

RESEARCH ON SUSTAINABLE PUBLIC ART INSTALLATION DESIGN BASED ON INNOVATIVE APPROACHES: A CASE STUDY OF SOLID FOUNDATION, STRONG WALLS AT ZHONGSHAN TALENT PARK

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ABSTRACT

Against the dual backdrop of accelerating global urbanization and mounting ecological pressures, the sustainability of public art installations as vital carriers of urban culture has emerged as a core issue at the intersection of contemporary art and urban planning. Building upon the doctoral dissertation *Innovative Research on Interactive Public Art Installations: A Case Study of “Solid Foundation, Strong Walls”* at Zhongshan Talent Park, this study focuses on its third research objective “Designing Sustainable Public Art Installations Using Innovative Methods.” Through literature review, mixed-method research, and interdisciplinary theoretical integration, it systematically explores the design principles and technical pathways for sustainable public art installations. Guided by the triadic mechanism of technology-culture-governance (TCG), this study employs the STEAM design model and utilizes Zhongshan Talent Park as a practical field. Virtual simulations demonstrate the design outcomes, providing practical references for the sustainable development of future public art installations.

Keywords: Public Art Installation, Sustainable Design, Innovative Approaches, STEAM Model, TCG Framework

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INTRODUCTION

Since the mid-20th century, public art installations have gradually evolved from static decorations into integral urban components that facilitate social interaction and cultural expression. However, with the acceleration of urbanization, these installations now face significant challenges in resource consumption, material selection, technological integration, and social acceptance. Research reveals that many current public art projects suffer from “short-sighted management,” “cultural disconnect,” and “technical limitations.” Incidents such as the controversy surrounding the Guan Yu sculpture in Xiangyang and the debate over the Cowherd and Weaver Girl sculpture in Henan expose deficiencies in the sustainability of public art. Therefore, how to achieve the sustainable development of public art installations across cultural, environmental, social, and technical dimensions through innovative design methods has become a core issue requiring urgent resolution. This study aims to explore design methodologies for sustainable public art installations, driving their transformation from “visually centered” to “ecologically intelligent.”

Research reveals that the core value of sustainable public art installations lies in their innovative design methodologies. By integrating interdisciplinary technologies, local cultural symbols, and community engagement mechanisms, these installations transcend the decorative function of traditional art, becoming practical vehicles for advancing urban ecological governance, fostering cultural regeneration, and strengthening social cohesion. On the environmental front, they drive the innovative application of low-carbon materials and intelligent recycling systems; culturally, they construct sustainable narratives to revitalize local identity; socially, they foster inclusive dialogue through participatory design; technologically, they integrate IoT and sensing technologies to expand the dimensions of artistic interaction. Only through such systematic innovative design can sustainable public art realize its comprehensive environmental, cultural, and social value, becoming a pivotal conduit connecting ecological consciousness, technological ethics, and social engagement.

RESEARCH OBJECTIVES

- 1) Using a mixed-methods approach, this study examines the guiding strategies for the creation and design of interactive public art installations from the perspectives of the public, experts, and government.
- 2) Creative Practice Based on the “STEAM” Design Model: Solid Foundation, Strong Walls

LITERATURE REVIEWS

Sustainable Development Theory

Sustainable development theory emphasizes achieving synergies among economic growth, social equity, and ecological conservation within the constraints of resource availability and environmental carrying capacity. Its core principle is meeting present needs without compromising the well-being of future generations. It advocates enhancing resource efficiency through energy conservation, emissions reduction, recycling, and green technologies, while coordinating benefit distribution via institutional governance and multi-stakeholder participation. Related research also explores pathways to urban resilience and low-carbon transformation by developing indicator systems and governance frameworks.

Symbolic Interaction Theory

Symbolic interactionism, represented by Mead and Blumer, emphasizes that social reality is constructed through shared symbols and meanings in interactions. Individuals form self-identity by interpreting others' actions and continuously negotiate and adjust their behavior within contexts. Research often centers on everyday interactions, identity performance, and role expectations, revealing how linguistic, ritual, and media symbols shape relationships and

order. In recent years, it has also been applied to explain impression management, group norms, and meaning-making mechanisms within online social networks.

