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Managing Facilities in Historic Buildings: A Stewardship-Based Strategy for Long-Term Socio-economic Value

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Abstract: The challenges of historic building adaption for reuse are well documented and often refer to building fabric, listed status, historical significance, environmental sustainability, and structural layout as limitations to their successful re-development. However, few studies have explored how such issues manifest in the operational use of historic buildings developed for reuse, the significance on cities, and the long-term socioeconomic value. This study proposes a stewardship-based strategy to manage facilities to improve the socioeconomic value of historic buildings and support the socioeconomic demand in cities and territories. Within the context of a selected case study in the UK, a mixed-method approach was used to attain the data. Quantitative evidence, using a questionnaire survey with building users, and qualitative evidence, using semi-structured interviews with the facility management team, are presented. The results suggest that historic buildings are empowered by an organisational stewardship strategy, resulting in an acceptable operational compromise that involves an acceptance of building issues and their impact on the building users' experience, and this can support the more operational adaption of facilities by the facility management team. The research proposes a stewardship-based strategy to support an improved socioeconomic value by incorporating user perspectives while ensuring a less preservation-centred and a more flexible-oriented approach towards managing facilities in historic buildings. This study constructively forms a base for further research into facility management strategies in historic buildings and their impact on cities' needs.

Keywords: historic building; facilities; users; socioeconomic; stewardship; cities; territories; land; urban land

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1. Introduction

The UK is replete with buildings of historic value or significance. For example, the BRE Trust suggests the UK has some of the oldest housing stock in Europe, with 35% of homes in the UK built before 1945 [1]. Historic Buildings (HBs) can be considered as having heritage, a broad concept that encompasses the importance of landscapes, places, or sites [2]. The heritage significance of places or built assets can be related to their cultural, historical, economic, or political importance [3]. Historic England (HE) is the body whose role is to monitor, report, and advise on all aspects of England's historic environment [3,4] with Section 1 of The Planning (Listed Buildings and Conservation Areas) Act 1990 allowing for the creation of a list of historic assets to provide legal protection to those buildings [5]. Indeed, buildings that are identified as having historical significance and defined as Heritage Assets will then merit consideration in local planning decisions [6]. The 'listing' of buildings considers traits such as rarity, state of repair, age, aesthetics, and

national interest [7], with listed buildings being judged and awarded a Grade to reflect their relative special architectural and historic interest [5]. Grade I buildings have exceptional historic interest, making up only 2.5% of all listed buildings, whereas Grade II listed means particularly important and of more than special interest (II*) or of special interest (II), and make up for most listed buildings [8]. More importantly, inclusion on the list places limitations or barriers to the adaption or alteration of whole or parts of those buildings on the list, depending upon their historical significance.

For historic buildings, adaptive reuse is considered to be crucial, as it supports maintaining the significance of the historical assets, considers new usage requirements, supports sociocultural demands and environmental regulations, and offers an alternative solution for the growing demand in cities and regions [9]. As a form of sustainable urban regeneration, adaptive reuse can be a key solution to our cities by extending the building's life while providing social and economic benefits for the urban territories and their communities [10]. However, the Heritage at Risk register for England highlights over 2000 entries of buildings, structures, or places of worship deemed to be at risk of dereliction through neglect, deterioration, or decline [11]. Adaptive reuse can increase the life and sustainability of a building with reductions in material use, energy consumption, and pollution associated with demolition; this suggests it is more cost-effective to convert old buildings to new uses than to demolish and rebuild them [12]. However, some argue that the biggest threats to HBs are added barriers, complications, and costs to planned adaptions associated with listing [7,9]. If a building cannot be adapted, it may limit its functionality, making it not investable and increasing the likelihood of further dereliction [13]. Therefore, there exists a tension between the desire or need to preserve HBs and their heritage and the business case to develop and maintain them and subsequently provide investment and ongoing protection for those sites through development, occupation, and maintenance. Such issues can potentially limit the range of new functions that can be imposed on the building [9]. However, the occupation and use requirements of a building and its users, and any subsequent impact on internal reorganisation requirements (for example, changes in staffing levels, additional environmental requirements, and updates to technology), can change over time and should ideally be considered in advance of any project but will inevitably need to be considered at later stages of the building life cycle [12,14]. While there may be existing studies on historic preservation and adaptive reuse, there is limited research that explores the practical strategies and economic implications of managing facilities in sustaining historical assets. Inevitably, facilities management (FM) is responsible for the efficient and sustainable operation of buildings over their entire life cycle. Furthermore, FM strategies can significantly impact the economic viability, environmental sustainability, and user satisfaction of historical buildings adapted for reuse. Indeed, historical buildings often face a delicate balance between preserving their heritage value and ensuring economic viability. Facilities managers are uniquely positioned to address this balance by implementing strategies that maximise asset value while safeguarding the historical significance of the building; this, therefore, places a spotlight on the role of facilities management (FM) in HB reuse and their capacity to adapt assets to the needs of the users with people, place, and process considerations [3,15]. Furthermore, it highlights the role of FM in the ongoing occupation and use of a listed building, given planning constraints associated with listed status.

The arguments presented above highlight the important practical and strategic role FM can play in the ongoing management of HBs adapted for reuse. However, little research exists on the maintenance and monitoring of HBs, with a dearth of contributions around FM applicable knowledge and strategies in HB conservation [15,16]. It is highlighted how there has been little research regarding the development of conservation plans into appropriate action [17]; critically, there has since been no development on how these may have been experienced or acted upon during HB occupation and use. On the one hand, whilst current research acknowledges the importance of managing facilities in HBs to achieve long-term use, it is considerably limited in exposing strategies that balance economic value for the

organisation and achieving occupants' expectations. On the other hand, there are many challenges that pertain to maintaining stewardship value within listed buildings, and this can limit strategies that can be implemented to maximise asset value and satisfy occupants' needs and requirements. Therefore, this study aims to explore effective FM strategies for the occupation of listed buildings following their adaption for reuse to achieve socioeconomic value and reduce environmental impacts.

