CHAPTER 1: INTRODUCTION

1.1 Background Information

The UK government is ambitious to attain zero carbon emissions in the near future. According to Killip et al. (2021), this attainment is projected to be one of the most significant approaches through which the UK can address climate change issues. There have been considerable challenges jeopardising the government's attempts to achieve zero carbon through sustainable energy use (Robinson, 2020). Despite the challenges, there are endless opportunities for government and industry to work together and develop a natural environment to decarbonise. As reported by Wilkinson and Sayce (2020), the collaboration between industry and government can help raise the bar of sustainability through effective policy, practice, and standards. RIBA and the PAS 2035 are notable drivers of shaping the sustainable world. RIBA guidelines and PAS 2035 standard regulations are being adopted by retrofitters and architects to promote the sustainability and comfort of dwellings (Killip et al., 2021). As Killip et al. (2021) asserted, architects and architects promote sustainability by constructing new buildings and renovating the existing buildings with appliances, reducing carbon emissions. Reducing carbon emissions through fixing sustainable accessories in dwellings promotes the government's attempts to tackle climate change.

The policy of the UK government's ambitions to decarbonise housing stock has a well-structured policy route. Retrofitters and architects have adopted a holistic retrofitting approach to promoting dwellers' comfort as they seek to reduce carbon emissions from dwellings (Robinson, 2020). In comparable research by Wilkinson and Sayce (2020), RIBA's guidelines and PAS 2035 regulations have been fundamental in renovating dwellings. Compliance with these guidelines in the UK has significantly impacted the comfort of the dwellers, the adoption of energy-efficient approaches, the reduction of energy consumption and energy costs, and most importantly, the reduction in carbon emissions. Retrofitting buildings to improve sustainability has been pointed out by previous researchers, such as Robinson (2020), as the most significant opportunity to realise outcomes that seek to address climate change. Retrofitting existing homes also accelerates the pace, thus driving social benefits of enhancing well-being and skilled job creation.

1.2 The rationale for the Study

The current study explores approaches to improve the outcome of retrofitting by decarbonising existing homesteads. The researcher was interested in the topic because of the rising controversies and concerns relating to the roles of retrofit coordinators and RIBA architects in enhancing decarbonisation in renovating existing homes. The researcher wanted to comprehensively explore the roles played by retrofit coordinators in adopting sustainable energy use when retrofitting building to exceed enhancement of dweller’s comfort. Specifically, the researcher wanted to investigate whether retrofit coordinators play an indispensable role in promoting the achievement of retrofit outcomes such as improvement of energy efficiency, reduction in energy consumption and costs, reduction in carbon emissions, and enhancement of dwellers' comfort. Retrofitting is one of the most imperative approaches architects, and retrofitters can use in the UK to promote energy use efficiency and decarbonise in attempts to address climate change.

Research by Robinson (2020) highlighted the need for retrofitters and architects to comply with RIBA guidelines and the PAS 2035 Standard. According to this researcher, these regulations in the UK promote retrofitted homes, thus helping the movement achieve its ambition of attaining zero carbon by 2050. Retrofitting for improvement of the thermal performance of dwellings is in the UK government's focus on fuel poverty and net zero carbon policies.

Reduction in space heating is well dictated by the RIBA guidelines for architects and PAS 2035 Standard for retrofitters, especially retrofit coordinators. The interest is to explore in-depth retrofit coordinators' and RIBA architects' roles in promoting retrofitting.

1.3 Aims and Objectives

1.3.1 Aim

This study aims to explore design approaches to improve the outcome of retrofitting for decarbonisation by comparing the roles of architect and retrofit coordinator.

1.3.2 Objectives

Based on the rationale and scope of the present study, the objectives are:

1. To examine the current role of Retrofitting Coordinator under PAS2035.
2. To inspect the existing role of Architects under current RIBA Guidance for practising architecture.
3. To formulate targeted retrofitting outcomes because of the role of Retrofitting Coordinator, whose role responsibilities comply with PAS 2035.
4. To define targeted retrofitting outcomes as a result of the role of the Architect, whose role responsibilities conform with considered RIBA guidance for practising architects.
5. To formulate expected retrofitting outcomes for the new, improved Retrofit Coordinator role to aim at. These retrofitting outcomes encompass compliance with decarbonisation targets and quality standards.
6. To construct a new, improved Retrofitting Coordinator role that meets decarbonisation targets and quality standards.

1.4 Research Questions

1. What can we learn from the role of the Architect and Retrofitting Coordinator in meeting the outcomes of retrofitting?
2. How does RIBA guidelines and PAS 2035 Standard inform Architects and Retrofit Coordinators to strive to meet both decarbonisation targets and creates quality homes?

1.5 Importance of the Study

The current study seeks to explore the roles of architects and retrofit coordinators in meeting decarbonising targets and creating quality homesteads. By exploring this topic, the researcher will offer an in-depth understanding of approaches to promoting dwellings' quality while reducing carbon emissions. Research findings can provide solutions to retrofit project managers. During retrofitting, retrofitters can apply findings from the study to enhance the quality of homes and meet the clients' intended outcomes while meeting professional standards and regulatory requirements. The results will also be important for policymakers, as they will inform construction practices to heighten decarbonisation and improve construction quality. Last, it is worth noting that the research's findings will reduce the literature gap and provide architects and retrofit coordinators with an imperative understanding of their roles and the importance of their compliance with RIBA and PAS 2035 guidelines.

1.6 Summary of the Study Sections

The organisation of the thesis was based on the four phases outlined by the researcher in the Research Plan. The research was organised into nine chapters. In the first chapter, Introduction, the researcher provided the background of the study, study rationale, aims and objectives, and research questions. Chapter 2, Literature Review, contains an in-depth comparison of RIBA architects' roles and Retrofit Coordinators' roles in meeting the outcomes of retrofit projects. Chapter 3, Methodology section, explains the procedure used by the researcher to obtain the research findings. The investigator developed the map for the retrofit coordinators

and architects in chapters four and five. Chapter 6 and chapter seven contain an evaluation and synthesis of the feedback from interviews with retrofit coordinators and architects. In chapter eight, the researcher compared the roles of retrofit coordinators and architects. Finally, chapter nine evaluates and synthesises the feedback from the focus group. The researcher finalised the dissertation with the discussion and conclusion parts to cover various aspects of the third and fourth phases, respectively.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Retrofit projects are undertaken to enhance dwellings' thermal performance with a focus on fuel poverty and net zero carbon policies in the United Kingdom. There is a demand to have carbon fuel consumption reduced and clean energy adopted. PAS 2035 Standard emphasises retrofitting to refurbish homes and promote energy efficiency, cost reduction, and reduced greenhouse gas emissions. The present chapter offers an understanding of the role of retrofitting coordinator under the PAS 2035 Standard. The chapter also highlights the roles and responsibilities of architects in new building construction as well as the retrofitting process. Chapter 2 critically appraises the existing literature to highlight valuable information about the importance of retrofit coordinators and architects in the project management of retrofit programs. Many previous studies focus on analysing targeted retrofit outcomes with the involvement of retrofit coordinators and architects.

