Research on the Risk Management of Real Estate Development Projects

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Keywords: Real estate project; Project risk management; Analytic hierarchy process.

Abstract. With the rapid development of China's social economy, the real estate industry has become one of the pillar industries. In this paper, the expert intuitive judgment method is used to identify the risks in real estate development projects, AHP is used to evaluate the risk factors, and the corresponding risk response strategies are formulated, and risk monitoring measures are proposed to help real estate enterprises effectively manage real estate projects.

Introduction
There are many risks in the development of real estate projects, which affect the quality of real estate projects and late sales to some extent. Therefore, it is of great significance to scientifically evaluate the impact results and occurrence probability of various risk factors, and then formulate risk response strategies to ensure the smooth progress of the project.

Literature Review
Risk identification is the basis of project risk management. Risk identification is to systematically and continuously predict and plan the risks that may affect the implementation of individual project objectives. Chen Hua (2012) divides the real estate project into five risks: environment, policy, technology, market and management. Ruan Xiangyu (2017) divided risk into systematic risk and nonsystematic risk according to whether it can be controlled by human. Hua Wei (2010) classified the real estate development projects according to their natural attributes and divided them into five categories: political risk, construction risk, financial risk, market risk and natural risk. Man Kun (2018) classifies it according to the development sequence, including investment decision-making phase, early development phase, project construction phase and sales phase.

The methods of risk assessment can be divided into qualitative analysis and quantitative analysis. Kang Yaqiong (2018), Man Kun (2018), Yu Xiaoyan, Wang Songjiang (2008) and other researchers have done the corresponding questionnaire survey. According to the experience of experts and subjective judgment and evaluation combined with risk quantitative analysis method is the most commonly used risk assessment method in the engineering field. Kang Yaqiong (2018) applied the analytic hierarchy process (AHP) to construct the risk assessment index system of real estate projects, and then used the subjective judgment method of experts to summarize the risk factors affecting the projects to form a questionnaire, and then the experts carried out weight scoring; finally, the fuzzy comprehensive evaluation method was used for comprehensive calculation and analysis to verify the feasibility of the risk assessment model.

Risk response generally includes risk retention, risk reduction, risk sharing, risk transfer and risk avoidance. Hua Wei (2010) proposed that four strategies should be taken to deal with the project: risk aversion, risk transfer, risk reduction and risk retention; Li Dacheng (2016) believed that we should pay close attention to the economic regulation and control policies, do a comprehensive market research, reduce the risk of debt financing, strengthen management and improve the professional level and comprehensive quality of managers.

Analytic hierarchy process (AHP) originated in the 1970s. It was proposed by Professor T.L. Saaty of the United States. It is a multi-objective decision-making method combining qualitative and
quantitative methods. Its core is to identify the hierarchical structure of risk in the project, and then compare the importance of risk factors in different levels by experts, so as to build a matrix model for quantitative calculation, and get the ranking of risk factors in the project according to the results of calculation, and then carry out the consistency test on this basis. If it fails to pass the one-time test, repeat the above process again, until the one-time inspection is passed, so that the managers can understand the risks in the project and their ranking.

**Risk Identification**

Risk identification is the basis of risk management. The purpose is to find out various risk factors that may affect the final deliverables in the project, so as to better serve the subsequent evaluation and control stage, so as to reduce or avoid project risks.

Based on the literature review, this paper divides the collected risk factors into investment opportunity decision-making stage, preliminary work stage, construction stage and lease and sale operation stage according to the whole life cycle of the project. 15 senior practitioners, engineering department managers and engineers who have been engaged in the construction industry for more than ten years were invited to evaluate the importance of risk factors in each stage by using the Likert scale (1-5, indicating different degrees respectively). The evaluation results are shown in Table 1.