Public Art and Installation Art

Public art research emphasizes the social function of artistic interventions in public spaces, focusing on site-specificity, public participation, and governance mechanisms. It aims to enhance urban image, local identity, and the visibility of public issues. Installation art, however, centers on the holistic spatial experience and conceptual expression, often employing multimedia and interactivity to create immersive scenarios that highlight audience presence and meaning-making. Recent literature indicates a convergence between the two in urban renewal and community building: installation techniques enhance the experiential and communicative aspects of public art, while the public context reshapes the ethical boundaries and maintenance management of installations.

System Methodology of the TCG Research Framework and STEAM Design Model

The TCG (Technology-Culture-Governance) research model is a systematic analytical framework whose theoretical core lies in constructing sustainability as an organic integration of three dimensions: technological application, cultural identity, and governance mechanisms. This framework transcends traditional technology-centric sustainable design paradigms, emphasizing that the vitality of sustainable public art stems not only from technological innovation but also depends on its meaning generation and institutional safeguards within specific sociocultural contexts. On the technological dimension, the model focuses on the integrated application of innovative technologies such as the Internet of Things, renewable energy, and smart materials to ensure environmental sustainability in terms of energy efficiency and material circulation. On the cultural dimension, it emphasizes the contemporary translation of local cultural symbols and the artistic construction of ecological narratives, aiming to stimulate public emotional resonance and cultural heritage awareness. At the governance level, it addresses the establishment of policy support systems, community participation mechanisms, and long-term operational maintenance models to institutionally ensure the sustainability of works throughout their entire lifecycle. Thus, the TCG model breaks through the limitations of traditional art evaluation at the methodological level, providing a structured theoretical framework for analyzing the diverse values inherent in sustainable public art.

The STEAM (Science-Technology-Engineering-Art-Mathematics) model is an interdisciplinary design and implementation methodology whose core strength lies in integrating systemic thinking with creative practice, providing a comprehensive pathway from concept to realization for sustainable public art installations. This model emphasizes breaking down disciplinary barriers to achieve synergistic integration of technical feasibility, artistic expression, and social utility. Its operational pathway unfolds across five distinct phases: During the artistic conceptualization phase, creative ideas are developed based on local cultural contexts and ecological concerns. In the technical integration phase, sustainable technology mapping transforms artistic concepts into technical solutions. The engineering implementation phase employs low-carbon materials, modular structures, and demountable designs to minimize environmental footprints. The public engagement phase utilizes interactive design to transform audiences into co-creators and collaborative maintainers. and in the effect evaluation stage, an iterative optimization mechanism integrating environmental data monitoring and social feedback is established. Thus, the STEAM model not only enhances the systematicity and operability of the creative process but also extends sustainability from conceptual frameworks to concrete practices. This provides methodological support for substantively advancing the synergistic integration of “technology-culture-governance” within the TCG framework.

Zhongshan Talent Park

Site Analysis: Zhongshan Talent Park is situated in the core area of Qijiang New Town, Zhongshan City, Guangdong Province, adjacent to Zhongshan High-Speed Rail Station. Spanning over 1,000 mu (approximately 66.7 hectares), the park embodies the theme “Embracing Talent, Gathering Wisdom in Zhongshan.” Its landscape design utilizes tidal variations to form the Chinese characters “中” (middle) and ‘山’ (mountain), while the main structure takes the shape of the Chinese character “人” (person), symbolizing the park's focus on talent. The park adopts a “One Axis, Two Banks, Four Zones” layout: centered on the Shenzhen-Maoming high-speed rail track as the central axis, the 2.8-kilometer Path of Talent Development extends along both banks of Zhixing Lake. It is divided into four thematic zones: Talent Appreciation, Talent Attraction, Talent Cultivation, and Talent Development featuring attractions such as the Talent Ecology Pavilion, Doctoral Garden, and Starlight Bridge. As a demonstration site for Guangdong's Green and Beautiful Ecological Construction initiative, the park integrates talent policy exhibition with ecological restoration.

