

# Research on Refined Cost Management and Skilled Talent Training of Cultural Tourism Supporting Construction Projects in Free Trade Port

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**Abstract:** Against the backdrop of free trade port development, cultural tourism supporting construction projects feature profound integration of cultural elements, highly compounded functions, tight construction schedules and stringent quality standards, which bring brand-new challenges to refined construction cost management. This paper systematically sorts out distinctive difficulties in cost management throughout the whole lifecycle of cultural tourism supporting buildings from investment decision-making to operation and maintenance, including difficulties in pricing non-standard components and special-shaped decorations, measuring premium values of cultural craftsmanship, controlling interfaces of multi-disciplinary cross-collaboration, and optimizing full-lifecycle costs. On this basis, a refined cost management framework is established from five dimensions: precise pre-project planning, quota-controlled design, transparent bidding and procurement management, dynamic construction process supervision, and data-based completion settlement. In view of existing shortcomings in the supply of skilled talents, such as narrow knowledge scope, insufficient practical experience in cultural tourism projects and inadequate digital application capabilities, this paper proposes a talent training model featuring "tripartite collaborative education, work-study integration and digital empowerment" as well as its implementation approaches. The research can provide theoretical and practical references for the overall improvement of cost management performance of cultural tourism buildings in free trade ports.

**Keywords:** Free Trade Port; Cultural Tourism Supporting Buildings; Construction Cost; Refined Management; Skilled Talent

## Training

### 1. Introduction

Free trade ports are special economic zones with the highest opening level and most concentrated preferential policies. Their cultural tourism industries undertake multiple missions including showcasing regional culture, attracting international tourists and upgrading urban quality. Different from residential or ordinary commercial buildings, cultural tourism supporting facilities cover theme hotels, cultural exhibition halls, characteristic commercial blocks, performance centers, wellness and vacation complexes and other constructions. Such buildings are required to deeply integrate local cultural symbols, adopting unique and artistic architectural forms, decorative craftsmanship and landscape design, which raise higher requirements for construction cost management beyond the traditional "unified measurement and pricing" model.

Meanwhile, refined management has become the core trend for high-quality development of the construction cost industry. Refinement not only improves the accuracy of measurement and valuation, but also targets value control covering the whole process, all elements and full lifecycle. For cultural tourism supporting buildings, refined cost management faces a series of inherent dilemmas: balancing artistic pursuit of cultural expression against cost constraints, reconciling non-standard construction with standardized pricing, and coordinating short-term construction investment and long-term operation returns. Resolving these contradictions requires systematic management methodologies, as well as a compound team of skilled professionals who understand the characteristics of cultural tourism buildings, master refined control tools, and integrate cost expertise with cultural literacy[1].

Current academic research on refined

construction cost management mostly focuses on residential real estate or general public buildings, while discussions targeting the unique features of cultural tourism buildings remain insufficient. Studies on talent training rarely systematically integrate free trade port policy context, cultural tourism industry characteristics and professional education of construction cost. Filling this research gap, this paper conducts analyses from three layers including problem diagnosis, system construction and talent cultivation, so as to deliver systematic references for cost management practices of cultural tourism buildings in free trade ports[2].

## **2. Unique Difficulties in Cost Management of Cultural Tourism Supporting Buildings in Free Trade Ports**

### **2.1 Pricing Predicament of Non-Standard Components and Special-Shaped Decorations**

To create distinctive spatial experience and striking visual effects, cultural tourism buildings widely adopt non-standard design elements such as curved curtain walls, antique components, artistic sculptures, customized lighting fixtures and themed reliefs. No ready quota sub-items or market price benchmarks are available for these elements, making it impossible for cost engineers to simply apply conventional bill quantities or quotas for pricing. Even through market inquiry, distinctive craftsmanship, limited suppliers and highly scattered quoted prices undermine the rationality and objectivity of pricing[3].

### **2.2 Challenges in Measuring Premium Values of Cultural Craftsmanship**

Cultural tourism buildings frequently involve construction works featuring traditional and intangible cultural heritage craftsmanship, including hand-carved brickwork, mortise-and-tenon timber structures, painted murals and traditional tile construction. The working hours of craftsmen, material loss and finished effects of such works contain high uncertainties. Their value lies not only in physical labor input, but also in additional cultural and artistic creation value. Reasonably measuring such "cultural premium" in cost estimation-without underestimating craftsmen's labor while providing auditable pricing basis for investors-constitutes an in-depth challenge for refined management[4].

