

Research on the Influencing Factors of Cost Overruns in Construction Projects

Wu Qian^{1,2}

¹Anhui Xinhua University, Hefei, Anhui, China, 230088

²Postgraduate Centre, Management and Science University, University Drive, Off Persiaran Olahraga, 40100 Shah Alam, Selangor, Malaysia

Abstract: As a pillar industry driving economic progress, the construction industry is currently experiencing rapid development and receiving strong support from the country and government. Nowadays, many construction projects involve a large amount of capital investment, and cost overruns often occur due to various factors. In order to achieve ideal economic benefits while ensuring the quality of the project, construction units should actively explore the possible influencing factors of project cost overruns and take timely control measures. This paper focuses on studying the main factors that affect cost overruns in construction projects, which can provide reference for practical situations.

Keywords: Construction engineering; Cost overruns; Influence factor

1. Introduction

After entering a new era, the development speed of the construction industry continues to accelerate with the continuous promotion of urbanization construction. In this background, the issue of cost control in construction projects has also received widespread attention in the industry, and research on cost control in construction projects is also increasing, such as research on construction project budgeting and cost control, research on the synergy between engineering cost control and quality control, and so on^[1-2]. To promote the vigorous development of the construction industry, China has increased its investment in construction assets, providing strong financial support for various engineering constructions. However, the growth of investment funds has also brought new challenges to the construction industry, and research on cost control of construction projects has exposed some urgent developmental issues, such as cost overruns, waste of funds, and so on. If the project cost cannot be controlled in a timely manner, the construction unit is likely to face serious economic losses. How to avoid cost overruns is worth pondering for each construction unit. Therefore, this paper systematically reviews the factors affecting cost overruns in construction projects in recent years, in order to provide useful ideas for industry researchers and guarantee the quality and efficiency of construction projects.

2. Current status of research on cost overruns in construction projects

2.1. Analysis on trend of research papers

This paper adopts the method of literature search to clarify the development trend of research on the factors affecting cost overruns in construction projects. We entered the keywords "construction engineering", "cost overrun", and "influencing factors" into the China National Knowledge Infrastructure database, and search for literature materials published between 2019 and 2024, totaling 20 articles, with a relatively small quantity. Considering the limited scope of keywords, this article replaces the above keywords with "construction", "cost overrun", and "factor", expanding the scope and retrieving a total of 467 articles. Among them, the total number of publications from 2019 to 2023 accounted for 16.27%(76/467), 19.27%(90/467), 18.84%(88/467), 27.19%(127/467), 17.34%(81/467), respectively. The Trend of research papers can be seen at Figure 1. So far, there are four papers in 2024. According to Figure 1, it is not difficult to see that the number of publications in this field has increased sharply from 2021 to 2022, with a total of 127 articles published in 2022, ranking first among the publications in the past five years. This indicates that the attention of the construction industry to the issue of engineering cost overruns has significantly increased during this period, and the research on

related influencing factors has become more in-depth. However, the total number of articles published in 2023 decreased to 81, which may be related to industry development bottlenecks and updates and iterations of construction engineering related technologies. However, the total number of articles published is still higher than 79 in 2019, indicating that the popularity of this research topic has remained relatively stable in recent years.