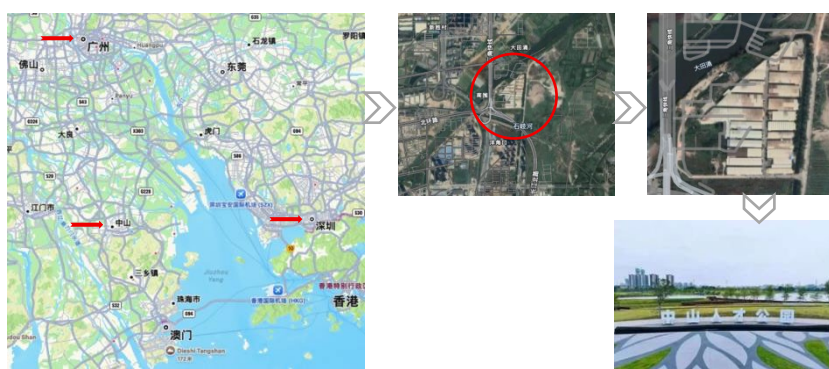


Figure 1 Site Location Diagram

Against the backdrop of Zhongshan City enacting special regulations to promote talent development and concurrently establishing the “Zhongshan Talent Park,” this paper draws inspiration from the city's sustained investment in talent recruitment, cultivation, and incentive systems. It proposes the public art installation concept scheme “Laying the Groundwork” and utilizes the Talent Park as the spatial medium for design creation.

RESEARCH METHODOLOGY

This study employs a mixed-methods research design, integrating quantitative and qualitative approaches to systematically explore the social interaction and value of interactive public art installations.

Quantitative Component: A structured questionnaire was administered to 1,296 valid respondents (N=1296) across Guangzhou (n=235), Shenzhen (n=403), and Zhongshan (n=658). Stratified and multi-stage random sampling ensured demographic diversity (age 18-65, including permanent residents, migrants, and tourists). The questionnaire, developed through literature review and expert validation (Cronbach's $\alpha = 0.946$; KMO = 0.946, $p < 0.001$), measured public perception across Technology (T), Culture (C), and Governance (G) dimensions using a 5-point Likert scale.

Qualitative Component: Semi-structured in-depth interviews and focus group discussions were conducted with 9 purposively selected experts: 3 public art designers, 3 urban planners/architects, and 3 government administrators. Interview transcripts were analyzed using thematic analysis with NVivo 12, employing open, axial, and selective coding. Additionally, Latent Dirichlet Allocation (LDA) topic modeling was applied to identify latent thematic structures and quantify focus areas across stakeholder groups.

Guided by the "TCG" triple mechanism and utilizing the 'STEAM' design model, this study validates the proposed methodology through the design practice of 'Solid Foundation, Strong Walls' at Zhongshan Talent Park."

RESEARCH RESULTS

Quantitative Research Data Analysis

Based on a survey of public acceptance of public art installations, the core findings are as follows: Overall public acceptance of public art installations is moderately high (average score approximately 3.6–4.0). Among these, design quality and artistic merit received the highest satisfaction ratings (42% gave scores of 4–5); however, only 42.9% of respondents highly endorsed (scores of 4–5) the installations' reflection of urban cultural characteristics. Regarding interactivity and practicality, nearly half of the public (50.4%) expressed neutral opinions. This indicates that while current public art is recognized for its aesthetic expression, there remains room for improvement in cultural representation and functionality.

Table 1 Public Recognition of Public Art Installations

Corresponding Question	1 Points (%)	2 Points (%)	3 Points (%)	4 Points (%)	5 Points (%)
Satisfaction with Design Level and Artistic Quality	4.2	12.4	56.2	19.4	7.8
Degree of Reflecting City's Cultural Characteristics	3.5	11.2	42.4	30	12.9
Degree of Participation and Practicality	3.3	13.8	50.4	18.5	13.9

Data Source: Frequency Table Analysis (N=1296) | Scoring Explanation: 1=Very dissatisfied/Not reflected at all/Barely any, 5=Extremely satisfied/Clearly reflected/Enhances life or provides practical functionality

Numerical Notes: Total Sample Size: N=1296 (all percentages are calculated based on the total sample)

Data Source: SPSS Frequency Analysis (FREQUENCIES), using valid case statistics.

Based on a survey of public awareness and preferences regarding various forms of public art installations, key findings are as follows: Digital and multimedia art enjoyed the highest recognition rate (83.3%), while VR/AR art had the lowest (37.8%). Among social interaction characteristics, visual appeal was most valued (86.0%), followed closely by cultural symbolism (79.9%) and interactivity (76.9%). Regarding interactive art's role in enhancing a sense of belonging, 53.2% of respondents expressed positive views (scoring 4-5 points), while only 6.8% disagreed. This indicates that novel digital art forms still require promotion, and the public most values the visual expression and cultural significance of public art.