2. Literature Review

2.1. Challenges within Historic Buildings and the Urban Fabric

It is argued that repurposing HBs is a more sustainable strategy than new construction [18]. Bullen and Love [12] argue that converting old buildings to new uses can be cheaper than demolishing and rebuilding them through retention of the buildings 'embodied energy' [12]. That is, building reuse can contribute to sustainability through the retention of existing structures and fabrics, as well as by improving the economic, environmental, and social performance of buildings and lowering material use, transport, energy consumption, and pollution [3,9,12]. However, cost is only one aspect of the spectrum, with environmental benefits gaining momentum in this field. The reuse of HBs can be of significant benefit for urban and territorial infrastructure, as they offer solutions in the current building/housing crisis and become a key sustainable solution. The extension of a building's life avoids waste coming from demolition and, therefore, boosts the reuse of embodied energy [19,20]. The importance of HBs for the urban landscape does not limit itself to the local historical and cultural characteristics. However, it is being recognised as a vital solution for environmentally sustainable communities, reducing the environmental impact of buildings by increasing their lifecycle [21]. Existing older structures are more likely to contain greater thermal mass and so benefit from more passive forms of heating and cooling [22]. However, many HBs were constructed when energy costs were low, and there was no concern about climate change [23], meaning challenges, including regulatory, design, and technical factors, can affect their sustainable adaptability [3]. For example, Conejos et al. [24] used multiple case studies and in-depth interviews with industry experts to examine barriers to successful adaptive reuse projects in Australia [24]. Their results identify regulatory compliance and building design as challenges to HB reuse. Specifically, they highlight how hazardous materials and contamination can cause costly developmental delays and how sound and fire regulations require specific and integrated solutions to comply. However, adaptations to meet regulatory safety and access requirements can also be difficult due to the physical characteristics and layout of HBs. Finally, they cite HB knowledge capacity as a potential barrier to HB adaptive reuse. Therefore, whilst there may be some advantages to HB reuse in terms of economic and environmental sustainability, the development of HBs may not be without its own set of financially onerous challenges.

Maintaining cultural heritage and managing HBs come with complex challenges to stakeholder management. When one considers the adaption for reuse of HBs, the organisation proposing the development must consider the potential social impact on that asset. In that sense, the role of the FM is to carefully manage any proposed changes to an HB to avoid damaging or irreversibly destroying it for future generations [25]. Some argue that this emphasises 'stewardship' or 'curatorship' in the maintenance objectives of an FM team, suggesting an added layer of social responsibility for that asset's upkeep and care [26]. Moreover, the tradition of cultural heritage designation and evaluation is as complicated as it is long and dominated by architects, town planners, conservationists, historians, accountants, analysts, and economists. Indeed, the practices of heritage professionals and statutory authorities can often seem unclear or inconsistent [27]. Therefore, from the outset, HBs emphasise the key role of the FM to HB reuse in mediating between a growing number of stakeholders and the added complexity of the technical and operational processes involving people and place [7]. Successful reuse of HBs should respect the different heritage values, spatial characteristics, socioeconomic impact, and associated

policy guidance [28], although effective identification of end-users needs and concerns can prove challenging [12]. According to Hou and Wu [15], it was found that involving FMs during the planning phase of an HB reuse project provided operation-oriented advice to the design team on design and construction to understand the facility needs of users [15]. Their study recognised the strategic role of FM teams and, importantly, their relationship with the whole lifecycle of buildings. It is important to emphasise the role of FM in stakeholder management and how this is important in successful public involvement and service delivery, which is arguably important for the preservation of cultural heritage [28]. However, these points neglect to consider the future needs and demands of a building and its users and instead reflect decisions made at the design stage before building occupation and use.

2.2. Historic Buildings Adaptation and Reuse

Pintossi et al. [29] evaluated HB adaptions and reuse practices using a case study in Croatia [29]. Their work explored stakeholder perspectives of HB reuse challenges and proposed solutions to overcome them. Using the UNESCO Historic Urban Landscape approach as a framework, they considered issues from a multi-scale perspective, adopting a site, urban, and elsewhere approach to their analysis of a historic urban landscape adapted for reuse in Croatia. The challenges they identified were related to participation, capacity, regulation, finance, and knowledge. Importantly, the challenges identified were directly linked to the role of an FM, specifically, capacity-related challenges describing limitations in the available expertise, skills, and human resources for HB reuse and development. Equally, regulatory-related challenges highlighted difficulties in complying with local regulations, such as respecting historic materials and skills required for cultural heritage refurbishment. Knowledge and financial-related challenges were uniquely identified as evidence of overlapping challenges emblematic of strategic concerns. Finally, their participants offered potential solutions to some of the concerns raised. Interesting among them were capacity building, knowledge dissemination and production, and documentation of information because knowledge of HB construction methodologies and materials can influence proposed alterations [14]. However, their work missed those responsible for managing the challenges identified: the FMs. Such studies demonstrate that HB reuse requires strategic considerations and input from FMs and refer to the ongoing issues that could pose challenges after an HB development takes place. More importantly, most studies on HB adaptation consider the perspectives of architects and building engineers, so the solutions offered may have lacked a strategic and practical perspective due to the absence of occupants' and building management perspectives.

Other constraints to adaptive reuse can include planning constraints, modern design requirements, access, and inflexible building design [22,24]. Indeed, Lynch and Proverbs [7] argue that a significant barrier to the sustained use of HBs is their accessibility to those with disabilities. They recognise that most of the literature which focuses on accessibility pertains mainly to altering the physical make-up of buildings to create access. Lynch and Proverbs [7] argue that, whilst improving accessibility may be appealing, physical alterations to HBs may not always be achievable [7]; providing access to HBs, which could cause irreparable damage, is not likely to gain local building consent because heritage legislation takes precedence over the Equality Act (2010) [7]. Moreover, this conflicts with the minimal change advocated by existing preservation strategies [16,30,31]. In that sense, Dyson and Matthews [14] advocate that matching the function of an HB to its new purpose will ensure a greater level of site integrity, which is maintained due to the limited need for structural change and, thus, limited expensive preservation work [14]. However, Dyson and Matthews' assertion that the "good fit between the old and the new function of the building" is key to its success in reuse ([14], p. 51) emphasises the existing HB literature's focus on the design phase of a reuse project rather than how these ideas may impact the occupation and use of HBs.

Dyson and Matthew [14] identified that critical success factors of HB adaption suggest the determination of a "good fit" between old and new building functions, which means that the closer the match, the more likely an appropriate and successful conversion [14]. However, functionality in buildings requires understanding what exactly can be altered or changed because the flexibility of buildings to adapt to changing business needs or patterns of working can be a significant limiter on an FM's capacity to support or meet those needs. Duffy [32] provides a model depicting the layered nature of building elements and their respective decision-making criteria and life cycles [32]. Simply, it describes the implications and constraints on different building layers and their temporal propensity to change. For example, the site of a building, its orientation, and its neighbourhood are decisions that can only really be made once within the lifecycle of the building, whereas decisions on building systems may be taken every 3 years. Finch [33] expanded this to include their work from 2009 and provides a 'Typology of Change Readiness' describing specific workplace flexibility and relevant building layers [33]. Therefore, even though constraints may exist, limiting what is permissible or possible in HB adaption, there remains a range of options to adapt, maintain, or improve space functionality in HBs.

