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Smart City and the Adaptive Reuse of Historic Buildings:
Preserving Cultural Identity and Mitigating Gentrification in Urban Regeneration

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Abstract

   The integration of smart technologies into the adaptive reuse of historic buildings has redefined the relationship between urban memory, cultural identity, and regeneration processes. In a time when cities are rapidly digitizing, tools such as Building Information Modeling (BIM), the Internet of Things (IoT), and digital heritage platforms offer new possibilities for documenting, managing, and reimagining historic environments. However, the application of these technologies is never neutral. While they present technical efficiencies and enhanced connectivity, they also risk simplifying complex histories, privileging market-driven narratives, and accelerating processes of exclusion under the guise of innovation. This thesis critically investigates how smart technologies reshape the adaptive reuse of historic sites, asking how they can be leveraged to support cultural preservation and resist the forces of gentrification that often accompany urban transformation.

Adopting a qualitative research design, the study combines a critical literature review with comparative analysis of four international case studies: Battersea Power Station in London, Xintiandi in Shanghai, Msheireb Downtown in Doha, and Porto Maravilha in Rio de Janeiro.

These cases illustrate how digital tools are not merely instruments of conservation, but active agents in producing selective urban memories and reshaping spatial belonging. Although smart systems enable detailed heritage visualization and real-time monitoring, their deployment frequently aligns with speculative redevelopment, rebranding historic spaces as commodities within global markets. The findings underscore that the success of adaptive reuse projects involving smart technologies hinges less on technical capability and more on governance models, cultural politics, and the inclusivity of urban decision-making processes.

By repositioning smart technologies as socio-political instruments rather than neutral facilitators, this thesis contributes to a critical rethinking of heritage practices in the digital age. It argues that the future of historic urban environments will depend not simply on how well they are digitally managed, but on how deliberately cities choose to confront the contested nature of memory, representation, and spatial justice. Only through ethical, participatory frameworks that foreground diverse narratives can smart adaptive reuse move beyond spectacle to serve as a true platform for inclusive urban regeneration.

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INTRODUCTION

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In contemporary urban regeneration, the challenge of balancing innovation with cultural preservation has become increasingly urgent. As cities evolve under the pressures of globalization, digitization, and economic restructuring, historic environments are frequently reimagined through the lens of "smart city" technologies. These developments promise new efficiencies, expanded connectivity, and enhanced livability, yet they also raise important questions about the protection of cultural identity and equitable urban development. Nowhere is this tension more visible than in the adaptive reuse of historic buildings, a practice situated at the intersection of technological innovation, heritage preservation, and urban transformation.

Smart city technologies encompass interconnected digital systems such as Building Information Modeling (BIM), the Internet of Things (IoT), digital heritage tools, and data-driven urban management tools, increasingly deployed to optimize infrastructure, facilitate decision-making, and reshape urban experiences. In parallel, the adaptive reuse of historic structures has gained renewed importance as a strategy to maintain cultural identity, foster community belonging, and preserve collective memory within rapidly transforming cityscapes.

Exploring a central and complex research question: How can smart city technologies facilitate the adaptive reuse of historic buildings in urban regeneration while preserving cultural identity and mitigating gentrification? In addressing this question, the research examines both the opportunities and challenges associated with the integration of smart technologies into heritage contexts. Rather than treating technology as a neutral technical solution, the study approaches smart tools as socio-political instruments whose impacts are shaped by the broader governance structures, cultural dynamics, and power relations within which they are deployed.

The adaptive reuse of historic structures presents significant potential for reactivating cultural memory and strengthening community identities in urban regeneration. At the same time, the application of smart technologies introduces new dynamics that warrant critical investigation. Emerging patterns suggest that digital innovations can enable more inclusive engagement with heritage, but also risk contributing to processes that reframe, simplify, or repackage cultural narratives. The extent to which smart tools support or undermine cultural identity and social equity remains context-dependent and shaped by competing urban agendas.

Against this backdrop, investigating how smart city technologies are influencing practices of adaptive reuse, and how they interact with broader questions of memory, representation, and belonging. It highlights the conditions under which digital interventions can foster inclusive urban regeneration and those under which they may inadvertently intensify gentrification and cultural displacement.

Coming from a background in architecture and urban theory, I approach this research with an awareness of both the design potential and the socio-political weight of smart technologies in urban regeneration. Rather than viewing these tools as inherently positive or neutral, I examine how they are applied, for whom, and with what consequences. This thesis reflects a position that prioritizes cultural integrity and social equity over purely technical performance. I align with a critical approach that questions dominant narratives of smart urbanism, particularly where these narratives intersect with heritage, identity, and urban inequality.

The study is structured to develop a progressively critical understanding of these dynamics. Chapter 2 establishes the theoretical framework through a literature review that interrogates definitions of smart cities, adaptive reuse, gentrification, and cultural identity.

Chapter 3 critically analyzes how specific technologies, BIM, IoT, and digital heritage tools, mediate urban memory and power relations in heritage contexts. Chapter 4 examines comparative case studies across different global cities, highlighting both enabling practices and emerging challenges. Finally, Chapter 5 synthesizes the findings, reflects on broader implications, acknowledges limitations, and offers critical insights into the ethical and political stakes of smart adaptive reuse.In framing this research, the thesis adopts a critical, interdisciplinary approach that foregrounds the socio-political dimensions of technology-mediated heritage practices.

It argues that the future of historic urban environments will not be determined solely by technological advancements but by the societal choices and ethical frameworks that shape their deployment. In doing so, it aims to contribute to a deeper and more politically conscious understanding of what it means to "reuse" the past in the age of the smart city.

FRAMING SMART TECHNOLOGIES AND
ADAPTIVE REUSE FOR INCLUSIVE
URBAN REGENERATION

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2.1 Rethinking the Smart City: From Utopia to Urban Complexity

The concept of the smart city has emerged as a dominant narrative in contemporary urban discourse, celebrated as a transformative model capable of addressing the complexities of urban management through digital innovation and advanced technologies. Early definitions emphasized the integration of Information and Communication Technologies (ICTs) into the urban fabric to improve the efficiency of services, governance, and infrastructure (Albino et al., 2015; Appio et al., 2019). In this framework, the smart city is often portrayed as a seamless, optimized, and data-driven system where urban life is rendered more convenient, transparent, and participatory. These mainstream perspectives largely reflect the technological enthusiasm of governments and industries eager to position cities as innovation hubs and engines of growth.

Townsend (2013) famously described the smart city as an "urban operating system," a new kind of city wherein computational systems act as invisible agents regulating traffic, consumption, behavior, and movement. The rhetoric of progress, modernization, and efficiency has allowed private actors, especially large tech corporations, to become key stakeholders in city-making processes.
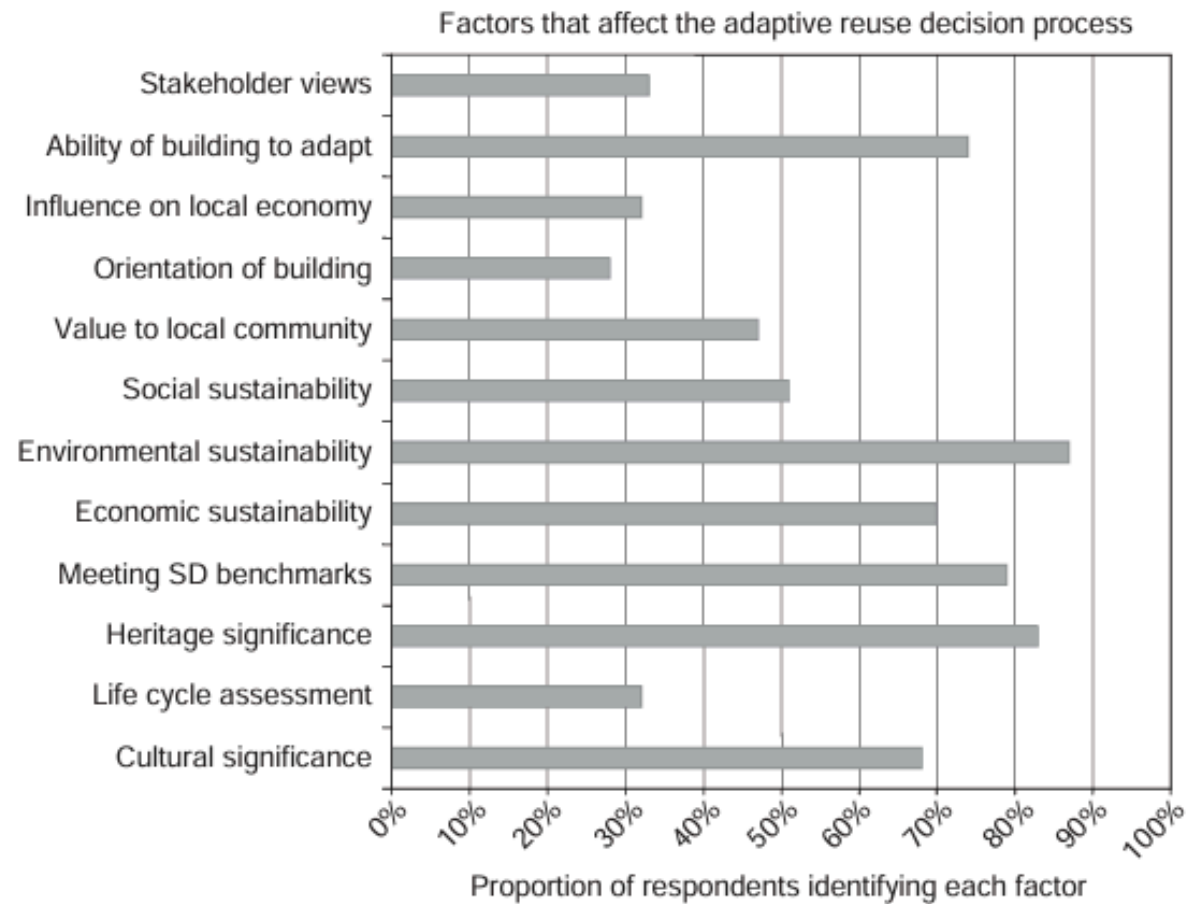
Figure 1: Factors affecting adaptive reuse decision making

This techno-centric vision equates "smartness" with infrastructure automation, data flow, and predictive modeling, reinforcing a market-oriented logic that sees the city as an investment platform rather than a lived space.

However, critical urban literature offers a powerful counter-narrative. Scholars such as Kitchin (2014, 2019), Greenfield (2013), and Vanolo (2014) challenge the celebratory accounts of smart urbanism by exposing their embedded assumptions, risks, and ideological underpinnings. According to Kitchin (2019), the smart city is not a neutral or benign evolution; rather, it embodies a "technocratic rationality" that reconfigures governance through algorithmic control, surveillance, and depoliticized forms of decision-making. Technologies become instruments of behavioral nudging, predictive policing, and real-time monitoring, extending state and corporate power in subtle yet profound ways (Kitchin et al., 2019).

Vanolo (2014) goes further by coining the term "smartmentality," highlighting how smart city discourse produces new moral orders through the classification of "good" and "bad" urban practices. In this model, cities are disciplined into compliance with metrics and indicators defined by international rankings and funding criteria.

The consequence is a transformation of urban governance from democratic deliberation to technical optimization, where legitimacy stems not from collective consensus but from computational efficiency. In this sense, smart cities can function as instruments of soft control, fostering docility rather than citizenship.

Greenfield (2013) similarly warns that smart urbanism often envisions the city as a "control interface," privileging the perspective of systems designers over those of local communities. These environments, he argues, are designed to be read and managed by machines, not inhabited by humans. As such, the risk of exclusion grows, especially for communities unable or unwilling to engage with digital infrastructures.

While smart city discourse often emphasizes participation and empowerment, the actual deployment of technologies frequently reinforces spatial inequality and institutional opacity. Data-driven governance models, for example, tend to marginalize non-quantifiable knowledge and dismiss forms of urban experience that cannot be measured or optimized. Moreover, the reliance on real-time data analytics can lead to the emergence of what Kitchin (2014) terms the "panoptic city," where all urban activities are made visible and thus governable.

Despite these critiques, the objective here is not to
to reframe it as a contested terrain, one where pos
technologies coexist with the threats of surveillanc
enclosure. This chapter seeks to hold open that ter
smart cities function but also for whom they funct
Smart city technologies will be approached not as
socio-technical assemblages whose impacts depend
dynamics of their implementation. The following s
technologies intersect with adaptive reuse, cultura
a more grounded and nuanced understanding of s

Exclusion, Displacement,
Docility vs. Empowerment

Social Outcoms

Efficiency, Surveillance,
Branding

Governance Logic

Smart Technologies
(IOT, AI, Platforms

Smart Technologies
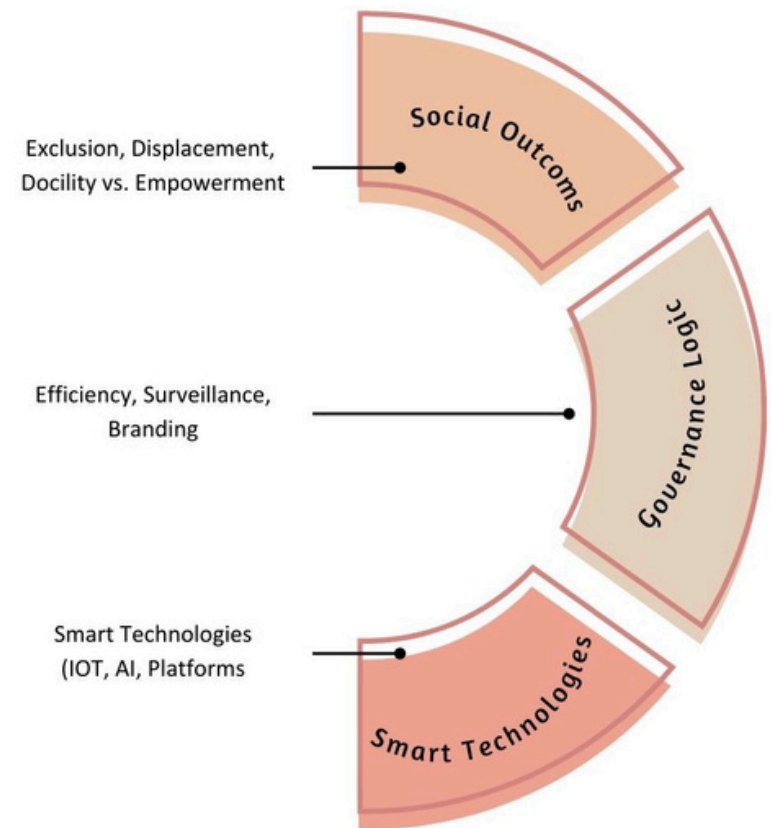
Figure 2: Smart City as a Layered System of Power:
From Technologies to Social Outcomes

2.2 Adaptive Reuse and Smart Technologies in the Built Environment

Adaptive reuse is increasingly viewed as a significant strategy in contemporary urban development, especially in cities with a rich historical fabric. The idea behind adaptive reuse is to repurpose existing buildings for new functions without erasing their original form, spatial logic, or cultural meaning. It allows historic structures to be reintroduced into daily urban life with a new identity, whether functional, symbolic, or social, while acknowledging the value of the past. In doing so, it opens a space where memory, continuity, and transformation can coexist in the built environment.

What distinguishes adaptive reuse from basic renovation is its relationship with urban change. Rather than approaching old buildings as static relics, adaptive reuse treats them as evolving urban actors. As Bullen and Love (2011) note, this practice is shaped not just by architectural goals but also by social values, power dynamics, and cultural narratives. Decisions about what is preserved, what is modified, and how these spaces are used reflect deeper negotiations about identity and belonging in the city. In heritage-rich contexts, reuse is never neutral, it reinforces certain histories while potentially sidelining others.