Table 2 Public Recognition and Preference for Different Forms of Public Art Installations

Category	Item	Number of Respondents	Percentage of Total Sample
Which types of public art are you aware of?	Sculpture	773	59.60%
	Digital and Multimedia Art	1081	83.30%
	Interactive Art	849	65.50%
	Art Incorporating Virtual Technology (VR/AR)	490	37.80%
What are the most important characteristics	Interactivity	998	76.90%
	Visual Appeal	1116	86.00%

of public art in social interaction?	Cultural Symbolism	1036	79.90%
	Fun and Playfulness	921	71.00%
Can interactive public art significantly enhance a sense of belonging and cultural identity?	1 Point (Not helpful at all)	14	1.10%
	2 Points	74	5.70%
	3 Points	518	39.90%
	4 Points	380	29.30%
	5 Points (Extremely helpful)	310	23.90%

Numerical Notes: Total Sample Size: N=1296 (all percentages are calculated based on the total sample)

Data Source: SPSS Frequency Analysis (FREQUENCIES), using valid case statistics.

Based on a survey of public concerns regarding interactive public art installations, key findings are as follows: Long-term maintenance plans are the top priority for the public (average score 4.34, 54.2% strongly required), followed by technical quality standards (average score 4.06), while demand for digital technology integration is relatively low (average score 3.95). Over 70% of respondents expressed expectations for high technical standards and digital integration (scoring 4-5 points). This indicates that while the public supports technological innovation, they place greater emphasis on the sustainability and reliability of the installations.

Table 3 Core Issues of Public Concern Regarding Interactive Public Art Installations

Core Issue/Corresponding Questionnaire Item	Mean Score	1 Point	2 Points	3 Points	4 Points	5 Points
Technology and Interaction Quality						
What level of quality should interactive technology (e.g., AR, touch functions) achieve?	4.06	1.60%	3.20%	24.80%	28.30%	42.00%
Safety and Maintenance						
Should public art installations have a long-term maintenance plan?	4.3	2.10%	1.50%	15.40%	26.80%	54.20%
Cultural Integration and Innovation						
How much do you desire the incorporation of digital and intelligent technologies into interactive public art?	3.95	0.80%	3.00%	26.40%	39.70%	30.10%

(1=Basic technology sufficient; 5=High technical standards required)

(1=Not needed; 5=Strongly needed)

(1=Completely unnecessary; 5=Absolutely necessary)

Numerical Notes: Total Sample Size: N=1296 (all percentages are calculated based on the total sample)

Data Source: SPSS Frequency Analysis (FREQUENCIES), using valid case statistics.

Analysis of the above data reveals:

Public expectations for public art installations follow a three-tiered progression: “value recognition, form preference, and quality concern.”

At the value level, the public demonstrates high recognition of the design aesthetics of public art, yet their perception of its cultural representativeness and functional utility remains relatively vague. This indicates that current public art still has room for improvement in achieving profound social value and local cultural expression.

Regarding form preferences, digital and multimedia art have become mainstream perceptions, while visual appeal and cultural symbolism are regarded as the most critical attributes in social interaction. This reveals that the public seeks both the visual experience and technological feel of art, while also highly valuing its cultural connotations and identity-affirming functions.

Regarding implementation concerns, public focus has shifted from “innovation” to “sustainability.” Long-term maintenance plans have emerged as the most critical issue, surpassing even the quality of technology and integration innovation in importance. This reflects a rational public stance: while supporting the fusion of art and technology, greater emphasis is placed on project longevity, reliability, and full lifecycle management.

In summary, the future development of public art installations should transcend mere formal innovation. It must commit to building a systematic practice integrating “cultural depth, visual expression, technological support, and sustainable operation and maintenance.” This approach will achieve a paradigm shift from “urban decoration” to “cultural infrastructure.”

LDA Analysis of Qualitative Interview Content

LDA thematic analysis based on expert interviews reveals significant perspective differences and systemic bottlenecks. Urban planning experts focused on interdisciplinary collaboration and project implementation, artists emphasized creative autonomy and social value, while government administrators prioritized sustainable operations and public engagement. Collectively, they revealed the structural contradictions confronting public art today: conflicts between artistic value assessment and engineering budget systems, balancing creative freedom with public acceptance, and the absence of long-term operational responsibility. This points to the urgent need for cross-disciplinary collaboration mechanisms and a comprehensive lifecycle management system for public art.

