

Reconciling UNESCO Site Accessibility and Sustainable Tourism Development by Co-Creation with Multiple Stakeholders

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Abstract

Background This study addresses the challenge of reconciling accessibility requirements with sustainable tourism development in UNESCO World Heritage Sites through co-creation involving multiple stakeholders. Focusing on the Citadel of Besançon (*Citadelle de Besançon*), the study employs user experience (UX) design approaches for comprehensive problem-solving.

Methods A case study methodology incorporating a design process is employed to investigate the intersection of accessibility needs and sustainable tourism in a specific UNESCO site. The chosen case provides insights into the complexities and dynamics of the issue, allowing for a comprehensive understanding of the challenges and opportunities involved.

Results The case study led to draw a pathway forward to sustainable tourism co-creation, which proved to be useful in identifying and addressing tacit problems when collaborating with multiple stakeholders.

Conclusions We hope to provide a new interpretation of using UX design approaches to address complex problems such as enhancing accessibility in sustainable tourism development at UNESCO sites.

Keywords Co-creation, UX Design, Problem-solving, Sustainable Tourism, Multiple Stakeholders, UNESCO

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1. Introduction

The tourism sector is often characterized by the presence of conflicting interests among its diverse range of stakeholders. For instance, in cities such as Barcelona, local residents have demonstrated against the considerable influx of tourists (AFP, 2024), whereas in Kyoto, the authorities have imposed restrictions on tourist access to specific areas of the geisha district with the aim of preserving the local culture (McCurry, 2024). These examples illustrate the persistent difficulties of reconciling tourism with the requirements of local communities. The challenge is further compounded in the context of UNESCO World Heritage sites, where the dual imperatives of preservation and accessibility frequently conflict, necessitating the formulation of strategies that can effectively address both objectives.

The guidelines and sustainable tourism programs established by UNESCO are designed to provide a framework for navigating the challenges associated with the aforementioned issues. The World Heritage Convention, in particular, advocates for a collaborative approach to the management of cultural and natural heritage, recognizing the complex interplay between human activity and environmental preservation (Meskell, 2013). This approach is exemplified by historical cases such as the Aswan Dam project, where the need for energy generation has been in conflict with the objective of heritage conservation (UNESCO World Heritage, 2024). Furthermore, more recent debates have centered on the installation of offshore wind turbines in proximity to heritage sites. These examples demonstrate the necessity for a balanced approach that considers both economic development and the preservation of cultural and natural heritage.

While UNESCO's frameworks provide valuable guidance, the effective implementation of these principles in the context of tourism development necessitates the development of innovative approaches. One such approach is the integration of diverse perspectives through co-creation and user-centred design (UCD). The importance of UCD as a crucial process that involves stakeholders from the earliest stages of service design is highlighted (Font et al., 2021). This ensures that their experiences, needs, and values are thoroughly considered. This is particularly pertinent in the context of sustainable tourism, where the intricate challenges of harmonizing environmental, social and economic objectives necessitate a design process that is not only collaborative but also agile, iterative and reflexive (Smit et al., 2024). Moreover, the discrepancy between strategic planning and practical implementation remains a significant challenge, as evidenced by the "design-implementation gap" discussed by Baldassarre et al. (2020).

Notwithstanding the increasing interest in sustainable tourism and co-creation, a discernible research gap persists in the development of frameworks that effectively integrate these concepts in practice (Briedenhann & Wickens, 2004). This gap is particularly evident in the context of UNESCO sites, where the necessity for sustainable tourism strategies is most acute. The multifaceted nature of these sites necessitates not only theoretical discourse but also practical, actionable frameworks that can be deployed to enhance visitor experiences while ensuring the preservation of the sites' intrinsic value. The literature indicates that user experience (UX) design as UCD methods have the potential to facilitate cross-disciplinary collaboration and stakeholder engagement, which could prove an effective approach to addressing these challenges (Font et al., 2021).

Given these considerations, the research question which guided this study was: How to handle the complexity of sustainable tourism development of a UNESCO site to improve visitors' access experience? The aim was to address this question by exploring how UX design approaches, such as the user's journey and self-diary methods, can break through complexity revealing hidden challenges in sustainable tourism development and enhance accessibility at UNESCO sites. In attempting to address this research gap, we hope to provide a new interpretation of using UX design approaches to address complex problems such as enhancing accessibility in sustainable tourism development at UNESCO sites.

This paper is organized into the following sections: 1) Introduction, 2) Literature review, 3) Research method, 4) Design process, 5) Results and discussion, 6) Limitations and future study, and 7) Conclusion.