The involvement of smart technologies in adaptive reuse has added a new layer of complexity and opportunity.
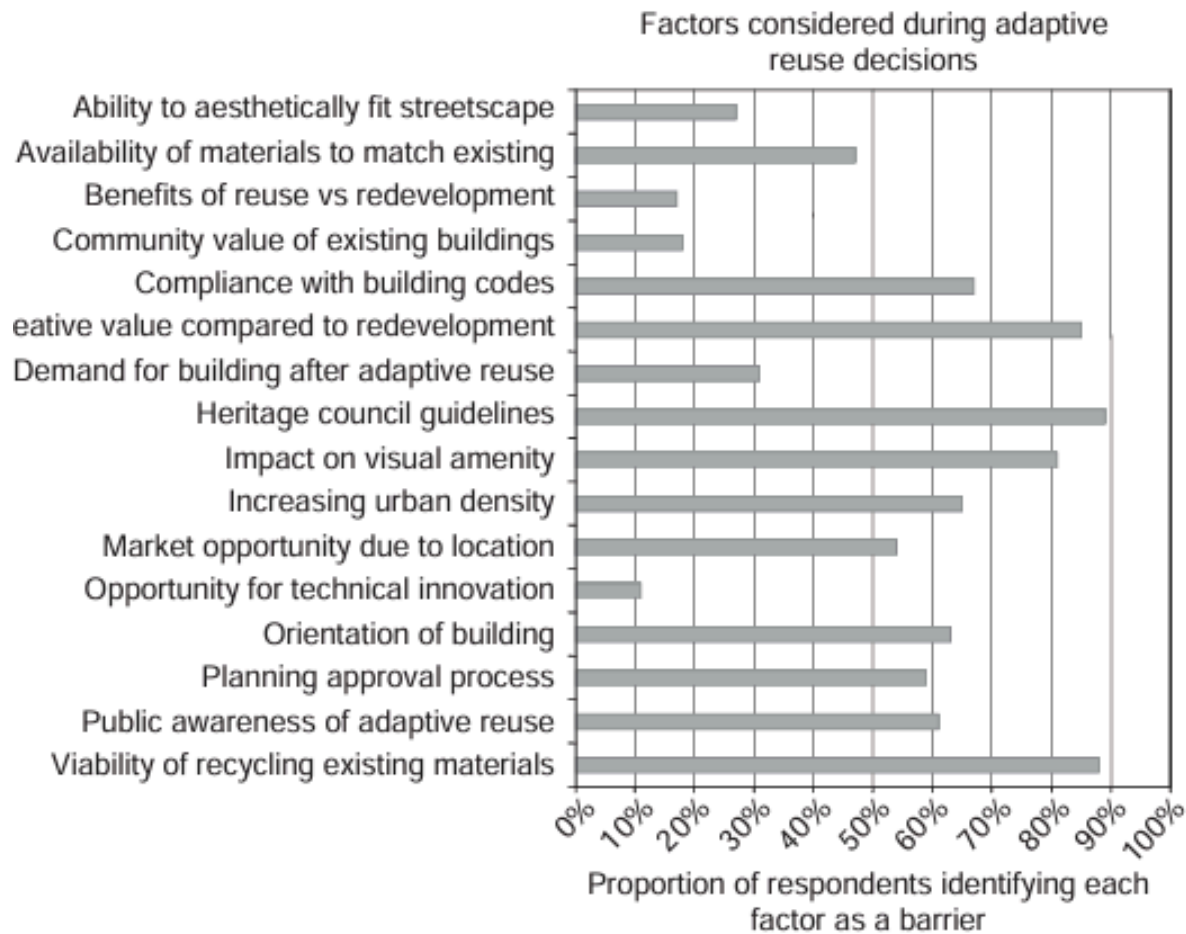
Figure 3: Barriers to implementing adaptive reuse

Digital tools such as Building Information Modeling (BIM), Internet of Things (IoT) systems, Digital heritage tools, augmented or virtual reality (AR/VR) are increasingly embedded in how reuse projects are imagined, documented, and implemented. These technologies can enhance precision, efficiency, and planning flexibility, but their impact goes far beyond technical capabilities.

For example, BIM allows architects and conservation experts to create multi-layered digital models of historic buildings that include both geometric and material data. This can help simulate structural behavior, plan interventions without compromising sensitive features, and coordinate between stakeholders (Angelidou et al., 2017). Similarly, IoT devices can be used to monitor environmental conditions in real time, such as humidity or vibration that may affect the building's physical integrity (Foster, 2020). These systems offer a powerful form of surveillance and control over heritage assets, extending maintenance practices into the digital realm.

Yet, the adoption of these tools also raises important questions. Who controls the data? What kinds of knowledge are prioritized, and which are left out? Technologies like 3D scanning or AR storytelling often capture and reproduce specific narratives about place and history.

Huertas et al. (2021) point out that even when these tools increase accessibility, they can also produce simplified, sanitized, or market-friendly versions of heritage sites, especially when designed with tourism or branding in mind rather than community use.

Lee et al. (2023) highlight that the role of smart technologies in adaptive reuse is not only shaped by technical innovation but also by political and institutional conditions. In some cases, digital tools enable more participatory and transparent planning processes, while in others they are used to reinforce exclusive development strategies. The social outcomes of smart reuse are therefore highly dependent on how technologies are embedded in local governance structures and who has access to decision-making processes.

A deeper concern lies in the tendency for digital systems to replace, rather than complement collective memory and lived experience. As more reuse projects rely on simulations, sensor data, and digital models, the process risks becoming detached from the social realities that give heritage meaning in the first place. This shift can contribute to a more technocratic understanding of historic buildings, where architectural value is measured through software rather than public significance.

In many cities, adaptive reuse has also become a vehicle for market-oriented regeneration.

Buildings that are digitally enhanced, sensor-equipped, or virtualized often gain appeal in real estate and tourism markets. When smart technologies are used to frame reuse as a symbol of innovation or cultural sophistication, they can accelerate processes of gentrification, especially when the surrounding community is excluded from planning or priced out after the intervention. In this sense, the smart city logic, when uncritically applied can turn reused into a tool of selective transformation, where the aesthetic and economic value of heritage is prioritized over its social embeddedness.

This concern reflects broader questions raised in urban theory. Jane Jacobs emphasized that the value of buildings lies not only in their structure but in their capacity to support diverse, socially active communities. Her view of the city as a living, ethical ecosystem reinforces the idea that adaptive reuse should enhance complexity and inclusion, not merely aesthetics or symbolic capital (Laurence, 2019).

Ash Amin (2006) similarly argues that cities must be guided by values of solidarity, rights, and relatedness. From this perspective, the success of smart reuse depends not just on technological innovation but on its ability to support the everyday lives and identities of those who inhabit or interact with historic spaces.

Technologies, therefore, must be critically assessed for how they contribute to or undermine the social function of heritage in contemporary urban life.

Adaptive reuse will be analyzed not only as an architectural or technological operation but as a social and political process. The aim is to investigate how smart technologies participate in shaping what is preserved, how it is interpreted, and who benefits from these transformations. Rather than evaluating digital tools by their technical performance, this study asks whether they help reinforce or challenge existing inequalities in urban regeneration especially regarding cultural identity and displacement. By treating technologies as actors within broader urban systems, the following chapters will explore how smart reuse strategies can either support inclusive futures or contribute to new forms of exclusion under the banner of innovation.

2.3 Cultural Identity and the Risks of Smart Urbanism

Cultural identity plays a fundamental role in shaping how people relate to their cities. It is not just about monuments or architecture but about how people live, remember, and belong to a place. In urban regeneration processes that involve historic areas, preserving this identity becomes even more important. However, when smart city agendas and digital strategies are introduced into these processes, they can complicate the picture. Instead of protecting local identity, technology-driven regeneration can sometimes reframe or even erase it, often unintentionally.

Digital platforms and branding tools are increasingly used to promote cities as attractive, modern, and connected. These narratives often highlight selected cultural features while ignoring others, especially those that do not align with tourist expectations or economic goals. Balakrishnan et al. (2023) show how cities use cultural identity as a marketing tool, turning neighborhoods and historic buildings into "content" for branding. In these cases, identity is no longer treated as something lived and shared by communities instead, it becomes something to sell.

This can create tensions in areas where adaptive reuse projects are happening. In many cases, cultural buildings are celebrated for their aesthetic or symbolic value, but the surrounding community, the people who give real meaning to those spaces, is overlooked.

Lee et al. (2023) warn that when identity is represented mainly through digital images or curated experiences, it becomes disconnected from daily life. What remains is often a simplified version of the past, one that looks good online but lacks depth and authenticity. This tension is echoed in Sharon Zukin's (2009) critique of "authenticity," which she argues has become a powerful tool for marketing and social control. Rather than protecting cultural life, the language of authenticity is often used to justify urban change that favors new users while marginalizing existing communities. In the context of smart cities, digital representations of place risk reinforcing these patterns by turning local culture into a consumable aesthetic curated for outsiders, detached from everyday social practices. Amin (2008) similarly reminds us that cities thrive when they foster shared practices, mutual recognition, and cultural coexistence. When identity is shaped only through digital narratives or economic branding, it loses its connection to the collective, lived experience that gives it meaning.

Another concern is how digital strategies often speak to outsider's tourists, investors, or policymakers rather than residents. Cultural storytelling is often designed for those passing through, not those who stay. Cocola-Gant (2015; 2018) explains how this shift in perspective can lead to the displacement of local cultures. As cities are reshaped to match

digital representations, communities may feel pushed aside or erased, even when their architecture remains intact.

It is also important to consider who has control over cultural narratives. In many smart city initiatives, decisions are made by institutions, private companies, or planners, not by the people most connected to the spaces being reused. As a result, certain voices are amplified while others are left out. Even when technologies offer new ways to experience heritage, they don't automatically guarantee inclusion. Huertas et al. (2021) highlight that digital tools can exclude people who don't have access to the internet or who are not familiar with technology, especially older residents, migrants, or working-class communities.

In this point, Cultural identity is not seen as a fixed label but as something shaped through relationships, memories, and participation. When smart urban strategies are applied to historic places, they need to be questioned: who defines the identity being promoted? Who benefits from these changes? And who might be left out of the picture? Explored how cultural identity can be reduced or altered when cities adopt digital tools without considering their social consequences. In the next chapter, the focus will shift to how these processes relate to gentrification and inequality, especially when cultural buildings and reused spaces are used to attract new users at the expense of long-standing communities.

2.4 Gentrification and Social Equity in Heritage Regeneration

In many cities, urban regeneration projects involving historic buildings are introduced as a way to improve quality of life, attract attention to overlooked areas, or bring value back into aging neighborhoods. On the surface, these goals seem positive. However, once these projects are implemented, especially when they are supported by smart city narratives or digital transformation strategies they can have unintended consequences. One of the most common is gentrification.

Gentrification does not always begin with aggressive displacement or demolition. In some cases, it starts slowly, through changes in aesthetics, rising rental prices, or the arrival of new types of businesses that cater to different social groups. When a cultural building is reused and framed as a symbol of innovation or smart urban growth, it can become a marker of change that indirectly pushes out the very people who once shaped its meaning. Cultural buildings are often linked to the identity of a community, yet once they are reused, especially in highly visible or branded ways, they can be separated from that community. Cocola-Gant (2015; 2018) describes how this happens through cultural regeneration: the past is re-packaged, not for those who live nearby, but for visitors, investors, and temporary users. The building remains, but the people may not.

Gentrification here becomes not just about real estate, it becomes a shift in who feels welcome, who is remembered, and who is forgotten.

Sharon Zukin (2009) offers a critical perspective on this shift by showing how cultural authenticity is often used as a tool of symbolic exclusion. In her view, historic and working-class neighborhoods are often rebranded through language that emphasizes uniqueness and heritage, but in ways that appeal to newcomers, not locals. This aestheticization of place, she argues, disguises deeper processes of displacement, as cultural buildings and streetscapes are transformed into marketable environments while their original social life is devalued or erased.

This is especially important in historic areas where the built environment carries emotional and social weight. Once a neighborhood is seen as "upgraded" through reuse, digital visibility, or cultural events, it can trigger changes in how the area is perceived and valued. Balakrishnan et al. (2023) explain how this new visibility attracts global attention but not always in a way that benefits those already living there. In fact, the opposite often happens increased investment leads to higher rents, followed by the slow exit of long-standing residents.

The use of smart city logic in these contexts doesn't directly cause gentrification, but it can make it easier to justify. A reused building equipped with digital experiences or promoted online may be seen as a success regardless of what happens around it. Without community involvement or policies that protect affordability, regeneration can quietly become an exclusion.

Smart technologies, even when not the main feature, often support this process by reinforcing certain narratives about efficiency, innovation, or progress. While these ideas are not wrong in themselves, they can sometimes push aside the more difficult realities of social inequality. When technology is used to make a space more attractive without addressing deeper structural issues, it adds a layer of polish to a process that might be displacing people behind the scenes.

As Amin (2006) argues, a just city must be grounded in practices of solidarity, recognition, and care, not only visibility or innovation. If urban regeneration fails to protect the rights and presence of long-standing communities, it risks becoming a form of spatial exclusion wrapped in cultural language.

Looks at gentrification as more than just an economic shift. It treats it as a slow reconfiguration of urban life, where identity, access, and inclusion are reshaped by

decisions about reuse, branding, and technological enhancement. The critical question is not whether reuse is good or bad, but who it serves. Are communities involved in these transformations, or are they simply expected to adapt or leave? Smart reuse will be considered not only for what it achieves architecturally or digitally, but also for what it means socially. If regeneration leads to cultural loss or exclusion, then we must ask: what kind of city are we building, and for whom?

Table 1: Comparison Table – Mainstream vs. Critical Smart City Models:

Dimension	Mainstream Model	Critical Model
Goal	Efficiency, Growth	Equity, Justice
Tech Use	Centralized, Proprietary	Participatory, Open-Source
Heritage View	Branding/ Commodification	Memory, Resistance, Local Empowerment
Urban Impact	Risk of Gentrification/ Control	Focus on Inclusion and Empowerment

2.5 Challenging the Logic of Smart Urban Regeneration

Through this chapter, we explored how smart city technologies, when applied to the adaptive reuse of historic buildings, interact with broader urban processes that affect cultural identity and social equity. Rather than presenting these technologies as neutral tools or technical solutions, the literature reviewed has shown that they are embedded within political, economic, and symbolic systems that influence how cities are shaped and for whom.

Mainstream visions of smart cities tend to focus on innovation, efficiency, and digital integration. While these narratives highlight the potential of smart technologies to improve urban life, they often overlook how power, access, and representation are distributed in practice. As discussed in Section 2.1, critical scholars challenge the idea that technology automatically leads to better or more inclusive outcomes. Instead, they point out that smart urbanism can reinforce existing inequalities, shift governance away from democratic processes, and produce cities that look modern but exclude many of their original inhabitants.

In this context, the adaptive reuse of historic buildings is not simply about architectural preservation or functional transformation.

It is a socially and politically charged process, one that can help strengthen cultural continuity or, alternatively, contribute to displacement and selective urban change.

As shown in Section 2.2, smart technologies may assist in documenting, monitoring, or visualizing heritage, but their application depends heavily on the intentions and structures behind them. Whether they serve inclusive goals or commercial interests is shaped by how, where, and by whom they are used.

Section 2.3 emphasized the risks that arise when cultural identity becomes part of a branding strategy. Digital storytelling and smart heritage tools can make places more visible, but they can also simplify complex histories or push certain narratives forward while excluding others. When heritage is filtered through platforms designed for tourism or global promotion, the result can be a version of identity that feels distant from the lived experience of local communities.

Finally, Section 2.4 examined how smart reuse projects are often linked to gentrification and social displacement. In these cases, the transformation of buildings, especially when paired with technological innovation or cultural prestige, may raise symbolic and economic value in ways that make areas less accessible to long-standing residents. Gentrification, in this sense, is not just an economic shift, but a redefinition of place and belonging.

This framework draws on thinkers like Jane Jacobs, who saw cities as ethical and social ecosystems shaped from the ground up, through lived complexity, adaptability, and mutual care (Laurence, 2019). Similarly, Ash Amin (2006) emphasizes the importance of solidarity, rights, and relational space as foundations for just urban futures. Their ideas support the position taken in this thesis: that adaptive reuse and smart city technologies must be judged not only by efficiency or innovation, but by their ability to sustain inclusive, culturally rooted urban life. Together, these perspectives form the foundation for a critical framework that will guide the rest of this thesis. Rather than treating smart city technologies or adaptive reuse as inherently positive or negative, the analysis will focus on their interactions with local contexts, social structures, and cultural meanings. Technologies will be considered not only in terms of what they do, but what they represent and how they shape urban life.

This framework will be applied in the following chapters to examine real-world case studies. The goal is to identify how smart technologies are used in the reuse of historic buildings, and to evaluate whether they support inclusive regeneration or contribute to exclusion and erasure.

By combining insights from critical urban theory with attention to cultural practice and community impact, the thesis aims to build a more nuanced understanding of smart urbanism, one that accounts for both its promises and its limitations.

This framework reflects a critical position that values inclusive, community-oriented urban regeneration over top-down smart development narratives.

