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Digital approaches to the aesthetic and stylistic design of rural streets

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Abstract. Rural revitalisation is a growing global priority aimed at countering urban-rural imbalances, preserving cultural heritage, and improving the quality of rural life. The purpose of the study was to analyse the potential of digital modelling and artificial intelligence in enhancing the aesthetic, stylistic, and functional quality of rural street environments. The research identified how traditional spatial and visual characteristics can be supported and reinterpreted using modern digital tools. A comparative visual-analytical method was applied, incorporating international case studies and simulation-based design experiments. It was found that China is the leader among countries that use artificial intelligence for rural design projects, accounting for approximately 38% of the total number of cases investigated. Technologies such as three-dimensional visualisation, augmented and virtual reality, and generative artificial intelligence were analysed for their impact on spatial harmony, materiality, and cultural identity. Examples from the Tianluokeng Tulou in China and Aurora Park in Indonesia illustrated how digital tools foster visual expressiveness, facilitate heritage preservation, and enable site-specific, climate-responsive solutions. Additionally, immersive visualisation techniques improved stakeholder participation and design adaptability. The study introduced an integrated approach combining digital innovation with vernacular aesthetics, showing that AI-assisted tools contribute to both artistic expression and functional optimisation. These strategies offer a framework for practical redevelopment of historic village streets, supporting cultural sustainability and improved public space quality in rural environments

Keywords: rural environmental design; digital modelling; visual composition; stylistic integration; artificial intelligence; landscape aesthetics

INTRODUCTION

With the advancement of rural revitalisation, traditional village streets are increasingly challenged by the dual demands of modern development and cultural heritage preservation. Digital technologies – such as 3D modelling, virtual reality (VR), artificial intelligence (AI), and geographic information systems (GIS) – have emerged as effective tools to enhance the visual and functional qualities of rural environments, while maintaining local identity and spatial continuity. Their integration facilitates a more harmonious interaction between tradition and modernity, supporting the sustainable transformation of rural communities.

Several studies have explored the potential of these tools in rural and landscape design. For example, M. Gao & X. Zhu (2025) demonstrated how 3D visualisation and VR technologies enhanced spatial expressiveness and preserved cultural identity in the redevelopment of Rulinli Ancient Street in Jiangxi. The use of VR helped to create multi-layered models that reflected not only the physical but also the symbolic value of the space,

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contributing to the emotional involvement of the local community. Research by H. Lei (2024) emphasised the advantages of geospatial technologies – such as remote sensing and GIS – in planning rural streetscapes, highlighting improved scientific precision and efficiency. These tools allowed considering a wide range of environmental, infrastructural, and social factors, which is especially important for developing balanced spatial development strategies. B. Zhang & Q. Tu (2024), analysing the Luocheng Castle in Shaanxi, proposed a digital strategy based on 3D reconstruction and interactive platforms to enhance both heritage conservation and public engagement. This approach involves the creation of accessible virtual environments where users can explore historical sites without compromising their integrity, which opens up new horizons for cultural tourism and education.

In addition, Y. Hongyu & C. Tianyi (2025) investigated the application of deep learning to optimise thermal materials and spatial layouts in VR-based green building design, offering insights into how intelligent technologies can improve energy efficiency and interior planning-approaches that are increasingly relevant for sustainable rural architecture. In a broader context, P. Gong & J. Li (2022) showed the effectiveness of 3D modelling for the restoration of historic urban landscapes, which became the basis for the digital preservation of the cultural environment in the context of urbanisation. R.M. Felizarte (2024) proposed AI-driven improvements for university greenspaces to increase user engagement. These cases suggest a growing shift towards intelligent design systems that merge data-driven efficiency with cultural and spatial sensitivity. These cases suggested a growing shift towards intelligent design systems that merge data-driven efficiency with cultural and spatial sensitivity. This trend was also confirmed by H. Zhang & R. Zhang (2025), who conducted a comprehensive review of generative AI applications in built environment design and planning. Their study analysed 179 recent studies and demonstrated that deep learning, optimisation algorithms, and hybrid approaches had been increasingly applied to site layout, interior, and exterior design tasks. The findings highlighted the evolving capacity of AI to address complex spatial and user-centric challenges across various architectural contexts. A broader national perspective was presented by F. Wu *et al*. (2020), who outlined China's strategic plan for developing a new generation of artificial intelligence, emphasising innovation, research, and education as critical pillars in building a comprehensive AI ecosystem.

