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Infrastructure Construction of the New Campus of Vocational Colleges and Universities: Practical Reflection and Optimisation Countermeasures

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Abstract: There is a continuous demand for vocational colleges and universities to improve the conditions of running schools. The domestic academic community has carried out a lot of research on the planning and design of new campuses in colleges and universities, cost control, project risk management, etc., and the relevant results have provided theoretical support and practical reference for project management. However, in the process of constructing new campuses in some colleges and universities, there are outstanding problems such as delays in the construction period, the estimated budget exceeding the risk that can be studied, and an unreasonable campus function layout. This article combines the practice of real construction projects, conducts research from the three dimensions of project overview, existing problems and optimization path, sorts out possible problems in the process, summarises the lessons learned from project construction, puts forward optimisation countermeasures, and provides practical reference for the infrastructure projects of new campuses of similar vocational colleges and universities.

Keywords: Vocational colleges and universities; New campus construction; Infrastructure; Cost control; Project risk

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1. Project construction overview

Many vocational colleges and universities have old campuses that have been built for a long time, the scale of land use is tight, school buildings, practical training sites and other infrastructure are ageing, and it is difficult for the on-campus space to meet the needs of teaching, practical training and accommodation after the expansion of enrolment. Some teaching classes and student dormitories rely on off-campus rental sites to ensure basic school management, and off-campus rental sites are scattered and messy. This brings hidden dangers to campus safety management and teaching. In order to make up for the shortcomings in the development of regional vocational education and improve the overall hardware conditions of colleges and universities, a new campus construction project of vocational colleges and universities was launched

in a certain place. However, in the whole process of promoting the project, there are shortcomings in the early research and judgement, planning scheme design, engineering cost management, external construction conditions coordination, third-party institution management, etc. , a variety of risk factors are intertwined, which restricts the overall construction effect of the project. The relevant construction should follow the construction standards of higher vocational schools and draw on the experience of planning new campuses of colleges and universities [1,2].

2. Outstanding problems in project construction

2.1. The preliminary basic research work is not meticulous enough, and the investment estimate is innately insufficient

The project feasibility study report and project proposal are the basis for project investment. The preparation cycle of project research and project proposals is relatively short, and the investment in work funds is limited. Local consulting institutions are entrusted to carry out the preparation work, and the professional and technical strength of the institution is limited. The preparation process is simply based on the construction drawings of ordinary high schools. The cost increase caused by the large area of the new campus of vocational colleges and universities, the long outdoor pipe network lines, and the complexity of the practical training supporting system is not fully considered. The investment forecast for site treatment, outdoor support, intelligence, greening, and other projects is obviously low [3,4]. There is a lack of professional project management units to follow up and intervene in the whole process, and there is not enough research on the current situation of the site and the construction needs in the early stage. The basis for the preparation of the budget is not solid enough, and some indicators refer to historical engineering data, which buries hidden dangers for the subsequent budget to exceed the estimate [5,6]. Once the proposed budget breaks through the estimated ratio of the policy red line, the project will face the risk of restarting or even leaving the project out of the warehouse, resulting in project stagnation [7,8].

2.2. Insufficient study and judgement of external constraints, and the high-voltage power grid constraint project is promoted

Large-scale college construction projects often encounter external preconditions such as high-voltage lines, pipeline relocation, archeology, etc. External factors greatly influence such work, and the implementation cycle is uncontrollable. There are multiple high-voltage transmission corridors inside the project site, and the construction of buildings, sports fields and other facilities cannot be carried out in the area. In the early planning and design stage, the scheme design is carried out directly according to the time node of the high-voltage line relocation plan. The default relocation can deliver the operation surface on schedule, and the difficulty and uncertainty of the implementation of the relocation work are not fully predicted [9,10].

The high-voltage line relocation work has not been implemented for a long time, resulting in the second phase of the project being forced to stall, and the design scheme can only be readjusted. Even if the second design work is carried out, the playground is still arranged within the control range of the high-pressure corridor. Due to the safety control requirements, it cannot be built that far. The campus lacks the necessary sports venues, and the overall construction period of the project is repeatedly delayed. This reflects that a major external risk identification mechanism was not established in the early stage of the project, the planned time was regarded as an established fact, and an alternative construction plan was not set up.

2.3. It is difficult for the service capabilities of third-party intermediaries to match the engineering needs

Whole-process tracking audit and cost consulting are important technical forces to control project investment and prevent project risks. The project tracking audit agency is determined by low-price bidding. The winning unit's business level is limited, and the on-site personnel stationed are weak. In the face of the complex construction projects of large-scale campuses of vocational colleges and universities, which involve multiple majors, it is difficult for audit units to achieve effective whole-process audit control, and they cannot timely identify the problems of budget deviations and visa changes [11,12].