As discussed in the sections of this chapter, retrofit coordinators manage the entire retrofitting process from the planning phase to completion (Bu et al., 2015). Other retrofit professionals include retrofit assessors, evaluators, monitors, installers, and advisors. All these professionals play a significant role in retrofitting dwellings. As highlighted in the reviewed studies, coordinators play an important role as they oversee the entire process of retrofitting initial buildings. Retrofitting buildings, as discussed below, has far-reaching advantages in enhancing occupants' comfort. For instance, retrofitting buildings enhances energy use, energy efficiency and sustainability, reduces energy costs, prevents dwellings from deteriorating, and generally enhances clients' comfort (Campbell et al., 2017). The chapter provides insights into outcomes achieved because of coordinator and designer participation. Their participation in the retrofit project is critical in the realisation of the success of the project. Further insights into the existing roles of retrofit coordinators and designers have been explained in the various sections of this chapter.

2.2 What is PAS 2035 and its Importance?

PAS 2035 is an energy efficiency retrofit standard for environmental and economical friendly measures which sets out updated requirements for the energy retrofit of domestic dwellings (Christie, 2021; Gibb, 2022). This standard began undergoing a transition period between June 2019 and June 2021, after which it became mandatory for all government-funded projects to include ECO-financed retrofit projects (Christie, 2021). Christie (2021) emphasised that ECO-financed projects highlight the need for environmental sustainability, thus important for retrofit coordinators. As highlighted by Eadson et al. (2022), this new standard aims to deliver a whole dwelling approach that considers the householders' home, occupancy, environment, and desires. In turn, this helps resolve the challenges of retrofit processes considered in isolation, which are likely to accidentally destroy the overall home energy efficiency (Gibb, 2022). In order to deliver ECO-financed retrofit measures and display

compliance with PAS 2035, installers and coordinators must acquire accreditation from Trustmark and other institutions.

2.3 Main Changes Required by PAS 2035

The new PAS 2035 energy efficiency retrofit standard demands new roles for companies operating with ECO-funded retrofit projects. The functions offer clear accountabilities and responsibilities and ensure that the professionals involved provide quality throughout (Du et al., 2019). The team taking part in retrofitting must work together to achieve the intended outcomes. Jia et al. (2021) documented the need for a retrofit assessor. According to Jia et al. (2021), retrofit assessors undertake proper property assessments on elements such as occupancy, energy use, and initial condition assessments. Comparable findings by Bhattacharjee (2016) also point out the need to have assessors for retrofit projects. According to Bhattacharjee (2016), the elements that makes us aware of assessors' evaluation equips retrofit coordinator with the expertise regarding to a plan to improve energy efficacy for the dwellings. This indispensable role of retrofit assessors is vital for the entire process of retrofitting. This is because the determination of the noted energy efficiency improvement plan guides other procedures of a retrofit project (Du et al., 2019). Conclusively, it is notable that adherence to PAS 2035 enhances retrofit coordinators' competence, thus increasing the probability of successful retrofit projects.

The retrofit coordinator is responsible for drawing up the energy efficiency improvement plan for the entire period of the plan's processes (Bu et al., 2015). The coordinator ensures that all conditions and requirements related to the planned improvement are accurate and complete. Findings by Zheng, Yu, and Wang (2019) show that the accuracy and completeness of the conditions and requirements significantly determine the success of a retrofitting process aimed at enhancing dwellers' comfort by fixing energy issues in the building. Furthermore, Hale, Jofeh, and Chadwick (2022) noted that retrofit coordinators arrange and design appropriate measures for a retrofit project and commission the installer to undertake the work. Additional responsibilities of retrofit coordinators, who are critical in the entire process of retrofitting, have been highlighted in the sections that follow.

Retrofit advisors and designers also play an imperative role in retrofitting buildings to enhance dwellers' comfort. According to a study by Eadson et al. (2022), retrofit designers install the measures. They are the architects of retrofitting processes and inform how the planned project will be done to achieve the ultimate outcomes (Bu et al., 2015; Tan et al., 2018). Retrofit advisors offer in-person advice to homeowners during the retrofitting process (Zheng, Yu, and Wang, 2019). As seconded by Tan et al. (2018), retrofit advisers direct clients to include behavioural changes to enhance energy use reduction and adoption of clean and safe energy for domestic use. The roles played by retrofit advisors also create a positive atmosphere for realising homeowners' desired outcomes from the retrofitting process. Further explanations about the roles of the retrofit designers and their appropriateness in realising the intended results have been outlined in the subsequent sections.

2.4 Ways in Which PAS 2035 Has Shifted Ways of Working

Professionals taking part in retrofitting homes, especially coordinators, architects, and installers, must understand the changes that come with this new standard to avoid unexpected risks and problems. As documented by Tan et al. (2018), complainec with the PAS 2035 standard can help reduce risks. The prevention of risks and issues throughout the retrofitting process can be followed by adhering to the practical steps in the property assessment process for retrofit energy efficiency measures (Lai, Manan, and Alw, 2018; Jiang et al., 2018; Lee et al., 2020). The first step of the retrofit process for effective compliance with the PAS 2035 Standard

includes an in-depth assessment. As Lee et al. (2020) recorded, in-depth assessment entails a comprehensive property assessment for retrofit. This thorough assessment offers retrofit professionals an in-depth understanding of the property's initial condition, clients' needs, and the energy efficiency measures to be adopted to realise the client's needs (Tan et al., 2018). This act is imperative in ensuring that the objectives of the retrofitting program are drawn perfectly to reflect the client's needs. A qualified retrofit assessor often carries out in-depth assessments.

The second step of retrofitting process for compliance with PAS 2035 entails data gathering. As recorded in a report by Lee et al. (2020), a retrofit assessor collects data but has no mandate to specify solutions. After the assessor completes the data collection process, the retrofit coordinator models specific solutions using the Passive House Planning Package (PHPP) (Lee et al., 2020). Critical elements considered by the assessors and coordinator during data collection and modelling of solutions include:

a. Current services
b. The dwelling's construction, heritage, and dimensions

c. Dwelling's defects and plans for improvement
d. Moisture properties and their suitability for improvement
e. Occupant appraisal- client's special requirements
f. Existing constrained planning
g. Ventilation review
h. Assessment of water, air, and heat permeability
i. Annual fuel consumption
j. Estimated carbon emissions according to the carbon footprint, and
k. The U-values.

