Economics & Business Management
ISSN Print: 3079-5214
ISSN Online: 3079-5222
https://doi.org/10.63313/EBM.9082

Analysis and Research on Factors Affecting the Cost of Residential Projects

Tianyu Qing
Southwest Petroleum University of Economics and Management, Chengdu 610500, China
Email: tiandot@163.com

How to cite this paper: Qing, T. Y. (2025). Analysis and Research on Factors Affecting the Cost of Residential Projects. Economics & Business Management, 2(2), 80-90. ISSN Print: 3079-5214; ISSN Online: 3079-5222. https://doi.org/10.63313/EBM.9082
Published: 2025-07-18

Abstract

As the center of China's economic construction, the real estate industry plays a pivotal role in national construction as well as economic development. However, with the current state of the real estate industry continues to regulate, so that the benefits of real estate enterprises is not as good as in previous years. Real estate enterprises from the previous "rapid development" constantly changing to "high-quality development", today's real estate is increasingly focusing on the quality of the project at the same time pay attention to its economic benefits, and as the center of the real estate industry's residential projects are also very important to it, the cost is an important indicator of economic efficiency.
First of all, through the literature survey method and the questionnaire survey method on the residential project cost impact factors for the initial identification, and then through the expert interview method, with the construction industry experts in the interview consultation, and ultimately determine the cost can affect the 29 factors. After developing the list of influencing factors, this paper analyzes the influencing factors through the hierarchical analysis method and calculates the weights of each factor. After that, the internal relationship between the influencing factors was analyzed through the Interpretative Structural Model (ISM), and the hierarchical structure between the influencing factors was finally determined. Next, a case study was conducted using the actual case of the YX project. Finally, a brief summary and outlook of the thesis is presented, describing the hopes for the future and the shortcomings of the thesis.

Keywords

Residential Projects; Costs; Influencing Factors; Hierarchical Analysis; Explanatory Structural Model

1. Introduction

Since the outbreak of the new crown in 2019, all sectors within China have faced severe tests, and the real estate economy has also shown a downturn. According to the National Bureau of Statistics, in 2022, the national real estate development investment of 132,895,000,000 yuan, a decrease of 10.0% compared with the previous year; among them, the investment in residential property was 100,646,000,000

yuan, a decrease of 9.5%.In 2022, the area of sales of commercial property was 135,837,000 square meters, a decrease of 24.3% compared with the previous year, among which, the area of residential property sales decreased by 26.8%. The total sales of commercial properties were 1,333.08 billion yuan, a decrease of 26.7 per cent, of which the sales of the residential portion decreased by 28.3 per cent.

For residential projects in real estate how to precisely control the cost is an important factor to keep its competitiveness, therefore, this study aims to explore in depth the various influencing factors of the cost of residential projects, to analyze the internal influencing relationship between these factors and their specific impact on the cost, to identify the key influencing factors and take measures to control the cost.

2. Concepts and methodology

2.1. Theory of Cost Control

Cost control is the core content of residential project management, is the use of the principles of systems engineering, the enterprise in the production activities of the project all the costs incurred in the calculation, regulation, and supervision of the process, but also to find the project's relative weaknesses, to take appropriate measures, and to do everything possible to find the possibility of reducing the cost of the process. It includes cost planning, cost monitoring and cost analysis.

In today's real estate industry, the comprehensive and systematic development of maturity, so that there are now two fundamental cost control principles, one is the principle of comprehensive control, the other is to focus on the principle of control. In the comprehensive control and includes the whole control and full control of two aspects. Comprehensive control is in the investment decision-making stage of the project has been controlled, mainly on the project data as well as feasibility and risk.

2.2. Analytic Hierarchy Process

Analytic Hierarchy Process (AHP), is a combination of qualitative and quantitative, systematic and hierarchical analysis method, which is highly practical and effective in dealing with complex decision-making problems, and its analysis steps are described below.

