Resident wellbeing in home energy retrofit programmes: A realist review on the role of project and programme organising

Abstract

Human wellbeing is an obligation and driver for sustainable transitions. Yet it remains underexplored in sustainable project management theories and practices. The existing housing stock is a major contributor to greenhouse gas emissions. Home energy retrofit programmes offer an opportunity to not only upgrade energy performance but also improve resident wellbeing and address energy poverty and health inequality. Through a realist review, this paper critically examines the role of project and programme organising in delivering wellbeing outcomes in home energy retrofit projects across Europe. It identifies four types of home energy retrofit programmes, energy-led, social-led, business-led and integrated programmes. Each type drives different practices and processes, which influence resident comfort, affordability and psychosocial factors. The findings reveal that most programmes treat wellbeing as an emergent and operational issue, instead of a strategically planned and integrated objective throughout the project life cycle. The study highlights the need to develop programme management capabilities that enable strategic planning for multidimensional sustainable outcomes, foster cross-disciplinary collaboration, enhance capabilities and competences to care for resident wellbeing, and improve communication, engagement and learning to support residents and families in the net-zero transition. The study argues for embedding an ethics of care and the capability approach into programme and project organising, reframing project outcomes beyond technical, economic and environmental factors and emphasising the enhancement of residents' abilities and opportunities to achieve healthy, meaningful and fulfilling lives.

Keywords: energy efficiency, home, housing, retrofit, resident wellbeing, sustainable project management

1. Introduction: Human wellbeing in sustainability transitions – a cross-displinary enquiry

There is urgent need for substantial reductions in greenhouse gas (GHG) emissions (IPCC, 2018). The EU and various levels of national governments have declared climate emergencies, setting ambitious reduction targets to become, for example, climate neutral by 2050. The UK has committed to net-zero emissions by the same year. Realising these high-level targets necessitates detailed actions to reduce emissions across all sectors, including housing as a current major contributor to emissions (Fawcett and Topouzi, 2020). Making the transitions raises a critical question: What does sustainable transition mean for human wellbeing? Specifically, to what extent do the transition processes and outcomes account for human wellbeing in home retrofit programmes?

Human wellbeing is an obligation and driver for sustainable transitions at the global climate level, but is this reflected in the organising of programmes and projects while executing the transitions? Certainly by including the right to health and mandating the protection of vulnerable groups the Paris Agreement has drawn attention to the notion that climate actions carry moral responsibilities (United Nations, 2015). Sustainability transition studies have framed the net zero transition as a socio-technical process, requiring a movement of mass participation across economy sectors and organisational levels including citizens (Geels, 2019; Watson, 2012). However, a recent study shows that people's participation is largely neglected in the current transition actions in the UK (The Young Foundation, 2022). For citizens to participate, they need to be supported and empowered in the process. This means not only looking into the sustainability outcomes but also how the policies are implemented. Projects are instrumental to implementing policies and achieving sustainability targets (Geels and Locatelli, 2024; Morris, 2017; Winch et al., 2023). However, transition scholars have paid limited attention to the role of project and programme management in large-scale change

processes, including how sustainability transition projects are executed (Ika et al., 2024; Terenzi et al., 2024; Winch et al., 2023).

Energy retrofit is a process of upgrading the energy efficiency of existing buildings. The extent to which wellbeing is addressed in home retrofit project and programme organising at individual, household and community levels is an important dimension, to which sustainable project management has paid limited attention (Winch et al., 2023). We use the term *home* regarding wellbeing as it embodies the sense of people living within (Ravetz, 2008), whereas 'housing' is the artefact. The programme level, which is akin to megaprojects in scale, has received scant attention. Drawing on megaproject studies has limited benefit as capabilities and innovation have not addressed wellbeing (Davies and Brady, 2016; Denicol and Davies, 2022). Sustainable project management considers sustainability of the project and sustainability by the project (Huemann and Silvius, 2017). Despite human wellbeing being a sustainable development goal, there is an underlying assumption that is largely managing technical and technological deliverables for low-carbon transition, paying scant attention to delivering positive outcomes for individual and societal wellbeing. Achieving net zero will affect people's homes, travel and the way of living and working. Any lack of resident engagement and wellbeing considerations in strategic planning, project execution, and post-completion services not only reduce project efficiency and sustainable outcomes but may also place the most vulnerable at further disadvantage (Morgan et al., 2024; Pellegrino et al., 2022).

Research on home energy retrofit has proliferated over the past two decades, particularly within the disciplines of energy transition, housing studies, architecture and public health (Clark and Kearns, 2012; Gilbertson et al., 2006; Hipwood, 2021; Karvonen, 2013; Koops-Van Hoffen et al., 2024). Despite this, few studies have focused on the project organising aspects of home energy retrofit or the role of project organising in resident wellbeing.

Through a realist review (Pawson et al., 2005) of home energy retrofit studies in different disciplines, this research aims to examine the role of project organising (Addyman and Smyth, 2023; Winch et al., 2022) in the wellbeing outcomes of home energy retrofits. The primary research question is:

How does project organising influence resident wellbeing in home energy retrofit programmes?

2. Research background

2.1. Home energy retrofit and resident wellbeing

Reducing carbon emissions from buildings is essential in addressing the climate crisis. According to International Energy Agency (2023), the operation of the world's buildings is responsible for 27% of energy-related GHG emissions and 30% of final energy consumptions. Existing homes significantly contribute to these figures, accounting for 17% of total global emissions and 21% of energy use (ibid). The poor energy performance of the existing housing stock and the high energy consumption that is embedded in contemporary household practices are the primary contributors to the emissions from homes (Zhao, 2023).

