

Article

Resilience of Living Streets in Small and Medium-Sized Towns: A Grounded Theory Study of Yixing, China

Chen Liu  and Jia Liu *

School of Design, Jiangnan University, Wuxi 214122, China; 6210307054@stu.jiangnan.edu.cn

* Correspondence: liujia11231123@jiangnan.edu.cn

Abstract: In the context of the global fine-grained urban renewal initiative, living streets closely related to people's lives have become a hot topic. This study provides a comprehensive framework for addressing prominent issues such as the limited adaptability and inability to accommodate development in living streets. It explores the value and design innovation points of incorporating resilience concepts in the renewal of living streets. Taking the living streets in Yixing, Jiangsu Province, as an example, the grounded theory approach was employed to conduct in-depth interviews and three-level coding of the data to systematically elucidate the influencing factors and implementation paths of resilience in living streets. The study reveals that the resilient development of living streets is influenced and constrained by six factors: positive values, demand factors, spatial environment, contextual factors, operation and management, and resilience characteristics. Each of these six main dimensions encompasses multiple subcategories and the factors influencing living streets' resilience through different mechanisms. Building upon the guidance-demand-design-context-operation pathway model for enhancing the resilience of living streets in small and medium-sized towns in the Jiangnan region, the study proposes new perspectives such as correct orientation, adaptability to change, and a balance between rigidity and flexibility tailored explicitly to the enhancement of resilience in living streets. These novel perspectives contribute to the theoretical research achievements on the resilience development of living streets in small and medium-sized towns in the Jiangnan region of China to a certain extent. Furthermore, these findings hold significant implications for attaining SDG11, which emphasizes sustainable urban development.



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Keywords: resilience concept; living streets; small and medium-sized towns; Jiangnan area; grounded theory; SDG11; sustainable city

1. Introduction

In recent years, cities have been experiencing rapid development and construction. Numerous social issues have become prominent with the emergence of new industrial structures, consumption patterns, and lifestyles. Urban renewal, as an important strategy for achieving sustainable urban development, has been widely adopted by countries worldwide [1]. In 2021, the implementation of urban renewal was included for the first time in China's five-year plan, emphasizing the importance of transforming spaces related to people's daily lives, such as old neighborhoods and streets. In the context of transforming urban renewal towards refining existing spaces in China [2], streets, as vital spaces that connect cities, public activities, and people's pursuit of a better life, hold immense value for revitalization.

As early as 1960, Lynch explored the relationship between street elements and urban imagery in his book, *The Image of the City* [3]. Jacobs regarded streets as the most vibrant organs of the city, emphasizing their importance to urban areas and their inhabitants [4]. With the rapid growth of urban populations, people's living spaces have become more constrained, drawing attention to issues related to human habitats. Redesigning streets can

not only improve the urban environmental quality and enrich residents' activities on the streets but also drive the benign development of surrounding areas.

Among them, "living streets" represent the largest proportion of urban streets and therefore hold significant importance regarding their potential for transformation, making them a subject of significant research. Building upon the overall approach found in world-wide street design guidelines, which often classify streets based on adjacent land uses or functional characteristics [5], this paper defines living streets as follows: They primarily traverse residential areas and are accompanied by life-service-oriented businesses, small-scale retail, dining establishments, and public service facilities that cater to the residents [6,7]. These streets exhibit a rich living atmosphere. The wide distribution, diverse functions, and spontaneous activities inherent in living streets indicate that the research on living streets should not only focus on the three-dimensional physical space but also consider the holistic elements embedded within this space, including material components, living scenes, local cultural information, operation management, and other aspects [8].

Due to the early formation of living streets, they are prone to problems such as delayed construction and reconstruction, uneven space utilization, and the inability to meet new needs [9]. With the increasing complexity of people's needs and the advent of an information society, mobility has become a prominent feature of contemporary society [10]. The fixed spatial scale can no longer meet the future development needs of the street. Furthermore, increasing uncertainty in world development highlights the importance of exploring ways to enhance the resilience of living streets to address current and future development challenges.

Enhancing the resilience of living streets enables flexible adaptation to residents' multifaceted needs at the micro-level resident activity spaces. It also contributes to resilience realization at the macro-level of the urban system. Resilience has emerged as a significant strategic concept in solving complex urban issues, with extensive research emphasizing the crucial role of infrastructure resilience in ensuring cities' ability to withstand climate crises, pandemics, and other emergencies while recovering from them [11]. Infrastructures, such as roads, bridges, lifelines, and utilities, play a fundamental role in bolstering a city's resilience. They provide the essential backbone for transportation and the efficient functioning of complex urban systems [12]. For instance, a well-connected road network with multiple alternative routes can mitigate the impact of disruptions in one area by rerouting traffic to other paths, enabling the smooth flow of goods, services, and people even during emergencies or disasters. As a crucial component of the overall urban road system, living streets can enhance the resilience of the city's transportation system when facing impacts by promoting multimodal transportation, adopting flexible spatial design, and adhering to sustainable development principles. This elevates the overall resilience within the city and even at the regional level.

Some cities have recognized the value of improving resilience at the micro-level spaces of living streets. The recent pandemic has also propelled the development of resilient public spaces. For instance, the London Transport Department in the UK has used floor markings and signage to demarcate distances, advocating social distancing at stations. Seattle has taken the lead in converting parking spaces near supermarkets and restaurants into loading and unloading zones to meet diverse needs in the United States. In some domestic cases, sharing has been introduced into street revitalization, creating multifunctional streets. Shanghai's PARK(ing) Day, where roadside parking spaces are transformed into social spaces, fosters space sharing, attracts crowds, and inspires various activities, thereby driving urban renewal. In the Gui Zhou Xi Li Alley on Nanjing East Road in Shanghai, Ziyunzhai Architecture has reorganized the existing elements of the street, incorporating catalytic points to create a new pattern and impart new functions to the street [13]. In summary, some existing practices have considered the application of resilience thinking in improving living streets. However, these efforts need to be more comprehensive and meet current needs, including responding to potential future challenges. Hence, when facing new impacts, these previously renovated streets may fail to promptly adjust and adapt

to the emerging changes, necessitating further refurbishments. Such frequent alterations could lead to the wastage of valuable resources. This predicament primarily stems from the current insufficient understanding of living streets' resilience at the theoretical level. Only a tiny portion of the research has focused on some dimensions, and identifying factors influencing living street resilience still needs to be completed. Moreover, existing studies have primarily concentrated on major cities such as Beijing, Shanghai, Guangzhou, and Shenzhen. At the same time, more attention should be given to the characteristics of living streets in other small and medium-sized cities. The living street renewal projects in small cities have mostly emphasized superficial refurbishments, failing to address the underlying contradictions comprehensively. The various issues associated with street living can be summarized as mismatches between people, space, and time. At their core, these issues stem from a lack of resilience. Hence, it is necessary to systematically explore what constitutes resilience in living streets (i.e., which aspects it encompasses), identify the influencing factors, and explore how to enhance it.

This study represents the first systematic exploration of the resilience of living streets. While the concept of resilience has gained significant attention in urban construction discussions, combining the resilience of micro-level spaces in living streets with its contribution to urban infrastructure for overall urban resilience is a novel and valuable attempt. To address the issues above, this paper employs field surveys, in-depth interviews, and grounded theory methods to conduct research, using living streets in Yixing, Jiangsu, as a case study. We examine the explicit spatial elements and other implicit factors that influence the resilience of living streets in small and medium-sized Chinese towns. By summarizing the mechanisms behind the formation of resilience in living streets, this study aims to provide guidance and inspiration for the development of humanistic, localized, and forward-thinking resilient living streets in the context of the new era.

