

PRESERVING TRADITIONAL DONGSHAN DWELLINGS THROUGH ADAPTIVE DESIGN: A THEORETICAL AND PRACTICAL APPROACH

Hao ZHOU¹, Akapong INKUER², Chanoknart MAYUSOH³, and Pisit PUNTIEN³

1 Doctoral Student of Philosophy Program in Visual Arts and Design, Faculty of Fine and Applied Arts, Suan Sunandha Rajabhat University, Thailand;
s63584948011@ssru.ac.th

2 Advisor in Visual Arts and Design, Faculty of Fine and Applied Arts, Suan Sunandha Rajabhat University, Thailand; akapong.in@ssru.ac.th

3 Visual Arts and Design, Faculty of Fine and Applied Arts, Suan Sunandha Rajabhat University, Thailand; chanoknart.ma@ssru.ac.th, pisit.pu@ssru.ac.th

ARTICLE HISTORY

Received: 3 February 2025

Revised: 17 February 2025

Published: 11 March 2025

ABSTRACT

This article focuses on the protection and adaptive design issues of traditional dwellings in Dongshan, Suzhou, China, in the modern context. Based on theoretical analysis and framework construction, it systematically explores how to achieve a dynamic balance between cultural inheritance and functional renewal through design strategies. The research combines literature analysis, field investigation, and case studies to systematically sort out the architectural features, cultural values, and adaptive needs of Dongshan dwellings in contemporary society. The research objectives include studying the regional characteristics of Dongshan dwellings in Suzhou, and summarizing the historical evolution laws of their humanistic features, folk culture, etc. It also summarizes and analyzes the construction techniques of Dongshan dwellings and studies the influence of Xiangshan craftsmen on the development of Dongshan dwellings. This study constructs an adaptive design theoretical framework centered on "cultural core protection - functional optimization and renewal - ecological adaptability improvement", providing theoretical basis and practical guidance for the protection and reuse of Dongshan dwellings. The research results show that adaptive design can not only continue the architectural cultural genes of Dongshan dwellings, but also meet the needs of modern lifestyles on the basis of functional optimization and spatial reconstruction.

Keywords: Dongshan Dwellings, Adaptive Design, Cultural Inheritance, Functional Optimization, Spatial Reconstruction

CITATION INFORMATION: Zhou, H., Inkuer, A., Mayusoh, C., & Puntien, P. (2025). Preserving Traditional Dongshan Dwellings through Adaptive Design: A Theoretical and Practical Approach. *Procedia of Multidisciplinary Research*, 3(3), 47.

INTRODUCTION

Located in the Taihu Lake Basin of Jiangsu Province, Dongshan Town in Suzhou is a typical representative of Jiangnan water town culture. Its Ming Dynasty dwellings are renowned for their exquisite architectural decorations, rigorous spatial layouts, and unique "Xiangshan Gang" craftsmanship. These dwellings not only reflect regional culture and architectural aesthetics but also embody the lifestyle and spiritual pursuits of traditional society. However, with urbanization and economic development, Dongshan's traditional dwellings face severe functional degradation and cultural erosion. In recent years, due to aging structures, resident relocation, and rising maintenance costs, some dwellings have been left vacant or abandoned. Meanwhile, the introduction of modern lifestyles has altered the logic of traditional space usage, revealing significant shortcomings in the functional adaptability of traditional dwellings. Against this backdrop, exploring how to achieve the integration of cultural inheritance and modern functionality in Dongshan dwellings through adaptive design has become an urgent and critical issue.

Research Objectives

The research objectives include the following two points.

- 1) This research aims to study the regional characteristics of the residential buildings in Dongshan, Suzhou, and sort out the historical evolution laws of the humanistic features and folk culture of Dongshan residential buildings.
- 2) This research aims to studies and analyzes the construction skills of Dongshan folk houses in Suzhou, and studies the influence of Xiangshan craftsmen on the development of Dongshan folk houses.

