

On the Construction of Cost Control System for Infrastructure Projects in Colleges and Universities

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Abstract: At this stage, the rapid development of China's higher education and the in-depth advancement of education system reform have put forward higher requirements for campus capital construction. In this context, how to make full use of the limited infrastructure funds to meet the needs of the majority of teachers and students for campus infrastructure is an issue that is widely concerned in the field of college and university capital construction management at present. This paper reinterprets the goal of cost control from the perspective of college capital management, that is, to maximize the cost-effectiveness of the project life cycle by constructing a cost control system in the process of infrastructure management. The article combined with the actual situation of university infrastructure management, in-depth analysis of the project implementation process of cost control commonly faced by the difficulties and problems, by summarizing the years of experience in infrastructure work, from the infrastructure project feasibility study report preparation, program and construction drawing design, bidding management, construction management, settlement audit and so on several aspects of the cost control of the specific measures listed one by one. After analyzing and researching, it is pointed out that the cost control of university infrastructure projects is carried out throughout the whole process of project construction, which is a forward-looking, dynamic and systematic management activity, and it requires active communication and close cooperation among all the participants to form a complete management system in order to realize the ultimate goal of cost control.

Keywords: University Infrastructure Management, Project Cost, Cost Control System

1. Introduction

In recent years, with the development of China's higher education and the deepening of the reform of the education system, higher education has put forward higher requirements for campus infrastructure construction. In order to optimize educational resources, most colleges and universities have repaired and renovated their old campuses, and some colleges and universities have initiated the construction of new campuses, which makes the number of infrastructure projects increase and the scale of the projects gradually increase. However, most colleges and universities have limited fund-raising capacity, and the project construction funds mainly come from financial allocations, how to effectively utilize the construction funds and better play the investment benefits, which is crucial for the management of college capital construction, therefore, the cost control has been generally valued in the field of college

and university infrastructure management. Some scholars compare the cost of university infrastructure projects with the cost of the real estate market, believing that the efficiency of the management model of university infrastructure projects is low, ignoring the fully functional characteristics of university infrastructure projects, and lacking differences in the quality requirements of engineering entities. There is still some research space on how to formulate and improve standards and norms related to engineering cost, and improve the standardization level of engineering cost management.

In view of some of the current problems of cost control, this paper will combine the author's work practice, reinterpretation of the objectives of cost control with a developmental perspective, in-depth analysis of cost control in recent years, generally faced with the problem of cost control, pointed out that cost control throughout the implementation of the whole process of infrastructure projects in universities, covering the project feasibility study, design, bidding, construction,

settlement and other aspects of the project through the project phases of the interconnection of each phase to gradually form a more complete management system. Then, from the perspective of building cost control system, it puts forward the cost control initiatives in the main aspects of infrastructure project management, aiming at providing useful reference for campus capital construction management. [1]

2. Interpretation of the Cost Control System

Generally speaking, project cost control refers to the determination, control, supervision and management of all construction costs required for pre-feasibility study, investment decision, design and construction of the project until completion and delivery of the project within the approved project cost limit, correcting deviations at any time to ensure that the project investment objectives are realized, so as to make reasonable use of manpower, material and financial resources in each construction project and to achieve good investment efficiency, and ultimately to keep the final account within the audited budget. In order to achieve reasonable use of human, material and financial resources in each construction project and better investment efficiency, and ultimately to realize that the final account of the completion of the project is controlled within the amount of the audited budget estimates. [2]

Traditional cost control tends to compression of construction costs based on the current construction standards, ignoring the project implementation period of policy, market and other uncertainties, as well as long-term life cycle costs after the completion of the project, resulting in the phenomenon of over-budgeting of the final accounts of the university infrastructure projects is very prominent, and the construction of the main body of the project implementation of the hard work, can not be reflected on the investment of the real savings. Some colleges and universities due to hasty decision-making beforehand, negligent management, so that after the final account cost disputes frequently. In view of this, cost control should be combined with the internal and external environment, from the perspective of project management as a whole, actively respond to the various difficulties that may be encountered in the project, and build a cost control system with a dialectical, comprehensive and systematic management model, so that the one-time investment in capital construction can be long-term, continuous and fully effective in the project life cycle, and realize the maximization of the cost benefits in the long term. [3]

3. Difficulties Faced by Cost Control in Practice

Due to the cost management of university infrastructure projects has the characteristics of multi-subjective, stage, dynamic and systematic [4], which makes the cost control easy to face all kinds of difficulties in the process of project

implementation. Through investigation and research, the difficulties and problems commonly faced by cost control in the construction of university infrastructure projects are as follows:

3.1. External Difficulties

The basis for investment estimates has a certain lag time. Currently, the investment estimation methodology generally used in the review of feasibility studies tends to be based on full.