| Name | Phase | Risk factor | Score | Description |
|------|-------|-------------|-------|-------------|
|      |       | Risk of decision errors | 4.82  | Risk of misprediction of real estate market or improper behavior. |
|      |       | Risk of location | 4.55  | Risks of choosing the wrong development location. |
|      |       | Environmental risk | 4.27  | Risks brought by cultural differences, local climate, natural environment and public security, etc. |
|      |       | Policy risk | 4.82  | Changes and modifications of various related national policies will directly affect the difficulty of the project, the confidence of investors, the layout of the enterprise and the cost of the project investment. |
|      |       | Tender risk | 4.36  | The bidding process is not standardized, the evaluation and investigation are not in place, and the design of bidding documents is not rigorous. |
|      |       | Design risk | 4.45  | Risks caused by improper selection of design basis, parameters and schemes, incomplete data or insufficient level of designers. |
|      |       | Financial risk | 4.09  | Changes in costs due to financing, bank interest rates, exchange rates, etc. |
|      |       | Policy risk | 4.55  | Risks arising from changes in national policies during the preliminary preparation process. |
|      |       | Contract risk | 4.36  | When signing the relevant contract, some terms are not clear or the project deliverables and scope are not clear. |
|      |       | Demolition risk | 4.45  | Demolition and resettlement will involve many social issues. If the two parties reach an agreement, the demolition's obstruction to the demolition will have a negative impact on the project duration and cost. |
|      |       | Enterprise internal management risk | 4.29  | Risks such as wrong instructions or improper management of the project by the internal management of the enterprise. |
|      |       | Capital risk | 4.27  | During the construction process, employees were suspended or went on strike because funds were not available in a timely manner. |
|      |       | Technical risk | 4.09  | Risks due to inadequate construction technicians or irrational design, etc. |
### Risk Analysis

#### Sales and Operation Phase

| Risk Type | Score | Description |
|-----------|-------|-------------|
| Risk of construction delay | 4.27  | In the process of construction, the project duration is delayed due to project change, poor supervision, etc. |
| Cost risk | 4.55  | Cost risk Risks such as cost overruns caused by project changes during construction. |
| Quality risk | 4.64  | Due to the delay of the project or insufficient costs, the quality of real estate caused by rush work or cost savings. |
| Security Risk | 4.82  | During the implementation of the project, human casualties, equipment damage, property damage, and the working environment were damaged, etc. |
| Policy risk | 4.45  | Risks caused by changes in national policies, such as purchase restrictions. |
| Sustainable property management risks | 4.45  | Whether there is ongoing property management to provide services to owners will also affect consumer choices. |
| Sales risk | 4.45  | During the sales process, sales risks caused by insufficient sales staff capabilities, irrational pricing, or changes in national policies, etc. |
| Delivery risk | 4.36  | Due to delay in construction period or other reasons, the house cannot be delivered on time on the delivery day. |
| Demand risk | 4.36  | As the real estate construction period is usually relatively long, changes in consumer preferences and changes in the local economy will affect changes in market demand. |
| Complaint risk | 4.23  | Consumer dissatisfaction caused by problems such as housing quality or irrational design |

### Risk Assessment

In this study, AHP is used to evaluate the risk factors in the process of real estate project development. In December 2019, experts are invited again to evaluate the relative importance of the risk factors in each phase after comparing them. Data statistics results are shown in Table 2.

### Risk Response

#### Investment Decision-making Phase

Decision making risk is not only the most important risk factor in this phase, but also the most important risk factor in the whole project. Therefore, when making decisions, real estate enterprises need to be extra cautious and cannot make decisions based on experience and subjective judgment. If the project is carried out rashly, it is easy to cause losses and negative effects. First of all, it is necessary to use scientific methods to analyze the market and make systematic prediction and evaluation of the project by comparing multiple schemes, and to carry out investment opportunity research and preliminary feasibility research, which can avoid or reduce decision-making mistakes. Secondly, invite experts or practitioners who have successfully operated similar projects to join in the evaluation, analysis and decision-making of the project. Enterprises should also take the method of risk transfer to insurance companies to reduce the risk of loss. Finally, if necessary, risk avoidance should be adopted to eliminate the risk, such as not participating in the project enterprises with high risk and beyond the enterprise's development ability.
Table 2. Ranking of Risk Scores of Real Estate Projects.