2. Literature review

2. 1. Holistic Approaches to Accessibility in UNESCO World Heritage Sites

Piechotka et al. (2020) and Ren et al. (2021) emphasize the need for a universal, holistic design philosophy and the integration of multiple interpretation technologies to enhance the accessibility of UNESCO World Heritage Sites. These studies collectively highlight the importance of holistic approaches considering the needs of diverse stakeholders, including people with disabilities, and the use of innovative technologies in the design of accessible UNESCO sites. According to Piechotka et al. (2020), important issues include accessible transport, pre-visit and in situ information, comfortable and safe pavements, safe pedestrian crossings, adequate public toilets, and accessible buildings (hotels, museums, and terminals). The aspect of gaining accessibility in a natural environment encourages reflection on reconciliation through biophilic design, stressing its positive effects on human well-being and eco-friendly practices (Jeon & Kim, 2012; Wolfs, 2015). To explore potential solutions to the issue of accessibility, Kim & Lee (2013) advocate for co-creation with users to foster empathy and emotional bonds, while Sin & Yun (2017) discuss the relationship between communication strategies and behavior change for sustainability, based on triggering the correspondent emotional level. Cho et al. (2014) proposed innovative business models in exploring sustainability within social-human interactions. Ranti & Lee (2023) emphasize the significance of fostering collaboration among a diverse range of stakeholders. This collaboration should include designers, users, businesses, policymakers, and local communities, all actively engaged in the co-creation process. It aligns with the human-centered design, design thinking renowned for its problem-solving capabilities (Brown, 2019). Papanek (2005) and Krippendorff & Butter (1984) emphasize design's role in serving human needs and creating meaningful order.

Prioritizing a human-centered approach over a technology-centered one introduces the importance of considering the entire ecosystem and engaging in collaborative iterations with stakeholders (Don, 2019, 2023). Hassenzahl & Tractinsky (2006) emphasize the need for UX methods beyond mere questionnaire-based assessments to comprehend the complete user experience.

The physical accessibility of tourist sites has been the subject of numerous scientific

investigations. Studies by Amos-Abanyie et al. (2012), Eves & Webb (2006), Meyer et al. (2018), Nocon et al. (2010) provide insights into designing better access to public places, with a focus on increasing stair climbing and improving ramp design. Other studies concentrate on hygienical and security problems, information and communication, social relationships, and sharing, with sustainability often overlooked (Chen et al., 2016; Fosgerau et al., 2023; Gunasekaran, 2016; Morgan et al., 2018; Sembajwe et al., 2020; Wang et al., 2022). Nevertheless, the studies exploring physical accessibility do not adequately reflect the necessity for a comprehensive approach to addressing complex sustainability issues. It is evident that the necessity for collaborative creation in the context of sustainable tourism has been elucidated through these studies.

2. 2. Sustainable Tourism & Co-creation

In cooperation with UNESCO, the United Nations World Tourism Organization (UNWTO) defines sustainable tourism within the framework of sustainable development as tourism that encompasses its economic, social, and environmental impacts while addressing the needs of visitors, industry stakeholders, host communities, and the environment (UN Tourism, 2024). Serrano et al. (2019) highlight the complex nature of contemporary understanding of sustainable tourism.

Co-design and co-creation in sustainable tourism suggest holistic and collaborative approaches to address sustainability challenges (Liburd et al., 2022). He et al. (2022) highlight individual motivations in driving pro-environmental behavior, alongside co-design initiatives. Warnholtz et al. (2022) advocate for realist theory-driven methods in tourism interventions, emphasizing contextual considerations. Bui et al. (2020) stress the complexity of adaptive resilience in managing tourism towards sustainable development, particularly in World Heritage Sites. Balakrishnan et al. (2023) proposed the integration of smart tourism technology into heritage tourism practices, emphasizing the importance of personalization and informativeness in the creation of an engaging experience.

Cannas et al. (2019) draw attention to value co-creation in sustainable tourism, promoting dialogue, trust, and reciprocity among stakeholders. Constraints and inclusive growth in tourism are discussed by Bakker & Twining-Ward (2018), while Bellato & Cheer (2021) explore urban tourism's potential for inclusivity and regeneration. Nyanjom et al. (2018) advocate for comprehensive strategies in accessible tourism, and Bose et al. (2017) provide insights into decision-making theory in the tourism sector.

Co-creation involves multiple stakeholders. Multiple stakeholders' partnerships are emphasized by Momen (2020) in public policy, aligning with Sustainable Development Goals. Despite various methodologies, no specific framework systematically handles complex problems and stakeholders.

2. 3. Enhancing User Experience and Sustainability in Design

Moalosi et al. (2004) assert that sociocultural factors increase innovation by generating novel design concepts. The importance of user participation in the design process for better user experience is highlighted by Jones (2013) emphasizing active co-construction of content, context, and meaning in digital ecosystems. Issa & Isaias, (2022) supports this, stating that user participation in the system development process improves performance, acceptance, and satisfaction with user interfaces and devices. Involving users in decision-making and

actions during the design process enhances the user experience and leads to successful and easy-to-use systems.

Co-creation with multiple stakeholders poses a challenge in contemporary design practices, as design has evolved from individual activities to collaboration (Peng & Martens, 2017). UX design methods, such as storytelling, serve as communication tools to evoke interaction and spark creativity (Lee-Remond et al., 2023). Idea sketching, as one of the UX media, facilitates creative interaction by externalizing abstract ideas (Peng & Martens, 2017). Effective communication among stakeholders is crucial for advancing sustainable community design in urban spaces (Shin et al., 2012).

Understanding the user's journey is essential for crafting narratives that evoke interaction and creativity. Woodcock & Tovey (2020) highlight the complexity of intermodal travel and emphasize the importance of a seamless whole journey experience. They suggest that targeted investment to rectify problems and encourage modal shift onto public and active forms of transport requires a valid and reliable means of assessing traveler dissatisfaction during their journeys. Self-diary data collection techniques, as employed by Park et al. (2021) in the field of tourism, provide a tool for individuals to document their thoughts, experiences, and observations, facilitating self-reflection, self-awareness, and personal growth.