GHG emissions are notably higher in countries with a large proportion of older buildings. In most EU countries, half of the residential buildings were constructed before 1970 (European Commission, 2016) and in 2022, the building sector represented 34% of EU energy-related emissions (European Environment Agency, 2024). In the UK, 20% of homes were built before 1919 and 75% before 1980 (Piddington et al., 2020). UK residential buildings contribute one-fifth of GHG emissions and a quarter of energy use (Rowe and Rankl, 2024). Given that many of the old buildings will still exist in 2050, achieving significant reductions in residential emissions requires considerable improvement of the existing housing stock.

Home is a significant determinant of health and contributor to health inequalities. Extant research found significant disparities exist in housing affordability, conditions, stability and neighbourhood, including, by income, race, age and ethnicity (Streimikiene and Balezentis, 2019; Swope and Hernández, 2019). Low income, poor heating and insulation, high energy price and high energy needs contribute to fuel poverty (Lee et al., 2022). Homes that are cold due to fuel poverty exacerbate health inequalities. With record high energy prices, nearly 10% of the EU population were unable to keep their home adequately warm in 2022 (Agnieszka, 2023). In the UK, 13% of households in England, 31% in Scotland, 14% in Wales, and 24% in Northern Ireland are classed as fuel poor (Hinson et al., 2024). Cold homes can worsen respiratory conditions and cause cardiovascular diseases, dementia, poor mental health and problems with childhood development (ibid). Properties that are old, deteriorating and badly maintained often have more health and safety hazards including mould, damp, cold and fire risks (Piddington et al., 2020). Vulnerable populations are more likely to experience the adverse wellbeing impacts of harmful housing conditions, including older adults, low-income households and individuals living with chronic illness and disabilities (Anderson et al., 2012; Willand and Horne, 2018). Age UK (2016) report that since 1950 2.5 million excess deaths have occurred from cold homes in the UK. It is suggested the full cost of leaving people living in poor housing is c.£18.5bn per annum (Garrett et al., 2021).

Energy retrofit therefore benefits the natural environment and potentially reduces energy poverty and health inequality, enhances quality of life and wellbeing, and decreases healthcare demands. Beyond technical performance, it provides opportunities for accessing affordable warmth, improving living comfort and preventing illness through improving the housing conditions. Despite the potential benefits, home energy retrofit progress remains slow (Zhang et al., 2021). According to extant research (Karvonen, 2013; Rodger et al., 2021; Tozer et al., 2023; Tweed, 2013; Wade et al., 2020), home retrofit is complex due to

- Housing stock diversity in design, specification, location and tenure.
- Diversity of resident activities and needs.
- Cross-sector responsibilities covering governments, public, private and third sectors, and civil society.
- Diverse data sets, lack of data and analysis to support decision-making across programmes towards retrofit planning, design and measures, including the physical state of buildings, building energy performance as well as the socio-economic and -demographic status of residents.
- The need for tailored advice and solutions at project level.
- The shortage of energy retrofit knowledge and skills among the institutional actors.

In the UK, complexity is compounded by the fragmented government policy landscape, the lack of legislative certainty and consistency in home decarbonisation standards and the slow progress of updating national building regulations to reflect the sector's transition to net zero, leaving local authorities, home builders and homeowners with limited guidance on expected standards for low-carbon housing (Alabid et al., 2022; Zhao, 2023). For owner occupiers and private landlords, they lack the incentives to invest in the energy efficiency upgrades due to the high costs, uncertainties about the benefits, the disruptions during the construction period, the barriers to learning new technologies and the reluctance to change habits and practices (Mininni et al., 2024; Streimikiene and Balezentis, 2019). It is commonly believed that deep retrofit is needed to secure the optimal benefits, which in practice normally involves staged measures spanning years to split the initial costs and accumulate the financial returns (Saffari and Beagon, 2022). Although various financial support are available including subsidies, tax incentives and loans (Bertoldi et al., 2021), may households especially the low incomes have difficulty accessing these measures (Liu et al., 2019; Streimikiene and Balezentis, 2020).

Government policy instruments and programmes are necessary to lead the home energy retrofit with organisational and individual actions following. Government retrofit strategies set the overall direction, guidelines and standards, and promote investment in low-carbon technologies. They offer financial support, initiate education and training programmes as well as pilot projects to experiment innovative products, services and delivery models (Zhang et al., 2021). In practice, retrofitting includes multiple projects and programmes at household, local and municipal levels, involving various organisations and cross-sector collaborations (Wade et al., 2020), making it necessary to coordinate processes via project and programme management. Project owners, designers, contractors and other delivery partners are conceptually middle actors in the low-carbon transition ecosystems (Janda et al., 2014; Parag and Janda, 2014). These actors have distinct motivations, strategies and capabilities to influence outcomes by incorporating retrofit activities with their business model (Cauvain and Karvonen, 2018; Rodger et al., 2021; Wade et al., 2020). However, less known is project and programme level practices for delivering sustainable outcomes and meeting policy goals.

Current policy frameworks and associated project practices have a technical focus, primarily upon building fabrics, heat pumps, renewables and environmental targets (Zhang et al., 2021; Zhao, 2023). These are important yet insufficient to address the complex socio-technical challenges (Verfuerth et al., 2023), specifically health and wellbeing, which is perceived to mainly be a post completion matter. However, residents need consistent and systemic support to maintain wellbeing during the disruptive retrofit process and any aftermath affects (Zhao, 2023). Further, if residents under-engaged, energy-efficiency improvement solutions might induce unintended consequences detrimental to their health (Koops - Van Hoffen et al., 2023; Willand et al., 2015).

