Yang, 2010), Information (Bulloch & Sullivan, 2010), Change in zone risk, change in accounting codes, customer relation (Bansal, 2011).

3. Research Methodology

The research methodology concentrates on these aspects of risk management i.e., Identification of Critical Risks, Risk Assessment and Allocation, Statistical Analysis, Development of Risk Assessment Framework. The research process adopted in this research work is shown in Fig. 1. It also shows the data analysis carried out to obtain the research objectives.
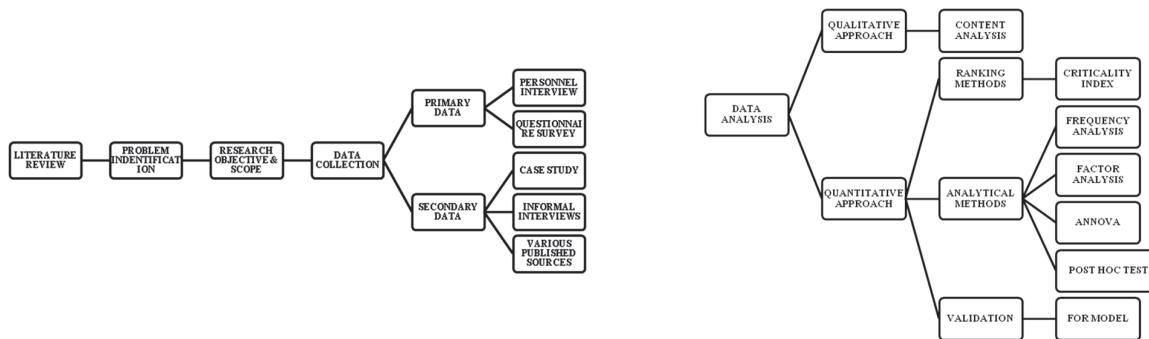
Fig. 1. Research process

4. Questionnaire Design and Critical risk Identification

The questionnaire was intended from the research methods to be used after the thorough investigation of the literature and recognizing various factors influencing risk in the RE. In the first stage survey, about 91 risk factors influencing the real estate residential sector were obtained but based on discussion with direct and indirect experts of the real estate sector few factors

were eliminated and a final questionnaire was prepared which contains 72 risk factors. The respondents had to simply share their perception regarding that factor based on their understanding, knowledge, and experience by choosing only one choice on a five-point Likert scale. As indicated by the example assortment figuring the absolute number of accessible populace contains 659 developing/constructing firms (Farhana, 2017). The information was gathered from the AUDA (Ahmedabad Urban Development Authority) and arrangements of enrolled development organizations of different divisions of development in Ahmedabad. Thus,

$$n = \frac{659 \times 1.96^2(0.60 \times 0.40)}{659 \times 0.1^2 + 1.96^2(0.60 \times 0.40)} = 81$$

From the above computation, it is deciphered that base 81 respondents ought to reach for the examination study. Out of the 120 surveys sent, 87 reactions were received. The reactions were gotten after close to home demands and visits to their separate workplaces. 87 reactions gathered i.e., 72.5% reaction rate which is viewed as generally excellent for this sort of study (Farhana, 2017). The quantity of the reactions acquired from singular partners' experiences savvy appears in Table 1.

Table 1
Respondents Experience Details

Numbers of respondents	Experience in Years	Category of respondents						Total	Percentage
		ER	DP	VR	AR	TP	AC		
	<5 years	5	4	1	6	0	2	18	20.68%
	5-10 years	10	3	0	2	1	3	19	21.83%
	10-15 years	4	6	2	3	3	0	18	20.68%
	15-20 years	3	3	3	1	0	0	10	11.49%
	>20 years	6	4	4	4	3	1	22	25.28%
	Total	28	20	10	16	7	6	87	
	Percentage	32.18%	22.99%	11.49%	18.39%	8.05%	6.90%	100%	100%

ER - Engineers; DP - Developers; VR - Valuers; AR - Architects; TP - Town Planners; AC - Academicians

(Source: Compiled by authors)