The exploration of holistic approaches to accessibility in UNESCO World Heritage Sites encompasses a multitude of dimensions, particularly in the context of multiple stakeholders' issues with diverse objectives, interests, and constraints. Co-creation with stakeholders has been identified as a method to privilege.

In order to support enhancing user experience in sustainable tourism, it is essential to recognize the multifaceted nature of sustainable tourism and to lay the foundation for examining its implementation in real-world scenarios.

Consequently, this article attempts to leverage UX design and single case study methodology to help disentangle complex problems in sustainable tourism, involving diverse stakeholders' objectives and societal concerns in line with United Nations Sustainable Development Goals (UNSDG).

3. Research method

3.1. Case study

This research employed a single case study methodology, coupled with qualitative analysis, to explore the experiences of key users and stakeholders about sustainable tourism and co-creation. The research question which led the study was "How to handle the complexity of sustainable tourism development of a UNESCO site to improve visitors' access experience?". The research team directed their attention towards a specific cultural and natural site within Vauban – the Citadel of Besançon.

The utilization of a case-study approach is well-suited for delving into real-world occurrences, fostering a profound comprehension, and contextual analysis (Gaus, 2017). Opting for a single case study offers the benefit of facilitating a thorough exploration of various types of secondary data records and engaging participants in interviews to glean insights into their experiences, thereby fostering a nuanced grasp of the subject matter (Ridder, 2017).

Utilizing a case study approach, researchers strive to grasp the intricacies and complexities inherent in their exploration (Petty et al., 2012). Case studies offer distinct features such as clearly defined boundaries, opportunities for thorough investigations in real-life contexts, inclusion of contextual factors, and utilization of diverse data sources (De Massis & Kotlar, 2014; Gaus, 2017; Leppäaho et al., 2016). According to Yin (2018), the choice of a case study hinges significantly on the nature of the research question, aligning with inquiries into the 'how' and 'why' of contemporary events, without the need to control participants' behavior.

A primary rationale for opting for a single case study design is when researchers can attain exceptional access to the phenomenon under investigation, facilitating deeper comprehension (De Massis & Kotlar, 2014). The advantage of a single case study lies in its capacity to garner a nuanced understanding through meticulous examination of organizational records and interviews with participants, thereby illuminating their experiences (Ridder, 2017).

A range of studies have explored the intersection of sustainable tourism and UNESCO sites, often using a case study approach. Bui et al. (2020), for instance, deployed an ethnographic single case study and highlighted various issues and complexities in the sustainable development of a World Heritage Site and the significance of considering tangible and intangible aspects of local practices. Warnholtz et al. (2022) deployed innovative qualitative methods grounded in a case study to design and assess tourism interventions in a sustainable way. Mijnheer & Gamble (2023) used a single case study and co-creation to explore possible improvements of cultural tourism experience and found that co-creation as a collaborative practice with stakeholders can lead to innovating the visitors' experience in a genuine and captivating journey. The integration of co-creation within a single case study methodology for sustainable tourism solutions is supported by Mitchell et al. (2016), Rinaldi et al. (2022).

3. 2. Single Case Study generalizability

Single case studies are a valid and generalizable methodology due to their ability to provide in-depth, contextually rich insights into specific phenomena (Simons, 2015; Yin, 2013). They are particularly useful when studying complex and unique cases where the depth of understanding is prioritized over breadth (Gustafsson, 2017).

According to Yin (2013), the validity of single case studies can be enhanced through the use of rival explanations, triangulation, and logic models. These methodologies allow for a robust analysis that can withstand scrutiny and offer substantial evidence for the findings (Yin, 2013). Generalization from single case studies is often achieved through analytic generalization, where findings are extended to broader theories rather than populations, enabling the application of insights to other contexts or cases with similar conditions (Simons, 2015; Yin, 2013). Such studies are best utilized in scenarios where a deep understanding of a particular instance can inform broader principles or practices, such as policy evaluation, program development, and educational interventions (Simons, 2015).

According to Simons (2015), to ensure generalizability, single case study evaluations should concentrate on context and particularity, with the researchers' tacit knowledge serving as the backbone for detecting differences and similarities, leading to new understanding. Simons (2015) specified that context could be examined at several levels, such as (a) cultural, (b) political, (c) persons, (d) subject, (e) policy, and (f) broader societal contexts. However, the choice of case contexts should be relevant to the subject being explored, and the findings are best reported based on the meaning derived from the interactions within these contexts (Simons, 2015).

As shown in Table 1, we adopted an initial single case study evaluation grid, based on Simons' (2015) recommendations for single case generalizability. Table 1 summarizes the major findings from the literature review under the suggested contextual categories.

