International Journal of Scientific Engineering and Research (IJSER)
ISSN (Online): 2347-3878
SJIF (2024): 6.623

Effects of PAS 2035 on the Management of Domestic Retrofit Projects

Peter Oluwaseyi Oladotun

Leeds Sustainability Institute, The School of Built Environment, Engineering and Computing,
Leeds Beckett University, Leeds, LS1 3HE, United Kingdom
Email: *poluwaseyi[at]gmail.com*

Abstract: ***The challenges identified with global warming leading to climate change has made the United Kingdom to aim for the net-zero carbon emissions target by 2050. To achieve this goal, one important sector that required attention is the residential sector which has witnessed challenges such as the existing stock of old buildings, energy performance gap, socio-economic issue, piecemeal approach to homes improvement, funding issue, difficulties in project delivery and timeline. Retrofitting, which is about improvement of buildings has not been able to effectively solve these issues under PAS 2030, this then led to creation of PAS 2035, which is a standard to ensure the energy efficient buildings, aimed to achieve the net-zero carbon emissions target by 2050. Since the introduction of PAS 2035, there has not been research to assess its ongoing impact on management of retrofit projects and led to the need for this research. With the adoption of quantitative method that utilised an inductive approach, this study was carried out with the use of online survey that consisted of 13 closed-ended questions with 6 open-ended questions incorporated. 81 respondents completed the questionnaire, and the data was analysed using SPSS and NVivo to ensure the validity and reliability of the findings. The integrated findings revealed that PAS 2035 is currently having its planned effects on areas such as the reduction of carbon emissions, alignment with handling climate change, and the impact on energy efficiency of buildings. In contrast, it was shown that there is a problem with the funding process, a delay in the timeframe for retrofit projects, limited stakeholder participation, and insufficient public awareness. Project management strategies should be developed for a better funding process, project timelines optimisation, and for enhancement of project delivery.***

Keywords: PAS 2035, Domestic retrofit, Net-zero carbon, Project management, Energy efficiency

1. Introduction

The United Kingdom has been at the forefront of the global fight against climate change, setting a legally binding target to achieve net-zero carbon emissions by 2050 [1]. A critical component of this national strategy is addressing emissions from the built environment, particularly the ageing housing stock that significantly contributes to carbon emissions [2]. The government's strategy highlights the urgent need to improve the energy efficiency of existing buildings, recognising that approximately 80% of the homes that will exist in 2050 are already built today [3]. This makes retrofitting a vital pathway to mitigate climate change, reduce global warming impacts, and meet the nation's sustainability goals [4]. The domestic sector thus plays a key role in this transition, requiring robust and innovative standards to guide energy-saving interventions.

In this context, the Publicly Available Specification (PAS) 2035 emerged as a pivotal standard, introduced to formalise a strategic approach to domestic retrofitting [5]. While PAS 2030, previously announced, focused on individual energy-saving systems in a fragmented manner, PAS 2035 takes a whole-house approach, integrating design, assessment, and monitoring to offer complete and long-term benefits [6]. This distinction is crucial because the piecemeal method often led to inconsistent results, performance gaps, and underperformance against predicted energy savings [7]. The introduction of PAS 2035 aimed to resolve these issues by promoting fabric-first strategies and ensuring that interventions work cohesively within the building system [8].

The whole-house approach emphasised by PAS 2035 marks a significant departure from traditional practices, which concentrated on single-component upgrades such as loft insulation or boiler replacements without considering the interplay of building elements [9]. This shift recognises that addressing the home as an interconnected system improves energy efficiency outcomes and reduces the risk of unintended consequences, such as condensation or poor indoor air quality [10]. By embedding assessment, design, and verification stages, PAS 2035 aims to ensure that retrofits achieve targeted carbon reductions while enhancing occupant comfort and health [11]. PAS 2030's fragmented approach has evolved into PAS 2035's integrated framework, reflecting larger developments in the sector's understanding of retrofit best practices [6].