2. Literature Review

2.1. Resilience in Cities

The concept of resilience is a crucial strategy for urban spatial development in the face of present and future challenges. Resilience can be defined as the complex social-ecological systems (SES) continually changing and adapting yet remaining within critical thresholds [14]. In the context of increasingly vulnerable urban systems, numerous studies have highlighted the significance of city resilience in ensuring a city's ability to withstand and recover from natural disasters, pandemics, and other disruptive events. Meerow et al. [15] reviewed relevant academic literature on urban resilience. They proposed a novel definition of urban resilience: the ability of an urban system and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to transform systems that limit current or future adaptive capacity quickly. The concept of resilience applies to communities, particularly in urgent situations such as natural disasters, ensuring critical services do not significantly degrade. If performance declines or fails, the services can recover to similar or better levels within a reasonable timeframe. Miles et al. [16] presented a simulation model called ResilUS. It quantifies the damage and recovery of critical services and community capital over time. The framework operationalizes community resilience across multiple hierarchical scales by incorporating a range of policy and decision variables associated with each scale.

The foundation for achieving resilient cities is ensuring the resilience of urban infrastructure. Infrastructure failures can lead to severe consequences, hindering emergency response efforts, disrupting critical services, and significantly impacting people's well-being and health. Therefore, incorporating resilience in designing, maintaining, and managing infrastructures is vital for enhancing a city's overall resilience. Resilience can be utilized throughout various stages of infrastructure development and recovery, including predicting potential risks, analyzing the impacts of disasters on functionality, and evaluating resilience under different disaster scenarios. Andrić et al. [17] employ fuzzy set theory

to propose new earthquake recovery functions and seismic assessment indicators. Their research proposed that enhancing the disaster preparedness of communities where bridges are located would improve the bridges' resilience and serve as a reference for assessing the recovery capabilities of similar infrastructure components. Forcellini et al. [18] introduce a resilience-based methodology to assess the soil–structure interaction on a benchmark bridge during earthquakes. This study highlights the significance of resilience as a critical parameter in evaluating emergency response and recovery strategies for bridge functionality. The calculated resilience findings offer valuable insights for bridge owners, transportation authorities, and public administrators to optimize recovery techniques and solutions. The introduction of infrastructure resilience assessment methods can provide the correct direction for disaster prevention decisions and actions in the communities where they exist, ultimately contributing to the construction of disaster-resistant cities. In addition, institutional, social, and economic factors also influence the multidimensional resilience of cities [11].

Another vital topic closely connected to urban resilience is climate change. The impact of climate change—including more frequent extreme weather events, rising temperatures, and rising sea levels—poses significant challenges to urban environments and the well-being of its residents. Cities worldwide are experiencing the effects of climate change, and it is crucial to integrate climate resilience into urban planning and design [19]. Introducing urban climate shelters is a promising approach to enhancing urban resilience in the context of climate change. Urban climate shelters are designated spaces in the city that provide refuge and protection during extreme weather events, such as heat waves, heavy rainfall, or storms. These shelters can be designed to offer shade, cooling, and protection from adverse weather conditions [20]. They serve as safe havens for vulnerable populations—such as the elderly, children, and homeless individuals—at higher risk during extreme weather events [21]. Barcelona serves as an excellent example in this regard. It provides a municipal network of “climate shelters” to provide thermal comfort to people who are especially vulnerable to extreme temperatures due to their socioeconomic situation, age, or health status. Amorim et al. [20] indicate that highly accessible climate shelters provide more significant value, effectively overcoming the vulnerability of most cities in addressing extreme climate challenges faced by marginalized populations. In recent years, extreme weather events such as heatwaves and floods have been occurring more frequently, making it particularly crucial to provide equal access to public urban spaces that protect all residents from the impacts of these extreme weather conditions.

In summary, some scholars have extensively explored the application of resilience in the field of urban studies, examining the definition of resilience in urban planning and construction [22], assessment of resilient cities [23], and theory development of the resilient design paradigm of landscape design [24]. However, only a few studies have mentioned the resilience of streets. Safri et al. [25] focused on the elasticity of road networks as part of transportation systems, highlighting the role of a street's physical form in urban resilience. Living streets are vital spaces for public activities, playing a crucial role in people's social lives and the smooth functioning of cities. However, they received limited attention regarding their resilience in the existing literature. Consequently, a systematic understanding of resilience in living streets needs to be improved. The resilience of living streets enables cities to recover swiftly from disasters or crises and ensures long-term prosperity and improved well-being of residents.

2.2. *Living Street*

Regarding the specific research on living streets, the current academic focus primarily revolves around spatial form, humanization, localization, and street vitality [26]. The origin of living streets can be traced back to the Dutch term “Woonerf”, which refers to public spaces designed for pedestrians, cyclists, and low-speed vehicles and primarily serves as a social and recreational space for residents [27]. Therefore, research on living streets mainly revolved around prioritizing slow travelers' rights, spatial tranquility, and

diverse sharing [28]. Many studies emphasize the humanization of living streets. For instance, Fang et al. [29] suggested that actively involving soft material elements and encouraging bottom-up public participation can enhance the sense of place and belonging in the living streets. Aman et al. [9] discovered problems related to inadequate street traffic management and the failure to meet pedestrian needs. They pointed out that the lack of humanized street facilities would hinder community engagement within the research area. Wang et al. [30] highlighted the importance of inclusive aspects such as the diversification of commercial and service formats and accessibility of open spaces to enhance the vitality of living streets from the perspective of integrating and sharing among different age groups [18]. Christodoulou et al. [31] reviewed Greece's progress in promoting gender mainstreaming in public policies, highlighting the importance of incorporating gender perspectives into urban planning. The study emphasized that practical actions taken to consider men's and women's interests from a gender equality perspective in urban design can achieve a more inclusive and resilient city. Anciaes et al. [32] suggested multiple spatial combinations and policy interventions for sidewalks, bicycle lanes, and bus stops, providing comprehensive and balanced design options to improve pedestrian spaces while enhancing the relationships of other types of street spaces, promoting sustainable street development. Some studies have also considered how streets can adapt to future development. Mackie et al. [33] explained the role of street infrastructure improvements in promoting active modes of transportation and the benefits of community participation in improving community well-being in their study of "future streets" projects. They proposed that public participation in the design process can create better street public spaces and enhance livability. Nassar et al. [34] discussed the role of intelligent street furniture in addressing various future needs and challenges within the context of smart cities.

In conclusion, the academic community has agreed on the importance of revitalizing living streets to improve residents' public life, promote community engagement, enhance urban vitality, and support sustainable urban development. Although some studies have begun to focus on how streets can adapt flexibly to future development [35,36], they mainly emphasize singular spatial aspects. There is a lack of comprehensive research on how streets can exhibit flexibility in multiple dimensions, such as time, operations, and policies to adapt to increasingly complex and dynamic social contexts, and how they can enhance their proactive resilience to promote sustainable operation at the mesoscale block level, further enhancing urban resilience. With the continuous increase in China's urbanization rate, exploring how limited urban space can flexibly meet the diverse needs of various population groups and how to enhance the resilience of living streets to meet people's pursuit of high-quality and desirable living has significant research significance in the post-pandemic era. Resilience theory and its design methods, as an important approach to balance change and stability [14], have inherent advantages in solving various problems of Chinese living streets. Therefore, based on the concept of resilience, this study takes the living streets in Yixing, Jiangsu Province, as an example to systematically construct the conceptual framework of resilience for living streets in small and medium-sized towns in the Jiangnan region of China. It aims to provide possible solutions for similar problems.