The respondents were asked to give weightage to all risk factors scaling from 'not critical' to 'very critical'. The criticality indexed is calculated based on the equation given below:

$$\text{Criticality Index (CI)} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + n_1}{5(n_5 + n_4 + n_3 + n_2 + n_1)} \quad \quad (1)$$

where, n_5, n_4, n_3, n_2, and n_1 represent no. of persons who responded most important to not important in decreasing manner respectively. The considered values of CI are ≤ 0.50 as not critical, >0.5 to ≤ 0.7 as critical, >0.7 to ≤ 0.9 as very critical, and >0.9 as most critical. Based on the risk criticality analysis, 15 risk factors were identified as "very critical" in Ahmedabad real estate projects. In the decreasing order of the criticality they are: incomplete design (0.7767) , faulty designers and construction(0.7632), cost overrun(0.7103), duration(0.6989), market down turn (0.6989), workforce availability(0.6874) , demand and supply(0.6828), interest rate(0.675), delay in payment(0.675), urban planning(0.673), transparency(0.666), inflation risk(0.6621), customer relationship management(0.6598), cash flow risk(0.6598) and laws and regulations(0.6506). (*The numbers in the brackets shows the criticality index.)

5. Analysis of Variance (ANOVA)

To identify any significant difference among the perception of all stakeholders, a one-way ANOVA F test was conducted for each risk as all factors were either very critical or critical. The hypothesis to be tested is:

The null hypothesis H_0: There is no substantial variance in the perception of various stakeholders.

The alternate hypothesis H_1: There is substantial variance in the perception of various stakeholders.

ANOVA F-test determines whether significant differences exist among different categories of the respondents. For cases where the significant difference exists i.e. null hypothesis is rejected, The Post-Hoc (Tukey HSD) test was performed. Thus, Post-Hoc test was used to find among which stakeholders the different perception exists. From Table 2, it is observed that 7 factors out of 15 were not perceived differently by the six stakeholders. Those 7 factors are Incomplete design, Inappropriateness of specification, Ineffective design updating, Checklist & methodology risks, Faulty designers and construction, Accessibility and evacuation, Inexperienced developers. For those factors for which a significant difference was observed Post-Hoc test was performed to find the substantial differences among the respondents. The details of the Post-Hoc test for the remaining 8 technical risk factors are shown in Table 3.

Table 2
ANOVA Analysis

Factors	F	Sig.	Result	Hypothesis
Incomplete design	1.768	0.129	Non Significant	Not rejected
Inappropriateness of specification	1.6	0.169	Non Significant	Not rejected
Uncertainty of material unavailability	3.057	0.014	Significant	Rejected
Ineffective design updating	0.427	0.828	Non Significant	Not rejected
Checklist & methodology risks	1.894	0.104	Non Significant	Not rejected
Information and communication	4.717	0.001	Significant	Rejected
Accidents risks	8.168	0	Significant	Rejected
Site condition inappropriateness	9.059	0	Significant	Rejected
Faulty designers and construction	1.877	0.107	Non Significant	Not rejected
Duration	3.115	0.013	Significant	Rejected
Accessibility and evacuation	0.83	0.532	Non Significant	Not rejected
Completion risk	3.233	0.01	Significant	Rejected
Prolonged contractor strikes	3.557	0.006	Significant	Rejected
Inexperienced developers	1.328	0.261	Non Significant	Not rejected
Obsolescence risk	3.797	0.004	Significant	Rejected

*ANOVA is significant at 0.05 level

Table 3
Post-Hoc (Tukey HSD) Analysis

Factor	(I)TYPE	(J) TYPE	Mean Difference (I-J)	Sig.
Uncertainty of material unavailability	VR	TP	1.95714*	0.01
Information and communication	VR	ER	1.49286*	0
		AR	1.35000*	0.01
		TP	1.81429*	0
Accidents risks	DR	ER	1.43571*	0
		AR	1.71250*	0
	VR	ER	1.48571*	0
		AR	1.76250*	0
	TP	AR	1.41964*	0.05
Site condition inappropriateness	ER	TP	1.53571*	0
	DR	ER	.77857*	0.05
		AR	1.10000*	0.01
		TP	2.31429*	0
	VR	AR	1.20000*	0.02
		TP	2.41429*	0
	AR	TP	1.21429*	0.05
	AC	TP	1.71429*	0.01
Duration	DR	AR	1.13750*	0.05
	VR	AR	1.63750*	0.01
Completion risk	VR	ER	1.22857*	0.02
	AR	ER	.92857*	0.05
Prolonged contractor strikes	VR	TP	1.85714*	0
Obsolescence risk	DR	AR	1.01250*	0.02
	VR	AR	1.36250*	0.01