### **2.3 Complexity of Multi-Disciplinary Collaboration and Interface Control**

Cultural tourism supporting buildings integrate more than a dozen disciplines, including architecture, structural engineering, heating ventilation and air conditioning, water supply and drainage, electrical engineering, intelligent systems, stage machinery, acoustics, stage lighting, landscape architecture and interior artistic decoration. Intertwined interfaces between disciplines lead to frequent design alterations. For instance, the ceiling structure of a performance hall simultaneously involves five disciplines: structural load-bearing, fire sprinkler system, acoustic absorption, light suspension frame and decorative surface layer. Ambiguous interfaces easily trigger duplicate billing, missing items or later demolition and reconstruction. The conventional cost management model separated by disciplines fails to address such highly intertwined complexity[5].

### **2.4 Insufficient Full-Lifecycle Cost Perspective**

For cultural tourism projects, construction only accounts for 30% of total costs while operation covers the remaining 70%. Energy consumption, maintenance and renovation expenses during operation far exceed those of ordinary buildings. However, prevailing cost management practices center on initial construction investment during investment decision-making and design phases, with inadequate consideration of long-term factors such as operational energy consumption, equipment renewal cycles, maintenance difficulty and material durability. This easily leads to a dilemma where projects are affordable to build yet unaffordable to operate. Integrating full-lifecycle cost thinking into front-end cost control represents a critical bottleneck to be broken through[6].

### **2.5 Cumulative Variables Brought by Free Trade Port Policies**

The zero-tariff policy of free trade ports reduces costs of imported construction materials and equipment, though value-added tax still applies to certain high-end cultural tourism equipment. Low tax rates adjust contractors' quotation strategies and profit expectations. Facilitated cross-border personnel movement enables overseas design teams and special craftsmanship

artisans to participate in projects, yet introduces exchange rate risks and tax compliance costs for cross-border payments. These policy variables add new layers of uncertainty to cost management.

### **3. Construction of Refined Cost Management Framework for Cultural Tourism Supporting Buildings**

Targeting the above difficulties, this paper proposes a five-aspect refined management framework forming a closed-loop control system covering the entire project lifecycle.

#### **3.1 Investment Decision-Making Phase: Precise Planning**

Refined management starts from the earliest project stage. During feasibility studies, cost teams shall collaborate with planning, design and operation parties to fully demonstrate project positioning, business format combinations, customer group expectations and revenue models. When compiling investment estimates, practitioners shall avoid mechanically applying unit cost indicators of similar projects, and instead split total costs into three segments: general construction costs, cultural special costs and experience-oriented special costs. General construction costs refer to average levels of similar local buildings; cultural special costs are separately listed to cover intangible heritage craftsmanship, artistic installations and themed decorations; experience-oriented special costs include audio-visual interactive facilities and intelligent experience equipment. Separate estimation and balanced aggregation of the three segments guarantee structured and flexible investment estimates, laying reliable benchmarks for subsequent quota-based design.

#### **3.2 Design Phase: Quota Refinement**

The design phase serves as a critical window for cost control. Cultural tourism building design tends to prioritize visual effects, with scheme comparison overly emphasizing aesthetic impact while ignoring cost constraints. Refined quota-based design requires the following measures: first, decompose total investment limits into a quota matrix by discipline, spatial zones and functional systems, rather than assigning a single overall cap; second, set flexible ranges instead of rigid ceilings for cultural special expenses to reserve moderate space for creative design; third, introduce value

engineering to systematically examine cost optimization potential of structural selection, material substitution and simplified craftsmanship while preserving core experience effects. Taking antique facade design as an example, pure hand-carved stone in the original scheme can be partially replaced with precast glass fiber reinforced concrete components with partial manual finishing after value engineering analysis, significantly cutting costs while retaining visual consistency.

#### **3.3 Bidding and Procurement Phase: Refined Supervision**

Works of cultural tourism buildings feature strong professionalism and numerous non-standard purchased items. The conventional model of bill quantity bidding with the lowest bid winning easily triggers performance disputes and quality risks in later stages. Refined bidding and procurement supervision adopts classified procurement strategies: standardized civil engineering and installation works apply bill quantity bidding; non-standard artistic decorations, special-effect lighting and themed soft furnishings adopt integrated design-supply-installation procurement. Tender documents shall specify requirements for detailed design, acceptance standards and maintenance clauses. For a small number of cultural craftsmanship works with extremely unique techniques only deliverable by designated craftsmen or workshops, single-source procurement may be adopted upon rigorous verification, accompanied by pre-valuation by independent cost consulting institutions and on-site supervision during construction.