3. Methods and Data

3.1. Conceptual Framework

In this study, we conducted participatory and non-participatory observations in the main urban area of Yixing to identify core problems associated with living streets. For ease of recording, observation points were placed inconspicuously yet offered a broad view of the street corners. Different types of living streets—including lane-type, branch-type, and main road-type streets—were selected for observation to capture diverse usage patterns (Appendix A). To ensure comprehensive insights, non-participatory observations were conducted during four time periods: morning rush hour (7:00 am–9:00 am), noon (11:30 am–1:00 pm), evening rush hour (5:00 pm–7:00 pm), and nighttime (9:00 pm–10:00 pm). The observations span one week to cover both weekdays and weekends. By observing interactions between pedestrians

and the street environment and analyzing how street spaces and material elements served residents' daily lives, we identified four significant issues: unequal distribution of block spatiotemporal usage, insufficient humanization and illogical internal zoning of streets, loss of regional humanistic features, and lack of future-oriented, resilient space. These four issues are rooted in their lack of resilience. To address this issue at its core, we introduced the concept of resilience and preliminarily summarized the dimensions of resilience in living streets. We conducted in-depth interviews with stakeholders involved in living streets to further explore the causal relationships of resilience phenomena in living streets, identify influencing factors and examining their potential relationships. The interview data were analyzed using the grounded theory approach, employing a three-level coding analysis. Ultimately, we developed a pathway model for the formation of resilience in living streets (Figure 1).

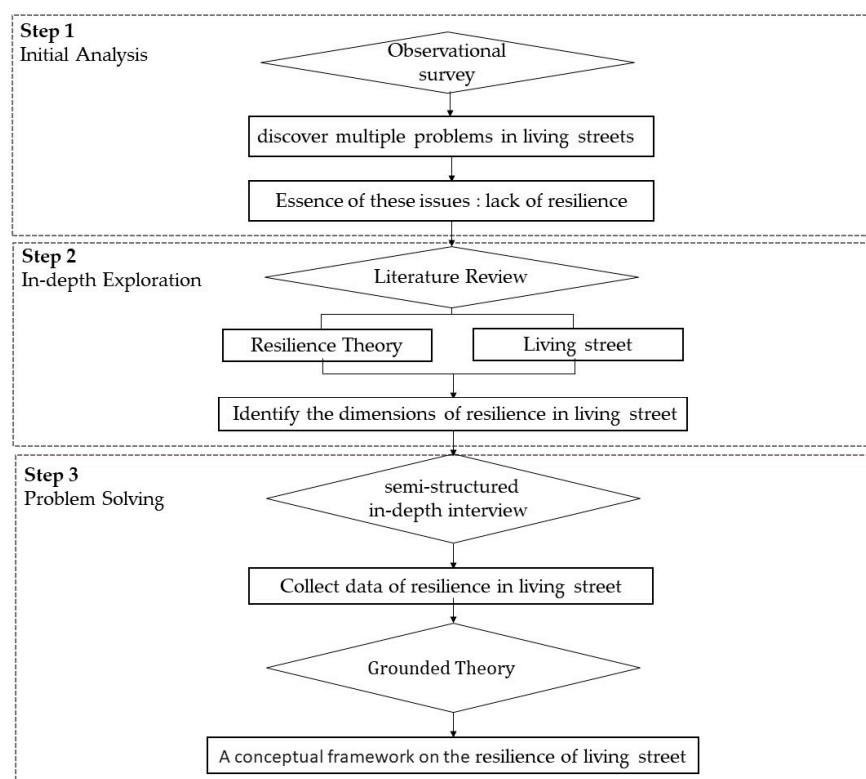


Figure 1. Conceptual framework of the resilience study of living streets. Source: drawn by the author.

3.2. The Feasibility of the Resilience Concept Intervening in Living Streets

The concept of resilience, initially introduced by Holling, describes the ability of ecosystems to maintain their primary functions, outcomes, and characteristics while undergoing external disturbances and engaging in self-repair [37]. Subsequently, the concept of resilience has been widely applied across various disciplines, each with its own focus. In the urban context, resilience can be summarized as the ability of urban systems to adapt to various negative uncertainties and sudden shocks while effectively capitalizing on positive opportunities [38]. Its application in spatial contexts originates from urban design, which implies leaving room for flexibility, providing multiple modes, and adapting to uncertain external market environments in macro-planning. China's land development and utilization process has predominantly been characterized by "rigidity" with the additional consideration of "resilience", even emphasizing flexibility in project processes [39]. In medium-scale spatial design, resilience is often associated with the compatibility of various functions to meet diverse needs and strong adaptability to changes. Specifically, regarding resilience in living streets, we can draw insights from dimensions found in urban planning, architecture, and interior space resilience design (Figure 2).

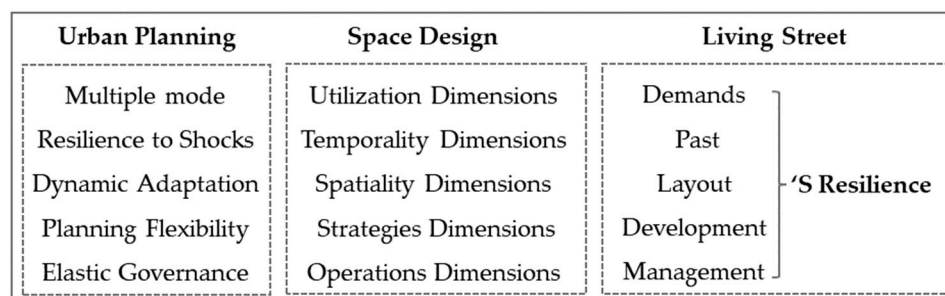


Figure 2. Resilience concepts intervening in living streets. Source: drawn by the author.

Early urban planning (1949–1989) and renewal focused on improving residential and living environments [40]. Small and medium-sized town transportation mainly relied on walking, with small-scale streets that almost all fit the definition of current living streets, characterized by highly diverse functions and inherent flexibility. In the post-pandemic era, the importance of constructing resilient urban public spaces has become increasingly prominent, with a greater emphasis on addressing sudden changes. Based on the everyday problems of living streets and the macro development background they face, this paper mainly focuses on the following aspects of resilience in living streets:

- Versatility: meeting a variety of basic and additional functions.
- Balancing past and present: maintaining urban regional characteristics in the face of modernization, coordinating the past, present, and future.
- Spatial flexibility: dynamically adapting to people's and city's changing needs.
- Long-term strategies: considering both the present and future, reserving space for development.
- Flexible management: balancing rigid control with flexibility.

3.3. Grounded Theory

Grounded theory is a qualitative research method developed by American sociologists in 1967, which employs a systematic procedure to discover, develop, and ultimately inductively guide the formulation of theory grounded in raw data. Its purpose is to help researchers identify core concepts reflecting social phenomena and construct relevant social theories based on the relationships between them [41]. This research method is particularly suitable for areas where existing theoretical frameworks need to be well established, such as application-oriented or procedural issues arising from new phenomena or specific trends. The study of resilience in living streets has yet to form a systematically comprehensive and directed approach, and relevant practices lack theoretical guidance. Moreover, the issues related to living streets involve multiple stakeholders, exhibiting complexity and dynamics, making the application of the grounded theory research method well suited for exploring these areas. The research follows the path of data collection, three-level coding, and theory formation.