Retrofitting offers substantial environmental and socio-economic benefits beyond reducing carbon emissions. It is instrumental in lowering household energy bills, improving the thermal comfort of homes, and creating green jobs that stimulate economic growth [12]. Retrofitting also helps to achieve the UK's sustainable development goals by decreasing fuel poverty, increasing public health, and supporting the transition to a low-carbon economy [13]. The Climate Change Committee's publications consistently highlight the possibility of retrofitting to reduce emissions, laying the groundwork for meeting the 2050 net-zero target [1], as illustrated in figure 1 [14]. Yet, despite these advantages, significant challenges remain in scaling up retrofit activities to the levels required.

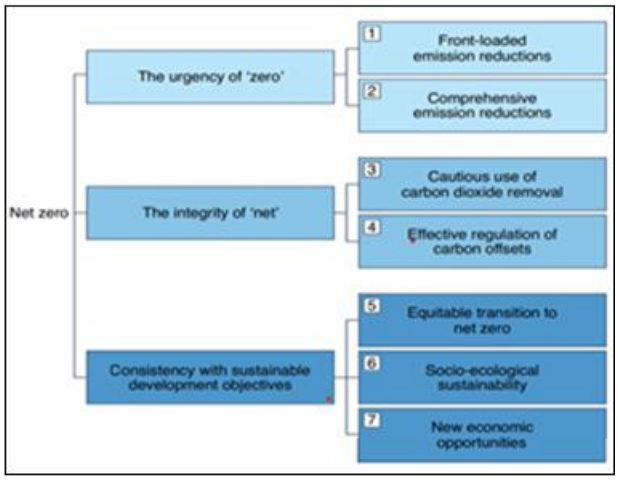

Figure 1: The robust framework of the 2050 net-zero target (Source: Fankhauser, 2022, p. 18)

Another critical challenge lies in balancing energy efficiency improvements with the conservation of heritage and historic buildings [3]. Since many older homes in the UK have distinctive architectural and cultural significance, sensitive retrofitting techniques that maintain their identity while improving performance are necessary [4]. PAS 2035 provides guidance on how to achieve this balance, offering a framework that accommodates conservation needs while delivering meaningful energy savings [6]. By adopting a strategic, whole-house approach, PAS 2035 enables tailored solutions that respect the diverse nature of the UK's housing stock.

The implementation of PAS 2035 has also been shaped by the need to address financial and socio-economic barriers to retrofitting. Homeowners, social landlords, and legislators have difficulties because retrofit projects frequently call for a sizable upfront investment [12]. Addressing these financial hurdles is essential for driving widespread adoption of retrofit measures, as is improving public awareness of the long-term benefits [13]. Furthermore, PAS 2035 encourages integration with broader policy frameworks, aligning retrofit activities with national and local strategies for climate mitigation, housing improvement, and economic regeneration [5].

2. Methodology

This study adopted a mixed-methods research design to investigate the impacts and effectiveness of PAS 2035 in retrofitting projects. The combination of quantitative and qualitative methodologies allowed for a thorough understanding of the research issue, including both statistical insights and detailed explanatory information. This approach was particularly suited to addressing the research questions, which spanned performance evaluation, stakeholder experiences, and systemic challenges in implementing PAS 2035.

The research sample comprised a total of 81 respondents drawn from a diverse range of stakeholders in the UK construction and retrofit sectors. These included retrofit coordinators, designers, assessors, installers, contractors, representatives from housing associations, and clients who were actively involved in or familiar with PAS 2035-compliant projects. The sample selection ensured that a broad spectrum of perspectives was captured, covering both technical and managerial viewpoints. The data sources mostly comprised of survey responses, supplemented by secondary literature as necessary, although the fundamental conclusions were generated from primary data collected directly from the targeted participants.