03

3.1 Technologies in Tension

The role of smart technologies in the adaptive reuse of historic buildings presents a compelling paradox at the heart of contemporary urban regeneration. On one hand, these tools offer promising new approaches for preserving cultural heritage, enhancing public engagement, and optimizing the performance of architectural interventions. On the other hand, they may also function as mechanisms of control, exclusion, and cultural commodification, shaping regeneration in ways that serve specific economic or political agendas. This double character, simultaneously enabling and endangering, forms the foundation of the critical inquiry in this chapter. While technologies such as Building Information Modeling (BIM), Internet of Things (IoT) systems, Augmented Reality (AR), and Artificial Intelligence (AI) are often celebrated for their technical efficiency and innovation, their socio-cultural impact in historic environments remains deeply contested. These tools do not simply digitize space, they actively reshape how historic spaces are understood, valued, accessed, and even remembered. This has significant implications for cultural identity, particularly in neighborhoods undergoing rapid transformation. This tension is not merely a reflection of technological limitations but a manifestation of governance structures and power relations that determine whose heritage is preserved,

how it is framed, and who benefits from its reuse. Control over data infrastructures, design processes, and narrative construction increasingly rests with institutions, developers, and technology providers, often sidelining local communities and reinforcing exclusionary urban dynamics (Cardullo & Kitchin, 2019; Meijer & Bolívar, 2016; Zuboff, 2019). Yet these technologies are not inherently detrimental. Their potential importance lies in their capacity to make heritage sites more legible, accessible, and resilient in the face of environmental and socio-economic pressures. The challenge is to improve how we use the shifting from exclusionary frameworks toward participatory, culturally sensitive applications that empower communities and democratize heritage governance (Giglitto et al., 2023). As argued by Lynch (2021), adaptive reuse is not a neutral act of preservation, but a spatial re-narration of heritage, one that is always shaped by present-day ideologies, power structures, and institutional frameworks. In adaptive reuse projects, this struggle becomes particularly acute, as decisions about which buildings are preserved, how they are repurposed, and whose narratives are highlighted are shaped not just by cultural concerns but by commercial and political interests (Soccali & Cinà, 2020; Zukin, 2010). However, smart technologies can also offer counter-narratives. Tools like AR and BIM, when

designed inclusively, provide opportunities to surface alternative histories and support resilient, culturally rich adaptive reuse. Their importance lies not simply in their technical capabilities but in how they can be reimagined as platforms for plural heritage representation, empowering local communities to reclaim their histories and spaces. This chapter builds on the foundation established in Chapter 2, where the conflicting narratives of smart urbanism were examined through both mainstream and critical perspectives. There, smart technologies were shown to occupy a complex position between innovation and inequality. Here, the focus turns from discourse to application. By exploring specific technologies within the context of adaptive reuse, critically engages with how these tools intervene in the material and symbolic layers of heritage architecture. The central question is not just what these technologies do, but what they mean and for whom. The term "smart" itself, as discussed by McFarlane and Söderström (2017), is heavily politicized. It carries with it a set of assumptions about progress, efficiency, and modernity, often disconnected from local knowledge and lived realities. When applied to cultural heritage, smartness can risk flattening the historical complexity of a place into a sanitized, visually enhanced, digitally manipulated image of the past, one that is easily consumed but

rarely questioned. This process is visible in many augmented reality applications that reconstruct historical buildings or narratives, sometimes without local consultation or cultural sensitivity (Giglitto et al., 2019; Marto et al., 2022). Equally, Krivý's (2018) critique of cybernetic urbanism provides a valuable lens through which to examine how smart technologies function as systems of feedback, control, and prediction.

For example, AR and VR tools that focus on delivering immersive experiences to tourists often exclude community-generated narratives or alternative interpretations of history (Waterton & Smith, 2010; Giglitto et al., 2023). Yet these same tools, if co-created with local communities, can facilitate inclusive heritage storytelling, offering spaces where marginalized voices are amplified. BIM and IoT systems, designed for efficiency and performance optimization, may limit participation by privileging technical expertise over local knowledge, reinforcing uneven geographies of power within urban heritage projects (Krivý, 2018; Colace et al., 2021). However, they also hold the potential to enhance collaborative decision-making, resilience, and resource efficiency if governed transparently and inclusively. These systems may appear apolitical, but they embed specific values about what should be preserved, how it should be visualized, and who should access it.

In contexts of adaptive reuse, this can result in buildings being reimagined for tourist or commercial appeal, rather than for the communities who once inhabited or used them. This shift raises ethical questions about authenticity, ownership, and the risk of symbolic displacement. This tension also plays out at the governance level. Scholars such as Meijer and Bolívar (2015) and Jiang et al. (2020) highlight that smart city technologies are not just technical tools; they are deeply entangled in the structures of urban governance. Whether a city uses BIM and IoT to empower local communities or to accelerate profit-driven redevelopment depends on who governs the data, who makes decisions, and what values are embedded in the systems. This framing positions adaptive reuse as a technical upgrade rather than a cultural and social process, reducing buildings to commodities and reinforcing urban branding strategies that prioritize market appeal over community needs (Lynch, 2021; Zukin, 2009; McFarlane & Söderström, 2017). Yet, we must also recognize that smart technologies, when deployed critically offer tools for addressing pressing challenges in urban regeneration. They can facilitate adaptive reuse that balances technical performance with cultural integrity, offering innovative ways to engage communities, preserve contested histories, and ensure long-term resilience in the face of environmental pressures.

In other words, the success of smart technologies in preserving cultural identity and mitigating gentrification is not guaranteed by their presence, it must be shaped by how, where, and for whom they are used. In adaptive reuse, this question becomes even more urgent. Historic buildings are not only spatial artifacts; they are memory sites, cultural anchors, and, in many cases, contested symbols of urban transformation.

When technologies are introduced into these spaces without considering their political and cultural implications, there is a risk that reuse becomes a form of rebranding, serving developers or external audiences more than the people and identities rooted in place.

As discussed in Chapter 2, this is one of the core criticisms of smart city development: that it prioritizes visibility over participation, and simulation over substance. Therefore, aims to interrogate smart technologies not in isolation, but as socio-technical systems embedded within broader dynamics of urban change. It asks whether these tools support inclusive regeneration or contribute to processes of gentrification and exclusion.

Each of the following sections explores a different dimension of this tension: from the role of digital representation in shaping memory and identity (Section 3.2), to the infrastructural and managerial functions of BIM and IoT (Section 3.3), to the governance

and branding strategies that frame smart urban redevelopment (Sections 3.4 and 3.5). The final section (3.6) brings these threads together to evaluate whether these technologies enable preservation or displacement and under what conditions. Ultimately, smart tools are not inherently inclusive or exclusionary. Their impact depends on how critically they are implemented, what social values they serve, and whether their use reinforces or challenges the uneven dynamics of urban change. This reflection is central to answering the broader academic question of this thesis, and to understanding the transformative role of digital technologies in contemporary urban heritage.

Moreover, the governance of these technologies is central to their socio-political impact. Decision-making processes often privilege technocratic expertise and institutional authority, sidelining local communities and reinforcing exclusion (Meijer & Bolívar, 2016; Cardullo & Kitchin, 2019). Yet the potential for improvement lies in designing governance frameworks that embed participation and equity into technology deployment. This would shift smart reuse from a driver of exclusion and commodification to a platform for community empowerment.

3.2 Cultural Memory or Digital Simulation? Technologies of Representation in Heritage

In recent years, smart city technologies have transformed not only the physical design and function of urban spaces, but also how cultural heritage is perceived, represented, and consumed. Among the most influential tools in this shift are those categorized under digital heritage tools such as Augmented Reality (AR), Virtual Reality (VR), 3D modeling, and increasingly, Artificial Intelligence (AI). These technologies are now frequently used in the adaptive reuse of historic buildings to visualize past forms, reconstruct lost elements, or create immersive experiences for public engagement. While these applications are often framed as progressive and inclusive, their integration into heritage practice raises deeper tensions around memory, authenticity, authorship, and cultural identity. This section critically examines how smart technologies reshape the cultural meaning of historic buildings through digital representation. Building on the framework of "technologies in tension" established in Section 3.1, it explores the politics of visibility in digital heritage: What gets shown, how it is presented, and most importantly, who controls these narratives. As digital simulations become more central to how cities preserve and present their pasts, a central question emerges: do these technologies preserve cultural memory or replace them with a curated, consumable digital simulation detached from local histories?

Digital heritage tools are often introduced under the promise of enhancing engagement, especially with younger or tech-savvy audiences. Through immersive storytelling and sensory interaction, they claim to "bring the past to life. Yet as Giglitto et al. (2019) argue, the use of digital media in heritage is never neutral. Every AR overlay, VR reconstruction, or AI-driven recognition system is a mediated interpretation, the result of design choices, curatorial decisions, and technological limitations. These decisions are not incidental but reflect deeper governance structures that prioritize certain stakeholders over others. The adoption of digital heritage technologies is often controlled by powerful institutions, commercial investors, or global tech providers, with little input from local communities. This dynamic risks transforming adaptive reuse from a participatory, culturally sensitive practice into a vehicle for urban branding and investment-driven redevelopment (Cardullo & Kitchin, 2019; Zuboff, 2019). Yet, from a critical perspective, these technologies are important because they can democratize heritage if designed to decentralize authority, amplify marginalized voices, and promote plural narratives. The challenge is to improve their use through inclusive governance and participatory design, ensuring they shift from tools of control to instruments of empowerment.

This process does not just communicate heritage; it restructures it, often privileging simplified or spectacular narratives over layered and contested ones.

This becomes particularly problematic in adaptive reuse projects, where digital technologies are used to reimagine buildings that carry complex historical, cultural, or even traumatic memories. Smyth et al. (2020) highlight how such technologies, unless grounded in inclusive and participatory practices, risk reinforcing dominant versions of history while erasing marginalized voices. Feminist and postcolonial critiques of digital heritage caution that "access" to heritage is not just about opening doors, it is about deciding who gets to frame the story inside. The shift from physical to digital also introduces an ontological tension between material authenticity and simulated presence.

While 3D reconstructions and VR models may provide visually accurate representations, they risk reducing heritage to what Krivý (2018) calls "cybernetic visuality", a controlled, feedback-driven image of space that prioritizes legibility and coherence over complexity and contradiction. In this sense, digital heritage can function less as a bridge to memory and more as a form of aesthetic smoothing, where the past becomes a stylized surface rather than a site of meaning and conflict.

SHAZARCH app, for instance, demonstrates the sophistication of AI-enabled heritage recognition and visualization. Yet this innovation also prompts critical reflection. The ability of an app to interpret and reconstruct architectural elements in real-time raises questions about whose understanding of the building is being encoded. As machine learning models are trained on dominant architectural data, there is a risk that local knowledge and alternative narratives are not only excluded but overwritten by algorithmic logic. This challenge becomes even more acute in heritage sites shaped by non-Western, vernacular, or hybrid traditions, which may not conform to the datasets on which AI tools rely. Similarly, Spallone's AR interventions in Pompeii provide an example of how mobile technologies can enhance spatial storytelling, offering users an enriched experience of a site's former appearance. Yet when such interventions are framed without critical context or community involvement, they may inadvertently contribute to a form of digital gentrification, where history is rendered in high-resolution but stripped of its human depth. By privileging visual coherence and spectacle, these technologies risk erasing the contested, layered memories embedded in heritage sites. This symbolic erasure often parallels material displacement, as digital simulations become justifications for transforming spaces to suit tourist or investor expectations.

However, these technologies also possess the potential to disrupt dominant narratives and foreground marginalized histories, if designed and governed with sensitivity. Improving their use involves embedding cultural complexity into digital representations and ensuring that local communities retain agency over how their histories are visualized and shared (Soccali & Cinà, 2020; Harvey, 2017).

Digital tools can also contribute to the commodification of heritage, especially in urban contexts driven by tourism or image-led regeneration. Marto et al. (2022) and Bekele et al. (2018) trace how immersive technologies increasingly prioritize sensory engagement, often designed to be consumed as entertainment. While such experiences can be compelling, they risk converting heritage into a marketable aesthetic rather than a cultural practice. This transformation aligns closely with what Soccali and Cinà (2020) describe as the "branding of heritage," where sites are curated to attract visitors or investors rather than to serve the needs of local communities. This logic of simulation also has material consequences. As Lynch (2021) notes, when the digital image of a building is privileged over its lived social function, the real structure may be altered, privatized, or even demolished, because the "idea" of heritage has been preserved in digital form. In this way, smart technologies can

paradoxically justify displacement even while claiming to honor memory. To be clear, not all digital heritage tools is reductive or exclusionary. The problem lies not in the tools themselves, but in their institutional framing and socio-political context.

As shown by Giglitto et al. (2023), digital heritage projects can in fact promote participatory memory-making, particularly when they are co-designed with local communities and reflect diverse cultural narratives. In such cases, technologies become tools of cultural affirmation rather than replacement. Examples include community-driven AR projects that allow multiple layers of interpretation or apps that include oral histories alongside architectural reconstructions. These approaches push back against the dominant model of polished simulation and instead promote a plural, open-ended vision of heritage, one that welcomes disagreement, adaptation, and reinvention. This underscores the need to shift from technology-centered adoption to governance frameworks that prioritize inclusivity, justice, and cultural sensitivity. Digital heritage tools are important because they can make intangible histories visible, foster intergenerational storytelling, and engage diverse publics. Improving their use means addressing not only technical design but also participatory processes and governance structures. By involving local communities,

ensuring transparency, and incorporating plural narratives, digital heritage tools can be reimagined as instruments of empowerment and resilience (Meijer & Bolívar, 2016; Giglitto et al., 2023). Digital technologies of representation sit at the heart of a paradox: they can extend access to cultural heritage while also reshaping or flattening its meaning. In the context of adaptive reuse, where the transformation of space already involves decisions about what to keep and what to change, this representational power becomes even more significant. Smart tools, when applied uncritically, may lead to a kind of simulated preservation, where the building remains but the memory is repackaged, abstracted, or commercialized. The stakes are not only symbolic but also social. As cities increasingly invest in digitally mediated heritage, the question is no longer whether these technologies will be used, but how, by whom, and toward what ends. This section has argued that cultural memory and digital simulation are not opposites but two poles of a continuum. The challenge lies in navigating that continuum responsibly ensuring that technologies serve as tools for remembering, not for replacing, and that they contribute to inclusive regeneration rather than symbolic or actual displacement. That digital heritage tools can facilitate adaptive reuse in a way that preserves cultural identity and resists gentrification, if

and only if they are governed by participatory, inclusive, and culturally sensitive frameworks. Their importance lies in their ability to democratize storytelling, make hidden histories visible, and support inclusive urban regeneration. Improving their use is essential not only for technical sophistication but for fostering justice, memory, and resilience in contested urban landscapes (Harvey, 2017; Cardullo & Kitchin, 2019).

The next section (3.3) moves from representation to infrastructure, exploring how smart technologies like BIM and IoT reshape not only how heritage is visualized, but how it is physically managed, controlled, and accessed. Yet the questions raised here, about identity, authority, and inclusion remain central. They remind us that digital tools are never neutral, and that even the most sophisticated simulation is still a choice about how we see the past and who gets to see it. Understanding these complexities is crucial to reimagining adaptive reuse as a practice of justice, not exclusion. This transition highlights the importance of examining how infrastructure and governance shape heritage spaces and urban power dynamics, setting the stage for deeper critical engagement in the next section.

3.3 Smart Structures or Exclusive Systems? Adaptive Reuse with BIM and IoT

As smart technologies increasingly mediate the adaptive reuse of historic buildings, tools such as Building Information Modeling (BIM) and the Internet of Things (IoT) have come to occupy a central role in heritage-led urban regeneration. Widely celebrated for their precision, efficiency, and ability to integrate complex data across multiple design and management processes, these systems have transformed how heritage sites are documented, retrofitted, and maintained. In theory, they support more adaptable and transparent development. In practice, however, their implementation often reflects deeper power structures embedded within the processes of urban renewal. Here, we critically investigate how BIM and IoT may serve not only as enablers of adaptive reuse, but also as mechanisms of infrastructural exclusion producing smart structures that operate within exclusive systems of governance, control, and representation. This highlights a fundamental tension in adaptive reuse: while BIM offers unparalleled technical precision and data integration, its true importance lies in its capacity to empower communities if designed for inclusivity. From a critical perspective, BIM is not just a tool for modeling buildings but a socio-political instrument that can either reinforce exclusion or enable participatory, culturally-sensitive design. Improving its use means challenging technocratic assumptions

and embedding participatory mechanisms that center local knowledge, thus transforming heritage from a dataset to a living, co-created space (Meijer & Bolívar, 2016; Cardullo & Kitchin, 2019). BIM enables architects, planners, and engineers to model buildings in three-dimensional space while embedding extensive metadata, on materials, structures, costs, and systems within a single digital environment. In heritage contexts, BIM is particularly valued for its capacity to capture and manage architectural complexity, simulate restoration interventions, and ensure continuity between historical and contemporary design languages. For example, Tapponi et al. demonstrate in the case of Durham Cathedral how BIM was used to support careful structural interventions that respected the site's cultural and spatial integrity. Similarly, Zainudin et al. (2021) document the use of BIM in the conservation of Traditional Malay Houses, showing how it can enable a nuanced understanding of vernacular forms and construction logics.