3.4. Case Selection

This study explores the resilience of living streets in small and medium-sized towns in the Jiangnan region for two main reasons. Firstly, small and medium-sized towns in the Jiangnan region share certain commonalities, and research conducted in a specific location such as Yixing can not only address local issues but also provide reference models for addressing the resilience challenges of living streets in other small and medium-sized towns in the Jiangnan region. "Jiangnan" represents the local characteristics within this geographical area, encompassing the harmonious coexistence of people and water and a poetic spirit that integrates humanity with nature. Traditional Chinese people think water is associated with "softness" and "dynamism". This is reflected in the region's gentle temperament, refined lifestyle, cultural inclusiveness, early and comparatively advanced economic development, and diverse and unified forms of street space. Similar develop-

ment backgrounds have resulted in similarities in transportation development, traditional transportation organization, and road space construction in small and medium-sized towns within the Jiangnan water network region [42]. However, during the 1960s, rapid urban economic development, accelerated population growth, and rapid land expansion led to the occupation of many ponds and water surfaces for urban construction. The expansion of streets, which were once small and intimate, resulted in the gradual loss of the traditional urban spatial texture and scale, leading not only to the loss of the unique Jiangnan style but also to the lack of humanization, inadequate resilience in the living street spatial environment, and a series of associated problems (Figure 3). In comparison to larger cities, most small and medium-sized towns have fewer independent public service facilities [43]. With the combination of the Jiangnan region's refinement since ancient times and residents' pursuit of a relaxed lifestyle, the multifunctionality of living streets in these towns requires further enhancement, and the spatial environment urgently needs upgrading. Lastly, as integral components of China's urban system, small and medium-sized towns in the Jiangnan region play a crucial role in optimizing the strategic spatial layout of urbanization and forming an organic urban network system [44]. Thus, research conducted in this context has significant implications for driving regional development.



Figure 3. Street insufficiency in resilience: characterized by high congestion during morning peak and low space utilization during off-peak hours. Source: photographed by the author.

Taking Yixing, Jiangsu Province, as a research sample for living streets, it represents, to a certain extent, the small and medium-sized towns in the Jiangnan region in terms of development history, geographic location, spatial scale, and existing issues. Similar to other small and medium-sized towns in the Jiangnan region, the main streets in Yixing's central urban area have undergone reconstruction and expansion since the 1980s, resulting from the second phase of urban renewal in China [45]. During this period, the regional characteristics associated with the ancient streets suffered significant impacts from modernization, resulting in increased traffic functionality and reduced social interactions. Geographically, Yixing is located in the southern part of Jiangsu Province and serves as the geometric center of the Shanghai–Nanjing–Hangzhou urban agglomeration (Figure 4), with the potential to promote collaborative development among neighboring cities. Leveraging its rich cultural and natural resources, Yixing has continuously developed and emerged as one of China's most powerful county-level cities, offering enormous regional spatial potential [46]. In the morphological dimension, the main urban area of Yixing city retains a pattern established since its founding. Similar to the formation of road networks in other small towns in the Jiangnan region, the development often follows a progressive and bottom-up approach, influenced significantly by geographical factors, economic activities, and regional perspectives, resulting in dynamic and diverse street forms (Figure 5). However, like many other small and medium-sized towns, the collision between the unsatisfactory environmental

conditions and the ideal urban vision is evident throughout the living streets in Yixing's central urban area (Figure 6), as witnessed by the population surge and the contradiction between limited space and increasing vehicular traffic. With the expansion of urban space beyond the central urban area and the preferential allocation of resources to new districts, the supply–demand contradiction in living street space in the main urban area has become more pronounced. However, these streets' cultural resources and life memories are incomparable to those of new districts. Therefore, research focusing on these areas is necessary and urgent. In conclusion, conducting analysis and research in this context provides significant insights and references for exploring the pathways to the resilience transformation of living streets in small and medium-sized towns in the Jiangnan region of China.

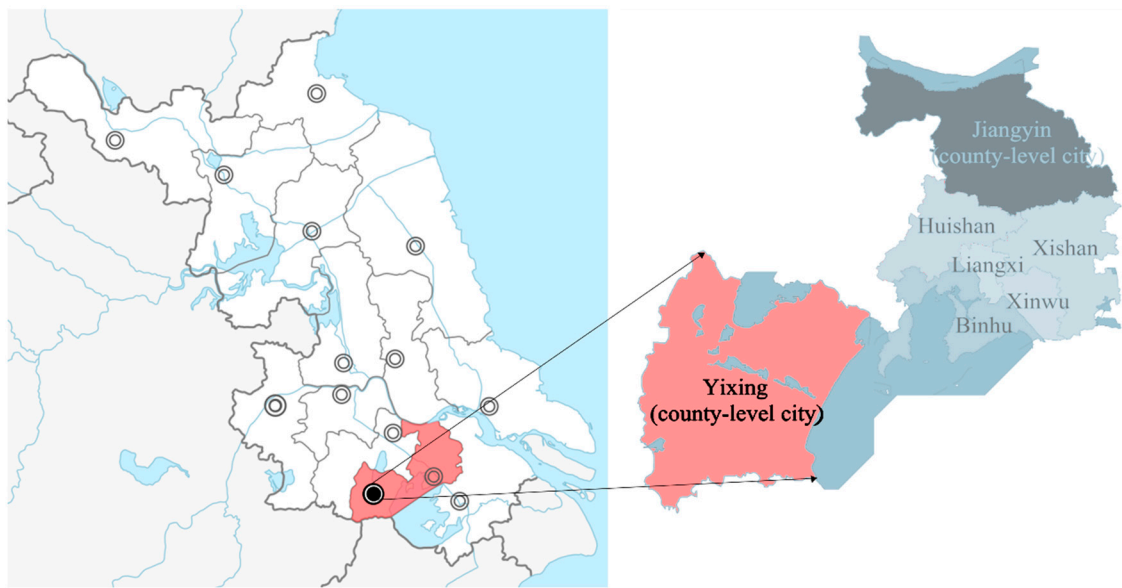


Figure 4. Location map of Yixing city. Source: <https://en.wikipedia.org/wiki/Yixing>, accessed on 5 June 2023.



Figure 5. Varied morphology of living streets in Yixing. Source: photographed by the authors.



Figure 6. Streets in urgent need of Facilities upgrade. Source: photographed by the authors.

3.5. Data Collection and Processing

This study uses in-depth interviews to collect data. Compared with survey methods, it is more conducive to capturing individual attitudes and emotions towards phenomena and has great potential for exploring the essence of abstract issues [47]. The transformation of living streets is primarily determined by two key stakeholders: managers and users. Therefore, this study collects data from user and management groups to investigate the utilization of living street resilience and flexible approaches to street management in Yixing city. In order to enhance the rationality and representativeness of the interview sample, the selected interview objects are mainly permanent residents or residents who have lived in the central city of Yixing for a period of time, as well as other stakeholders involved in the Yixing Street Renewal Project. The latter mainly includes government officials, developers, and road engineering design teams. The study employed semi-structured interviews that allowed for deep and wide-ranging dialogue and discussion between the interviewer and the interviewee. A core interview outline was developed for each group of respondents (Table 1). The outline consists of three parts: basic information to understand the interviewee's background and verify the validity of the interview sample, general questions related to perceptual aspects, and a more in-depth exploration of the nature of the questions. Other questions were adjusted as necessary according to the interview situation so that the interviewees could fully express their opinions, and follow-up questions were asked in a timely manner based on the interviewees' answers. Semi-structured interviews yield important ideas by generating new questions and insights that researchers may not have anticipated. Through a combination of online and offline methods, 36 interviewees (Table 2) were selected according to the ratio of residents and other stakeholders at a ratio of approximately 1:1, and in-depth interviews lasting 20 to 30 min were conducted. At the beginning of each interview, the interviewees were briefed on the main content and duration of the interview, and their consent was obtained for recording. To ensure that interviewees can better immerse themselves in the interview environment, the conversation starts with engaging questions related to the content and then gradually transitions to the main questions. All recordings were transcribed into written transcripts to facilitate analysis and summarize interviews. Among the 36 interview transcripts, 30 were randomly selected for grounded analysis, and the remaining 6 transcripts were used to test the saturation of grounded theory analysis. NVivo 12 software was used to preprocess and encode all question-answer sentences in the 30 selected recordings. After removing irrelevant content, the original data are numbered. The numbering sequence is the respondent number followed by the statement number. For example, A-2 represents the second statement in the interview with the first respondent. Then, each word and sentence are systematically marked, and the original data are repeatedly checked and classified according to concepts and categories. A three-level coding analysis is carried out following the principle of greatest possibility [48].