To collect the data, a structured questionnaire survey was developed and distributed electronically. Both closed-ended and open-ended questions were thoughtfully incorporated into the survey instrument to enable respondents to give quantitative responses while simultaneously providing space for further discussion of their experiences, viewpoints, and recommendations. The closed-ended questions focused on specific themes such as perceived effectiveness of PAS 2035, challenges encountered during implementation, satisfaction with project outcomes, and observations on performance gaps. Meanwhile, the open-ended sections invited respondents to share detailed insights, contextual factors, and potential improvement suggestions. To improve question clarity and make sure the survey flow made it easier for respondents to complete, a small sample of respondents participated in a pilot study of the questionnaire.

The quantitative analysis was performed on the closed-ended survey questions. These responses were coded and entered the Statistical Package for the Social Sciences (SPSS) for systematic analysis. To describe the key findings, descriptive statistics including frequencies, percentages, and mean scores were computed. For instance, the study examined the percentage of respondents who agreed or disagreed with claims about PAS 2035's effectiveness in reducing the performance gap or its sufficiency in meeting energy efficiency goals. Frequency tables were generated to provide an overview of response patterns across key thematic areas. Cross-tabulation was employed to explore relationships between respondent categories and their views on implementation outcomes. Where applicable, statistical tests were used to determine the significance of observed patterns, ensuring the reliability of the quantitative interpretations.

In total, 81 completed survey responses were included in the analysis, ensuring a solid data foundation. The response rate was deemed sufficient to provide meaningful insights into the research questions, especially given the targeted nature of the sample and the specialised expertise of the participants. The inclusion of diverse respondent roles enhanced the robustness of the quantitative findings, as it allowed for triangulation across perspectives.

Beyond the numerical data, the study placed particular emphasis on analysing the open-ended responses provided in the survey. Using thematic analysis methodologies, these qualitative findings were systematically analysed. To find recurrent themes, issues, and recommendations regarding the implementation of PAS 2035, the responses were first examined. Common themes such as training gaps, cost implications, challenges with the whole-house approach, and perceived benefits of the standard emerged from this review. The qualitative data was then coded and categorised, allowing for the identification of prominent patterns and the construction of narrative explanations that complemented the quantitative results.

To ensure rigor in the qualitative analysis, responses were cross-checked to confirm consistency and validity. Representative quotations from respondents were selected to illustrate key themes and highlight specific experiences or viewpoints. By ensuring that stakeholder voices were effectively included into the study findings, this method gave the numerical patterns found during the quantitative phase rich contextual depth.

Overall, the integration of quantitative and qualitative analysis methods provided a comprehensive methodological framework for the study. While thematic analysis of open-ended responses added subtle insights to the study, statistical analysis using SPSS guaranteed that the closed-ended data was handled methodically and appropriately. This method not only strengthened the validity of the research outcomes but also aligned well with the multifaceted nature of retrofitting under PAS 2035, where both measurable performance indicators and subjective stakeholder experiences are critical to understanding success and identifying areas for improvement.

By combining robust data collection, systematic quantitative analysis, and careful thematic exploration of qualitative insights, this study was able to offer a well-rounded and evidence-based examination of PAS 2035's role in the UK's retrofit landscape.

3. Results and Discussion

This section presents the research findings derived from quantitative and qualitative analyses, offering a comprehensive evaluation of how PAS 2035 has influenced the management of publicly funded domestic retrofit projects. The findings, which combine statistical data and thematic insights to identify trends, advantages, and difficulties in retrofitting techniques, are based on survey responses from 81 professionals. The tables and figures discussed here systematically convey the data collected, enabling a robust discussion that connects directly with the study objectives and later informs the conclusions and recommendations.

Table 1 summarises the demographic breakdown of the 81 respondents. Notably, 74.1% identified as male, while 23.4% were female, with the remainder preferring not to disclose. Age-wise, the largest group (28.4%) was aged 46–55, followed by equal shares (23.5%) in both the 26–35 and 36–45 age brackets. Project management was the most popular profession at 23.4%, followed by energy management at 13.5% and surveying at 14.7%. This demographic diversity ensured that different points of view were recorded by offering a range of opinions on the implementation of PAS 2035.

