

Developing a Research Framework on Place Attachment and Outdoor Activity for Sustainable Development of the Fengyu Ancient Bridge: A Literature Review

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ABSTRACT

Fengyu ancient bridges are significant heritage resources that bear the historical and cultural. However, it has not received enough attention or strong protection globally. Existing research has largely focused on physical aspects rather than the people-place relationships. Behavior, as a concrete manifestation of the people-place relationship, is regarded by Gonçalves et al., (2020) as a core element in promoting the sustainable development of heritage. Based on it, this study aims to investigate if place attachment can elicit particular behavioral responses that aid in the sustainable conservation of the ancient bridge. The methodology of the study included a review and analysis of 37 scholarly papers pertaining to place attachment, activity categories, ancient bridge heritage, Bai ethnic culture, and public space. These constitute the theoretical basis for the proposed framework. This research examines the Fengyu Ancient Bridge as a case study-an outdoor public space characterized by a distinctive structural design and significant social and recreational roles-investigating the relationship among place attachment, Behaviour, and sustainable conservation. Findings show that place attachment can effectively stimulate interaction between residents and the ancient bridge, which will help promote its sustainable development. Moreover, the suggested framework provides both theoretical insights and practical tools to assist in identifying critical priorities for the conservation of Fengyu Ancient Bridge. Subsequent research may enhance the applicability of this approach by integrating various heritage sites and community situations. Empirical studies on the connections between place attachment and protective Behaviour can enhance actionable methods for the sustainable development of architectural heritage.

Keywords: Place attachment, Outdoor Activity, Research Framework, Fengyu Ancient Bridge, Heritage Conservation

INTRODUCTION

Architectural heritage maintains the integrity of collective memory, enhances cultural understanding, and promotes sustainable development. However, global heritage conservation initiatives continue to encounter significant hurdles across economic, political, and socio-cultural aspects (Roy & Kalidindi, 2017). The relevant literature classifies these issues into five primary categories: ambiguous scope, inadequate knowledge, restricted capacity, feeble managerial frameworks, and insufficient community backing. In China, Fengyu Bridges, as a type of architectural legacy, faced similar issues. In the last 30 years, the number of Fengyu Bridges decreased from more than 3,000 to under 2,000 (Wen& Qiong, 2022; ZHANG, 2018). Another amazing aspect of their disappearance is how quickly it happens. This has become one of the key motivations for this study to focus on ancient bridges. That is the sustainable development of Fengyu ancient bridges.

It is worth noting that some Fengyu ancient bridges have been abandoned due to community relocation, resulting in a lack of use. This can be attributed to insufficient community backing. The disappearance of ancient bridges is linked to the reduction in citizens' interaction with them. This matches the thesis stated by Gonçalves et al. (2020), who contend that architectural conservation needs to highlight the behaviors of inhabitants inside the constructed environment. These daily actions accurately reflect the real relationship among individuals and their environment. Therefore, the activities in ancient bridge areas and the factors that trigger them have become the primary focus of this study. In this context, the literature review seeks to provide a research framework for exploring whether place attachment acts as a significant motivator for enhanced resident interaction with ancient bridge areas. This framework not only provides a research direction, but also lays the foundation for its practical application in the conservation of ancient bridges in the future.

Fengyu Ancient Bridges in the study, as architectural cultural heritage, hold significant importance. They represent both the culmination of historical architectural and engineering technology, as well as a symbol of Bai culture and emotional connections (Huang, 2011). Preserving ancient bridges not only maintains their physical structure but also safeguards the intangible assets associated with them, including traditional knowledge, local importance, and communal spirit (Wilkinson & Harvey, 2017). Consequently, establishing a non-physical conservation framework for Fengyu Ancient Bridge as an architectural asset is of crucial significance.