Risk assessment is the third phase and is performed by the project coordinator (Christie, 2021). A retrofit coordinator assesses retrofit project risk with the help of a Measuring Matrix. This activity helps the coordinator determine the level of technical expertise required to ensure that the project's goals and intended outcomes are successfully achieved within the project's timeline (Du et al., 2019; Jiang et al., 2018). This is an imperative predictor of client satisfaction through adopting energy efficiency measures that address the client's special requirements (Jiang et al., 2018). By determining the level of expertise required, the coordinator ensures that qualified professionals are recruited to undertake the retrofitting process. This undertaking is important in ensuring that services rendered solve the identified issues in the property and that effective thermal stabilisation is achieved in dwellings to enhance customers' comfort while protecting the environment against the negative impacts of greenhouse gases (Christie, 2021).

Fourth, the retrofit coordinator modifies the medium-term retrofit plans, such as construction strategy, for the building based on the assessment. Lai, Manan, and Alw (2018) emphasised that this plan details the installations and is later uploaded to a data warehouse. Design input is the fifth step. In this phase, retrofit architects recruited design professional for retrofit input to meet specifications (Du et al., 2019). After the design input, the design and installation stage follows. At this phase, the coordinator manages the retrofit install up to completion. The last two steps include handover and monitoring or evaluation.

During handover, the retrofit coordinator ensures the property owners or homeowners understand how to benefit from most of the improvements in their dwellings (Jiang et al., 2021). Some benefits homeowners and property owners are let to understand include reduced fuel bills, health benefits, and enhanced warmth and comfort (Jiang et al., 2018). In the last phase, monitoring and evaluation, retrofit projects are put through a series of testing, evaluation, and monitoring (Du et al., 2019). The series of testing, monitoring, and evaluation ensures prompt resolution of emerging risks and issues.

PAS 2035 standard outlines the framework for the efficient application of energy retrofit measures to UK buildings and offers the best mechanisms for implementation. As narrated by Grey et al. (2017) and seconded by Gillich, Sunikka-Blank and Topouzi (2018), PAS 2035 Standard specifies the so-called "whole building" or whole-house" retrofit. This entails an approach to clean energy installation by fixing energy efficiency measures (EEMs). As emphasised by Tingey, Webb, and van der Horst (2021), EEMs consider the requirement of the entire existing building, from a technical standpoint, with a focus on factors such as occupancy comfort. A report by Gillich, Sunikka-Blank and Topouzi (2018) highlights that retrofitting coordinators and architects play a crucial role in ensuring the efficient application and installation of EEMs. PAS 2035 assess domestic dwellings of energy conservation by identifying areas of improvement as well as specifying and designing the appropriate improvement measures. It also takes into account the close monitoring of fundamental retrofit programmes.

Retrofit programmes in the existing homes in the UK, done by proficient retrofit coordinators and architects, significantly help in decarbonisation (Edwards, 2021), especially in the wake of the global fight against the adversative impacts of global warming.

2.5 Persons Engaged in Retrofit Programmes

According to the PAS 2035 standard specifications, retrofit projects in existing buildings in the UK are conducted by professionals, including but not limited to retrofit advisors, retrofit assessors, retrofit evaluators, and retrofit designers, and retrofit coordinators (Alabid, Bennadji, and Seddiki, 2022). As Boyle (2020) emphasised, the mentioned professionals work together to ensure that retrofit projects in the UK building are performed ethically and appropriately to achieve the ultimate purpose of reducing energy consumption in dwellings. As recorded by Dauda and Ajayi (2022), these persons should have a comprehensive working knowledge of building science- also known as building physics, appropriate to the scale and nature of retrofit projects they are hired to perform. In a different study, Seddiki et al. (2022) emphasised that retrofit coordinators and architects should have extensive knowledge of moisture, heat, and air movement through dwellings. Comparable findings are echoed by Jahed et al. (2020), who noted that a comprehensive understanding of the flow of air, heat, and moisture in the dwellings is importance. Jahed et al. (2020) argued that such understanding enhances better management and control of their movement in order to maintain dynamic moisture and thermal equilibriums. Pérez-Fargallo et al. (2018) noted that the dynamic moisture and heat equilibriums in dwellings are essential in realising energy efficiency. It is evident that professionals who engage in retrofit programs, such as retrofit coordinators and designers, should have required knowledge of balancing dwellings' moisture and heat to sustain the dwellings' sustainable conditions.

Retrofit assessors, evaluators, architects, and coordinators must display an in-depth understanding of building pathology as well as occupants' needs to enable the realisation of the success of various retrofit projects they engage in. According to Gooding and Gul (2016), building pathology refers to the process by which a dwelling's condition and history, as well as its suitability for improvement, are systematically and critically analysed, as part of the evaluation process (Fylan and Glew, 2022). In a different study, Grey et al. (2017) echoed this finding by asserting that building pathology knowledge established how defects in a building arise and identified work to be done to restore performance, even before retrofit, to prevent such defects from occurring. When adhering to building pathology, coordinators, installers, and architects must work with other professionals to outline improvement options concerning building fabric, heating, ventilation, appliances, hot water, and lights (Fylan and Glew, 2022; Topouzi et al., 2019). Retrofit projects significantly limit heat loss from dwellings to improve energy efficiency (Topouzi et al., 2019). There must also be a serious emphasis on renewable energy systems and the occupants' needs. Focus on renewable energy during retrofitting has far-ranging positive implications in curbing the adverse effects of climate change.

2.6 Retrofit Coordinator

Domestic retrofit projects that comply with the PAS 2035 standard must be coordinated by a qualified retrofit coordinator (Gori et al., 2021). Retrofit coordinators are qualified personnel who provide end-to-end retrofit project coordination (Jahed et al., 2020; Killip et al., 2021). According to Killip et al. (2021) and Topouzi et al. (2019), retrofit coordinators provide coordination of work during retrofitting from the commencement of a retrofit project to handover and beyond. In a comparable study, Hay et al. (2018) noted that these professionals undertake essential evaluation and monitoring work to identify, evaluate and manage all technical and process risks linked with homestead retrofit projects. Retrofit coordinators play a significant role

in ensuring the success of a dwelling's retrofit programme. Despite their indisputable contribution to this course, Edwards (2021) noted that retrofit coordinators cannot work as loners without the help of other professionals in retrofit projects. When they work together to achieve satisfy client demands, the retrofitting of dwellings is done in compliance with the PAS 2035 standard. According to Edwards (2021) compliance to PAS 2035 helps meet the ultimate purpose of addressing fuel poverty. This is imperative in predicting the success of a retrofit team in the course of a retrofit project.