The basic function of the project is sufficient for the standard compression of construction investment. However, with the long-term development of academic construction, talent training and deepening reform, scientific research and innovation is steadily advancing, the school teachers and students for the requirements of hardware and facilities are more and more presenting the diversity, personalization, flexibility, integrated features, compression of the construction investment to bring great difficulties in cost control at the same time, but also increased the project later operation and maintenance, repair and renovation costs. [5]

Relevant standards and specifications are likely to change during the construction period. In recent years, due to the project feasibility study approval and project implementation there is a certain time gap, the government attaches increasing importance to green building, fire, safety and other norms more and more stringent requirements, the corresponding supporting standards have also been raised year by year, coupled with raw materials, labor prices are generally rising, increasing the possibility of the final account over the budget to the construction of various projects to control the cost of construction has brought great difficulties.

3.2. Internal Difficulties

3.2.1. Widespread Rush to Meet Deadlines

On the one hand, the infrastructure project as a major issue in the development of universities, vulnerable to political factors, such as early completion of the school celebrations for the dedication; on the other hand, subject to the constraints of the university enrollment scale, in order to ensure that the timely occupation of the year, the year of the completion of the completion of the construction of the rush project in colleges and universities in general, in particular, the teaching building, the student cafeteria, the student apartments, and other projects usually have to be completed before new students report to the completion of the project [6], so that the construction organization needs to develop a series of measures to catch up with the schedule, in order to ensure the quality of the project as far as possible, the technical parameters of raw materials to improve, the price increases, long hours of continuous operation, the labor cost increases, and inevitably increase the cost of rush measures.

3.2.2. Unclear Functional Positioning of Construction Projects

Colleges and universities as the main body of teaching,

research work, administrative authority is relatively decentralized, the use of infrastructure projects, the management unit of the division of powers and responsibilities is not clear enough, resulting in the project design, construction process of adjusting, changing the use of the function of the phenomenon from time to time, to the cost of cost control has brought great difficulties.

3.2.3. The Various Stages of Project Cost Management Are Prone to Disconnection

Infrastructure projects are affected by the current stage of the division of higher education institutions into administrative departments and management institutional mechanisms.

The coherence of the implementation process management is not strong, the preliminary stage, construction, settlement and other aspects of the project are often divided into different management bodies, participating units are not the same, infrastructure management, supervision, with the department to undertake operational work at the same time, but also have to perform the corresponding administrative functions, it is difficult to focus entirely on infrastructure projects, such as the lack of unified management and effective communication, the project is prone to bias in the transmission of information at all stages of the project, causing the project to be inconsistent with the initial decision-making. Construction is inconsistent with the initial decision-making, which increases the difficulty of investment analysis and is not conducive to cost control. [7].

4. Specific Initiatives for the Construction of a Cost Control System

In view of the above difficulties and problems faced by the university infrastructure cost control, for the external difficulties, it is recommended to scientifically and reasonably prepare the investment estimate to form the basis of cost control with long-term benefits; for the internal difficulties, it is recommended to do a good job of cost-benefit analysis of rushing work within the scope of the institutional norms; taking into account the construction, use, management of all aspects of the factors for comprehensive consideration, and try to make clear the functional positioning and the main body of the project before the project. After that, unnecessary adjustments should be avoided or reduced; from the perspective of the project as a whole, communication and coordination of all aspects of infrastructure should be strengthened, so that infrastructure operations can be carried out in a relatively smooth, coherent and orderly manner. By constructing a complete, scientific and dynamic cost control system, balance the interrelationship of quality, progress and investment, and realize the reasonable and effective use of funds [8]. Specific measures are as follows:

