ART AND DESIGN PRESS INC
(United States)

2025 Volume 1, Issue 1
Economic Development Studies

Research on Risk Identification and Control of Bidding for Construction of College Training Site Projects

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Abstract: The bidding process for the construction of teaching and training facilities in higher education institutions faces multiple risks, including insufficient market research, procurement demand deviations, inadequate professional evaluation, and supplier qualification fraud. These risks can lead to failed bids, project delays, or substandard delivery quality. This paper explores strategies for identifying and managing bidding risks in the construction of university training facilities, systematically analyzing the characteristics of the bidding process and the sources of risk. Using tools such as risk matrices and cause-effect diagrams, it identifies risk sources systematically, sets risk management goals, and designs control strategies, including legal norms, professional capability enhancement, and dynamic management mechanisms. This provides theoretical support and practical approaches for risk prevention and control in university bidding processes.

Keywords: bidding; risk management; risk control

Online publication: July 20, 2025

1. Introduction

As a vital component of higher education infrastructure, university training facilities serve multiple functions, including physical education, athletic training, competition activities, and fitness for faculty and students. The quality of construction and management directly impacts the effectiveness of school sports programs and the quality of talent development. In recent years, with the continuous increase in national investment in higher education and the deepening implementation of the 'Healthy China' strategy, the development of university training facilities has seen unprecedented opportunities. However, these facilities also face stricter policy regulations and regulatory requirements.

From a policy perspective, the State Council's' Several Opinions on Accelerating the Development of the Sports Industry and Promoting Sports Consumption 'clearly states the need to' improve all types of sports facilities. 'The Ministry of Education's 'Standards for the Allocation of Sports Venues in Ordinary Higher Education Institutions' sets specific requirements for the construction standards, functional configurations, and management of sports venues in higher education institutions. From an educational development standpoint, as the 'Double First-Class' initiative advances, universities are placing higher demands on the quality of talent cultivation. As a key component of quality education, the level of sports facility construction has become a significant indicator of a university's overall strength. In terms of functional changes, modern university training facilities have evolved from a single teaching and training function to a more diverse and multifaceted approach.

To adapt to the evolving educational landscape of the new era, enhance teaching and training facilities, and improve the learning experience for both teachers and students, universities annually undertake numerous construction and renovation projects. These projects focus on acquiring high-quality materials and constructing state-of-the-art facilities. However, due to the current procurement methods and bidding environment, as well as various policy and market constraints, issues such as failed bids and abandoned projects often arise during the implementation process. The bidding process for university training facility construction projects is fraught with procedural, technical, integrity, and management risks, which can directly impact project quality, the efficiency of fund utilization, and even lead to integrity issues.

To this end, this paper systematically analyzes the characteristics and risk sources of the bidding process in the construction of teaching and training facilities at universities. It identifies and analyzes potential risk points in the bidding process, using tools such as risk matrices and cause-effect diagrams to systematically identify risk sources. The paper proposes control strategies, including legal norms, professional capability enhancement, and dynamic management mechanisms, to provide theoretical support and practical approaches for the prevention and control of bidding risks in universities.

2. Analysis of the characteristics of bidding for the construction of teaching and training site conditions in colleges and universities

As a special educational infrastructure, the construction bidding process of university teaching and training facilities not only shares common characteristics with general engineering projects but also exhibits distinct professional features. A thorough analysis of the unique aspects of such project bidding can help accurately identify risks and optimize control strategies. The bidding for the construction of university teaching and training facilities has the following characteristics.

2.1. The project must be completed within a strict timeframe, and construction must avoid the teaching cycle (such as winter and summer breaks).

The bidding timeline should be scheduled in reverse to prevent delays that could disrupt the teaching schedule. Unlike other organizations, universities have a regular pattern of class schedules and holidays. Whether it's a material or engineering project, construction often requires working during times when teachers and students are not using the facilities, such as weekends, holidays, and winter and summer breaks. By scheduling the bidding process based on construction times, the entire bidding timeline can be clearly defined. This means that the project leader must consider various potential delays during the bidding process. If the bidding is delayed, the project may not be completed by the scheduled time[1], leading to serious consequences, such as classroom renovation projects not being completed before the start of the new semester, which would leave teachers unable to teach.

2.2. The high complexity of professional training and teaching in modern universities has evolved from a single function to a multifunctional setting, which must meet multiple needs such as professional training, physical education, competitions, physical fitness tests, and teacher-student fitness activities.