Like other professionals in the field of engineering and construction, retrofit coordinators must have undergone training and education relevant to actualising their mandates. As documented by Maby and Gwilliam (2022), a retrofit coordinator must hold a Level 5 Diploma in Retrofit Coordination and Risk Management (Alabid, Bennadji, and Seddiki, 2021). A retrofit coordinator may also possess evidence of currently working towards the mentioned qualification via a recognised and reputable certification process. Boyle (2020) and Small-Warner and Sinclair (2022) also assert that retrofit coordinators must have undergone training courses entailed on the register, maintained by UK's Ofqual, Northern Irelands' the Council of Curriculum Examinations and Assessments (CCEA), Scotland's Scottish Qualification Authority (SQA), or Wale's Qualifications in Wales. Furthermore, the personnel must also portray an in-depth understanding of vocational or professional qualifications related to constructions(Boyle, 2020). Pérez-Fargallo et al. (2018) noted that such qualifications are indispensable prerequisites for the Level 5 Diploma in Retrofit Coordination and Risk Management. Before undertaking any retrofit project, further information must be sought from the appropriate training institution or awarding body.

2.6.1 Roles and Responsibilities of a Retrofit Coordinator Based on PAS 2035

A retrofit coordinator protects the public and the client's interests. At the outset of a retrofit project, the coordinator consults the client and agrees while recording the retrofit project's intended outcomes (Alabid, Bennadji, and Seddiki, 2022; Fylan and Glew, 2022). The intended outcomes to be recorded during the consultation between the project's coordinator and client must consider the condition of the building. This consideration occurs long before retrofitting process to ensure that the client's interests are well understood. In a study, Edwards (2021) noted that project coordinators oversee a retrofit project from the start to completion. Any risks associated with the project that might harm the interests of the public and the client's interests must be addressed promptly to ensure client satisfaction. In an incomparable study, Fylan and Glew (2022) noted that the project's risk evaluators and assessors majorly for purposes of risk assessment. Despite this finding, it is imperative to note that retrofit coordinators coordinate the entire process during a project, thus, are the most appropriate to ensure that the assessors and evaluators address the risk before it worsens. Collectively, it can be argued that retrofit coordinators protect the client's and public's interests by ensuring that a retrofit project is undertaken with strict compliance with the PAS 2035 Standard from inception to completion.

Retrofit coordinators' exclusive responsibility is to ensure and claim compliance with PAS 2035 Standard. A retrofit coordinator works with other professionals during the entire process of a retrofit project to ensure that all activities align with the PAS 2035 (Maby and Gwilliam, 2022). Hay et al. (2018) emphasised that retrofit coordinators ensure that retrofit installers claim compliance with the EEMs installation process. EEMs installation results in the replacement of traditional energy sources with sustainable ones to ensure that attempts toward decarbonisation are encouraged and adopted. It is essential to underscore that adopting and implementing sustainable energy use during retrofit projects significantly promotes a clean environment, thereby reducing the far-reaching negative implications climate change has had on

global climatic patterns (Bobrova, Papachristos, and Cooper, 2022; Hay et al., 2018). In a different but similar study, Gillard, Snell, and Bevan (2017) underscored that the retrofit coordinator coordinates the entire process of retrofitting dwellings, ensuring that retrofit evaluators, assessors, installers, and monitors perform their roles and responsibilities religiously as dictated by the PAS 2035 Standard. It is imperative to underscore that compliance with this standard significantly predicts the success of a retrofit project (Hay et al., 2018). Successful retrofit projects helps the UK government address the challenge of poverty fuel.

Retrofit coordinators are employed by an organisation or client commissioned to undertake a retrofit assessment, design, installation, evaluation, and monitoring or commissioning work. According to Bobrova, Papachristos, and Cooper (2022), retrofit coordinators can be recruited to perform any of the mentioned activities or combinations of some. In a study by Killip et al. (2021), significant success is achieved when clients or institutions employ retrofit coordinators to handle the entire process in retrofit projects because of their vast knowledge and qualifications. However, contrasting findings by Seddiki et al. (2022) noted the need to have various professionals working in different stages of a retrofit project, such as assessment, evaluation, installation, and monitoring.

According to Seddiki et al. (2022) and supported by Edwards (2021), retrofit projects can be coordinated perfectly by retrofit coordinators with the indispensable help of retrofit assessors, designers, evaluators, and installers. According to a study by Gillard, Snell, and Bevan (2017), retrofit coordinators have extensive knowledge of project management, retrofitting, and risk management, which is vital in ensuring the success of a retrofit project. Campbell et al. (2017) further found that retrofit projects where clients and organisations recruited retrofit coordinators achieved the desired outcomes timely and recorded enhanced client satisfaction. Owing to the amplifications made, it is evident that arrangements made by clients and organisations to employ retrofit coordinators can present far-ranging positive implications as far as the achievement of a retrofit project's outcomes is concerned.

It is the responsibility of a retrofit coordinator to consult with the client or employing organisations to agree on and record the anticipated retrofit project's outcomes. Consultation between the client or organisation and a retrofit coordinator concerning the intended goals marks one of the most significant steps in achieving the success of a retrofit project (Wang, Liu, and Zhang, 2022). Such consultations are often done with consideration of the buildings' initial condition and the clients' admirations and preferred approaches to realise personal comfort in the dwelling. As emphasised by Pérez-Fargallo et al. (2018), consultations between the client and a coordinator might be expressed in terms of energy use reduction, a shift to sustainable energy use, and reductions in energy costs.

Additional outcomes of retrofit coordinator-client consultations include improvement of internal comfort of the dwelling, reduction in emissions resulting from energy use, meeting performance standards, protecting the dwelling against decay, and enhancement of resistance to water penetration (Gupta et al., 2015). The retrofit coordinator can also develop the intended outcomes of a retrofit project based on clients' needs, such as enhancement of the architectural design of the dwelling, integration of energy efficiency, and protection of the building against deterioration (Kerr, Gouldson, and Barrett, 2017; Tingey, Webb, and van der Horst, 2021). As indicated, it is evident that a retrofit coordinator significantly determines the intended outcomes of a retrofit project following consultations with clients.