Table 1 Single case evaluation grid based on the literature review

Cultural	Communication strategies & behavior change for sustainability, based on triggering emotional levels; Need to understand the multifaceted interpretations of participation in cross-cultural design contexts; Socio-cultural factors.
Policy	Complexity of adaptive resilience in UNESCO sites management.
Persons (Stakeholders)	Accessibility issues: transport, pre-visit & in-situ information, safe pedestrian crossings, adequate public toilets, accessible building; UX methods to understand complete user experience; Effective communication among stakeholders advances design; Dialogue, trust, and reciprocity in value co-creation in sustainable tourism among stakeholders; Importance of seamless whole journey experience; Facilitate self-reflection, self-awareness, & personal growth.
Approach	Multiple interpretation technologies & innovative design technologies; Co-creation with users for empathy and emotional bonds; Collaborations with co-creation; Design for better access, hygiene, security, information & communication, social relationship, sharing (often sustainability overlooked); Co-design, co-creation & collaborative approaches; User involvement in system development: impact on success, acceptance, and satisfaction of interfaces; Design communication efficacy influences decision making and UX design outcomes; Co-construction of content, context & meaning in digital ecosystems; User participation in system development improves performance, acceptance & satisfaction with user interfaces & devices.
Societal	Design's role in serving human needs in creating meaningful order; Consider diverse stakeholders' needs; Complexity of sustainable tourism; individual motivations in driving pro-environmental behavior & co-design.
Economic	Innovative business models in exploring sustainability with social-human interactions.
Environmental	Accessibility in a natural environment: Human-centered approach to consider the entire ecosystem; Biophilic design.

3. 3. The case

The Citadel of Besançon (*Citadelle de Besançon*) is a complex UNESCO site as it combines natural reserves, history and culture. Initially conceived by Vauban, the Louis XIV's military architect, as a key point of State defense providing for an exceptional exposure, today, the Citadel offers a zoological park and several museums, together with a beautiful scenery and hiking possibilities. The present study focused on improving the accessibility to the Citadel through the potential visitors' journey starting from the Besançon's historic town and city center to the entrance of the Citadel marked by the Saint-Etienne pediment, aiming to enhance its tourism and heritage value. The study was assigned to a dedicated multidisciplinary research team, by one of the local institutions in charge of the Citadel's management. A key constraint of the assignment resided in the need to respect the physical characteristics of the site, protected by various laws and regulations.

A significant portion of the case's complexity stemmed from the divergent goals, interests, and requirements of the stakeholders involved. The municipality of Besançon serves as the local governing body responsible for managing the site. The Vauban Club of Besançon, a local non-profit organization, is mandated to promote the historical and cultural heritage, sanctioned by the municipality, and includes members from the town's population only. Another critical stakeholder is the Regional Department of Cultural Affairs, tasked with ensuring the implementation of state policies regarding UNESCO and other local heritage sites. The visitors to the Citadel are primary stakeholders. Additionally, the residents living adjacent to the Citadel are also affected by its operations and activities.

The municipality of Besançon requested a preliminary condition report regarding accessibility to the site, through a questionnaire designed by the stakeholder’s team. The questionnaire was deployed between April and August 2023. Four-hundred-seventy-eight valid answers were received, mainly from inhabitants of all ages of Besançon and its close area. Although the questionnaire was not originally included as a primary research instrument by the research team to address the research question, the analysis of the questionnaire data contributed to our understanding of the context. Some major highlights showed that the primary motive for visiting the Citadel, as reported by 85% of respondents, was tourism, with a notable emphasis on family outings, preferred by 70% of visitors. Additionally, other motivations for visits included attending concerts, viewing art exhibitions, participating in professional events, walking, and more. The primary transportation methods were ‘by car’ and ‘on foot’. Reported difficulties included issues with vehicles’ use, availability of parking spaces, cost accumulation, and challenges for pedestrians, particularly those with young children, to access certain areas.

4. Design process

Figure 1 illustrates the principal stages in the process of our study.

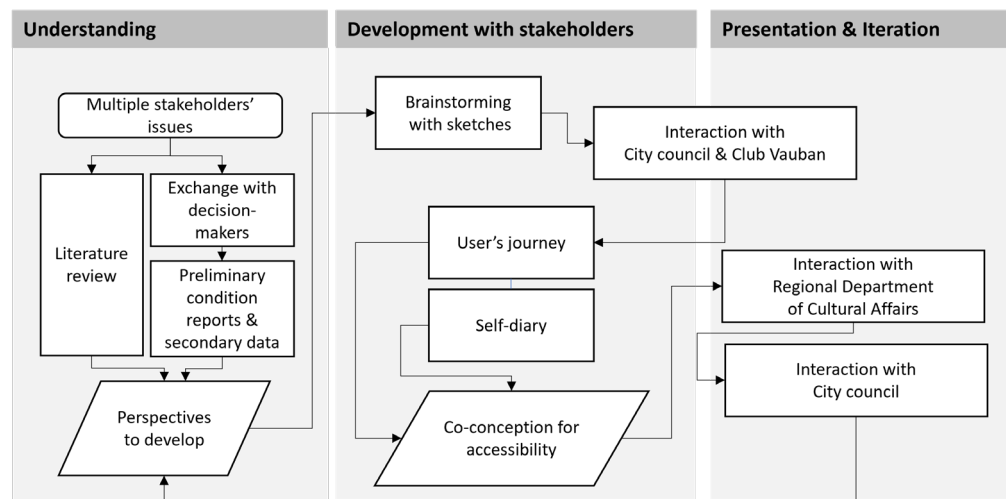


Figure 1 Research process

The initial phase of the research process involved an in-depth examination of the complexity of multiple stakeholders’ issues, followed by development with stakeholders, and culminates in an interactive refinement cycle.

