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# Rural building cost research practice based on BIM

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***Abstract:*** *Starting from the current situation of rural building cost control, this paper studies the current problems of rural building cost control, analyzes the inherent elements of its generation, and expounds the application value and approach of BIM technology in this field, in order to guide rural construction investment. The investment in rural housing construction is mainly direct cost, including labor cost, material cost and part of machinery cost. Labor costs, including the wages of contractors and small workers, occupy the main part of investment. The cost of materials includes raw materials, finished products and semi-finished products, and is the largest part of rural housing investment. The cost of machinery includes purchase and hire. It is mainly the cost of small construction machinery, such as concrete mixer and steel cutting machine, bending machine. In the rural economy, the awareness of compound interest is not clear, you may have heard of "interest rolling interest", and the specific number, whether it is worth borrowing, often cannot choose, and then choose to build a house loan, always feel that it will be a loss, and dare not apply for a loan.*

***Keywords:*** *BIM, cost control, rural architecture*

## 1. Overview of rural building cost control

### *1.1 Poor capital supply, insufficient construction funds.*

The funds for building houses in rural areas mainly come from the wealth accumulated by farmers' families over the years, from farming crops or from migrant work. Not only does a big house-building bill drain the capital reserve, it also creates new debt. Some rural construction projects are halted for lack of funds and will continue to be built when the owners have the funds.

### *1.2 No indirect costs such as design fees, bidding fees, project management fees, taxes, etc.*

Rural housing construction mostly belongs to the individual behavior of the owner, so the owner undertakes all the building tasks. At present, rural building owners have no sense of quality and will not hire professional designers for building structural design, nor will they hire qualified construction enterprises through bidding. Therefore, there will be no indirect costs such as design fees, bidding fees, project management fees and taxes in construction costs.

### *1.3 No bank loans, no stable repayment ability, not to mention loan policies, such as interest-free mortgage loans, credit loans, etc.*

Constrained by traditional ideas of self-sufficiency and a lack of confidence in repaying loans, rural housing construction rarely applies for bank loans. At the same time, the poor information dissemination leads to the failure of the loan preferential policies to be timely communicated to rural housing owners.

### *1.4 Rural housing loan is mainly on credit, and the main content of credit is raw material cost, labor cost and lease cost.*

Loans are not smooth, but there is a demand for building projects, so credit becomes the preferred way to borrow money for building houses, and it also becomes the established form of rural construction economy. In some rural areas, construction workers' wages and building materials fees, as well as masonry tools and furniture decoration can be owed on credit. Credit was a feature of the rural

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economy and could be paid back when money was available, and most credit was interest-free.

### *1.5 No cost details, no clear bill of quantities.*

Building without design drawings, there is no bill of quantities, and then no cost details. This has become the rural construction cost is difficult to control the reason. No budget is easy to cause over investment, resulting in project shutdown.

### *1.6 No comprehensive unit price, no measure project fee, no supervision of funds, no account flow.*

There is a vacuum in the supervision of rural construction market, and basically no third party is involved in it. Rural areas are wide, construction projects are scattered, management timeliness is poor, and there is no housing construction record, so rural housing owners will not calculate the comprehensive unit price, and then there is no budget, settlement.

## 2. Analysis on the causes of current situation of rural building cost control

### *2.1 Rural buildings have small volume and thin profit.*

At the present stage, yard-type independent houses are quite common in new rural construction. The floors of such buildings are basically 1-3 floors, and the building area is 100-400 square meters [1]. Take 2-4 floors as an example, the total cost of yard-type rural buildings is about 200,000 to 800,000 RMB. If a qualified construction enterprise to undertake the project construction task, first of all to solve the current situation of no design drawings, according to the needs of owners design corresponding drawings, and then have to modify the design scheme according to the actual investment of rural owners, at the same time have to equip the corresponding technical personnel to arrive at the site, and build temporary living area. Then organize construction by design plan, each construction process can not be omitted, including measure project (scaffold, template, etc.), the final completion of settlement, have to pay corresponding taxes by project revenue. For the construction enterprise, the project income is little, the procedure is many, the cost is high, the profit is thin, can only be prohibitive.

### *2.2 There is a management vacuum in the rural construction market.*

Economic development in rural areas lags behind, and local governments are more concerned about agricultural production, so most rural areas are equipped with a sufficient number of agricultural technicians and agricultural technology stations, while technical consultants for housing construction are rare in rural areas. The rural construction market is in a state of management vacuum, the quality of building materials in the building materials market cannot be guaranteed, the qualifications of workers engaged in the construction industry cannot be guaranteed, and the quality testing of buildings after completion cannot be guaranteed.