With the introduction of the PAS 2035, retrofit coordinators offer oversight for a range of processes during retrofitting. According to Bennadji et al. (2022), a retrofit coordinator

communicates directly with the client about the achievements, challenges, and activities at different levels of retrofit project implementation from site assessment to completion. During assessment, evaluation, implementation, and adoption, the retrofit coordinators must oversee activities being done by the recruited professionals and advice as it might be deemed necessary. For instance, during an assessment of sites for domestic refurbishment, a retrofit coordinator might help assessors select sites with the potential of achieving the intended outcomes. A retrofit coordinator also allows designers and evaluators to develop retrofit plans per the client's needs (Gori, Marincioni, and Altamirano-Medina, 2021; Wang, Liu, and Zhang, 2022). At various stages of retrofitting, the coordinator reports to the clients about the progress made and how the identified challenges are addressed to manage risks. Coordinators also manage and monitor other project-related and technical requirements introduced by the novel PAS 2035 framework. The practices of management and monitoring conducted by the coordinator enhance their ability to provide oversight of the entire process of retrofit projects.

Retrofit coordinators identify, evaluate, and manage the retrofit project's technical and process risks. According to Kerr, Gouldson, and Barrett (2017), risk aversion is mainly done through proper communication channels and a positive information-sharing environment. A retrofit coordinator ensures appropriate integration and communication between retrofit teams (Fylan and Glew, 2022). Communication between teams ensures that retrofit processes in the selected dwellings are undertaken in compliance with the stipulated laws and the PAS 2035 Standard, limiting the possibility of a risk emerging (Kerr, Gouldson, and Barrett, 2017). Retrofit coordinators also encourage communication between teams when a risk occurs to ensure that the various project teams work together to address the risk and find a better mitigation approach (Fylan and Glew, 2022). This, in turn, leads to swift project management, with the ultimate result being the timely achievement of the intended outcomes as dictated by the customer demands, needs, or pronunciation during the early stage.

Post-installation evaluation is critical in determining a retrofit process's success and future projects' success. Gori, Marincioni, and Altamirano-Medina (2021) discussed that retrofit coordinators evaluate after completing a project to ascertain whether the client's intended outcomes were achieved. In a comparative study, Wang, Liu, and Zhang (2022) confirmed that post-installation evaluation allows coordinators to note down issues and challenges encountered to ensure that future projects are undertaken without such issues jeopardizing the retrofitting process. In a qualitative study by Wade and Visscher (2021), lessons learned from post-installation assessment ensure that all project team members understand approaches to undertake subsequent projects and satisfy the client's requirements by delivering the intended outcomes within the stipulated time. In post-installation analysis, coordinators guide other project teams to improve project development. This evaluation allows coordinators and other retrofit project team members to monitor energy use in dwellings, monitor internal temperatures, evaluate internal humidity, and use sensors and loggers to assess carbon dioxide concentration to ensure that a lot of care is taken when undertaking future projects (Bennadji et al., 2022; Wade and Visscher, 2021). In summary, retrofit project managers continue playing a vital role even after retrofitting is done to ensure that there is improvement in undertaking future retrofit projects.

Retrofit coordinators also ensure retrofit projects are safe and of the desired quality. As already discussed, retrofit coordinators oversee the retrofitting process from the beginning to the end. It is the responsibility of the retrofit coordinator to ensure that any dwelling proposed for retrofit focuses on enhancing energy efficiency and reducing carbon emissions (Bennadji et al., 2022). Importantly, most clients choose retrofitting to increase their comfort as they stay in their

dwellings (Wade and Visscher, 2021). This finding is emphasised by Gori, Marincioni, and Altamirano-Medina (2021), who reported that improvements should be made in the initial dwellings' conditions to promote the realisation of safe and energy efficient refurbishments. Safe and high-quality refurbishment, energy efficient apparatus, and a focus on appliances that reduce greenhouse gas effect are aspirations of most clients seeking retrofitting projects. Coordinators must therefore coordinate other members of the team undertaking retrofitting to ensure that the process yields safe and energy efficient buildings to enhance clients' comfort. This role is indispensable and cannot be delegated to any other team member.

2.6.2 Targeted Outcomes of Retrofit with Involvement of Retrofit Coordinator

Consultations between the coordinator and the client help outline the intended outcomes of a retrofit program on a selected houses. The intended outcomes must be considered in the initial condition of the conditions. There are indispensable benefits associated with retrofitting. First, retrofitting conserves embodied energy (Bobrova et al., 2022). Bobrova et al. (2022) further noted that retrofitting is a cost-effective approach to decarbonising existing dwellings by cutting down energy consumption, operational costs, and lifecycle costs. This, in turn, creates higher investment returns for the client than buildings which have not been retrofitted. Owing to the explanations, retrofitting significantly achieves the aim of sustainability and energy efficiency.

Improvement of air quality of dwelling is an essential intended outcome of retrofit projects. This is achieved through Internal Air Quality (IAQ) and Internal Environment Quality (IEQ) improvement (González et al., 2015). According to González et al. (2015), the internal comfort of dwelling is an anticipated outcome of the retrofit coordinator's involvement in retrofit projects. PAS 2035 Standard underscores the need to eliminate pollution sources to improve internal comfort (Fasna and Gunatilake, 2018). PAS 2035 standard also highlights the coordinators' role in ensuring that retrofitting process seeks to enhance air quality and environment quality in within dwellings by reducing carbon emissions. Retrofit projects involving certified retrofit coordinators achieve IEQ and IAQ by reducing carbon emissions and eliminating pollution (Gooding and Gul, 2016). This promotes quality air improvement, contributing to client comfort.

Energy use reduction is another key intended outcome of retrofit projects. As Gupta et al. (2015) reported, retrofitting buildings is key to cutting energy use and energy costs in existing dwellings. In a different study, González et al. (2015) asserted that well-retrofitted buildings cut energy use by implementing deeper retrofit measures that enhance dwellers' ability to avoid overreliance on energy use for activities that do not necessarily need energy. Similar assertions were made by Fasna and Gunatilake (2018), who noted that poverty fuel depends on energy efficiency improvements in the existing dwellings. This author indicated that coordinators' presence during retrofitting helps implement strategies proposed by retrofit designers towards improving energy efficiency in buildings. Retrofit coordinators, therefore, ensure that installers and other professionals undertaking retrofit projects adhere to the PAS 2035 standard concerning the need to implement dwellings' modifications that reduce energy consumption. It is imperative to underscore that energy efficiency and energy use reductions significantly lead to the reduction in the household spendings on energy, which is another crucial intended retrofit outcome (Gupta et al., 2015). As noted above, retrofit coordinators play a vital role in promoting energy efficiency, energy consumption reduction, reduction in carbon emissions, and a significant reduction in energy costs.