Theoretical Supporting

This research reviews the literature in four parts. The first part is place attachment, which is the psychological context in the study. It is an emotional connection between the residents and the ancient bridge. Furthermore, place identity, place dependence, place social bonding, and place affect were selected as the variables suitable for measuring the place attachment in ancient bridges. The second part is outdoor activity. This part belongs to the human context. The producers of the activity are Bai villagers. Researchers do the categories of activity. The third part is an overview of Fengyu ancient bridges. It is the physical context under study. It is worth noting that it is a kind of public semi-open space. And in the review of the ancient bridge, researchers pay attention to the physical elements (behavior-carriers). Ultimately, these literature reviews consistently point toward the sustainable development of Fengyu Ancient Bridge (see Figure 1).

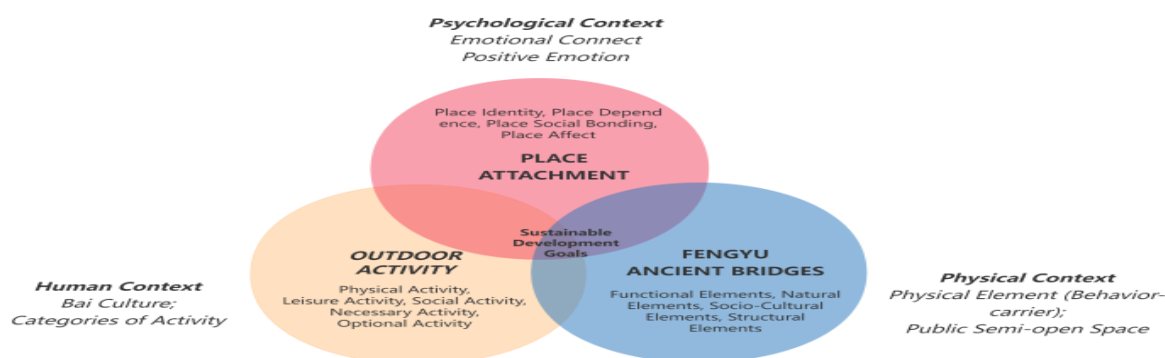


Fig. 1 Structure of literature review

A. Place Attachment

Place attachment is a positive emotional connection between people and places, which belongs to the category of sense of place (Jorgensen & Stedman, 2006; Hashemnezhad et al., 2013). Do Bai inhabitants foster place attachment to ancient bridges through prolonged daily interactions? This study proposes that they do, and current research provides substantial evidence for this perspective.

First, most studies on place attachment have focused on community settings (eg., Altman & Low, 1992, Jorgensen & Stedman, 2006, Dubois et al., 2021, Wang et al., 2023). This indicates that individuals living

in the same environment for a long time are more likely to foster place attachment. This emotional connection develops not alone from everyday social interactions and spatial utilisation but is also closely linked to the life experiences collected via prolonged residency. Such attachment plays a significant role in shaping their level of community engagement (Shaykh-Baygloo, 2020). Secondly, Environments containing ethnic cultural elements enhance the probability of forming place attachment. Shutika (2008), in her research on ethnic integration among immigrants, posited that ethnic activities may enhance place attachment. Jelić & Stanić (2014) argued that, regarding ethnicity or race, more homogeneous groups are predisposed to cultivate a stronger attachment or loyalty to a location. This is mostly due to the shared cultural traditions, language, religious beliefs, and social conventions of these communities, which promote mutual recognition and trust, thereby fostering a sense of community.

Thirdly, The religious beliefs of a place play a significant role in shaping people's attachment to it (Najafi & Shariff, 2011; Puspitasari & Hanan, 2022). In other words, local inhabitants have broaden opportunity to comprehend and value the religious aspects of the region, fostering a deeper emotional bond with places of worship (P.-S. Chen & Chang, 2015). Nursanty & Husni (2020) argue, Religious activities offered at places of worship fill the locale with significance and enhance place attachment. Patwardhan et al. (2020) also expressed a similar view in their article, pointing out that organizing religious festivals rich in ethnic and cultural elements can enhance emotional solidarity. Fourthly, Multiple studies have shown that residents have a strong sense of identity and attachment to architectural heritage (eg., Ujang, 2016; Stober et al., 2018; Mei et al., 2022). These findings indicate that historic buildings can easily transition from "potential cultural memory" to "actual cultural memory," serving as memory anchors for the local population. The rate of memory formation is contingent upon environmental elements, including illumination, the colour and substance of structures, and natural flora.