Table 1: A summary of the demographic information of the participants

Category	Subcategory / Field	Count	Column N %
Gender	Female	19	23.40%
	Male	60	74.10%
	Prefer not to say	2	2.50%
Age	18–25	5	6.10%
	26–35	13	15.90%
	36–45	19	23.50%
	46–55	23	28.40%
	56 and above	15	18.50%
Professional Field	Construction	1	1.20%
	Architecture	8	9.80%
	Certification	1	1.20%
	Charity	1	1.20%
	Commercial in PAS2035 practice	1	1.20%
	Construction (main)	11	13.50%
	Consulting	1	1.20%
	Energy Management	11	13.50%
	Engineering	4	4.80%
	Many years as an engineer in the built environment followed by last 18 years in retrofit	1	1.20%
	Oversight body	1	1.20%
	Project Management	19	23.40%
	Retrofit Assessor	1	1.20%
	Retrofit Coordination	1	1.20%
	Retrofit Coordinator	2	2.50%
	Retrofit coordinator & architect	1	1.20%
	Retrofit Designer	1	1.20%
	Retrofit Programme Manager	1	1.20%
	Specification, environmental, carbon counting, education	1	1.20%
	Surveying	12	14.70%
	Tutor	1	1.20%
Years of Experience	0–5	29	35.70%
	6–11	16	19.80%
	12–15	12	14.80%
	16–20	8	9.90%
	21 and above	16	19.80%

Table 2 presents the Cronbach's Alpha reliability statistic, a critical indicator of internal consistency. The results of the analysis showed that the Cronbach's Alpha was higher than the generally accepted cutoff point of 0.7, indicating that the survey's items were dependable and that the respondents' opinions were consistently measured. Also, Table 3 showing the Relative Importance Index (RII), ranks the influence of PAS 2035 across various dimensions. High RII scores appeared for stakeholder perceptions, carbon emissions reduction, and energy efficiency, highlighting areas where PAS 2035 has made substantial contributions. Conversely, aspects like cost-effectiveness, funding mechanisms, and project timelines recorded lower RII values, indicating areas needing targeted improvements.

Table 2: Item-Total Statistics with the Cronbach's Alpha

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
The implementation of PAS 2035 has made the management of retrofit projects more effective	46.49	24.578	0.59	0.798
The implementation of PAS 2035 has positively impacted the project delivery and timeline	47.02	24.574	0.394	0.814
The implementation of PAS 2035 has improved the overall energy efficiency out-comes of retrofit projects	46.47	24.552	0.539	0.801
PAS 2035 has added to a better understanding of reducing carbon emission through retrofit projects	46.56	24.675	0.465	0.807
Climate change issue can be addressed through retrofit projects	46.49	27.678	0.09	0.833
PAS 2035 has an impact on carbon emission reduction	46.44	25.35	0.507	0.805
PAS 2035 has impacted positively to the stakeholders' perception of retrofit projects	46.75	24.288	0.563	0.799
The standardized approach of PAS 2035 has enhanced project management	46.54	25.176	0.426	0.81
PAS 2035 has significant impact by improving energy efficiency of retrofit projects	46.43	24.873	0.559	0.801
PAS 2035 has favourably impacted the financing mechanism for retrofit projects that is aimed to enhance energy efficiency	46.86	25.619	0.405	0.811
PAS 2035 has had an important effect on improving the energy efficiency of retrofit projects	46.41	24.544	0.599	0.798
PAS 2035 has enhanced collaboration among project stakeholders	46.6	24.542	0.472	0.806
The implementation of PAS 2035 has led to noticeable improvements in the cost-effectiveness of retrofit projects	47.43	23.373	0.466	0.809