LITERATURE REVIEWS

Cultural History and Spatial Characteristics of Dongshan Dwellings

1) Regional Characteristics of Dongshan Dwellings

Dongshan dwellings in Suzhou were initially constructed during Jiajing period of the Ming Dynasty (1522-1566) and are located in Songyuan Lane, Dongshan Town, Wuzhong District, Suzhou, Jiangsu Province (Figure 1). They are also a typical representation of the "Xiangshan Gang" craftsmanship. Historically, Dongshan experienced rapid economic development. During the Southern Song Dynasty, it had already formed a rural community with a certain social structure, integrating the artistic culture of the Northern Song period. The rise of merchant guilds during the Ming and Qing dynasties led to the emergence of culturally rich and prosperous residential villages such as Yangwan Street, Luxiang Street, and Wuxiang Street. The development of commercial markets during this period brought unprecedented prosperity to Dongshan's residential architecture, and craftsmanship reached its peak.



Figure 1 Location analysis of Dongshan Town

Dongshan dwellings are primarily distributed in ancient villages such as Yangwan and Luxiang in Dongshan Town, Suzhou. Notable examples include Ningde Hall, Huaiyin Hall, Mingshan Hall, Shaode Hall, Suigao Hall, and Huihe Hall. Dongshan, also known as "Dongting Dongshan," has evidence of human activity dating back over 10,000 years (Shen, 2002). According to *Cultural Relics of Wuzhong Ancient Towns, Villages, and Architecture*, Dongshan was originally an island surrounded by the waters of Taihu Lake. During the Song Dynasty, as wars erupted in the north, many scholar-officials from the Central Plains migrated south, with a significant number settling in Dongting Dongshan (Jin & Tang, 2017).

Furthermore, the courtyard spaces of traditional Dongshan dwellings serve as carriers of family life units, continuing the historical trajectory of traditional residential lifestyles and social development. They embody material space, institutional norms, rituals, spirituality, and behavioral patterns. By studying human behavior, cognitive patterns, and spatial adaptability, adaptive spatial reconstruction design methods and operational mechanisms can be developed. These approaches can preserve the social, historical, cultural, and locational characteristics of Dongshan dwellings, reflect their diverse cultural value, and meet the sustainable demands of traditional residential spaces in relation to societal needs.

2) Construction Techniques and Aesthetic Features of Dongshan Dwellings

The study of Dongshan dwellings in Suzhou cannot be separated from the renowned craftsmen group known as the "Xiangshan Gang." As a folk artisan organization, the Xiangshan Gang represents the construction techniques of the Suzhou region and is a pioneer of "Suzhou-style architecture." During the Ming Dynasty, the development of cultural rituals, the economy, and the involvement of literati and painters in Suzhou promoted the emergence of a "poetic" character and "humanistic" essence in Suzhou's residential architecture.

From the perspective of the Dongshan dwelling system, the development of its construction techniques aligns with the historical evolution of Suzhou-style architecture. The formation of Dongshan's construction techniques and stylistic features is closely tied to the origins and development of the Xiangshan Gang. The systematic and unique craftsmanship of the Xiangshan Gang is deeply rooted in the fertile cultural soil of Dongshan. Since the Ming Dynasty, the Xiangshan Gang craftsmen group in Suzhou has produced many talented and skilled artisans, earning the reputation that "the most skilled carpenters in Jiangnan come from Xiangshan." A local folk saying, "Every household has a craftsman, every family has an embroiderer," reflects the production structure of the local community. Xu Zhuxian's book *Xiangshan Xiaozhi* records that many people in the Xiangshan region took up carpentry due to family hardships, abandoning their studies to learn the craft for livelihood. Skilled craftsmen often had ongoing projects, while those with average skills typically lived a life of "farming during busy seasons and working as craftsmen during idle times" (Li, 1994).

In the 30th year of the Daoguang reign (1850), an inscription on a stele carved by the Suzhou Ziyi Guild mentioned, "In the carpentry and construction industry, the Xiangshan Gang is the best" (Suzhou Historical Museum, 1981). One of the most prominent figures of Xiangshan Gang was Kuai Xiang (1398-1481), a native of Yufan Village in Wu County, Jiangsu (now part of Suzhou). Kuai Xiang was a renowned architectural craftsman during Ming Dynasty and was promoted to Vice Minister of the Ministry of Works in 1466, receiving a first-rank official salary. Throughout his life, he dedicated himself to architectural construction, leaving behind a rich legacy of architectural cultural heritage. "Kuai Xiang's greatest achievement was successfully spreading Xiangshan Gang's construction techniques, which are characteristic of southern Jiangsu, to the north. He integrated the strengths of both northern and southern styles into imperial palace architecture, refining the layout of palace buildings during the Ming and Qing dynasties" (Shen, 2015). Kuai Xiang is widely recognized as the designer of the Tiananmen Gate Tower and the Three Great Halls of the Forbidden City (the Hall of Supreme

Harmony, Hall of Central Harmony, and the Hall of Preserving Harmony). He was honored by the emperor as "Kuai Lu Ban" (a reference to the legendary craftsman Lu Ban).