The retrofit coordinator's involvement helps realise the intended result of alleviating fossil fuels consumption in existing homesteads. As discussed above, retrofit coordinators play a

crucial role in reducing energy costs through efficient energy use and a considerable reduction in energy consumption. According to an empirical study by Fasna and Gunatilake (2018), fuel poverty results from unsustainable energy consumption. Important to note that retrofit coordinators' involvement in retrofit projects has wide-ranging positive implications for fuel poverty reduction. Comparable findings by Topouzi et al. (2019) affirm that improving energy efficiency in retrofitting lowers fuel spendings and energy consumption, thereby contributing towards fuel poverty. Taken together, the literature review confirms that retrofit coordinators have a primary role to play in contributing towards reduction of fuel poverty through adopting PAS 2035 requirements in retrofitting.

Reduction in carbon emissions linked to effective energy use can be achieved better through the involvement of a retrofit coordinator. As already discussed, retrofit coordinators oversee the implementation of retrofit projects from planning to completion. It has also been emphasized that coordinators work with other professionals to enhance energy efficiency and reduce consumption (Gupta et al., 2015). As reviewed, a reduction in the use of traditional fuels, especially fossil fuels, is imperative in reducing carbon emissions (Gooding and Gul, 2016). A fact worth underscoring is that retrofit coordinators oversee adherence to PAS 2035 guidelines, which necessitate replacing buildings with sustainable energy to contribute to mitigating climate change impacts. Given the evidence, retrofit coordinators ensure compliance with the PAS 2035 standard, thereby enhancing the adoption of clean energy during retrofitting. Energy efficiency measures and energy consumption reduction strategies are highly emphasized during retrofitting (Gori et al., 2015). These are some techniques highlighted by retrofit coordinators to reduce carbon emissions.

2.7 The Royal Institute of British Architects (RIBA) Guidelines

RIBA is a global professional body driving quality in architecture. This professional membership body serves its members and the societies to deliver aesthetic and quality buildings and places, a sustainable environment, and stronger communities (RIBA, 2021). RIBA's undertakings are done in an inclusive, environmentally aware, ethically, and collaborative underpins (*RIBA plan of work, 2022*). RIBA executives often strive to make changes across the architectural practices to create a leaner, more agile, and more member-focused entity. This entity has a streamlined cooperating structure with RIBA staff organised in key strategic areas for quality service delivery. RIBA guidelines are suitable when consultants or architects are recruited to perform a commission, often for architectural services on projects for a public authority or business client (Gyurkovich, 2019). The RIBA guidelines provide a wide-ranging set of RIBA Standard Contract terms whose main objective is to enhance the quality of construction and quality of living (Gyurkovich, 2018; Häkkinen et al., 2015). The RIBA guidelines also offer a set of rules and aligned services that architects follow to ensure that quality is delivered. As is the case with retrofitting, quality is critical in constructions that involve architects and consultants.

2.7.1 Connection between RIBA and Quality Buildings

During retrofitting, architects and other construction professionals meet the client's needs. In the process of improving occupied buildings, architects play a vital role in developing their designs (Charef, 2022). As underscored by Attia (2019), architects must understand the performance of building service systems when designing buildings. This important role can only be achieved if they adhere to RIBA guidelines as well as PAS 2035 Standard. RIBA guidelines outline the specialist knowledge of Mechanical and Electrical Engineering or Building Services (Charef, 2022). Energy conservation activities during retrofitting of a formerly occupied building

require architects to demonstrate an in-depth understanding of the construction system's behaviour, environmental performance, and energy use. These three elements are often the significant concerns raised by individuals wanting their households or premises retrofitted (Gyurkovich, 2016). It is essential to underscore that during design stage, architects consider clients' needs, the anticipated outcomes, and the need to meet retrofitting goals relating to carbon reduction from existing dwellings and addressing fuel poverty (Hay et al., 2018). For all these to be achieved, architects must demonstrate a sufficient understanding of RIBA Guidelines and PAS 2035 Standard.

There have been many attempts to improve the quality of buildings in the UK. According to a study by Kurwi et al. (2021), significant progress has been achieved in enhancing quality construction in the UK. This researcher pegs this improvement on the advocacy of well-trained and equipped architects. Similar findings by Attia (2019) amplify the fact that quality construction is a critical measure of aesthetic appeal and regulatory compliance, although both are assuredly important. However, contrasting findings by Gyurkovich (2019) reported that the issue surrounding the improvement of quality construction has resisted effective solutions. According to Gyurkovich (2018), the resistance shows that the problem relating to quality buildings is unlikely to be resolved soon. Comparable findings by Charef (2022) attribute this resistance to adherence to regulatory compliance such as RIBA and PAS 2035 guidelines. Contactors and architects who adhere to statutory guidelines promote the quality buildings as well as professional and ethical retrofitting of existing properties (Stevenson, 2019). Professional architects adhere to RIBA guidelines, thus being able to establish comfortable and energy-efficient buildings.

Quality buildings achieved through architects' compliance with RIBA guidelines promote human health and the public good. As emphasised in a study by Djabarouti and O'Flaherty (2019), the quality building has an aesthetic appeal and enhances the dweller's health, which is critical to enhancing compliance with requirements that lead up to client's comfort. Kurwi et al. (2021) documented concerns relating to clients' special needs during retrofitting. Many clients, as Rice (2019) suggested, involve retrofit coordinators and designers to improve their dwellings' condition so they can be more comfortable. In a similar study, Häkkinen et al. (2015) noted that architects who follow RIBA guidelines promote customer satisfaction by enhancing the aesthetic value and improving dwellers' comfort. This shows that adherence to RIBA guidelines is key in helping achive goals for retrofitting old houses. It is important to highlight that the requirement of electrical and mechanical engineering, as dictated by RIBA guidelines, is key for architects and can significantly help balance moisture, air, and heat in dwellings during retrofitting as required by PAS 2035 Standard.

The public good is achieved through the quality construction of public spaces and public buildings. As reported by Marsh, Pilkington and Rice (2020), architects must adhere to PAS 2035 and RIBA guidelines to enhance the quality of the buildings they design (Häkkinen et al., 2015). Häkkinen and co-authors underscored the fact that financial value depends on the achievement of short-term and long-term quality dividends (Djabarouti and O'Flaherty, 2019). For instance, hospital buildings must help improve our positive health outcomes, school structures must boost academic excellence, and social facilities should set a quality scene for enhancing the life chances of taxpayers without compromising the environment or disparaging a sense of the site. When constructing these public buildings, RIBA guidelines expect architects to promote environmental conservation, improvement of human health, and improvement of comfort to make the buildings suit the dynamic needs of citizens. It should be noted that carbon

reduction techniques can be used when retrofitting quality dwellings (Killip et al., 2021). Taken together, the reviewed literature confirms that adherence to RIBA guidelines by architects has far-reaching positive implications for enhancing public good and satisfaction, which is a key determinant of quality construction.