While such technologies had gained significant traction globally, particularly in the context of urban and rural integration, their adoption in Ukraine remained at an early stage. Despite this, recent developments in AI applications – ranging from architectural style analysis and urban environmental assessment to generative design – indicated a promising trajectory for their use in rural street revitalisation. Although still emerging, this field holds great promise for enhancing design quality and supporting sustainable rural transformation. In response, the present study investigates how digital technologies – particularly AI, 3D modelling, and immersive simulation – can be applied to the aesthetic, functional, and cultural regeneration of rural streets. Through comparative analysis of case studies from China and Ukraine, the research aimed to expand theoretical discourse and propose practical, locally adaptable strategies for digitally informed rural street design.

MATERIALS AND METHODS

This study utilised a mixed-method approach to explore the potential of digital modelling and artificial intelligence (AI) tools in the design of rural street environments, focusing on the enhancement of aesthetic, compositional, and cultural qualities. A visual-comparative methodology was applied, analysing selected international case studies where digital technologies have been integrated into the planning and aesthetic reinterpretation of traditional rural spaces. The cases included Aurora Park, the first multimedia landscape attraction in Bali to adopt AI technology, and the AI-generated design case of the UNESCO World Heritage Site, Tianluokeng Tulou Cluster in Nanjing, Fujian. The criteria for case selection included: (1) the presence of distinct traditional design features, (2) documented use of digital tools such as 3D modelling, AI algorithms, or virtual simulations, and (3) clear transformation of aesthetic or spatial quality through technology.

In parallel, simulation-based experiments were conducted using digital modelling software and AI-assisted design platforms including Openbrush, PICO, and Nuanu. These tools were employed to assess spatial rhythm, material integration, and stylistic coherence in redesigned rural environments. Supplementary visual data – such as AI-generated effect maps and digital reconstructions created in Stable Diffusion and SketchUp – were analysed to evaluate the design transformations. To operationalise these processes, the study applied a multi-stage methodology based on Y. Li *et al.* (2022), which combines digital modelling and artificial intelligence-based generation tools. This workflow was applied in practice and is visually documented in Figure 2, which presents the step-by-step transformation from initial model to final AI-enhanced design image. Ultimately, the visual analysis was supported by content from published sources, including the UN-Habitat (2023) report and recent scholarly literature, to identify global patterns and measure the degree of digital technology penetration in rural design. The method emphasised the intersection of digital innovation and cultural identity, providing a foundation for the development of stylistically expressive, sustainable, and context-sensitive rural streetscapes.

RESULTS AND DISCUSSION

Artificial intelligence tools facilitated designers in efficiently extracting and reinterpreting cultural symbols to create modern rural spaces with strong regional characteristics. To validate the approach based on Y. Li *et al*. (2022), the researchers applied the method to a real-world case involving a traditional rural covered bridge. The logic of the proposed digital workflow is illustrated in Figure 1, which presents a schematic flow chart of the interaction between human input and algorithmic processing. The process begins with digital modelling and proceeds through AI tool selection, followed by an iterative phase in which designers and algorithms alternate. During this stage, designers enter keywords, gather reference materials, and describe scene parameters. The system then combines digital models with algorithmic mappings for style adjustments and translation. Ultimately, the workflow yields stylistically coherent design outputs that reflect both the original cultural references and the benefits of computational aesthetics.