2.3. Facilities Management for Historic Buildings

An important part of the building lifecycle is the functionality and appropriateness of the building and its resources. In that sense, building management and maintenance are important roles FMs play in the occupation and reuse of HBs. Shiem-Shin and Hee [34] suggest that central to the idea of FM as strategic support to an organisation is the extent to which the demand for space and facilities meets the needs of the business in terms of accessibility, functionality, condition, security, and, increasingly, sustainability [34]. Challenges for businesses in meeting these needs can include the accurate anticipation of future needs, the capacity for adjustment to changing demands, and the costs of facilities, both in terms of their performance and as long-term physical assets [7,14,33,34]. Effective and efficient utilisation of space is about matching demand for an appropriate workspace to support business activities and availability in terms of timing and duration of requirements [34]. However, space use patterns are changing, which may have implications for the way businesses procure and occupy space and the provision of resources to them [34,35]. In that sense, utilisation is not only a function of the efficiency of space layout but also the flexibility space affords the organisation in terms of user churn (the capability to support group, department, or function relocation) and changing patterns of work [34]. Consequently, this will ask questions of FMs responsible for effective and efficient space use of HBs; namely how HB spaces support users, and how users appropriately access HBs as the required business resources they should be. Additionally, maintenance of HBs is deemed essential to the longevity of any structure, with well-maintained buildings offering higher quality environments and limiting risks to dilapidation, demolition, and the social and economic losses attributed to HBs decline [3,36]. HB maintenance, management, and development require, in part, a passion for older buildings and tailored strategies that include an emphasis on stewardship, curation, and maintenance of the HB fabric and cultural significance [26,37]. Barnes [38] citing the IFMA, places FM in the centre of people, process, place, and technology, reflective of the multi-stakeholder perspectives prevalent in HB reuse, and recognises the role of FMs in understanding user needs and space use and their integration in the maintenance of building fabric, services, and contents [39,40]. Therefore, FM in HBs requires careful maintenance and effective management of the historic spaces under their custody if they are to remain effective and functioning assets.

All buildings should be appropriately maintained if they are to continue their functions, though some argue that the main principle of maintenance in HBs should prioritise conservation and preservation by promoting models of minimum intervention. Dan et al. [17] argued that heritage organisations and non-heritage organisations might differ in their cultural preservation philosophy [17]. They surveyed 20 non-heritage (e.g., housing associations, universities, and diocese) and 12 heritage organisations (e.g., NGOs, national

agencies, and building trusts) about their maintenance practices. These were evaluated against the key elements of best practices for the maintenance of built cultural heritage [17], which identifies several factors of maintenance approaches. They conclude that both heritage and non-heritage organisations were falling short of best practice maintenance, though these differed between the non/heritage and non/commercial organisations. Specifically, they suggest heritage organisations lack systematic and integrated approaches to maintenance linking to wider corporate objectives, whereas non-heritage organisations adopted processes that may work against historic preservation.

Cruz et al. [41] suggested that HBs be protected through preventative maintenance and monitoring rather than extensive restoration and reconstruction. The maintenance-focused heritage building conservation model advocates an approach to maintenance appropriate for the preservation of HBs [41]. The model places maintenance at the centre of the essential components in conservation and is surrounded by relevant key drivers required for maintenance-focused conservation to function [16]. For example, monitoring through the effective use of tools and technology. Importantly, Cruz [41] places 'Repairs & Restorations' outside of the heritage maintenance cycle [41]. In doing so, it highlights the need to distinguish between maintenance and repair or replacement, suggesting that the latter will ultimately lead to an eroding of that which is important or the reason for a building's designation as heritage. However, whilst such effort primarily focuses on strategic level considerations, reflecting elements of place, process, and technology, the purist focus on the preservation of heritage neglects the point of maintenance and repurposing in the first place—to preserve the functionality of a building [7]. Therefore, the perspective missing from both works mentioned above is that of the user or people. Therefore, whilst strategies to preserve the heritage value of an asset are important, their efficacy for the functionality of HBs, their impacts on use, and their impacts on user experience are not clear. In that sense, the FM perspective, at the intersection of people, process, place, and technology [30], could be made clearer.

2.4. Facilities Management for HBs Adaptation and Reuse: The Socioeconomic Gap

Mehr and Wilkinson [42] examined technical issues related to comfort, safety, and energy efficiency in HBs in Australia [42]. They recognise that user expectations in terms of technical standards and comfort levels can change over time and argue that HBs should adapt to those expectations if they are to remain sustainable and in use. Mehr and Wilkinson's [42] results identified technical challenges relating to insulation, acoustic performance, and AC installation that did not compromise the architectural integrity and visual quality of the building [42]. These challenges pose risks to the usability of a building and, thus, require strategies to extend the working life of a building. Another study by Wang and Liu [28] aimed to establish an evaluation method of HB reuse and proposed adaptive reuse strategies based on complex adaptive system theory [28]. In so doing, they argue they provide the means to maximise the adaptive reuse of HBs whilst minimising stakeholder conflict. They analysed 32 HBs, taking testimony from 10 experts responsible for HB protection and reuse, 10 adaptive reuse researchers, 32 property owners, and 362 urban residents. Wang and Liu [28] argue that their results allow for a better understanding of adaptions to HBs and identify weaknesses that may threaten the applicability of HB reuse [28]. They suggest that this can systematically help key stakeholders plan for HB reuse. Specifically, their model highlights some useful approaches relevant to the FM of an HB. These include principal strategies for spatial efficiency, spatial quality, and utilisation of spatial features. However, as with Mehr and Wilkinson [42] above, Wang and Liu [28] do not consult with FM professionals engaged with the implementation of these strategies, and thus, their efficacy in an operational setting is not clear [28,42]. Therefore, whilst strategies exist to minimise the impact of challenges to HB adaption, reuse, and sustainability, the efficacy of those strategies and the impacts on users and operators of those buildings will need to be explored if sustainable HB reuse is dependent on successful implementation.

It has been recognised that the advantages of HB reuse may not be without their own set of numerous challenges for FMs. These challenges include a complicated array of stakeholders to manage, the impositions on HB flexibility and adaptions that may limit FM's capabilities and the careful consideration of maintenance approaches, building use strategies and their impact on the historical relevance of HBs, the impact on space utilisation, and the impact on users of HBs. The existing literature reflects a recognition of the challenges and the considerations HB developers need to be aware of when developing HBs for reuse. However, questions remain over the impact of these challenges and the efficacy of the strategies for the ongoing occupation and use of HBs. This work explores the challenges and strategies that support improved facilities management in historic buildings; this asserts the socioeconomic challenges that face adapting and reusing historic buildings, showing the need to further inquire into strategies that support maintaining stewardship whilst providing socioeconomic value for adapting and reusing historic buildings. Hence, this research will explore the role of FM strategies for the occupation of listed buildings following their adaption for reuse to achieve socioeconomic value in their territories.