1）Modelling of recursive hierarchies

2）Constructing a judgement matrix

To quantify the results of the evaluation, a 1-9 scale was used to evaluate the results. The judgement scale indicates the quantitative scale for judging the relative importance of element I_i to element I_j as shown in the table1 below.

Table 1. Quantitative scale of relative importance of elements in the judgement matrix

define（a_{ij}）	scales
Factor i is definitely more important than factor j	9:1

define（a_{ij}）	scales
Factor i is very clearly more important than factor j	7:1
Factor i is significantly more important than factor j	5:1
Factor i is slightly more important than factor j	3:1
Factor i is as important as factor j	1:1
Factor i is midway between the above two adjacent judgement scales than factor j	2,4,6,8

2. consistency judgement。

In the two-by-two comparison of the elements of the hierarchical model to judge the importance, since the main use of tacit knowledge of experts, it is impossible to accurately judge the ratio of W_i/W_j, it is necessary to judge the results of the compatibility and error. Estimated error values inevitably lead to deviations in the eigenvalues of the judgement matrix, according to which the compatibility index is defined as follows.

If matrix A is fully compatible, it can be seen that$\lambda_{max} = n$,if it is incompatible, then $\lambda_{max} > n$,so the size of $\lambda_{max} - n$ can be used to define the degree of deviation from compatibility. Let the compatibility index be CI, then there are

$$CI = \frac{\lambda_{max} - n}{n - 1} \tag{1}$$

Where CIdenotes the consistency test index; λ_{max} denotes the maximum eigenvalue of the judgement matrix; n denotes the dimension of the judgement matrix. The calculation formula is as follows:

$$\lambda_{max} = \sum_{i=1}^{n} \frac{[AW]_i}{nW_i} \tag{2}$$

where $[AW]_i$ denotes the ith component of the matrix $[AW]$.

Define the consistency indicator CR as

$$CR = \frac{CI}{CR} \tag{3}$$

Where CR is the randomness index.

When the matrix A has full consistency, $CI = 0$. When it is inconsistent, $CI > 0$ by $\lambda_{max} > n$. The general case can be determined according to whether $CI < 0.1$ or not. As for whether CI is accepted or not, we must refer to the value paradigm of CR range, as shown in Table2 below.

Table2. The value of CR

n	1	2	3	4	5	6	7	8	9	10	11
CR	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51

When the consistency indicator $CR < 0.1$, the consistency is acceptable and the weights W are acceptable.

2.3. Interpretative Structural Modelling Approach

Interpretative Structural Model (ISM) is a kind of structural modelling method, this

method was proposed by john N.war field in 1976, mainly used to analyze the structure of complex systems at different levels, can find the internal laws that exist among the disordered and discrete elements. Due to the specificity of the research object scholars continue to adjust and expand the method, and successively put forward the fuzzy explanatory structural model method and the confrontational explanatory structural model. The steps of the explanatory structure model method are as follows:

1) Identification of Influencing Factors

The first step is to identify the research problem and objectives which will be used to plan the scope of the research. Through identification methods such as literature research, expert interviews, and brainstorming, the influencing factors of the research problem are identified and numbered to form a list of influencing factors. This is shown in Table 3 below.

Table3. List of factors influencing

ordinal number	Influencing factors
S1	
S2	
S3	
...	
Si	
S1	

2) Construct the adjacency matrix

After obtaining the list of influencing factors, the correlation relationship between each influencing factor is evaluated two by two, if there is a correlation relationship between two factors it is marked as 1, if not it is marked as 0. Finally, according to the judgement result of the binary correlation relationship of the influencing factors, the adjacency matrix is formed. As shown in Table 4 below.

Table4. List of factors influencing

S_{ij}	S_1	S_2	S_3	S_4	...	S_i
S_1						
S_2						
S_3						
S_4						
...						
S_i						

3) Calculate the reachable matrix

After constructing the adjacency matrix, the adjacency matrix is denoted as A and the unit matrix is denoted as I. Boolean operations are performed on A+I.

