-RESEARCH ARTICLE-

OPTIMIZING ART PARK CLUSTER DEVELOPMENT IN SOUTH KOREA THROUGH STRATEGIC RESOURCE MANAGEMENT AND INNOVATION

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─**Abstract**─

This study examines the development of Art Park Clusters in South Korea by exploring the interactions between resource management strategies, technological innovations, stakeholder participation, and policy oversight. The research adopts a mixed-methods approach, utilising quantitative techniques through Python and R alongside qualitative analysis via NVivo. Data were collected through a structured questionnaire administered to 200 participants, and interview transcripts were analysed using thematic coding to capture stakeholder insights. Analytical procedures included regression analysis, K-Means clustering, and correlation matrices, while NVivo facilitated both thematic clustering and word cloud visualisation. Findings indicate that the integration of technological tools with active stakeholder engagement enhances cluster performance. Nonetheless, the initial regression model revealed limited explanatory power, suggesting the need to incorporate additional variables. The study further demonstrates that combining sustainable practices and digital interventions with community involvement improves visitor satisfaction and operational outcomes, as evidenced by qualitative results. The research establishes a comprehensive framework for enhancing Art Park Clusters, illustrating the interconnections among key concepts. This paper provides actionable guidance for policymakers, urban planners, and cultural strategists tasked with aligning innovation with cultural preservation and sustainable practices. The results suggest that the future success of Art Park Clusters in South Korea and beyond will depend on their capacity to simultaneously foster cultural and economic development.

Keywords: Art Park Clusters, Technological Integration, Stakeholder Engagement, Sustainable Development, Policy Framework.

INTRODUCTION

Art Park Clusters constitute a novel paradigm that merges artistic expression, cultural heritage, and innovation to shape urban and regional development. Initiatives promoting cultural exchange alongside creative experimentation stimulate economic progress by cultivating synergistic relationships between artists and local communities, as well as between artists and industrial actors (Aldianto et al., 2020). South Korea offers particularly advantageous conditions, combining profound cultural resources with advanced technological infrastructure, thereby consolidating its position as a global leader in art and innovation. This study investigates strategies to strengthen Art Park Clusters across South Korean regions, emphasising the strategic allocation of resources to construct a sustainable international framework that delivers benefits to diverse stakeholder groups (Awung & Marchant, 2020).

RESEARCH BACKGROUND

Over time, clustering has evolved into a transformative model for integrating art and culture, aimed at maximising economic, social, and creative value. Exemplary cases such as the Museum Quarter in Vienna, the West Kowloon Cultural District in Hong Kong, and the Guggenheim Museum in Bilbao illustrate how strategic utilisation of resources and innovation can convert art clusters into urban catalysts, tourist attractions, and instruments of cultural diplomacy (Bittencourt et al., 2018). These instances underscore the importance of a strategic management perspective that optimises financial, spatial, and human capital alongside operational and technological advancements to maintain competitive advantage (Kolak et al., 2020). South Korea emerges as a particularly promising context due to its rich cultural diversity, encompassing both traditional and contemporary dance forms and the Hallyu (Korean Wave), which represents a potential prototype of next-generation Art Park Clusters (Fink et al., 2020). Realising this potential, however, requires addressing key challenges systematically, including urban space constraints and limited funding, through innovative solutions and the establishment of collaborative communities involving non-state actors (Gao et al., 2020).

Leveraging its leadership in AI, VR, and green technologies, South Korea can incorporate smart systems such as IoT for visitor management and blockchain for intellectual property protection to enhance operational efficiency and audience engagement. Achieving a balance between commercial objectives and cultural authenticity necessitates eco-conscious design approaches, including energy-neutral installations, and policies that prioritise long-term community benefits over immediate gains (Gerstenberger et al., 2020). This study investigates how strategic management of resources—including optimised funding structures, talent pipelines, and spatial planning—combined with technological innovation and governance strategies, can foster the success of Art Park Clusters in South Korea (Hayashi et al., 2020). By analysing global and local examples, such as the Oil Tank Culture Park in Seoul and the proposed Eco Art Cluster in Busan, the research develops a framework that aligns artistic vision with financial viability while reshaping societal perceptions of art and culture (Göteman et al., 2020).

Problem Statement

In South Korea, the effective management of resources and integration of innovative technologies are pivotal factors affecting the establishment of Art Park Clusters as enduring cultural and economic hubs. Despite global examples of successful clusters, many initiatives encounter obstacles such as inefficient or rigid resource allocation, insufficient funding, overexploitation of urban and rural spaces, and limited network effects, all of which undermine operational sustainability (Fink et al., 2020). While South Korea exhibits advanced technological capabilities and a thriving creative sector, numerous art parks have yet to implement tools such as AI-driven curation, smart energy systems, or blockchain-based solutions to enhance visitor experiences and operational performance. A central challenge lies in devising cohesive strategies that reconcile artistic authenticity with economic viability (Awung & Marchant, 2020). Commercial imperatives frequently take precedence over cultural objectives, and inadequate public private partnership frameworks constrain long-term financing. Rural clusters contend with population decline and infrastructural deficits, whereas urban projects are constrained by limited space and environmental considerations (Mohapatra & Rath, 2020). Absent systematic approaches to optimise financial, spatial, and human resources while embedding advanced innovations, Art Park Clusters risk stagnation. This study examines how targeted resource management and strategic innovation can bridge these gaps, supporting the development of sustainable, inclusive, and internationally competitive cultural ecosystems.

Research Objectives

The principal aim of this study is to examine and propose strategies for enhancing the development of Art Park Clusters in South Korea through the strategic management of resources and the adoption of innovative practices. Specifically, the research seeks to:

➢ Evaluate and optimise strategic resource allocation within Art Park Clusters by examining funding mechanisms, including public–private partnerships and crowdfunding, spatial utilisation of repurposed urban and rural sites, and talent management initiatives such as artist residencies and skill development programmes.
➢ Explore the contribution of technological innovations such as AI, IoT, blockchain, and renewable energy systems in improving operational efficiency, visitor engagement, and sustainability, with particular consideration of South Korea's advanced digital infrastructure.
➢ Formulate a governance framework that harmonises artistic integrity with economic sustainability, underpinned by policy recommendations, stakeholder collaboration, and impact assessment tools to ensure long-term viability.