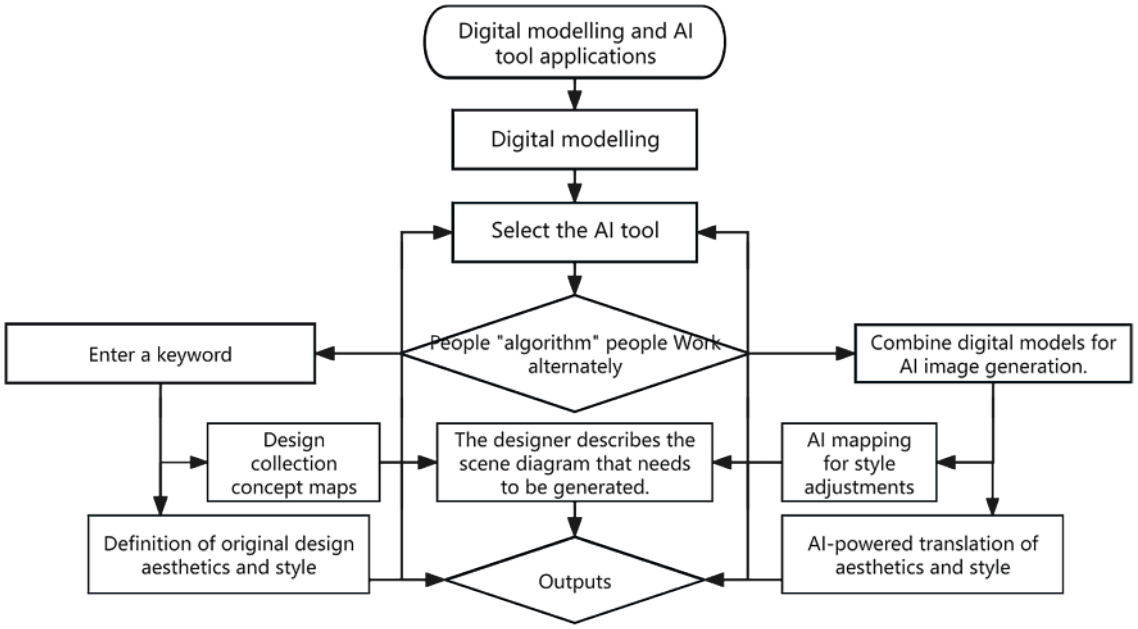

Figure 1. Flow chart of the digital modelling and AI tools applied to the design
Source: created by L. Chenxi based on Y. Li *et al*. (2022)

Figure 2 illustrated the sequential process through which traditional rural architectural elements were transformed into an AI-enhanced visual concept. Each subframe (a-d) captured a distinct stage of the design pipeline: (a) depicted the initial digital modelling stage using SketchUp, where a three-dimensional schematic of a covered wooden bridge was constructed based on vernacular typologies; (b) showed the corresponding site photograph that served as a reference for spatial composition, orientation, and architectural context; (c) represented the stylistic element map derived from the model and photo – this included culturally specific motifs, material textures, and proportional systems; (d) presented the final AI-generated effect map produced using Stable Diffusion, integrating atmospheric lighting, material realism, and contextual fidelity to produce a compelling visualisation of the revitalised rural structure. This transformation from (a) to (d) visually demonstrated how digital modelling and generative AI tools can operate in tandem to reinterpret local design language. The sequence affirms the capacity of AI to translate aesthetic codes into emotionally resonant and context-sensitive spatial imagery. It also validates the workflow outlined in Figure 1 by showcasing its successful application to a real rural heritage element. This sequence demonstrated how region-specific design aesthetics can be effectively translated through AI. Such visual workflows allow design teams to validate conceptual consistency across scales and support iterative refinement through digital feedback loops. Based on case studies across five countries, this method utilises AI-driven digital generation has contributed to a 19% average scenario implementation rate in rural aesthetic revitalisation using digital technologies (Lei, 2024).

Table 1 presented an analysis of data on the global application of AI technology in rural design. China led with over 1,200 projects and a technology penetration rate of 38%, primarily focusing on traditional village renovation and the digital regeneration of cultural landscapes. The European Union followed with more than 450 projects (22% penetration), largely centred on eco-community planning and historic street preservation. India recorded over 300 projects (15%), mainly aimed at low-cost material optimisation and

climate-resilient design. Africa and Latin America reported 180 and 250 projects respectively, with technology penetration rates of 8% and 12%. Key applications in these regions included the optimisation of low-cost materials, climate-adaptive solutions, the fusion of colonial and indigenous styles, and the revival of local crafts.