Home retrofit is a moment of change when residents' activities and perceptions can shift dramatically. Targeting these moments of change is an effective way to realise more

sustainable and healthy practices and behaviour (Cleland et al., 2016; Verfuerth et al., 2023). The housing stock – the homes of people and families – is a cultural asset that is embedded in the fabric of everyday lifestyles, communities and livelihoods (Ravetz, 2008). Home retrofitting is an intervention into the domestic practices (Karvonen, 2013), which involves activities beyond changing a house from a poor to good state of energy performance. Academic studies and industry reports have argued for new approaches that simultaneously address the social and technical issues of domestic energy use in order to achieve widespread low-carbon transitions (Verfuerth et al., 2023). Exploring practices and processes of organising projects to achieve the co-benefits of net zero emissions and human wellbeing offers scopes for advancing sustainable project management bodies of knowledge.

2.2. Wellbeing impacts of home energy retrofits

Individual wellbeing is often viewed as the physical, mental and social state of individuals and as a resource for everyday life (WHO, 2021). The concept is rooted in two distinct streams of Western philosophy: 1) a hedonic view – the subjective experience of happiness or pleasure; and 2) a eudemonic view – the ability to contribute to the world with a sense of meaning and purpose (Huta and Waterman, 2014). Wellbeing is determined by social, economic and environmental conditions, which could be facilitated or constrained by actual or prospective living conditions (Hayward et al., 2015; Swope and Hernández, 2019). Several reviews and synthesises have examined the empirical evidence on the health impacts of housing improvements intended to better home quality and energy efficiency, concluding that such programmes may change the socio-economic determinants of health, with the low-income householders seeing greater benefits (Maidment et al., 2014; Thomson and Thomas, 2015).

Comfort, affordability and psychosocial factors such as feelings of status and sense of safety and security are identified as the primary pathways from home energy retrofits to wellbeing

improvement (Koops - Van Hoffen et al., 2023; Willand et al., 2015). Residential comfort is conceptualised as an overall bodily involvement with the surrounding environment, which is sensed through different senses such as warmth and coolness, indoor air, light and materials (Madsen and Gram-Hanssen, 2017). Energy retrofit measures such as loft insulation and upgrading to more efficient space conditioning appliances improve the thermal quality, indoor air quality and the efficiency of the dwellings' operational systems, resulting in warmer and drier homes with potential physiological and mental health benefits (Willand et al., 2015). The affordability pathway posits that energy efficiency measures reduce energy consumption and consequently energy bills, with associated physical (e.g., more disposable incomes for nutritious food) and mental health benefits (e.g., alleviating financial stress) (Gilbertson et al., 2012; Thomson and Thomas, 2015).

The psychosocial pathway explains the wellbeing improvements from home energy retrofits through the enriched meaning of the home (Willand et al., 2015). For example, social wellbeing was found to be enhanced by improved privacy and relationships within families as householders could utilise more areas at home due to more efficient heating (Gilbertson et al., 2006). The expansion of the heated and used spaces contributes to a feeling of greater autonomy and empowerment (ibid). More effective use of the house for leisure and study also enhances personal development, leading to long-term wellbeing benefits (Hernández et al., 2019). Greater hospitality due to increased home environment enhances social relations, status and identity. In addition, more satisfied with and proud of their house encourages housekeeping behaviour, which reduces amounts of dust and mould, improving poor respiratory health conditions (Koops - Van Hoffen et al., 2023). If residents are truly involved in the retrofit programme, for example being consulted in decision-making and educated regarding the retrofit process and technologies, they may experience enhanced self-efficacy, competence and personal identity.

Despite the various possible pathways, wellbeing outcomes of home energy retrofits cannot be assumed – empirical evidence suggests adverse effects due to noise, increased humidity and inadequate ventilation (Willand et al., 2015). Shortcomings in construction works and programme design and delivery confounded potential thermal comfort and energy reductions (Qi et al., 2020; Willand et al., 2020). The behaviour of operatives also has impacts; it can be damaging, especially on the most vulnerable (Koops - Van Hoffen et al., 2023). When residents are not involved in the retrofit process, they might experience stress and anxieties due to disruption in the construction phase and/or inability to use low-carbon technologies post occupancy (Koops-Van Hoffen et al., 2024). Resident behaviour also plays a role. For example, the 'take-back' factor, that is the choice of householders to compromise the expected energy cost savings in favour of warmer winter rooms, resulted in smaller than expected reductions or even increase in energy consumption and bills (Willand et al., 2015). In some cases, the implementation of energy improvement measures has entailed a cost burden for tenants, disproportionately affecting low-income households (Von Platten et al., 2022). A heightened displacement pressure was also found on tenants due to increased property values and rental prices after the retrofit, which caused anxieties and insecurities (Baeten et al., 2017).

The inconsistent results points to the needs to identify contextual issues to further explain how and why energy efficiency interventions work and in which conditions (cf. Bhaskar, 1998). In this paper, we focus on project organising as one of such issues.

3. Methodology and methods

This study employs a realist review method, grounded in the philosophical perspective of critical realism, which considers structure and agency (Bhaskar, 1998; Harré, 2009). Realist reviews focus on the nexus of context-mechanism-outcome to explore 'what works for whom, in what circumstances, in what respect and how' (Pawson et al., 2005, p. 21). This

approach is particularly well-suited for unpacking how complex interventions work in particular contexts. A realist review starts by articulating likely underlying mechanisms, in this case the pathways from home energy retrofit to wellbeing outcomes. Evidence from primary studies is then scrutinised to find out whether and how these mechanisms are applicable (Pawson et al., 2005).

3.1. Scope of the review

Energy retrofit is commonly recognised as a multidimensional intervention that requires cross-disciplinary insights. Our realist review brings together evidence from studies in various disciplines such as energy transition, public health and housing and seeks to explain the diversity of wellbeing outcomes of home energy retrofit programmes from the perspective of project organising.