3. Methodological Approach

This research aims to explore effective FM strategies for the occupation of listed buildings following their adaption for reuse to achieve socioeconomic value and reduce environmental impacts. For the nature of this research, a case study of a listed building that is adapted and currently in use as a university building was used to contextualise the findings and support providing a more informative outcome (Figure 1). In that regard, this study adopted an inductive approach where reasoning is connected to an individual context in which knowledge or events take place, moving from the specific and observable phenomena out to the generalisable [43,44]. Due to the intricate nature of the research problem, a mixed-methods approach using a sequential data collection strategy was adopted. This research employed mixed method research (MMR) to provide a more nuanced approach to exposing socioeconomic value within the scope of listed buildings [45]. The research uses convergent MMR to allow triangulation of the results and enhance a better understanding of the research problem being investigated [46]. By utilising convergent MMR, the impact of listed buildings on socioeconomic value, as well as the role FM strategies play in this field, is being explored. The primary data collection was carried out in two phases: the quantitative phase and the qualitative phase.

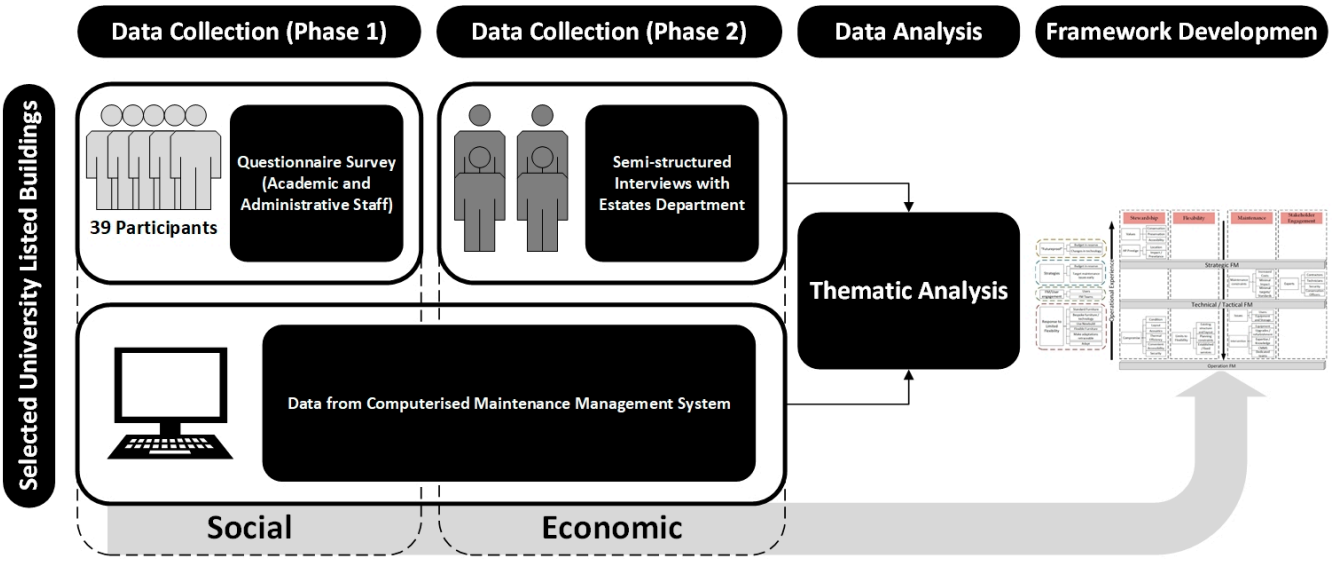

Figure 1. Research design employed in this study.

For the first phase of data collection, quantitative data using an online questionnaire survey was used to collect the data from building users, where the focus was on their experiences and issues that they encountered in the building. Online surveys allow for the collection of data from participants who may be dispersed, varied, or challenging to access [47], as could be the case with a range of building users possible in any given setting. The questionnaire survey was distributed amongst office users of the targeted listed building and shared with departmental, administrative, and facilities staff of the wider university, requesting responses from only those who work or operate in the listed buildings (Table 1). In total, 39 responses (combining participants from academic and administrative staff) were received from users of the targeted historic building. In addition to the quantitative data, data from a Computerised Maintenance Management System (CMMS) was provided by the FM team. The importance of this stage of primary data collection was to identify the day-to-day challenges of operating within an HB, which highlights its social angle. It also allowed for the identification of changes, alterations, and adaptions observed by building users and their views on the efficacy of those adoptions. Data from the university's Computerised Maintenance Management System (CMMS) was shared with the authors, which provided detailed information on the buildings and maintenance and facility job request logs.

Table 1. Interview participants' roles in the identified historic buildings.

Participant No.	Role
P1	Director of Estates and Facilities
P2	Assistant Director Estates
P3	Assistant Director Security and Operations
P4	Project Manager

For the second phase of data collection, qualitative data using in-person semi-structured interviews were conducted with high-level management to gather perceptions of FM strategy applied within the historic building in terms of identifying lessons learned, changes to practice, and recommendations for future practice. Although qualitative, open-ended questionnaires may save time in both administration and analysis [48], the limitation of such a method is to help participants answer the questions asked to them [49]. Structured interviews, in the same vein, allow for a set of questions to be asked across a range of subjects but provide limited flexibility to explore thoughts, feelings, and personal meanings. The second phase is focused on gaining experiences and perceptions from the building management team (estates department) on the adaptive use of historic buildings while incorporating the data received from CMMS. The goal of this phase was to achieve deeper insights into the economic status of the building and investigate the ways in which it is being utilised to satisfy different functionalities. In addition to the quantitative phase, findings from this phase will support constituting the right inputs for the FM strategy that will be proposed by this research.

4. Results and Analysis

4.1. Challenges in Listed Buildings

To examine existing challenges for FMs arising from the occupation of HBs, this study used information from two sources: 'Job Request data' from the university's CMMS and a Building User Survey (BUS) distributed to building users. Data provided by the CMMS showed that a total of 305 jobs were requested for the year 2021 and that 41% of the issues reported were concerning plumbing and heating (Table 2). These requests included those related to leaky pipes, heating operability, or faulty taps. The next most common issues were pertaining to electrical and building issues (31% and 21%, respectively). Interestingly, 7% were related to furniture. Specifically, these included requests to attach shelves or notice boards to the wall, as well as requests for bookshelves, chests, and cabinets, which piqued

their interest because one of the listing constraints with that building was that no fixtures or fittings be allowed on the walls.

Table 2. Data obtained from CMMS systems of the identified listed buildings.