This setup involves various types of venues, including smart classrooms, laboratories, and sports facilities, with significant differences in technical specifications, necessitating interdisciplinary collaboration. The diversification of functions poses significant challenges for the preparation of tender documents: it is essential to accurately convey the technical requirements of the user departments while avoiding biased clauses that could restrict competition. Universities are comprehensive, large-scale institutions with a high degree of specialization, typically featuring hundreds of different types of classrooms (such as ordinary classrooms, smart classrooms, lecture halls, and seminar rooms), laboratories for various disciplines, outdoor sports areas, and indoor comprehensive sports facilities. The professionalism of bidding projects for different venues varies significantly.

2.3. High demand for multi-department collaboration.

Modern university teaching and training facilities have evolved from single-function to multifunctional, meeting the needs of professional training, physical education, competitions, physical fitness tests, and faculty and student fitness. The bidding process for university teaching and training facility projects involves multiple internal departments, including infrastructure, sports, assets, finance, auditing, and disciplinary inspection. Each department has different focuses: the sports department emphasizes functional requirements, the infrastructure department focuses on project implementation, the finance department controls investment budgets, and the disciplinary inspection department guards against integrity risks. While this multi-departmental involvement helps to comprehensively manage project risks, it can also result in a lengthy decision-making process and reduced efficiency. The bidding process, involving multiple departments such as assets, logistics, and finance, is complex and prone to communication issues, which can lead to omissions.

3. Analysis of risk sources in bidding for construction of teaching and training site conditions in colleges and universities

The bidding process for the construction of teaching and training facilities in higher education institutions, as a complex system project, involves a variety of risks at multiple levels. These risks are present throughout the bidding process and involve various dimensions such as institutional design, operational execution, technical standards, and the behavior of the parties involved. A thorough analysis of these risk sources and their interaction mechanisms is essential for establishing an effective prevention and control system. This section will systematically analyze the risk sources of the bidding process for the construction of teaching and training facilities in higher education institutions from five perspectives: institutional environment, party behavior, technical characteristics, market conditions, and process management, to reveal the underlying logic of risk formation.

3.1. The policy and legal framework is incomplete.

The regulations applicable to the bidding for the construction of teaching and training facilities in higher education institutions overlap, have gaps, and lack clarity. While the ‘Bidding and Tendering Law’ and the ‘Government Procurement Law’ [2]along with their implementing regulations form the basic legal framework, they lack specific provisions for special construction projects in the education sector. Particularly, there is a lack of detailed implementation rules and technical standards for professional projects like teaching and training facilities, leading to significant discretionary space in practice.

3.2. Deficiencies in the internal management systems of universities.

The design of bidding and procurement systems within universities often emphasizes procedures over expertise. While most universities have established relatively comprehensive bidding process management systems, they lack specific regulations for specialized projects like teaching and training facilities. This is evident in unreasonable procurement requirements and evaluation criteria. Bidding documents often contain vague or missing technical specifications, and the subjective nature of evaluation standards undermines fairness. Additionally, the expert database lacks dynamic management, and some experts are not familiar with specialized equipment or engineering fields, leading to inaccurate technical evaluations.

3.3. The risks at the entity behavior level are diverse.

A significant risk stems from the limitations in professional capabilities of universities as tendering entities. The construction of teaching and training facilities requires high technical standards, but university infrastructure departments often lack specialized sports facility personnel, leading to inaccurate needs and unprofessional tender documents. Departmental interests can affect the fairness of the bidding process. The construction of teaching and training facilities involves multiple departments, including infrastructure, sports, and assets, and differing departmental stances may lead to bidding plans deviating from the optimal choice. Bidders may engage in false bidding, such as fabricating

qualifications, fictitious performance records, or maliciously bidding at low prices, which can result in insufficient performance capabilities and project quality risks. The construction of teaching and training facilities requires professional qualifications, but some unqualified enterprises participate in bidding through affiliation, and after winning the bid, the actual construction teams do not match the promised commitments. Bidders may intentionally lower the quoted prices for obvious items and inflate those for hidden items to increase their chances of winning the bid, and later obtain excessive profits through changes and claims. Bid rigging disrupts the competitive order. The market for constructing teaching and training facilities has certain professional barriers, and the number of qualified bidders in the region is limited, making it easy for interest alliances to form.