2.7.2 Roles of Architects

All UK architects are mandated to register with the Architects Registration Body (RIBA, 2021) so as to perform their activities within the dictates of the law. Most architects in the UK are members of RIBA. All valid RIBA architects in the UK with educational qualifications in architecture and practical experience are validated by the RIBA. Architects associated with with RIBA must adhere to this institution's code of ethics and professionalism when performing their duties. This enables the constriction of high-quality buildings as well as highly comfortable retrofitted homes (Shelbourn et al. (2017). They must have ownership of Professional Indemnity (PI) insurance. As Schneider-Skalska (2018) recorded, PI insurance provides a cover when a registered architect gives unsound guidance or makes a mistake. This is one of the critical legal requirements of all architects in the UK for retrofits and new-builds (Shelbourn et al., 2017). It is important to note that some individuals might pose as architects to provide architectural services to clients without proper validation by RIBA and registration by ARB. Such individuals might present quality issues in the buildings they design from scratch as well as those structures they are recruited to retrofit. As such, scrutiny of certification and professional qualification is imperative in promoting the United Kingdom's attempts to promote aesthetic and quality housing by managing architectural projects through RIBA and ARB.

Architects can participate in the entire constriction process, starting from the design to completion. In the initial phases, they view construction sites, propose locations, and organise meetings with clients to draft intended outcomes. An empirical study by González et al. (2015), showed how architects inform the roles of designers and retrofit coordinators. Furthermore, González et al. (2015) confirmed that architects have a significant role in influencing the lives of buildings and places, as their design, construction and property quality are considerably affected by design quality. According to RIBA guidelines, architects' most critical role is to promote quality construction to improve the durability, comfort, and energy efficiency of constructed buildings or retrofitted homes (Kurwi et al., 2021). Architects work together with retrofit coordinators and assessors to design homes to be retrofitted with quality amendments that enhance the comfort of dwellers (Kurwi et al., 2021). Evidentially, highly trained architects, registered with RIBA, design quality buildings during construction and retrofitting to enhance the complete quality of dwellings.

Architects use the much of their input in the planning stages. Schneider-Skalska (2018) reported that during the planning stage, architects involve validation officers and their clients in making design attempts until the final design is produced. As echoed by González et al. (2015), architects often liaise with clients to translate their intended designs and receive feedback throughout the entire retrofitting period. During the planning phase, RIBA guidelines highlight the need for architects to adhere to the UK's building regulations (González et al., 2015). As Schneider-Skalska (2018) pointed out, RIBA architects must seek planning permission and the certainty of the building's grade of retrofits. As such, authorisation must be approved and the building grade accepted before the commencement of construction. RIBA architects also consider environmental factors when designing. Per this RIBA Standard relating to environmental conservation, they must depict an in-depth understanding of building materials and appliances when developing designs throughout the period set for retrofit projects (Samuel,

2020). Therefore, architects design new buildings and homes to be retrofitted with environmentally friendly appliances that uses sustainable energy sources such as solar. This, in turn, helps the UK government to address climate change issues relating to global warming and fuel poverty. RIBA architects are trained to enhance buildings' energy efficiency and reduce carbon emissions as much as possible (Gibb, 2022). As explained, RIBA architects are certified designers who professionally and ethically design buildings to satisfy client needs while enhancing energy efficiency, clean energy use, and cost reduction.

Architects work with contractors after the production of a coordinated design information. Many architectural firms can recruit contractors to undertake the building works if requested by contractual agreement with client (Ismail, Keumala, and Dabdoob, 2017). As Ismail, Keumala, and Dabdoob (2017) emphasised, architectural constructions comply with RIBA guidelines to achieve the intended outcomes. This is often successful when recruited contractors and collaborate with architects to promote quality construction. Evidentially, during the retrofitting process, the retrofit coordinator works with retrofit assessors and designers to ensure that the intended outcomes are achieved after the process (Alnaggar and Pitt, 2018). RIBA guidelines outline the need for the construction works team to work with the architects to promote consultations. The cooperation promotes the construction of the building as designed and according to client demands and the government's requirements. Schneider-Skalska (2018) highlighted that the cooperation between architects and contractors yields quality construction in retrofitting. Contrasting findings offered by Shelbourn et al. (2017) assert that the collaboration between architects and contractors results in a conflict of interest and duplication of responsibilities, making it difficult to achieve the intended goals. According to Shelbourn et al. (2017), architects must pave the way for contractors to finalise their work and appear later with evaluators to ascertain the quality of the construction. Despite this finding, it is imperative to understand that the mentioned cooperation is vital because employed architects offer guidance to contractors regarding the design in case of any technicality.

Architects are often on particular sites to oversee the construction process this is subject to terms of appointment and procurement contract. RIBA chartered practice have an extensive understanding of managing contractors who carry out construction works after the design (Ismail, Keumala, and Dabdoob, 2017). They, therefore, play a vital role in team and project management. In their study, Ismail, Keumala, and Dabdoob (2017) noted that contractors are used for various site works. During retrofitting, contractors participate in modernising dwellings' internal designs as planned by the architect. The design sometimes changes during construction to address emerging risks and challenges or meet dynamic clients' needs or regulatory specifications (Hay et al., 2018). According to this finding by Hay et al. (2018), it is deemed necessary for architects to be ever-present at the site to make any adjustments to the design for immediate implementation by chartered architects and other teams. Similar findings reported by Alnaggar and Pitt (2018) confirm that changes in design and planning can be made throughout the whole process of construction. Because of this issue, architects should always available to make changes and advice on how changes can be effected on the initial design submittals. This undertaking is also imperative for retrofit projects. Coordinators liaise with architects and retrofit installers to ensure that changes made on the initial retrofit project are effected to improve dwellings' comfort, energy efficiency, cutting the cost of energy and reducing carbon footprint.