ER - Engineers; DP - Developers; VR - Valuers; AR - Architects; TP - Town Planners; AC - Academicians

From Table 3 it can be stated that there is a difference in the perception of valuer and town planner for the risk factor uncertainty of material unavailability. Similarly, for information and communication, the perceptions differ i.e. there is a substantial variance in the opinion of the Engineer and Valuer, Valuer and Architect, and Architect and Town Planner. Similarly, the ANOVA and Post-Hoc tests were carried out for all factors.

6. Factor Analysis (FA)

FA is a method to group the risk factors in similar groups having the same pattern that may exist among the variables due to the difference in perceptions of the respondents.

This method is used to recognize a relatively small number of factor groupings. Initially, the Kaiser-Meyer-Olkin test KMO and Bartlett test was carried out to test the sample adequacy. The Bartlett's sphericity test and the KMO index enable to spot the analysis for further summarizing the information into parts provided by the initial variables in a few numbers of factors (Kothari, 2004). Using principal component analysis and varimax rotation, the data reduction was carried out. Factor loading shows the relationship between original variables and factors. The main application of the factor analysis in this research work is to reduce the number of factors and to classify the risk factors in groups having a similar pattern (Bachwani & Malek, 2018). Before conducting the factor analysis, it is necessary to perform the KMO and Bartlett test. So KMO and Bartlett test was performed initially in the SPSS software. The sample adequacy for performing factor analysis for all risk factors is shown in Table 4.

Table 4
KMO and Bartlett's Test Analysis

Factors	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity		
		Approx. Chi-Square	Df	Sig.
Technical Risk Factors	0.747	440.403	105	0.000
Social Risk Factors	0.738	294.702	28	0.000
Economic Risk Factors	0.759	634.615	105	0.000
Legal Risk Factors	0.822	428.611	36	0.000
Financial Risk Factors	0.778	220.845	28	0.000
Strategic Risk Factors	0.828	432.935	45	0.000
Marketing Risk Factors	0.816	128.059	10	0.000

For the KMO test to be satisfactory for factor analysis the value of sampling adequacy should be more than 0.5. Here, all the values are more than 0.5 indicates the adequacy is significant.