Request Type	Description	No.	% of Listed
Plumbing: Facilities	Relating to leaks in toilette/kitchen/water fountain areas	25	23%
Plumbing: Heating	Relating to heating faults, and operation problems	12	11%
Plumbing: leaks	Relating to leaky pipes or observable water leaks other than in toilette/kitchen areas	7	7%
Electrical	Relating to lights, sockets, and power supply	33	31%
Building	Relating to decoration, building, doors, stairs, walls, ceiling, roof, and windows RWGs.	23	21%
Furniture	Relating to blinds, shelves, and notice boards	7	7%
	Total listed	**107**	100%

The questionnaire survey explored users' satisfaction, perceptions of building services, perceptions of the 'Accessibility, Suitability, and Usability' of the access and movement and toilet facilities and sought their commentary on any problems experienced, adaptions observed, and changes they might recommend. The results showed that most building users (67%) felt the buildings were sufficient for their needs. Equally, most building users felt that building access and toilette facilities were suitable and usable. However, almost half of the respondents felt the accessibility of the buildings could be better. Thematic analysis of the qualitative data from the questionnaire survey gave more insight into user perceptions of operational issues in the buildings, revealing two general dimensions: building use and user experience. Specifically, building use describes users' spatial interactions with the building and relates to building accessibility, acoustics, and space management themes. The users felt that the buildings' layout limits access to and through the buildings, noting that this could prove problematic for those with mobility issues, whilst adding how the attempts to improve access by adding a small lift were less-than-ideal due to its positioning. Users' responses suggest that whilst recognising spatial improvement attempts with the addition of flexible furniture, improved windows, and attempts to divide the spaces, they still felt that the spaces were awkward, with limited access to sockets, and were less than ideal for some teaching approaches. Figure 2, for instance, illustrates the perceptions of users on different building services. In essence, these perceptions show that the users' evaluation of building services is generally satisfactory, but issues were faced in some aspects, including temperature, lifts, kitchen facilities, IT, and ventilation.

The questionnaire survey has highlighted some issues common to HBs; the reviewed literature has emphasised how the structure and layout of HBs can act as barriers to meeting user requirements [34] or accessibility standards in HB reuse [7]. Equally, technical challenges inherent with HBs relating to insulation and acoustic performance may negatively impact spatial efficiency and spatial quality [23,28], with some citing the potential for mismatching user needs to build fabric and layout as a limitation in appropriate HB reuse [14]. Moreover, studies in education, retail [50,51], and housing [52] show how perceptions of safety and security can impact staff and end-user perceptions of operational facilities. However, the main rationale for conducting a questionnaire survey was to provide an objective account of operational issues in HBs from the perspective of building users. This section observed existing challenges that arise from the occupation of HBs, and the results from the questionnaire survey lend some support to challenges in HB reuse, but, importantly, they do so from the perspective of building users' operational experiences. Specifically, they give some insight into how an HB's structure and fabric and building layout can affect building user experiences in how they occupy and operate in HBs. They point to infrastructure, service provision, and maintenance of HB settings as having an impact on their physical interaction and sensory experiences in HBs. The objective reality

of user experiences informed the analysis of management strategy provided through the semi-structured interviews and is discussed in the next section.

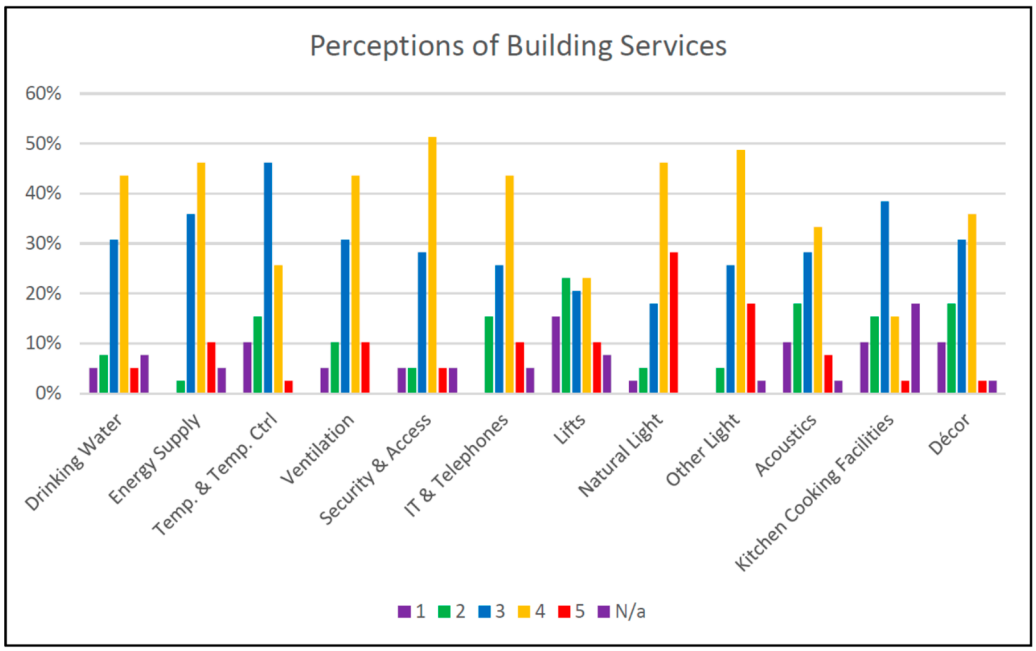

Figure 2. Building users' perception of building services.

4.2. Facilities Management Approach in Listed Buildings

The main findings from this study resulted from the thematic analysis of the four interviews and produced the general dimensions of Stewardship, Flexibility, Maintenance, and Stakeholder Engagement. The full table of themes can be found in appendix 8. The main themes within the dimensions and how they relate to the organisational management structure are discussed here.

4.2.1. Stewardship

The general dimension of stewardship supports how enthusiasm for older buildings may influence strategies that emphasise stewardship, curation, and maintenance of the HB's fabric and cultural significance [26,37]. The themes depict the university's values, its perception of HBs, and the resulting operational compromises and are indicative of strategic FM concerns akin to the general direction of travel and goals of the organisation [53]. Specifically, a perception clear from the interviews was the responsibility to conserve and protect HBs when occupying them. For example, Participant (P.) 2 stated:

> "We took the view at the time that we're merely custodians. . . (I know it's a cliché) we're custodians of those buildings".

Across all four participants, a general perception questioned the point of purchasing an HB if the intention was to fundamentally change it beyond that which makes it historic. Equally, the participants reflected that the university also valued accessibility, as with most universities, accessibility for a multitude of stakeholders is reflective of the diverse operational needs and processes commonplace in universities [54–56]. However, the participants felt that this did pose a challenge when set in the context of an HB. P.1 stated:

> "It's something that, as a university, we kind of had to achieve".

The above reflects a tension between the need to preserve and protect and the need to remain accessible [7,24]. That said, the theme HB Prestige reflected the relevance of the specific HBs to the strategic goals of the university; the importance of the HB's location and their local significance and prominence filtered the perception of those HBs justifying their acquisition. However, rather than this emphasis of the HB aesthetic informing priorities that

are less about conservation [17], the evidence here is that they may support conservation through the final theme in the dimension of stewardship: that of compromise. This theme reflected the operational implications of strategically valuing HBs and their prestige. Specifically, the theme indicated the acceptance of operational compromises relating to building conditions, layout, acoustics, thermal efficiency, security, and convenient accessibility. The theme indicates an acceptance that some indicative HB issues are "part of the character" (P.4) and something one must accept. Responses recognising that the interventions were not perfect or offered less-than-ideal solutions were also reflected here. This finding is important because it demonstrates how the strategic framing of an HB asset can influence the perception of operational issues. Existing research that has presented challenges to the successful adaption of HBs and citing sustainable adaptions [3], the need to respect heritage values [28], and identifying end-user needs or concerns is extended when positioning HBs as an asset to be preserved [12]. Rather than a problematic constraint, the results from this research suggest that HB values enable FMs and building users to accept some operational issues as a compromise, part of the aesthetic, or necessary requirement for the privilege of occupying such a space; this creates ownership over the issues likely to be found in HBs by allowing for an operational 'eyes-wide-open' approach that accepts there are things one cannot do and instead focuses on what one can do. This operational adaptability is discussed further in the next dimension of flexibility.