Through these objectives, the study aims to foster a self-sustaining Art Park Cluster ecosystem in South Korea, enhancing the nation's cultural landscape, driving economic growth, promoting sustainable practices, and reinforcing its position as a global leader in art and innovation.

Significance of the Research

This study addresses a critical gap in the scholarly literature by examining the intersection of art, culture, and innovation within the South Korean context (Lam et al., 2020). Few studies have explored the unique opportunities and challenges that South Korea faces regarding cultural clusters and the creative industries (Liang & Wang, 2020). By presenting its findings, the research offers adaptable frameworks that can effectively support urban planners, cultural organisations, and policymakers in optimising the development of Art Park Clusters (Mohapatra & Rath, 2020). The study highlights the considerable implications for sustainable development, demonstrating the role of art and culture as both a solution to urban challenges and a driver of economic growth (Mohile et al., 2020). The advancement of Art Park Clusters in South Korea provides a practical approach to integrating art, culture, and innovation within national development strategies. Through the implementation of innovative technological management and intelligent resource allocation, South Korea can cultivate an enriched cultural environment that benefits both its citizens and international audiences (Mohile et al., 2020). The study ultimately aims to develop a strategic framework to guide South Korea in achieving its cultural and artistic aspirations while promoting the sustainable growth of its creative and cultural sectors (Munim et al., 2020).

LITERATURE REVIEW

Awareness Score

Effective strategic resource management begins with cultivating awareness, an essential intangible asset that shapes stakeholder engagement and visitor participation (Park et al., 2020a). From a resource-based perspective, awareness constitutes a form of social capital that can be mobilised to secure investment and foster community endorsement. The Bilbao Effect exemplifies how focused cultural branding and deliberate awareness-building transformed a declining industrial city into a globally recognised arts hub (Park & Shea, 2020). In the South Korean context, uneven awareness patterns between metropolitan and rural clusters underscore disparities in resource allocation, whereby urban projects capitalise on Hallyu-driven promotion while regional initiatives frequently lack equivalent marketing support. To address these imbalances, strategic measures may include the establishment of integrated digital platforms for shared promotional resources across clusters, alongside tiered awareness campaigns tailored to regional conditions (Park et al., 2020b).

Funding Satisfaction

Financial resource management constitutes a foundational element for the sustainable growth of Art Park Clusters. An excessive dependence on single funding sources, particularly governmental allocations, generates systemic vulnerability, whereby fluctuations in these resources can threaten the stability of entire projects (Parmaxi & Demetriou, 2020). Effective strategic resource management necessitates the establishment of diversified funding portfolios that integrate public–private partnerships, corporate

sponsorships, and international cultural grants. The funding approach of the West Kowloon Cultural District illustrates how multi-layered revenue mechanisms encompassing initial government funding, commercial leasing, and philanthropic contributions can enhance financial resilience (Pavithran et al., 2020). In the South Korean context, strategic financial management could involve pooling resources across multiple clusters to mitigate individual project risks, alongside the development of transparent return-on-investment frameworks designed to attract private sector participation (Rosenberg & Brent, 2020).

Infrastructure Quality

Physical infrastructure represents one of the most capital-intensive components of cluster development. Within the framework of strategic management, the objective is to optimise existing resources through adaptive reuse repurposing underutilised urban spaces and the implementation of flexible, multi-functional designs that facilitate more frequent infrastructure renewal (Simamora, 2020). The transformation of the Tate Modern Turbine Hall serves as a notable example of strategic management applied to physical resources. In South Korea, similar approaches offer the potential to enhance space utilisation within previously constrained sites, particularly through vertical cluster designs, shared facility arrangements among neighbouring cultural institutions, and the integration of smart technologies. These technologies, including data-driven scheduling and predictive maintenance systems, can significantly improve operational efficiency and the utilisation of physical infrastructure (Suprayoga et al., 2020).

Budget Efficiency

The strategic management of financial resources extends well beyond acquisition, encompassing their deliberate and efficient deployment. This entails the implementation of performance-driven allocation frameworks that are tied to quantifiable outcomes, real-time monitoring of expenditures through advanced digital tracking systems, and participatory budgeting processes that ensure alignment with stakeholder priorities (Xue et al., 2020). South Korea's advanced public sector digital transformation initiatives offer adaptable infrastructures that Art Park Clusters can leverage to enhance budgetary transparency and operational effectiveness (Arefieva, Egger, & Yu, 2021). Within this paradigm, strategic management conceptualises financial resources as dynamic and responsive assets rather than static allocations, thereby enabling clusters to adaptively respond to evolving operational and developmental demands (D'Urso et al., 2021).

Digital Tools Usage

The integration of technology functions as a force multiplier, enhancing the productivity of limited physical and human resources. Blockchain-based art registries can reduce authentication costs, while virtual reality exhibition platforms enable spatial expansion without additional physical infrastructure, and AI-supported tools can optimise staffing and environmental controls (Dizdaroglu, 2022). Digital technologies should therefore be

regarded as essential infrastructural assets that amplify the effectiveness of all other resources (Dotan et al., 2021). In the South Korean context, this entails leveraging the nation's advanced technological sector by establishing strategic industry partnerships that provide Art Park Clusters with early access to innovations, while simultaneously offering technology companies a real-world testing environment (Duarte-Duarte, Talero-Sarmiento, & Rodríguez-Padilla, 2021).

Sustainability Practices

Sustainable infrastructure initiatives, such as green buildings, contribute to the preservation of asset value, while water recycling measures reduce operational expenditures, and renewable energy systems serve as strategic hedges against future energy price fluctuations (Fazlagić, Szulczewska-Remi, & Loopesko, 2021). The climate-positive initiatives exemplified by the Copenhagen Cultural District demonstrate that environmental responsibility can be harmonised with financial sustainability (Gavurova et al., 2021). Within this framework, strategic management reframes sustainability investments not merely as costs, but as proactive measures that future-proof operations and enhance the value of all other cluster resources (Hassan et al., 2021).

AI Integration

Artificial intelligence presents strategic avenues to magnify the impact of constrained human and financial resources, ranging from predictive maintenance that prolongs equipment longevity to personalised recommendation systems that enhance visitor spending without incurring additional marketing expenses (Kasznar et al., 2021). Effective strategic deployment, however, necessitates meticulous planning for workforce training, ethical governance, and seamless system integration (Li et al., 2021). South Korea's leadership in AI research and development provides Art Park Clusters with the opportunity to pilot innovative applications, contingent upon framing AI as a collaborative partner that augments human labour rather than replaces it (Liu et al., 2021a).