Bartlett's test is performed to check the relationship among variables. From Table 4 one can observe that Bartlett's test of sphericity is significant for all risk factors as its related probability is 0.000 which is less than 0.05. This means that the correlation matrix is not an identity matrix. Little entities (under 0.05) of the importance level demonstrate that a factor examination might be helpful with the current information. The test also gives a table of the Eigenvalues of each factor but it is not clear sometimes to group the factors in different categories and hence scree plots have been used for the classification and factor reduction. The scree diagrams for all factors are mentioned in Fig. 2. Fig. 2 represents the elbow shape for all the risk factors. And it is very much clear that the factors can be divided into two parts for all risk factors. Table 5 shows the rotated component matrix with the factor loadings for each factor. Factor coefficients <0.3 are ignored.
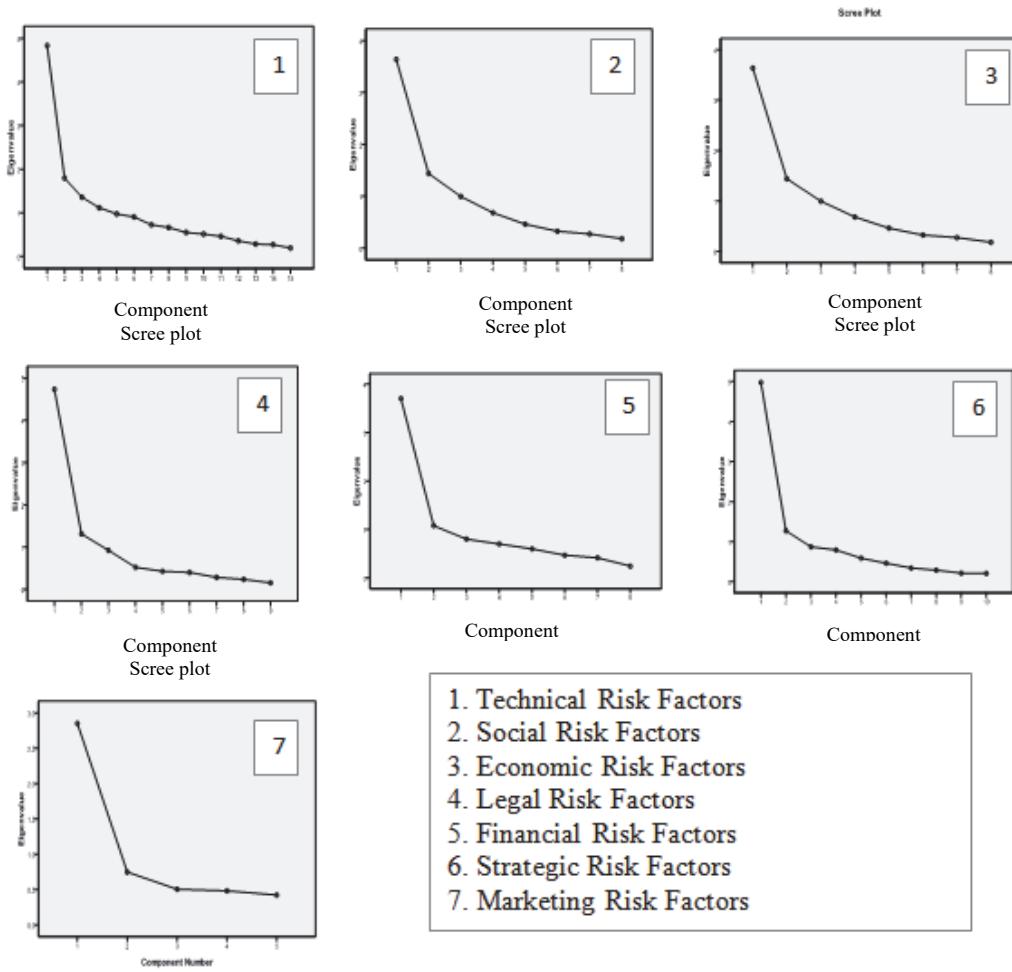

Fig. 2. Scree Diagrams for all Risk factors

From Table 5, it can be seen that incomplete design and checklist and methodology risk have factor loading 0.563 and 0.561 respectively and hence this can be combined with a single risk factor i.e. design and methodology risks. Similarly, the inappropriateness of specification and faulty designers and construction can be combined with single factor i.e., tactless efforts by

the employees. As mentioned in Fig. 2, two categories are obtained i.e., time and cost affecting risk and quality risks. Risk factors with factor loadings varying from 0.510 to .782 are in cost and time affecting risk group and factor. Cost and time saving comprises four factors with factor loadings varying from 0.450 to 0.727 and quality risk comprises factors with factor loadings from 0.45 to 0.708. Regional planning and urban planning have factor loading near to each other i.e., 0.873 and 0.863 respectively and hence they can be grouped into one risk factor i.e., smart city planning. The two categories can be classified as smart city planning factors and quality risk factors.