However, while such projects demonstrate BIM's technical capability, they also reveal its limitations. As Bratuškins et al. (2020) argue, smart city frameworks often privilege measurable data and quantifiable performance over intangible cultural values. In the context of adaptive reuse, this can result in heritage being represented through a lens of

architectural legibility, rather than cultural or emotional significance. The building becomes a dataset rather than a lived place. Decisions about what to model, which elements to prioritize, and how to visualize historic materials are not neutral, they reflect institutional priorities, funding pressures, and aesthetic preferences that may marginalize local or non-expert knowledge. Furthermore, the authority to construct, manipulate, and maintain these BIM models is typically held by professional consultants, engineers, or state agencies. For communities connected to heritage sites particularly marginalized or displaced groups, this creates a distance between cultural ownership and digital control. As the model becomes the primary representation of the building, those without technical literacy or institutional access are effectively excluded from participating in how their heritage is interpreted or reused. What appears as democratization of information may in fact produce new hierarchies of access, where visibility is granted through data infrastructure rather than shared cultural memory. These dynamics are compounded when BIM is integrated with IoT systems. IoT refers to the network of connected sensors and devices embedded in the physical environment to collect, transmit, and process real-time data.

In heritage reuse projects, IoT is often used to monitor structural performance, environmental conditions (e.g. humidity, temperature, vibrations), and user behavior. For instance, Colace et al. (2021) present a smart system in which IoT sensors guide preventive maintenance in historical buildings by alerting managers to physical risks before deterioration occurs. This proactive, data-driven care model is presented as both cost-effective and conservation-sensitive. Yet beneath the surface of efficiency lies a deeper transformation of the heritage site: it becomes a sensorial object, constantly tracked, adjusted, and optimized. This shift from stewardship to surveillance raises critical questions. Who installs and manages the sensors? What types of data are collected, and how are they used? And more fundamentally, does the presence of sensors change how people experience space itself? As Krivý (2018) warns, smart systems tend to reproduce a cybernetic logic of control: heritage is no longer interpreted through collective memory or sensory experience, but through algorithms and feedback loops.

This change is not merely conceptual, it is material. Buildings embedded with smart

This change is not merely conceptual, it is material. Buildings embedded with smart infrastructure can be programmed to respond to select types of users, restrict access based on behavioral profiles, or become optimized for particular uses (such as luxury residences, tech hubs, or curated experiences). Adaptive reuse under such systems becomes more than renovation; it becomes digital gentrification, where smartness justifies exclusion. Publicly meaningful heritage can be transformed into privately managed smart assets, with decisions driven less by historical memory and more by performance data. These processes align with broader critiques of smart urban governance. Meijer and Bolívar (2016) emphasize that smart city systems are often implemented without adequate attention to political context, leading to outcomes that reflect efficiency goals rather than social equity. From a critical stance, IoT systems are not merely technical add-ons for heritage conservation; their importance lies in their potential to redistribute control, foster local engagement, and enable inclusive decision-making, if designed with transparent governance, data literacy support, and community oversight. Without deliberate improvements in how these technologies are governed and deployed, they risk perpetuating exclusionary practices, transforming heritage from a living memory into a commodified, performance-optimized

asset (Krivý, 2018; Zuboff, 2019).

Jiang et al. (2020) reinforce this point, arguing that truly inclusive smart governance must be contextual, participatory, and adaptable, not merely responsive. In the context of heritage reuse, this means that digital systems like BIM and IoT should not be viewed as neutral infrastructures but as embedded governance mechanisms with the power to shape cultural outcomes.

There are, however, efforts to reorient smart systems toward inclusion. The AdRem platform developed by Palma et al. (2021) proposes an integrated diagnostic approach using AI to support adaptive reuse. While technically sophisticated, the platform emphasizes interpretative flexibility and user accessibility, suggesting that smart systems can be designed to respect the ambiguity and multiplicity of heritage. This example shows that the exclusionary tendencies of BIM and IoT are not inevitable, they are a matter of design, intention, and governance. Nevertheless, these inclusive examples remain rare within the dominant paradigm of smart reuse. In most cases, as Bratuškins et al. and Lynch (2021) argue, smart city tools are deployed to support regimes of urban optimization and investment-friendly redevelopment.

Heritage is used to generate cultural value, but its management becomes increasingly centralized, and data driven. The outcome is a paradox: smart systems that promise transparency and openness may, in practice, narrow the field of participation to those with technical expertise, institutional backing, or private interest.

Yet these technologies are not inherently exclusionary. Their importance lies in their capacity to shift the balance of control if deliberately reoriented towards cultural equity and inclusivity. Improving their use requires a fundamental shift from performance optimization and market logic to frameworks that embed community agency, cultural narratives, and plural memory into digital infrastructure. Only through such a reorientation can adaptive reuse resist the pressures of commodification and gentrification (Soccali & Cinà, 2020; Krivý, 2018).

This section has shown that BIM and IoT, while powerful tools in adaptive reuse, must be approached critically. Their integration into heritage projects is not only a question of technology but of urban ethics: who has the right to define, use, and benefit from historic space in the age of smartness? Adaptive reuse with smart systems should not mean transforming cultural buildings into optimized, managed, and exclusive sites.

Instead, it should ask how technology can support cultural plurality, local agency, and shared memory within regeneration processes. Next step, exploring these systems do not operate in isolation. They are part of a broader urban platform logic that governs not just buildings, but neighborhoods, access, and identity. Whether smart tools ultimately serve inclusion, or displacement depends on how we understand and intervene in the infrastructural politics of heritage. These technologies are important not because of their technical sophistication but because of their capacity to either reinforce exclusionary regimes or foster inclusive, culturally grounded urban regeneration. Improving their use is essential—not to achieve efficiency, but to embed equity, participation, and cultural memory at the heart of adaptive reuse processes (Harvey, 2017; Cardullo & Kitchin, 2019).

3.4 Platforms of Control: Integration, Intelligence, and Urban Power

In the current wave of smart city development, heritage buildings are no longer treated only as static monuments or symbolic spaces; they are increasingly seen as dynamic components of urban platforms, technological infrastructures designed to centralize, integrate, and govern diverse layers of city life through data. While previous sections have focused on how individual technologies like BIM, IoT, or AR shape the reuse of historic buildings, this section shifts focus to the systems that connect and coordinate these tools: the platforms that drive urban intelligence, influence governance, and redistribute power across the built environment. Smart platforms are software-based frameworks that collect data from various sources, sensors, digital models, mobile applications, and databases and organize it into centralized systems that can support decisions about mobility, energy, safety, infrastructure, and increasingly, culture. In theory, they allow city authorities, developers, and institutions to manage buildings and urban functions more efficiently. In practice, they risk reproducing hierarchies of access, control, and representation, particularly when applied to historically sensitive sites.

In this point, explores how smart platforms, when applied to adaptive reuse, can shape not only how heritage is maintained, but also how it is interpreted, valued, and used.

It argues that while platforms may offer new forms of coordination, they also embed cultural buildings within systems of control that prioritize visibility, functionality, and data legibility over local memory, identity, and community participation.

Smart platforms are central to how the smart city operates. They are the invisible backbone that links buildings, services, users, and data into an interactive system. In adaptive reuse, platforms link tools like BIM models, IoT sensor data, AI diagnostic systems, and heritage archives, transforming reused buildings into nodes into a wider urban network. For example, a reused church that has been fitted with structural sensors, visitor-tracking systems, and energy-monitoring devices might be visualized in real-time through a digital dashboard, where its performance, risks, and use patterns are monitored and managed alongside hundreds of other assets. While this seems efficient, it also signals a shift in logic: reused cultural buildings are no longer managed for their historical, social, or symbolic value, but for their performance within a platform of control. Their role in the city becomes increasingly technical and less cultural. As Krivý (2018) argues, platform logic reduces the city to a cybernetic system, a place of inputs and outputs, where cultural identity becomes an operational category, not a lived experience.

Highlighting that platforms are important from a critical stance because they act as gatekeepers of meaning, determining whose histories are told, which memories are preserved, and which communities are included or excluded. Improving their use is crucial not only to enhance technical functionality but to challenge the prevailing logic that prioritizes data efficiency over cultural integrity. Platforms must be reimagined as participatory spaces where community agency, plural narratives, and cultural complexity are central. This shift transforms adaptive reuse from a process of optimization into a practice of resilience and inclusion (Harvey, 2017; Cardullo & Kitchin, 2019).

The key danger here is that data replaces dialogue. Buildings are evaluated not for their embedded memories or community roles, but for their capacity to produce measurable outcomes: energy performance, visitor flows, safety compliance, or investment potential. The platform produces a new form of visibility, where buildings are only "seen" if they are legible to the system. Another critical issue is ownership and control of data. When a reused heritage site is part of a platform, data is continuously generated, from sensor feedback, BIM updates, visitor tracking, or AI interpretation. But who owns this data? Who has access to it? And more importantly, who interprets it and uses it to shape future decisions?

In many cities, smart platforms are managed by public-private partnerships or third-party technology providers. This creates a governance gap, where decisions about heritage may be made by actors who have no direct cultural or social connection to the site. As Meijer and Bolívar (2015) point out, smart governance often promotes a surface-level inclusion narrative, but in reality, it strengthens top-down decision-making, leaving limited room for community input. This becomes especially problematic in contexts where the building carries contested or vulnerable histories. A heritage site connected to a platform may be optimized for performance but lose its identity in the process. As McFarlane and Söderström (2017) note, smart platforms abstract space, they reduce it to what is measurable, analyzable, and profitable. This logic marginalizes heritage that cannot be captured through sensors or metrics. Some practical cases illustrate both the opportunities and risks of platform-based reuse. Palma's AdRem platform uses AI to assess the physical state of heritage buildings and propose reuse options. While the system includes advanced features for diagnostics, it also introduces a data-driven approach to heritage transformation, which could privilege stability and profitability over historical meaning. If not handled critically, such systems risk replacing interpretive depth with computational

logic. More generally, reused buildings in smart cities are increasingly enrolled in platforms that monitor energy use, occupancy, and climate adaptation. The platforms shape the cultural, social, and political dimensions of urban life. Their governance determines whether adaptive reuse serves as a tool for inclusive regeneration or as a mechanism of exclusion and commodification. Improving their design means embedding participatory governance, recognizing plural histories, and resisting the tendency to reduce cultural heritage to standardized, performance-optimized metrics (Soccali & Cinà, 2020; Meijer & Bolívar, 2016). This approach directly showing that the potential of smart platforms depends not on their technical sophistication, but on the social, ethical, and political frameworks within which they operate.

This is evident in urban dashboards where reused heritage buildings are grouped with schools, libraries, and transport hubs under one system. While this integration may help urban coordination, it also imposes standardization reducing cultural uniqueness to fit platform templates. Platforms not only organize data, but they also shape how people behave in reused spaces.

In smart heritage sites equipped with motion sensors, cameras, or mobile tracking systems, platforms can control lighting, access, and even how visitors move through space. This type of ambient surveillance may be justified as safety or optimization, but it changes the atmosphere of the site.

Where people once moved freely in a heritage space, they may now experience it as a monitored environment, where lingering in certain areas, touching materials, or participating in informal activities becomes restricted. Heritage becomes scripted, and visitors become users whose actions are recorded and interpreted.

This changes not only access but meaning. A building reused for collective memory may turn into a platform-managed installation, where behavior is shaped by backend logic, not cultural context. As Zuboff (2019) warns, this form of surveillance capitalism extends beyond commerce into the cultural domain, shaping how history is consumed. It is important to note that platforms are not inherently exclusionary. They are designed and can be redesigned with different values. Scholars like Jiang et al. (2020) argue for human-centered intelligence, where platforms are built not just for city managers but for citizens, historians, and cultural stakeholders.

In reuse projects, this means building platforms that allow communities to access, critique, and contribute to the data that represents their buildings. It means allowing multiple interpretations of a site's value, not just the one that performs best on a dashboard. It also means acknowledging what data cannot see: memory, emotion, resistance, and unresolved histories.

Some pilot projects have attempted this, using open-source platforms, participatory design, and hybrid interfaces that combine data with oral histories or community maps. However, these remain limited in scope, and the dominant trend still favors efficiency over expression.

As platforms become the organizing logic of smart cities, they are also shaping how adaptive reuse is imagined and implemented. They create systems that make heritage visible, measurable, and manageable but often in ways that reduce complexity, erase context, and limit participation. Cultural buildings become platform objects, optimized for performance but disconnected from their social meanings. If platforms are to support heritage reuse that truly preserves identity and resists gentrification, they must move beyond visibility and into accountability.

This means designing platforms that welcome cultural friction, plural narratives, and shared control, not just technical integration. Otherwise, platforms risk becoming another form of exclusion, digitally efficient, but culturally hollow.

That platforms are critically important because they determine whether adaptive reuse strengthens cultural identity or erodes it. Improving their use is not optional but necessary, to shift control from centralized systems of surveillance and optimization to inclusive, participatory frameworks where local communities co-create heritage futures. This approach reclaims technology as a means of cultural resilience and social justice, not just efficiency and control (Zuboff, 2019; Giglitto et al., 2023).

3.5 Rebranding the City: Smart Narratives and the Politics of Urban Renewal

In recent years, the use of smart technologies in urban planning has extended far beyond infrastructure. Today, many cities use these technologies as a way to promote themselves, to present a new image of being modern, efficient, and innovative. This is where smart city strategies turn into urban branding. Within this trend, the adaptive reuse of historic buildings has become part of a larger effort to rebrand cities. Through smart tools like AR, 3D modeling, and IoT systems, old buildings are made to appear as symbols of progress. While this may seem like a way to preserve heritage, it often serves a different purpose: to market the city and attract investment. These technologies are not merely tools for visual enhancement. Their importance lies in their capacity to embed certain narratives into the urban landscape while excluding others. Improving their use is essential, not to perfect aesthetic appeal, but to embed participatory frameworks that prioritize cultural memory, inclusion, and justice. This ensures adaptive reuse moves beyond a marketing strategy into a practice that genuinely reflects the lived experiences of local communities (Harvey, 2017; Zukin, 2009; Cardullo & Kitchin, 2019). Now, look at how smart reuse of historic buildings is being used in city image-making. It argues that instead of preserving cultural identity, reuse projects often support a controlled and simplified story about the city's past and

future. This has major implications, not only for how people experience heritage, but for who is included or excluded in the process of urban change. Many smart city initiatives rely on storytelling. As scholars like Vanolo (2014) explain, the smart city is not only a technical project, but also a discursive one, it's about how the city is imagined, presented, and sold. In this process, heritage buildings reused through smart technologies are often turned into icons. A former factory has become a tech hub. An old school has been transformed into a coworking space. These projects are shown as proof that the city is both modern and respectful of its past. But in many cases, this image is carefully curated. Only certain buildings are selected. Only some histories are told. The result is a simplified version of the city's identity, one that fits well into tourism campaigns, investment brochures, and international competitions. As Zukin (1995) notes, culture becomes a branding tool, and buildings are turned into aesthetic symbols rather than lived places. Adaptive reuse is often described as a way to preserve memory and protect history. But when combined with smart technologies, it can also become a way to market certain parts of the city. The importance is not just about preserving memory but about determining which memories are preserved and which are commodified or erased.

Improving their use means reorienting these tools away from market-driven narratives and towards inclusive frameworks that amplify diverse histories, resist symbolic displacement, and foster cultural resilience (Soccali & Cinà, 2020; Giglitto et al., 2023).

Smart tools such as interactive apps or digital reconstructions help cities present themselves as places that can innovate without forgetting tradition. These stories are appealing, but they also hide complexity. They don't always reflect who lived in these buildings before, what the space meant to local communities, or what was lost in the process of transformation.

As McFarlane (2020) suggests, smart urbanism often hides power behind the language of innovation. Buildings are reused, but not always for the people who once relied on them. Reuse is sometimes driven more by real estate value than by cultural meaning. Across many cities, similar visuals appear in promotional materials: clean lines, smart lighting, transparent glass extensions, digital overlays. This "smart aesthetic" is not accidental. It is used to show that the past is being respected but also controlled and updated. However, this visual language often removes the complexity of history. Difficult or marginalized pasts such as stories of labor, migration, or inequality, may be excluded because they don't

fit the clean, futuristic image being promoted.