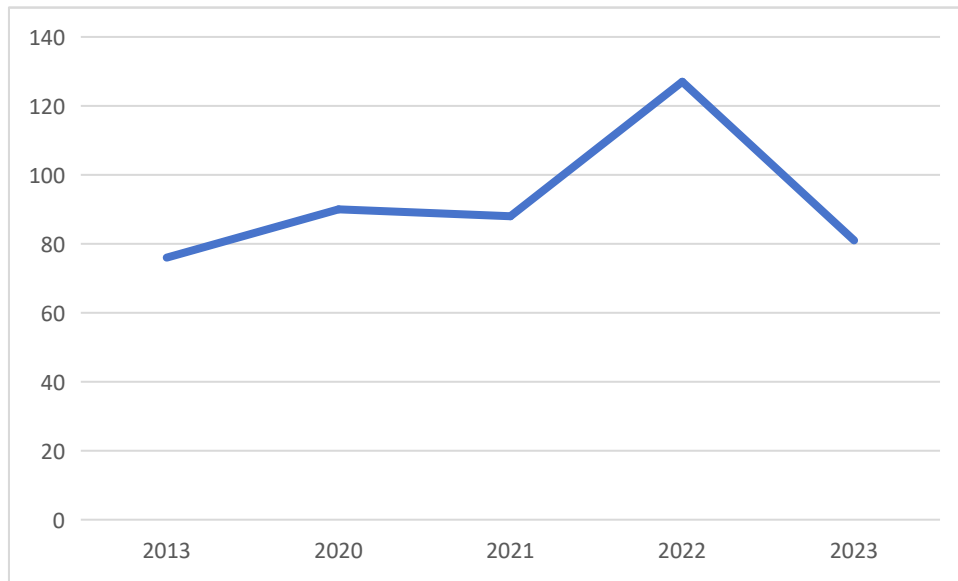


Figure 1: Trend of research papers.

2.2. Analysis on research topic

When analyzing the research topic, this article removed fields that were not significantly related to construction project costs and obtained a distribution bar chart of the research topic, and the distribution of research topics on the influencing factors of construction cost overruns from 2019 to 2024 can be seen at table 1. It can be seen that in the research on cost overruns in construction projects, cost control is a key research topic, which also indicates that the main research purpose of scholars is to effectively solve the problem of cost overruns and better control the cost of construction projects.

Table 1: Distribution of research topics on the influencing factors of construction cost overruns from 2019 to 2024.

Factor	Numerical value	Factor	Numerical value
Cost control	114	EPC	12
Cost management	49	Application research	11
Earned value method	39	Construction project stage	11
Project cost control	38	Construction projects	10
Project cost management	31	Construction projects cost control	9
Optimization	19	Engineering projects	9
Engineering projects cost control	17	Construction project	7
Construction cost	15	Project cost	7
BIM	14	Construction stage	6
Construction cost control	13	Improving Earned Value Method	6

2.3. Analysis of the Current Status of Factors Influencing Cost overruns in Construction Projects

Construction engineering is a massive and systematic engineering project that involves multiple links and elements. Normally, the total cost of a construction project is composed of multiple costs such as labor, equipment, materials, and management. It is the total amount of economic resources invested

throughout the entire project cycle, including both fixed assets and various intangible assets, covering both direct and indirect costs throughout the entire construction process. The detail of cost composition of construction projects can be seen at table 2.

Table 2: Cost composition of construction projects.

Cost composition of construction projects	Project	Detail	
	Cost of the project		Labor costs
			Material costs
			Machinery costs
	Enterprise management fees	Personnel salaries and office expenses	
	Unforeseeable expenses	All expenses arising from unforeseen emergencies	
	Regulatory fees	Regulations on Payment of Fees	
Taxes	Payment of national fees		

In engineering construction, cost overruns often occur, and cost overruns will have a direct impact on the benefits of the project, which is related to the vital interests of the construction unit. Since the new era, the continuous expansion of the development scale of the construction industry, coupled with the rise of various advanced technologies and the updating of construction equipment, has created favorable conditions for its rapid development. However, while the industry is flourishing, issues related to cost management in engineering construction are gradually emerging. Among many issues, cost overruns have a high occurrence rate and a significant negative impact. In order to promote the healthy development of the industry and maximize the economic benefits of construction units, scholars have conducted research on the issue of engineering cost overruns, aiming to clarify the factors affecting overruns and provide direction for effective management of construction project costs. Kumar TU's research shows that construction delay is one of the common problems in the construction industry, and this problem has a significant negative impact on project construction time, cost, and quality. In addition, improper planning, insufficient comprehensive capabilities of contracting units, low construction efficiency, harsh environment, and frequent changes in construction plans are the primary factors affecting the time and cost of engineering construction^[3]. Generally speaking, construction units will prepare budgets for the possible costs incurred in each link in the early stage of project construction, and further control the project cost through project cost, mainly reflected in on-site mechanical equipment selection cost control, raw material procurement cost control, installation cost control, and personnel cost control. However, due to various unpredictable situations during the construction period, these situations are likely to lead to an increase in construction costs, resulting in the phenomenon of project cost overruns. Muhammad Ilyas conducted an in-depth investigation into the cost and time overruns of construction projects in Malaysia and identified three of the most influential factors: improper arrangement by the contracting unit, unreasonable site selection, and insufficient experience of the construction team^[4]. From a holistic perspective, the emergence of environmental, site selection, planning and other influencing factors is often caused by unscientific scheme design, while the insufficient capacity of contracting units is mainly due to the lack of comprehensive and strict qualification review of the winning bidder during the bidding stage. Low construction efficiency and lack of personnel experience are caused by inadequate construction supervision. In addition to these three factors, industry policies and regulations will also have a certain impact on the effectiveness of cost control.