4) Divide the system layers

After obtaining the reachable matrix Q, the reachable set, the prior set, and the intersection set corresponding to each influencing factor are further examined. Compare the intersection set with the reachable set, and then keep the influencing fac-

tors with two equal sets as the first layer; then delete the rows and columns where the influencing factors of the first layer are located from the reachable matrix, and repeat the above operation to obtain the factors of the second layer, and so on, until the division of all the factors is completed. Finally, the hierarchy table of the system is obtained, as shown in Table 5 below.

Table 5. Hierarchical structure

hierarchy	constituent
First layer	S_1
Second layer	S_3、S_5
Third layer	S_2、S_4
.....	...
Layer n	S_i、S_j

5) Constructing the explanatory structural model

Based on the results of the system hierarchy obtained in step 4, a skeleton diagram of the explanatory structural model of the system of the research problem is drawn. This diagram is the basis for model analysis, and based on the constructed system model, the overall structural characteristics and key influencing factors are analyzed and explained respectively.

3. Identification of cost impact factors

When conducting a cost impact factor analysis study for residential projects, the step of identifying the influencing factors is very crucial. By accurately identifying the influencing factors, it can help the company can better control the cost and optimize the project design.

On the investigation of cost impact factors, the paper has investigated and collected the research of domestic scholars in recent years, and the factors with higher degree of recognition and greater impact have been summarized and counted. Through the literature survey, it is found that scholars have more mentions on several factors such as 'people, materials and machines', 'cost consciousness', 'management system', 'engineering technology', etc., indicating that they all believe that these factors have a greater impact on costs and should be controlled.

After sorting through the 21 research papers and contents mentioned above, it is not difficult to find that different scholars have different research directions on cost influencing factors. Some scholars research from the external factors of the project, while others research from the internal factors of the project or their own projects. The fundamental reason for this phenomenon is that different scholars have different understanding of the definition of the concept of impact factors. Based on the above research results, according to the former's division criteria for influencing factors, the influencing factors are integrated and divided according to the content attributes of the influencing factors, and the preliminary list of influencing factors for residential project costs is finally obtained with 4 categories of first-level influ-

encing factor indicators, 10 second-level influencing factor indicators, and 28 third-level influencing factor indicators.

Through the initial identification of influencing factors in the previous section, we have finally summarized 30 factors that can influence costs. To improve the accuracy of the list of cost influencing factors, interviews were conducted with experts in the field of cost influencing factors for residential projects. Five experts with many years of experience in the construction industry were selected to provide a comprehensive and reliable perspective. Through expert interviews we reduced the number of primary indicators to 3 and increased the number of tertiary indicators to 29. The expert interviews not only improved the cost impact list, but also ensured the accuracy of the list. The final list of cost impact factors for residential projects was determined, categorized and labelled. This is shown in Table 6.

Table6. The list of cost impact factors for residential projects

First indicators	Secondary indicators	Tertiary Indicators
Internal factor(I)	Management（I_1）	Improvement of cost control system (I_{11})
		Level of construction site management (I_{12})
		Personnel's awareness of cost control (I_{13})
		Information communication ability (I_{14})
		Selection of suppliers (I_{15})
		Improvement of the system of incentives and penalties (I_{16})
	financial（I2）	Level of labor costs (I_{21})
		Loss rate of materials (I_{22})
		Machinery utilization (I_{23})
		Accuracy of costing (I_{24})
		Payment for work (I_{25})
	technical（I3）	Use of new technologies and materials (I_{31})
		Professional competence of technicians (I_{32})
		Accuracy of construction drawing budgets (I_{33})
		Reasonableness of choice of construction programme (I_{34})
		Reasonableness of choice of construction sequences and construction techniques (I_{35})
External factor(E)	policy（E1）	Changes in national policies (E_{11})
		Changes in local laws and regulations (E_{12})
	environments（E2）	Force majeure (E_{21})
		Advantages and disadvantages of the geographical environment (E_{22})
	financial（E3）	Inflation (E_{31})
		Changes in market prices (E_{32})
project	management（P1）	Reasonableness of programme (P_{11})
		Difficulty of visa changes (P_{12})
	technical（P2）	Engineering claims (P_{13})
		Reasonableness of design changes (P_{21})
		Ease of construction of the project (P_{22})
	scale（P3）	Floor area (P_{31})
		Decorating and finishing capacity (P_{32})