As Zukin (2009) and others have noted, when heritage is used this way, it can become a tool of gentrification. The reused building becomes a signal of change, attracting a new population and reshaping the social makeup of the area.

Even when the physical building is preserved, cultural memory can be lost. This is what some scholars call symbolic displacement. The building remains, but its meaning has changed. The people it once served may no longer feel welcome.

This demonstrates that AR, 3D modeling, and IoT are not neutral or inherently beneficial; they are pivotal in determining how cultural spaces are experienced and who gets to define their meaning. Improving their use is crucial to shift from spectacle to substance, embedding practices that respect contested histories and engage communities in shaping their cultural futures (Waterton & Smith, 2010; Krivý, 2018).

The history it represents may no longer be visible. Smart reuse often creates these kinds of shifts especially when it's tied to city branding. A building might be turned into a museum or gallery, but its past as a place of community gathering or social resistance is forgotten. As Krivý (2018) and Lynch (2021) argue, smart heritage practices can flatten memory into

simulations, experiences that are attractive but not authentic.

This section has shown that the smart reuse of historic buildings is not only a technical or cultural project, but also a political and economic one. When these projects are used to rebrand the city, they may help attract attention and resources. But they also risk turning heritage into a marketing strategy, disconnected from the communities that once gave it meaning. To answer the main question of this thesis, smart technologies must do more than create beautiful visuals or efficient reuse models. They must support memory, inclusion, and justice. They can create appealing visuals, but because they hold the power to shape cultural narratives and urban identities. Improving their use is essential to shift from market-oriented adaptive reuse to inclusive regeneration that centers cultural equity, social justice, and community agency (Harvey, 2017; Zuboff, 2019; Cardullo & Kitchin, 2019). The next section looks directly at this issue: Who is truly included in smart heritage practices and who is left out?

3.6 Inclusion or Displacement? Rethinking Smart Heritage Practices

Smart technologies in urban regeneration are often introduced with promises of inclusion. In theory, adaptive reuse powered by tools such as BIM, IoT, AR, and AI allows cities to better preserve cultural memory, increase public access, and revitalize underused spaces. However, as demonstrated in the earlier sections of this chapter, these technologies are not neutral, they are implemented within broader systems of economic interest, governance, and social power. The result is a gap between the inclusive ideals of smart heritage and the actual experiences of communities impacted by urban transformation. This section asks a key question: Do smart technologies genuinely support inclusive heritage practices, or do they lead to new forms of displacement both physical and symbolic? By critically examining how inclusion is defined, measured, and practiced in smart reuse, this section outlines the risks of superficial engagement and explores what would be required to make adaptive reuse truly equitable. Smart city discourse often presents itself as inherently participatory. Digital platforms are said to create transparency, enable engagement, and give more people access to culture and decision-making. Therefore, the importance of improving and adapting these tools lies not in perfecting their efficiency, but in redirecting their use toward justice, equity, and co-authorship.

Rather than using digital tools to showcase heritage as a polished product for tourism or investment, cities should leverage them to restore intergenerational memory, support grassroots narratives, and co-create urban futures. This reorientation requires deliberate mechanisms such as citizen-led heritage councils, open-data protocols, and participatory mapping tools that redistribute decision-making power. As Waterton and Smith (2010) note, inclusive heritage practice must "embrace the plurality of voices rather than prioritize dominant epistemologies rooted in professional or commercial expertise.

In smart heritage projects, tools like AR, 3D scanning, VR, mobile storytelling apps, and sensor networks are widely used to document and share cultural sites in more interactive and engaging ways. These tools have been praised for lowering barriers to cultural access. For instance, people with mobility challenges may now explore heritage spaces through virtual walkthroughs. Local residents can contribute oral histories or images via open platforms. Public data dashboards and real-time monitoring can enhance accountability in the management of reused buildings. Examples like SHAZARCH and AdRem, developed by Palma, show how digital diagnostics and AI planning systems can support informed and sensitive reuse processes. Likewise, community-led digital heritage projects, as discussed

by Giglitto et al. (2023), have demonstrated the value of participatory design, especially when local knowledge is used to shape content. In such projects, technology becomes a medium for collective memory, rather than a top-down interpretation of history.

These examples show what is possible. But they are still relatively rare. In many smart reuse initiatives, the potential for inclusion is undermined by technical, institutional, and social barriers. Displacement is often understood in physical terms, the removal of residents, the loss of housing, or the replacement of local businesses. But in the context of smart heritage, displacement can also be symbolic and representational. A building may remain in place, but the way it is used, narrated, and represented may exclude those with long-standing cultural ties to it.

This form of symbolic displacement occurs when smart technologies frame history through curated lenses that prioritize some stories over others. Smart platforms tend to simplify complexity for usability. As Krivý (2018) notes, heritage narratives are often packaged in ways that are visually appealing and easy to consume, but that flatten conflict, erase uncomfortable truths, and re-center dominant perspectives. For example, an industrial building reused as a tech center may present itself as an icon of innovation while ignoring

its labor history.

Smart reuse can also create cultural alienation, especially when reuse serves external stakeholders such as tourists, investors, or new residents, more than local communities. Even where heritage is preserved, its transformation into a smart, branded asset can lead to the displacement of meaning, where the space no longer feels familiar, relevant, or welcoming to its original users. Many smart reuse projects claim to involve communities. But participation is often symbolic, limited to feedback sessions, pilot workshops, or guided tours.

These forms of consultation rarely influence major decisions about building function, technology selection, or heritage interpretation.

As Jiang et al. (2020) argue, smart governance must go beyond inclusion as a slogan. Real participation requires shared control over processes and systems. In adaptive reuse, this means that communities should not only contribute content, but they should also help define how technology is used, which stories are told, and what priorities shape design and management. Unfortunately, most reused buildings are governed by public-private partnerships, architectural firms, or digital service providers whose incentives are not

aligned with equity. In many cases, smart reuse becomes another layer of managerial control, where the cultural space is opened for use but closed to influence. This is even more problematic in areas where gentrification is already underway. The smart reuse of heritage buildings often signals the beginning of broader neighborhood change, raising land values, attracting new businesses, and pushing long-time residents to the margins. While this is not always the direct intention, smart reuse can become part of a broader urban displacement machine, where inclusion is framed in aesthetic terms but not in structural ones.

To avoid these outcomes, smart reuse must be rethought. Inclusion cannot be a side note, it must be central to the logic of how technologies are designed, implemented, and governed. First, there must be a shift from efficiency and branding to equity and care. Adaptive reuse is not just a technical challenge; it is a cultural and ethical one. The question should not only be, "How can we digitize this space?" but also, "Whose history are we preserving, and for whom?"

Second, smart heritage must be context sensitive. Standardized apps and models do not reflect the layered and contested nature of local history.

Projects must adapt to the specific cultural, political, and emotional dimensions of each site. This includes acknowledging histories of exclusion, struggle, or trauma rather than hiding them behind innovative narratives. Third, platforms and data systems should be open, transparent, and accountable. Communities must have access to the data produced about their spaces and a say in how it is used. Participatory tools should not only allow for input but also support shared decision-making. This might involve citizen advisory boards, collaborative BIM platforms, or open heritage APIs that allow for flexible reuse of digital content. Finally, inclusion must also account for the limits of technology.

Not everything meaningful can be scanned, mapped, or simulated. Emotional connections, spiritual practices, and informal social ties often resist digitization, but they remain essential parts of cultural identity. A truly inclusive reuse project makes room for these forms of value, even when they are hard to visualize.

Smart technologies hold promises for heritage conservation and adaptive reuse, but they also bring new risks. Inclusion cannot be assumed just because digital tools are used. Without attention to governance, access, participation, and context, smart reuse may reinforce the very inequalities it claims to resolve.

Displacement in smart cities does not always happen through demolition. It can happen quietly through language, design, data, and the selective telling of history. If smart heritage is to serve the public good, it must center not only memory and innovation, but also justice and inclusion.

Only then can adaptive reuse truly become a tool for cultural continuity rather than a symbol of exclusion dressed in digital form.

Having explored the socio-technical and political dimensions of each smart city technology in the context of adaptive reuse, it is necessary to consolidate these insights. The following synthesis table critically compares the five key technologies discussed in this chapter BIM, IoT, AR/VR, Smart Platforms, and Digital Heritage Tools, based on their roles in reuse, cultural impact, risks of gentrification, and alignment with inclusive governance. This comparative framework provides a conceptual bridge between the theoretical arguments developed here and the empirical analysis that follows in Chapter 4.

	Technology	Role in Adaptive Reuse	Cultural Value Alignment	Inclusion/Exclusion Dynamics	Risk of Gentrification or Displacement	Government and Power Implications	Critical Insight for Thesis
1	BIM	Enables precise 3D modeling and documentation of historic buildings for restoration planning. Encodes physical attributes but often excludes intangible heritage unless purposefully integrated.	Moderate: depends on whether the model incorporates community input and contextual meaning. Without stakeholder participation, risks being technocratic.	Usually excludes non-expert input. Participatory BIM is rare and requires intentional efforts. Risks reinforcing professional authority and excluding local voices.	Medium: by improving building value and attracting investment, it can enable upscale reuse strategies unless governance frameworks ensure social protections.	Typically controlled by architects, engineers, and developers. Citizens are not usually model contributors. Risk of technocratic dominance.	To align with inclusive heritage goals, BIM must be used in participatory ways that acknowledge both tangible and intangible values. Otherwise, it risks becoming a tool of elite planning.
2	IOT	Provides real-time monitoring of building performance (e.g., humidity, vibrations) to support maintenance. Can preemptively address decay but operate largely outside community memory.	Low: focused on structural safety and building efficiency. Cultural significance is rarely embedded unless paired with narrative or visualization tools.	Low inclusion: sensor networks are typically proprietary or managed by municipal/tech actors. Can reinforce top-down control over heritage space behavior.	High: feeds into data-driven optimization that may justify privatization, increased rents, or behavior-targeted redesigns that exclude low-income users.	Data ownership often lies with municipalities or tech firms. Lack of transparency in how decisions are derived from sensor data is common.	IoT should not be treated as a neutral enabler. Its use must be critically assessed in terms of who benefits from the data and whether it reinforces or resists exclusionary urban change.
3	Digital Heritage Tools	Supports documentation and interpretation through 3D scanning, digital archives, photogrammetry, and VR tours. Often used for preservation and access but can shape public understanding of heritage.	Moderate to High: depends on curatorial intent and whether digital content reflects diverse and localized memory. Risks arise when models prioritize visual fidelity over cultural context.	Content is often curated by institutions or heritage professionals. Community co-curation is rare but possible. Public access to models is limited by licensing or platform control.	Medium: digital replicas and virtual tours can increase tourism visibility and speculative interest, particularly in contested or marginalized neighborhoods.	Decisions about what gets digitized, archived, and displayed shape cultural memory. Institutions often retain control over metadata and access, raising questions of narrative authority.	Digital heritage tools should not be assumed neutral. They encode cultural priorities and exclusions. Projects should foreground transparency, narrative plurality, and access equity to support inclusive adaptive reuse.
4	AR/VR	Immerse users in digitally reconstructed environments. Used for interpretation, education, and experiential tourism of cultural sites. Allows narrative enhancement or re-writing.	High when designed with community consultation. It can support localized storytelling and memory preservation, but risks simplification or commercial framing.	Potentially inclusive if content is co-produced with local communities. Can amplify underrepresented voices but often lacks co-creation mechanisms in practice.	Medium: creates "experience-rich" environments that attract tourism or upscale consumption. May displace existing cultural practices if not critically curated.	Curatorial decisions about what is shown or emphasized in AR often reflect institutional agendas. Public interpretation is often limited to passive consumption.	AR/VR offer the most narrative flexibility, but their power lies in authorship. Projects must foreground local memory rather than impose external representations.
5	Smart Platforms	Integrates multiple data streams (BIM, IoT, citizen feedback) to centralize decision-making. Often operates through urban dashboards or management tools that affect city branding and funding allocation.	Mixed: some platforms allow participatory governance, but most reinforce dominant urban narratives shaped by developers or city officials.	Highly variable. When open-source or civic tech-based, inclusion is possible. When closed or commercial, it amplifies exclusion and systemic bias.	High: used in marketing, predictive policing, or smart district design that prioritize economic redevelopment over social equity. Can erase contested histories.	Governance encoded into platform logic. Whose data is collected, whose narratives are privileged, and who controls outputs are key political concerns.	Smart platforms are the clearest example of techno-political systems. They can either democratize reuse decisions or reinforce exclusion depending on their design and ownership structure.

Table 2: Critical Synthesis Table – Smart Technologies and Adaptive Reuse:

ADAPTIVE REUSE IN PRACTICE: SMART TECHNOLOGIES, CULTURAL IDENTITY, AND THE STRUGGLE AGAINST GENTRIFICATION

04

4.1 Contextualizing Smart Reuse: Global Cases in Urban Heritage Regeneration

Shifting the focus from theoretical exploration to real-world applications, critically analyzing how smart city technologies are used in the adaptive reuse of historic buildings in different urban contexts. Building on the conceptual groundwork laid in Chapters 2 and 3, it examines the tensions that arise when digital innovation meets heritage preservation, especially in cities undergoing rapid transformation. The analysis is grounded in four case studies: Battersea Power Station (London), Xintiandi (Shanghai), Msheireb Downtown (Doha), and Porto Maravilha (Rio de Janeiro), each chosen not for technological novelty, but for the contradictions they reveal between cultural preservation and socio-spatial exclusion. These projects incorporate a variety of smart technologies, from Building Information Modeling (BIM) and Internet of Things (IoT) systems to digital simulation tools and urban monitoring platforms. However, the primary concern here is not their technical capacity but their social and political implications. These technologies are examined as instruments of power that can either support inclusive regeneration or contribute to cultural displacement, depending on how and by whom they are implemented. Each case reflects a different governance model and cultural setting. Battersea Power Station illustrates investor-led redevelopment in a post-industrial context (Al Sulaiti, 2021).

Xintiandi presents a model of heritage branding and controlled tourism development that prioritizes global capital over local narratives (Martínez, 2021; Ren, 2008; Luduvice, 2016). Msheireb Downtown Doha represents a national effort to combine tradition with innovation, offering a carefully managed approach to modernization (Eddisford & Carter, 2017; AlHammadi, 2023). Porto Maravilha stands out for its emphasis on financialization and its impact on marginalized communities, particularly Afro-Brazilian populations (Mosciaro et al., 2019; Carranza, 2021; Al Sulaiti, 2021). Together, these cases were selected not only for their global diversity, but for the way they bring into focus how adaptive reuse, when digitally mediated, can reconfigure power, identity, and belonging in the city. This chapter does not attempt to categorize these technologies as inherently positive or negative. Instead, it critically reflects on their deployment, who benefits are, what identities are preserved or erased, and what forms of participation are enabled or denied. As the literature on Rio and Shanghai demonstrates, smart urbanism often masks deeper inequalities behind a facade of innovation (Martínez, 2021; Carter, 2017). The analysis of each case will follow a consistent structure: (1) historical and urban background, (2) the integration of smart technologies, (3) effects on cultural identity and the urban fabric, and (4) a critical reflection on gentrification and symbolic meaning.

This structure allows for detailed insights while keeping the analysis tied to the overarching research question. By bringing together diverse global examples, this chapter highlights how adaptive reuse, when guided by digital tools, can either challenge or reinforce dominant urban narratives. It aims to show that smart heritage is never neutral, it is shaped by broader power relations, governance structures, and market dynamics that determine whose heritage is remembered and whose is forgotten.

Case Study	Symbolic Reuse	Displacement Type	Smart Tech Framing
Battersea Power Station (London)	The Industrial past rebranded for global elites; memory aestheticized through design and branding.	Symbolic displacement via luxury redevelopment and exclusionary pricing.	BIM and IoT used to support commercial redevelopment and investment, not community inclusion.
Xintiandi (Shanghai)	Traditional Shikumen turned into a simulated lifestyle district; curated memory replaces living heritage.	Physical displacement of 3,800+ residents; symbolic erasure of lived working-class heritage.	3D modeling and simulation used to stage heritage for tourism, removing social and political depth.
Msheireb Downtown (Doha)	Selective cultural revival rooted in state-led identity; isolates Qatar's pluralist architectural past.	The symbolic displacement of migrant communities through controlled spatial narratives and curated tradition.	BIM and smart infrastructure reinforce centralized planning and aesthetic control.
Porto Maravilha (Rio de Janeiro)	Heritage status of Valongo Wharf used symbolically; Afro-Brazilian history commodified and marginalized.	Physical eviction and symbolic displacement of low-income Afro-Brazilian populations through speculation.	Digital tools support speculative urban governance via smart infrastructure and exception-based zoning.