| Index system               | Primary indicator | First-level indicator Bi weight | Secondary indicator Cij | Relative weight of secondary indicator Cij | Secondary index Cij weight | Sort |
|---------------------------|-------------------|---------------------------------|-------------------------|------------------------------------------|---------------------------|------|
| Real estate development project A1 | Investment decision-making phase B1 | 0.5967                          | Risk of decision errors C11 | 0.6025                                  | 0.3595                    | 1    |
|                           |                   |                                 | Risk of location C12     | 0.2174                                  | 0.1297                    | 2    |
|                           |                   |                                 | Environmental risk C13   | 0.1219                                  | 0.0727                    | 4    |
|                           |                   |                                 | Policy risk C14          | 0.0582                                  | 0.0347                    | 7    |
|                           | Preliminary work phase B2 | 0.2292                          | Tender risk C21          | 0.0852                                  | 0.0195                    | 12   |
|                           |                   |                                 | Design risk C22          | 0.2264                                  | 0.0519                    | 5    |
|                           |                   |                                 | Financial risk C23       | 0.0328                                  | 0.0075                    | 17   |
|                           |                   |                                 | Policy risk C24          | 0.4580                                  | 0.1049                    | 3    |
|                           |                   |                                 | Contract risk C25        | 0.0565                                  | 0.0129                    | 13   |
|                           |                   |                                 | Demolition risk C26      | 0.1411                                  | 0.0323                    | 8    |
| Construction phase B3    |                   | 0.1188                          | Enterprise internal management risk C31 | 0.0978                              | 0.0116                    | 14   |
|                           |                   |                                 | Capital risk C32         | 0.0763                                  | 0.0091                    | 16   |
|                           |                   |                                 | Technical risk C33       | 0.0296                                  | 0.0035                    | 21   |
|                           |                   |                                 | Risk of construction delay C34 | 0.0478                              | 0.0057                    | 19   |
|                           |                   |                                 | Cost risk C35            | 0.1716                                  | 0.0204                    | 11   |
|                           |                   |                                 | Quality risk C36         | 0.2655                                  | 0.0315                    | 9    |
|                           |                   |                                 | Security Risk C37        | 0.3114                                  | 0.0370                    | 6    |
| Sales and operation phase B4 |                   | 0.0554                          | Policy risk C41          | 0.4666                                  | 0.0258                    | 10   |
|                           |                   |                                 | Sustainable property management risks C42 | 0.1980                              | 0.0110                    | 15   |
|                           |                   |                                 | Sales risk C43           | 0.1300                                  | 0.0072                    | 18   |
|                           |                   |                                 | Delivery risk C44        | 0.0915                                  | 0.0051                    | 20   |
|                           |                   |                                 | Demand risk C45          | 0.0506                                  | 0.0028                    | 22   |
|                           |                   |                                 | Complaint risk C46       | 0.0250                                  | 0.0014                    | 23   |

A successful real estate project cannot be developed without a proper location. Enterprises should know and choose the natural conditions and resources such as the topographical structure and topographical characteristics of the site selection area. If it is found that the area is not suitable for project development, risk avoidance measures shall be taken to eliminate the risk.

Because different environment will lead to different scheme selection and implementation difficulty, which will affect the market positioning of the project, the enterprise should fully understand the risks brought by environmental differences, and make a risk plan in advance. Part of the risk should be transferred to the insurance company.

The real estate industry is a typical industry deeply influenced by government policies. Because the adjustment of policies is unpredictable, enterprises should take risk mitigation measures to prevent and control policy risks. Establish a policy analysis and prediction department, communicate with local government departments, understand the corresponding policy trend as early as possible, invite experts to interpret it, put forward targeted views and suggestions, and reduce the risk of policy change through the interpretation of the team and experts.
Preliminary Work Phase

As the policy is constantly changing, the policy analysis and prediction team at this phase should constantly track and interpret the policy, and timely respond to the change of the policy to avoid the loss caused by the policy inconsistency.

Unreasonable design scheme may lead to deliver quality not up to standard or construction period extension and other problems, so the enterprise should take risk mitigation and risk transfer measures. First of all, enterprises should take the design data of similar projects as a reference, invite experts to participate in the design process and check the data repeatedly; forbid low-level designers to join the team; strengthen the review and careful selection of the design scheme, or outsource the design scheme to the design company for risk transfer. At the same time, insure with the insurance company and share the loss with the insurance company to reduce the risk.

The measures of risk reduction and risk transfer should be taken for demolition risk. First of all, keep in touch with relevant government departments to coordinate the demolition work; at the same time, the enterprise shall formulate a detailed demolition compensation plan for the value of the demolished houses according to the market price and the national compensation standard, and communicate well with the demolished people to obtain their support and understanding. Secondly, outsource demolition activities to excellent demolition companies, and insure with insurance companies to transfer risks to third parties to protect the interests of enterprises.