Even in contemporary times, the Xiangshan Gang craftsmen team remains well-preserved. In 1979, they were commissioned by the Metropolitan Museum of Art in New York to construct the Ming Garden. Seizing this opportunity, Suzhou exported a large number of Suzhou-style garden designs and antique buildings worldwide. Artisan groups undertaking traditional residential construction projects proudly identify themselves as descendants of the Xiangshan Gang. In 2009, the "Traditional Chinese Wooden Structure Construction Techniques," which encompass Xiangshan Gang's traditional architectural techniques, Huizhou-style traditional residential construction techniques, southern Fujian traditional residential construction techniques, and Beijing courtyard-style construction techniques, were inscribed on UNESCO Intangible Cultural Heritage List (Shen, 2020).

The Yingzao Fashi (Treatise on Architectural Methods), written by Li Jie during the Song Dynasty, is China's most comprehensive architectural technical manual and the first officially published architectural construction standard. Its purpose was to regulate architectural layout design, material specifications, and structural components, ensuring standardized relationships between construction trades and quality control, thereby facilitating design, management, and construction. The promulgation of the Yingzao Fashi made significant contributions to the integrity of China's ancient architectural system. The Yingzao Fashi introduced a modular system known as the "Cai Fen System" (Figure 2), which divides materials into eight grades. Here, "Cai" serves both as a unit of measurement and as the timber used in the construction of "dougong" (Bracket sets). In dougong, the cross-section of the "gong" (bow-shaped bracket) is called "Cai," which also serves as the basic unit of the modular system. In dougong, the "dou" is a block-shaped wooden cushion block, and the "gong" is a bow-shaped short timber. The gong is placed on the dou, projecting outward, and another dou is placed on the end of gong. This process is repeated layer by layer, creating a stacked, outward-flaring framework. As a unit of measurement, "Cai" can be further divided into "fen," with a height of 15 fen and a width of 10 fen. Compared to official architecture, the dougong in residential buildings is simpler and more practical (Figure 3). As a result, the materials and scales of Ming and Qing architecture are significantly smaller than those of Song Dynasty structures.

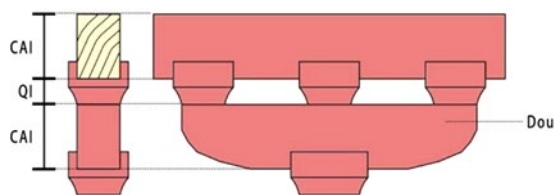


Figure 2 Schematic diagram of wood division system

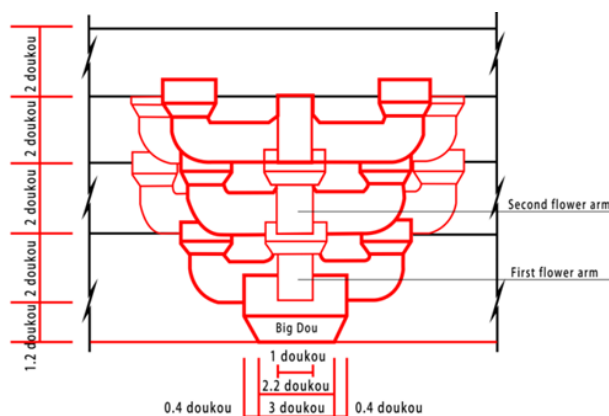


Figure 3 The relationship between dougong and Doukou in Qing Dynasty

To this day, Xiangshan Bang craftsmen and their construction techniques continue to play a significant role. As research into traditional construction techniques deepens and need for skill transmission grow, studies on Xiangshan Bang's craftsmanship have become increasingly diverse.