RIBA architects have extensive digital literacy, enabling them to design aesthetic and quality constructions. Computer-aided activities in the contemporary digital world have significantly helped professionals perform their core mandates (Samuel, 2020). RIBA guidelines

underscore the use of computer-aided designs (CAD) and programs during a building's planning, designing, and construction (Ismail, Keumala, and Dabdoob, 2017). In a different study, Gibb (2022) noted that retrofit designers use information technology and computer-aided designs and programs to design appliances and tools that can be fixed in existing buildings to enhance dwellers' comfort, energy efficiency, and a reduction in carbon emissions. RIBA architects use computer-aided designs to produce construction plans, which are later improved using their expertise to offer a design that meets the client's needs and the government's regulations. As Samuel (2020) emphasised, architects often use CAD during trial planning and developing final designs. This act entails using various software to produce sketches from which final designs can be extracted. As a result, architects perform their work within stipulated timelines, therefore aiding in the realisation of construction or retrofit projects as dictated in the work plan.

Architects draw designs for new construction projects, redevelopments, and alterations. They are indispensable professionals during the construction and initial stages of retrofit projects (Charef, 2022). During the planning phase of a retrofit or new construction project, architects specify requirements relating to comfort and energy resilience for each project. In a study by Gori et al. (2021), study findings show that architects use their specialist redevelopment, alteration, and new construction knowledge and top-class drawing skills to design functional, sustainable, safe, and aesthetically pleasing buildings. In a different study, Karydis (2020) found a positive relationship between architect qualification and certification by RIBA with construction quality and high-level retrofitting. According to this author, RIBA-compliant architects offer their services during construction and retrofitting processes, as they work closely with a wide-ranging team of construction and retrofitters to realise quality construction and renovations that satisfies clients' interests. Architects have to consider budget constraints, client needs, and environmental well-being in their plans (Seddiki et al., 2022). Owing to the explanations offered, it is evident that architects, especially those who abide by RIBA standards, have far-reaching positive implications on the quality of a building they participate in the commencement stages of construction or retrofitting.

It is the responsibility of architects, if agreed by the client and requested by the contract, to produce proposals, reports, contracts, and applications. The mentioned documents are essential in the construction process, from planning to completion (Hay et al., 2018). Hay et al. (2018) also emphasised that these documents are presented to various authorities, clients, and architectural institutions to ensure the safety, sustainability, and comfortability of a new building or a retrofitted dwelling. When producing these documents, architects may consult with the local authorities, building service engineers, contractors, project managers, architectural technologists, and quality surveyors (Charef, 2022). Relationship between architects and other professionals at and away from the construction site is significant in predicting the quality and sustainability of a construction or retrofit project (Tan et al., 2018). From this perspective, it is evident that architects liaise with the mentioned professionals to write construction and retrofitting documents about the feasibility of potential projects, the project being undertaken, and how projects can be enhanced to realise maximum success.

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2.7.3 Intended Outcomes of Retrofit with Involvement of an Architect

Clients and retrofit organisations have highly involved architects to realise outcomes that address efficient energy use, energy cost reduction, reduction in carbon emissions, and dwellers' comfort improvement (Lupton and Anderson, 2021). To preserve the environment, Gori et al. (2021) underscored that existing buildings have undergone modifications and redevelopments to tackle the issue of increased carbon footprint. According to Samuel (2020), architects have been

at the forefront of reducing carbon dioxide footprint by reducing overreliance on fossil fuels, reusing wastes from demolished dwellings as well as fixing existing buildings with sustainable appliances and tools. Tools and appliances used in retrofitting should be of sustainable energy sources such as solar (Tan et al., 2018) During retrofitting, architects are often hired to provide guidelines on how retrofits are done (Tan et al., 2018). According to Tan et al. (2021), retrofit project coordinators and installers needs to follow the provided guidelines to enhance sustainable energy use in the internal thermal balance of buildings while reducing carbon emissions. When enhancing sustainability, traditional energy sources that produce a lot of carbon, such as fossil fuels and charcoal, are replaced with sustainable ones, such as solar energy. In a survey by Karydis (2020), study respondents reported that RIBA architects are imperative in ensuring that buildings are fixed with sustainable energy sources during retrofitting. Sustainable energy sources are imperative in promoting the comfort of dwellers after retrofitting.

Another targeted outcome, besides carbon footprint reduction, is promoting efficient energy use. Opportunities to reduce energy consumption in an existing building might differ from those in the design of new construction projects (Lupton and Anderson, 2021). Architects play a vital role in ensuring that designs drawn for retrofitting dwellings seek to reduce energy consumption (Wade and Visscher, 2021). This is under the RIBA principles relating to key competencies of certified architects that need to be implemented by engineers, contractors, and designers to contribute towards sustainability (Lupton and Anderson, 2021). Architects promote efficient energy use by considering appliances that encourage energy efficiency during retrofitting projects (Karydis, 2020). Alnaggar and Pitt (2018), who affirmed that sustainable electronic appliances in modern marketplaces have been designed to use less power without compromising quality, echo this finding. Architects propose using such devices during planning, thereby affecting the realisation of efficient energy use. Architects also train home dwellers on how to use energy sparingly to reduce their carbon footprint, which is crucial in enhancing clean energy.

Architects' involvement in retrofit projects results in quality redevelopments and renovations. As already discussed, architects play a vital role in modelling dwellings for retrofit. According to Charef (2022), architects have extensive knowledge of construction science or construction pathology that helps them design quality buildings. Comparable findings by Hay et al. (2018) emphasised that architects recruited to design models for retrofitting existing buildings significantly predict the quality of the end product of the retrofit project. Qualified architects, especially from RIBA chartered practices, plan for building modification by offering steps and activities to enhance the quality of an existing building. Alnaggar and Pitt (2018) reported that architects work with retrofitting coordinators to ensure that clients' needs are considered in planned retrofit projects to enhance their internal comfort and help them achieve efficient energy consumption, reduced costs of energy, and reduced carbon emissions. As already emphasised, reduced carbon emissions is achieved through the use of sustainable energy sources such as solar. It can be argued that architect involvement in retrofit projects positively impacts the quality of retrofitted dwellings.

During retrofitting, architects plan to modify dwellings to promote clients' needs and comfort. As designers draw various designs for retrofitting homes, their designs must reflect dwellers' need for comfort. According to Hay et al. (2018), dwellers' comfort can be attained through an architecture's consideration of approaches to coding buildings for parameters toward achieving indoor environmental quality (IEQ) and indoor air quality (IAQ) to eliminate discomfort. Achieving IEQ and IAQ through retrofitting the existing dwellings enables the

dwellings to respond positively to climate change (Karydis, 2020). RIBA architects have adequate knowledge of how a dwelling's internal thermal comfort can be improved. As reiterated in a study by Hay et al. (2018), architects take into account metabolic heat producers and relative humidity stabilisers when designing new constructions and existing dwellings under retrofitting. This is among other parameters qualified architects utilise in realising thermal comfort in existing buildings.

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