Main Obstacles

The challenges identified largely originate from shortcomings in resource management, including limitations in spatial availability, fluctuations in financial resources, and tensions in human capital (de Loizaga & Elguezabal, 2020; Liu et al., 2021b). Strategic solutions include the establishment of shared land banks to support cluster development, the implementation of multi-year funding agreements linked to performance metrics, and the creation of hybrid artist–business roles that bridge the divide between creative and commercial domains. These approaches represent opportunities for innovative governance models in resource management. Such reorganisation aligns with broader cultural policy frameworks emphasising decentralisation, state–citizen co-creation, and creative placemaking, specifically adapted to the evolving arts landscape in South Korea. The next step involves a select number of institutions piloting these models at

scale and systematically evaluating their impacts using both economic and cultural performance indicators (Melesse, Di Pasquale, & Riemma, 2021).

Strategic Resource Management

The advancement of Art Park Clusters necessitates the application of strategic resource management to ensure sustainable growth while maximising both cultural and economic impact. This involves the deliberate planning, allocation, utilisation, and maintenance of critical resources including financial, spatial, human, and technological assets to address recurring challenges such as funding shortfalls, land scarcity, and operational inefficiencies (Pan et al., 2021). Potential solutions include diversifying financial streams through public private partnerships and crowdfunding, optimising infrastructure via adaptive reuse and intelligent technologies, and enhancing human capital through hybrid artist–administrator roles (de Loizaga & Elguezabal, 2020, p. 3). Cluster effectiveness and engagement can be further strengthened through performance-based budgeting and the strategic deployment of digital resources (Park et al., 2021). To compete on a global scale, strategic resource management must address the urban rural divide in South Korea and capitalise on technological advantages, such as AI and blockchain, to enhance operational efficiency. Long-term sustainability is supported by collaborative governance models, encompassing policy frameworks and community-driven initiatives. Ultimately, strategic resource management transforms Art Park Clusters into innovative spaces that harmonise economic viability with aesthetic value while promoting cultural and social significance (Pasieka et al., 2021).

Theoretical Foundations

The development of Art Park Clusters in South Korea necessitates a strategic approach that integrates resource management and innovation to achieve sustainable growth and maintain competitive advantage. The Resource-Based View (RBV) and Dynamic Capabilities Theory (DCT) offer essential theoretical lenses, providing a foundation for understanding how strategic resources can be effectively deployed and how dynamic capabilities can facilitate the optimal performance and evolution of Art Park Clusters.

Resource-Based View (RBV) and Art Park Cluster Development

The Resource-Based View (RBV) posits that sustainable competitive advantage arises from the effective utilisation of resources that are valuable, rare, inimitable, and non-substitutable (VRIN) (Barney, 1991). In the context of Art Park Clusters, critical resources encompass financial support, infrastructure quality, digital technologies, and the integration of AI (Beamish & Chakravarty, 2021). When these resources are strategically allocated and managed, cultural and creative spaces can achieve optimal budget efficiency, implement sustainable practices, and enhance long-term strategic planning. RBV provides policymakers and stakeholders with a framework to identify and leverage distinctive artistic, cultural, and technological assets, positioning South Korea's Art Park Clusters for

global competitiveness (Sugiarno & Novita, 2022). The framework further underscores the importance of investing in enduring infrastructure and digital platforms to streamline processes and foster innovation-driven cultural experiences. Without careful management, Art Park Clusters risk resource scarcity, inefficient planning, and the inability to attract artists, investors, and visitors (Lubis, 2022).

Dynamic Capabilities Theory (DCT) and Innovation in Art Park Clusters

While the Resource-Based View emphasises the significance of internal resources, DCT extends this perspective by highlighting an organisation's capacity to adapt to external changes through reconfiguration, innovation, and strategic adjustment (Buzzao & Rizzi, 2021). The competitiveness of Art Park Clusters depends on their ability to dynamically integrate emerging technologies, sustainable practices, and stakeholder engagement strategies. Process-oriented DCT, in particular, underpins innovation-driven development within these clusters, facilitating enhancements in visitor experiences, artistic collaborations, and operational sustainability. For instance, the strategic incorporation of AI enables the transformation of digital exhibitions, interactive installations, and cultural programming, while sustainability initiatives strengthen both environmental and economic resilience (Kurtmollaiev, 2020). Furthermore, as South Korea asserts its leadership in the creative and cultural industries, the capacity to seize opportunities such as international collaborations, evolving artistic strategies, and technological innovations ensures that Art Park Clusters remain relevant and globally competitive. Conversely, a deficiency in dynamic capabilities can stifle creative processes and hinder cultural participation due to rigid management structures (Vu, 2020).

Integrating RBV and DCT for Strategic Development

The integration of RBV and DCT establishes a strategic foundation for optimising resource management and promoting continuous innovation in South Korea's Art Park Clusters. This combined approach ensures that essential resources are efficiently deployed while maintaining the flexibility to adapt to evolving market conditions and technological advancements. By applying this dual framework, Art Park Clusters can achieve sustainable, innovative, and globally competitive outcomes, simultaneously supporting economic growth and strengthening the nation's cultural landscape (Gupta et al., 2020). Figure 1 presents the key dimensions of Strategic Resource Management and their dynamic impact on cluster development, highlighting the interplay between elements such as funding adequacy and AI integration, the resulting operational outcomes, and the persistent challenges that require ongoing attention.

Figure 1: Research Layout.

METHODOLOGY

Qualitative Study

This study examined the development of Art Park Clusters in South Korea through qualitative interviews (see Appendix I) with 20 experts, including policymakers, urban planners, and cultural strategists. Employing NVivo 12 Pro alongside a bespoke coding framework, the research identified key thematic areas: resource management (including funding constraints and workforce gaps), technological integration (smart infrastructure and AI/VR applications), stakeholder engagement (community-driven initiatives), and policy frameworks (sustainability regulations). The analysis revealed notable regional distinctions: Seoul emphasised regulatory scalability, whereas Busan concentrated on tourism-oriented digital art initiatives, such as a proposed VR gallery.

Table 1: Respondents Profile.