3) Spatial Composition and Functional Characteristics

Due to its mountainous location, the spatial layout of Dongshan dwellings is relatively flexible. Unlike the clear distinctions seen in plains areas, the settlements in Dongshan are naturally integrated, with central axes that are not strictly linear but adapt to the terrain, resulting in a more flexible spatial arrangement. The layout can extend both longitudinally along the central axis and horizontally, typically consisting of two to five courtyards. The overall layout of the residential compounds is lower in the front and higher in the back. Each courtyard is separated by gardens, tianjing, or partition walls, with small utility paths surrounding the courtyards. Larger residential compounds often feature left, central, and right utility paths. The residential courtyards are enclosed by walls, with "most dwellings divided into front and rear sections: the front section faces outward and includes a gate hall, tea hall, and main hall, sometimes with a flower hall; the rear section serves as living quarters, usually with an upper floor and a hall on the ground floor. Some dwellings feature two symmetrical buildings, connected by double-layer corridors and side rooms, commonly known as 'horse-riding towers'" (Jin & Tang, 2017). The spatial layout of Dongshan dwellings is composed of multiple individual units, appearing simple at first glance but internally complex and varied. Upon closer examination, one can find small courtyards, corridors, gable walls, and gate towers, creating a sense of refined elegance. While people live within these dwellings, they are not confined to the interior spaces; the interaction between interior and exterior spaces further enriches the unique and vibrant living environment of Dongshan dwellings. On the other hand, "the spiritual function of ancient Chinese architecture lies not only in its aesthetic appeal, which brings visual pleasure, but also in its role in reinforcing social ethics, promoting education, and regulating social order. The concept of 'ritual' must be reflected in architecture, and in feudal society, the ideological content of 'ritual' was closely related to the cosmos, yin and yang, the five elements, celestial bodies, seasons, and deities" (Tao, 2006). Influenced by Confucianism and ritualistic thought, the layout of Dongshan dwellings was primarily designed to align with religious rituals and the lifestyle needs of the time. Subsequent expansions, often due to multi-generational living, were still centered around the central axis, progressing layer by layer. Larger residential compounds might feature multiple axes (Figure 4).



Figure 4 Aerial view of Mingde Hall

Adaptive Design Framework for Dongshan Dwellings in a Modern Context

1) Theoretical Foundations of Adaptive Design

Adaptive design is a design strategy centered on cultural inheritance and functional renewal, emphasizing the dynamic response to changes in the functional requirements of traditional architecture within a modern societal context. Among its principles, the cultural continuity principle requires the preservation of core cultural symbols in design, such as spatial layouts and decorative details, to ensure continuation of historical value. The ecological sustainability principle advocates optimizing the relationship between architecture and natural environment through the use of eco-friendly materials and energy-saving technologies to achieve symbiosis between humans and nature. The functional dynamism principle emphasizes the flexible adjustment of spatial functions to meet the diverse needs of modern life.

In ancient China, there existed a rudimentary concept of "adaptation," encapsulated in the theory of "harmony between humans and nature" (Tian Ren He Yi), which emphasizes that humans are part of nature and, like all natural beings, must follow its universal laws. Ancient Feng Shui theories also reflect this concept. For example, the Yellow Emperor's Classic of Dwellings states, "A dwelling takes its form as the body, water as its blood, land as its flesh, vegetation as its hair, and buildings as its clothing. If all these are in harmony, it is considered auspicious." This expresses the idea that human living spaces must consider the integration of humans and nature, and that environmental modifications should be based on understanding natural laws and moderate utilization. Zhao Xinshan, in his book *Architecture is a Philosophical Poem*, describes: "People in agrarian civilizations maintained an intimate kinship with nature through ecological residential architecture, forming a poetic chain of harmony: humans-dwellings-local architecture-nature" (Zhao, 1999).

The concept of "adaptability" originated in the field of biology. In 1858, Charles Darwin presented his theory of natural selection at the Linnean Society of London, and in 1859, he fully elaborated this evolutionary theory in *On the Origin of Species*. The core of natural selection explains the connection between organisms and their environment, emphasizing not only the survival of organisms within their environment but also the decisive role of the environment in their survival. The ability of an organism to survive depends on its capacity to adapt to its environment. In the 1950s, with the rise of the neo-evolutionary school, anthropologist and cultural ecologist Julian Steward introduced the concepts of "cultural ecology" and "cultural core," extending the application of adaptability to anthropological theory. He unified human culture and ecological environments, stating that "the primary significance of ecology is adaptation to the environment." Against this backdrop, in 1969, Ian McHarg, the father of ecological planning, integrated adaptability theory with design in his book *Design with Nature*. He argued that "all material forms in nature are the result of adaptation; thus, all human-made forms, including architecture and cities, should also be created and evaluated based on adaptability" (Mc, 1992).