It can be concluded that there is a strong potential for place attachment to emerge in the context of Fengyu ancient bridges. Previous research on Fengyu bridges in Yunnan (e.g., Huang, 2011; Zhang, 2007) indicate that these bridges exhibit different characteristics while functioning concurrently as community spaces, carriers of ethnic culture, sites of religious significance, and architectural heritage. Hence, this study incorporates place attachment as a primary research focus, intending to develop a framework to investigate the correlation between place attachment and activity.

1) Variables of Place Attachment in Community: The first measurement of place attachment was conducted by Williams & Roggenbuck (1989). In their research, they identified two measurement dimensions of place attachment, which include "Place dependence" and "Place identity." Subsequently, Williams & Vaske (2003); Kyle et al. (2004); Brown & Raymond (2007); Gross & Brown (2008); Brown et al. (2015); Anton & Lawrence (2016); Woosnam et al. (2018) and Boley et al. (2021) each measured place attachment in their respective articles using a two-dimensional scale comprising of place identity and place dependence. Indeed, the two dimensions of place attachment, namely place identity and place dependence, are widely used in related research. These dimensions find application in various contexts, including heritage sites, various types of parks, rural communities, urban neighborhoods, immigrant regions, tourist destinations, and many others. They have proven to be versatile tools for understanding the emotional and cognitive connections individuals have with different places across diverse settings. Hence, when examining the relationship between Bai residents and bridge, the concepts of place identity and place dependence develop as definite variables to measure place attachment.

However, some scholars have pointed out that adopting the two-dimensional structure of place attachment may lead to the oversight of other important dimensions of attachment. These dimensions include social bonds (Kyle et al., 2005), lifestyle (Bricker & Kerstetter, 2000), social attachment (Raymond et al., 2010), and place affect (Kil et al., 2012). As a result, research on place attachment has evolved into a three-dimensional model to comprehensively explore the relationship between individuals and places. This three-dimensional model aids in capturing and interpreting the complex and diverse connections between individuals and different locations more effectively. Subsequently, Ramkissoon et al. (2014) conducted research on tourists in national parks and proposed four dimensions of place attachment, namely place dependence, place identity, place affect, and place bonding. Later, Brown et al. (2016) studied place attachment among spectators in sports event venues and introduced a new dimension called

place symbolism. It considered place dependence, place identity, place affect, and place symbolism as the four dimensions to measure place attachment. Chen et al. (2014) published an article in the journal "Tourism Analysis," which presents a comprehensive analysis of place attachment among urban residents in two tourism cities, Shanghai (China) and Sydney (Australia). It explores the relationship between individuals and places, using place attachment as an intermediary. The article introduces six dimensions to measure place attachment, which are place dependence, place identity, place affect, place bonding, place memory, and place expectation. This multidimensional approach provides a more nuanced understanding of the complex connections between individuals and their urban environments in the context of tourism cities. Given the research context, this study will not only concentrate on the dimensions of place identity and place dependence when analysing place attachment. Instead, it may also encompass other aspects such as social bonding or other relevant variables.

"Place attachment" is a widely used concept with multiple dimensions across different fields. This study focuses on its application in community settings. The ancient bridge is more than 500 years old, and the emotional connection between the locals and the ancient bridge is immeasurable. The Bai people have resided in this community for multiple successive generations. This study mainly refers to the dimensions of place attachment proposed by Shaykh-Baygloo (2020) in his study of the Baharestan New Town community in Iran, and then sorts out the dimensions of place attachment suitable for this study. The research focuses on four aspects: place identity, place dependence, place social bonding, and place affect. In this process, the researchers read extensively previous studies on the dimensions of place attachment, and combined with the background of this study (Bai community and ancient bridge heritage), screened out the parameters of place attachment suitable for this study.