Table 3: Case Study Selection Criteria: Linking Symbolic Reuse, Displacement, and Smart Technology Framing:

4.2 Battersea Power Station, London: Smart Heritage Renewal and Urban Exclusion

The redevelopment of Battersea Power Station in London represents a high-profile example of how smart city technologies and heritage branding converge in the reshaping of urban landscapes, often in ways that obscure the social costs of regeneration. Framed as a success story in architectural conservation and urban renewal, the Battersea project is in fact deeply embedded in broader processes of spatial inequality,

Figure 4: Battersea Interiors: From Industry to Retail

symbolic displacement, and elite urbanism. Rather than simply preserving a historic structure, the redevelopment orchestrates a transformation of both space and meaning, converting industrial memory into luxury spectacle. The role of smart technologies in this transformation has been central. Tools such as Building Information Modeling (BIM) enabled planners and developers to model preservation strategies for the Grade II* listed structure with precision, integrating the old fabric into an expansive and visually cohesive luxury development (Al Sulaiti, 2021). These tools did not merely serve conservation goals, they also allowed for the optimization of circulation flows, infrastructure coordination, and
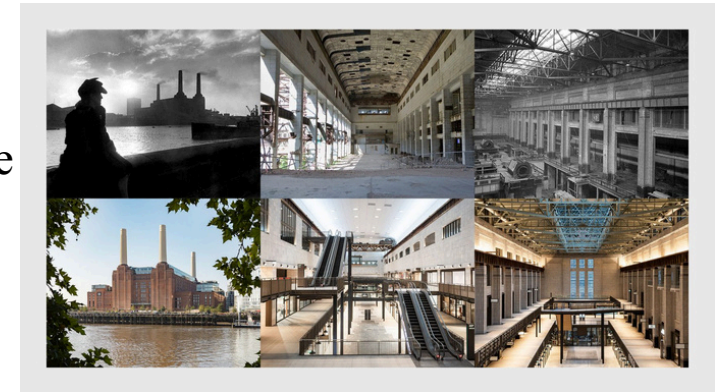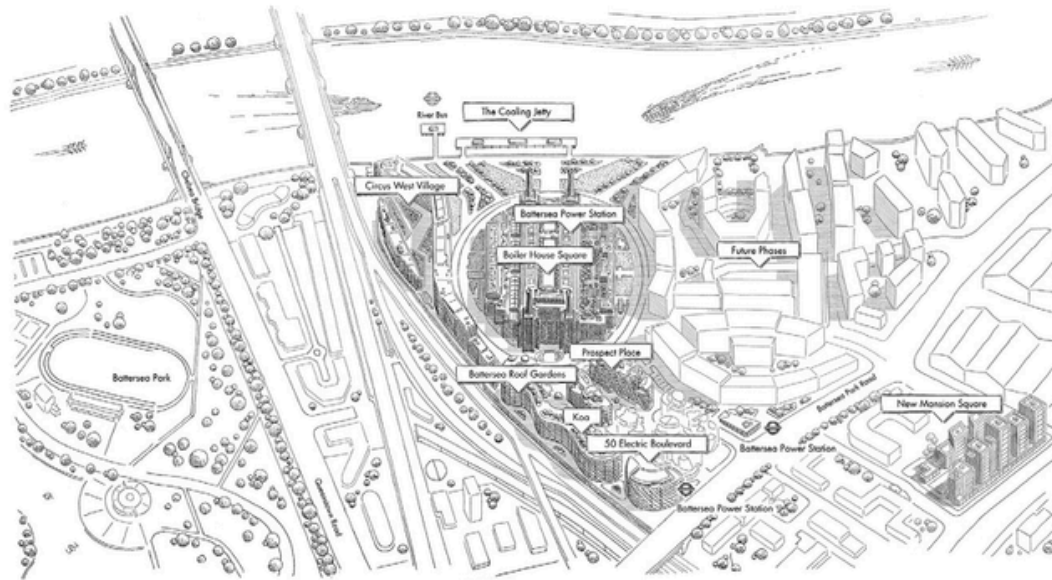
Figure 5: Battersea masterplan (Credit: Battersea PowerStation Development Company)

In the case of Battersea, smart technologies such as BIM and IoT were primarily leveraged to attract investment, optimize development logistics, and enhance marketability—rather than to foster community inclusion or cultural continuity. This illustrates a deeper structural logic where digitization reinforces capital-driven redevelopment. The power to shape urban memory and access is thus concentrated in the hands of developers and global investors, raising the question: who truly benefits from the integration of smart tools in heritage reuse?

real-time management, aligning the logic of the site with the imperatives of market-led regeneration (Mosciaro et al., 2019). Yet the project's technological sophistication masks a deeper ideological shift. Battersea Power Station, once a site of labor, energy production, and working-class identity, has been reconfigured into a lifestyle enclave. Its redevelopment celebrates a curated form of heritage, where the aesthetic of the past is preserved while the social histories it once embodied are strategically excluded. As Melhuish (2016) argues, digital visualizations are not neutral, they generate a particular kind of urban future, one that aligns with dominant interests. In Battersea, these tools constructed a sanitized narrative in which industrial legacy becomes a decorative backdrop for high-end consumption.

This selective remembering enables what can be termed symbolic displacement. The working-class narratives historically tied to the site have been overwritten by a new cultural imaginary centered on affluence and cosmopolitanism. There is no forced eviction, yet what has been displaced is the right to representation, the right to memory, and the right to shape urban identity. This erasure is not incidental; it is structured into the very design and governance of the project. Smart technologies facilitate not just material reuse, but

ideological realignment, turning heritage into an exclusive commodity circulated within global capital markets. Recent evaluations of the Battersea redevelopment underscore how smart technologies were not just tools of preservation, but instruments of rebranding. Phillips et al (2024) explains that the use of original steel structures and historical materials was promoted as sustainable, but in practice, these decisions also contributed to repackingthe space for elite consumption. Rather than creating an open, inclusive narrative of industrial labor, the site was strategically transformed into a showcase of high-end redevelopment. Adding another layer to this transformation, Morezzi (2017) refers to the new Battersea as an "Electricity Cathedral," reflecting how memory and identity are now curated through spectacle. Smart tools helped shape a selective aesthetic, focusing on surface appeal while detaching the site from its socio-political roots. These processes demonstrate how digital heritage, when driven by market logics, can obscure more than it reveals.

Importantly, this case must be understood within the broader logics of gentrification. The redevelopment of Battersea reflects the strategic use of heritage to unlock real estate value, where smart technologies assist not just in building management but in narrative

construction. By making preservations appear seamless and forward-looking, they depoliticize the redevelopment process, framing it as innovation rather than appropriation.Gentrification here is not merely physical, it is cultural and epistemic, redefining whose histories matter and whose futures are imagined in the city. Governance mechanisms in the project further deepen these dynamics. The decision-making process privileged private developers and global investors, with limited avenues for community engagement or contestation (Mosciaro et al., 2019). The use of technological tools lent the entire operation a sense of expertise and inevitability, sidelining dissent and alternative visions for the site. What might have been an opportunity to explore inclusive, memory-rich reuse instead became a tightly managed exercise in spatial branding.

In this context, smart city technologies must be understood not only as technical facilitators but as instruments of urban storytelling and control. In the case of Battersea, they enabled the preservation of façades while hollowing out the deeper meanings historically embedded in the site. The project reveals how adaptive reuse, when dominated by speculative interests and digitally mediated governance, can reinforce rather than resolve the exclusions it claims to overcome.

Battersea Power Station offers powerful lens on the contradictions of smart heritage regeneration. While praised for its design and conservation efforts, the project exemplifies how technological innovation can serve exclusionary narratives of progress. It raises fundamental questions about the politics of urban memory: Who decides what is worth preserving, and why? What forms of heritage are elevated, and which are erased? As the following chapters will show, these dynamics are not unique to London. In Shanghai, heritage is remade for global consumption through stylized vernacular forms; in Doha, tradition is re-engineered through state-managed identity; and in Rio, the memory of marginalized communities is overwritten by speculative redevelopment. Battersea signals the need for a critical approach to smart adaptive reuse, one that confronts the unequal power relations embedded in both technology and urban transformation.

Figure 6: Battersea Power Station: Before and After

4.3 Xintiandi, Shanghai: Commodifying Vernacular Heritage in a Global City

Xintiandi, a high-end commercial enclave in the heart of Shanghai, offers a powerful case study of how smart technologies and adaptive reuse can become tools for reimagining urban identity under neoliberal urbanism. Marketed as a flagship example of urban renewal that integrates heritage with innovation, Xintiandi was developed by Shui On Land in collaboration with local government as part of Shanghai's broader ambition to become a global city. Yet beneath its curated streetscapes and polished façades lies a process of displacement, cultural erasure, and symbolic repackaging. From its inception, the project was less about preserving historical authenticity and more about manufacturing an image of tradition that could be commodified within a global real estate market. At the center of this transformation were the Shikumen lane houses, dense, narrow brick dwellings that once provided affordable housing to working-class families in Shanghai. Rather than conserving the lived heritage of these structures, the redevelopment project relied on selective demolition and digital simulation to reassemble a picture-perfect version of the past. As Ren (2008) emphasizes, this process involved not restoration, but reinvention. Using smart tools like 3D modeling, developers reconstruct façades, courtyards, and alleyways to create a sanitized and stylized version of Shikumen that aligned with

Located between Ma Dang Road and Huang Pi Nan Road, the site is embedded in a broader matrix of commercial and office development. While the interior of the Xintiandi block features preserved façades and digitally simulated "heritage" architecture, the surrounding area reveals the project's integration into Shanghai's speculative real estate landscape. The map highlights how adaptive reuse in Xintiandi is spatially insulated from the residential fabric of Taipingqiao and instead embedded within elite commercial circuits. This spatial arrangement underscores the critique that smart heritage redevelopment, while visually referencing tradition, serves exclusionary economic functions in practice.
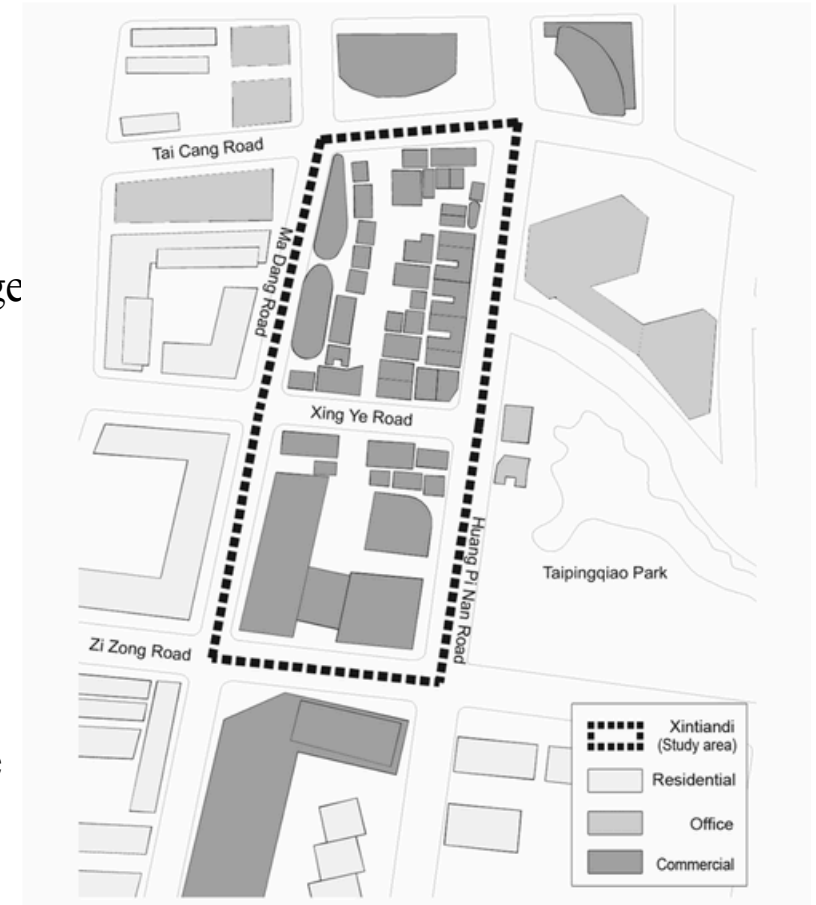

Figure 7: Map of Xintiandi and the main built use of its surrounding buildings

international aesthetic expectations while omitting the messier realities of daily life, decay, and communal struggle. Qian (2016) details how nearly 1,950 households were displaced for a single commercial block in Xintiandi, showing how the pursuit of smart urbanism can result in large-scale social restructuring. The project's polished aesthetic masked the intensity of removal and erasure. This type of planning, while marketed as progress, created a sanitized cultural space unmoored from lived reality. Meanwhile, Ma (2022) argues that while physical symbols were retained, intangible practices, like oral traditions, everyday rituals, and community-specific arts, were systematically erased. The result is a simulation of history, where buildings are preserved in form, but emptied with meaning. This highlights the limits of smart technologies when they prioritize visual harmony over cultural authenticity.

This architectural scripting was not limited to form; it extended to meaning. The deployment of digital heritage tools allowed planners to stage a narrative of cultural continuity while simultaneously displacing the very communities that had embodied it. As Al Sulaiti (2021) notes, this selective memory was further institutionalized through curated museums, themed exhibitions, and cultural branding efforts that framed the site as acelebration of heritage rather than a site of loss.

Year	Area Demolished (hectares or million m²)	Residents/Households Relocated (thousands)
1995	65.5 ha	31.2
1996	97.3 ha	41.5
1997	94.6 ha	38.3
1998	117.5 ha	46.6
1999	116.3 ha	44.9
2000	130.4 ha	50.8
2001	145.6 ha	54.9
2002	134.2 ha	52.3
2003	120.6 ha	48.5
2004	3.08 million m²	42.4
2005	12.23 million m²	75.9
2006	15.17 million m²	81.1
2007	8.25 million m²	51.4
2008	10.29 million m²	53.6
2009	9.28 million m²	68.3
2010	5.86 million m²	39.7
2011	3.34 million m²	23.1
2012	2.19 million m²	21.9
2013	1.60 million m²	30.9
2014	1.19 million m²	26.8
2015	0.79 million m²	23.1
2016	1.36 million m²	28.4
2017	0.77 million m²	19.1
2018	0.63 million m²	16.8
2019	1.46 million m²	35.8
2020	1.61 million m²	43.3
2021	2.65 million m²	57.4
2022	0.95 million m²	19.9
2023	0.85 million m²	15.7

Table 4: Demolition and Resident Relocation in Shanghai (1995–2023): From Physical Clearance to Smart Urban Reuse

This table presents a longitudinal view of urban demolition and population displacement in Shanghai over nearly three decades. The first phase reflects early waves of clearance tied to post-socialist restructuring, while the second reveals how such trends intensified and evolved under contemporary urban regeneration. Despite shifts in narrative, from redevelopment to digital heritage and smart urbanism, the material outcomes remain structurally similar: extensive demolition, mass relocation, and the displacement of communities. The continuity across both periods highlights the persistent logic of erasure behind projects framed as cultural preservation. In cases like Xintiandi, smart technologies served not to interrupt this trajectory, but to aestheticize and legitimize it under the language of innovation and memory.

Through visualization and spatial design, the project created a highly legible environment tailored to consumer legibility, producing an urban imaginary that is emotionally resonant, but historically hollow. The result is what Martínez (2019) describes as "aestheticized displacement": a condition in which architectural symbols remain while their social functions and meanings are stripped away. In Xintiandi, smart technologies enabled this transition by making heritage appear seamless, clean, and apolitical. The buildings retain visual cues of Shanghai's past, but their function has been inverted, from affordable housing to premium retail, from community space to spectacle. The authenticity presented to visitors is thus not historical truth, but curated affect, engineered through the precision and abstraction of digital design tools. Governance frameworks played a decisive role in shaping this transformation. Shanghai's strategic embrace of global urbanism emphasized the symbolic power of heritage in city branding. As Bittencourt (2024) argue, the authenticity pursued in Xintiandi was not about preserving cultural identity in any substantive sense but about producing verisimilitude, a version of tradition that was convincing enough to serve economic and political goals. Public-private partnerships between the municipal government and private developers

allowed for rapid and tightly controlled redevelopment, sidelining public participation and ensuring that planning outcomes aligned with the logic of capital rather than community. Furthermore, the use of smart technologies in Xintiandi should not be viewed as neutral or purely functional. These tools actively shaped how history was visualized, experienced, and consumed. By digitizing and simulating the past, they made it possible to package memory as a product, visually coherent, emotionally evocative, and politically unthreatening. This instrumentalization of heritage transforms culture into a surface-level design motif, detaching it from the social practices and power struggles that gave it meaning. What results is a cityscape that looks historical but is deeply contemporary in its function: to attract capital, to host elite consumption, and to erase the alternative futures once imagined in the everyday life of the neighborhood.