Participant	Age	Location	Category
P1	52	Seoul	Policymakers
P2	45	Seoul	Policymakers
P3	58	Busan	Policymakers
P4	49	Gyeonggi Province	Policymakers
P5	55	Incheon	Policymakers
P6	47	Daegu	Policymakers
P7	60	Seoul	Policymakers
P8	42	Seoul	Urban Planners
P9	38	Busan	Urban Planners
P10	50	Incheon	Urban Planners
P11	45	Daegu	Urban Planners
P12	55	Gyeonggi Province	Urban Planners
P13	40	Seoul	Urban Planners
P14	48	Jeju Island	Urban Planners
P15	35	Seoul	Cultural Strategists
P16	42	Busan	Cultural Strategists
P17	39	Gwangju	Cultural Strategists
P18	50	Jeju Island	Cultural Strategists
P19	44	Incheon	Cultural Strategists
P20	47	Daegu	Cultural Strategists

Policymakers (80%) underscored the importance of public–private partnerships in funding, while urban planners highlighted the role of IoT and AI in enhancing visitor engagement. Cultural strategists spearheaded community involvement, with 70% facilitating participatory workshops. Visualisations, including word clouds and concept maps, underscored the prevalence of terms such as innovation and sustainability and illustrated the intersections between policy, technology, and public participation. The findings indicate that successful Art Park Clusters require collaborative governance

structures, adaptive financing models, and the integration of innovative technologies, offering a potential template for analogous projects internationally. Table 1 presents the demographic profile of the 20 participants, categorised into policymakers, urban planners, and cultural strategists, detailing their age, location, and professional roles, ensuring balanced representation across regions and expertise.

For Quantitative Study

The study employed a quantitative approach, distributing structured questionnaires to 200 South Korean participants actively involved in Art Park Cluster initiatives. The survey instrument was derived from insights gathered during the qualitative phase and incorporated validated measures to assess Resource Management, Technological Integration, and Stakeholder Engagement. Established scales from prior research were utilised, with Sutrisno, Kraugusteeliana, & Syamsuri (2024) providing the basis for 5-item measures of both Resource Management and Technological Integration. Respondents rated items on a five-point Likert scale ranging from Strongly Agree (1) to Strongly Disagree (5), with intermediate options. To ensure internal validity and mitigate common method variance, the survey incorporated reverse-coded items and randomised question sequencing. The online administration enabled participation across diverse geographic regions in South Korea. Data preparation and preliminary cleaning were conducted in Python, followed by exploratory data analysis within Python and advanced statistical analysis in R, including regression modelling. Demographic variables such as age, sex, occupation, and location were summarised using descriptive statistics, while inferential techniques, including regression analysis, evaluated relationships among constructs. Specifically, regression was applied to examine the impact of Technological Integration on Stakeholder Engagement and the influence of Policy Frameworks on Resource Management optimisation. Post hoc analyses were conducted to uncover subtleties potentially overlooked by initial statistical procedures. The integration of Python and R, utilising Pandas and NumPy for data processing alongside R's lm() function for linear regression and ggplot2 for visualisation, facilitated comprehensive and reliable analysis. The combination of multiple methodological instruments enhanced measurement accuracy and bolstered the credibility of the findings. Quantitative results were triangulated with qualitative insights to identify variables that accelerate Art Park Cluster development. This mixed-methods approach strengthened the validity of the conclusions and generated actionable recommendations for urban planners and cultural strategists. By leveraging Python and R for data processing and statistical evaluation, the study illuminated critical success factors, offering significant contributions to the sustainable development and management of Art Park Clusters in South Korea.

FINDINGS

Qualitative Analysis (Nvivo)

Table 2: Excerpts from Qualitative Interviews.

Theme	Question	Excerpt
Resource Management	How do Art Park Clusters secure funding for their development and operations?	We rely on a mix of government grants, private sponsorships, and crowd funding to stay afloat.
	What strategies ensure efficient budget allocation?	We use cost-benefit analysis to prioritize projects and ensure funds are used effectively.
	How do public-private partnerships contribute to financial sustainability?	Collaborations with private companies bring in additional resources and expertise.
	What role do training programs play in talent development?	Training programs help artists and staff acquire new skills, ensuring the cluster's growth.
	How can sustainable infrastructure reduce costs?	Using renewable energy and eco-friendly materials lowers long-term operational expenses.
Technological Integration	How are digital tools like VR and AR used in Art Park Clusters?	VR allows visitors to experience art in new ways, making it more engaging and accessible.
	What role does AI play in optimizing operations?	AI helps us manage resources efficiently and personalize visitor experiences.
	How can smart infrastructure improve functionality?	IoT-enabled systems streamline maintenance and enhance energy efficiency.
	What challenges arise when integrating advanced technologies?	High costs and the need for technical expertise are the main barriers we face.
	How does South Korea's tech expertise contribute to innovation?	Our tech leadership allows us to implement cutting-edge solutions in art and culture.
Stakeholder Engagement	How do Art Park Clusters involve local communities?	We hold regular meetings with residents to ensure their needs and ideas are incorporated.
	What role do public awareness campaigns play?	Campaigns help attract visitors and build community support for our initiatives.
	How can collaborative governance enhance participation?	Involving stakeholders in decision-making ensures transparency and shared ownership.
	What strategies ensure cultural relevance and inclusivity?	We design programs that reflect the diverse cultural heritage of our community.
	How do Art Park Clusters foster a sense of belonging?	They provide a space where people can connect, celebrate, and share their cultural identity.
Policy Frameworks	What policies support Art Park Cluster development?	Tax breaks for investors have been crucial in attracting private funding.
	How can grants encourage creative projects?	Grants provide the necessary funding for innovative art installations and programs.
	What role do sustainability-focused policies play?	They ensure that our projects are environmentally friendly and socially responsible.
	How can regulatory frameworks be streamlined?	Simplifying approval processes can accelerate project implementation.
	What recommendations address funding and talent challenges?	We need more incentives for private investment and better training programs for artists.

Thematic analysis was employed as an analytical technique to identify recurring patterns within qualitative data. Table 2 illustrates how Art Park Clusters implement

strategic resource management to promote sustainability. Key strategies include the adoption of diversified funding mechanisms encompassing government grants, private sponsorships, and crowdfunding alongside enhanced budget allocation guided by cost-benefit analyses, and the establishment of public–private partnerships to strengthen financial resilience. The findings also emphasise investment in skills development through targeted training programmes and the deployment of sustainable infrastructure, such as renewable energy systems, to reduce long-term operational costs. These Resource Management strategies, as presented in Table 2, exemplify a comprehensive approach that balances economic efficiency with cultural and environmental objectives within the context of urban development.