4.2.2. Flexibility

The general dimension of flexibility was characteristic of the challenges of having to adapt to an existing building [33]. Themes in this dimension recognised limits to flexibility, described operational responses to those limitations, and reflected considerations for "Futureproofing" operations in HBs. In that sense, this dimension pivots away from the notion of a 'good fit' between building and user needs and more toward operational adaptability indicative of reflexive practice and making the best use of the buildings in which one operates [14]. The theme 'Limits to Flexibility' describes how operations in the HBs were limited by the buildings and refers to the existing structure, services, and planning constraints. Equally, this reflects the user data from the BUS and illustrates building-related challenges in providing them with appropriate spaces. P.2 alluded to how the existing structure and layout can limit the adaption of offices into open plans:

> "Because of the structure of the building the ability to create large open-plan offices is somewhat limited".

Also, this theme indicated how planning constraints could limit teaching operations by restricting internal adaptions:

> "We couldn't put any TV screens on the walls. They [planning officers] were very protective over that. And obviously, it's quite difficult to teach with no screens on walls or no projection [equipment]" [P.2].

Furthermore, they provide an explanation of the limits to the kitchen and drinking water facilities because of having to utilise existing services and the difficulty of introducing new ones; for example, P.3 stated:

> "If you need water supplies somewhere, you know, and you've got an old building and you look at them, Yeah, I need water in here. That can be a huge business. You know, your nearest connection point is probably 50 to 200 m away".

These themes reflect how the building characteristics [7,24] and the whims of planning officers can pose barriers to adapting HBs for reuse [25]. In adaptive reuse projects, the existing literature has often cited how the suitability of the site to its intended new use is important for the long-term use of that asset [12–14]. However, it may be suggested that a 'best-fit' is indeed the ideal; the reality is never so simple, as the theme of responses to limited flexibility indicated some of the practical realities of not having a 'best-fit'. The theme responses to limited flexibility is best characterised by the word adapt. The

theme reflects the variety of strategies, often contrasting, used to adapt to the operational challenges that presented themselves in the HBs. For example, one approach suggested was to standardise office furniture and, thus, reduce the physical challenges of office moves in complicated HB layouts. However, bespoke solutions were required for some offices where standardised furniture was not appropriate. Equally, flexible furniture solutions were applied in response to the listing constraints imposed on the HBs. As P.4 stated:

> "That's something in the type of AV, IT, and furniture [that] is given. Making spaces a bit more flexible and yeah, you know, to be able to alter. . . And accepting that the envelope and the fabric; you can't do anything major to alter that. But I think the Flexibility's coming through the choice of furniture, different A.V. and the portable screens".

That said, another approach was to make adaptions retractable, for example:

> "...because we did everything in such a way that was flexible at the time ... putting something new in has had no detrimental impact on the building" [P.2].

What these themes show is how the university FMs were able to adapt and respond to the challenges imposed on operations by the existing structure or its listed status by focusing on the scenery and settings [33]. In that sense, this finding extends our understanding of adapting for reuse by emphasising the strategic implication compromise plays in an FM's operational decision-making. It suggests that, rather than a static acceptance of a building's best-fit (or not), an FM can act flexibly, draw upon their toolbox, and provide a workable solution. However, flexibility does not just refer to building structure or fabric; it can also refer to the flexibility that space affords the organisation in responding to changing circumstances and ways of working [34,42]. The theme futureproof referred to the FMs' awareness of what may happen and how they may have to adapt to suit. Both this theme and response to limited flexibility were positioned alongside 'Operational Experience' in last figure to illustrate how they reflect experiences that pose questions at the strategic level. For example, homeworking practices and changes in technology can mean changes in usage patterns for buildings that may then require a re-evaluation of how that building functions or what purpose it serves; as P.2 stated:

> "Well, people are working differently nowadays, aren't they? My first question is, does MH need to be an office block anymore? Do we need as many cellular offices as we've currently got? That's a wider discussion for the university to have ... People use laptops now, whereas at the time when we built [CH and RI's server room] laptops were not the norm. Every student has a laptop now. They didn't have a laptop or an iPad when we built that building. It was a plug-in PC, and that's where you shall work. [it] Doesn't work like that anymore".

This is indicative of the feedback function the operational level provides to the strategic level [57]. How spaces are to be changed and what function they then serve will inevitably be dictated by the organisational strategy, but the most appropriate usage and adaptions for those spaces are informed by operational experience. Therefore, this section shows how HBs are not strictly limited to a 'best-fit' approach to adaptive reuse; instead, it shows how FMs are able to adapt to the needs of users within the constraints of an HB and how those adaptions are indicative of what works best in those spaces and, therefore, the most appropriate means to meet organisational strategic demands.

4.2.3. Maintenance

The general dimension of maintenance reflected maintenance issues and constraints that one may expect from the occupation of an HB. Equally, it gave insight into maintenance interventions in an HB and alluded to suggestions for future practice relevant to HB maintenance. Specifically, the issues evident from the analysis of the interview data reflected results from the analysis of the BUS, pertaining mainly to dampness, temperature management, and draughts from windows. Interestingly, one issue concerned the storage of

operationally important equipment; this suggests that maintenance issues pertinent to HBs are not only important due to their impact on user experience but also can negatively affect ongoing operations by limiting the storage of or damaging important equipment. Interview participants perceived cost to be a constraint to HB maintenance and are indicative of the existing literature. However, participants noted the objective of having a minimal impact as a constraint to making potential adaptions or improvements due to the need to protect the HB image or heritage. Whilst this may be preferable in HBs [17,41], motivation to make potentially needed refurbishments or repairs could be limited due to the lack of external regulation or non-enforceable guidance [13], as evident when P.1 said:

> "It's a 5000 square metre building in a 95,000 square metre estate. So, [heating costs are] relatively small, it's got an energy efficiency of D on our EPC, so it's not great, but it's not terrible. It's not our worst building".