4. 1. Understanding

A multiple stakeholders’ map has been created to identify the challenges facing the Citadel of Besançon, as shown in Figure 2. The map illustrates the complex relationships among the various stakeholders connected to the Citadel of Besançon. The primary concerns identified included the conservation and transfer of heritage, sustainability, and accessibility.

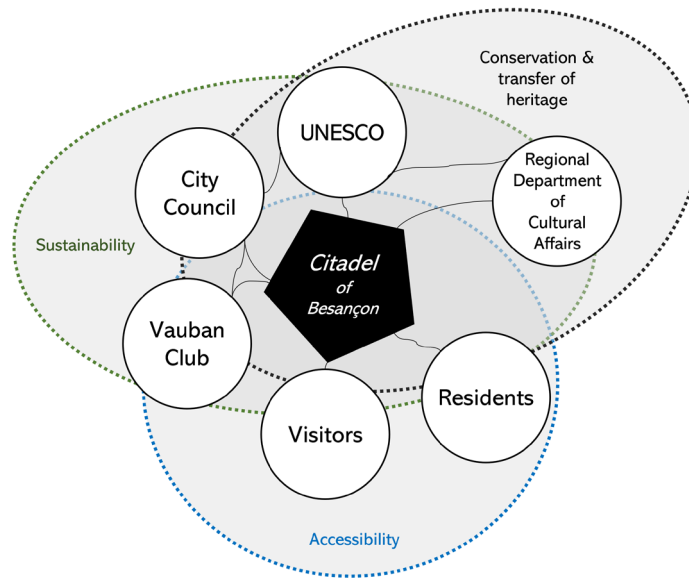


Figure 2 Multiple stakeholders map of the Citadel of Besançon

Informal interviews were conducted with representatives of stakeholders such as a municipal councillor in charge of the Citadel and Tourism, a head of the Citadel’s Vauban Monument Development Department, and a representative of the Regional Department of Cultural Affairs, revealing contradictory viewpoints and highlighting each stakeholder’s inclination towards a preferred solution. Some stakeholders expressed a desire for innovation, as evidenced by statements such as:

“It might be advisable to avoid adopting solutions that are typical of large cities or Southern environments. A “copy paste” strategy might not be the most effective approach.”

Another stakeholder expressed the following: “Potential solutions are often hindered by policies. Residents suffer, yet it is understandable that those with a stake in the matter are reluctant to impose restrictions on visitors.”

The cited statement underscores a critical challenge in the realm of sustainable tourism and heritage conservation. It highlights the complex balance between addressing the needs of residents and preserving the cultural and historical integrity of the site, while also accommodating the interests of visitors. This tension between policy constraints and the desire to enhance accessibility while minimizing negative impacts on the community illuminates the complexities inherent in multiple stakeholders’ dynamics within heritage tourism contexts.

As a result of this stage, an evaluation of the dominant objectives, interests, and constraints (OIC) of each stakeholder has been performed and is reported in Table 2. For the purposes of the present study, we define an objective as the specific target that guides actions towards a desired outcome, providing clarity for progress. Interest is defined here as the subjective valuation assigned to activities or opportunities, driving attention, exploration, and commitment based on commonly agreed significance. A constraint is defined as any factor, internal or external, that restricts decision-making or action execution, necessitating adaptation within given boundaries. The OIC evaluation illustrates the interconnection and occasional conflicts of interests among stakeholders. However, a significant common agreement resides in the willingness of all stakeholders to maintain UNESCO’s recognition.

Table 2 Objective – Interest – Constraint of multiple stakeholders (OIC evaluation)

	Objective	Interest	Constraint
UNESCO	Conveying and identifying exceptional universal value	Ensuring the compliance with the UNESCO convention concerning the protection of the world cultural and natural heritage	Compliance & budgetary monitoring
Citadel of Besançon	Promoting the Citadel	Increase revenues from tourism	Budgetary constraints Regulations
City Council	Attracting more visitors	Good political feedback	Decision-making procedure for improving accessibility
Vauban Club of Besançon	Creating UNESCO & Vauban's heritage ambassadors	Promoting UNESCO & Vauban's heritage	Restricted to the inhabitants of the town of Besançon, No decision-making power
Regional Department of Cultural Affairs	Preservation of the site	Exercising state power and implementing state policy	Coordination between the city and the state Enforcing the application of laws in the cultural field
Residents	Convenient daily life	Well-being	Regulations Violation of privacy & neighborhood disturbance generated by visitors
Visitors	Visiting the Citadel	Participating & enjoying the culture	Physical / budgetary / temporal constraints

4. 2. Development with stakeholders

Under the slogan “create enjoyable access to the Citadel for everyone” which is one of the management plan axes of UNESCO 2019-2024, a workshop was held (12 June 2023) by the city council between multiple stakeholders (10 members of Vauban Club of Besançon, a municipal councillor in charge of the Citadel and Tourism, a head of the Citadel's Vauban Monument Development Department, a development officer at the City of Besançon's Participatory Democracy Department and one resident and 2 visitors).

This workshop gave an occasion to share the interests of each stakeholder and co-create: a) Communicating the local authority's accessibility initiative for the Citadel; b) Conveying the approach taken by researchers; c) Offering a collaborative workshop to members of the Vauban club so that they can express their views on the current state of awareness in terms of accessibility (means of transport and information); d) Communicating to club members with the opportunity to test roads to the Citadel from different locations and using different means of transport to complete the diagnosis, using a user's journey template during the summer.