Table 4 Experts' Overall Evaluation of Public Art Installations

Expert Group	Core Focus	Main Attitude/ Evaluation	Core Challenges/ Problems
Urban Planning & Architecture Experts	Cross-disciplinary collaboration, socio-cultural functions, engineering implementation	Public art is a complex system project requiring multi-party collaboration	Inefficient collaboration mechanisms, rigid budgeting systems, difficulties in value assessment
Artists	Artistic autonomy, rural development, public participation	Emphasis on artistic expression and social value, focus on rural practice	Excessive government intervention, imperfect public participation mechanisms, disconnect between education and practice
Government Administrators	Project management, long-term maintenance, public interaction	Emphasis on manageability, sustainability, and public acceptance	High maintenance costs, difficulties in handling public feedback, challenges in policy implementation

Data source: LDA topic analysis from three perspectives: urban planning & architecture, artists, and government management

Analysis of the three-party proposals for public art creation reveals a complementary system of demands and a progressive implementation pathway. Urban planning experts advocate establishing early collaborative platforms to break the “relay-style” process, artists call for a tripartite dialogue mechanism to safeguard creative autonomy, while the government emphasizes clarifying decision-making procedures to balance multiple stakeholders' opinions. Regarding value orientation, all parties emphasize cultural symbolism and spatial integration,

though with differing priorities: artists focus more on locality and interactivity, while governments prioritize social benefits and public resonance. At the implementation level, budget system reform and long-term maintenance mechanisms emerge as shared focal points, indicating that public art urgently requires systemic institutional innovation to support its sustainable development.

Table 5 Key Focus Areas Recommended by Three Stakeholder Groups (a, b, c)

Stakeholder Group	a. Collaboration Mechanism & Process	b. Content & Value Orientation	c. Implementation & Sustainability
Urban Planners & Architects	Establish early "architect-artist" collaboration platforms to avoid "relay baton" models	Strengthen cultural symbolism and spatial integration, balancing aesthetic unity and artistic uniqueness	Optimize engineering cost audit systems to accommodate artistic creation value assessment
Artists	Improve "artist-public-government" tripartite dialogue mechanisms to ensure creative autonomy	Emphasize site-specificity (especially in rural areas), interactivity, and educational functions	Establish flexible budgeting and post-implementation evaluation mechanisms to support experimental creation
Government Administrators	Clarify decision-making processes and communication channels, balancing leadership intentions with public opinion	Focus on cultural value embodiment and public emotional resonance, highlighting social benefits	Develop long-term maintenance plans and responsibility allocation, controlling operational costs

Note: Organized based on focal issues discussed by each expert group in LDA topic analysis

A multidimensional analysis of long-term permanent public art installations reveals core findings that highlight the tension and equilibrium between artistic aspirations, public expectations, and urban management. Artists view these works as vessels for cultural symbolism and aesthetic expression, while the public seeks emotional resonance and interactive experiences. Administrators, however, prioritize their role as urban calling cards and social benefit functions. Significant divergences exist in the core considerations of these three parties: art prioritizes material durability and formal timelessness; the public emphasizes safety and comprehensibility; and administrators focus on maintenance costs and policy continuity. This reflects that long-term public art installations are not merely aesthetic objects but complex systems requiring the coordination of artistic experimentation, public accessibility, and sustainable operation. Their success hinges on the organic integration of these three value systems.

Table 6 Multidimensional Understanding of Long-term Permanent Public Art Installations

Dimension	Artistic Perspective	Public Perspective	Management/City Perspective
Core Attributes	Cultural symbolism, aesthetic expression, creative freedom	Visual enjoyment, emotional resonance, interactive experience	City landmark, spatial quality, social benefits
Value Expectations	Become a classic work, convey the spirit of the era	Become a memory landmark, enhance sense of belonging	Become a cultural asset, improve city competitiveness

Key Considerations	Material durability, formal permanence, artistic originality	Safety, accessibility, comprehensibility	Maintenance costs, risk resistance, policy continuity
Potential Conflicts	Artistic experimentation vs. public acceptance	Personal aesthetic preference vs. public space attributes	One-time investment vs. long-term operational burden

Note: Comprehensive analysis of long-term permanent installations from three expert group perspectives

Based on a systematic analysis of multiple perspectives within the public art field, core insights can be elevated to the following level:

Public art has evolved into a complex system requiring the coordination of three dimensions: the intrinsic value of art, its social public attributes, and the logic of urban governance.

Differences in expert perspectives reveal structural tensions within the industry's development: the systemic thinking of urban planning experts, artists' demands for value creation, and the managerial rationality of government form a tension field that is both complementary and antagonistic. This tension manifests most acutely in the fundamental conflict between artistic value assessment systems and engineering management paradigms.