This could highlight the precarity of HBs and their condition being determined by the owner organisation [17] and may influence whether a planned preventative or reactive maintenance strategy is preferred [16]. Importantly, maintenance interventions apparent in the analysis were reflective of a maintenance-centred approach proposed by Cruz's Maintenance-Focused Conservation Model [41]. Maintenance interventions at the university suggest that tools and technology, including the application of a CMMS, were useful operational maintenance strategies. Equally, they highlighted the relevance of expertise and knowledge with the creation of dedicated maintenance teams. Knowledge and capacity for the specific requirements of HB restoration, development, and conservation have been identified in the literature as in need of curation and cultivation, with P4 suggesting [14,24,29]:

> "A dedicated team working down [on that campus]. They get to know the buildings there. They get to know what the issues are in each area. They get to know the buildings as well".

This finding suggests that a CMMS, the deployment of specialist equipment, and having specific teams dedicated to HB maintenance and management could be useful strategies in a maintenance-centred approach in HBs.

Finally, P.2 suggested that it was important to keep some budget in reserve for specific issues that one may predict arising in an HB reuse project. Similarly, P.4 advised that budgets be targeted towards interventions that prepare against damp early in the development of HBs; this supports strategies proposed by Mehr and Wilkinson [42] for extending the working life of an HB reuse project. Equally, these points reflect the fact that issues with HBs are not too difficult to predict, but targeted intervention early on could limit the maintenance commitment at the latter stages of HB occupation. In that sense, a minimal impact and maintenance-focused approach prioritising early intervention and budget preparedness can mean less damage through interventions required later [15,41].

4.2.4. Stakeholder Engagement

As with Cruz [28], Wang and Liu [29], and Pintossi et al. [41], this research highlights the importance of communicating with stakeholders. Specifically, the general dimension of stakeholder engagement suggests that experts and users are engaged early in the process of HB reuse. Firstly, at the tactical level, the importance of engaging with technicians, contractors, and specialists early in a reuse project will provide greater insight into the impact any constraints will have on operations in HBs. For example, P.3 said of security:

> "You talk to the CCTV company before. [ask] Can you come and have a look at this room? Tell us what we need to do".

By "talking to the right people" [p.3], FMs can develop a more acute understanding of what will and will not work in the HB prior to occupation and allow for better operational preparedness. Equally, it will allow for more meaningful communication with the conservation officers. One of the key reflections from the participants in this study

was the relationship with the conservation officers and how they should be nurtured and maintained. P.3 said:

> "One of the key things is [to] get your conservation officer on-side. Bring him (sic) on the journey, keep them informed".

Also, P.1 stated:

> "I think if we were doing it tomorrow, they would have a different approach . . . I think we're probably a bit braver in saying what we want these days than we used to be. And that comes from good relationships".

This way, decisions regarding building adaptions deemed necessary may be better informed as to their impact on the operation and use of the HB because ultimately, as P.1 said:

> "it has to be functioning as a building as well for our purposes and for the next 50 years or it's no good to anyone. . . if occupiers like the university don't come along and do the right thing in all probability these buildings will just continue to decline. . . [Planners]".

Finally, this general dimension highlights the role of users and FM staff as valuable for informing HB use and development strategy. It emphasises the potential contribution offered by FM teams and building users, suggesting that those views should be sought at the earliest practical point in the development of HBs as they have the most to offer in terms of practical considerations of the physical, spatial, and operational constraints present in an HB.

5. Discussion and Practical Implications

To explore effective strategies for facility management in historic buildings, this study utilised a university and two of its HBs as a case study. Users of those HBs were surveyed, CMMS data from those buildings were analysed, and members of the FM team were interviewed to give a multifaceted and detailed perspective of operating in an HB. Interview and survey data were thematically analysed to identify themes pertinent to the participants' experiences of operating in an HB and to garner their views on approaches necessary for the continued operational delivery of university services in that context. Key findings from that analysis are presented in a framework (Figure 3) utilising the concept of organisational management levels comprising strategic, tactical, and operational for the results' meaning to be understood more widely. The key findings based on that framework are as follows:

The first key finding is that stewardship as a strategic concern has given an alternative perspective to the current and dominant HB discourse consisting of the drive for sustainability [3], the effect of heritage regulation [28], and HB usability [12] as limitations on HB reuse. Specifically, the findings presented here suggest that rather than a constraint, limitation, or barrier to the development of HBs, stewardship, if perceived as an organisational strategy and shaped by the organisation's desire to protect the HB, can enable FMs and building users to accept operational issues as a compromise, part of the aesthetic, or a necessary requirement for the privilege of occupying such a space; this is particularly pertinent when considering historic buildings, such as monuments, where the life cycle costs are primarily composed of restoration expenses [58]. In fact, one of the recent studies discussed the complexities and challenges faced when preserving and maintaining historic buildings. The study presented the heritage and economic importance of ongoing maintenance and early repairs and proposed a system for their planning [59]. However, within the context of operational costs to preserve the economic value of historic buildings, preserving stewardship is still seen as one of the complex challenges [60]. Therefore, the stewardship-led FM strategic perspective presented in this study provides an overarching approach that recognises the importance of stewardship while informing tactical or technical constraints imposed on operational approaches to maintain a sustainable balance between economic and historical aspects of the building [3,36]. The strategy acknowledges that different

organisations will have different priorities when it comes to the preservation of HB and built heritage [31]. This overarching positioning could influence the prioritisation of preservation, conservation, and access and, thus, have the potential to alter the implication of stewardship as a strategy. Further research should consider the operational approaches in HBs and user experiences of HBs in other organisations, both non-profit and public, to see how their results differ—for example, hospitals and office-based businesses.