It can be seen that if the selection of intermediary institutions simply takes the bidding price as the core judgement criterion, it is prone to the phenomenon of "low price and low quality" [13,14]. In order to reduce costs and reduce professionals, intermediaries cannot play the role of cost risk prevention and control, which may cause a concentrated outbreak of problems in the later stage of the project. The project management of the new campus construction of colleges and universities based on the PPP model can effectively prevent risks [15].

2.4. The design review time is rushed, and the functional layout of the campus is unreasonable

During the implementation of the project, the early stage is affected by the urgent start time, the design review time is rushed, and the functional layout is unreasonable. For example, the administrative office space is under-considered, the independent office space is not built, and the office design of the temporary office space does not fully consider the long-term needs in the later stage. The design of underground parking spaces is too small to meet the parking needs of office vehicles fully. The parking space position of the charging pile does not fully consider the temporary parking and charging needs, resulting in a non-charging vehicle occupying the parking space. Due to changes in external conditions, it is necessary to carry out secondary design, but the time for secondary design is rushed, and the functional layout is also not well considered. There is no underground parking area in the teaching and training area. The underground parking spaces are all centrally arranged downstairs of the dormitory and the restaurant. The parking needs of a large number of teachers and foreign training personnel during the teaching and training period are not met. The layout of parking spaces is not combined with the actual flow of people on campus, and the placement of many points is unreasonable, which easily causes congestion for people and cars. There are safety hazards.

In the design stage of the campus logo signboard, it only considers the needs of campus use. It does not coordinate with the urban planning management department in advance, and there is insufficient consideration of urban control requirements such as the logo's position, installation height, and lighting standards. If it conflicts with the requirements of urban planning in the later stage, it needs to be rectified on a large scale, increasing additional investment, and delaying delivery and use. Progress. The campus of vocational colleges and universities should not only meet the on-campus teaching operation, but also take into account the control of the urban landscape. The design stage must do a good job of external docking [16-18].

2.5. The cost control system is not perfect, and the risk of market and policy changes is not fully considered

The construction cycle of large-scale campus projects is long, and there are cyclical fluctuations in the price of the building materials market. Policy adjustments and changes in engineering processes will also bring about cost changes. The price of steel in the main construction stage of the first phase rose, and the cost of copper,

warehousing and transportation in the cable construction stage of the second phase rose. At the same time, the application of assembly-type buildings, the adjustment of the labour unit price policy, the change of the building foundation form, the elevation of the site and other engineering change factors further push up the project cost [19].

The reserve fee in the early stage of the project is insufficient, and all kinds of external supporting expenses such as power support are not included in the investment calculation. During the construction process, there is a lack of cost dynamic monitoring mechanism, and the risk of market price increase is insufficiently predicted. In the end, the design budget may exceed the researchable estimate, resulting in the policy risk of project re-approval [20].

3. Construction optimisation countermeasures

3.1. Do the preliminary work of the project and introduce the whole process of professional project management

Fully guarantee the working cycle and necessary funds for the preparation of feasibility study reports, project proposals and budget proposals, and do not blindly compress the preliminary consulting expenses. Strengthen the review of the preliminary results, stop simply copying the drawings of other institutions and directly applying the program, and carry out program preparation based on the positioning of the school. Hire professional project management units to participate in the whole process of project construction, carry out in-depth field research and judgement on the site conditions, network management scale and construction scale, and fully identify all kinds of unfavourable construction conditions of the site. Consolidate the basis for budget preparation, distinguish between different construction standards of teaching areas, living areas and practical training areas, and prevent the distortion of investment estimates. Strengthen the allocation of project managers on the owner's side, clarify the main responsibilities of each position, establish a normalised project regular meeting mechanism, improve the external consultation and communication mechanism, give full play to the professional support role of external consulting institutions, and select and hire consultants with rich experience in infrastructure projects of similar institutions to participate in program demonstration, risk assessment and other work. Reasonably plan the working hours and work responsibilities of the project team, carry out targeted learning around the campus infrastructure standards of vocational colleges and universities, the key points of the construction of practical training venues, and the control requirements of government investment projects, and make up for the professional shortcomings of the on-campus infrastructure team.