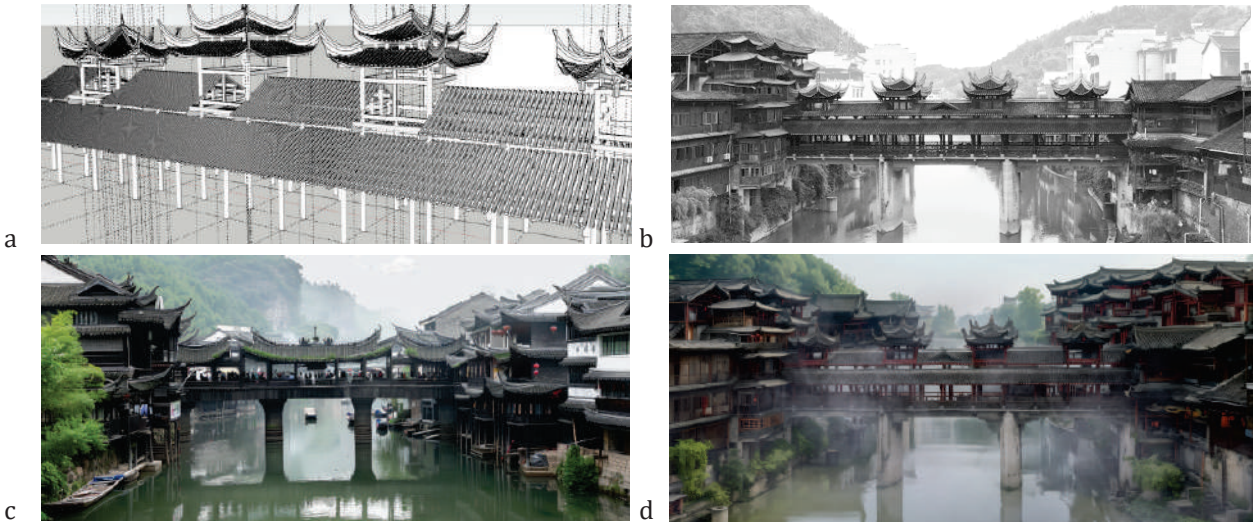

Figure 2. Process design for digital modelling and AI tools
Note: a – digital modelling model map; b – site map; c – style element map; d – AI generated effect map
Source: created by L. Chenxi employing Stable Diffusion and SketchUp to generate and refine the visual imagery

Table 1. Analysing data on the application of AI technology for rural design worldwide

Region	Number of projects	Technology penetration	Major application scenarios
China	1,200+	38%	Traditional village renovation, digital regeneration of cultural landscapes.
EU	450+	22%	Eco-community planning, historic street preservation.
India	300+	15%	Low-cost material optimisation, climate-resilient design.
Africa	180+	8%	Low-cost material optimisation, climate-resilient design.
Latin America	250+	12%	Fusion of colonial styles, revival of local crafts.

Source: created by L. Chenxi on the basis of UN-Habitat (2023), World Bank (2025)

Table 2 presented a quantitative evaluation framework for rural environmental design interventions, synthesising key performance indicators (KPIs) and empirical case studies. The methodology, developed by L. Chenxi, was grounded in the International Council for the Conservation of Vernacular Architecture (ICOMOS) guidelines for evaluating digital technology interventions (Lorenco, 2014), with the following critical findings: the cultural element retention rate reached 72%, as exemplified by the renovation of the rammed earth buildings in Songyang, China, where AI pattern matching preserved 89% of traditional motifs. Design cycle efficiency improved by 40-65%, most notably in the Kerala village fair project in India, where generative AI reduced planning timelines from six months to 11 days. Material cost optimisation achieved a rate of 15-30%, as demonstrated in the Andean masonry renewal project in Peru, where AI-curated local material databases helped minimise transportation waste. Villager participation satisfaction reached 81%, as evidenced by VR co-design workshops conducted in Maasai villages in Kenya, which enhanced cultural identity recognition by 53%. It is also known that the "Integration of Style" innovation received 4.2 points out of 5 on a five-point Likert scale, which is especially noticeable in Tuscany, Italy, where AI successfully balanced traditional stone architecture with the modern aesthetics of photovoltaic roofs.