2) Principles of Adaptive Design for Dongshan Dwellings Preservation

"The existing Ming and Qing Dongshan dwellings largely align with the summaries in *Yingzao Fayuan* (Methods of Architecture). Although some are incomplete, the central axis remains clearly defined. In each building, the central axis serves as the spiritual core of the architectural layout" (Zang, 2005). Typically, structures such as screen walls, front halls, gate halls (Sedan halls), main halls (Upstairs halls), and courtyard gates are arranged along the central axis. Side axes may include flower halls, studies, and gardens, while kitchens and utility rooms are placed on the sides, forming residential compounds with left, central, and right axes. Dwellings are categorized by scale into two-courtyard, four-courtyard, and five-courtyard types. Narrow utility corridors are sometimes added beside the main hall or along the central axis, reflecting spatial distinctions between hosts and guests, elders and juniors, and genders. Brick-carved gate towers, symbolizing auspiciousness, are often placed opposite the main hall, with shallow-

depth corridors occasionally added. Courtyards (Tianjing) are typically placed before and after the main hall, with the front courtyard being larger to facilitate ventilation and drainage. Rainwater from the eaves flows into the courtyard and is drained through internal water networks, preventing dampness. The front eaves are always higher than the rear eaves, optimizing sunlight exposure (Figure 5).

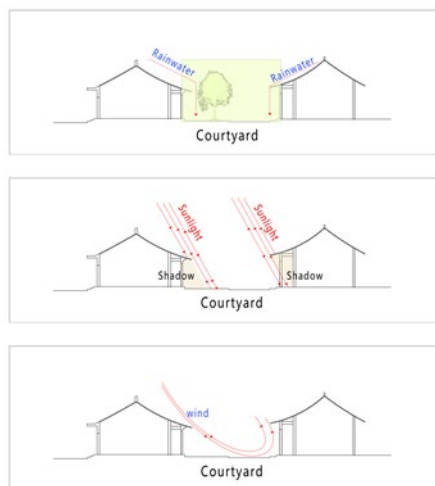


Figure5 Courtyard space climate analysis

Based on the above research, adaptive design should adhere to the following principles: First, protect the cultural core. Designs should respect the cultural essence of Dongshan dwellings, preserving key elements such as courtyards, brick carvings, and mortise-and-tenon structures, avoiding excessive modernization that could damage cultural symbols. Second, optimize functional adaptability. By reasonably adjusting spatial layouts, designs should meet modern families' diverse needs for entertainment, study, and work, such as transforming main halls into multifunctional spaces. Third, integrate technology and craftsmanship. Modern digital technologies should be used to document and reproduce traditional craftsmanship, enhancing design efficiency while supporting the inheritance and innovation of traditional techniques.

3) Spatial Reconstruction Strategies

Spatial reconstruction is a core aspect of adaptive design, encompassing the following three strategies: First, modernize courtyard spaces. By adding transparent canopies and greenery, traditional courtyards can retain their lighting and ventilation functions while becoming modern spaces for leisure and social activities. Second, adapt functional spaces. While preserving traditional structures, optimize layouts for kitchens and bathrooms, and add modern functional areas such as studies and children's playrooms. Third, innovate decorative elements. Through digital archiving and the use of modern materials, traditional carving arts can be integrated into modern designs in new forms, preserving their cultural and aesthetic value.

RESEARCH METHODOLOGY

Data collection

1) Data collection method: Obtain first-hand research materials through databases (CNKI, Google Scholar, etc.), systematically sort out and analyze the historical background, construction skills and artistic style of the houses of Dongshan Dynasty in Suzhou in Ming Dynasty by consulting historical documents, architectural drawings, library book resources and other relevant research results. Deeply and comprehensively understand the cultural connotation, historical context and other contents of Dongshan Ming Dynasty folk houses. This process provides theoretical support for the theoretical framework and adaptive design of the research.