Theme 1: Resource Management and Financial Sustainability

The success of Art Park Clusters is contingent upon the implementation of strategic resource management alongside practices that ensure financial sustainability. Long-term operational viability is achieved through the effective allocation of financial, human, and physical resources (Prabhu et al., 2021). One project participant emphasised the advantages of public–private partnerships, noting that such arrangements provide secure funding while enabling access to specialised expertise for large-scale initiatives (Scuttari, Pechlaner, & Erschbamer, 2021). Budgeting processes grounded in cost–benefit analysis allow organisations to prioritise and allocate resources to high-impact activities. Cluster growth is further dependent on comprehensive training programmes that cultivate a skilled workforce encompassing both administrators and artists (Wang et al., 2021). Sustainable infrastructure, particularly the incorporation of renewable energy systems, reduces operational costs while minimising environmental impact. Participants also highlighted that investments in green technologies generate economic efficiencies that advance global sustainability objectives. The extent to which Art Park Clusters effectively integrate these dimensions of resource and financial management directly influences their long-term operational excellence and overall success (Wei et al., 2021).

Figure 2: Word Cloud.

Figure 2 provides a visual representation of the most frequently occurring terminology

within the study, highlighting critical relationships between technological innovation and resource management, as well as the intersections of sustainability, community participation, and generational differences. The optimisation of Art Park Clusters should be guided by the technologies emphasised in prominent terms such as "digital," "audiences," "cultural," and "funding," ensuring that strategic development aligns with key thematic priorities and stakeholder expectations.

Theme 2: Technological Integration and Innovation

The integration of advanced technologies and innovative practices constitutes a foundational requirement for the development of neighbourhood-based interactive Art Park Clusters. Enthusiasts of technology increasingly prioritise immersive experiences that combine virtual reality (VR) and augmented reality (AR) applications (Campbell et al., 2022). VR platforms enable seamless access to contemporary artistic experiences without spatial constraints, as highlighted by collaborative partners (Cooper et al., 2022). The deployment of IoT-enabled smart infrastructure further enhances energy efficiency while simultaneously reducing operational costs. Addressing the substantial implementation expenses associated with these technologies requires specialised technical expertise. Participant feedback indicates that the effective adoption of innovative technological solutions positions Art Park Clusters as international exemplars of cultural innovation, delivering distinctive and memorable visitor experiences through the strategic application of emerging technologies (Kim et al., 2022).

Theme 3: Stakeholder Engagement and Community Involvement

The sustainable development of Art Park Clusters is contingent upon active stakeholder engagement, particularly involving community members. Planning outcomes are strengthened when communities participate, as this preserves cultural authenticity and fosters collective ownership over decision-making processes (Liu et al., 2022). Digital marketing strategies designed to enhance public awareness not only attract visitors but also cultivate community support for cluster initiatives (Moon et al., 2022). The pooling of cultural resources and effective decision-making is achievable only through the inclusion of both general and specialised stakeholders within collaborative governance frameworks (Moula, Palmer, & Walshe, 2022). One participant—a cultural strategist from Busan—emphasised that, regardless of their professional expertise, local artists should contribute to cluster development to ensure regional traditions are honoured and neighbourhood values are respected (Pandey et al., 2022). Prioritising stakeholder engagement enables Art Park Clusters to foster social cohesion and civic participation, ultimately establishing enduring spaces that authentically reflect community identities and values (Prahani et al., 2022).

Figure 3 illustrates the clustering of key themes based on lexical similarity, revealing the interconnections among the primary dimensions of Art Park Cluster development: Resource Management and Financial Sustainability, Stakeholder Engagement and

Community Involvement, Policy Frameworks and Strategic Recommendations, and Technological Integration and Innovation. The visualisation underscores the relationships among these central themes, highlighting their mutual influence and the necessity of an integrated approach for optimising Art Park Cluster outcomes in South Korea. The observed thematic integration emphasises that organisations must address these elements collectively to achieve sustainable cultural development and long-term cluster success.

Figure 3: Items Clustered by Word Similarity.

Theme 4: Policy Frameworks and Strategic Recommendations

Policy frameworks, when coupled with strategically formulated recommendations, establish the foundational conditions necessary for the successful development of Art Park Clusters. Robust policy mechanisms enable organisations to secure funding, enhance bureaucratic efficiency, and foster innovative solutions. Sustainability-oriented standards provide guidance for environmentally responsible construction and operational practices (Wang et al., 2022). Addressing challenges such as funding limitations and workforce stability requires targeted intervention measures. Policymakers play a crucial role in ensuring that accessibility and inclusivity are embedded within benefit distribution to diverse social groups (Yan et al., 2022). Participants highlighted that the synergy between strategic recommendations and established policies offers essential support for cluster growth while advancing sustainability objectives.
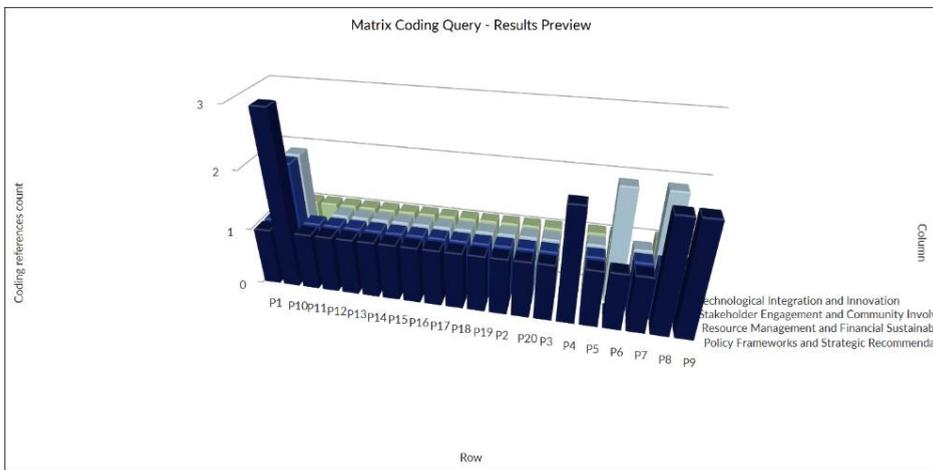
Figure 4: Matrix Coding Query - Results Preview.