Table 1. Interview outline. Source: drawn by the author.

Interviewee	Category of Interview	Main Content
Permanent/Former Residents of Yixing	Basic Needs, Barrier-Free Access, Humanized Experience	Gender, Age, Education Level, Profession, Occupation, Hometown
	Experience of Using Living Streets	Activities commonly done on the streets. Impressions and observations? Perceived issues and inconveniences with the current streets? Are there any perceived problems with street management?
	Perspectives of Street Resilience	How do you understand street resilience/flexibility/multi-functionality? Do you think it is important? What are the differences between Yixing's current streets and its past streets? In your opinion, how do Yixing's streets differ from streets in other areas?
Other Stakeholders in Yixing's Street Renovation Projects	Basic Information	Gender, Age, Education Level, Profession, Occupation, Hometown, Specific work
	Usage and Management Status	According to your observations, what are the shortcomings of the current streets? What practices can improve the city streets in this regard? How do you evaluate the current street management model?
	Factors Influencing Street Resilience	How do you understand street resilience? Do you think it is important? Why? How can street resilience be enhanced?

Table 2. Basic information of interviewee. Source: drawn by the author.

Variable	Categories	Number of People	Frequency (%)
Gender	Men	16	44%
	Women	20	56%
Age	13–17	2	5.5%
	18–45	12	34.5%
	46–69	18	50%
	>69	4	11%
Educational level	High School and Below	8	22%
	College/ Associate Degree	8	22%
	Bachelor's Degree and Above	20	56%
Job status	Students	4	11%
	Nonprofit Organizations	4	11%
	Corporate Employees	12	34.5%
	Street Cleaners	2	5.5%
	Street Management and Operation Staff	14	38%
Major	Planning and Design-related	12	34.5%
	Non-planning Design	24	65.5%
Hometown	Yixing	25	69%
	Jiangsu (excluding Yixing)	8	22%
	Others	3	9%

4. Results

4.1. Coding Results

Following the steps of open coding, the 30 transcripts containing a total of 1365 original statements were sequentially subjected to preliminary conceptualization (a1), conceptualization (AA1), and categorization (A1), all centered around the core research question, “What is the resilience of living streets, and how can it be achieved?”

4.1.1. Open Coding

In the open coding stage, through continuous analysis, comparison, abstraction, and induction, a total of 46 concepts and 14 categories were identified, as shown in Table 3.

Table 3. Example of open coding analysis. Source: drawn by the author.

Example from Data	Initial Concept (AA1)	Initial Scope (A1)
(B-13) “Living streets should meet our basic needs (AA1), such as safe walking, places for relaxationwe love good infrastructure (AA3)”.	Basic Needs (AA1) Barrier-Free Access (AA2) Humanized Experience (AA3)	Deficiency needs (A1)
(F-22) “At least, there should be spaces available for residents to use spontaneously (AA4), where they can manage them independently, and provide outdoor seating options for nearby small eateries”. (AA6)	Flexible Function (AA4) Balance between Rigidity and Flexibility (AA5) Appropriate Non-Design Space (AA6)	Characteristics of elasticity (A2)
(P-54) It would be better if there could be some small activities held periodically. (AA7) “(N-24) All streets look the same, no characteristics, Can’t give me the feeling of hometown” (AA8).	High-Quality Spiritual and Cultural Life (AA7) Urban Sense of Belonging (AA8) Leisurely Pace of Life (AA9)	Growth needs (A3)
(J-113) Traditional festivals such as Lantern Festival and street festivals can be celebrated with lights. (AA-11)	Everyday Use (AA10) Festive Scenes (AA11) Temporary Occupancy (AA12) Unpredictable Events (AA13)	Event factors (A4)
(G-87) For example, parking is allowed on the roadside at night, and on weekend mornings temporary stalls are allowed (AA15).	Usage Guidelines (AA14) Multiple Spatial Use Patterns (AA15) Categorized Design (AA16)	Certain demonstrativeness (A5)
(F-23) Some streets in Shanghai now have smart phone booths (AA17), which can help the elderly avoid traffic. Future street design should be more human-oriented and smarter (AA19).	Physical Elements of Streets (AA17) Phased Construction (AA18) Trend towards Smartness (AA19) Long-term Design (AA20)	Street planning and design (A6)
(L-163) In the past, street vendors (AA22) and night markets (AA21) have brought convenience to our daily life, but they are not so common now.	Openness in Usage Permissions (AA21) Informal Economy (AA22) Blurred Functional Zoning (AA23)	Management model (A7)
(M-121) Nowadays city emphasize green living (AA24). I often choose to walk to work. Streets should not only facilitate our lives, but also promote the city and attract external economic investment (AA26).	Resource-Efficient Society (AA24) Demand-Driven Updates (AA25) Interests of Multiple Stakeholders (AA26)	Attitude towards resilience (A8)
(C-117) Serious traffic jams (AA27) between students going to and from school. One side is full of cars, while the other side is almost empty (AA28). (F-47) It would be beneficial to designate waiting areas for parents and create a multi-purpose (AA29) area near the school.	Serious Traffic Congestion (AA27) Imbalanced Space Utilization (AA28) Monofunctional Spaces (AA29)	Assessment of the current situation (A9)
(T-87) Some roads are already time-shared (A30). Accessibility and ramps are a must and cannot be overlooked (AA32). (U-76) The stalls and merchants on the ground floor need to be flexible, such as operating in different formats according to the needs of residents during the day and night (AA33).	Appropriate Control at Different Times (A30) Variable Intervals (AA31) Mandatory Regulations (AA32) Management of Street Businesses (AA33)	Policy support (A10)
(P-56) Street corners can add urban furniture and interactive elements (AA34). Work efficiency should be improved. (A-90) With the emergence of big data platforms (AA35), management should be more convenient.	Completeness of Urban Furniture (AA34) Degree of Smartness (AA35) Urban Development Strategy (AA36)	Current level of development (A11)
(K-84) Yixing’s urban identity (AA37) is associated with being a city of literature, and in recent years, some newsstands have been transformed into shared book houses.	Yixing-Cultural City (AA37) Guidance of Positive Values (AA38) Moral Consciousness Behavioral Norms (AA39)	Social atmosphere (A12)
(V-59) As residents, we should conscientiously maintain (AA40) the street environment and remind each other not to privatize the street space. (F-167) The voluntary maintenance by citizens, along with the diversity of street volunteers and governance approaches, can enhance management efficiency (AA42) and reduce administrative costs.	Consciousness of Self-Maintenance (AA40) Public Recognition of Management (AA41) Management Efficiency (AA42)	Maintenance cost (A13)
(X-154) Some people may occupy the streets (AA44), which is inappropriate. (F-23) The current street has a single function and cannot cope with development and change (AA46).	Excessive Regulations (AA43) Selfish Behavior (AA44) Unified Standards (AA45) Rigid Spaces (AA46)	Obstacles factors (A14)