Table 3: Relative Importance Index Table of the Ordinal Variables

#	Questions/Items	Strongly Disagree	Disagree	Neutral	Agree	Strong Agree	Total (N)	A × N	RII	Rank
1	The implementation of PAS 2035 has made the man-agement of retrofit projects more effective	0	1	12	50	18	81	405	0.81	4
2	The implementation of PAS 2035 has positively im-pacted the project delivery and timeline	0	13	21	38	9	81	405	0.71	12
3	The implementation of PAS 2035 has improved the overall energy efficiency outcomes of retrofit projects	0	0	17	43	21	81	405	0.81	4
4	PAS 2035 has added to a better understanding of reduc-ing carbon emission through retrofit projects	1	2	11	50	17	81	405	0.8	8
5	Climate change issue can be addressed through retrofit projects	2	3	12	43	21	81	405	0.79	9
6	PAS 2035 has an impact on carbon emission reduction	0	0	17	43	21	81	405	0.81	4
7	PAS 2035 has impacted positively to the stakeholders' perception of retrofit projects	0	0	11	51	19	81	405	0.82	3
8	The standardized approach of PAS 2035 has enhanced project management	0	2	15	45	19	81	405	0.8	7
9	PAS 2035 has significant impact by improving energy efficiency of retrofit projects	0	0	12	48	21	81	405	0.82	2
10	PAS 2035 has favourably impacted the financing mechanism for retrofit projects that is aimed to enhance energy efficiency	0	1	32	40	8	81	405	0.74	11
11	PAS 2035 has had an important effect on improving the energy efficiency of retrofit projects	0	0	12	46	23	81	405	0.83	1
12	PAS 2035 has enhanced collaboration among project stakeholders	0	5	12	47	17	81	405	0.79	10
13	The implementation of PAS 2035 has led to noticeable improvements in the cost-effectiveness of retrofit pro-jects	4	19	26	28	4	81	405	0.62	13

Table 4 presents the normality test results using Kolmogo-rov-Smirnov and Shapiro-Wilk statistics. The dataset was statistically dependent, as evidenced by the p-values ($p < 0.05$), which further validated the quantitative results re-ported and supported the suitability of the analytical meth-odologies used. These statistical tests are vital in confirming that the data's underlying assumptions hold, enabling sound interpretation of correlations, patterns, and relationships.

Table 4: Test of normality of variables showing Kolmogorov-Smirnov and Shapiro-Wilk values

#	Items/Questions	Kolmogorov-Smirnov Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
1	The implementation of PAS 2035 has made the management of retrofit projects more effective	0.309	81	<0.001	0.79	81	<0.001

2	PAS 2035 has positively impacted the project delivery and timeline	0.288	81	<0.001	0.85	81	<0.001
3	PAS 2035 has improved the overall energy efficiency outcomes of retrofit projects	0.258	81	<0.001	0.81	81	<0.001
4	PAS 2035 has added to a better understanding of reducing carbon emission through retrofit projects	0.334	81	<0.001	0.78	81	<0.001
5	Climate change issue can be addressed through retrofit projects	0.269	81	<0.001	0.8	81	<0.001
6	PAS 2035 has an impact on carbon emission reduction	0.33	81	<0.001	0.76	81	<0.001
7	PAS 2035 has impacted positively stakeholders' perception of retrofit projects	0.281	81	<0.001	0.84	81	<0.001
8	The standardized approach of PAS 2035 has enhanced project management	0.29	81	<0.001	0.82	81	<0.001
9	PAS 2035 has significant impact by improving energy efficiency of retrofit projects	0.31	81	<0.001	0.78	81	<0.001
10	PAS 2035 has favourably impacted the financing mechanism for retrofit projects aimed to enhance energy efficiency	0.277	81	<0.001	0.8	81	<0.001
11	PAS 2035 has had an important effect on improving energy efficiency of retrofit projects	0.299	81	<0.001	0.79	81	<0.001
12	PAS 2035 has enhanced collaboration among project stakeholders	0.322	81	<0.001	0.81	81	<0.001
13	PAS 2035 has led to noticeable improvements in the cost-effectiveness of retrofit projects	0.211	81	<0.001	0.9	81	<0.001

Beyond the quantitative measures, the study used qualitative analysis through NVivo to deepen the understanding of stakeholder experiences. Figure shows a word cloud based on open-ended responses identifying the challenges encountered during PAS 2035 implementation. Terms like "funding," "training," and "compliance" stood out, reinforcing the quantitative findings that resource constraints and technical capacity gaps are perceived as major barriers to successful retrofit delivery. This visualisation also highlights the consistency between numerical data and lived stakeholder experiences.