2) Relationship between Place Attachment and Activity: When correlating place attachment to specific behaviours, it is crucial to highlight elements such as cognition (perceptions and beliefs), emotion (feelings and affective responses), and synergy (place-related intents and commitments). For instance, research on attitudes distinguishes between performance behaviors and instrumental behaviors. The former refers to actions used as means to an end, driven by attitudes with a robust cognitive basis. The latter, performance behaviors, are primarily driven by affective attitudes, undertaken for their own sake, for amusement, or out of interest (Millar & Tesser, 1989; Tesser, 1995; Wilson et al., 1989). In essence, specific people exhibit mainly cognition-driven attitudes, whereas others are primarily influenced by emotions. These disparities affect the motivations underlying activity. Consequently, numerous researches have endeavoured to associate place attachment with activity. For example, Vaske & Kobrin (2001) used structural equation modeling to study the impact of these two concepts on ERB. They proved that attachment to a local natural resource can influence environmentally responsible behavior (ERB) in an individual's everyday life. MacDonald et al. (2019) focuses her research on assessing the driving forces behind conservation actions, with an emphasis on place attachment as a critical factor in promoting such behaviors. Shaykh-Baygloo (2020) has analyzed how place attachment exerts a positive influence on civic involvement, which refers to the level of engagement one has towards a particular activity.

Most existing studies on place attachment focus on its link to pro-environmental behavior, with a confirmed significant relationship. However, its influence on outdoor behavior remains largely unexplored. This study addresses this gap by exploring the potential connection between place attachment and outdoor behavior.

B. Outdoor Activity in Public Space

Gonçalves' (2020) paper presented the concept of sustainable conservation through the examination of occupants' behavior. However it was focused on contemporary architecture rather than ancient bridges. This study focuses on villager activity on ancient bridges, using Gonçalves' (2020) research as a foundation to investigate their long-term conservation. It will offer insightful information about the motivations for Bai inhabitants' activities in the bridge area. The research framework aims to assist individuals in investigating whether place attachment can motivate the activities of the Bai people on the Fengyu ancient bridge.

1) *Bai Culture and Outdoor Activity in Community*: Due to strong social ties within Bai communities (Liang, 2021), where residents are familiar with and trust one another, Bai residents tend to engage in personal or group outdoor activities within the community. For example, Bai residents often sit and rest at the entrances of their courtyards or chat on communal platforms within the neighborhood. Women are accustomed to doing embroidery outdoors (see Figure 2).



Fig. 2 Bai People's daily life (source: Baidu)

Furthermore, in this study, the outdoor activities of the Bai people are intricately connected to local traditions. Temple fairs and ritual events focused on Benzhu worship, along with traditional festivals when individuals congregate in public squares or community areas to sing, dance, and showcase folk performances, represent prominent types of outdoor activity (see Figure 3). In addition, life ceremonies, including weddings and funerals, incorporate numerous outdoor components. The escorting of the bride and husband to the wedding venue, together with village parades, exemplifies a robust feeling of communal involvement (see Figure 4).



Fig. 3 Bai people's daily life (source: Baidu)



Fig. 4 Bai people's life rituals (Left: Funeral, Center: Wedding, Right: Birth Ceremony)

2) *Classifying Outdoor Activity in Public Space*: As defined by Gehl (2011), who classifies outdoor activities into two distinct groups: those deemed essential and required, such as commuting to work or school, waiting for public transportation, engaging in grocery shopping, and similar activities. Optional pursuits that individuals opt for when the circumstances and location are advantageous include engaging in pedestrian activities, exploring the surroundings, basking in the sun, engaging in retail therapy, and indulging in the leisurely act of occupying a seat on the pavement outside a café, among other possibilities. Furthermore, Han et al. (2022) classifies activities and believes that physical activity, leisure activities and social activities have been studied the most. Hence, this research aims to examine the outdoor activity of individuals living in the Bai community within the range of ancient bridges. Specifically, the study focuses on the categories of Bai residents' activities recorded include physical activity, leisure activities, social activities, optional activities, and necessary activities. These items were adapted from Han et al. (2022) and Gehl (2011).