Table 5
Varimax Rotated Factor Loadings with Rotated Component Matrix

		Component 1	Component 2
Technical Risk Factors	Site condition inappropriateness	0.782	
	Information and communication	0.712	
	Prolonged contractor strikes	0.657	
	Obsolescence risk	0.646	
	Uncertainty of material unavailability	0.601	
	Completion risk	0.564	
	Duration	0.516	
	Accidents risks	0.51	
	Inappropriateness of specification		0.708
	Faulty designers and construction		0.703
	Ineffective design updating		0.68
	Inexperienced developers		0.601
	Incomplete design		0.563
	Checklist & methodology risks		0.561
	Accessibility and evacuation		0.45
Social Risk Factors	Regional planning	0.873	
	Urban planning	0.863	
	Public intervention	0.739	
	Workforce availability	0.611	
	Customer relationship management risk	0.442	
	Social security		0.851
	Community acceptance		0.782
	Immoral developers		0.781
Economic Risk Factors	Demand and supply	0.796	
	Resettlement & rehabilitation risk	0.73	
	Market liquidity	0.72	
	Debt risk	0.628	
	Delay in land acquisition risk	0.602	
	Property type	0.545	
	Lifecycle value	0.516	
	Buyers/tenants	0.442	
	Pre-investment risk	0.439	
	Insurance risk		0.826
	Capital exposure		0.816
	Interest rate		0.803
	Investment risk		0.729
	Cost overrun		0.624
	Brand visibility		0.401
Legal Risk Factors	Change in building bye-laws	0.864	
	Change in taxation code	0.813	
	Change in accounting rules	0.761	
	Change in zone risk	0.732	
	Laws and regulations	0.713	
	Political risks		0.868
	Partnership risks		0.827
	Regulatory risk		0.684
	Permit and approval risk		0.529
Financial Risk Factors	Delay in a financial enclosure	0.811	
	Local taxes	0.772	
	Inflation risk	0.755	
	Bargaining power of the developer	0.593	
	Delay of payment	0.518	
	Lease length		0.832
	In availability &fluctuation in foreign exchange		0.825
	Financial strength		0.509
Strategic Risk Factors	Information system for decision making	0.832	
	Development exposure	0.774	
	Records	0.74	
	Professionalism	0.739	
	Transparency	0.665	
	Innovation	0.596	
	Reputation risk		0.798
	Competitions risk		0.788
	Administrative / governance risk		0.76
	Survival in market		0.704
Marketing Risk Factors	Efficiency risk of the client	0.835	
	Distribution risk	0.804	
	Cash flow risk	0.657	
	Market downturn		0.868
	Labor /market price fluctuation		0.808

Similarly, Factor analysis was carried out for Economic Risk Factors, Legal Risk Factors, Financial Risk Factors, Strategic Risk Factors, and Marketing Risk Factors as mentioned in Table 5.

7. Reliability of Risk Factors

Cronbach Alpha is a dependability test directed inside SPSS to check the inner consistency for example unwavering quality of the Risk Factors. It is most normally utilized when the survey is created utilizing different Likert scale proclamations and thus to decide whether the scale is dependable or not.

In the analysis of this research work total, 72 risk factors are considered and the value for Cronbach alpha is 0.968 which indicates a very high reliability of the data collected. Also, it reflects a very high level of internal consistency in the context of the specific sample.

8. Decision Tree Model

For modeling and assessing the proposed solutions, formation, and the explanation of the framework of risk management through the model is the one objective of this research work. This paper gives a generic model based on simple logic by presenting a decision tree model as an analytical and graphical framework. For multiple variable analyses, decision trees are a simple and powerful form. It is easy to execute and makes an easy-to-understand graphical representation of the causes, categories of causes, and the need.

To get the percentage contribution of each risk factor in the risk occurrence the data can be converted in a single value. For all variable factors, the response was collected according to a Likert scale of 1 to 5, so each response has a contribution of 20. So finally, the percentage contribution of mean is converted in constants according to the Likert scale. The risk factors are distinguished and the next phases which are most vital for modeling are placed and the decision tree is completed in all three levels as shown in Figure 3.

8.1 Validation of the Model

Six most interested and rich qualified respondents one from each stakeholder was selected for the validation process. The experts rated three characteristics of the framework as indicated by Likert's 1 to 5 scales. Rating over 3 denotes adequate enactment for that aspect. The outcomes indicated that all aspects were praised over 3. The utmost appraised aspect was overall suitability at 4.6 scores and that appraised the lowermost by stakeholders was the overall reliability at 4.3 scores. Hence it can be concluded that the derived decision tree model was validated to be appropriate, practical, reliable, and suitable for risk management in Real Estate projects for Ahmedabad. Table 6 shows the outcomes of the validation of the Decision Tree Model.