The implementation of these initiatives contributes to creating an enabling environment in South Korea that promotes the sustained expansion and resilience of Art Park Clusters (Zabelskyte, Kabisch, & Stasiskiene, 2022). Figure 4 presents a comprehensive overview of the matrix coding query results, illustrating the frequency of coding references assigned to participants P1 through P20 across Model Integration, Innovation, and other pivotal themes. The matrix not only captures participant responses to the research questions but also highlights the relative prominence and significance of each theme in relation to the development of Art Park Clusters in South Korea.

Quantitative Results

Application of Python

The Python-based analytical tools provided critical insights into the structural relationships within the dataset, as depicted through the accompanying visualisations. The Correlation Matrix Heatmap elucidates the strength and direction of variable relationships, highlighting how technology adoption and stakeholder engagement influence the development of Art Park Clusters. Applying K-Means Clustering to Principal Component Analysis (PCA) demonstrates that dimensionality reduction enhances the identification of meaningful clusters, facilitating the optimisation of data segmentation strategies. The Elbow Method was employed to balance model accuracy against complexity, determining the optimal number of clusters for effective data partitioning. Additionally, the PCA Explained Variance analysis illustrates how principal components preserve essential information, thereby capturing the key patterns of variability across the dataset.

Regression Analysis

Table 4 presents the regression analysis, detailing coefficient estimates along with standard errors, t-values, p-values, and confidence intervals for all predictor variables. The constant term, valued at 2.149, is statistically significant ($p < 0.05$), indicating a reliable baseline effect.

Table 4: Regression Analysis.

	Coef	std err	t	P> t	[0.025	0.975]
Const	2.2407	0.544	4.117	0	1.169	3.313
AS	0.0413	0.064	0.648	0.518	-0.084	0.167
FS	0.1235	0.062	1.999	0.047	0.002	0.245
BF	0.0309	0.062	0.501	0.617	-0.091	0.152
DTU	0.0541	0.06	0.897	0.37	-0.065	0.173
SP	-0.1075	0.063	-1.718	0.087	-0.231	0.016
AI	-0.0203	0.06	-0.342	0.733	-0.138	0.097
MO	0.0674	0.063	1.07	0.286	-0.057	0.192
SRM	0.0893	0.06	1.487	0.138	-0.029	0.208

Among the predictors, Funding Satisfaction (FS) emerges as a significant determinant, exhibiting a positive correlation with the outcome variable ($p = 0.047$). Conversely, other variables including Awareness Score (AS), Budget Efficiency (BF), Digital Tools Usage (DTU), Sustainability Practices (SP), AI Integration (AI), Main Obstacles (MO), and Strategic Resource Management (SRM) did not reach statistical significance ($p > 0.05$) within this analysis. The results summarised in Table 4 elucidate the factors that exert direct influence on Art Park Cluster outcomes, thereby guiding future research priorities and informing strategic decision-making processes.

K-Means Clustering on PCA Components

Figure 5 illustrates the outcomes of the K-Means clustering analysis conducted on the PCA components. PCA reduces the dimensionality of the dataset, transforming it into principal components that capture the most significant variance within the data. These reduced-dimensional representations provide the foundation for K-Means clustering to assign data points to distinct groups. The resulting analysis reveals clear clustering patterns, demonstrating how observations are systematically organised into discrete clusters, thereby facilitating the identification of underlying structures within the Art Park Cluster dataset.
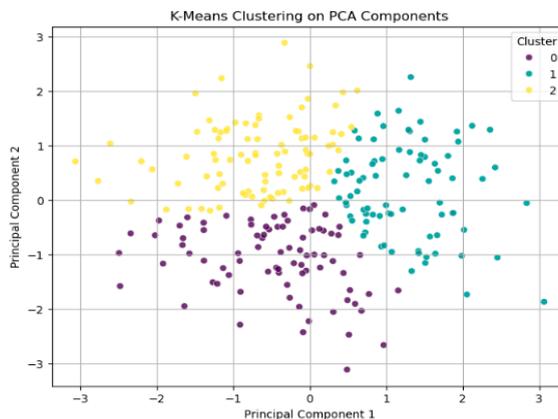
Figure 5: K-Means Clustering on PCA Components.

Descriptive Statistics

Table 5 summarises the descriptive statistics for Art Park Cluster development across nine assessed variables: AS, FS, IQ, BF, DTU, SP, AI, MO, and SRM. Each variable comprises 250 observations, with mean values ranging from 2.868 to 3.1, reflecting moderate performance across the evaluated dimensions. Variability is indicated by standard deviations spanning 1.381 to 1.474. The dataset demonstrates full utilisation of the five-point Likert scale, encompassing both minimum (1) and maximum (5) values. Quartile analysis reveals that the majority of responses cluster around the scale midpoint (3), although distributions exhibit mild skewness toward higher or lower values depending on the specific variable, capturing nuanced patterns in participant evaluations.

Table 5: Descriptive Statistics.

	AS	FS	IQ	BF	DTU	SP	AI	MO	SRM
Count	250	250	250	250	250	250	250	250	250
Mean	3.004	2.904	3.04	3.088	2.968	3.1	2.936	2.936	2.868
Std	1.38116	1.4251	1.38784	1.43124	1.45307	1.40638	1.474	1.401	1.454
Min	1	1	1	1	1	1	1	1	1
0.25	2	2	2	2	2	2	2	2	1
0.5	3	3	3	3	3	3	3	3	3
0.75	4	4	4	4	4	4	4	4	4
Max	5	5	5	5	5	5	5	5	5

Correlation Matrix Heatmap

Figure 6 depicts a correlation matrix heatmap illustrating the interrelationships among AS, FS, IQ, BF, DTU, SP, AI, MO, and SRM. The heatmap employs a colour intensity gradient to represent both the magnitude and direction of correlations, ranging from -1 to 1. Positive relationships are indicated by values approaching 1, signifying strong direct associations, whereas values nearing -1 denote strong inverse correlations, highlighting opposing variable dynamics.
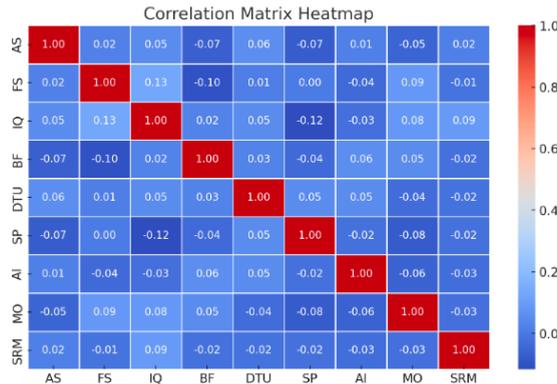
Figure 6: Correlation Matrix Heatmap.