4.1.2. Core Coding

Core coding refers to the systematic integration of the categories obtained in the previous open coding stage using the paradigm model of “causal conditions → phenomenon → context → intervening conditions → action/interaction strategies → outcomes” [41]. Based on the research question of this study, the core phenomenon can be summarized as “resilience in living streets”. The connections between different categories were established through abstraction, refinement, and inductive analysis. In the previous stage, we obtained 14 initial scopes by continuously comparing and exploring potential relationships among these initial categories, such as causal relationships, contextual relationships, functional relationships, process relationships, and temporal relationships. For instance, a certain association exists between A1 and A3, where people’s deficiency needs (A1) must be satisfied before growth needs (A3) can be addressed, thus categorizing them as factors contributing to the resilience of living streets. Both A8 and A12 can be considered as positive contextual conditions that promote the generation of resilience attributes; hence, they can be classified into the category of positive value. Following such an encoding process, ultimately, six main categories were identified: positive values, demand factors, street spatial environment, contextual factors, operation management, and resilience characteristics. The other categories became subcategories that interpret these main categories (Table 4).

Table 4. Category and subcategory from axial coding. Source: drawn by the author.

Primary Category	Corresponding Subcategory	Explanatory Logic of Main–Subcategory Relationship
Positive Values	Social and Cultural Environment Attitude towards Resilience Evaluation of the Current Situation	Evaluation of the Current Situation: A favorable social and cultural environment serves as the foundation for cultivating positive values. The attitude towards resilience and the evaluation of the current street situation influences the public’s perception of street resilience.
Street Space Environment	Preliminary Planning Positioning Current Built Environment	The street space environment consists of two parts: the preliminary planning positioning and the current built environment.
Factors of Demand	Basic Needs Expectation Needs	The factors of demand consist of the basic needs and expectations of various user entities, directly influencing the design of the street space environment.
Contextual Factors	Elements of Events Policy Support Urban Strategies	Contextual factors, including elements of events, policy support, and urban strategies, form the immediate conditions driving the resilience of living street spaces. The differences in contextual factors determine the variations in resilience characteristics.
Street Operation and Management	Multiple Modes Cost and Efficiency Demonstrative Nature	Street operation and management encompass various operational and management modes adaptable to different contexts, associated costs, efficiency, and demonstrative nature. They support the progressive enhancement of resilience in living street spaces.
Characteristics of Resilience	Balance between Rigidity and Flexibility Dynamic Sustainable Development Functional Complexity, Adaptability to Change	The characteristics of resilience include the balance between rigidity and flexibility, dynamic sustainable development, functional complexity, and adaptability to change. These characteristics vary in different contextual conditions.

4.1.3. Selective Coding

Selective coding is used to figure out the core category from the main categories identified in the previous stage and systematically establish their connections with other categories. In line with the research objectives of this study, the core category was deter-

mined as “factors influencing resilience in living streets and their formation pathways”. Among the other categories, positive values and demand factors serve as prerequisites, the street spatial environment acts as the primary material condition, contextual factors and operation management act as reinforcing factors, and resilience characteristics serve as benchmark elements. Together, they drive the realization of resilience in living streets.

Based on the analysis results of grounded theory, a general pathway for the development of “rigid-flexible” living streets in China’s small and medium-sized towns can be constructed (Figure 7). Firstly, it is essential to actively guide the public to develop positive values, enabling them to recognize and understand the value of using elastic living streets in their lives and urban development. In the current context of urban renewal driven by demand [49], living streets already fulfill the basic needs of various user groups, and the increasing higher-level demands of the public are driving the transformation of living streets towards greater flexibility. Secondly, the street spatial environment, as the material foundation for resilience implementation, should be strategically planned in the early stages to ensure long-term sustainable development, which will give the future living streets more resilience. The current spatial conditions of living streets, such as the soft or hard segregation of internal zones and the movability of urban furniture, also affect the difficulty of street resilience transformation. Lastly, in the current unstable external environment, contextual factors and corresponding operation management determine the degree of resilience that can be achieved, with both factors collectively supporting and driving the attainment of resilience goals.

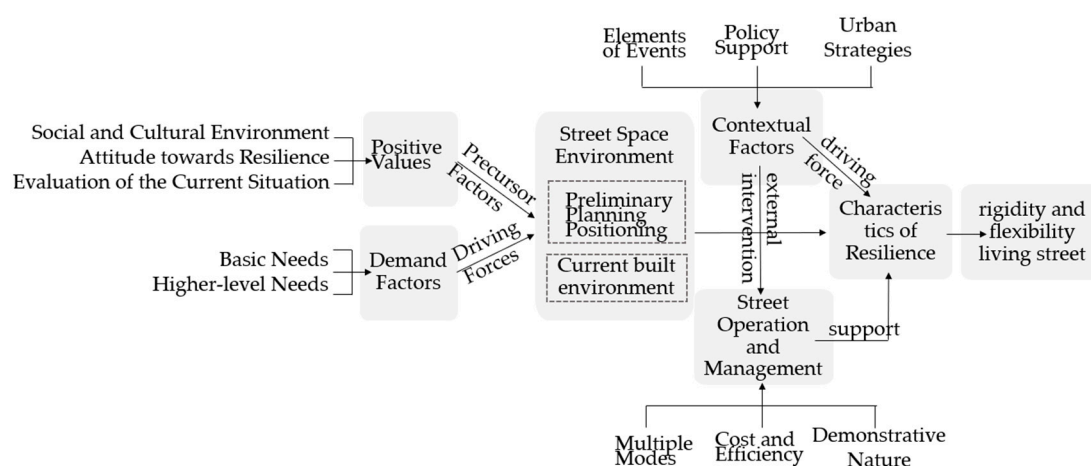


Figure 7. Formation path of living street elasticity in small and medium-sized towns. Source: drawn by the author.

4.1.4. Theoretical Saturation Check

The theoretical saturation check is the criterion for determining when to stop sampling. In this study, the remaining six samples, after the previous stage’s random selection, were subjected to a repeated analysis using the three-level coding method of grounded theory. The results obtained still conform to the logical relationships presented by the “formation pathway of resilience in living streets” model without introducing new categories or relationships. Therefore, the theoretical model is deemed saturated.

4.2. Structure and Mechanisms of Living Street Resilience Model

The formation of resilience in living streets involves four dynamic mechanisms: guiding correct perceptions to establish resilience-oriented cognition, recognizing multi-level demands to expand street functions, combining short and long-term perspectives to form a resilient physical environment, and responding to external factors to enhance operational flexibility. Furthermore, external driving factors such as the emergence of new events, relevant policy support, or urban development strategies also prompt the follow-up of

corresponding operational measures, ultimately facilitating the achievement of resilience in living streets. Next, we will explore these four pathways for enhancing resilience in living streets and elucidate their formation rationale.