4.1. Preliminary Management

4.1.1. Emphasize the Preparation of Feasibility Study Reports and Scientifically Formulate the Basis for Cost Control

Infrastructure projects are characterized by large investment, complicated work processes, high technical and quality requirements, and ultimately form fixed assets, which have far-reaching impacts on construction units. Feasibility study report is an important reference for the design mission statement of infrastructure projects, and the investment estimate is an important basis for the design estimate. A high-quality feasibility study report is a good start for effective control of project cost. Therefore, the construction unit in the preparation of feasibility study report, must analyze the necessity and feasibility of project construction according to the actual demand, overall consideration of the project's use of function, scale content, economic indicators, technical indicators and other important information, and strive to estimate accurately, so as not to omit the item, reiterate the item, do not overestimate the calculation of the lesser, the formation of the Beijing senior professional and technical qualifications assessment declaration paperPage - 5Scientific and reasonable investment estimates. If necessary, they should be compared with the project settlements and final accounts of similar recently completed projects, so as to check for deficiencies and make adjustments. [9]

4.1.2. Grasp the Management of the Design Stage to Control the Project Cost

In the design stage, first of all, the use of value engineering should be emphasized, through the analysis and accounting, seeking to achieve the necessary use of functions at a reasonable cost of the life cycle of the building. Due to the use of university infrastructure projects in different departments on the functional needs of the building, and some projects have relatively complex functional requirements, so infrastructure managers should actively communicate, in-depth investigation and research, collect and collate information, under the premise of meeting the necessary functions, try to maximize the investment efficiency, and appropriate for the maintenance of the subsequent management unit, renovation of a good reservation. Secondly, we should advocate the limit design, use the investment estimate to control the preliminary design, the preliminary design estimate to control the construction drawing design, to avoid and reduce the phenomenon that the project estimate exceeds the estimate, the budget exceeds the estimate, and the settlement exceeds the budget. Again, to strengthen the communication and coordination within the infrastructure management department, together with the university construction site management personnel to verify the construction drawings, confirm the feasibility of each professional practice, put forward rationalization proposals to reduce the occurrence of changes and negotiations in the later construction. [10]

4.1.3. Doing a Good Job of Bidding for Projects and Rationally Reducing Project Costs

Tendering is an important part of cost control. At present, the bill of quantities is an important reference for the preparation of tender bids and tender offers, and is also an important basis for cost management. Therefore, in the process of list preparation, it must be strictly based on the relevant requirements of the bidding documents, according to the construction drawings, technical specifications, the actual situation on the project site, and calculated and prepared in strict accordance with the relevant standards and specifications. For the drawings may occur outside the project, such as sporadic labor, sporadic earth, sporadic machinery, etc., can be appropriate amount of compiled into the list, by the bidders on its own offer, these items in the final accounts only refer to the unit price, the amount of work by the site visa settlement. In order to improve the accuracy of the bill of quantities, in the bidding documents must emphasize the bidding unit to review the bill of quantities, such as found in the list of discrepancies with the drawings or omissions can be made to supplement, will be used as an integral part of the tender. Tender offer should contain a comprehensive unit price analysis of the project table, for the benefit of future. It is convenient to switch when the construction unit changes the project. [11] At the same time, the bidding process should prevent the phenomenon of winning bids below cost, leading to increased claims and jerry-building and poor construction quality in the construction process.

4.2. Construction Management

4.2.1. Reasonable Decomposition and Refinement of Cost Control Objectives

In order to effectively control the project cost during the construction period, the university infrastructure department in the various periods of project construction, combined with the actual situation to develop a reasonable cost control objectives, give full play to the role of the project budget, regularly convene the site management personnel and the cost of the actual value of the cost of the project cost and the target value of the comparison, to find out the deviation, analyze the reasons, and take effective measures to control in order to ensure that the cost of the cost control objectives are achieved.