In addition, a separate special bill quantity list for cultural works shall be added to tender documents, separating themed packaging, artistic components and scene construction from general decorative works with clear calculation rules and measurement units, eliminating disputes over category attribution during subsequent settlement.

#### **3.4 Construction Phase: Dynamic Process Refinement**

Construction shifts cost management from static control to dynamic supervision. Refined on-site supervision establishes a three-budget comparison and early warning mechanism: the approved design budget as the control baseline,

contract price as the execution baseline, and actual completed output value plus estimated settlement amount as the dynamic baseline. Deviation analysis is conducted monthly, and early warning is activated for sub-items exceeding threshold values. Root causes including design alterations, material price hikes, construction rework or interface conflicts are traced, followed by targeted corrective actions. Given frequent alterations in cultural tourism projects, a pre-assessment system for alteration costs shall be established. Before approval of any design alteration application, cost engineers must complete an evaluation of its expense impact, alongside assessment of associated costs for linked disciplines. Major alterations affecting cultural effects shall undergo dual-dimensional review covering cost and visitor experience, ensuring additional investment corresponds to perceptible improvement of project experience. During on-site supervision, image recording and quantity confirmation of concealed works shall be strengthened, especially cultural base layers, embedded parts and artistic frameworks covered by surface layers later. Measurement shall be completed upon construction finish and quantity verified before concealment to reduce settlement disputes.

### **3.5 Completion and Operation Phase: Precise Settlement and Data Accumulation**

Completion settlement prioritizes phased interim settlement with final liquidation as a supplement. Settlement work is distributed across construction stages and acceptance links to avoid backlog of massive settlement work upon project completion. For cultural special works and non-standard components, physical quantity records, construction images and acceptance certificates jointly serve as supporting settlement documents.

More importantly, full-lifecycle cost data shall be archived after project delivery. Complete data chains covering investment estimates, design budgets, contract prices, settlement prices and actual maintenance costs in the first five years of operation are compiled into enterprise or industry databases for cultural tourism building costs. The database includes key cost indicators such as unit construction costs of different business formats, proportion of cultural special expenses and equipment renewal cycles, as well as prices of major materials and equipment and contractor performance records. Such data

enables accurate benchmarking and rapid cost estimation for subsequent similar projects.

### **4. Deficiencies in Cultivating Skilled Cost Professionals for Cultural Tourism Buildings**

Implementation of the refined cost management framework ultimately relies on competent personnel. Current supply of skilled professionals exhibits prominent shortcomings as follows:

#### **4.1 Monotonous Knowledge Structure and Insufficient Cultural Literacy**

Current curricula and vocational training for construction cost majors center on measurement and valuation of civil and installation works, with few courses covering cultural architecture, traditional craftsmanship and artistic decoration. Frontline cost professionals are proficient in quota application and bill compilation yet lack feasible solutions when handling antique buildings and intangible heritage craftsmanship. Deficient cultural aesthetic literacy prevents them from understanding architects' cultural intentions during design communication or reasonably judging cost composition of cultural craftsmanship.

#### **4.2 Single Practical Training Projects and Lack of Cultural Tourism Experience**

Internship programs in universities and onboarding training in enterprises mostly adopt ordinary residential and office building cases for practice. Students are accustomed to quantity calculation based on standard drawings, without perceptual understanding or hands-on training targeting complex shapes, special-shaped joints and multi-disciplinary overlapping of cultural tourism buildings. Surveys show that even cost engineers with three to five years of working experience often feel incapable when undertaking their first cultural tourism project, with steep learning curves.

#### **4.3 Shallow Application of Digital Tools**

Despite years of BIM promotion across the industry, most cost professionals only master basic operations of BIM quantity calculation software. They lack capabilities in advanced applications including BIM 5D cost management platforms, quantitative analysis of cost impacts derived from multi-disciplinary collision detection based on BIM, and visualized presentation of cost data, which fail to meet



demands of refined supervision for highly complex cultural tourism buildings.

#### **4.4 Weak Full-Lifecycle Perspective and Operation-Oriented Thinking**

Most existing skilled professionals focus on construction-phase cost management, with limited attention to pre-investment planning and post-operation maintenance. Without systematic training to examine costs through the full investment-construction-operation chain, they cannot provide forward-looking cost proposals in early project phases.