4.2.1. Indicating Development Direction: Establishing Resilience Goals for Streets through Positive Cognition

In the current complex and dynamic urban context, concepts such as “resilient cities”, “sustainable development”, and “flexible design” guide the resilient development of living streets [50]. According to behavioral psychology, cognitive awareness determines behavioral motivation [51]. One participant stated, “Under the influence of community low-carbon activities, I now prefer riding a bicycle to work, not only avoiding traffic congestion but also contributing to urban environmental protection”. By conveying positive urban development perspectives through city promotion—such as advocating for green and low-carbon travel modes, supporting environmental conservation activities, and highlighting urban regional characteristics—street users are more inclined to support pedestrian-friendly, cycling-friendly, and public transport-friendly street environments. This effectively supports street construction aligned with sustainable principles, facilitating the creation of pleasant and inclusive public spaces, thus advancing the goals of a healthy city. According to the theory of values, values play a guiding role in people’s understanding and transformation of external objects [52]. The perception and positive attitude towards street resilience influence people’s emotions and behaviors on the street, further promoting the practical support for sustainable travel modes, active participation in diverse street activities, fostering a sense of belonging among residents, and stimulating spontaneous maintenance of street order, thereby driving the resilient development of living streets. Another participant also mentioned, “Now the government is paying attention to the construction of pedestrian spaces, and some corners of the streets have been furnished with seats. The streets are brighter at night, and I am more willing to take a stroll on the streets in the evening without feeling unsafe”. Well-illuminated streets enhance the street environment’s safety, reduces the fear of crime among vulnerable groups, and creates a more harmonious community atmosphere. Forming a positive social and cultural atmosphere and values prompts street planners to focus on improving non-motorized lanes, pedestrian environments, and recreational facilities to support sustainable street usage, thereby promoting resilience at a larger regional scale.

4.2.2. Meeting the Dual Needs of the City and People: Demand-driven Functional Flexibility

In the theoretical model constructed in this study, the demand factors and values constitute the precursor factors that influence the resilience of living streets. Living streets serve the people and the city, and their mutual needs drive the streets’ flexible provision of various functions. Meeting the satisfaction of “rigid” needs is the foundation for achieving “resilience”. Psychologist Abraham Maslow classified human needs into five levels, and after meeting lower-level rigid needs, people begin to pursue higher-level goals [53]. Similarly, as street renewal progresses from dehumanization to humanization, fulfilling higher-level needs, such as belonging to the city, becomes crucial. One participant expressed, “I feel that the streets in my hometown lack distinctiveness. Yixing has rich natural and cultural resources. It would be significant for both local residents and visitors if the streets could showcase some urban history”. Living streets are expected to meet high-level needs such as spiritual and cultural fulfillment, respect, self-actualization, and essential mobility and social functions. An elderly participant stated, “Some community cultural activities could take place in street spaces, enriching our elderly lives and boosting urban vitality”. The close relationship between living streets and communities enables them to serve as highly cohesive spaces that emphasize community engagement, promote local characteristics, and encourage interpersonal interactions.

4.2.3. Providing Physical Environment: Adjusting Internal Elements for Space Resilience

The theory of mutual permeation in environmental behavior studies affirms the inseparable relationship between individuals and their environment [54]. The street spatial environment serves as the material foundation for achieving resilience, encompassing both the initial planning and design stage and the current state of development. Firstly, incorporating foresight during the design or renovation phase enables living streets to possess flexible spaces that can adapt to changes, thus enhancing their resilience. A respondent from the urban planning department stated, “Most street renovations nowadays are due to the inability to meet people’s needs, necessitating updates. If future scenarios are considered in the early design phase, the costs of subsequent renovations can be significantly reduced”. Present-day street transformations should establish sustainable long-term goals, allowing future development and dynamically considering emerging needs. Secondly, by identifying the predominant activities along the street based on the functions of the adjacent buildings, it is possible to tailor the usage patterns of the street space in different periods according to specific needs. For instance, near school zones, designated drop-off and pick-up points for student vehicles can be established using removable bollards to facilitate the conversion between peak and off-peak periods; variable tidal lanes can be implemented to improve traffic efficiency when necessary; and movable urban furniture can be strategically placed, allowing for flexible adjustment of spatial scale. By incorporating flexible adjustment spaces (Figure 8), the utilization of street space can be significantly enhanced.

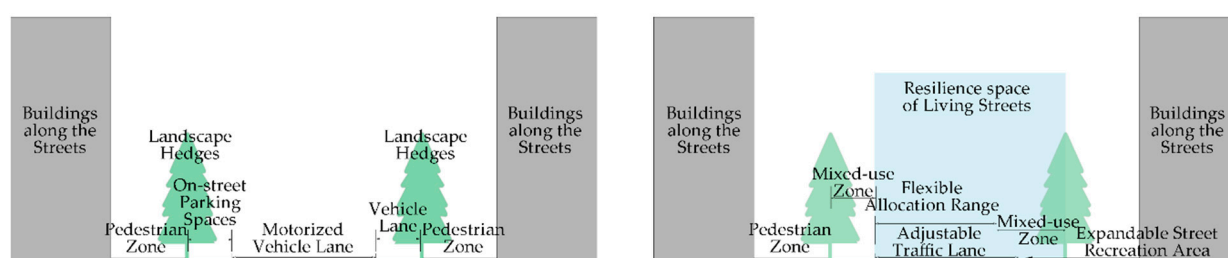


Figure 8. Profiles of service-oriented living streets and recommended profiles. Source: drawn by the author.

4.2.4. Responding to External Factors: Identifying Change Characteristics to Enhance Operational Flexibility

Contextual factors and comprehensive operational management are key factors driving the resilience of living streets. Contextual elements, including events, policies, and urban development strategies, serve as external intervention conditions. Meanwhile, diverse modes, cost-effectiveness, and a certain level of exemplarity in street comprehensive operational management serve as internal support. External contextual factors drive corresponding adjustments in operational management modes, directly promoting the realization of resilient living streets. Event elements possess certain unpredictability and suddenness. For instance, the recent pandemic has prompted people to reconsider how public spaces can be more resilient in addressing public health emergencies. Drawing from past experiences to identify patterns and learn lessons enables living streets to exhibit resilience in the face of future changes. At the policy level, current urban renewal regulations encompass rigid requirements and flexible ranges. Additionally, the widespread adoption of sustainable development principles in society contributes to the overall development strategy of urban revitalization, encompassing spatial, managerial, and procedural flexibility. Correspondingly, achieving resilience within living streets requires flexible operational approaches that can adapt to different types of living streets, regulate the supply of street space services, and enhance vibrancy and resilience.

5. Practical Guidance of the Theoretical Model

The model constructed in this study has significant implications for enhancing design and management practices in living streets. It can effectively guide the transformation of most small and medium-sized town living streets in China, promoting the improvement of street living quality and facilitating the realization of resilience at the block, city, and even regional levels. Based on the research findings, relevant stakeholders can advance the sustainable development of streets from the following perspectives.

5.1. Urban Planning Departments

Considering the unique characteristics of specific cities, adjustments tailored to local conditions can be made to spatial strategies, policies, and regulatory frameworks. For example, during interviews, the label “Literary City” was frequently mentioned concerning Yixing. The residents’ desire for a culturally enriched life and the long-standing urban characteristics of valuing culture and education in Yixing determine that the revitalization of its living streets should consider the creation of city-specific cultural symbols. This could involve developing a unified signage system in the renewal strategy to help people better understand and experience the distinctive cultural atmosphere of the streets. When formulating management regulations, corresponding oversight mechanisms should be established to provide operational flexibility and facilitate the organization of cultural activities.