4.2.2. Strict Control of Material Supply Chain

The quality of materials is directly related to the quality of construction, so the materials should be strictly inspected to prevent inferior products from entering the construction site. In addition, the price of materials is an important factor affecting the construction cost, under the premise of ensuring quality, reasonable control of material prices is an effective means to reduce the cost. In the construction process, should be timely investigation, serious research, to eliminate the phenomenon of changing the high price of materials on the grounds that can not find the prescribed brand. [12]

4.2.3. Strengthening the Organizational Management of Construction Sites

The cost management of the construction stage is the difficult point of the project cost control, the construction unit in this stage should be strictly according to the investment objectives and plans that have been determined to control the cost of the construction process of the project. First, rationalize the progress plan. Coordination of indoor and outdoor works of all professions in the order of entry, the overall realization of ancillary supporting, large and small outdoor works and the main project synchronization. Especially outdoor pipeline projects, such as water, sewage, rainwater, heat, strong electricity, weak electricity, gas, etc. The entry time and duration should be reasonably arranged to reduce the outdoor trench backfill gray soil and pavement paving is completed and then many times the phenomenon of excavation, to avoid all kinds of pipelines, inspection wells in order to avoid each other and increase the workload bypassing, and try to minimize the waste of the secondary construction. Do a good job in the actual project management technology Beijing senior professional and technical qualifications assessment declaration paper Page - 7 Combination of technology and economy, careful handling of cost-related technical measures in construction. [13]

Secondly, emphasize quality management. Do a good job of site preparation, strengthen process control, strict supervision of the operating process, nip unqualified factors in the bud, and take the necessary corrective and preventive measures to prevent the re-emergence of unqualified factors. Grasp the quality of the project, can effectively prevent the quality problems caused by stoppage, repair and even rework phenomenon, and further eliminate the occurrence of nesting costs, repair costs, scrap loss, re-inspection costs, accident treatment costs and other costs, but also reduces the waste of materials, labor costs increase, the risk brought about by the delay in the construction period, is a strong guarantee of cost control.

4.2.4. Standardize the Management of Design Changes and Engineering Negotiations

In the construction process, in principle, should try to avoid design changes, engineering negotiation, especially on the cost of changes have a greater impact. For the projects which are really necessary to change, we should pay attention to the acceptance and measurement of the change procedure, the determination of the change price and the amount of change works. Due to the special nature of the project itself, there are some hidden works and cross-process operations during construction, and the objective data after the end of the process will be difficult or even impossible to verify, so the project negotiation must be objective, accurate and timely. [14] When dealing with on-site negotiations, managers should distinguish whether the project is within the scope of the list and, if necessary, should work with the budget, audit and finance departments to study and deal with it, and record the process of dealing with it.

4.3. Project Settlement

Project completion settlement, is the basis for the construction unit to the construction unit to settle the project payment, is the final confirmation of the project cost. Therefore, the accuracy of project completion settlement is particularly important for the final control of project cost. In order to ensure the accuracy of the project completion settlement and effectively control the project cost, the school infrastructure management department, internal audit department and the commissioned auditing organization should work closely together. In particular, the infrastructure management department should pay attention to the file management, collect and organize all the information required for the audit of the project completion settlement, including the construction contract, bidding documents, construction completion drawings, engineering changes and hidden works visa, engineering qualified acceptance form, construction unit reported for review of the project. Settlement book and so on, and carefully check to ensure the authenticity, completeness and validity of the engineering audit information for the follow-up to carry out the completion of the settlement audit work to lay a good foundation. [15] Auditors should be handed over to the infrastructure department of the project audit information carefully check and audit, against the project construction contract, clear contract terms agreed upon in the project settlement methods, pricing basis, pricing quota, fee standards, material price concessions, etc., the approved amount of work, audit engineering changes and hidden works visa, and timely with audit opinions.

5. Conclusion

In summary, the cost control mode of university infrastructure projects has been gradually shifted from the traditional "point" control to the "line" and "surface" dynamic system control of the whole process of the project, which will help to improve the cost control system of university infrastructure projects to a certain extent. By constructing the project cost control system, coordinating the management of all stages of the project, the work of all parties involved in the interface, and strengthening the infrastructure management department and the school audit, finance and other related departments to work closely and cooperate, to a certain extent, it will help to enhance the level of management of the university capital construction, and better play the role of the capital construction for the development of higher education to ensure the role of the development of the cause.

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Conflicts of Interest

The authors declare no conflicts of interest.

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