In the review conducted by Han et al. (2022), physical activity is defined as a comprehensive term encompassing all forms of activity that are generated by skeletal muscles and need energy expenditure. These physical activities can be classified as various forms of motion. Inextricably linked to both leisure and work, and deeply interconnected with an individual's general state of health. The outdoor climate is identified as a primary determinant of engagement in outdoor physical activities (Nasir et al., 2013). The mean annual outdoor temperature in Yunnan is approximately 27 degrees Celsius, a factor that surely contributes to the inclination of locals to engage in outdoor activities.

Leisure activities are voluntary and not goal-oriented, undertaken during spare time for relaxation, enjoyment, social interaction, or personal interest. They are distinct from professional responsibilities or daily tasks and contribute to enhancing well-being or acquiring new abilities (Chang et al., 2019). Numerous forms of leisure activities exist, including strolling, travelling, reading, exercising, socialising, watching films, and engaging in crafts. Participants typically desire a tranquil and comfortable setting for relaxation or enjoyment (Han et al., 2022). In China, numerous recreational activities include the participation of two or more individuals, including but not limited to chess, mahjong, and square dancing. As a result of these recreational pursuits, social activities saw a progressive intensification. Furthermore, scholarly research indicates that communities have a strong correlation with individuals' daily lives, making them an important topic in studies examining leisure activity (Burton et al., 2009; Turrell et al., 2010). Ancient bridges in Yunnan, serving as public spaces inside villages, indicate a heightened probability of local inhabitants participating in recreational activities.

Social activity is an essential component of human existence, encompassing an exchange of communication and interaction among people or collectives. It includes informal interactions such as chatting, having meals together, visiting neighbors, and dancing in public squares, as well as formal organized group behaviors such as weddings, festival celebrations, and team-building activities. There exists a strong correlation between social activities and public space. In the study conducted by Han et al. (2022) The correlation between the quality of the physical environment and the impact of social interaction on individuals' behavioral patterns in spatial settings has been demonstrated. The research focus of this study is on the ancient bridge, which has a historical existence extending over five centuries. This particular place holds substantial importance for the local community, serving as a public space for social interactions and hosting various communal activities.

In general, this research categorises the activities of Bai residents into five classifications: physical, leisure, social, necessary, and optional activity, as per Han et al. (2022) and Gehl (2011). The bridge serves as a conduit linking both sides of the settlement, facilitating everyday commutes and necessitating certain activities. The public nature also promotes diverse additional applications. Consequently, Gehl's classifications of essential and discretionary activities are incorporated. Han's analysis emphasises that physical, recreational, and social activities are the most extensively researched in public areas, therefore serving as primary observation parameters.

C. Fengyu Ancient Bridge

The ancient bridge discussed in this study has been described by Knapp et al. (2020) as a 'covered bridge' and is frequently regarded as a communal area for public gatherings. His research indicates that both tourists and inhabitants engage in many activities on these covered bridges, encompassing social and recreational pursuits. This indicates that covered bridges possess distinctive features that set them apart from conventional bridges. In this study, the word 'covered bridge' means the 'Fengyu qiao' (Bridge that resists wind and rain), a concept that is understood differently within the Chinese context. In contrast to the Western emphasis on structural elements, the Chinese perspective prioritises the functional characteristics of the space within the bridge. This is particularly applicable in ethnic minority regions, like Yunnan and other areas in Southwest China (refer to Figure 5). This research is specifically conducted in Yunnan Province, situated in the southwestern region.