The workshop was organized around three dimensions: 1) make access to the site easy, from all points of access, for all types of users, with the right means of transport and by offering solutions adapted to daytime and night-time use, as well as to low and high season; 2) improve visitor information on roads, means of transport and fares; 3) simplify accessibility in terms of purchasing.

Following the workshop, the user journey for club members was initiated.

User's journey

A total of six members of the Vauban Club of Besançon completed their journey to the Citadel using a variety of access modes. The participants recorded their observations in a series of individual travel diaries, which they subsequently transmitted via email to the Citadel's

Vauban Monument Development Department. The journey remarks were then subjected to analysis by researchers, who classified them as either positive or negative points and assigned codes. Table 3 illustrates the resulting coding of the journey.

Table 3 Coding of user's journey report

User	Mode	Positive	Code	Negative	Code	Suggestion
User 1	Car then foot	Used to it, no particular problem	Usual	Information may be challenging for those not familiar with the subject.	Information	
		Indication of parking	Information	No information from train station	Information	
		Clear entrance information	Information	Road traffic	Security	
User 2	Car then electrical bike	Pleasant landscape view (pedestrian or cycle)	View	Danger for cyclists	Security	Entrance price including parking
				Unclear information	Information	Clear information according to the access modalities.
				Tight road (Bike vs. Car)	Security	
User 3	Car then foot	Pleasant landscape view	View	Steep, sloping staircases	Climb	Pedestrian safety (for pushchairs)
User 4	Foot	Sport	Health	Lack of light when dark	Security	
				Security (Pedestrian vs. Bus) Lack of security Narrow road	Security	Adapted bus size Separation of roads according to the access modalities.
				Paid parking	Parking	Best link (info & rates)
				Steep, sloping staircases	Climb	
				Difficulty to ride with children	Climb	
User 5	Bike with GPS			Ambiguity of information (Google map)	Information	Clear information appropriate to the access method
				Lack of information Bike information error (GPS)	Information	
				Difficult ascent by bike (without assistance)	Climb	Parking for bikes
User 6	Bike	Pleasant landscape view	View	Indication for cars not adapted for bicycles	Information	Adapted communication according to the access modalities.
				Difficult ascent by bike	Climb	

The user's journey helped identify several areas for improvement that could enhance the user experience. Although users who were already familiar with the system reported overall satisfaction, the provision of clear parking and entrance information, along with the inclusion of sports and health amenities and scenic views, could further enhance their experience. However, the journey revealed several challenges, including information gaps, particularly for new visitors, and security concerns due to limited communication and road traffic issues. To address these issues, it is recommended that better communication channels,

stronger security measures, and modifications to road infrastructure and pedestrian safety be implemented. Furthermore, enhancements to parking fees, family-friendliness, and the provision of transportation options are essential for the creation of a more inclusive and secure environment.

Self-diary

The self-diary was used with two different groups of internal residents of Besançon and external non-residents. Participants in both groups traveled from the central train station to the Citadel, engaging in note-taking and photographic documentation (Figure 3).

The participants utilized a combination of local bus transportation and walking to reach the Citadel.



Figure 3 Self-diary examples

Upon departing from the station, three bus stops were identified; however, the absence of explicit signage indicating the specific lines that serve each stop may have resulted in confusion for non-residents. The information provided was found to be overwhelming for some, with issues such as poor lighting, complex language, and readability problems making navigation difficult. Furthermore, the challenging ascent to the Citadel of Besançon, coupled with uneven surfaces on the staircase, presented a potential safety concern, as evidenced by a participant's slip incident. This situation highlights the necessity for the implementation of affordance and inclusive design principles to guarantee universal access.

The identified visitors' pain points were clustered and assessed with regard to potential improvement axes using the KJ method. The KJ method, named also affinity diagramming (Scupin, 2008), helps make sense of qualitative data by organizing and interpreting it effectively. This technique was suitable for this study due to the predominantly qualitative nature of the data collected (Nylund, 2020).

The treatable needs were clustered into design elements such as visibility, mapping, consistency, entertainment, unicity, comfort and feedback, then categorized into three axes, such as (a) information and communication, (b) experience, and (c) continuous improvement process, as shown in Table 4.

Table 4 Improvement axes and treatable needs

Improvement axis	Element	Treatable need
Information & Communication	Visibility	Clear information
	Mapping	Coherence between divers media
	Consistency	Consistency of information
Experience	Entertainment	Playful experience
	Unicity	Clearly identifiable on-foot access mode
	Comfort	Ergonomical aid
Continuous improvement process	Feedback	Collect visitors' insights

Then, the participants engaged in collaborative sketching during a brainstorming session. The sketches are presented in Figure 4.



Figure 4 Thumbnail sketches of collaborative brainstorming session

In enhancing the visitor's experience, the idea of creating a playful interface for accessing and distinguishing between various access modes has emerged. Consideration is given to the possibility of designing an ergonomic aid to further improve usability.

We have explored ideas like incorporation of playfulness, integration of entertainment elements, assistance with climbing, transforming the ascent into a captivating experience, making the climb itself a noteworthy visit.