We regard energy retrofit as a process of upgrading the energy efficiency of existing buildings, including a range of activities such as upgrading the building fabric, heat generation system and lighting of a building (Saffari and Beagon, 2022). The review included shallow retrofit projects comprising one or two retrofit measures as well as deep or whole-house retrofits that consider the interaction of multiple measures to achieve substantial carbon reduction targets. To analyse the role of project management practices and processes, our literature review focuses on projects and programmes initiated by organisations, such as local authorities, housing associations, housing cooperatives and private property owners across Europe.

3.2. Search process

A systematic and iterative process was used to select studies (Figure 1). An initial search in Scopus for peer-reviewed studies published after 2004 yield 3,861 results. This time frame ensured a focus on contemporary retrofit programmes. Title, abstract and keyword were

searched by combining terms ‘retrofit*’, ‘renovation’, ‘refurbishment’; and ‘energy’; and ‘housing’, ‘home’, ‘resident*’.

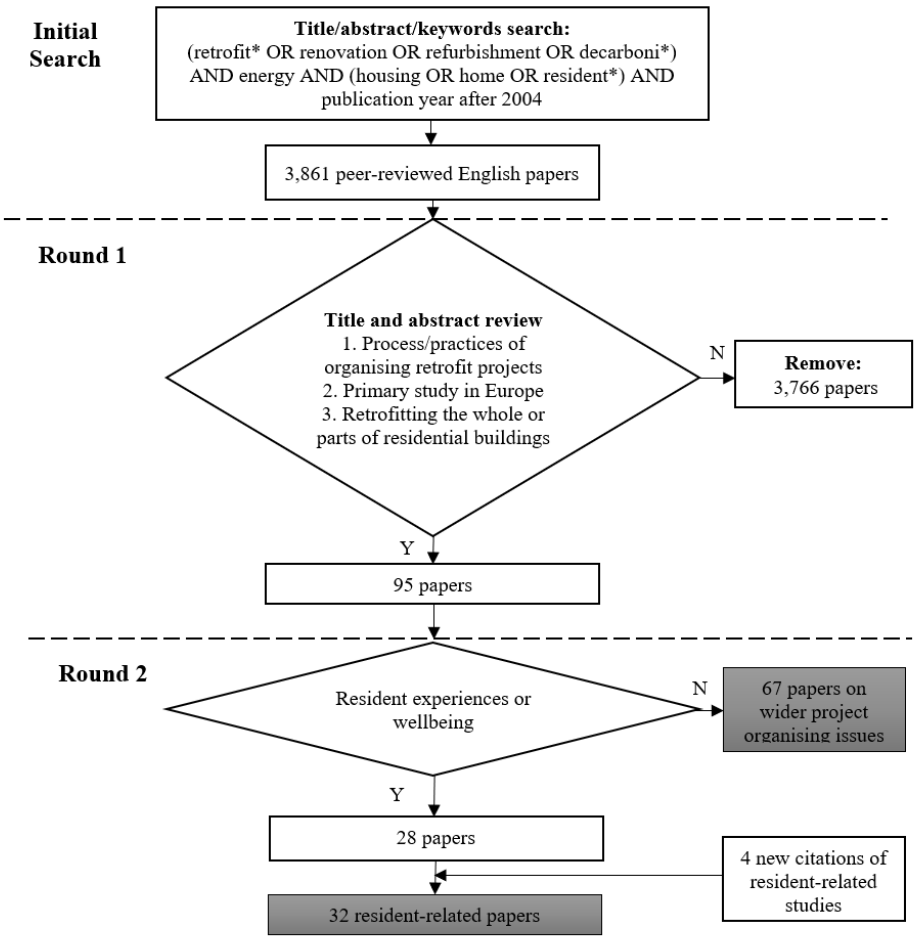

Figure 1 Search process

The 3,861 studies underwent two rounds of screening. The first round focused on collecting primary studies that reported the process, activities or practices of organising residential retrofit projects. Titles and abstracts were reviewed to exclude literature reviews, the modelling of carbon emission or energy saving, engineering-focused research on low-carbon technologies, and purely economic analysis of housing investments. Post-occupancy evaluations such as indoor environment assessment and resident surveys were included if they addressed project-related issues. Studies on individual owner occupiers or landlords were excluded. The first round resulted in a pool of 95 papers that provided insights into

project organising including structures, actions and relationships in delivering retrofits. Based on the first-round result, the second round aimed at identifying studies directly addressing resident experiences or wellbeing, which narrowed the pool to 28 papers. In addition, we identified 4 resident-related papers from the references of selected papers, which were added into to our review.

3.3. Data analysis

The study took an interpretive approach and used thematic analysis to examine the role of project organising in influencing wellbeing outcomes. Given the limited focus on project management in the existing literature (except (Duong et al., 2024; Rodger et al., 2021, 2020; Wade et al., 2020), this method allows us to interpret the implications of case evidence for project organising and its influence on resident wellbeing.

All documents were firstly put into a matrix and key characteristics of reported retrofit programmes were tabulated in terms of project/programme name, location, type (social or private or mixed), stakeholders (client and delivery partners), and other specific issues. The analysis then focused on the 32 resident-focused papers and mapped the wellbeing outcomes along the pathways illustrated in Section 2 (i.e., Comfort Pathway, Affordability Pathway and Psychosocial Pathway). After this, the remaining 67 studies were reviewed to infer the impacts of broader project issues on resident experience, wellbeing and the related pathways. For example, the lack of knowledge sharing about retrofit process and technologies between the procurement, supplier- and the resident-facing departments within the local authority (Duong et al., 2024) might cause miscommunication with residents, hence confusion and insecurity that negatively affects mental health (psychosocial pathway).

This matrix provided a useful tool to identify the coverage of issues across studies or programmes and to compare wellbeing outcomes. Programmes were categorised to examine how the scope or type of measures affected the outcomes (i.e., energy-led, welfare-led,

energy-welfare-integrated and business-led). The findings were further aggregated into themes.