Tender risk and contract risk should adopt the strategy of risk reduction and risk transfer. In the bidding process, the Contractor shall be inspected in advance according to the proportion of each index balanced by different projects, and external experts shall be invited to participate in the audit work; The terms and deliverables shall be clearly defined when the contract is signed. Meanwhile, in the bidding process, risks can be transferred by means of bank guarantee, third-party guarantee and deposit. Small financial risk, enterprises should take risk retention, large and medium-sized risk transfer and risk mitigation strategies to reduce losses.

Construction Phase

In this phase, the potential safety hazards of construction site and mechanical equipment are the main safety risk factors. Enterprises should take corresponding strategies of risk reduction, risk transfer and risk retention. First of all, a safety supervision group shall be established to conduct safety education for relevant employees regularly to strengthen their safety awareness, ensure the use of personal protective equipment, strictly prohibit the violation of safety operation regulations, and regularly inspect and evaluate the construction site to prevent safety risks. Secondly, establish risk early warning system, risk emergency plan and risk responsibility management system, clarify the responsibility and corresponding evaluation criteria and reward and punishment measures. When there is any sign of risk, report it immediately and take measures to remedy it in time to prevent further expansion of risk leading to more serious loss. Finally, assist the construction personnel to purchase relevant insurance before construction, and transfer the safety risk to the insurance company. When the amount of compensation exceeds the maximum limit of insurance compensation, the enterprise shall perform risk retention to bear the loss.

Quality not only affects the project itself but also the external image and core competitiveness of the enterprise, so the enterprise should adopt the strategy of risk reduction and risk transfer. First of all, regularly check and accept the quality of the project deliverables; strictly select and inspect the construction materials and construction team according to the standards; and monitor the whole construction process to prevent the occurrence of quality risks and hidden dangers. Secondly, when there are signs of quality risk, timely report and take immediate measures to remedy. The enterprise may contract part of the work to a third party and apply to the insurance company for risk transfer.

The cost may change with the progress of the project due to the change of scheme and other reasons. For this kind of risk, we should adopt the strategies of risk avoidance, risk mitigation and risk retention. First of all, the financial department calculates and specifies the available funds and prepares a fund for risk retention in case of small cost risk of the project. Secondly, a strict project change management system should be established. The managers and experts should strictly review
the changes and calculate the cost changes before and after the changes. At the same time, the construction stage is divided into smaller stages for cost control and cost monitoring throughout the whole process. At the end of each small stage, cost accounting should be carried out in time if problems are found and remedied in time, so as to reduce the probability of cost risk and profit loss.

Risk aversion and mitigation measures shall be taken for internal management risks, so as to improve the leadership and management level of the management to reduce the risks; risks of capital, technical risk and construction delay risk shall be reduced or resolved through risk transfer and risk mitigation strategies.

**Sales and Operation Phase**

Due to the long development cycle of the real estate project, when entering the sales phase, the change of the policy may affect the housing rental and sales situation, so the policy analysis and prediction team should continuously track and analyze the corresponding policies, so as to adjust the price of the housing and other aspects, adopt the prevention strategy of risk reduction, so as to reduce the loss of profits.

At this phase, sustainable property operation will also affect the rental and sale of houses. Enterprises should respond through risk reduction. Enterprises can establish their own property team or choose a good property team to continue to serve the owners.

Enterprises should strengthen the construction of internal management system to reduce or reduce sales risk, delivery risk, demand risk and complaint risk.

**Risk Monitoring**

The risk response of real estate projects may no longer be effective over time, and the purpose of risk monitoring is to ensure that the project runs on a predetermined track to prevent huge deviations. Therefore, real estate companies should carry out continuous monitoring. The risk management team is responsible for special evaluations, establishing reporting mechanisms, and constantly improving the risk control management system. Also, reasonable use of monitoring tools and methods.

**Summary**

This article takes real estate projects as the research object, and uses literature references and expert intuitive judgment methods to identify project risks. It is divided into investment opportunity decision-making phase, preliminary work phase, construction phase, and sales operation phase according to the entire life cycle. AHP was used to evaluate each risk index, and the final calculation results were given and the countermeasures were proposed in phases based on the evaluation results. Due to limitations in research practices and data, this article has certain limitations on the risk management of real estate development projects, and the approach to risk control is relatively one-sided, which needs to be improved in future research.

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