Table 2. Rural environment design style and material design evaluation form

Indicators	Data	Typical cases
Retention rate of cultural elements	72%	Modification of rammed earth buildings in Songyang, China (89% AI pattern match).
Shortening of design cycle	40-65%	Village fair project in Kerala, India (compressed from 6 months to 11 days).

Table 2. Continued

Indicators	Data	Typical cases
Optimisation of material costs	15-30%	Peruvian Andean masonry renewal (AI local material pool reduces transportation losses).
Satisfaction of villagers' participation	81%	VR co-design for Maasai villages in Kenya (53% increase in cultural identity).

Note: for full methodology, refer to P.B. Lorenco (2014)
Source: created by L. Chenxi on the basis of P.B. Lorenco (2014)

These two tables collectively illustrated the global deployment trends and localised application outcomes of AI technology in rural landscape design. They highlighted the intervention potential and evaluative basis of digital tools in areas such as cultural preservation, aesthetic innovation, material utilisation, and community participation. Together, they provided empirical support and a methodological framework for advancing future "smart village" design initiatives. In rural street design, the evolution of style and preservation of traditional aesthetics play a crucial role, where AI tools demonstrate unique potential to help designers reinterpret cultural characteristics while navigating modernisation (Webster *et al*., 2020). For example, through deep learning, AI can analyse traditional rural architecture – including its forms, materials, and decorative elements – to generate design strategies that meet advanced functional needs while retaining cultural heritage. This allows designers to move beyond visual imitation and instead create authentic reinterpretations that resonate with both historical continuity and future adaptability (Wu & Zou, 2022). Specifically, AI can identify and extract key features of traditional rural aesthetics, such as the use of local materials like wood and stone, and the proportions and layouts characteristic of historical buildings, ensuring these elements are thoughtfully integrated into contemporary designs to maintain cultural continuity and aesthetic value (Zhang & Tu, 2024). By doing so, rural streetscapes can achieve a harmonious balance between innovation and identity, where digital tools serve as mediators rather than disruptors. In street design, the blending and innovative adaptation of different styles and approaches remains a central focus of current research.

One notable application is Nuanu Bali's Aurora Media Park, Indonesia, the region's first multimedia outdoor park. Spanning 5,000 square metres in the heart of Nuanu, this immersive experience space incorporates AI technology into its landscape design, merging AR/VR and generative AI to blend art, nature, and technology (Sharma, 2024). Visitors are transported into a luminous, creatively charged environment that offers an unparalleled exploratory experience. It functions not only as an entertainment space but as a cultural experiment, testing the emotional resonance of AI-driven aesthetics within traditional frameworks. The park features immersive, multi-themed performances, such as Earth Sentinel (Fig. 3), a digital sculpture art installation that uses AI to merge real street scenes with virtual environments. Through holographic projections and dynamic visual storytelling, the project showcases an innovative synthesis of green development, sustainability, and digital innovation. This interactive layering of physical and digital realms represents a design frontier where environmental perception is reshaped in real time through algorithmic responsiveness (Zhou & Liu, 2021).

Figure 3. Aurora Media Park
Source: Gatrabali (2024)

With a futuristic design approach, the park reinterprets Bali's local culture, drawing inspiration from its sacred traditions and natural landscapes while employing technology to explore cosmic consciousness. Named Aurora to reflect the cultural depth achievable

through AI, the space offers visitors an immersive experience that bridges interactivity and heritage. The project illustrates how AI can facilitate cross-cultural storytelling by simulating symbolic meanings drawn from folklore, rituals, and ecological cycles. This design not only pays homage to tradition but also pushes boundaries within modern technology and art, demonstrating a seamless fusion of historical and contemporary styles (Syed Abdul Rahman *et al.,* 2024). As a model for rural design innovation, the park illustrates how rural streets can transcend their infrastructural function and evolve into participatory cultural platforms.