4. Risk management objectives for the construction of teaching and training site conditions in colleges and universities

As a special educational infrastructure, the construction of teaching and training facilities in higher education institutions involves multiple stakeholders, complex technical requirements, and strict standards. Risk management is crucial. A scientifically sound risk management system can effectively prevent and address various risks that may arise during bidding, procurement, construction, operation, and maintenance, ensuring the realization of project quality, schedule, investment, and safety goals. It also helps to prevent corruption risks and enhance the efficiency of fund utilization.

4.1. Core Objective: Integrated Quality Assurance.

The primary consideration in risk management for teaching and training venues is functional adaptability. Risk management must ensure that the constructed facilities fully meet the diverse needs of physical education, sports training, competition activities, and teacher and student fitness, with all functional indicators meeting professional standards. The safety and reliability goal is a non-negotiable red line. Teaching and training venues directly impact the personal safety of teachers and students, and risk management must ensure the structural safety of buildings, the operational safety of equipment, and the absolute safety of use. The economic rationality goal emphasizes maximizing the efficiency of fund utilization. Risk management should control construction costs through scientific decision-making, standardized bidding, and meticulous management, ensuring quality and safety while avoiding waste and overruns. Key areas for control include design changes, material substitutions, and on-site endorsements, to prevent risks such as unbalanced quotations and false claims. The compliance and integrity goal is a special requirement for public projects in higher education institutions. Risk management must ensure that the entire project construction process complies with laws and regulations such as the Bidding and Tendering Law and the Government Procurement Law, preventing risks such as bid splitting, bid rigging, and interference by leaders.

4.2. Process Objectives: Full Life Cycle Risk Management.

The goal of risk management during the decision-making phase is to ensure that project initiation is scientifically sound, requirements are clear,[3] and plans are reasonable. This involves conducting professional feasibility studies and demand analysis to avoid fundamental risks caused by decision-making errors. In the design phase, the objective is to achieve a balance between technological advancement, economic rationality, and constructability. This is achieved through design reviews, value engineering analyses, and other methods to prevent design flaws and improper standards. During the bidding phase, the aim is to ensure full competition, standardized procedures, and the selection of the best bidder. This is accomplished through scientific bidding planning, meticulous document preparation, and standardized evaluation processes to prevent risks such as bid rigging, qualification hanging, and unfair evaluations. In the construction phase, the focus is on ensuring quality compliance, controlled progress, and accident-free safety. This is achieved through strict process supervision and professional quality inspections to prevent risks such as cutting corners, non-compliance with technology, and safety hazards. In the operation phase, the goal is to achieve efficient facility utilization, controllable maintenance costs, and extended service life. This is achieved through scientific operational plans and preventive maintenance to

prevent risks such as facility idleness, excessive wear, and premature aging.

4.3. Tiered Objectives: Differentiated Risk Management.

The goal for major risks is 'absolute avoidance,' which includes structural safety hazards, significant integrity issues, and severe cost overruns that could lead to catastrophic outcomes, thereby effectively increasing the success rate of bidding. By scientifically predicting and avoiding risks (such as supplier qualification fraud and evaluation biases), the aim is to reduce the likelihood of failed bids and ensure projects proceed according to plan. For significant risks, the objective is 'effective control,' which includes functional defects, common quality issues, and general procedural violations that could significantly impact project goals. Through legal norms and process supervision, the aim is to reduce bid rigging, contract loopholes, and other irregularities, maintaining a fair competitive environment. For general risks, the goal is 'reasonable acceptance,' which includes minor design changes, material price fluctuations, and weather impacts that have limited effects on project goals. This involves accurately identifying demand deviations and technical parameter tendencies to ensure efficient use of funds and improve procurement quality.