Proposals from all three parties outline a progressive path from institutional restructuring to value reformation: early collaborative platforms address process fragmentation, tripartite dialogue mechanisms balance power dynamics, while reforms to budgeting systems and evaluation mechanisms point toward deeper institutional innovation needs. This underscores that public art development must transcend project-based thinking to establish a full-lifecycle institutional framework.

A multidimensional understanding of long-term installations further reveals temporal challenges: art pursues permanence, the public demands accessibility, and urban management requires sustainability. This necessitates a cognitive shift for public art installations from being viewed as mere “works” to being recognized as “public cultural assets,” incorporating systematic considerations for maintenance, operation, and iteration from initial creation phase.

At its core, the fundamental contradiction in contemporary public art lies between the “uniqueness of cultural production” and “standardization of public administration.” Future development should not involve unilateral compromise but rather institutional innovation to establish a new model of public cultural governance. This model must accommodate artistic experimentation, safeguard public value, and enable sustainable management.

Cross-Analysis and Core Integration Discovery

Through cross-validation analysis of public survey data and expert interview conclusions, the following systematic insights emerge:

A significant “cognition-practice” disconnect exists within the public art sector. Public surveys reveal high acceptance of digital art forms (83.3%) and expectations for technological integration (70% approval), aligning with artists' emphasis on technical experimentation. However, this conflicts with government concerns over operational costs and urban planning experts' critiques of rigid budget systems.

The divergence among these three perspectives fundamentally reflects the inherent tensions within public art's multifaceted nature as a “cultural product.” The public's visual preferences and interactive demands (86% prioritize visual appeal) align with artists' aesthetic pursuits, while the government's managerial rationality (focusing on long-term maintenance) converges with urban planners' systemic thinking (emphasizing project implementation) in governance logic.

The deeper contradiction lies in the absence of a unified value assessment system. The uniqueness pursued by artists, the comprehensibility expected by the public, and the

sustainability demanded by administrators lack unified metrics. This leads to fragmented objectives across all stages from creation to operation and maintenance, urgently requiring the establishment of a comprehensive evaluation framework integrating artistic value, public benefit, and governance feasibility.

The future development of public art necessitates a paradigm shift from a “project-based” approach to an “ecosystem” model, building new cultural infrastructure that balances artistic innovation, public participation, and sustainable governance.

Practical Application of the Strategy-Guided STEAM Design Model

Creative Concept: This concept uses “city walls” as a symbol of historical urban governance and security order. Ancient city walls were typically constructed with brick or stone exteriors and rammed earth cores, forming a stable protective system through the structural logic of “external protection internal solidity” to ensure the safety and prosperity of residents within. Translated into the contemporary urban competitive landscape, city development and high-quality growth similarly depend on the continuous supply and structural optimization of talent resources. By refining talent policies, strengthening incentive mechanisms, and cultivating welcoming public spaces for talent, the cycle of “talent aggregation - growth - retention” can be transformed into a tangible, sustainable “foundation” for urban development. This approach builds resilient advantages for regional competitiveness.

Form Concept: Drawing inspiration from the structural language of ancient Chinese city walls and their load-bearing and protective mechanisms, the design extracts structural motifs such as “compacting foundations, layered accumulation, enclosed spaces, and load-bearing capacity.” These are translated into a spatial installation form with public recognizability, emphasizing the symbolic significance of “fundamental support” and “systemic protection.”

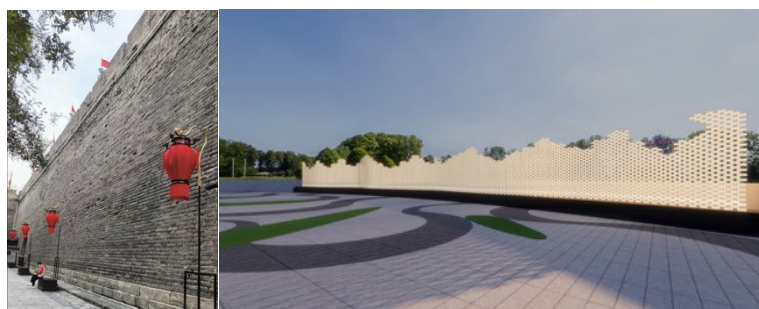


Figure 2 Of Solid Foundation, Strong Walls

Table 4 Integration Application Framework of STEAM Design Dimensions in Public Art Installations