The analysis process is abductive and iterative (Dubois and Gadde, 2002). While the theoretical pathways and project management theories and concepts guided the analysis, the process remained open to new findings (e.g., the capability pathway that the social-led and the integrated programmes generated), which were constantly compared with existing theories (e.g., capability approach to wellbeing) to refine understanding and enhance project management bodies of knowledge (e.g., ethics of care and programme management in home retrofits).

4. Findings

This section presents the preliminary findings of our review.

4.1. Categorisation of home retrofit programmes

The selected programmes were categorised according to the primary goals, which are energy-led, social-led, energy-social-integrated and business-led. Different priorities shape practices and processes at the project level, hence influencing the wellbeing impacts.

Energy-led programmes predominantly focus on implementing retrofit measures and technologies to meet environmental targets. For example, the Retrofit for the Future programme funded by the UK Technology Strategy Board was initiated with an ambition of reducing in-use CO2 emissions by 80% per property compared to a 1990 baseline. The clear target encouraged project teams to innovate and experiment with various retrofit approaches, with the selection of properties often driven by their technical suitability for meeting carbon reduction goals (Lowe and Chiu, 2020). In other words, it is the technical solutions that drove the retrofit project, instead of the needs of residents.

In contrast, social-led programmes prioritise resident needs, particularly vulnerable groups such as households with low-incomes households, older adults, families with young children, and individuals with disabilities or long-term illnesses. These programmes are often aligned with wider welfare policies such as aging in place and reducing fuel poverty. For example, the Care and Repair programme in Scotland offers advice and a range of services such as replacing heating sources and adapting for mobility to support older adults or those with disabilities to improve their homes so that they can live healthily, safely and in comfort in their own community (Rodger et al., 2020).

Integrated programmes combine environmental and social objectives, often taking an area-based approach. These programmes may be government-led aimed at district-level development or regeneration (e.g., Busà, 2024), or community-led, addressing local issues while strengthening community identity (Putnam and Brown, 2021). Energy efficiency is among a diversity of goals such as community development and local economy development.

Business-led programmes are initiated by property owner organisations or contractors seeking to develop business strategies or explore new business models. The growing retrofit market and the expanding green economy provide opportunities for organisations to gain competitive advantages (Vlasova and Gram-Hanssen, 2014). For property owners, retrofits that improve energy efficiency and aesthetic appeal can increase the asset value of buildings. Contractors, on the other hand, use these programmes to demonstrate their capability to deliver cost-effective ‘green’ projects, thereby diversifying their services and expanding their market share. Business-led projects thus tend to be technoeconomic (ibid), unless companies actively involve tenants or residents in the decision-making.

4.2. The role of project organising in influencing resident wellbeing

4.2.1. Cross-disciplinary research and collaboration

Cross-disciplinary research and collaboration is essential to delivering the various aspects of sustainable outcomes. However, the review shows that few studies are overtly cross-disciplinary (Zerjav et al., 2023), indeed arguably more focused in the housing field where the artefact, technology or social dimension tends to become the empirical focus. This contrasts with many other fields, say project management, where cross-disciplinary research has a place, although it cannot be assumed that such research is used for explanatory purposes (Sayer, 2000). In housing the more focused, the more descriptive many studies become (Brown et al., 2014; Busà, 2024).

A slightly more mature picture emerges concerning interorganisational and/or cross-sector collaboration to address multiple vulnerabilities of local residents. Patterson (2016) and Jacques- Aviñó et al. (2022) report that interconnected social and energy government policies induce collaborations between governmental departments, helping delivery organisations in delivering energy efficiency measures but also addressing unemployment by training and employing local residents to support vulnerable families by caring for specific needs such as identifying and switching to optimal energy contracts, conducting micro energy efficiency measures and providing aftercare services. The involvement of local residents in projects, voluntary or paid, helps build trust and reduces the negative psychosocial impacts of the retrofit project (Boess, 2022; Patterson, 2016). It also provides a path to wellbeing outcomes via capability development (see Kimhur, 2020), which we will discuss later.

Supported by the existing community networks, community-led integrated programmes are capable to address local issues in a more holistic way, for example, energy, food and affordable housing (Putnam and Brown, 2021). The community networks also enable the access to vulnerable residents, understanding their needs and tailoring the retrofit approach

(ibid). However, the current community projects grapple with policy geared towards consumer-focused individualism, which can clash with the care-based values inspired by the communities.

4.2.2. Client organisational structure and process

Many case studies demonstrate how siloed organisational structures and processes within client organisations hinder cross-displinary and interorganisational working and knowledge sharing (Palm and Reindl, 2016; Rodger et al., 2020; Wade et al., 2020). Business-led programmes, for example, tend to incorporate energy efficiency measures into routine refurbishment or maintenance activities. However, sustainability goals in these programmes are found ambiguous, with market competitiveness taking precedence (Vlasova and Gram-Hanssen, 2014). There is a lack of shared understanding of required energy-saving measures in the project planning and execution (Palm and Reindl, 2016). Property owners often lack formal processes to manage sustainability aspects, including property inspections, procurement and post-occupancy evaluations (Olsson et al., 2015), which leads to questions about the effectiveness of the energy interventions. Moreover, established routines for traditional renovation can also exclude energy retrofit measures, as prioritisation criteria for retrofits often differ from those for standard renovations (Palm and Reindl, 2016). To achieve cost efficiency, the existing structure and project management processes sustain the pattern of working in professionals' own specialised areas and ensuring minimum compliance to building regulations and standards, which are not necessarily about energy efficiency (ibid). In addition, project managers normally lack the knowledge and skills to concern sustainability measures in relation to cost, return in investment and economic analysis (Olsson et al., 2015).