3. Analysis of Factors Influencing Cost Overruns in Construction Projects

3.1. Policies and Regulations

Any industry should be guided by national policies and relevant regulations in its business development process, and the construction industry is no exception. Policies and regulations can reflect the various requirements of the country for the operation and development of the industry, and also provide precise basis for the scientific formulation of development decisions for various enterprises in the industry. If development strategies are not deployed in combination with industry policies and regulations, the industry is likely to fall into development difficulties. In engineering construction, the influence of industry policies and regulations is widespread, reflected in various aspects of engineering construction and management. It should be noted that industry policies and regulations have a direct impact on the effectiveness of engineering cost management. Even minor policy adjustments can have a significant impact on engineering costs, increasing the risk of cost overruns^[5]. Therefore, construction

units should always pay attention to policy directives and laws and regulations related to construction project costs, adjust budget plans flexibly according to actual changes, and ensure the effectiveness of cost management. However, in reality, some construction units did not consider the potential impact of policies and regulations on cost management when preparing project budgets in the early stage, and the guiding role of policies and regulations in engineering construction cost management was not fully reflected. In this situation, raw material management, cost expenditures, and allocation of construction resources may all be affected, leading to an increase in construction costs and even hindering the smooth progress of later construction management work.

3.2. Project design

In the project design stage, whether the engineering design is reasonable and whether it can meet the needs of the owner is a key factor affecting cost overruns. Drawing design is an important part of architectural engineering design work. In construction, drawings are extremely crucial construction materials and the prerequisite foundation for the orderly progress of construction work. From the perspective of construction principles, the construction party needs to plan the construction plan reasonably based on the drawing design, and the preparation of the engineering cost budget also needs to refer to the drawings. So, after the drawing design is confirmed, it cannot be adjusted arbitrarily, otherwise it will bring unnecessary trouble and also cause a series of problems such as increased costs. Kawmudi N et al. explored the possible influencing factors of cost overruns in construction projects in Sri Lanka in their research. They used questionnaire and interview methods to collect relevant data, and processed the data using relative index method and content analysis method. Finally, they identified three factors: poor initial estimation, deviation in project construction plan, and project overtime completion^[6]. It can be seen that the initial scheme design has a significant impact on the efficiency of later construction and the cost management of the entire project. It is generally believed that when designing engineering and construction plans, the feasibility and economic applicability of the building should be comprehensively considered, while also taking into account construction technology, terrain, and on-site operating environment. The above factors need to be carefully considered in the initial design stage, and the best construction plan should be determined based on this. Otherwise, it is likely that adjustments to the design drawings and plans may be required due to the difficulty of construction in the later stage, increasing unnecessary cost expenditures. In principle, on the basis of meeting the requirements for building use, cost savings can be achieved by reducing the flow space. But if there are uncontrollable factors, the relevant problems can be solved through design changes, and after the design changes, the drawing design should also be adjusted according to the actual situation. In addition, the design of building engineering schemes can also be influenced by human factors. For example, designers have insufficient understanding of the internal structure of the project, and there are certain problems with the design of the drawings and the entire construction plan, which do not match the actual construction. In order to reduce the impact of design problems on the efficiency and effectiveness of the project construction, it is necessary to appropriately rectify the construction plan during the subsequent construction period. This type of plan change not only increases the construction workload, but also leads to cost overruns^[7]. In addition, when designing the construction plan, full consideration should be given to factors such as lighting and heating to avoid changes in the plan due to poor lighting and heating effects during later construction, and to minimize the possibility of cost overruns.