Xintiandi exposes the risks of adaptive reuse projects that adopt smart city technologies without attending to cultural integrity or social justice. Beneath its image of successful urban regeneration lies a layered process of displacement, exclusion, and cultural simplification. What appears as heritage preservation is in fact a digitally mediated performance, one that preserves appearance but erases substance. Like Battersea, this case

illustrates how smart technologies can serve as instruments of cultural engineering, shaping not only space but also the meaning of identity, history, and belonging. Xintiandi reminds us that the question is not merely whether heritage is retained in physical form, but whether it continues to hold meaning for the communities it once served. In smart cities, where images often supersede substance, such questions become not only architectural but deeply political.

4.4 Msheireb Downtown, Doha: Smart Urban Renewal Rooted in Cultural Heritage

Msheireb Downtown Doha presents a compelling counterpoint to commercially driven smart heritage developments by offering a model rooted in cultural revival, state-directed planning, and digital integration. Situated at the historic core of Qatar's capital, the project represents one of the most ambitious state-led efforts to reconcile modern urban growth with traditional aesthetics. Msheireb exemplifies how digital tools and smart city infrastructure are deployed not only to manage buildings and services, but also to shape collective identity and national memory. However, beneath this polished narrative lies a more complex reality, one that brings to light the tensions between authenticity, control, and representation in the smart city. The project was undertaken by Msheireb Properties, a subsidiary of the Qatar Foundation, and reflects Qatar's broader ambitions under its National Vision 2030 to position itself as a cultural and innovation hub. Msheireb's design drew inspiration from the vernacular architecture of traditional Qatari courtyard houses, integrating features like wind towers, shaded alleyways, and low-rise blocks with modern technology. According to Carter (2017), this architectural revival was made possible through smart technologies such as digital surveying, 3D modeling, and Building Information Modeling (BIM), which enabled architects to digitally reconstruct spatial

patterns and embed historical elements into a new urban matrix. In this sense, smart tools played a role not only in facilitating efficiency but in scripting a visual language of national identity. Yet this process of digitized heritage reconstruction also illustrates how adaptive reuse can be harnessed to convey a top-down narrative. Msheireb's carefully curated vision of the past, rendered through state-supported technologies, presents a version of heritage that emphasizes uniformity and nostalgia while marginalizing urban complexity. As Al Sulaiti (2021) observes, the district's emphasis on order, elegance, and tradition aligns closely with national branding objectives, effectively transforming heritage from a living, contested resource into a stylized image of cultural continuity. Boussaa (2021) critiques the Msheireb project for reviving architectural motifs without the participatory structures that once gave them life. The reimagined "fareej" — a traditional Qatari neighborhood characterized by interconnected courtyard houses, narrow alleys, and strong social ties — may reflect local aesthetics, but not the pluralism or informality of the original community. It becomes a heritage as product, tailored to visual coherence rather than social memory. Gharib (2014) adds that the site functions more as a curated exhibit than a living neighborhood. Advanced surveillance and spatial zoning reinforce exclusion, making it

Figure 8: Master plan of the Msheireb Downtown Doha project, highlighting the location of the Heritage Quarter. Source and copyright: Msheireb Projects

The diagram illustrates the strategic segmentation of space, where the Heritage Quarter is spatially framed as a curated zone of national identity. This zoning supports a controlled narrative of cultural continuity, while the surrounding fabric reflects a digitally scripted, high-end smart city image.

difficult for displaced communities to return. Smart systems here manage behavior as much as infrastructure, shaping public space in ways that appear open but are tightly controlled. The use of smart technologies in this context becomes less about preserving memory and more about reinforcing a selective story, one that validates the present political agenda while obscuring alternative histories. While Msheireb has been praised for enhancing the visual and spatial coherence of downtown Doha, it has also raised concerns about social inclusion and memory erasure. The former neighborhood was home to diverse working-class and migrant communities, populations that have largely disappeared from the redeveloped site. Though not displaced through direct eviction, these groups have been symbolically excluded through the reconfiguration of space and access. Aspects such as pervasive surveillance, smart control systems, and design-led exclusivity have reinforced a spatial order oriented more toward elite users, tourists, and institutional actors than toward everyday urban life. The district's high-end character and strict zoning reflect a broader smart city trend: the prioritization of technological sophistication over cultural pluralism. The project also illustrates how smart technologies, despite their promise of precision and transparency, can reproduce systems of control and exclusion. In Msheireb, digital

infrastructures are not only used to optimize services but also to regulate behavior, organize access, and shape public space. Surveillance systems and automated design responses, based on data analytics, create an environment that may be technologically efficient but lacks the openness and unpredictability that characterize historically lived urban environments. In this sense, the district is a highly choreographed space where heritage is programmed rather than practiced.

Crucially, Msheireb challenges the assumption that state-led heritage projects are inherently more inclusive than market-driven ones. Despite the absence of speculative private capital, the project illustrates how smart technologies can still be deployed to enforce ideologically driven urban imaginaries. The visual coherence and spatial legibility of Msheireb, while impressive, obscure the underlying reality of social transformation, where memory is digitized, standardized, and instrumentalized in support of a national vision. This digital translation of culture, while visually coherent, may exclude the nuances, contradictions, and multiplicities that characterize real urban memory. Msheireb Downtown Doha reflects both the potential and the pitfalls of smart adaptive reuse. On the surface, it offers a model of regeneration that blends innovation with heritage, but a closer

look reveals how digital tools can also facilitate cultural control and socio-spatial exclusion. While the project succeeds in creating a cohesive urban aesthetic rooted in tradition, it also raises pressing questions about who gets to define that tradition, and who is left out of the story. In this context, smart city technologies are not neutral, they shape what is remembered, how it is represented, and for whom it is made visible. Msheireb exemplifies the need to interrogate the narratives embedded in smart heritage projects, reminding us of that preservation, when filtered through digital frameworks, can risk becoming a polished form of forgetting. The challenge moving forward is not simply how to incorporate heritage into smart urbanism, but how to ensure that such incorporation remains open, inclusive, and reflective of the complex, layered realities of cultural identity in a rapidly changing world.

4.5 Porto Maravilha, Rio de Janeiro: Cultural Memory, Displacement, and Smart Urban Regeneration

Porto Maravilha, a large-scale urban regeneration project along Rio de Janeiro's port zone, exemplifies how smart city technologies can be mobilized to reshape space, identity, and memory in ways that serve speculative urbanism. Framed as a revitalization of an underutilized waterfront district, the project promised to restore historical significance, improve infrastructure, and integrate the area into Rio's global city image. However, Porto Maravilha has come under sustained critique for promoting a sanitized vision of heritage while facilitating the displacement of vulnerable communities, particularly Afro-Brazilian residents whose histories are deeply rooted in this area, historically known as Pequena África. At the core of the project is the application of smart infrastructure tools to enable real-time monitoring, service optimization, and large-scale redevelopment. These technologies, including sensor-based traffic and lighting systems and digital modeling for infrastructure coordination, were intended to enhance the livability and economic appeal of the port area. Yet, as Mosciaro (2019) and de Al Sulaiti (2021) argue, the smartness of the project was less about equitable urban development and more about enabling a speculative governance model. Through public-private partnerships and the creation of the CDURP (Companhia de Desenvolvimento Urbano da Região do Porto), the project was governed

as a space of exception, removing traditional public planning checks in favor of technocratic management and land valorization strategies.

One of the most contentious aspects of Porto Maravilha is its erasure of Afro-Brazilian cultural memory. The port area was a key entry point for enslaved Africans and home to generations of Black communities who developed unique cultural, religious, and political traditions. While the project included the creation of heritage markers such as the Valongo Wharf, a UNESCO World Heritage Site, the broader transformation of the area rendered much of this history invisible. As Carranza (2021) notes, the symbolic gestures of heritage recognition did little to protect existing communities or preserve their lived connection to the space. Instead, these heritage elements were instrumentalized to promote tourism and branding, not cultural justice. Smart urbanism in Porto Maravilha thus functioned as a mechanism for narrative control. By integrating selective memory into a technologically enhanced urban fabric, the project depoliticized the space while intensifying gentrification pressures. Residents were not only priced out through rising rents and development-driven evictions, but also displaced symbolically as their stories were rewritten through digital exhibitions, architectural redesign, and curated public spaces.

Figure 9: Porto Maravilha Regeneration

Urban regeneration proposal by 3XKO for the Morro da Conceição neighborhood, one of Rio's oldest historic districts. The schematic overlays a dense parcel framework atop satellite imagery, showcasing an effort to reintegrate the area into broader redevelopment plans tied to Porto Maravilha. While framed as a community-led revitalization project, the design reflects branding and identity strategies aligned with speculative regeneration. The structured grid and emphasis on visual order mirror the aesthetic priorities of the surrounding port district, raising questions about whose vision of heritage is being advanced, and who benefits from such transformation.

Broudehoux and Monteiro (2017) describe how Porto's transformation was driven by Eurocentric ideals, replacing Afro-Brazilian identity with stylized facades and imported symbols. These interventions were backed by smart infrastructure and planning tools that helped legitimize speculative redevelopment under the banner of heritage renewal. Osorio & Versiani (2014) that Rio's Olympic ambitions allowed projects like Porto Maravilha to bypass public scrutiny. Digital infrastructure and visual design elevated the global brand of the city while marginalizing its historic communities. What was celebrated in urban form often came at the cost of cultural authenticity and inclusion.

The contrast between celebrated ruins and displaced lives highlights a key tension in smart heritage discourse: who controls the script, and whose past becomes a decorative backdrop for a rebranded urban future? Moreover, Porto Maravilha reveals how smart technologies can intersect with financialization. The use of Certificates for Potential Additional Construction (CEPACs) allowed developers to speculate on air rights and buildability, turning the port zone into a marketplace of digitalized urban futures. As illustrated by Mosciaro (2019), these instruments enabled the detachment of physical development from democratic planning, making heritage and identity subordinate to market logic.

In this environment, smart tools were less instruments of public service than components of a financial ecosystem that profited from transformation while externalizing its social costs. Porto Maravilha underscores the dangers of integrating smart technologies into heritage-led urban regeneration without safeguards for cultural continuity or social justice. It reveals how digital tools, when coupled with speculative governance, can erase rather than preserve memory, especially the memory of marginalized communities. The project offers a stark contrast to the rhetoric of innovation and inclusion that often surrounds smart city discourse. Instead of democratizing urban space, Porto Maravilha demonstrates how smart heritage can become a stage-managed spectacle that commodifies the past while displacing the present. In the context of this thesis, the case stands as a warning: without critical reflection, smart adaptive reuse risks becoming an instrument not of regeneration, but of refined displacement cloaked in historical imagery.

4.6 Synthesizing Insights: Balancing Smart Heritage and Urban Equity Across Cases

The four case studies presented in this chapter, Battersea Power Station in London, Xintiandi in Shanghai, Msheireb Downtown in Doha, and Porto Maravilha in Rio de Janeiro, reveal a layered and often contradictory relationship between smart technologies, heritage conservation, and the social dynamics of urban regeneration. Although these projects operate within different political, economic, and cultural frameworks, they share a common thread: the integration of smart city technologies into heritage contexts often reshapes not only the built environment but also the cultural narratives attached to it. As a result, smart adaptive reuse becomes a double-edged process, capable of preserving historic forms while simultaneously displacing the very communities and memories that give them meaning. One of the most evident patterns across all four cases is the instrumental use of smart technologies in framing cultural identity and urban memory. From BIM and 3D modeling in Battersea (AlHammadi, 2023) and Xintiandi (Ren, 2008) to digitally guided master planning in Msheireb (Eddisford & Carter, 2017) and smart infrastructure overlays in Porto Maravilha (Mosciaro et al., 2019), these tools were employed not merely for functionality but as mechanisms of aesthetic and ideological control.

This heatmap visualizes the relative intensity of displacement types, physical, symbolic, and cultural, across the four case studies. Xintiandi and Porto Maravilha show consistently high scores in all categories, highlighting the deep layers of exclusion embedded in their smart heritage strategies. Msheireb shows limited physical displacement but still scores high in symbolic and cultural erasure. Battersea's transformation, while visually preserved, still embodies significant symbolic and cultural displacement through market-driven reinvention.
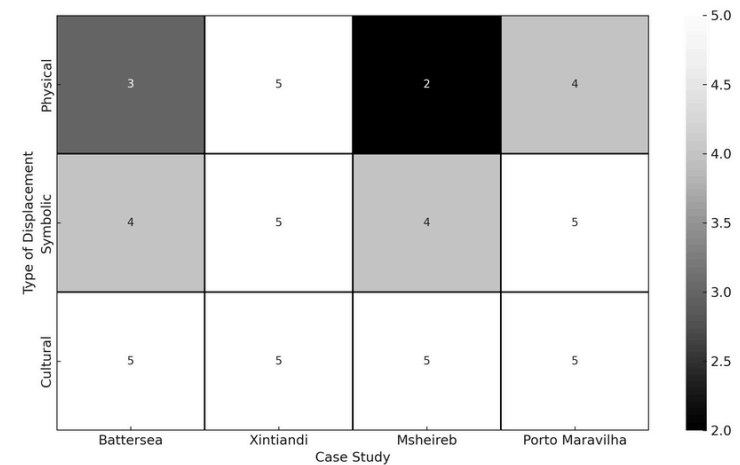

Figure 10: Displacement Impact Heatmap Across Case studies

Case Study	Physical Displacement	Symbolic Displacement	Cultural Displacement
Battersea	Indirect (gentrification)	Cultural erasure via repurposing	Consumerized identity
Xintiandi	Direct evictions	Simulated facade	Aestheticized tradition
Msheireb	Minimal	National narrative scripting	Curated memory
Porto Maravilha	Partial relocation	Selective heritage branding	Afro-Brazilian erasure

Table 5: Displacement Types Across Case Studies

In each instance, technologies were used to produce polished visual narratives of the past, ones that aligned with economic goals or political ambitions, but often disregarded the lived experiences of marginalized groups. What is remembered, and how, was shaped less by historical complexity and more by what could be monetized or branded.

The four cases demonstrate a shared pattern: smart tools can either reveal or distort heritage, depending on how they are deployed. In Xintiandi, smart visualizations enabled the reconstruction of nostalgic facades while masking mass displacement (Qian, 2016; Ma, 2022). In Msheireb, technology reproduced architectural tradition without restoring the community it once held (Boussaa, 2021; Gharib, 2014) Battersea's conserved structures became decorative symbols within a luxury landscape (Phillips et al., 2024; Morezzi, 2017). Porto Maravilha used digital governance and design to rewrite Afro-Brazilian identity into a marketable story (Broudehoux & Monteiro, 2017; Osorio & Versiani (2014)). What emerges from this comparison is that adaptive reuse in smart cities has increasingly shifted from material preservation to what might be termed narrative construction. These projects do not simply conserve buildings, they reshape their symbolic meaning. This transition is particularly visible in Xintiandi's romanticized reimagining of working-class Shikumen housing (Al Sulaiti, 2021), in Msheireb's digitally reconstructed national

image (Eddisford & Carter, 2017), and in Porto Maravilha's selective memorialization of Afro-Brazilian history (Carranza, 2021). In each case, the physical markers of heritage remain, but their meanings are repackaged and simplified, often for touristic appeal or investor confidence. Cultural identity becomes a visual product, designed for legibility rather than authenticity.

In addition to reshaping cultural identity, smart adaptive reuse projects also produce economic effects that merit critical reflection. In addition to cultural and symbolic consequences, adaptive reuse projects also bring measurable economic effects. Scholars acknowledge that heritage redevelopment often results in increased tourism, job creation, and rising land values, particularly in projects framed within smart city strategies. However, critical research challenges the assumption that these benefits are equitably distributed or inherently positive. For instance, studies show that while visitor numbers often rise post-redevelopment, tourism tends to benefit wealthier consumers and can trigger displacement, as seen in cases like Xintiandi and Porto Maravilha (Lin et al., 2023; Zhu & González Martínez, 2021). Similarly, although employment opportunities are often cited as outcomes, surveys reveal that local

populations may see little change in real income or access to these jobs (Pongsermpol & Upala, 2017). Moreover, property value increases typically concentrate around high-end developments, further accelerating class-based exclusion in redeveloped districts (Bertacchini et al., 2024). These findings emphasize that while economic gains may emerge from adaptive reuse, they should be treated as secondary outcomes, not as the primary justification for transformation, particularly when such gains come at the expense of cultural memory or equitable participation.