Similarly, clients in the public sector such as local authorities are recognised as unprepared to deliver programmes with mixed purposes such as energy and public health due to the siloed

structure (Duong et al., 2024; Rodger et al., 2020). It is difficult to engage officers outside of the housing department with relevant knowledge and skills into retrofit programmes (Wade et al., 2020). Resident-facing teams such as social workers are good points of contact to understand resident needs but they are unfamiliar with retrofit processes and technologies (Duong et al., 2024). On the other hand, housing officers and building contractors generally lack social and emotional competences required to effectively engage with vulnerable residents (Broers et al., 2022). Consequently, most energy-led programmes do not have formal process to proactively recognise the needs of vulnerable groups, hence creating inconvenience and exacerbating health conditions. Low-income families and older householders are vulnerable in more ways than to cold exposure (Willand and Horne, 2018). Without an adequate understanding of resident practices and the multidimension of poverty, retrofit measures were found to be ineffective to make energy use more affordable (Desvallées, 2022).

4.2.3. Strategic and collaborative planning and design

Strategic and collaborative planning among different stakeholders including local governments, clients, contractors, manufacturers and service providers directly affects resident experiences during retrofits, the quality of deliverables and living comfort post occupancy (Boess, 2022; Busà, 2024; Vlasova and Gram-Hanssen, 2014). Engaging residents in the design stage also contributes to good use values of zero-energy products and services (Boess, 2022).

However, the emergence of New Public Management and the introduction of market-driven principles in the public sector in some countries like the UK have significantly reduced government resources and capabilities, especially at the local authority level. This has shifted the focus towards cost control with an associated audit culture and outsourcing key competences such as data analysis and resident engagement (Rodger et al., 2020; Wade et al.,

2020). As a result, local and national governments have less capabilities to strategically shape retrofit programmes to align with their priorities (Wade et al., 2020).

Strategic procurement is identified as an effective mechanism for fostering long-term relationships with competent contractors, aligning diverse interests, and ensuring service consistency across projects (Boess, 2022; Duong et al., 2024). Long-term collaborative relationships encourage knowledge sharing, jointing planning and co-creation of solutions among contractors, manufacturers and designers, which are key to ensuring consistent workmanship and service quality (Patterson, 2016). Multidisciplinary project teams that integrate expertise from housing, construction and social services are more effective in identifying and addressing resident needs (Broers et al., 2022). Despite this potential, strategic procurement is often underutilised at the local delivery level (Duong et al., 2024). Poor contractor performance can erode residents' trust in retrofit programmes and the social landlords (Brown et al., 2014). Outsourcing resident-facing engagement to contractors has also been linked to dissatisfaction and increased risks for vulnerable populations (Broers et al., 2022).

The volatility and short-term nature of government funding schemes poses significant barriers to effective strategic planning. Limited funding periods often leave insufficient time to gather and analyse pre-intervention property data, understand household needs or evaluate the long-term impacts of various retrofit approaches (Fylan et al., 2016). Many energy-led programmes, which rely partially or entirely on government funding, are rushed in planning and delivery, compromising thermal quality and resident health (Patterson, 2016; Rodger et al., 2021). A lack of understanding of properties and residents can result in 'surprises' for site operatives, rework, extra home visits and extended project duration (Boess, 2022; Fylan et al., 2016). It also causes faulty information and lack of communication (Morgan et al., 2024),

inconsistent services and project delay, inducing distrust and a sense of intrusiveness among residents (Gilbertson et al., 2006).

Fragmented structures in government funding allocation is another barrier. For example, some UK government funding schemes are specific to retrofit measures. Consequently, programmes are operated in isolation, such as installing a new boiler and external wall insulations (Fylan et al., 2016), which prevents planning for a whole-house retrofit. In social-led programmes, achieving social value such as wellbeing requires collaboration between local authorities and service providers across housing, energy, construction and health (Rodger et al., 2020). However, the funding allocation is found to be different across organisations and sectors, reducing the efficacy of joint planning (Rodger et al., 2021).

Transparent quality assurance processes embedded from the project outset are essential for ensuring consistent and effective outcomes (Brown et al., 2014). These procedures are found to be unclear particularly in community-led programmes unless led by some larger community retrofit organisations (Putnam and Brown, 2021).

4.2.4. Communication, engagement and learning

Resident care and wellbeing are built upon effective engagement and communication throughout the project lifecycle. The common practice across programmes is the one-way communication, which can be top down via notification letters, home visits to discuss advantages of the retrofit project or progress meetings and a handover, or bottom up via complaints or customer satisfaction surveys (Charles et al., 2025; Koops-Van Hoffen et al., 2024). Some programmes tried to address the fear of disruption via cash compensation, providing decanting during the daytime or temporary relocation (Charles et al., 2025; Pellegrino et al., 2022). Despite these efforts, many programmes report that residents lack understanding of the retrofit process, are unaware of project changes, and have limited trust in or capability to use zero-carbon technologies. This has led to feelings of shock,

dissatisfaction, frustration, discomfort and a perceived loss of control (Brown et al., 2014; Sunikka-Blank et al., 2012; Webb et al., 2016). The lack of communication at the front end and in the execution results in additional resources and costs being required post-completion to resolve residents' complaints and issues related to technology usage (Boess, 2022).

Many energy-led programmes provided demo dwellings to help demonstrate a fully retrofitted home where residents could visit, see how the property felt, experience the technologies installed and ask questions about the retrofit works, which helped create trust (Boess, 2022; Charles et al., 2025; Morgan et al., 2024). While these demonstrations can foster resident engagement, they can also create high expectations on what would be installed. When project teams fail to clearly communicate the specific measures planned for individual homes, residents may feel confused or disappointed by the actual deliverables (Boess, 2022).