2) Methods of site investigation: Go to Dongshan Area of Suzhou, conduct field investigation, surveying and mapping, and take real photos of representative residential buildings in Dongshan area of Suzhou, and collect first-hand information about architectural structure, decorative details and material application.

3) Mixed research method: By combining qualitative and quantitative analysis, the cultural value, functional adaptability and aesthetic effect of the design scheme are comprehensively evaluated through comprehensive historical analysis, field investigation, questionnaire and expert interview results. Through cross-analysis of multi-dimensional data, a systematic regularity conclusion is formed, and a systematic scheme of adaptive design is proposed.

Data analysis

Data analysis is aimed at the historical documents, video materials, papers and books in the early stage, using Endnote to systematically sort and classify the documents to ensure the systematic and traceable data. Secondly, through the content analysis method, this paper deeply analyzes the changes of skills, materials and techniques of Dongshan residential houses in Suzhou in different periods, and extracts the evolution law of its cultural connotation and design methods. Thirdly, SPSS software was used for content analysis and statistical analysis of the interview data to ensure clear and academic accuracy of the results. Fourthly, office and wps software were used to quantitatively analyze the opinions of different groups of interviewees (such as Dongshan local residents, tourists, designers and Xiangshan craftsmen), and statistical charts were generated to reveal the trends and differences in folk art, materials and spatial design. In addition, through qualitative analysis, combined with the theme clustering function of SPSS, the innovative views of experts, scholars and craftsmen on space design are deeply explored to ensure the academic accuracy and consistency of the analysis results.

RESEARCH RESULTS

Analysis of Practical Pathways for Adaptive Design of Traditional Dongshan Dwellings

1) Analysis of survey results

The questionnaire is organized around seven sections. The first part is the basic information of the researcher; the second part focuses on the culture and history of folk houses; The third part focuses on the art of residential construction; The fourth part revolves around spatial features and composition; The fifth part starts from the spatial renewal strategy; The sixth part starts from the comprehensive evaluation; The seventh part is set up with open-ended questions to understand people's real feelings about the living space of the dwelling.

The questionnaire survey on the adaptive design of Dongshan folk houses covered different groups of people. Most of the respondents had a certain understanding of the Ming - Dynasty folk houses in Dongshan. Traditional folk house elements were relatively common in the existing living environment, but the protection was insufficient. The satisfaction with the living environment was relatively high. However, there was still much room for improvement in terms of the rationality of the spatial layout and the protection of traditional elements. Most respondents supported improving modern living conditions while retaining the traditional spatial features and carrying out appropriate modernization transformations, especially paying close attention to the spatial layout and facility modernization. Regarding the balance between historical protection and modernization transformation, they tended to prioritize the protection of historical and cultural heritage and carry out appropriate transformations to meet modern living needs (Table 1). These survey results provided important data support for the adaptive design of Dongshan folk houses. When designing, more attention should be paid to the combination of traditional culture protection and modern functions.

Table 1 Data sheet of the needs of balancing historical protection and modernization

No.	Classify	Content	Number of proportion
1	How to balance the needs of historical protection and modernization	How to balance the needs of historical protection and modernization	40%
2		On the premise of ensuring the historical value of the moderate transformation	35%
3		We will fully support modernization and transformation	15%
4		Emphasize that tradition should not have too much modern intervention	10%

2) Current Condition Assessment and Cultural Extraction

Through on-site surveys and research, document the current state of Dongshan dwellings, including spatial forms, structural stability, and functional usage. Extract and categorize core cultural symbols (such as mortise-and-tenon structures and brick carvings) to provide data support for design. Conduct comprehensive documentation and analysis of the functions, forms, materials, and cultural-historical values of residential structures, using standardized methods to classify and compare components across different dwellings. This provides theoretical and practical support for preserving Dongshan's traditional residential culture while meeting modern living needs. Analysis tables categorize and summarize various architectural components (e.g., roofs, window grilles, ridges, walls, gate towers) to clarify functions and characteristics of each component, offering a clear analytical framework for further research (Table 2).