Design Dimension	Core Functions & Strategies	Specific Implementation & Outputs
Science	Function Definition & Environmental Analysis	Scenario Planning & Operational Indicators
	Focus on the core issue of “Talent Development - Innovation Incentive”	Organize usage scenarios for talent activities and public cultural dissemination
	Analyze the micro-environment of public spaces (foot traffic, sound, light)	Establish environmental indicators for installation operation and public experience
	Provide scientific basis for content iteration and low-carbon operation	
Technology	Interactive System & Energy Support	Content Supply & Closed-loop Operation

	Integrate sound pressure sensing and near-field interaction modules	Provide media resources such as talent images and public narratives
	Build an updatable digital content system	Achieve contextual information evocation and interactive experience
	Adopt an integrated photovoltaic power generation and energy storage solution	Form a “self-generate, self-store, self-use” energy closed-loop
Engineering	Structural Prototype & Material Construction	Performance Indicators & Maintenance Design
	Use ancient city wall forms and structural mechanisms as prototypes	Achieve weather resistance (typhoon, high temperature, rainproof, etc.)
	Adopt modular hollow glass construction	Facilitate installation and maintenance of sensors, displays, and energy storage components
	Use stainless steel for the main framework	Ensure long-term stable operation of the installation
Art	Aesthetic Translation & Narrative Expression	Value Presentation & Public Perception
	Use the “Fengji - Layered Accumulation” city wall imagery as the formative motif	Transform the logic of “talent growth – urban resilience” into aesthetic experience
	Integrate light and shadow projection with visual narrative techniques	Create a public art image with cultural identity
Mathematics	Data Acquisition & Evaluation System Construction	Analytical Verification & Effect Assessment
	Acquire multi-source data under the guidance of symbolic interaction theory	Conduct statistical analysis on formal aesthetics, interaction mechanisms, etc.
	Construct a quantifiable artistic value evaluation index system	Verify creative objectives and design assumptions through model testing

Effect Demonstration: Due to uncertainties in the project implementation timeline and negotiations, the final results are presented through virtual simulation (video demonstration).

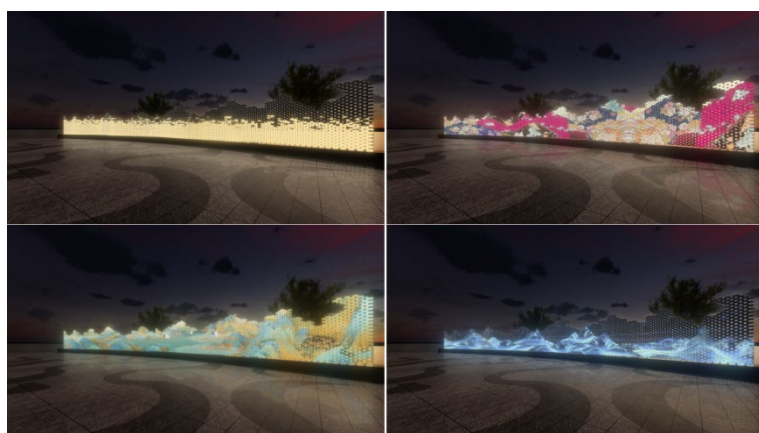


Figure 3 Effect Demonstration

The design of 'Solid Foundation, Strong Walls' serves as the practical embodiment of our mixed-methods findings. The public's 'triple-high' technological concerns (Section 4.1) directly informed the Engineering (E) dimension of the STEAM model, prioritizing durable stainless steel frameworks and modular construction for long-term reliability. The strong public demand for cultural identity (C5: M=4.23) guided the Art (A) dimension, translating the 'city wall' structural motif into a narrative of 'talent development.' Finally, the governance cognitive gap (G3: M=2.74) highlighted the need for a clear, transparent maintenance plan, which is now embedded in the project's proposed governance framework. This iterative feedback loop between empirical data and creative practice validates the TCG framework's utility as both an analytical and a prescriptive tool for sustainable public art.