Two-way communication where residents can have an active voice in decision-making is rare in energy- and business-led programmes. For example, the demo-properties are used to showcase the pre-determined design and technologies, instead of as co-learning spaces where residents' ways of interaction with the technologies and daily practices and needs could be better understood and incorporated into the actual implementation. Top-down decisions cause negative emotions, for example, emotional 'unhoming' and frustration resulting from the sense of losing ownership of the place and the challenges of having to adapting to the disruption of daily habits (Busà, 2024). Except for one programme that focused on experimenting innovative retrofit solutions in a limited number of properties (Chiu et al., 2014), residents generally have limited voice to determine what/how to install the measures in energy- and business-led programmes.

In contrast, residents are more empowered in the integrated projects to influence planning and delivery, becoming key decision makers. In these programmes, project clients' capabilities to

make strategic planning, support supplier development, build stakeholder networks including residents and suppliers, and facilitate network activities are key to enhance individual and collective competences in local communities so that individuals can actively participate in the transition to net-zero society (Putnam and Brown, 2021; Vlasova and Gram-Hanssen, 2014).

It is found that the value of clean energy for home, personal security, welfare, and the neighbourhood is only weakly incorporated into energy-led programmes. It is better considered in some integrated programmes but more as an emergent quality rather than an integrated objective. It is challenging to deliver multiple goals in regeneration projects including economic, physical environment, housing and social (Beck et al., 2010). Furthermore, residents do not fully understand the wider project value and benefits. The engagement activities were used by some project organisations to gain acceptance, hence the discussion being focused on price (Webb et al., 2016). In some cases, tenants, particularly older tenants, are deliberately excluded from engagement activities to expedite project delivery (Morgan et al., 2024). Consequently, the engagement activities result in few incentives to adapt domestic practices and energy consumption behaviour and learn new technologies in order to gain the full benefits and participate in the transition to a low-carbon society. Misunderstanding or misuse of new technologies and heating systems often leads to minimal energy savings, distrust in energy suppliers or landlords, and emotional distress (Brown et al., 2014; Walker et al., 2014; Webb et al., 2016).

4.2.5. Project finance and affordability

Most programmes in our review were funded by government schemes, which are free for residents at the point of delivery, although rental and service costs can subsequently increase which disproportionately affects low-income households (Von Platten et al., 2022). There are cases where underfunding caused incomplete or low-quality construction works, resulting in few savings in energy use or on occasions extra costs for residents to rectify problems

(Patterson, 2016). In some cases, the data gathered from the newly installed energy management system were used against tenants. For example, claims of dampness can be refused because the heating data shows that the tenant did not use heating properly (Morgan et al., 2024). Moreover, there is associated displacement pressure damaging the mental health of residents, which includes the actual displacement but also the anxieties, uncertainties, insecurities and temporalities that arise from possible displacement due to the course of events leading rent increases after the retrofit as well as the rental costs (Baeten et al., 2017).

Affordability can be ensured by the welfare state and the strategic partnerships among funding parties and the delivery organisations to leverage the capital, resources and expertise. For example, in the Garden City regeneration programme funds from the state Brandenburg and the contract with Land Brandeburg safeguard the rent at the social level after the renovation, with provision of guaranteed subsidies from the state to cover social rents (Busà, 2024).

Alternatively, energy performance contract (EPC) is advocated in some programmes to address the affordability issues (Pellegrino et al., 2022). Specifically, households will pay a sum of rent and energy bills split in an extended period after the retrofit (e.g., 30 years), although the actual economic model and repayment methods vary across countries. The idea is that by guaranteeing neutral energy performance, the home will pay for itself through reduction in energy bills. However, EPC does not guarantee energy cost saving especially without learning and behavioural change (Broers et al., 2022). For example, EPC in the Energiesprong programmes defines 'normal occupation conditions', such as the setting of room temperature during the year. These requirements may not be consistently and sufficiently communicated and understood by residents. The failure of changing behaviour results in residents paying for overconsumption and more complaints and conflicts between residents and the landlord (Pellegrino et al., 2022).

For integrated programmes led by local communities, project financing remains challenging. These projects are unlikely to scale without government support. Some social enterprises provide direct financing by using project returns to reinject capital into retrofit delivery, but this remains a niche activity. Many project organisations could only offer finance advice, making residents aware of the range of financial resources available (Putnam and Brown, 2021).

5. Discussion

The findings identified four types of home energy retrofit programmes and explained the role of project and programme organising in influencing resident wellbeing across these types.

The review reveals the need for programme management to allow strategic planning, early involvement of suppliers and residents to shape the planning and design, boundary spanning across functional departments and organisations, and resource sharing through training programmes, knowledge transfer and relationship management.

To safeguard and enhance resident wellbeing requires project/programme governance to integrate dimensions such as resident comfort, affordability, psychosocial factors and capability development throughout the project lifecycle. Current practices tend to treat resident wellbeing as an emergent and operational issue, leaving responsibility to contractors and individual operatives who may lack the necessary competence to work with vulnerable groups. Training programmes should therefore address both technical competences and resident-facing behaviour to ensure service consistency across projects. There is a need to change established routines that prioritise cost efficiency and sustain siloed working to enable collaboration and resource sharing across organisations and professionals including housing, energy, construction, healthcare and social care. Strategic procurement and continuous relationship management can help align diverse stakeholder interests, foster shared goals, and

sustain knowledge-sharing and co-creation of solutions. Furthermore, knowledge management at the programme level could shift post occupancy evaluations from procedural compliance towards dynamic monitoring and learning processes regarding wellbeing.