3.3. Engineering bidding and tendering

Tendering and bidding is one of the key links in engineering construction, which is the process by which the engineering development unit selects the contracting unit and establishes a cooperative relationship with it. However, there are also some unpredictable risk factors that may have an impact on the engineering cost. If ones want to avoid cost overruns during the bidding process, he need to choose a reliable contracting unit to ensure that the project can be constructed in a step-by-step manner according to established standards. However, during the bidding process of construction projects, some units may engage in unfair bidding behavior in order to obtain the qualification for winning the bid, which contradicts the concept of fair bidding. Construction units should be vigilant about this. For example, in order to successfully win the bid, some contracting units may maliciously lower their prices and obtain the qualification for winning the bid through a low price competition strategy. This approach not only leads to more intense competition in the bidding process, but also may affect the quality of engineering construction^[8]. In the case where the contracting unit successfully wins the bid at a low cost, in order to ensure its own interests, the contracting unit often continuously adjusts the

construction plan in the later stage of construction, or obtains greater benefits through bad methods such as cutting corners and materials. This will inevitably increase the risk of engineering construction, increase the difficulty of cost control, and even infringe on the rights and interests of the construction unit. In addition, incomplete bidding documents are also a major factor affecting cost overruns. The bidding documents are the main channel for bidders to understand the detailed information of engineering projects. If the content of the documents is not comprehensive enough, the description is unclear, and the key information is not prominent enough, it will lead to the problem of information asymmetry. Bidders will find it difficult to obtain the required information through the bidding documents, and their understanding of the purpose of the engineering project will not be further improved. In this case, budget deviations may occur.

3.4. Construction stage

The various potential risks during the construction phase not only hinder the orderly progress of the established construction plan, but may also bring additional costs, leading to costs exceeding the budget limit. From an overall perspective, whether various construction steps can be implemented in accordance with engineering construction standards and procedures not only affects the quality of the project, but also has an impact on cost control. Mohammed Tayyab et al. conducted a study on cost overruns during the construction phase of high-rise building projects in India, identifying 70 factors that lead to cost overruns. They then conducted expert inquiries through a survey questionnaire and distributed questionnaires to 150 local professionals. Through Likert scale data analysis and ranking, they determined the importance index and found that engineering changes during the construction phase were the key factors causing cost overruns^[9]. After the engineering change, the relevant design schemes need to be adjusted synchronously, the original plan is disrupted, and even the early construction behavior becomes "useless", and the cost expenditures in this process are likely to go to waste. Normally, under the premise of meeting practical needs in decision-making and scheme design, following the established plan and procedure for construction is not only a key way to ensure the completion of the engineering project within the expected time period, but also a necessary condition to avoid cost overruns. In addition, before the construction of the building project, various materials need to be purchased according to the construction plan, and preliminary preparation work needs to be done. It should be noted that at present, the building materials market has not yet formed a unified standard for material quality control, which leads to uneven material quality. In this situation, strict control of material sources and quality is crucial for engineering cost management. Some unscrupulous manufacturers may cut corners and compromise the quality of building materials for personal gain. If these materials are misused, it can have an extremely serious impact on the safety of construction projects, often requiring more funds to remedy the situation, which will inevitably increase cost expenditures. Some unscrupulous individuals, in order to profit from purchasing raw materials, may substitute inferior materials for high-quality building materials, resulting in frequent problems during the construction process, which not only delays the construction period but also increases additional costs^[10]. In this regard, construction units should strengthen communication with construction units and conduct construction supervision, requiring construction units to strictly control the quality of building materials and not purchase raw materials with unknown sources and substandard quality to save funds. In addition, the rationality of the procurement time for building materials can also affect project costs. If the time is too late, it may affect the construction plan, while if the time is too early, it will result in more material storage and maintenance costs.

4. Conclusion

This article is based on the perspective of scientific metrology and conducts research on the problem of cost overruns in construction projects through literature search, review, and summary. It is found that industry policies and regulations, design changes, adverse bidding behavior, and construction behavior are all key influencing factors of cost overruns. Based on these influencing factors, construction units should strengthen engineering cost control, improve the engineering design change system, improve the bidding system, and increase supervision of construction units to avoid unnecessary cost consumption during the construction period, so as to generate greater economic value for the construction project and ensure that the economic benefits of the unit are not influenced.

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