4. Example analysis

4.1. Project profile

YX project is in T city, Jiangsu province, the building function is a residential project, the construction unit is AZ construction company in T city, Jiangsu province, the construction company is JT construction and installation limited company in T city, Jiangsu province, and the design unit is Architectural Design and Research Institute in W city, Jiangsu province. The building area of the whole project reaches 8950m2, and the building is a six-story above ground, no basement, with an eave height of 16.2m. The housing is a public tender for the form of bidding, the structure type is brick structure, to bill of quantities as the pricing method, fixed lump sum contract for the type of contract, and the use of state-owned investment type.

4.2. Project evaluations

1) Indicator weight calculation

In this paper, five experts with many years of experience in the construction industry were invited to score the list of cost-influencing factors made in the previous paper.

Based on the weights (which all passed the consistency test), the cost impact factors for residential projects were constructed, as shown in Table 7.

Table 7. Residential Project Cost Influencing Factors Weighting

First indicators	Wi	Secondary indicators	Wi	Tertiary Indicators	Wi	integrated Wi
Internal factor(I)	0.5224	Management（I1）	0.2602	(I11)	0.3217	0.0437
				(I12)	0.2055	0.0279
				(I13)	0.2017	0.0274
				(I14)	0.1394	0.0189
				(I15)	0.0797	0.0108
				(I16)	0.0520	0.0071
		financial（I2）	0.5635	(I21)	0.1120	0.0330
				(I22)	0.3690	0.1086
				(I23)	0.2716	0.0800
				(I24)	0.1703	0.0501
				(I25)	0.0772	0.0227
		technical（I3）	0.1763	(I31)	0.0733	0.0068
				(I32)	0.1467	0.0135

				(I33)	0.2160	0.0199
				(I34)	0.2864	0.0264
				(I35)	0.2777	0.0256
External factor(E)	0.2742	policy（E1）	0.3740	(E11)	0.7101	0.0728
				(E12)	0.2899	0.0297
		environments（E2）	0.1456	(E21)	0.6667	0.0266
				(E22)	0.3333	0.0133
		financial（E3）	0.4804	(E31)	0.2500	0.0329
				(E32)	0.7500	0.0988
project	0.2034	management（P1）	0.3244	(P11)	0.2347	0.0155
				(P12)	0.1196	0.0079
				(P13)	0.6457	0.0426
		technical（P2）	0.4311	(P21)	0.2240	0.0196
				(P22)	0.7760	0.0680
		scale（P3）	0.242	(P31)	0.2052	0.0101
				(P32)	0.7948	0.0392

Based on the calculation of the residential project cost impact factor indicator weights, from which it is not difficult to analyze, in the residential project cost impact factors, the cost control system, the perfection of the loss rate of materials, the utilization rate of machinery, the accuracy of cost accounting, changes in national policies, changes in market prices, the difficulty of the project construction and other factors accounted for a relatively large weight of these factors, the greatest impact on the cost of the residential project, therefore. Therefore, the control and optimization of residential project costs should focus on these factors.

Therefore, the establishment of the index system of residential project cost influencing factors can provide a complete and systematic way for the control and management of residential project cost, and the relevant project managers can also control and improve the control programme of residential project cost from several aspects, such as economy, management and technology.