Importantly, the outcomes of these projects are not determined solely by the technologies themselves, but by the governance models and power relations that shape their implementation. State-driven initiatives, like Msheireb, can still reinforce exclusion when they lack genuine public engagement (Al Sulaiti, 2021). Conversely, private-led projects, like Xintiandi or Battersea, illustrate how heritage can be commodified when guided by speculative interests (Melhuish, 2016). Porto Maravilha shows how both dynamics can converge, where state authority and market speculation use smart tools to transform urban memory into real estate value (Mosciaro et al., 2019). These cases suggest that smart heritage is not a neutral or universally beneficial strategy. It is a highly malleable process,

capable of being shaped by competing ideologies, political agendas, and commercial imperatives. While smart technologies have the potential to document, simulate, and visualize cultural memory with unprecedented accuracy, their application often flattens historical nuance, simplifies contested pasts, and constructs selective imaginaries. The issue is not simply technological but fundamentally ethical: whose heritage is preserved, who controls the tools of preservation, and who benefits from the outcome?

Moreover, the global comparison reveals that while the smart city discourse promotes innovation, efficiency, and connectivity, it often masks deeper struggles over identity, representation, and access. In all four cases, heritage becomes a terrain of negotiation, between old and new, public and private, visible and invisible. Adaptive reuse, when combined with smart systems, becomes less about retaining physical structures and more about managing collective memory. When embedded within speculative urbanism or top-down governance, this management frequently translates into exclusion. What these case studies reveal is that smart heritage is not inherently inclusive or exclusive, it is context-dependent, and shaped by whose interests drive its design. If left unchallenged, smart technologies risk being appropriated by dominant forces to flatten historical memory,

aestheticize displacement, and displace the communities they claim to honor. Yet the potential also exists for these tools to democratize memory, enhance access, and empower local narratives, if embedded in critical, participatory, and equity-focused frameworks. This synthesis reinforces the broader argument of this thesis: the adaptive reuse of historic buildings in smart cities is not just a technical exercise, but a deep political process. To move toward truly inclusive urban regeneration, smart heritage practices must resist becoming simulations of authenticity. They must instead foreground contested memory, support cultural diversity, and enable new forms of civic engagement. Only through this shift can the promise of technology be reoriented toward justice rather than spectacle. Ultimately, these comparative insights directly reinforce the central academic question of this thesis: while smart city technologies can technically facilitate the adaptive reuse of historic buildings, their impact on cultural identity and social equity is shaped by deeper political and institutional forces. Whether smart heritage serves as a tool for inclusive regeneration, or a mechanism of exclusion depends not on the tools themselves, but on how and why they are deployed. It is in this tension between innovation and inequality, preservation and displacement, that the future of heritage in smart cities will be decided.

To visually consolidate the critical insights explored throughout this synthesis, the following table presents a cross-case comparison. It highlights the relationships between technologies, governance models, heritage strategies, and their respective socio-spatial outcomes. This comparison clarifies the contrasting logics of inclusion and exclusion that shape smart adaptive reuse across diverse contexts.

Project	Technology Focus	Governance Dynamics	Heritage Approach	Displacement or Inclusion	Critical Reflection
Battersea Power Station (UK)	BIM, smart energy, monitoring systems	Private-led redevelopment with symbolic public presence	Heritage framed as luxury asset	Symbolic and material exclusion of lower-income groups	Smart tools used to support elite-driven urban renewal
Xintiandi (China)	Digital simulation, curated traditional façades	Government-corporate partnership	Cultural heritage used as consumer attraction	Full displacement of original residents	Smart reuse aligns with heritage commodification
Msheireb Downtown (Qatar)	AR, digital archives, smart planning systems	Centralized state-led initiative	Local heritage integrated into modern design	Minimal direct displacement, but high-end exclusivity	Heritage employed to build a controlled national identity
Porto Maravilha (Brazil)	GIS, surveillance, mobility networks	Complex public-private financial instruments	Memory through selective monument preservation	Mass displacement and speculative housing development	Smart regeneration linked to land valorization and socio-spatial inequality

Table 6: Comparative analysis of smart heritage reuse projects across case studies

4.7 Charting a Path Forward: Smart Heritage Reuse for Inclusive Urban Regeneration

The analysis presented throughout this chapter has highlighted that while smart city technologies can contribute meaningfully to the adaptive reuse of heritage spaces, they also carry the risk of reinforcing systems of exclusion and cultural erasure. If the future of smart heritage is to genuinely support inclusive urban regeneration, then it must shift away from frameworks focused on visual appeal and speculative gain, and toward models that prioritize cultural authenticity, shared memory, and spatial justice. This final section proposes a set of forward-thinking strategies rooted in the lessons learned from the four case studies, offering practical and ethical directions for future action.

To begin with, it is essential to center community participation in all stages of heritage redevelopment. Across the case studies, especially Xintiandi and Porto Maravilha, the absence of local voices resulted in symbolic displacement and selective representation (Martínez, 2021; Carranza, 2021). Inclusive co-design, participatory mapping, and community-led heritage archives are not optional add-ons; they are necessary processes for ensuring that technologies support, rather than overwrite, local knowledge and identity. Community-driven planning must be recognized as an integral part of both technological development and heritage protection, with policies structured to guarantee accessibility,

transparency, and responsiveness to culturally specific needs. In parallel, we must challenge the dominance of aestheticization over authenticity. The visual smoothness of digitally modeled reconstructions as seen in Battersea and Msheireb, can obscure layered, sometimes uncomfortable, histories (AlHammadi, 2023; Eddisford & Carter, 2017). While tools like BIM and AR can enhance access and understanding, their application should be guided by critical interpretation, not just visual impact. Smart heritage should reflect complexity, acknowledge contested narratives, and resist turning memory into marketable spectacle. This also means rethinking how visual representations are curated, ensuring that what is rendered digitally does not become detached from the social realities of heritage. Third, a more ethical approach to smart heritage requires confronting the economic logics of exclusion embedded in many urban regeneration models. Too often, adaptive reuse becomes a strategy to attract elite capital, not retain cultural community (Melhuish 2016). Public policy must actively counter this trend, through inclusive zoning, legal protection for cultural tenants, and technology used to track displacement risk. Smart systems can support this by providing transparent data on social impacts and holding stakeholders accountable to equity outcomes (Mosciaro et al., 2019).

More critically, they must be configured to expose patterns of exclusion and to support reparative practices that restore displaced communities' rights to space, history, and representation. A fourth step forward is embracing cultural pluralism and contextual design. The case studies show that no single model of smart heritage reuse fits all cities or communities. Future projects must embrace diversity, not only in architectural forms but in values, histories, and uses (Al Sulaiti, 2021). This calls for flexible platforms that evolve with the community, rather than impose static narratives. Technologies must be designed to accommodate multiple readings of heritage and adapt over time, rather than locking communities into narrow, institutional definitions of what should be preserved or how it should be visualized. Finally, we must redefine how smart cities engage with the politics of memory. Heritage is not fixed, it is dynamic, lived, and contested (Carranza, 2021). Smart technologies should be used to open up space for dialogue, not close it. This means investing in tools and platforms that amplify marginalized histories, support grassroots storytelling, and reconnect people with place through creative, critical, and inclusive means. The digital archive must become a living one, capable of evolving through collective input, and responsive to the shifting contours of urban identity and memory. This includes

supporting multilingual, multi-sensory, and non-linear modes of historical representation that challenge dominant visual paradigms.

Together, these strategies point to a new paradigm: one in which smart technologies are reclaimed as tools for collective empowerment, not just urban efficiency. As this chapter has argued, the challenge is not about abandoning innovation but about using it wisely. A just model of smart heritage reuse is not one that polishes the past for display, it is one that reckons with it, preserves its depth, and makes space for those often left out of its telling. Only then can we move toward urban futures that honor memory while protecting the right to remain. In the end, the role of smart technologies in heritage must not be defined solely by their technical sophistication, but by their capacity to serve public memory, social inclusion, and urban justice. Moreover, if smart heritage strategies are to succeed globally, they must be attentive to uneven access to digital tools and platforms across geographies (AlHammadi, 2023). The ability to preserve and share cultural memory through smart technologies must not become a privilege of wealthier cities or institutions, but a right extended across regions, histories, and communities. Achieving this vision requires interdisciplinary collaboration among architects, historians, technologists, and community

stakeholders, working together to ensure that digital heritage practices remain inclusive, equitable, and responsive to the communities they intend to serve. Boussaa (2021) cautions that heritage without people is only façade. Msheireb's revival of form did not equate to revival of meaning. Likewise, Ma (2022) shows how intangible cultural practices are difficult to capture through smart systems and are often overlooked in favor of neat visuals. Morezzi (2017) warns that symbolism alone cannot protect memory, especially when memory is curated for consumption. If smart heritage is to be truly inclusive, it must be shaped with, not just for communities and must engage with the complexities that make heritage meaningful.

Principle	BIM Role	IoT Role	Digital Heritage Tools Role
Participatory Governance	Co-design workshop with stakeholders	Sensors collect community-driven data	Community archives integrated into AR/VR platforms
Transparency in Digital Heritage	Open-source 3D modeling processes	Transparent access to data streams	Metadata reveals authorship, edits, and sources
Community-Centered Tech Use	Local heritage needs guide modeling priorities	IoT supports inclusive public services	Tools designed for multilingual, multivocal engagement
Equity-Driven Design	BIM models consider social equity	Deployment based on social benefit, not just efficiency	Narrative layers reflect equity and contested histories
Inclusive Memory Representation	Historical modeling includes diverse narratives	IoT used to amplify underrepresented voices	Cultural memory co-curated with local groups
Digital Tools for Empowerment	Interactive models for education and access	Feedback systems for real-time citizen input	Apps for participatory storytelling and immersive learning

Table 7: Inclusive smart heritage reuse frameworks

CONCLUSION

05

Setting out to explore a crucial question: how can smart city technologies support the adaptive reuse of historic buildings in urban regeneration, while safeguarding cultural identity and addressing the risk of gentrification? Through critical analysis, it became clear that while digital tools offer valuable opportunities, their impacts are shaped by deeper political and social forces that often complicate their potential benefits. Adaptive reuse, as demonstrated throughout this research, is not simply a technical or aesthetic task, but a profoundly political process rooted in the negotiation of memory, belonging, and power. Technologies like Building Information Modeling (BIM), the Internet of Things (IoT), and digital heritage tools have expanded what is technically possible in preserving historic structures. They enable detailed documentation, more responsive conservation management, and immersive ways for communities to engage with their built heritage, as seen in examples like Battersea Power Station and Msheireb Downtown Doha. When used thoughtfully, these tools can strengthen preservation efforts and open new channels for public participation in shaping the meanings attached to historic spaces. However, the potential of smart technologies is neither neutral nor guaranteed. Across the case studies, it became apparent that digital interventions often transform heritage into a curated product

aimed at economic consumption rather than authentic preservation. In projects such as Xintiandi and Porto Maravilha, smart technologies facilitated the rebranding of historic neighborhoods into luxury enclaves, displacing the very communities whose cultural identities were meant to be preserved. In these cases, adaptive reuse shifted from a practice of protection to a strategy of commercial redevelopment.

Similarly, when examining the role of smart technologies in mitigating gentrification, the findings were mixed. Although digital platforms and sensing technologies can, in theory, enhance participatory planning, their real-world deployment often favors market-driven urban renewal, reinforcing social exclusion rather than preventing it. The celebrated economic outcomes of increased tourism or rising property values need to be critically questioned, as they often exacerbate rather than alleviate urban inequalities, offering benefits primarily to investors and new arrivals rather than longstanding residents. This study emphasizes that smart technologies themselves are not inherently emancipatory or oppressive; their outcomes depend entirely on how they are embedded within governance structures, urban policies, and cultural priorities. Heritage, when mediated through smart systems, becomes a flexible and contested field, one that can either reinforce

commodification or serve as a platform for inclusive memory-making, depending on whose interests are prioritized.

contributing to the wider academic discussion by approaching smart technologies as political and cultural agents rather than purely technical tools. It stresses the need for critical engagement in digital heritage practices, urging that technology must be wielded consciously to protect collective memory and foster urban justice, rather than passively advancing market-led redevelopment.

Beyond the specific limits of this research, broader structural barriers remain significant. Technologies are introduced into environments already marked by uneven distributions of power, resources, and recognition. Digital systems tend to highlight aspects of culture that are easily visualized or commodified, often neglecting the deeper, more contested dimensions of memory. Additionally, when heritage regeneration aligns too closely with economic logics, it risks transforming collective memory into a market asset rather than a living public good. These entrenched conditions mean that even the most ethically designed smart reuse projects must navigate a landscape shaped by profound inequalities and systemic pressures.

In light of these systemic conditions, the deployment of smart technologies in adaptive reuse cannot be justified solely on the basis of efficiency, innovation, or preservation. Instead, their deeper value must be evaluated through the lens of inclusion, cultural integrity, and urban justice. Smart tools such as BIM, IoT, AR, and digital platforms possess the potential to democratize access to heritage, foster participatory planning, and preserve layered, contested histories, but only when they are governed through frameworks that prioritize equity over optimization. From a critical perspective, these technologies are not neutral instruments; they are socio-political infrastructures that carry embedded logics of control, representation, and exclusion. As this thesis has shown, improving their use in adaptive reuse is essential, not to accelerate commodification or urban branding, but to recover community agency, challenge symbolic erasure, and foster more inclusive modes of regeneration. The future of adaptive reuse in smart cities therefore depends on reconfiguring these tools to serve cultural memory and social continuity, rather than market-led transformation.

Ultimately, arguing that the fate of historic urban environments will be decided not by the sophistication of technological tools, but by the collective values and political choices that

shape their use. Without deliberate efforts to center community agency, protect contested histories, and resist the flattening pressures of market logic, smart city interventions will likely deepen existing injustices. Yet if guided by critical, inclusive frameworks, smart technologies still have the potential to help cities preserve their diverse pasts while building more equitable urban futures.

The challenge ahead is not merely technical, but profoundly ethical and political. The future of adaptive reuse in smart cities will depend on our willingness to fight for memory, justice, and belonging as central pillars of urban life. It is within this ongoing struggle, between innovation and exclusion, remembrance and commodification, that the future of heritage will be decided. Whether adaptive reuse in smart cities serves as a platform for inclusive urban memory or as a tool for selective erasure will depend on the critical choices we make today.

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APPENDIX

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Appendix A – Visual Scoring Methodology: Displacement Impact Heatmap

This appendix explains the rationale and evidence behind the numerical scores used in the Displacement Impact Heatmap (Figure 10), which assesses the relative intensity of physical, symbolic, and cultural displacement across the four case studies. Scores range from 1 (very low) to 5 (very high), based on qualitative and quantitative evidence drawn from case study analysis, academic literature, and visual materials discussed in Chapter 4.

Battersea (London)

·Physical Displacement – Score: 3 – No direct eviction, but strong market exclusion and gentrification. (Carranza, 2021)

·Symbolic Displacement – Score: 4 – Cultural erasure through aestheticized adaptive reuse and commercial design. (Melhuish et al., 2020)

·Cultural Displacement – Score: 5 – Full transformation into global luxury space, removing working-class identity. (Phillips, 2021)

Xintiandi (Shanghai)

·Physical Displacement – Score: 5 – Forced relocation of 3,800+ residents; broader citywide demolition trends. (Ren, 2008; Qian, 2016)

·Symbolic Displacement – Score: 5 – Simulated historicism via façade preservation and 3D modeling. (Martínez, 2019)

·Cultural Displacement – Score: 5 – Social memory erased in favor of tourist branding. (Broudehoux & Monteiro, 2022)

Msheireb (Doha)

·Physical Displacement – Score: 2 – Minimal displacement; some land clearance but no mass evictions. (Al Sulaiti, 2018)

·Symbolic Displacement – Score: 4 – Controlled visual scripting of national tradition, excluding migrant narratives. (Gharib, 2014)

·Cultural Displacement – Score: 5 – Curated memory, reinforced through surveillance and zoning. (Melhuish et al., 2020)

Porto Maravilha (Rio de Janeiro)

·Physical Displacement – Score: 4 – Displacement through land transfer, evictions, and redevelopment pressures. (Mosciaro, 2020)

·Symbolic Displacement – Score: 5 – Selective use of heritage to legitimize speculative planning. (Luduvice, 2022)

·Cultural Displacement – Score: 5 – Marginalization of Afro-Brazilian memory and practice. (Osorio & Versiani, 2022)

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