Fig. 5 Fengyu Ancient Bridge in Yunnan

China's Fengyu bridges are very famous in the world. There are three reasons: 1) There are more than 3,000 Fengyu Bridges, making it the country with the highest number of Fengyu Bridges (Wen & Qiong, 2022). 2) Bridges in China boast a longer history compared to those in other countries, with the earliest Fengyu Bridges originating in China (Knapp et al., 2020). 3) They have their own features and technologies (Cucco, 2022). Fengyu Bridge, as one of the categories of ancient bridge heritage resources, represents a distinctive form of architectural cultural heritage. Consequently, Fengyu ancient bridges must be carefully preserved as they are often associated with spiritual worth rather than monetary benefits. Chinese Fengyu bridges serve not only as bridges, like their counterparts in North America and Europe, but also as venues for destination weddings, and wedding photo shoots for couples, with the "wind and rain bridges" being central to such photographic documentation (Knapp et al., 2020). These bridges in China are often deeply intertwined with community life. Similarly to old houses, pagodas, ancestral halls, tombs, and temples, bridges are generally regarded as the surviving remnants of once-complete villages (Amsterdam Declaration 1975).

1) Ancient bridges and Public Place: Place encompasses more than simply its physical property. According to Lefebvre (2014), the material property of place might serve as an initial point or fundamental factor, but it is essential to recognize that place is fundamentally shaped by social processes. This implies that human activities and lived experiences play a crucial role in the creation and ongoing transformation of place. The ancient bridge examined in this study serves as a primary location for Bai residents to engage in outdoor activities. It serves as a prominent communal area where individuals belonging to the Bai people gather and engage in social activities. Moreover, the Fengyu Bridge is a semi-open space in terms of its physical structure. Open, semi-open, and enclosed spaces mainly differ in how enclosed they are. Open spaces predominantly consist of natural components such as soil, water, flora, and fauna (Maruani & Amit-Cohen, 2007). Lynch et al. (2024) characterised semi-open spaces as zones that exist between open and enclosed places, frequently distinguished by elements such as arcades or covered pathways. Enclosed spaces, as identified by Jeffrey et al. (2012), are characterised by physical walls or borders and represent the most distinctly divided category of space.

Consequently, according to the aforementioned definitions, Yunnan's Fengyu bridges can be categorised as public spaces regarding their social purpose and as semi-open spaces about their physical structure. These Fengyu bridges, as public spaces, transcend mere physical architecture; they are influenced by human activities and interactions within them. Interactions such as conversing, congregating, or collaborating infuse vitality and a sense of community into the environment, facilitating its development through regular engagement. Moreover, its semi-opened physical structure significantly advantages Bai residents by offering protection from wind and rain, in addition to providing a cool resting area. This style of venue provides a secure and inviting atmosphere for activities, promoting engagement, interaction, and socialisation. Consequently, it facilitates more frequent utilization and invigorates the space.



Fig. 6 Fengyu Ancient Bridge is a public semi-open space

2) Physical Elements of Outdoor Public Space: This study emphasises physical elements in public spaces due to their strong association with human activities (Neto et al., 2016). Alwah et al. (2020) asserts that these elements influence human activity, rendering it crucial to evaluate the characteristics of spatial components while analysing space utilisation. Ghavampour (2014) discovered that the arrangement of physical elements in public areas substantially influences their activity frequency. These elements can convert a space into a significant place and cultivate a social atmosphere that promotes human connection (Del Aguila et al., 2019). In this setting, the Fengyu bridge serves as a communal place inside the Bai community, where people's activities are intricately linked to its physical attributes. Consequently, the physical elements in the bridge region are considered as determinants of activity in this research.