### *2.3 Lack of investment sources and no awareness of cost management.*

Rural owners' economic strength is limited, but always think of the residence to be lofty, resulting in insufficient structural bearing capacity, buried hidden safety hazards. Even if they had saved enough money to build a house, they didn't know how to plan and match the size of the building. Cost management is more based on experience, the project progress to what extent, what kind of construction materials need to buy, what kind of construction workers need, how many, all by feeling, no planning consciousness.

### *2.4 Small building volume, convenient construction, flexible change, stop and start, no need to report, no contract management, manual, material, machinery nearby, no large equipment, low technical requirements.*

Courtyard type rural independent building, building volume is small, the required construction technology requirements are low, no construction contract, these conditions provide convenience for the rise of rural construction team. Construction technology content is low, the quality of personnel is not high, after a simple training can be on the job, no construction technical qualification certificate, and no contract constraints, insufficient staff on temporary employment, surplus staff can be dismissed

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immediately, at the same time without solving the problems of workers on the construction site. This also provides convenience to the owners of rural buildings. When the capital is enough, people are invited to start construction. If the capital is not enough, the site construction can be stopped immediately. Personnel, materials and machinery can be solved nearby, there is no need to worry about the entry of large equipment, construction preparation. Compared to large-scale engineering projects, the actual operation is more flexible.

## 3. Application of BIM technology in rural building cost control

### *3.1 In the early stage of investment, schemes can be compared to save investment and avoid rework.*

Using BIM technology, 3D modeling can visually more intuitively show the appearance and characteristics of the project. Roaming technology can give people the enjoyment of beauty, and investors can clearly see the project profile after the completion of the future [2]. In the traditional construction process, construction engineering products will be difficult to change and change once completed because of the long construction cycle, and the simplicity of the effect, which requires that when making investment decisions, investors must carefully consider the scheme, clear goals can be determined before the project scheme. With the application of BIM technology, investors can truly feel the advantages and disadvantages of the project scheme before construction according to the 3D entity model provided by the designer, put forward their own requirements and standards when making decisions, and guide the designer to modify the project scheme.

### *3.2 Calculate project quantities and generate detailed quantities list.*

BIM technology can not only carry out entity modeling, but also carry out information sharing on the model. For example, for the study of cost control, according to the established entity model, the project quantity statistics table can be automatically generated, and the list details are counted according to the rules of the bill of quantities. Figure 1 shows the wall quantity statistics of a certain engineering project.

**Schedule of wall**

| A | B | C | D |
|---|---|---|---|
| Thickness | Highly | Length | Volume |
| 240 | 3300 | 1200 | 0.95 |
| 240 | 3300 | 4500 | 3.56 |
| 240 | 3300 | 1200 | 0.95 |
| 240 | 3300 | 4500 | 3.56 |
| 240 | 3300 | 14700 | 11.64 |
| 240 | 3300 | 9900 | 7.84 |
| 240 | 3300 | 8400 | 6.65 |
| 240 | 3300 | 6900 | 5.46 |

*Figure 1: Wall quantity statistics of a project*

### *3.3 Cost, budget and schedule are generated simultaneously.*

According to the BIM information model, with the planned construction period of the project, the quantity statistics in line with the planned construction period can be calculated (BCWS); If the model matches the actual construction period of the project, the engineering quantity statistics in line with the actual construction period can be calculated(BCWP). According to the earned value method, the project schedule can be determined in advance or behind. If combined with relevant cost software, the total cost of the project can be calculated, namely BIM-5D.

BCWP-BCWS <0, the progress is behind; BCWP-BCWS >0, ahead of schedule.

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### *3.4 Arrange labor, machinery and materials according to the schedule to avoid material waste and labor sluggishness.*

The key point of construction project cost management is the cost management in the construction stage, which directly determines the effect of project cost management and project construction quality [3]. To join the construction period of BIM information model, to account for in accordance with the amount of time limit for a project plan, according to this quantity can be sure every day recruitment plan and materials plan, which avoids material loss caused by the material transport and handling more loss, also can avoid workers slowdown caused by the improper use, thus saving the project investment.

### *3.5 Visual technical disclosure can be made during the construction period to avoid rework and reconstruction caused by construction quality problems and save investment.*

BIM information technology can provide 3d animation technology disclosure.

## 4. Summary

BIM technology has the characteristics of visualization, coordination, optimization and simulation. It can efficiently simulate the construction process and construction effect, quickly and accurately calculate the engineering quantity and project cost, allocate reasonable resources and plan, avoid cost increase and save project investment.

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