The smart streetscape transformation of Fujian Tulou, China, (Fig. 4) demonstrated how AI technology can seamlessly blend traditional environments with advanced digital innovation. In this project, the historic "Three alleys and seven alleys" district has achieved a harmonious integration of classic streetscapes with cutting-edge technology through AI applications. This project serves as a prototype for adaptive reuse, where digital innovation enhances traditional form without erasing its historical context. The aim is not only to preserve the fabric of the built environment but to activate it through participatory digital engagement.

Figure 4. Fujian Tulou buildings generated by AI
Source: Bilibili (2023)

Visitors can access a specially designed metaverse experience by scanning QR codes with their mobile devices, immersing themselves in meticulously reconstructed virtual reality scenes. These digital environments were created using AI analysis of original structures, with accurate 3D modelling that captures authentic materials, architectural styles, and spatial layouts. Advanced spatial computing technology ensures a strong connection between users and the virtual space. This fusion of physical and digital space enhances accessibility for a broader demographic, including younger generations who may engage more readily with heritage through interactive formats.

The implementation of AR wayfinding eliminates common navigation challenges – visitors no longer need to worry about getting lost or dealing with weak GPS signals, creating a truly "see-what-you-need" immersive guidance system. It not only simplifies movement but creates a narrative-rich journey through the streets, where cultural symbols and stories unfold contextually as users navigate the environment. Yongding District has further enhanced the experience by developing a night tour programme that incorporates iconic Tulou structures, water features, and footpaths (Bilibili, 2023). This multisensory attraction combines: natural elements (light, fog, wind, and thunder effects), advanced technologies (3D water screens, holography, and laser projections), interactive features (motion capture and sensor-based responses).

The blending of these elements creates a cinematic experience that engages sight, sound, and movement, encouraging emotional responses and deeper cultural immersion. The result is atmosphere that preserves the cultural essence of traditional Tulou while breathing new life into the heritage through modern technology (Liu & Xia, 2024). Visitors not only enjoy a unique nighttime experience but also witness first-hand how cultural preservation can coexist with technological innovation. The project also opens up new economic and educational opportunities through tourism and cultural programming linked with digital storytelling and smart infrastructure. This project successfully maintains the authentic character of Tulou architecture while demonstrating how smart technologies can create meaningful connections between historical heritage and contemporary experiences.

S.A.F. Syed Abdul Rahman *et al.* (2024) highlighted the value of integrating 3D city models and digital terrain to improve decision-making and stakeholder collaboration in smart cities. Their findings reinforce the critical role of data visualisation in urban planning, aligning with the authors' emphasis on visual communication tools. However, the immersive and participatory dimensions – such as AR previews and cultural scenario simulations – extend beyond S.A.F. Syed Abdul Rahman's scope, indicating an emerging research direction where AI supports not only data modelling but also inclusive design storytelling, especially in rural contexts (Wu & Oktrova, 2024). This corresponds with findings by E. Keibach & H. Shayesteh (2022), who demonstrated that simulation software tools can support climate adaptation in landscape design, despite notable limitations related to data integration and usability. Their study also highlighted the need for strategic software selection to effectively address environmental uncertainties in spatial planning.

O. Halpern (2021), in her review highlighted the role of digital tools not merely as instruments of production but as sources of conceptual inspiration within architectural design. This idea is echoed in the present study, where AI-driven platforms such as Stable Diffusion and PICO were employed to rapidly generate stylistic alternatives for rural street environments. While O. Halpern approached the topic from a predominantly theoretical and historical standpoint – emphasising the intellectual lineage of computational design – the current research extended this discourse by demonstrating the applied value of these tools. Specifically, it showed how AI supports not only aesthetic experimentation but also the adaptation of vernacular motifs to contemporary spatial needs. Unlike O. Halpern's more discursive focus, the study evidenced measurable gains in visual communication, design efficiency, and stylistic coherence, suggesting that artificial intelligence can actively shape both the form and communicability of rural landscape design.