2) Explanatory Structural Modelling Analysis

In the process of project implementation, the various factors affecting the cost of a residential project do not have an impact on the cost alone, but rather on the cost of the residential project under the interaction between the various factors, i.e., one

factor has an impact on the other, which leads to a direct impact on the cost of the residential project.

The hierarchical decomposition table shows the hierarchical distribution of the elements; the purpose of the hierarchical decomposition is to understand the hierarchical distribution of relationships between the elements; where the top level represents the ultimate goal of the system, and the levels downwards represent the causes of the previous level, respectively; and the bottom level represents the initial causes of the system, and the levels upwards represent the results of the next level, respectively.

The directed graph is a graphical representation of the "adjacency matrix"; one-to-one with the "adjacency matrix", where the number 1 in the "adjacency matrix" indicates that there are arrows and the number 0 indicates that there will be no arrows. A schematic diagram of the hierarchical relationships was drawn according to the spss software, as shown in Figure 1:

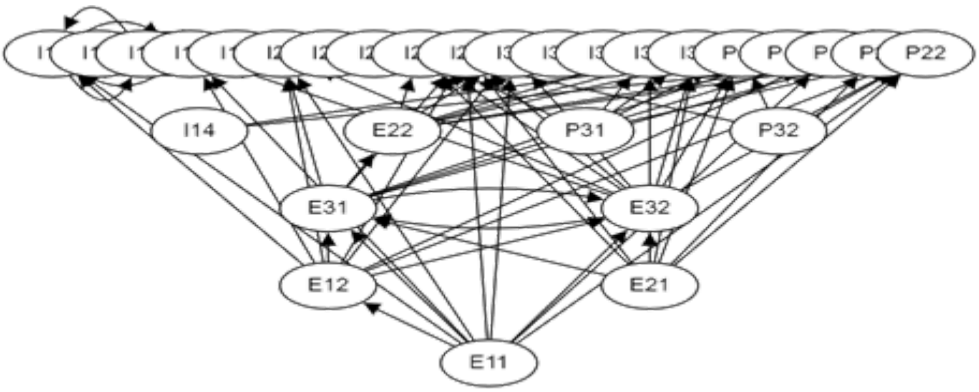

Figure 1. The hierarchical relationships

The influencing factors in Layer 1 are surface-level factors that will directly affect the cost of the residential project. The influencing factors in layers 2, 3 and 4 are intermediate factors that will not affect the cost, but will influence the cost of the residential project indirectly by influencing the factors in layer 1. The influencing factors in layer 5 are deep influencing factors, which are the basis of cost control of residential projects, meanwhile, the deep influencing factors affect the cost of residential projects by influencing the intermediate and surface influencing factors.

5. Conclusion

A series of studies on residential projects in the real estate industry is to make the project achieve better economic benefits through a series of control and management work. The cost of real estate residential projects is an important indicator to measure the economic efficiency of the project, only to control the cost well, to improve the core competitiveness of enterprises in the market. However, China's research in the real estate industry started late, many of the technologies and methods

are not mature enough, and even many of the foreign technologies and methods used, coupled with China's reform of the real estate industry in recent years, so that the real estate industry is facing a serious test. Based on this, the real estate enterprise residential project cost factors to carry out analysis and research, to find out the important factors affecting the cost, so that the real estate enterprise according to this important degree of influence factors to formulate a reasonable control measure, so that the cost of residential projects to be optimized, which is an important and necessary work.

References

[1] Yun S,ChoiJ,Oliveira DD,etal. Development of performance metrics for phase-basedcapital project bench marking[J].International Journal of Project Management,2016,34(3):389-402.

[2] Xue H, Zhang S, Su Y, etal. Effect of stake holder coll aborative management on off-site construction cost performance[J]. Journal of Cleaner Production,2018,184(MAY20):490-502.

[3] Zebrowski Paweł, Zawierucha Jacek, Prystacki Tomasz, Marcinkowski Wojciech,Małyszko Jolanta. Medical waste management-how industry can help us to protect environment and money[J].Mans field Woodhouse2014:42.