Figure 1: NVivo's Word cloud for the question- The challenges experienced during the implementation of PAS 2035

Figure 2 presents the word cloud summarising respondents' suggestions for improving PAS 2035's effectiveness. Terms such as "awareness," "engagement," and "capacity" were dominant, pointing towards the need for improved communication strategies, broader stakeholder involvement, and enhanced technical training. This suggests that respondents think social and organisational dynamics that guarantee inclusive and knowledgeable involvement are just as important to the standard's success as technical frameworks.

Figure 2: NVivo's Word cloud for question- What suggestions would you offer to enhance the effectiveness of the implementation of PAS 2035?

Figure 3 shifts attention to socio-economic impacts, with frequently mentioned terms like "cost," "household," and "burden" suggesting that many respondents are concerned about the potential unintended financial consequences of PAS 2035. These findings indicate that stakeholders are still concerned about the short-term cost implications for consumers, which raises concerns regarding affordability and practicality even though the standard is intended to result in long-term energy savings.

Figure 3: NVivo's Word cloud for question- What suggestions would you offer to enhance the effectiveness of the implementation of PAS 2035?

Figure 4 reflects additional qualitative insights, featuring key terms such as "policy," "alignment," and "integration." Respondents emphasised the need for stronger alignment between PAS 2035 and broader policy frameworks, indicating that technical standards alone cannot drive successful retrofits without supportive policy environments that promote operational coherence and integration across sectors.

Figure 4: NVivo's Word cloud for the question- Additional comments respondents have concerned about the effects of PAS 2035 on retrofitting of domestic buildings that receive public funding

NVivo findings identified patterns from the open-ended question which are beneficial to this report and further supports the findings from the SPSS results. Themes such as need for stakeholder engagement, perceived unfavourable socioeconomic impacts due to high living standards, need for proper alignment of PAS 2035 with existing policies, implementation challenges experienced by stakeholders with administrative burdens and funding issues were mentioned by the respondents. These qualitative findings provided in-depth understanding in the current situations being experienced due to the impacts of PAS 2035 on domestic retrofit projects that receive funding.

It was also observed that challenges of the implementation of PAS 2035 are the compliance's complexity, financial limitations, and barriers of previous regulations. Also, on PAS 2035 impact on Public Awareness, there appeared to be low awareness on the public as energy-efficient retrofit projects has not been known by majority of the populace considering the patterns of responses.

Furthermore, to enhance a seamless integration into the broad area of energy efficiency initiatives, project management and sustainable building practices, more efforts should utilise to align PAS 2035 standard with existing policies and regulations. It is important to address the identified challenges in this research related to project timeline, funding means, and project delivery. To mitigate delays and guarantee the prompt completion of retrofit projects, strategies should be developed for a better funding process, project timelines optimisation, and enhancement of project delivery.

Figure 5 offers a cluster analysis on the key challenges identified, grouping related terms and revealing complex interconnections between issues like administrative burdens, limited funding, and technical knowledge gaps. This visualisation helps clarify how challenges are not isolated but often interact in ways that compound project delivery difficulties, reinforcing the need for systemic solutions rather than isolated fixes.