5.2. Street Managers

Firstly, raising public awareness of streets’ flexible usage and value through various media and propaganda can enhance people’s sense of responsibility in maintaining street resilience. Living streets are characterized by diverse activities and rich streets, particularly in small and medium-sized towns. While they inherently possess a certain degree of flexibility, sustaining street resilience long term requires more than just spatial design. When organizing the participation of residents in street renovation projects, it is essential to extensively understand the needs of residents, consider the unique needs of vulnerable groups, incorporate gender perspectives, and ensure equal consideration for all users. Inclusive public engagement can foster the realization of resilient and sustainable urban goals that benefit everyone. Secondly, employing systematic and intelligent management approaches to cater to different street usage patterns enhances the efficiency of street services, ensuring smooth operations under both normal and exceptional circumstances. Strategies that balance rigidity and flexibility—such as time-based management, providing appropriate outdoor spaces for informal economies, and allowing flexible, functional transformations for ground-level businesses—effectively optimize the utilization of living streets during different periods. Lastly, organizing regular events such as art exhibitions, cultural markets, and festive night markets attracts more people and attention, promoting living streets’ continuous and resilient development.

5.3. Street Designers

Resilience should be incorporated in the early stages of street construction and renovation. During the initial planning phase, future urban development goals should be considered while maintaining a keen awareness and insight into the era and the external world. Anticipating potential changes enables streets to possess the attribute of timely adjustment. Utilizing emerging technological tools to update the spatial environment and promptly adapt to event elements facilitates positive interactions, promoting sustainable development in urban spaces, the economy, and society. In design practice, designers should meticulously consider users’ needs from their perspective, ensuring that living streets exhibit flexibility that accommodates diverse demands.

6. Discussion

The main theoretical contribution of this paper lies in constructing a theoretical model for the influencing factors of urban street resilience, elucidating the mechanism of resilience

formation, and providing directions for improvement in future work for stakeholders involved in urban street construction projects. The study also reveals that the foundation for achieving resilience is ensuring a certain level of rigidity, controlling certain variables within the composition of elements to maintain a relative balance between rigidity and flexibility, and ensuring an appropriate degree of resilience. Furthermore, enhancing the resilience of living streets in small and medium-sized towns is a progressive and dynamic endeavor. Different cities should tailor their resilience goals based on their specific urban matrix, development strategies, and policy guidelines at different stages. The research expands the scope of living street studies in the new era, providing a framework for how living streets can contribute to the environment and promote the sustainable development of society, civilization, and ecology.

Moreover, compared to similar studies, this research confirms the role of street spaces in promoting macro-level urban resilience [25], demonstrating the significance of street resilience for sustainable urban development, deserving continuous attention. The research highlights that strengthening infrastructure resilience is a complex process involving events, actions, and mechanisms. At different stages, active responses from individuals, communities, and cities are essential in resisting and mitigating emergency impact. The theoretical model proposed in this research explains how various factors at different levels influence the implementation of resilience in living streets. By considering the dimensions presented in this model, relevant departments can prepare essential resources in advance to enhance resilience, establishing a foundation for cooperative responses to emergencies in the future. This also emphasizes the positive role of developing a resilience assessment framework in urban disaster prevention and mitigation [16]. Additionally, factors mentioned in other studies—such as urban development policies [55], new technological elements, public participation [33], and green infrastructure [56]—also influence urban-level resilience, aligning with the viewpoints of this study. Given that the focus of this research is on living streets, which connect neighborhoods and cities, it has the characteristics of caring for people's lives, so a more comprehensive exploration of the resilience factors influencing the human-scale aspect of living streets has been achieved. It aligns with the current trend of urban development shifting towards focusing on the well-being of residents. The research expands the research perspective on resilience in living streets by identifying the value-oriented factors, contextual factors, and urban development factors. Among these, the contextual factors, such as policy support and urban development strategies, are distinctive elements influencing the development of resilience in small and medium-sized urban living streets, which have not been mentioned in domestic and foreign literature and deserve further exploration and expansion to better guide specific practices.

7. Conclusions

The research presented in this study aimed to explore the resilience of living streets in small and medium-sized towns, with Yixing, China, as a case study. Through grounded theory and in-depth interviews, we systematically examined the factors influencing the resilience of living streets. We provided potential strategies to enhance street resilience for relevant street construction and management personnel.

The findings of this study are derived from empirical research and supported by relevant theories, providing valuable insights. The theoretical model obtained in this study systematically demonstrates the resilience mechanism in small and medium-sized towns' living streets, making it applicable to guide further research and practice.

The limitations of this study lie in its early stage, as limited research resources led to a relatively small sample size during the interview phase, with an uneven distribution across age groups. In our future research, we will expand the sample size based on the demographic characteristics of the cities and incorporate new indicators to enrich the theoretical model. It is essential to expand the sample size to better address the needs of vulnerable groups, particularly the elderly and minors. Furthermore, the research

employed the grounded theory approach, which may be influenced by the researchers' knowledge and subjective judgments, potentially impacting the research results.

Future research can consider the specific circumstances of individual cities and make corresponding adjustments to research methods and focus aspects. In addition, researchers could extract quantifiable indicators from various elements to evaluate the resilience of living streets and develop tailored strategies. Quantitative studies can explore the correlation between different elements and the resilience of livable streets, focusing on specific contextual factors and proposing corresponding solutions. Each component of the theoretical model warrants further exploration and can be developed into more detailed and updated design methods. The research applies to the renewal and transformation of livable streets in other small and medium-sized towns in the Jiangnan region. However, it can also serve as a foundation for exploring the resilience model of living streets in different regional contexts and addressing broader issues. The exploration of resilience in living streets is a response to the rapidly changing social situation, existing urban spaces, and the concept of sustainable development. It aims to meet people's needs, create a better street life, and make urban spaces adaptable to future challenges.

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Appendix A

Table A1. Sample Table of Living Streets in the Main Urban Area of Yixing.

Road	Type/Width	Length	Status Photo	Road	Type/Width	Length	Status Photo
Dongshan W Rd.	30	148		Gongyuan Rd.	18	216	
Yangxian E Rd.	27	1350		Xiyin Rd.	18	3300	
Yingbin Rd.	24	240		Chaju Ln.	16	320	
Jiaoyu Rd.	22	1500		Xueqian Rd.	14	330	

Table A1. Cont.






































Road	Type/Width	Length	Status Photo	Road	Type/Width	Length	Status Photo
Taige East Rd.	20	740		Xieqiao Rd.	13	336	
Chaoyang Rd.	20	680		Guangming W Rd.	13	200	
Nancangcun Rd.	12	650		Xiyouchang Ln.	8	124	
Tongzhenguan Rd.	12	610		Baiguo Ln.	8	322	
Jiuxiang Ln.	10	390		Guangrong E Rd.	8	176	
Guangrong W Rd.	9	500		Dongmiao Ln.	8	496	
Dazhong Rd.	9	230		Xiyouchang Ln.	8	124	
Shizi Ln.	9	75		Banqiao S Rd.	8	1120	
Xihou St.	9	240		Ximiao Ln.	7	320	
Wangfu Rd.	7	183		Gongti Rd.	5	176	
Beimen Ln.	7	260		Chengxi Rd.	5	344	
Xiheng St.	7	264		Shamao Ln.	5	106	

Table A1. Cont.

Road	Type/Width	Length	Status Photo	Road	Type/Width	Length	Status Photo
Duifang Rd.	6	350		Tucheng Rd.	5	600	
Daren Ln.	6	167		Qingyun Ln.	5	210	
Xiheng Ln.	6	68		Dongyouchang Ln.	5	180	
Caixing Ln.	5	85		Yelingtang Ln.	3	65	
Dongzhu Ln.	4	416		Minzhu Ln.	3	55	
Zhongshan Ln.	3	200		Duanjia Ln.	3	200	
Xizhu Ln.	3	354					

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