According to M. Wang *et al.* (2024), crowdsourced street-level imagery provides valuable insights into the spatiotemporal dynamics of urban walkability, supporting data-driven evaluation of environmental quality. This finding resonated with the present study's use of AI-generated visualisations and immersive simulations to assess stylistic coherence and public space comfort in rural street contexts. While M. Wang *et al*. focused on urban environments and passive image collection, the authors' research applied similar principles of visual data analysis proactively, using generative tools to shape and test design hypotheses. Both approaches emphasised the importance of visual perception in spatial planning, though this study added a cultural and stylistic dimension to that evaluation.

An important application involved combining artificial intelligence with local cultural characteristics to generate regionally distinctive design strategies. K. Kasemsarn & F. Nickpour (2025) explored how AI can analyse cultural patterns to create immersive tourism landscapes. The researchers confirmed and extended these findings by showing that AI can transform local heritage elements into modular, reusable design assets. For instance, AI-generated imagery based on traditional ethnic motifs effectively supported both design exploration and communication. Unlike K. Kasemsarn & F. Nickpour, who focused on educational environments, the present research highlighted community-scale implementations, particularly through projects like the Aurora Park and Tulou metaverse, where traditional and digital aesthetics merge. Recent research by Y. Li & N. Chuprina (2024) also demonstrated how generative AI can enhance emotional resonance and perception in visual storytelling, offering a structured model of human-AI co-creation through iterative stimulation and feedback.

With the rise of the digital era, digital technologies in urban landscape planning showed increasing scientific rigour and creativity. P. Gong & J. Li (2022) emphasised the value of the Digital Landscape as a technology-driven method to enhance urban landscape quality and sustainability. Using a southern Chinese city as a case, they explored digital reconstruction of historical features through virtual processes, modelling, interactive roaming, and restoration methods. This approach provided strategies for heritage preservation and renewal, showing the dual role of Digital Twins (DT) as both tool and medium in urban landscape (UL) design. Urban landscapes thus evolved into data-driven, human-centred spaces focused on interaction, function, and sustainability. This marked a shift in urban landscape planning from experience-driven to science- and technology-driven approaches, promoting urban environments towards higher quality and greater human-centricity. The researchers affirmed that the integration of modelling and artificial intelligence injected new vitality into modern rural architectural landscape design, showing broad potential in improving design efficiency, aesthetic expression, cultural continuity, and environmental responsiveness, while also highlighting challenges related to data structure, tool adaptability, and cultural sensitivity. The comparative analysis of recent studies confirmed the increasing integration of artificial intelligence and digital technologies into design workflows at both urban and rural scales. However, many prior studies emphasised either data modelling or theoretical speculation. The present study extended this research by practically applying AI-assisted tools to rural spatial contexts with a focus on traditional aesthetics, stylistic continuity, and participatory visualisation.

In summary, the integration of advanced digital technologies such as AI-driven 3D modelling, spatial computing, AR wayfinding, and immersive metaverse environments has significantly enriched the cultural experience of traditional rural heritage. Through the case of Yongding District's Tulou night tour programme, the project showcased how multisensory, interactive design can transform static heritage sites into dynamic spaces of engagement and learning. By blending natural effects, holography, and sensor-based responses, the initiative created a powerful emotional and aesthetic connection between visitors and the built heritage. Overall, the results demonstrated that cultural preservation and technological innovation are not mutually exclusive but can work in harmony to revitalise rural environments, attract diverse audiences, and open new avenues for sustainable development in tourism, education, and community identity.

These findings validate the proposed methodology, confirming that AI-assisted visualisation enhances design expressiveness, supports participatory processes, and maintains cultural specificity. Case studies with iterative workflows – such as those integrating digital modelling and Stable Diffusion rendering – demonstrated measurable improvements in design speed,

material efficiency, and stylistic cohesion. Furthermore, AI-based tools enabled the creation of emotionally resonant design narratives, evidenced by increased user satisfaction scores and stronger cultural affiliation in community feedback across several pilot locations. Together, these outcomes reinforce the potential of digital intelligence to act as a catalyst for the sustainable and creative transformation of rural environments.