Table 2 Design component analysis list

No.	Component name	Structural location	Functional analysis	Materials & Technology	Decorative content	Cultural and aesthetic values
1	Lintel	Facades	Lighting, ventilation and isolation of the external environment	Wood, glass, mortise and tenon work	Dragon patterns, plant patterns, auspicious characters	Family blessings and status symbols
2	Ridge	Roof	Waterproof, protective	Wooden frames, tiles, traditional firing techniques	Roof Beast	Pray for blessings and avoid disasters, and realize the concept and skill of feng shui
3	Brick	Gatehouse, façade	Ornament	Green bricks, relief craft, etc	Patterns of labor, plants, animals, etc	Patterns of labor, plants, animals, etc
4	Wood carving	Beams, wall doors, columns, etc	Ornament	Wooden, carved process	Geometric patterns, plants, animals, etc	There are many decorations for official eunuchs and wealthy families
5	Stone carving	Gardens, entrances, facades, etc	Ornament	Stone, stone carving process	Flora, animal and other motifs	It reflects social life, expresses the artist's aesthetic feelings and emotions, and has strong cultural symbolism

No.	Component name	Structural location	Functional analysis	Materials & Technology	Decorative content	Cultural and aesthetic values
6	Stained	Hall beams, etc	Ornament	Pigments, color painting process	Geometric patterns, plants, animals, etc	Literati feelings, faith sustenance, etc
7	Screen	Indoors	Space separation and privacy protection	Wooden, patchwork inlay	botanical patterns, etc	It means noble and reflects Chinese aesthetics
8	Pane	Facades	Beautify the space, lighting and isolation from the external environment	Wooden, openwork carving	Flower and bird patterns	It embodies the aesthetics of Soviet architecture

3) Steps for Implementing Adaptive Design

3.1) Spatial Analysis and Functional Planning

Through on-site surveying, literature review, and resident interviews, data on the historical background, spatial layout, and artistic features of the buildings can be collected. At this stage, it is also essential to identify the most culturally and artistically significant core elements of residences (Such as courtyards, brick carvings, and mortise-and-tenon structures) and determine the priorities and challenges of adaptive design in the modern context.

Based on the research findings, spatial optimization and functional renovation plans can be developed. The primary focus of spatial optimization is to preserve the original logic of traditional spaces (Such as the centrality of the main hall and courtyard) while adapting these spaces to meet the demands of modern lifestyles. For example, the traditional main hall could be redesigned as a multi-functional family activity area, integrating reception, dining, and entertainment functions. Partitioning the side rooms could create independent bedrooms, studies, or office spaces. During the renovation process, special attention should be given to ensuring the rationality of circulation routes so that traditional buildings can meet the diverse lifestyle needs of modern family members. Additionally, optimizing the layout and facilities of kitchens and bathrooms is a key step in improving the quality of life in traditional residences. By incorporating modern kitchen and bathroom appliances along with eco-friendly materials, the comfort and functionality of these spaces can be enhanced while maintaining harmony with the overall architectural style.

3.2) Material Optimization and Technological Integration

Traditional residential buildings often rely on materials such as wood, bricks, and tiles, whose durability and stability decline over time. Consequently, adaptive design requires the introduction of modern, eco-friendly building materials for replacement or supplementation. For instance, composite materials can be used to reinforce wooden structures, improving their earthquake resistance and decay resistance. Additionally, new breathable bricks and tiles can be introduced to enhance the building's weather resistance. Wang Shu, a famous Chinese architect and winner of the Pritzker Prize, is committed to the transformation of traditional Chinese architecture into a contemporary architectural language, and in the design of Wen Village, he adheres to the concept of protecting rural culture and allowing the new village to grow naturally like the old village, refuses to demolish the old houses and builds new houses, encourages villagers to find the charm of the ancient village, looks for philosophical expressions in traditional architecture, and interprets contemporary architecture with the architectural techniques of ancient craftsmen and the concept of ecological and environmental protection (Figure 6).



Figure 6 Wen Village

The construction of traditional Dongshan residences heavily relied on locally sourced materials and site-specific craftsmanship. Local resources such as bluestone, timber, and granite were extensively used. These raw materials, often minimally processed, formed the basic framework of residential spaces through their transformation into bricks, tiles, and carved artworks. Advances in modern construction materials and technologies have further influenced spatial patterns, residential forms, and even decorative motifs. Modern lifestyles have become increasingly diverse, and the demand for residential spaces has grown more complex. Thus, renovation designs must consider how to balance the fulfillment of modern functional requirements with the preservation of traditional spatial cultural connotations. A harmonious integration of tradition and modernity, culture and technology, should be explored to develop a design pathway that caters to contemporary needs without compromising the distinctive regional culture.