Regression Model Summary

Table 6 presents the regression analysis of SRM predictors. The model incorporates eight independent variables: AS, FS, IQ, BF, DTU, SP, AI, and MO. The predictors collectively explain only 1.3% of SRM variance, as reflected in an R^2 of 0.013, while the adjusted R^2 of -0.02 indicates minimal explanatory power. The F-statistic of 0.397 demonstrates that the model does not adequately fit the observed data. The constant term (3.011) is statistically significant ($p < 0.01$), representing the baseline SRM value when all predictors are zero. None of the individual predictor variables exhibit statistically significant effects ($p > 0.1$), suggesting limited influence on SRM within this dataset. These findings highlight the need for further research incorporating

additional variables and alternative modelling approaches to better elucidate the determinants of SRM in Art Park Cluster development.

Table 6: Regression Model Summary.

Regression Model Summary	
	Dependent Variable
	SRM
AS	0.009
	-0.068
FS	-0.027
	-0.066
IQ	0.102
	-0.068
BF	-0.025
	-0.066
DTU	-0.022
	-0.065
SP	-0.017
	-0.067
AI	-0.032
	-0.064
MO	-0.038
	-0.067
Constant	3.011***
	-0.569
Observations	250
R2	0.013
Adjusted R2	-0.02
Residual Std. Error	1.469 (df = 241)
F Statistic	0.397 (df = 8; 241)
Note: *p<0.1; **p<0.05; ***p<0.01	

Application of R and R Studio

The R software analysis illustrates the relationship between AS and SRM through figures and tabular outputs. A polynomial regression model, presented in Figure 6, reveals a non-linear association across five data points. The R/n metric demonstrates how the regression coefficient varies relative to the sample size. The analysis indicates that AS moderately predicts SRM outcomes, as reflected by the corresponding coefficient values. These results provide insights into variable interactions and offer essential information for the development of robust statistical prediction models within the context of Art Park Cluster management.

Regression Coefficients

Table 7 summarises the regression analysis for SRM, presenting coefficients, standard errors, t-values, and p-values for the predictors. The baseline SRM value of 3.0106 is highly significant ($p < 0.001$) when all predictors are set to zero. However, none of the independent variables—AS, FS, IQ, BF, DTU, SP, AI, and MO—exhibit statistically significant effects ($p > 0.1$). IQ displays the largest coefficient (0.1018), yet it does not reach significance ($p = 0.138$). These findings indicate that the current set of predictors does not meaningfully explain variations in SRM, highlighting the need for further research to identify additional variables or alternative modelling approaches to better capture the determinants of SRM in Art Park Cluster development.

Table 7: Regression Coefficients.

	Estimate	Std. Error	T Value	SRM(>|t|)
(Intercept)	3.010624	0.569177	5.289	2.75e-07
AS	0.009309	0.068044	0.137	0.891
FS	-0.027482	0.066488	-0.413	0.68
IQ	0.101801	0.068482	1.487	0.138
BF	-0.024528	0.065814	-0.373	0.71
DTU	-0.022363	0.064501	-0.347	0.729
SP	-0.016976	0.067227	-0.253	0.801
AI	-0.032349	0.063534	-0.509	0.611
MO	-0.03765	0.067423	-0.558	0.577

Regression Analysis Polynomial Plot

Figure 7 depicts the relationship between AS and SRM through a second-degree polynomial regression. The scatter points represent observed values, while the red curve indicates the fitted quadratic trend. The modest curvature suggests a weak non-linear association between AS and SRM, highlighting limited predictive influence within the current dataset.
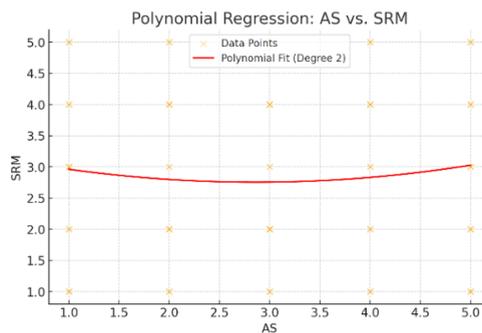
Figure 7: Polynomial Regression Analysis Plot.

DISCUSSION

The findings of this study on Art Park Cluster development in South Korea align closely with existing literature on SRM, innovation, and culture cluster sustainability. Anchoring the results within RBV and DCT provides a nuanced understanding of how these creative ecosystems function and evolve. A key strength of the study lies in its focus on diversified funding models as a central success factor, reflecting prior research on cultural clusters. Revenue diversification including public subsidies, private funding, and participatory financial mechanisms emerges as a primary driver of financial sustainability (Andersson et al., 2024; Prabhu et al., 2021). The analysis identifies FS as the sole statistically significant predictor ($p = 0.047$), corroborating prior arguments that strategic budgeting and resource allocation exert a more critical influence on sustainability than absolute fund levels. Within an RBV framework, financial resources represent a VRIN asset crucial for the competitive positioning of Art Park Clusters (Pasieka et al., 2021).

Beyond mere resource availability, the effective utilisation of investments is essential for competitive advantage (Kumar et al., 2023). Descriptive results suggest that South Korean clusters possess financial assets but lack coherent strategies to maximise their impact. Here, DCT underscores the necessity for adaptive financial planning to restructure funding mechanisms in response to environmental and economic fluctuations (Liu et al., 2022). The qualitative findings indicate interest in digital tools (VR/AR), whereas quantitative measures reveal limited technological adoption ($p = 0.733$ for AI; $p = 0.370$ for digital tools usage). This aligns with Open Innovation Theory, which emphasises ecosystem-wide collaboration over isolated technological investments (Zhang et al., 2020). High implementation costs and technical expertise requirements further constrain technological integration, confirming qualitative insights regarding barriers to adoption (Moula et al., 2022). From a DCT perspective, clusters may have access to technological resources but lack the adaptive capabilities to integrate them effectively; gradual capability development, supported by training and demonstration projects, may offer a more sustainable approach than isolated technology procurement.