A care-based approach to resident engagement is necessary at both project and programme levels. This requires embedding care practices into the process and structure of project management, supported by client organisations (Derakhshan, 2022). The current resident engagement practices that aim at securing acceptance and emphasising one-way communication result in unethical behaviour (e.g., deliberately excluding difficult groups) and unfair processes and outcomes for residents. These practices align with critiques of utilitarian stakeholder management, which is often skewed towards self-interest utility and creates a credibility gap (Smyth, 2008). Moreover, these practices are insufficient to address wellbeing issues in projects, which calls for an ethics of care in the process of resident engagement and programme management. Existing studies revealed the multidimensional vulnerabilities that residents and families may experience (Anderson et al., 2012; Middha and Willand, 2023). An ethics of care offers an alternative approach that better recognises the interests and listens to the voices of diverse stakeholders, especially the vulnerable and marginalised groups (Xu and Smyth, 2023). By involving local residents in project organising and actively acknowledging their needs, projects could foster a sense of belonging and empowerment (Derakhshan, 2022), which in turn enhances individual and collective wellbeing (Kearns and Whitley, 2020).

An emergent review finding and an important insight is the capability pathway to resident wellbeing, particularly evident in social and integrated programmes (e.g., Jacques- Aviñó et al., 2022; Patterson, 2016; Vlasova and Gram-Hanssen, 2014). At the broad level, this aligns with the capability approach to human wellbeing, which emphasises freedoms, capabilities and functionings as central concepts (Nussbaum, 2003; Sen, 1999, 1980).

Functionings refers to “beings and doings” that a person values, such as being healthy and happy (Sen, 1999, p. 75). Capabilities represent the real opportunities and abilities to achieve to achieve these functionings, while freedoms reflect the ability to make meaningful life choices (ibid). The fundamental objective of the capability approach is to create meaningful and fulfilled lives (Alkire, 2002). In this vein, societal arrangements, including policies and associated programmes, should aim to expand people’s capabilities to enable them to achieve and enjoy ‘valuable beings and doings’ (ibid., p.2). The capability approach investigates the evaluative space of wellbeing, re-establishing ethics at the centre of policy discussion and reconnecting ethics and economics (Deneulin and McGregor, 2010).

The capability approach has gained some interest in housing studies (Kimhur, 2020) but has not in project and programme management. The evaluative spaces of project outcomes have largely been material resources, monetary resources, and satisfaction, which are in turn used as surrogates for assessing the wellbeing dimensions such as comfort, affordability and psychosocial issues mentioned above. The capability approach argues that resources such as income, wealth, commodities and basic goods are important but not the ends of project outcomes; instead they provide means for human flourishing and wellbeing (Kimhur, 2020). In this sense, the capability approach aligns well with the ethics of care and the care-based approach to stakeholder management in project management (Smyth, 2008; Xu and Smyth, 2023).

In this review, we found evidence in some programmes that improved residents’ capability to better make their own life choices and in this way benefited their wellbeing. Most measures are emergent during project delivery. Examples include involving residents and local communities through voluntary or paid jobs when opportunities emerged (Boess, 2022) and when project organisations recognise involvement to respond to the negative community campaigns (Busà, 2024). Some programmes are better strategically planned through

connected policy interventions to induce effective cross-displinary working to address multiple local challenges (Patterson, 2016; Vlasova and Gram-Hanssen, 2014). However, the literature shows these better and more integrated practices are rare. To apply the capability approach requires effective programme management to establish governance for resident wellbeing, induce boundary spanning across functional departments, organisations and sectors and develop capabilities and competences to engage and care for residents.

6. Conclusion

Sustainable project management research increasingly positions projects as vectors for low-carbon transitions, intermediation spaces to form and translate sustainability visions and outcomes and interventions to addressing grand societal challenges (Gasparro et al., 2022; Geels and Locatelli, 2024; Ika et al., 2024; Terenzi et al., 2024). Project management community has called for greater focus on sustainability *by* the project (Geels and Locatelli, 2024; Terenzi et al., 2024). Our review contributes to sustainable project management bodies of knowledge by highlighting the challenges faced by home energy retrofit programmes across Europe in achieving the co-benefits of carbon reduction and resident wellbeing.

A key finding of this review is the need for capability development at programme and project levels, which is a gap largely unaddressed in current project management literature. While megaproject research has provided insights into programme capability development, its emphasis has been on technical innovation. Home energy retrofit projects, however, intervene in complex socio-cultural systems in different ways from megaprojects (Winch et al., 2023). There is a need for more cross-disciplinary research to facilitate conceptual learning to build the body of knowledge (cf. Bhaskar, 1998) and contributes to a research programme that supports practice.

Human wellbeing is an important outcome for low-carbon transitions, adding the social to environmental policy objectives in the triple bottom line of people, planet and prosperity. Yet wellbeing has not been explicitly considered in sustainable project management studies. A purely technoeconomic approach risks the most vulnerable, worsens economic hardships and potentially wellbeing outcomes. In the context of home energy retrofit, the existing housing stock is resistant to change due to a disconnection between top-down energy efficiency policy agendas and bottom-up behavioural change initiatives as well as technical, organisational and social complexities of organising retrofit projects. Projects are intermediation spaces in sustainable transitions (Gasparro et al., 2022), providing opportunities for connecting initiatives and behaviour to ensure equity and effectiveness. Examining how home retrofit projects are organised to address the dual challenge of climate change and human wellbeing (or fail to do so) offers new insights for sustainable project management theories and practices (Ika et al., 2024; Winch et al., 2023).

The capability approach is insightful for project and programme management and specifically for the sustainable development or grand challenge projects that require mass participation of citizens. Residents' apathy, lack of interest and participation in any societal issues and the socio-economic status were identified as major barriers to delivering low-carbon transition projects (Brown et al., 2014). Terenzi et al. (2024) has pointed out a lack of behavioural intervention programmes in parrel to energy transition projects. This realist review sheds light on the potential for integrating resident capability development into programme design and delivery. By enhancing residents' abilities and opportunities for making meaningful life choices, such programmes can contribute to individual and collective wellbeing, foster practice and behavioural change and support the broader societal transition to a net-zero future.

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