#### **5. Talent Training Model Featuring "Tripartite Collaborative Education, Work-Study Integration and Digital Empowerment"**

Addressing the above deficiencies, this paper proposes a talent training reform scheme jointly delivered by universities, enterprises and industry associations (tripartite collaborative education).

#### **5.1 Restructure Curricula with Integrated Cultural Tourism and Free Trade Port Modules**

New optional and extended courses such as Introduction to Cultural Tourism Architecture, Traditional Construction Craftsmanship & Costing, and Measurement & Valuation of Themed Architectural Decoration shall be added to construction cost major curricula. Special topics on return analysis of cultural tourism projects are embedded into Engineering Economics courses, explaining correlations between core operation indicators (including hotel revenue per available room and exhibition hall revenue and expenditure) and cost decision-making. Lectures on Free Trade Port Policies and Construction Costs are offered to help students master cost management key points under special backgrounds including zero-tariff policies, cross-border payments and international contracts.

#### **5.2 Build Characteristic Practical Training Bases for Cultural Tourism Building Costing**

Relying on university-enterprise cooperation, practical training platforms for cultural tourism building costing are established on campus or within enterprises. The platforms contain BIM models and scaled physical models of typical cultural tourism spaces including theme hotel

guest rooms, restaurants and performance venues; physical displays of structural joints covering conventional and intangible heritage craftsmanship; full sets of simulated project documents spanning investment estimation to completion audit. Students conduct full-process practices including quantity calculation, pricing, alteration simulation and settlement compilation on the platforms to accumulate near-real operational experience in cultural tourism projects.

#### **5.3 Implement Integrated Work-Study Training with Project-Based Learning and Dual Mentorship**

Ongoing or recently completed cultural tourism projects within free trade ports are selected as teaching cases, with dual mentor teams composed of university instructors and senior enterprise cost specialists. Students are divided into groups to follow project progress and participate in compiling construction drawing budgets, auditing monthly completed output values and handling completion settlement. Under supervision of enterprise mentors, students may process desensitized data after signing confidentiality agreements. Senior undergraduates shall complete at least three months of on-site internships in cultural tourism projects to practice soft skills including cross-disciplinary interface coordination, alteration negotiation and pricing verification of cultural craftsmanship in real working environments.

#### **5.4 Specialized Training on Digital Cost Management**

Practical courses on BIM Cost Application and Data Management are delivered based on authentic BIM models of cultural tourism projects. Students receive training on 5D dynamic cost management, quantifying cost impacts from multi-disciplinary collision reports, and rapid quantity calculation & cross-verification supported by models. Data analysis tools are introduced to teach students to measure cost indicators, excavate deviation causes and predict trends with historical project data, cultivating decision-making logic driven by data.

#### **5.5 Establish Skill Certification and Lifelong Learning Channels**

Specialized skill certification standards for

Cultural Tourism Building Cost Management are developed jointly with industry associations, covering theoretical examinations and practical assessments to provide competency endorsement for practitioners. Short, targeted micro-courses are launched on online learning platforms for in-service personnel, covering themes such as practical costing of themed packaging projects, budget key points of performance equipment installation, and calculation methods for imported construction materials under free trade port tax policies, supporting continuous knowledge updating for skilled professionals.

## 6. Conclusion

Cultural tourism supporting buildings in free trade ports undertake dual missions of cultural display and high-quality service, with cost management far more sophisticated and complex than ordinary construction works. Breaking through bottlenecks including pricing difficulties, chaotic interface coordination and talent shortages requires both a refined cost management framework covering investment decision-making, design, bidding and procurement, construction and operation phases, and a cohort of compound skilled professionals proficient in engineering, cultural knowledge, digital data and long-term industrial vision.

The five-aspect refined management system and the "tripartite collaborative education, work-study integration and digital empowerment" talent training model proposed in this paper constitute systematic explorations toward the above goals. As cultural tourism industries in free trade ports continue to upgrade and digital technologies penetrate deeper, refined cost management will further evolve toward intelligence and real-time dynamism. Talent

training shall continuously advance in fields such as cross-cultural communication, green building economics and smart operation & maintenance cost management. Only dual-driven progress in management systems and talent cultivation can deliver high-quality construction and sustainable development of cultural tourism buildings in free trade ports.

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