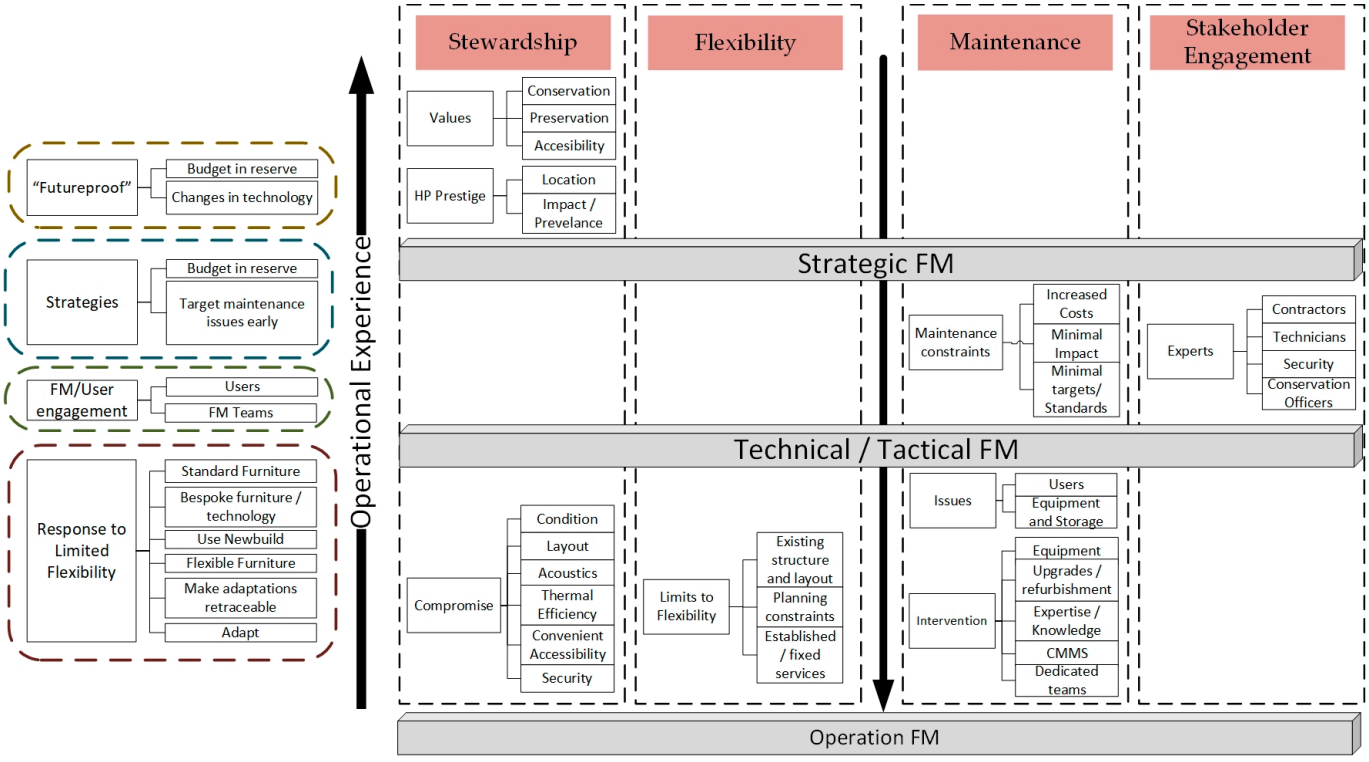

Figure 3. Proposed FM framework to drive socioeconomic value in historic buildings.

A second key finding related to operable flexibility and involved strategies for adaptive FM. This finding contrasts with the notion that HB reuse and development should represent a 'good fit' between the existing building and its intended use [14] for two reasons: First, the impact of operational experience reflects building operation and use as a continuing, dynamic process. Specifically, adaptive operability is not just adapting to fit an existing space or deploying the most appropriate organisation resource to that space; it is about learning how that space works, recording how users respond to its issues, and keeping track of how user-needs adapt and change over time; then, feeding that back to inform future strategy and ultimately future HB use and development. Secondly, this finding shows that HB constraints were not as limiting as a part of the literature suggests, and instead, the nuance was more discerning of an intelligent and adaptable FM workforce; specifically, given the strategic acceptance and compromise toward HB-related building issues, FMs in the case study were empowered to adapt and respond to the challenges presented to find the best iteration of space use, contents, and user requirements. This research argues that this can create ownership over issues likely to be found in HBs by allowing for an operational 'eyes-wide-open' approach, which requires a collective and collaborative approach. However, it must be said that the premise of 'operable flexibility' determined the acceptance of compromise and governed the strategic valuing of the HB aesthetic, feel, and prestige; in that regard, the freedom to act flexibly is, in some way, related to the type of user; in this case: students and academics. It is possible that those users may respond differently to HB-related operational issues, and that change may have various implications in other business settings. For example, would corporate office staff be

so readily willing to accept an office that is cold in the winter, or would a hospital patient be pleased to be treated in a room where damp persistently affects the ward walls? Exploring the implications of user-defined HB operational issues and how FM teams respond to them would help develop our understanding of effective FM strategies for operating in HBs.

Finally, this work has demonstrated that engaging with building users and FM teams can offer important contributions and insight into the ongoing operations and management of HB use. Specifically, it has given insight into how an HB's structure, fabric, and building layout can affect building user experiences in how they occupy and operate in HBs. Building users point to infrastructure, service provision, and maintenance of HB settings as having an impact on their physical interaction and comfort in HBs. Importantly, the perspective of building users' operational experiences is a perspective seldom provided in the HB literature. When one considers the notion of compromise, this finding demonstrates the importance of garnering the views of building users as important to discerning the impact and prevalence of HB operational issues. The views of users can then inform future HB adaptions and assist in the prioritising of maintenance works or refurbishments. Equally, this work suggests that by consulting early with users and FM teams, along with developing relationships with planning officers and early consultation of appropriately trained technicians, organisations can develop a clearer operational picture of the implications of occupying an HB and work to limit the impact operational issues that may develop later in the building life cycle and, thus, a potentially useful strategy for those intending to develop HBs for reuse. However, it must be noted that building users in this study were not asked about their disability status, and thus, it is not clear whether any of the participants were of limited mobility or users of wheelchairs; this could have influenced the perspectives of building accessibility and skewed the focus of operational issues. Equally, the extent to which an organisation can deploy its resources to consulting with specialist teams or responding to early user requests during the construction stage is limited in part by that organisation's budget. Therefore, future research should consider the specific experiences of building users with disabilities in HBs and investigate other types of businesses where their budget priorities may be different from those of a university.

6. Conclusions

This research was set to explore effective FM strategies for the occupation of listed buildings following their adaption for reuse to achieve socioeconomic value and reduce environmental impacts for the buildings, as well as the wider area or neighbourhood and city. The value of historic buildings is often discussed, but it usually does not take into account the benefits of reuse and the impact on the community or the landscape. The literature demonstrated that a number of studies have looked into the adaptive reuse of historic buildings, but limited research focused on the role facilities management plays in terms of balancing economic value for the organisation while satisfying occupants' expectations. Additionally, it has been highlighted that there are many challenges that pertain to maintaining stewardship value within listed buildings. Following the findings from the mixed methods approach in this research, the authors argue that the reuse of HBs can be a vital solution for dense urban settings to address the pressure on the lack of buildings and play a key role in urban regeneration, minimising environmental impacts. The benefits of historic building reuse vary; expanding a building's lifespan can result in the reuse of embodied carbon, minimise waste, provide for the community, preserve cultural characteristics and the character of the area, reduce further construction in the neighbourhood and overall be part of a wider sustainable urban development.

The current huge demand for commercial, residential, public, or private spaces in our cities and regions does not only pose a threat to the landscape and territories but also to our societies and communities. The development of a holistic approach on the wider urban/territorial land, taking into account the new uses HBs can accommodate, could potentially result in several benefits for the city, society, the economy, and the environment. This research provides a more holistic approach to how facilities management can support

the repurposing of historic buildings, but it also suggests that a wider framework on landscape and urban design in relation to historic buildings is required. Whilst this study examined a mechanism towards managing facilities whilst maintaining stewardship in HBs, future work should investigate enriching the outcomes identified in the study; this can be the further expansion towards a sustainable city and community and how this can be integrated in relation to flexibility and maintenance. Future studies should also look into the evaluation of the proposed FM strategy in other HBs, such as museums and offices, where the social and economic dimensions may vary depending on the user or the location.

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