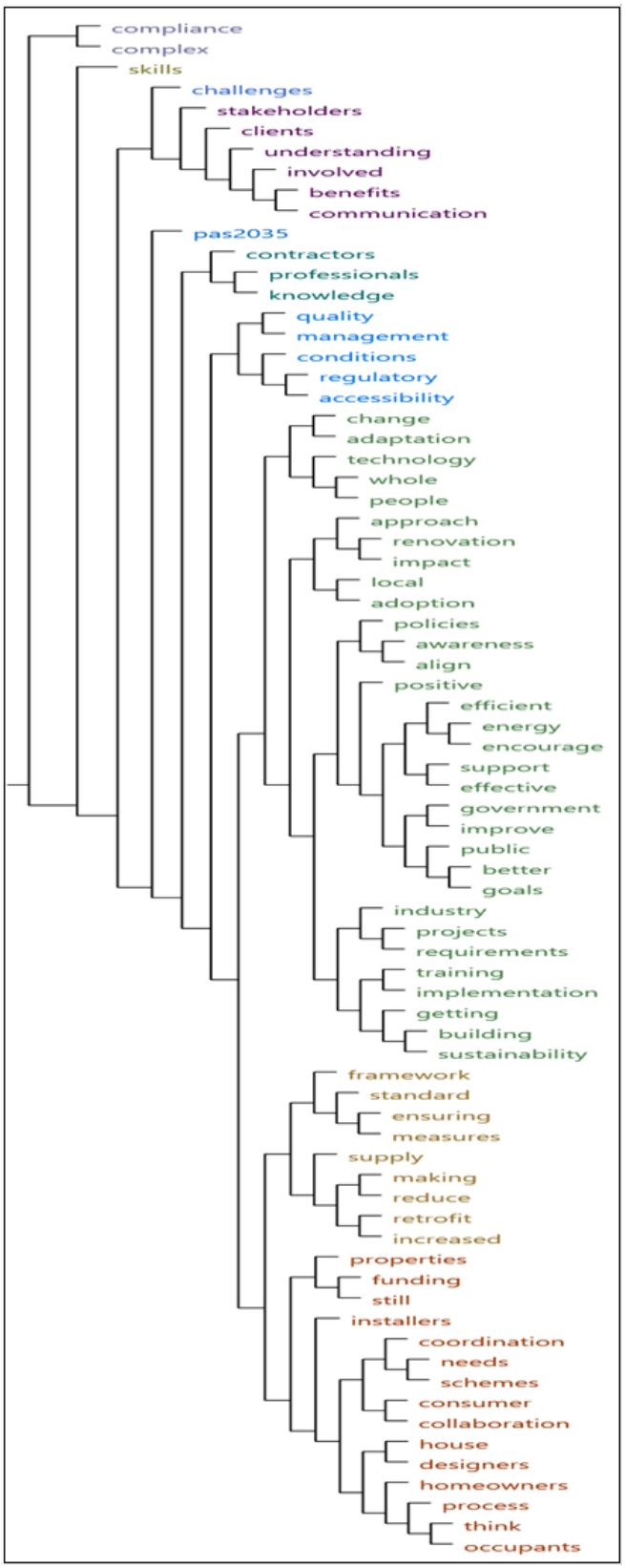

Figure 5: NVivo's Cluster Analysis for the Open-ended question Outline the main challenges experienced during the implementation of PAS 2035

4. Conclusions

This study has provided valuable insights into the implementation of PAS 2035 in domestic retrofit projects, revealing both promising achievements and persistent challenges. Through a mixed-methods approach combining quantitative data and qualitative insights, it has been possible to assess the perceptions, experiences, and recommendations of a wide range of stakeholders engaged in retrofit delivery. The analysis has highlighted that while important progress has been made in areas such as energy efficiency, carbon reduction, and project coordination, several barriers continue to limit the full realisation of the standard's potential.

One of the most encouraging findings is the positive stakeholder perception of PAS 2035's impact on improving energy performance and reducing carbon emissions. These factors were regularly given high rankings by survey participants, demonstrating that the whole-house strategy encouraged by the standard is having a noticeable positive environmental impact. The integration of assessment, design, and monitoring stages has contributed to improved coordination among project teams, helping to address previous fragmentation that often resulted in underperforming retrofits.