The process of idea generation was focused on two key areas of improvement: enhancing information and communication and enriching the visitor's experience while considering the sustainable aspect and the respect of UNESCO heritage requirements.

Effective communication strategies employed visible concepts to raise visitor awareness. Subsequently, attention shifted to enhancing the physical experience, with a focus on practical solutions such as rail ramps and resting shelters, as well as interactive elements like wheel cages and tubes to engage visitors with children (Figure 5). It was acknowledged that families represent a substantial proportion of the visitor demographic. Consequently, the objective was to implement an inclusive design that would cater to the needs of children. This

highlights the necessity of adopting a comprehensive approach that takes into account the diverse experiences and interactions of all visitors (Bryce, 2024; Holmes & Maeda, 2018).



Figure 5 Generated ideas following the improvement criteria

The focus shifted from merely addressing surface-level issues to envisioning and enacting transformative changes that enhance inclusivity, sustainability, and overall visitor experience.

The objective of these proposals is to minimize the impact on the Besançon Citadel site while allowing for a degree of reversibility. This would enable the slope area to be returned to its pre-development state.

4. 3. Presentation with stakeholders

The generated ideas were presented and discussed with a variety of stakeholders, including the Vauban Club of Besançon, municipal councilors, representatives of the Citadel’s Vauban Monument Development Department, residents, visitors, and representatives of the Regional Department of Cultural Affairs.

It was agreed that, in addition to physical enhancements, effective information communication is also of great importance. Furthermore, it was acknowledged that there were a range of perspectives among stakeholders on this issue.

The emphasis on interactivity is evident; however, challenges such as vandalism and maintenance must be addressed. Notwithstanding these concerns, the concept of establishing a playful and engaging space is worthy of further consideration. Stakeholders emphasized the significance of incorporating temporal considerations into the design (e.g. proposing the use of lighting techniques in the trees rather than on the ground).

The ongoing design process proved to be helpful in addressing sustainable challenges within UNESCO-protected areas and ensuring improved accessibility. The involvement of stakeholders has proved useful, particularly in terms of offering insights into how functional improvements in accessibility can be achieved through a multi-disciplinary approach.

5. Results and discussion

Table 5 summarizes our single case study results as per the categories of the initial evaluation grid.

Table 5 Single Case results

Cultural	Distinction between resident visitors & non-residents: non-residents being unfamiliar with the place and access helped identify information inconsistencies and insufficiencies, as well as inadequacy of the guidance to prepare the visits;
Policy	Security & safety measures were indicated;
Persons (Stakeholders)	OIC (Objective Interest Constraint) of multiple stakeholders: conflicting divergencies;
Approach	UX Design methods – transformative embodiment to overcome divergences and reveal tacit problems, potentially conflictual in decision-making;
Societal	Indication of parking facilities needed: Presence of sports & health conveniences: Identified issues: information gaps, infrastructure, family-friendliness, information, unoptimized ascension paths, clear language, hard to navigate;
Economic	Fees and costs to be reviewed, eventually with options and packaged offers;
Environmental	Pleasant landscape views, all identified as possible improvements of the access journey;

Drawing on the work of Simons (2015) we have made the epistemological choice of relying on a constructivist and interpretive perspective, which postulates that reality is in fact a construct of the human mind.

In the particular case of Citadel of Besançon and UNESCO sites, the objective elements result from two points translated by UNESCO regulations. In accordance with the categories of context presented in Table 1, the preservation and protection of the site are of primary importance. However, the question of sustainability also arises. This is influenced by two factors: regulations in the strict sense of the term and a social consensus that human activity must be considered in terms of its temporal placement and the consequences for its surrounding environments, including natural, cultural, and human ones.

Although our article does not deal directly with ethnography or sociology, we are working on human relations and social interactions between stakeholders. The aim was to understand the complexity of sustainable tourism development of a UNESCO site to improve visitors' access experience.

In order to enable individuals and stakeholders to achieve accessibility and sustainability objectives, we were able to develop a pathway because, as Simons (2015) puts it regarding "holistic understanding", "much of the meaning is in the situationality or particular case".

It could be argued that by focusing on a specific case, we are oversimplifying a complex issue. However, this is not the intention. On the contrary, interpretation in context is much richer, as Simons (2015) has shown, provided we don't adopt a linear, narrative point of view. This pitfall has been avoided by setting up a pathway that makes relationships and links explicit and reveals what is tacit.

This case study resulted in the development of a sustainable tourism co-creation-driven pathway, presented in Figure 6, helpful to unveil tacit problems while collaborating with multiple stakeholders, partially driven by diverging interests.