3.3) Cultural and Community Integration

Traditional residential spaces not only preserve implicit cultural memories but also serve as the foundation for historical narratives. The adaptive design of residential spaces involves more than just creating a new type of residential architectural space or preserving traditional residences as cultural artifacts. What truly needs to be preserved is the cultural essence of the residential space itself. Residents are the central subjects of residential spaces, and overemphasizing preservation without considering their needs or the conveniences of modern life would make it difficult to sustain the traditional craftsmanship of residential spaces.

Theoretical research on Suzhou Dongshan residences reveals that their functional divisions are not merely based on structural rationality but are deeply rooted in the lifestyle, etiquette systems, and cultural beliefs of the Ming Dynasty. Moreover, preliminary surveys and visits show that residents themselves often prioritize the improvement of living conditions in traditional residences. Different age groups also have varying spatial requirements. Therefore, it is crucial to work collaboratively with community residents to explore renewal models that align with local culture and living habits.

DISCUSSION & CONCLUSION

This study, based on the cultural and spatial characteristics of traditional Dongshan residences, proposes a theoretical framework and practical pathway for adaptive design. By analyzing the cultural and spatial attributes, the study identifies the regional features, aesthetic values imparted by the craftsmanship of the “Xiangshan Gang,” as well as the spatial composition and functional characteristics of these residences. Building upon theoretical analysis, a systematic pathway for practical implementation has been constructed, offering theoretical foundations and practical guidance for the preservation and renovation of traditional architecture. Future research can further validate and refine the framework through specific case studies, advancing

the sustainable development of Dongshan residences in the modern context and perpetuating their cultural heritage.

ACKNOWLEDGMENT

Researcher would like to express her sincere to the thesis advisor, Asst. Prof. Dr. Akapong Inkuer for his invaluable help and constant encouragement throughout the course of this research. In addition, the researcher has to give thanks to all lecturers for their assistance: Asst. Prof. Dr. Chanoknart Mayusoh, and Asst. Prof. Dr. Pisit Puntien. At the same time, the researcher gratefully thanks to Miss Kanyanee Phuangsa, Miss Sasanant Rattanapornpisit, Miss Visitha Chintaladdha, Mr. Chat Sukarin, and others who give great supports. Finally, the researcher would like to express her gratitude to the Faculty of Fine and Applied Arts, Suan Sunandha Rajabhat University for supporting in every aspect.

REFERENCES

- Jin, J., & Tang, X. D. (2017). *Wuzhong Cultural Relics: Ancient Towns, Villages, and Buildings*. Shanghai Scientific & Technological Literature Publishing House.
- Li, J. Q. (1994). Xu Zhuxian and A Draft of Xiangshan Records. *Jiangsu Local Chronicles*, (1), 2.
- McHarg, I. (1992). *Design with Nature*. China Architecture & Building Press.
- Shen, B. R. (2002). *Dongshan Town Chronicles*. Southeast University Press.
- Shen, L. (2020). The Evolution and Craftsmanship Characteristics of Xiangshan Builders. *Architectural Heritage*, (2), 18-26.
- Shen, Q. N. (2013). *The Charm of Ancient Residences: A Cultural Overview of Traditional Suzhou Residences*. Soochow University Press.
- Suzhou History Museum. (1981). *Collected Stele Inscriptions of Ming and Qing Dynasty Suzhou's Commerce and Industry*. Jiangsu People's Publishing House.
- Tao, J. (2006). *Hall and Grandeur: Chinese Architecture and Halls*. Liaoning People's Publishing House.
- Zang, L. N. (2004). The Architectural Art of Dongshan Residences in Suzhou during the Ming and Qing Dynasties and Xiangshan Craftsmanship. *Folklore Studies*, (1), 131-141.
- Zhao, X. S. (1999). Architecture as a Poetic Philosophy. *Yangtze Construction*, (5), 2.

Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.



Copyright: © 2025 by the authors. This is a fully open-access article distributed under the terms of the Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0).