[4] Max A. Schumm, Christopher P. Childers, James X.Wu, KyleA. Zanocco.Cost Saving of Short Hospitalization Nonoperative Management for Acute Uncomplicated Appendicitis[J]. Ronald W.Hilto.,2013:255.

[5] Eick SG, Hollan B, Stacklin AJ. Automate Fecture Base Analysis for Cost Management of direct Materials.US. Patent Application Publication Go,US2006/0253403AI,2006:11-9P.

[6] Ellram LM, Stanley LL.Integrating strategic cost management with a3CE environment:Strategies,practices,and benefits[J].Journal of Purchasing&Supply Management,2008,14(3):180-191.

[7] Kim Soin, Willie Seal, John Cullen. AB Cand Organizational Perspective[J].Management Accounting Research2003.

[8] Robin Cooper. Regine Slagmulder: Target Costing and Value Engineering[M].Routledge,2000,135-136.

[9] Kaushik A, VermaS, SinghHJ, etal.Soft ware cost optimization integrating fuzzy system and COA-Cuckoo optimizational go rithm[J].International Journal of System Assurance Engineering&Management,2017(8):1461-1471.

[10]]Simmonds K. The accounting assessment of competitive position[J].European Journal of Marketing,1986(01):16-31.

[11] Robin CRegine S. Inter organizational cost management and relational context[J].Accouting Organization and Society,2024;（29）：25-26.

[12] Barrett G.How to conduct analyze real estate market and feasibility life cycle cost[M].A Tool for Comparing Building Alternative, in Proceeding Symposiumon on Quality and Costin Building,2005:41-43

[13] Nuchira K, Thongchai B, Piyapong N, Wajaree W.Guaranteed cost control for exponential stability of an onli near system with mixed time-varying delay sinstates and controls[J].Advancesin Difference Equations,2018(1):96-99.

[14] Trond T, Terje P. Thehealth policy pendulum:Cost control vs activity growth[J]. The International Journal of Health Planning and Management,2018,33(1):143-146.

[15] L.Jiao,Li\TXD.Application of prefabricated concretein residential buildings and its safety management[J].Archives of Civil Engineering,2018,64(2):21-35.

[16] Back WE, Moreau KA.Cost and Schedule Impacts of Information Management on EPCP

rocess[J].Journal of Management in Engineering,2000,16(02):59-70.

[17] Nobuaki, Ishii, Yuichi, Takano, Masaaki, Muraki. A Revised Algorithm for Competitive Bidding Price Decision under Limited Engineering Man-Hoursin EPC Projects[J].Oukan,2016,10(01):47-56.

[18] Yu Feng. Research on responsible cost management and evaluation system of real estate project[J]. New Vision,2012(06):50-52.

[19] KE Hong, ZHOU Fuyan. Research on performance evaluation index system of highway project cost management[J]. Highway Traffic Science and Technology,2012,29(12):48-54+68.

[20] ZHU Binmei, HU Jinyu, WAN Peng. Evaluation of quality cost management effect of urban metro project[J]. Friends of Accounting,2014(04):41-44.

[21] YANG Xin, YANG Liming. Application analysis of target cost method in cost management of project department[J]. Transportation finance and accounting,2014(07):69-73.

[22] Jia Yingfang. Cost management of building construction enterprises under the perspective of value chain theory[J]. The study of finance and accounting,2014(17):163-164.

[23] Fan Liyan. Research on cost management and control in construction phase of building project[J]. Journal of Taiyuan City Vocational and Technical College, 2015 Report,2015(09):171-172.

[24] Xu Wenming. Research on cost management of construction project in construction stage[J]. Value engineering,2017,36(01):27-29.

[25] Cao Lixiang. Construction project cost management problems and improvement measures[J]. Journal of Longdong College,2018,29(05):72-75.