Table I lists the physical elements of public space. Whyte (1980) posits that elements like as seats (chairs, steps, terraces), sunlight, trees, water features, crowds, street connectivity, retail stores (food), public toilets, and wind can promote public engagement. Carmona (2010) incorporates components including seating, shading structures, trash receptacles, water fountains, greenery, sculptures, murals, accessible pathways, and ground materials, all intricately connected to the utilisation of public areas. These aspects not only influence the physical setting but also enhance comfort, convenience, aesthetics, and safety-promoting individuals to remain, interact, and engage with the area. Their synergistic impact renders public areas multipurpose and vibrant. K. Lynch (1960) recognised five elements—paths, paths, edges, areas, nodes, and landmarks—as essential to human comprehension and navigation of space. Paths facilitate travel, edges delineate boundaries, districts categorise comparable areas, nodes serve as activity hubs, and landmarks assist with navigation. Aelbrecht et al. (2019) observed that communal amenities, such as community gardens, and cultural features, including statues or murals, are intricately linked to public activities, fostering social contact and cultural events. Mehta (2013) emphasised sidewalks, vegetation, and street furnishings as fundamental infrastructure that facilitates activities in public places.

In short, this study primarily examines the influence of physical components on behavior in public settings, amid several contributing factors. The word "physical elements" is broad, embracing all tactile and visible objects. This study categorises natural, socio-cultural, structural, and functional factors as subcategories of physical elements. Collectively, they constitute the supplementary parameters within the research framework.

TABLE I Physical Elements in Public Space

Authors	Physical Elements			
	Nature Elements	Socio-Cultural Elements	Structural Elements	Functional Elements
William H. Whyte (1980)	Sunlight; Trees; Water features; Wind	Crowds ;	Street connectivity	Seats (chairs, steps, terraces); Retail stores(food); Public toilets;

Matthew Carmona (2010)		Green plants; Sculptures; Murals;	Shading structures; Ground surface	Seating; Trash bins; Drinking water facilities; Wheelchair access;
Kevin Lynch (1960)		Landmarks	Paths; Edges; Districts; Nodes;	
Patricia Aelbrecht & Quentin Stevens (2019)		Cultural elements (Sculptures, Murals, Archways, Lanterns, Stone carvings)		Shared facilities (community gardens or long tables);
Vikas Mehta (2013)		Green areas;	Pedestrian paths;	Lighting; Street furniture;

D. Sustainable Development of Fengyu Ancient Bridge

Sustainable development constitutes the theoretical background of the research framework, directing the overall trajectory of this study. The exploration of Bai inhabitants' place attachment to bridges, the examination of their activities on the bridge, and the analysis of whether place attachment can encourage such activities all contribute to the sustainable development of the bridge. Therefore, understanding the concept of sustainable development is a fundamental step in this research.

Sustainability initially encompassed three components: environmental, economic, and social. Over time, culture was added as a fourth pillar in 2002 and confirmed in 2010. Culture is regarded as a crucial element of sustainable cities, offering social cohesion, identity, creativity, and economic and environmental advantages (Bandarin & Van Oers, 2012). Social sustainability entails preserving or enhancing the well-being of present and future generations (Forrest & Lee, 2003; Pugh, 2014). The objectives include social cohesion, stability, and enhanced quality of life. Social and cultural sustainability emphasise the preservation of values, traditions, and communal relationships. They collaborate to establish surroundings that honour diversity and bolster heritage and communities, thus they are frequently examined collectively—termed socio-cultural sustainability in this research (Chiu, 2004).

The sustainable development of Fengyu ancient bridges is crucial for preserving historical and cultural connections, hence fostering greater community engagement with these structures. UNESCO (2011) emphasises that the preservation and management of heritage are essential for development. This study indicates that place attachment reflects the emotional connection and identity individuals possess about bridges, hence reinforcing cultural legacy and community cohesion (Mihaylov et al., 2020). Behaviour manifests the expression of these emotions in everyday life, such as participating in community events (McKenzie, 2004). Together, they help maintain cultural values and community stability, which are central to socio-cultural sustainability.