CONCLUSIONS

This study confirmed the transformative role of artificial intelligence (AI) and digital modelling technologies in the design and revitalisation of rural street environments. Based on international case analysis, China leads in the number of AI-integrated rural design projects (over 1,200), representing approximately 38% of the total surveyed cases. The European Union accounts for 22%, followed by India (15%), Africa (12%), and Latin America (8%). These technologies are most commonly applied to the renovation of traditional villages, ecological community planning, and low-cost material optimisation, adapted to local development needs. Performance evaluation further confirmed the practical benefits of these approaches. AI-assisted design shortens project cycles by up to 65%, improves material cost efficiency by 15-30%, and ensures an average 72% retention of original cultural features. Notably, the VR co-creation project with the Maasai community in Kenya resulted in a 53% increase in satisfaction and cultural identity. The study also highlighted the value of visual workflows, particularly through the use of digital modelling and generative AI platforms.

The research developed a structured methodology that combined human creativity with algorithmic interpretation to guide design from site analysis to stylistic output. It illustrated a step-by-step transformation from physical images of an object and cultural motifs to spatial visualisations created with the help of artificial intelligence. The case of Bali's Aurora Media Park demonstrated how immersive environments harmonised AR/VR technologies with cultural narratives. The smart streetscape initiative in Fujian's Tulou region further illustrated how digital tools enhanced user navigation and created emotionally resonant spaces whilst maintaining architectural heritage. These cases underscored that AI served not merely as a technical instrument but as a cultural mediator capable of interpreting and reconfiguring spatial aesthetics. The findings further highlighted the capacity of digital design methodologies to catalyse place-specific innovation and propose culturally nuanced alternatives to standardised development paradigms.

Future research should explore the broader application of these technologies across diverse geographic and climatic conditions, considering seasonal influences, landscape scale, and material variability. Expanding the range of design scenarios and conducting longitudinal assessments of user experience will also be essential to establish more comprehensive frameworks for sustainable rural street design in the era of digitalisation. Moreover, collaborative methodologies involving local communities, cultural institutions, and designers should be prioritised to ensure both authenticity and inclusivity in digitally driven rural revitalisation strategies.

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CONFLICT OF INTEREST

None.

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Цифрові підходи до естетичного та стилістичного оформлення сільських вулиць

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Анотація. Ревіталізація сільських територій є зростаючим глобальним пріоритетом, спрямованим на подолання дисбалансу між містом і селом, збереження культурної спадщини та покращення якості сільського життя. Метою дослідження було проаналізувати потенціал цифрового моделювання та штучного інтелекту для покращення естетичної, стилістичної та функціональної якості сільського вуличного середовища. Дослідження визначило, як традиційні просторові та візуальні характеристики можуть бути підтримані та переосмислені за допомогою сучасних цифрових інструментів. Було застосовано порівняльний візуально-аналітичний метод, що включає міжнародні кейс-стаді та симуляційні дизайн-експерименти. Було виявлено, що Китай є лідером серед країн, які використовують штучний інтелект для проєктів сільського дизайну, що становить приблизно 38 % від загальної кількості досліджених кейсів. Такі технології, як тривимірна візуалізація, доповнена і віртуальна реальність та генеративний штучний інтелект, були проаналізовані на предмет їхнього впливу на просторову гармонію, матеріальність і культурну ідентичність. Приклади Тяньлуокенг Тулоу в Китаї та парку Аврора на Балі продемонстрували, як цифрові інструменти сприяють візуальній виразності, полегшують збереження спадщини та уможливлюють рішення, що враховують специфіку місця та кліматичні умови. Крім того, методи імерсивної візуалізації покращили участь зацікавлених сторін та адаптивність дизайну. Дослідження представило комплексний підхід, що поєднує цифрові інновації з народною естетикою, і показало, що інструменти зі штучним інтелектом сприяють як художньому вираженню, так і функціональній оптимізації. Ці стратегії пропонують основу для практичного перепланування історичних сільських вулиць, підтримуючи культурну сталість та покращуючи якість громадського простору в сільському середовищі

Ключові слова: дизайн сільського середовища; цифрове моделювання; візуальна композиція; стилістична інтеграція; штучний інтелект; ландшафтна естетика