In addition, the study found strong alignment between the goals of PAS 2035 and broader sustainability objectives. Stakeholders acknowledged how the standard will help the UK's housing stock become more resilient over the long run and meet national carbon reduction ambitions. The reliability and internal consistency of the collected data also confirmed that stakeholder experiences were being captured coherently, lending weight to the conclusions drawn.

However, despite these achievements, several areas require urgent improvement. The persistent finance issues, which were shown to be a significant obstacle to broader adoption, are the most pressing of these. Accessing financial support is a challenge that many respondents pointed out, posing serious challenges for both homeowners and project implementers. Furthermore, the shortage of adequately trained professionals emerged as another critical issue, undermining the consistent delivery of high-quality retrofit measures.

The findings also pointed to gaps in stakeholder engagement and public awareness. Although there is technical alignment with sustainability policies, there is still a lack of operational alignment, particularly regarding buy-in and communication. Addressing these gaps will be essential for building public confidence, increasing participation, and ensuring that retrofit measures deliver both environmental and social value.

This study helps to know that while PAS 2035 has established a robust framework that is delivering notable successes, its effectiveness will depend on overcoming key implementation barriers. Stakeholder outreach, professional training, and targeted finance mechanism adjustments are required to improve delivery, close performance gaps, and fully achieve the lofty objectives of low-carbon, sustainable retrofitting in the UK.

Acknowledgements
The author wishes to express our profound gratitude to the members of staff of the School of Built Environment, Engineering and Computing, Leeds Beckett University, Leeds and in particular, the project supervisor, Prof David Johnston. They rendered high level of assistance during the experimental set up of the research.

References

[1] GOV.UK (2021) Build Back Better: our plan for growth. GOV.UK.
[2] Alabid, J., Bennadji, A. & Seddiki, M. (2022) A Review on the Energy Retrofit Policies and Improvements of the UK Existing Buildings, Challenges and Benefits. Renewable and Sustainable Energy, 159 May, p. 112161.
[3] Climate Change Committee (2020) The Sixth Carbon Budget. Committee on Climate Change.
[4] Andy Cameron-Smith (2023) UK Has Some Way to Go despite Retrofit Progress. Unlock Net Zero.
[5] Bennadji, A., Seddiki, M., Alabid, J., Laing, R. and Gray, D. (2022) Predicting Energy Savings of the UK Housing Stock under a Step-by-Step Energy Retrofit Scenario towards Net-Zero. Energies, 15(9), p.3082.
[6] The Royal Institution of Chartered Surveyor (2022) New Standards in Retrofit: PAS 2035 [Online]. Built Environment Journal.
[7] British Standards Institution (2019) PAS 2035:2019 Retrofitting Dwellings for Improved Energy Efficiency. Specification and Guidance.
[8] Skidmore, C. (2023). Mission Zero: Independent Review of Net Zero [Online]. GOV.UK.
[9] Climate Change Committee (2020) Sixth Carbon Budget: The UK's Path to Net Zero.
[10] Climate Change Committee (2023) Reducing Emissions in the UK Housing Sector.
[11] Cousins, F. (2023) Retrofitting the UK's Housing Stock: Opportunities and Challenges. Building Research and Information.
[12] The Royal Institution of Chartered Surveyors (2020) Net Zero Policy Position Paper.
[13] Glew, D., Parker, J., Fletcher, M., Thomas, F., Miles-Shenton, D., Brooke-Peat, M., Johnston, D., and Gorse, C., (2021). Demonstration of Energy Efficiency Potential; Literature review of benefits and risks in domestic retrofit practice and modelling. Department for Business, Energy & Industrial Strategy.
[14] Fankhauser, S., Smith, S. M., Allen, M., Axelsson, K., Hale, T., Hepburn, C., Kendall, J. M., Khosla, R., Lezaun, J., Mitchell-Larson, E., Obersteiner, M., Rajamani, L., Rickaby, R., Seddon, N. & Wetzer, T. (2022) The Meaning of Net Zero and How to Get It Right. Nature Climate Change [Online], 12 (1) January, pp. 15–21