Table 6
Outcomes of Validation of the Decision Tree Model

Validation Aspect	Respondents						Mean
	1(E)	2(D)	3(AR)	4(V)	5(TP)	6(P)	
Degree Of Practicality	4	5	5	4	4	5	4.5
Overall Reliability	5	4	4	5	4	4	4.3
Overall Suitability	5	5	5	5	4	4	4.6

9. Conclusion

9.1 Conclusions drawn out from the study for identification of critical risk factors

1. Risk management doesn't dispose of the dangers associated with real estate completely. It is a way to deal with oversee diverse hazard classifications and risk factors in a city like Ahmedabad which in the blink of an eye will be a metro city
2. The Indian RE has been getting increasingly composed, this is a direct result of the section of universal land players, remote financial specialists, and Indian corporate houses.
3. 15 risk factors were identified as "very critical" in Ahmedabad's real estate projects. In the decreasing order of the criticality, they are: incomplete design, faulty designs and construction, cost overrun, duration, a market downturn, workforce availability, demand and supply, interest rate, delay in payment, urban planning, transparency, inflation risk, customer relationship management, cash flow risk, and laws and regulations.

9.2 Conclusion drawn out from the perception analysis of the factors

1. Based on questionnaire results it is observed that people's attitude towards risk management is still conservative. Perceptions of different stakeholders vary with each other. There is a serious extent of contradiction on chance criticality

rating among different respondents for a large portion of the dangers and hazard factors in the Real Estate. The similarity of opinions among the stakeholders considered in the study exists only in the case of legal risks and marketing risks.

2. Eight main risk factors can be separated into diverse groupings based on the perceptions going through a similar pattern. The factor analysis results show that the technical factors can be separated into two categories i.e. cost and time affecting risk and quality risk.

3. Economic risk factors are classified into two main risk factors i.e. benefits to local development risk and interest risk. Social risk is classified into two risks as smart city planning risk and quality risk. Legal risk factors are divided into policy environmental risk and administrative risk. Financial risk factors are divided into organizational risk and period-ical risks. Strategic risk factors are divided into management and operational risks. Marketing risks are classified into financing risk and uncertainty in market conditions risks.

9.3 Highlights from the model

1. Model through the decision tree model with simple logic has been developed which gives a graphical representation of the risk factors in the real estate risk management.
2. The idea of the decision tree model suits Real Estate conditions where the impacts of lower-level hazard factors on the acknowledgment of upper-level hazard factors/occasions are probably going to change with other outer components.
3. The percentage contribution of each risk factor has been determined using the mean distributions of third level events and their varying influences on the upper-level events. The model has been validated by experienced experts and has been found reliable, practical, and suitable.
4. Among the main categories of risks in real estate, the technical risk factors influence the risk management activities by the highest contribution i.e., 20.158%. The risk categories as per the decreasing order are arranged as technical risks, economic risk, legal risk, strategic risk, financial risks, social risks, marketing risks, and natural risks.

10. Recommendations and Future Scope of Work

It is recommended that companies that are associated with real estate business must create or rearrange the framework for a systematic risk management process. Real estate is different compared to any other industry, there are so many unique factors which makes real estate different from other industries. These factors are historical background, culture, and social system. The Indian real estate sector should focus on all these factors in the application of risk management technology. It is strongly recommended that Indian real estate companies must stop the ignorance of risk management.

For making Ahmedabad's real estate sector motivating, comparative, and committed, there should be a collaborative culture between the government, insurance companies' realty, and institutes. This will be helpful to cultivate an ideal RM in the real estate sector and solve many risk problems easily.

The work can be carried further on for other cities of India and a risk management strategy for the entire country can be assessed. The identified factors can help take as a study for various projects in India and comparative case study analysis can be made. The model can be made using a fuzzy logy or any other approach. The risk management strategy can be applied to fields other than the real estate projects.

References

Apgar, M. (1976). Managing the risks in real estate. *The Mckinsey Quarterly*, 26-40

Bachwani, D., & Malek, M. (2018). Parameters indicating: The significance of investment options in real estate sector. *International Journal of Scientific Research and Review, 7*(12), 301-311.