Qualitative evidence also highlights the importance of community and collective cultural ownership, consistent with literature on stakeholder-driven governance in creative economies (Sadraei et al., 2023). While the quantitative model failed to achieve statistical significance, RBV suggests stakeholder engagement functions as a relational resource that promotes long-term sustainability (Cooper et al., 2022). Its influence appears indirect, mediated by factors such as policy support and funding security, in line with Stakeholder Theory, which posits that stakeholder relationships must be embedded within broader strategic frameworks to achieve cluster success (Spielhofer, Schwaab, & Grêt-Regamey, 2023). Policy frameworks further illustrate the interplay between qualitative impact and limited quantitative explanatory power ($R^2 = 0.013$). Contextual factors often shape policy outcomes in ways that are difficult to capture with general quantitative metrics (Liu et al., 2021a). From an RBV perspective, policies constitute external institutional resources that can facilitate or hinder cluster development. DCT refines this view, emphasising that adaptability and quality of implementation are more critical than policy existence per se

(Scheuer, Davies, & Roitsch, 2024). Current policy frameworks in South Korea may require enhanced localisation to translate effectively into cluster performance.

Overall, RBV highlights the value of tangible and relational resources including financial stability, stakeholder networks, and technological access while DCT emphasises the importance of adaptive responses to dynamic challenges. Effective Art Park Cluster development depends on strategic financial allocation, phased technology integration, systematic stakeholder engagement, and citizen-centric policy design. The interplay between RBV and DCT perspectives offers a robust foundation for enhancing the long-term sustainability and international competitiveness of South Korean Art Park Clusters.

CONCLUSION

The findings of this study provide a comprehensive understanding of the trends and challenges in developing Art Park Clusters in South Korea, particularly regarding sustainability. Successful clusters must balance competing priorities: artistic integrity and financial viability, technological adoption and practical application, top-down policy support and bottom-up community engagement. The convergence of these components, rather than any single element, underpins long-term success. Financial sustainability emerges as critical, with diversified funding from public, private, and community sources offering the most stable model. Yet, securing funds alone is insufficient; the allocation and management of these resources determine outcomes, explaining why some well-funded projects underperform while modestly financed initiatives excel. A similar pattern appears in technology: South Korea's advanced digital infrastructure does not guarantee success. Instead, applications that enhance visitor experiences, address operational challenges, or align with current trends prove most effective. Equally important is human and group vitality; qualitative evidence underscores the value of inclusive governance and local participation, even when these factors are not statistically significant. This divergence suggests that traditional quantitative measures may inadequately capture critical yet intangible elements such as trust, cultural authenticity, and community ownership, which remain central to practical success.

Implications for Policy and Practice

The study highlights the pivotal role of government authorities and leading practitioners in Art Park Cluster development, with technological integration emerging as a central factor. Digital platforms incorporating VR, AR, and AI enhance visitor access and engagement while improving experiential quality. Successful implementation requires substantial capital investment and the cultivation of workforce competencies, as technical complexity remains a key barrier. Stakeholder inclusion is essential for cultural relevance and sustainability, with public-community-artist partnerships fostering collective governance, civic engagement, and collaborative management. Public awareness campaigns and cultural festivals further strengthen local support and attract international visitors. Sustainable infrastructure development, including energy-

efficient green buildings, reduces operational costs and meets global environmental standards. Strategic budgeting ensures resources are directed toward critical initiatives, maximising both economic and cultural impact.

Future Research Directions

These findings illuminate multiple avenues for future research. Investigations into cultural preservation alongside regional economic indicators should adopt multi-variable approaches to capture complex dynamics. The use of machine learning algorithms could provide alternative modeling techniques to better predict the effects of policy interventions on cluster performance. This study leveraged a multi-dimensional methodology, combining Python, R, and NVivo, to analyse Art Park Cluster development in South Korea. By integrating these tools, the research establishes an advanced framework for optimising cultural hubs and ensuring long-term sustainable performance. It underscores the critical need to align technological solutions with community participation and sustainable practices, offering actionable guidance for policymakers and practitioners in the sector.

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APPENDIX: I

Interview Guideline

Section 1: Resource Management and Financial Sustainability

No.	Interview Question
1.1	How do Art Park Clusters in South Korea secure funding for their development and operations?
1.2	What strategies are employed to ensure efficient budget allocation and utilization within Art Park Clusters?
1.3	How do public-private partnerships contribute to the financial sustainability of Art Park Clusters?
1.4	What role do training programs and talent development play in supporting the long-term success of Art Park Clusters?
1.5	How can sustainable infrastructure investments reduce operational costs and environmental impact in Art Park Clusters?

Section 2: Technological Integration and Innovation

No.	Interview Question
2.1	How are digital tools like VR and AR being used to enhance visitor experiences in Art Park Clusters?
2.2	What role does artificial intelligence (AI) play in optimizing resource allocation and creative processes within Art Park Clusters?
2.3	How can smart infrastructure, such as IoT-enabled systems, improve the functionality of Art Park Clusters?
2.4	What challenges arise when integrating advanced technologies into Art Park Clusters, and how can they be addressed?
2.5	How does South Korea's technological expertise contribute to the innovation of Art Park Clusters?

Section 3: Stakeholder Engagement and Community Involvement

No.	Interview Question
3.1	How do Art Park Clusters involve local communities in their planning and management processes?
3.2	What role do public awareness campaigns play in attracting visitors and fostering community support for Art Park Clusters?
3.3	How can collaborative governance models enhance stakeholder participation in Art Park Cluster development?
3.4	What strategies are used to ensure cultural relevance and inclusivity in Art Park Clusters?
3.5	How do Art Park Clusters contribute to a sense of community and belonging among local residents?

Section 4: Policy Frameworks and Strategic Recommendations

No.	Interview Question
4.1	What policies are currently in place to support the development of Art Park Clusters in South Korea?
4.2	How can tax incentives and grants encourage private investment in Art Park Clusters?
4.3	What role do sustainability-focused policies play in promoting eco-friendly practices within Art Park Clusters?
4.4	How can regulatory frameworks be streamlined to facilitate the growth of Art Park Clusters?
4.5	What strategic recommendations can address obstacles such as funding limitations and talent retention in Art Park Clusters?