DISCUSSION & CONCLUSION

Research Significance

This study establishes a systematic design framework for sustainable public art installations. The empirical analysis, grounded in data from 1,296 respondents, demonstrates that sustainability must be operationalized through measurable social and economic outcomes. The findings reveal a structural public perception that directly informs the project's socio-economic value: The public exhibits a 'triple-high' profile towards technology (high demand: M=4.03; high expectations: M=4.06; high concerns: M=4.10), indicating that the 'Solid Foundation, Strong Walls' installation must not only be innovative but also exceptionally reliable to mitigate perceived risks. Crucially, the cultural dimension shows a 'high value recognition but weak foundational understanding' structure, where the demand for local cultural integration (C4: M=4.16) and identity enhancement value (C5: M=4.23) are paramount. This confirms that the installation's role as a 'cultural carrier' is its primary social contribution, directly contributing to the place-branding of Zhongshan Talent Park by strengthening collective identity and urban attachment. Furthermore, PLS-SEM path analysis confirms that the TCG (Technology-Culture-Governance) composite indicator exerts a strong influence on sociocultural identity (SCI) ($\beta=0.575$, $Q^2=0.569$). The cultural dimension demonstrates the strongest predictive power ($\beta=0.911$), validating that the project's focus on the symbolic translation of the 'city wall' concept into a narrative of 'talent development' is the core driver of its social impact. By grounding artistic innovation in this concrete social science data, the 'Solid Foundation, Strong Walls' installation transcends mere aesthetic decoration to function as social infrastructure, generating measurable psychological well-being and civic pride for the urban community.

Core Findings and Design Validation:

- 1) System Integration: Design practice demonstrates that sustainable public art must transcend isolated technical applications to achieve multidimensional integration of environmental, cultural, social, and technological dimensions. The "Laying Foundations" project exemplifies the feasibility of this integrated approach through local material transformation, ecological narrative construction, and community co-creation mechanisms;
- 2) Methodological Effectiveness: TCG-STEAM framework provides systematic guidance for interdisciplinary design in practice, effectively coordinating engineering standards, artistic expression, and ecological requirements particularly within complex urban contexts;
- 3) Participatory Value: Design practice demonstrates that public participation is not merely a means to an end but the core value itself. Taking "Solid Foundation, Strong Walls" as an example, the community collaboration network established during its construction process became a vital safeguard for the work's enduring vitality.

Research Gaps:

Design practice simultaneously reveals that the primary constraint on sustainable public art development today is not technological inadequacy, but rather the systemic absence of

governance mechanisms. Threefold challenges evident throughout the project lifecycle underscore this need:

- Lack of standardized maintenance protocols for technical implementation
- Absence of institutionalized renewal mechanisms for cultural expression
- Lack of sustainable collaborative platforms for public engagement

Strategic Business Implications and Investment Value

The sustainable public art paradigm introduced in this study holds meaningful implications for urban economic development and public investment strategy. From a business research perspective, the proposed installation should be understood as a long-term urban asset requiring systematic lifecycle cost-benefit analysis.

Lifecycle Cost Considerations Informed by Public Perception: Quantitative findings reveal a governance cognitive gap characterized by high prioritization of safety alongside weak participatory awareness. While the public places strong emphasis on technical safety and durability, their understanding of long-term maintenance arrangements coexists with considerable ambiguity regarding responsible entities. This data directly informs the project's governance framework. Preliminary analysis based on the proposed modular design indicates three cost phases: capital investment for modular construction, operational expenditure for technological integration and energy use, and periodic renewal costs for digital content. The identified public concern regarding maintenance accountability necessitates that the project's business model clearly define a maintenance protocol, potentially through a public-private partnership with the park's management authority.

Return on Investment Framework: The installation's economic contribution can be understood through multiple interconnected channels, anchored by the high public value placed on cultural identity. From the perspective of tourism enhancement, by embodying the local narrative of talent development, the installation contributes to place-branding strategy. Comparative evidence from similar urban contexts suggests that such iconic installations can generate measurable increases in visitor activity, translating into tangible revenue growth for local tourism and hospitality sectors. Regarding real estate value appreciation, the strong public demand for local cultural integration positions the installation as a cultural amenity capable of enhancing the perceived value of adjacent properties, contributing to increased real estate values and associated tax revenues. In terms of human capital sustainability, by framing talent policies through a resonant artistic metaphor, the installation serves as a form of soft infrastructure investment aimed at attracting and retaining the highly educated workforce critical to regional economic competitiveness. This analysis redefines the project not merely as cultural expenditure but as strategic infrastructure investment with demonstrable economic returns.

Future Design Practice Directions:

Reflecting on existing practices, future efforts should prioritize:

- 1) Establishing end-to-end governance standards for “design-implementation-maintenance-renewal”
- 2) Building institutionalized platforms for interdisciplinary collaboration
- 3) Developing evaluation tools grounded in design practice
- 4) Exploring localized implementation approaches tailored to regional characteristics

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