5. Risk management strategy for the construction of teaching and training site conditions in colleges and universities

5.1. The system employs risk identification methods to achieve early-stage risk assessment.

The Delphi method is particularly suitable for identifying risks in the early stages of constructing teaching and training facilities. This method involves anonymously soliciting opinions from sports facility experts, engineering construction experts, and management experts. Through multiple rounds of feedback, a consensus is gradually reached, systematically identifying potential risks at each stage of the project. Experts' opinions are collected anonymously, and multiple rounds of feedback are integrated to form a risk list, such as gaps in supplier qualification reviews or ambiguous contract terms. The method uses a back-to-back communication approach to gather predictive opinions from the expert panel members. After several rounds of consultation, the predictions from the expert panel become more focused,[4] leading to a final conclusion that aligns with future market trends. The WBS-RBS matrix method (Work Breakdown Structure-Risk Breakdown Structure) is used to systematically identify risks at each work stage. The construction project of teaching and training facilities is broken down into decision-making, design, bidding, construction, and acceptance stages. Each stage is further divided into specific work packages, and potential risk factors are identified for each work package, forming a risk list. The historical data analysis method involves analyzing historical risk events of similar projects to identify common risks in the construction of teaching and training facilities. A database can be established for university sports facility construction projects to statistically analyze the occurrence frequency and impact level of various risks. The scenario analysis method is especially useful for identifying sudden risks in the construction of teaching and training facilities. By setting various possible scenarios (such as changes in competition standards, extreme weather, and skyrocketing material prices), the impact on project goals is analyzed. Analyze similar project cases (such as complaints caused by parameter tendency in the laboratory renovation of a university) and extract risk prevention and control experience

5.2. By comprehensively applying risk assessment methods, we can achieve effective risk evaluation.

The risk matrix method is the most commonly used tool for assessing risks in construction projects of teaching and training venues. It evaluates identified risks based on their probability of occurrence and impact. Typically, a 5x5 matrix is used to categorize risks into high, medium, and low levels. The fuzzy comprehensive evaluation method is suitable for assessing risks in teaching and training venue construction that are difficult to quantify. Experts are invited to evaluate various factors (such as technical complexity, market maturity, and management difficulty) and provide fuzzy scores for each risk, which are then combined using algorithms to derive a comprehensive risk value. This method is particularly effective for assessing subjective risks, such as 'unprofessional bidding experts' or 'vague sports process acceptance standards.' The Monte Carlo simulation method is used to assess the overall risk level of construction projects of teaching and training

venues, especially investment and schedule risks. It simulates thousands of possible project scenarios using computers, analyzing the probability distribution of key indicators (such as total cost and total duration). The fault tree analysis (FTA) method is used to analyze the pathways leading to major risks in teaching and training venues. Starting from the top-level risk event (such as 'structural collapse'), it decomposes all possible causes and logical relationships leading to this event, calculating the probability of occurrence.

5.3. System design risk response methods to reduce the probability of risks. Risk avoidance is the most thorough strategy, suitable for major risks in the construction of teaching and training facilities.

By altering project plans or abandoning risky activities, the likelihood of risks occurring can be fundamentally eliminated. Common measures include: adjusting design plans to avoid technical challenges; changing procurement methods to avoid market risks; terminating non-compliant contracts to prevent integrity risks. Risk transfer involves transferring part or all of the risk to a third party through contracts or insurance, which is suitable for specialized risks that universities find difficult to manage on their own. The main methods include: purchasing engineering insurance to transfer the risk of accidental losses; adopting the EPC model to transfer the risk at the design and construction interface; requiring performance guarantees to transfer the risk of contractor breaches. Risk mitigation is an active strategy to reduce the probability or impact of risks, suitable for risks in the construction of teaching and training facilities that cannot be entirely avoided. Specific measures include: strengthening design reviews to mitigate the risk of design defects; enhancing process monitoring to control quality risks; optimizing construction organization to mitigate schedule risks. Risk retention is the proactive acceptance of unavoidable and controllable risks, suitable for general risks in the construction of teaching and training facilities. This can be divided into planned retention (such as setting up a risk reserve fund to address material price fluctuations) and unplanned retention (such as passively accepting unidentified risks).

6. Conclusion

This article systematically explores the risk management and control of bidding for the construction of teaching and training facilities in higher education institutions, highlighting three key features of such projects: strict timeliness, high professionalism, and multi-department collaboration. By thoroughly analyzing the sources of risk, the study innovatively constructs a 'four-in-one' risk management goal system, which includes core requirements such as functional compatibility, safety and reliability, economic rationality, and compliance and integrity. It also proposes a lifecycle-based hierarchical control approach. Methodologically, the Delphi method and WBS-RBS matrix are used to achieve precise risk identification, and scientific assessments are conducted using a risk matrix and fuzzy evaluation. This results in a diversified response strategy that includes avoidance, transfer, mitigation, and retention. The research not only enriches the theory of risk management in educational infrastructure projects but also provides a practical, systematic solution for higher education institutions through an operational control framework.

Disclosure statement

The author declares no conflict of interest.

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