Bansal, D. A., Sirohi, M. R., & Jha, M. (2011). A Review on Indian Real Estate: Trends, Challenges and Prospectus. *KKIMRC IJRHRM, 1*(1), 39-54.

Blundell, G. F., Fairchild, S., & Goodchild, R. N. (2005). Managing portfolio risk in real estate. *Journal of Property Research*, *22*(2-3), 115-136.

Bulloch, B., & Sullivan, J. (2010). Information–the key to the real estate development process. *Cornell Real Estate Review, 8*(1), 78-87.

Cannon, S., & Vogt, S. (1995). REITs and their management: an analysis of organizational structure, performance and management compensation. *Journal of Real Estate Research*, *10*(3), 297-317.

Dixon, T. (2005). The impact of information and communications technology on commercial real estate in the new economy. *Journal of Property Investment & Finance, 23*(6), 480-493.

Kothari, C.R. (2004*). Research Methodology, Methods and Techniques*. 2nd ed., New Age International Publishers.

Ke, C., Wang, Z., & Cheng, G. (2007). The financing and abandonment options in Chinese real estate development projects. *Journal of Corporate Real Estate*, *19*(2).

Clauretie, T. (1988). Regional economic diversification and residential mortgage default risk. *Journal of Real Estate Research, 3*(1), 87-97.

Chen, J., & Hobbs, P. (2003). Global real estate risk index. *The journal of portfolio management, 29*(5), 66-75.

Hartzell, D., Pittman, R., & Downs, D. (1994). An updated look at the size of the US real estate market portfolio. *Journal of Real Estate Research*, *9*(2), 197-212.

Farhana, S., Pitroda, J., & Malek, S. S. (2015). Reaping the returns: Review on risk management in real estate. *International Journal of Futuristic Trends in Engineering and Technology, 3*(1).

Farhana, S. (2017). Identification of Major Risk factors in Real Estate Sector of Ahmedabad, Gujarat: Perception Analysis. *International Journal of Research Cultural Society, 1*(10), 2017.

Fei, L., & Li. L. (2014). Real estate investment project risk analysis. *Journal of Chemical and Pharmaceutical Research, 6*(5), 1789-1794.

Hoesli, M., Jani, E., & Bender, A. (2006). Monte Carlo simulations for real estate valuation. *Journal of Property Investment & Finance, 24*(2), 102-122.

Jiang, G. M., Hu, Z. P., & Jin, J. Y. (2007). Quantitative evaluation of real estate's risk based on AHP and simulation. *Systems Engineering-Theory & Practice, 27*(9), 77-81.

Kaiser, R., & Clayton, J. (2008). Assessing and managing risk in institutional real estate investing. *Journal of Real Estate Portfolio Management, 14*(4), 287-306.

Knight Frank India Research, India real estate residential and office. (2015).

Ling, F., & Lim, H. L. (2007). Foreign firms' financial and economic risk in China. *Engineering, Construction and Architectural Management. 314*(4), 346-362.

Liu, J., Li, B., Lin, B., & Nguyen, V. (2007). Key issues and challenges of risk management and insurance in China's construction industry. *Industrial Management & Data Systems*, *107*(3), 382-396.

Kryvobokov, M. (2007). What location attributes are the most important for market value?. *Property Management*, 24(3), 257-286.

Jagdishbhai, P. V. (2015). Evaluation of factors affecting risk in real estate industry by Important Index method. *Journal of Advance Research in Mechanical & Civil Engineering (ISSN: 2208-2379)*, *2*(4), 01-05.

Shah, H.C. (2014). Ranking of risk factors in real estate: AHP analysis. *Global Journal of Research Analysis, 3*(9).

Shiwang, Y., Jianping, W., & Na, G. (2009, October). Application of project portfolio management in the real estate corporations. In *2009 16th International Conference on Industrial Engineering and Engineering Management* (pp. 1225-1228). IEEE.

Yang, N. (2010, August). Research on the customer relationship management of real estate enterprise. In 2010 *IEEE 2nd Symposium on Web Society* (pp. 458-461). IEEE.

Fig. 3. Decision Tree Model