3.2. Identify risk constraints and improve the planning and design scheme

It is necessary to fully evaluate major external constraints such as uncertainty, high-pressure relocation, pipeline migration, etc., and formulate alternative construction plans. In the second design stage, important facilities should take the initiative to avoid restricted construction areas, reduce the repeated adjustment of the later plan, and avoid the problem that the plan cannot be implemented. Practice shows that it has little effect on allowing large-scale teachers and administrators to make suggestions, and even many teachers will be full of complaints. You can ask for opinions in a certain way, but don't take this as the only way. A field-specific expert review mechanism should be implemented. Experts will ask questions to the point. For the special traffic contents such as campus traffic flow organisation, people-car diversion, road line layout, etc., traffic planning professional experts are hired to carry out demonstrations to ensure campus traffic safety and reasonable traffic layout. For the core contents of the school, such as the layout of the teaching room,

the function of teaching use, and the adaptation of the campus teaching environment, experts in campus architecture are invited to conduct a special audit. At the same time, experts in construction, planning, fire protection, costing and other fields carry out comprehensive research and judgement on the overall design scheme, comprehensively investigate design defects, standardise conflicts and layout loopholes, sort out various problems in advance, unify the meeting, and form a complete demonstration record to ensure that the secondary design scheme is scientifically compliant and meets the needs of the school. The maximum avoidance of hidden dangers of later design changes and construction to the extent.

3.3. Optimise the selection mechanism of third-party institutions and abandon the low-price priority orientation

Bidding by third-party institutions for audit and cost consulting: change the model from only low-price bidding; comprehensively evaluate the past campus project performance of the institution, the professional strength of the on-site personnel, and the technical implementation plan; and give priority to third-party institutions with brand awareness. The brand itself is a value embodiment. Establish a process assessment mechanism for intermediaries, exit mechanisms, and clearly write them in the contract. During the implementation of the project, carry out a phased evaluation of service quality, require intermediaries to have professional staff, and give full play to the role of intermediaries in cost control and risk identification.

3.4. Strengthen multi-departmental joint review and improve the scientificity of secondary design

Establish a multi-party joint review mechanism for the school's use department, design unit, cost unit and planning department. Reasonably plan parking spaces in combination with the characteristics of campus traffic, and coordinate the parking needs of teaching and training areas and living areas separately. Implement the people-oriented design concept. Consider the actual needs of teachers and students to study and rest. For third-party service institutions such as bathing, hot water, air conditioning, laundry, etc., use them carefully to avoid problems such as increased usage costs and inconvenience to teachers and students. In the design stage of campus signs, take the initiative to connect with the competent department of urban planning, implement the relevant control requirements such as location, height, and brightness in advance, and reduce later changes and rectification. Vocational colleges and universities have a lot of practical training equipment. In the design review, the installation needs of follow-up practical training equipment should be synchronously matched to avoid the inability to adapt the practical training equipment after the completion of the building.

3.5. Improve cost risk control and reasonably reserve space for price adjustment and reserve fee

When preparing the budget, we should fully study and judge various risks such as price fluctuations of building materials, policy adjustment, project changes, external support, etc., fully reserve the project reserve fee, and take into account various supporting expenses such as electricity. During the construction process, dynamically track the market situation of building materials, establish a dynamic cost monitoring mechanism, strictly control the approval process of project changes, calculate all changes first and implement later, and strictly control the risk of budget overruns. For major building materials with large price fluctuations such as steel, copper and storage, price adjustment clauses are set in the contract to share the investment risks caused by market price increases.

3.6. Establish full-cycle risk monitoring and do a good job in construction and operation file management

Sort out all kinds of risk points in the whole cycle of the project and establish a risk ledger. Set up a risk warning node. Give full play to the main role of the user, participate in the review of the plan and construction drawings in advance, and put the needs of teaching, practical training and logistics in front of the design link. For the parts that you don't understand, the consulting builder will provide and explain before making a decision. Identify dedicated file managers, provide certain subsidies, and replace those who perform their duties poorly in file management as soon as possible. File management is the lubricant of the whole project. There are many aspects. Good file management makes work easier with less effort, and vice versa. Problem summary, work report, sending and receiving documents, and document processing and prompting are inseparable from large file management, and the project office should pay attention to this work.

4. Conclusion

The construction of a new campus of vocational colleges and universities is a systematic project, which cannot be separated from top-level design and support. The bones are not there, and the skin is safe. A good organisational structure, management mechanism and incentive mechanism are the foundation of project construction. Judging from project practice, the root cause of many construction problems is in the early stage of the project, and post-remediation is often expensive and takes a lot of time and energy. Project construction should learn from past practice lessons, shift the focus of management work to the front end, carry out preliminary research and judgement, improve the design review mechanism with multi-party participation, improve the cost risk control system, scientifically select third-party service institutions, properly handle various external constraints, and balance the scale of construction, functional requirements and investment. Only by investing in and controlling the relationship between the three can we build a campus infrastructure with perfect functions, controllable investment, and adapted to the characteristics of vocational education.

Disclosure statement

The author declares no conflict of interest.

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