Research Framework

The theoretical construction of this study encompasses three levels: underpinning, supporting concepts, and theoretical context. The fundamental theory comprises two key theories: place attachment and outdoor behavior theory, which lay the groundwork for the study by exploring the relationship between Bai residents and ancient bridges. The supporting concepts are utilized within outdoor behavior research, primarily aimed at identifying the physical elements that facilitate such behavior. The theoretical context employs the sustainable development proposed by Axon (2020). Axon suggests that public participation is crucial for community-based sustainable development, involving knowledge, emotion, and behavior. Based on this, the study focuses on place attachment (emotion) and activity (behavior) as two core aspects of socio-cultural sustainability, aiming to explore their connection.

The conceptual construction of this study encompasses two levels: parameters and ancillary parameters. The parameters of place attachment measured by Shaykh-Baygloo (2020) were adopted, specifically place identity, place dependence, place social bonding, and place affect. Moreover, the study used Han et al. (2022) and Gehl (2011)'s classification of outdoor behavior to observe the behavior of residents on the ancient bridge and the physical elements that affect behavior. At the same time, functional, natural, socio-cultural, and structural elements were used as ancillary parameters to observe the physical elements that support human activities. Finally, these conclusions point toward the socio-cultural sustainability of the Fengyu bridges.

As a unique structure, the ancient bridge serves to connect the residents on both sides of the village. It is not only an architectural heritage that has been passed down for hundreds of years, but also a gathering place for ethnic groups, a belief of Bai people, and a place where Bai people have lived around the ancient bridge for generations. It is also a passage connecting the two sides of the village (Yunlong County culture and tourism Bureau, 2013). Therefore, Fengyu ancient bridge is important toward Bai people.

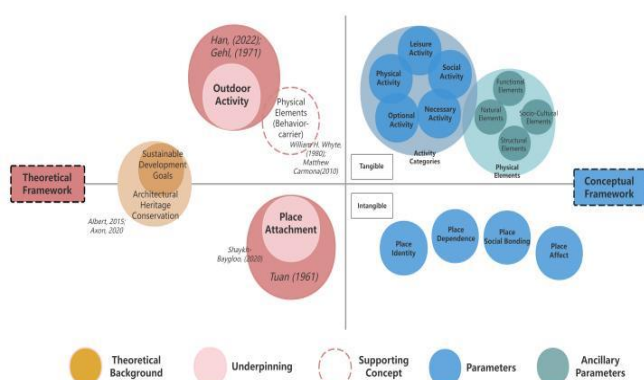


Fig. 7 Theoretical Framework & Conceptual Framework for Sustainable Development of Ancient Bridges

CONCLUSION

In summary, this study draws on theories of place attachment, outdoor activities, and public space to propose a research framework for sustainable human-place relationships centered on the 'Fengyu' bridge. This framework clarifies the underlying theories and identifies key variables. Thus, the place attachment is the independent variables including place identity, place dependence, place social bonding, and place affect. The residents' activities are dependent variables including daily activity, culture activity, leisure activity and socio-interaction activity (see Figure 8). However, as the participants are homogenous, this research is not interested in generalising gender, age, and socioeconomic status. According to UNCR Articles 12 and 31, everyday outdoor activity is viewed as equal regardless of gender, age and socioeconomic status. The practical application of this framework offers local governments a more direct and sustainable approach, providing valuable guidance for the long-term preservation and development of Fengyu bridges.

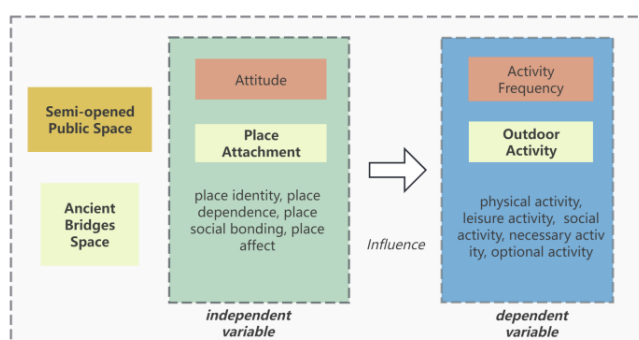


Fig. 8 Dependent and Independent variable in the Study

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