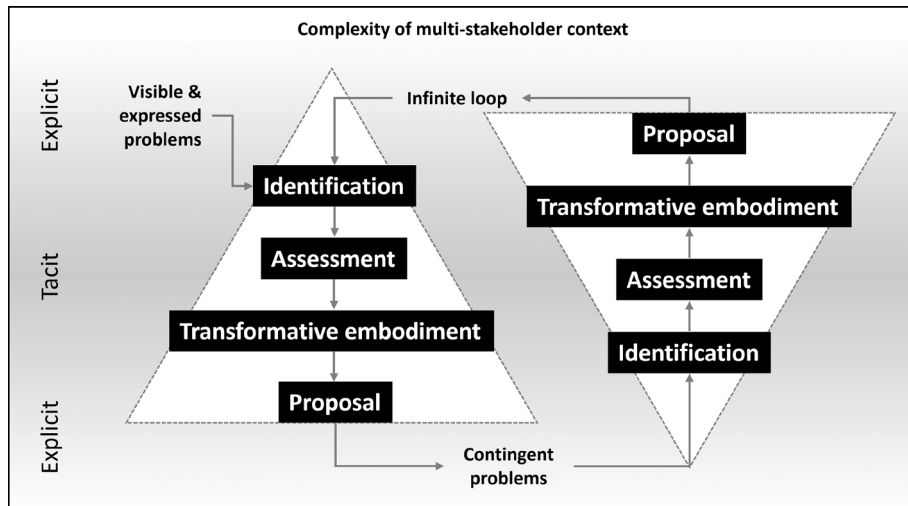


Figure 6 Sustainable tourism co-creation-driven pathway

The process represents an iterative loop, starting from identification of multiple stakeholders and their objectives, interests and constraints and continuing with the assessment of the environment and experience.

The stage of *transformative embodiment* comprises the mapping of the tacit problems to ideas and represents the paramount phase in the process. The concept of “transformative embodiment” emphasizes the role of physical and sensory experiences in creating knowledge and understanding. This approach integrates the body and mind, suggesting that ideas are generated through embodied practices that involve sensory engagement and physical actions, leading to transformative insights and innovations. The creative transformation of ideas into a physically embodied form, such as sketching or prototyping, sharpens and advances initially fuzzy ideas, molding them into refined versions accessible to other team members, even without verbal interactions (Davies et al., 2023).

In the context of problem-solving involving abstract concepts, the utilization of transformative embodiment can be a valuable approach. This involves the use of external visual representations, which can facilitate the process of visual reasoning, as described by Kokotovich & Purcell (2001). Kokotovich and Purcell (2001) consider this transformative embodiment to be a fundamental activity in the resolution of design problems. In the same line, Leung et al. (2012) argue that the embodiment of creative metaphors will facilitate creative problem-solving. Transformative embodiment is particularly significant in fields like sustainability where complex challenges require innovative solutions.

In summary, transformative embodiment represents a holistic approach to idea generation, integrating physical, emotional, and cognitive experiences to foster deep, meaningful change and innovation. This approach is particularly valuable in fields that require creative problem-solving and the generation of new, impactful ideas (Leavy, 2020).

The proposal stage reflects the final dialogue and communication of the solutions formulating the tacit problems which had unveiled at the identification stage as explicit ones, which leads to applying again a new version of the process based on new contingent problems. We hope that this pathway ensures a structured and iterative approach to addressing complex design challenges involving multiple stakeholders.

Our study of the Citadel of Besançon aligns with the literature's emphasis on holistic and inclusive design in UNESCO World Heritage Sites. The development of a sustainable tourism co-creation-driven pathway involved integrating diverse stakeholder interests, which is consistent with the calls for collaborative approaches in the literature (Piechotka et al., 2020; Ren et al., 2021; Ranti & Lee, 2023). The use of transformative embodiment in our process resonates with the importance of creative interaction in addressing complex sustainability challenges (Kokotovich & Purcell, 2001; Leung et al., 2012; Peng & Martens, 2017).

Our findings also support the need for co-creation in sustainable tourism, as emphasized by Liburd et al. (2022) and Cannas et al. (2019). By engaging stakeholders in a co-creation process, we targetted the multifaceted challenges of sustainability at the site, addressing both accessibility and the visitor experience. This approach aligns with the broader goals of sustainable development set by UNESCO and UNWTO, reinforcing the importance of comprehensive strategies that consider not just physical access but also social, cultural, and environmental factors (UN Tourism, 2024; Chen et al., 2016; Nyanjom et al., 2018).

6. Limitation & Future study

The study has been engaged as a single case study within a qualitative explorative approach and bears the limits of the possibility of subjective biases in the interpretations of the inputs by the researchers. Another inherent challenge represents the engagement in a long-term iteration, which may impact the comprehensiveness of the findings over time. Moreover, the complexity of legal regulations poses a limitation to this research, as navigating and interpreting intricate legal frameworks may introduce uncertainties in the analysis and conclusions.

Future studies can enhance the application of the pathway in different contexts bearing new collaborative aspects and co-creation challenges of multiple stakeholders. The possibility of engaging in a more quantitative approach could be equally considered in combination with other design research methods.

7. Conclusion

The study of accessibility to the Citadel of Besançon is a complex undertaking, as it necessitates the reconciliation of numerous parameters. The aim of this study was to gain insights into the ways of handling the complexity of sustainable tourism development of a UNESCO site in order to improve visitors' access experience. To address this challenge, UX design approaches were employed.

The co-creation process revealed the existence of tacit problems associated with the involvement of multiple stakeholders, including political decision-makers, UNESCO ambassadors, visitors, residents, and site managers.

The research process resulted in the development of a pathway that can be described and defined as a tool developed from a UX design approach. At this stage of the research, the

pathway represents a promising first step towards reconciling access to a UNESCO site and sustainable tourism. This is due to its capacity to facilitate dialogue between stakeholders and enable the co-construction of consensual proposals.

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