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Dissertation Title: Investigating public awareness and opinions toward residential retrofitting to decrease energy demand and improve environmental performance: an analysis of existing housing stock in Letchworth Garden City.

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Being a dissertation submitted to the faculty of The Built Environment as part of the requirements for the award of ***MSc Housing and City Planning*** at University College London:

I declare that this dissertation is entirely my own work and that ideas, data, and images, as well as direct quotations, drawn from elsewhere are identified and referenced.

ACKNOWLEDGEMENTS

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ACROYNMS

SAP	Standard Assessment Procedure
EPC	Energy Performance Certificate
LPA	Local Planning Authority
BEIS	Department for Business, Energy and Industrial Strategy
DLUHC	Department for Levelling Up, Housing and Communities
ONS	Office for National Statistics
NGO	Non-Governmental Organisation
AECB	Association for Environment Conscious Building
LA	Local Authority
RP	Registered Provider
UNFCCC	United Nations Framework Convention on Climate Change
LGCHF	Letchworth Garden City Heritage Foundation
NHDC	North Herts District Council
PHPP	Passive House Planning Package
MHCLG	Ministry of Housing, Communities and Local Government (now called DLUHC)

ABSTRACT

The aim of this dissertation is to investigate public awareness and opinions of residential retrofitting in Letchworth Garden City, focusing on identifying the most important benefits, drawbacks and drivers. This dissertation also seeks to identify differences in opinions between residents living in older and newer properties. Retrofitting – the act of introducing components into an existing building with the aim of reducing its energy consumption – is critical in achieving the government's net-zero carbon goal by 2050 due to households being the highest source of emissions in the UK. Mass retrofitting is seen by academics and professionals to be a potential solution to decarbonise the existing housing stock.

The research methods include a review of relevant theoretical and empirical literature, followed by data collection in the form of a survey. This survey was distributed to local businesses and community organisations in Letchworth Garden City to gather a high response rate from residents of various backgrounds and interests. The findings provide evidence that there is a lack of awareness of retrofit policy incentives and services, but relatively high awareness of retrofitting components. Respondents noted lower fuel bills, improved environmental performance and better indoor comfort as the most important benefits. The most important drawbacks are associated costs, requiring permission and lack of known practitioners. Respondents living in older properties note requiring permission and affecting the building aesthetic as more important drawbacks compared to newer properties. The most important drivers for retrofitting include reducing the cost of components and lowering fuel bills, however, climate change concerns also held high importance.

The implications of this research denote a reform of retrofitting policy is required to improve financial incentives and retrofit services, and the requirement of a retrofit strategy from LGCHF to allow retrofits whilst still being sympathetic to Letchworth's unique history.

1. INTRODUCTION

> "*We either choose to recognize that business as usual isn't worth the devastating price we're paying and make the necessary transition to a more sustainable future — or we accept that we're investing in our own extinction.*"
> (Patricia Espinosa, UNFCCC Executive Secretary, 2021).

1.1 Study Background

Climate change concerns continue to be the subject of academic research and international organisations (Hulme, 2022; Intergovernmental Panel on Climate Change, 2022), whom largely imply that human activity is predominately to blame for a significant rise in emissions (Cohen, 2019). CO2 produced by human activities has resulted in its atmospheric concentration rising to 48% above pre-industrial levels (European Commission, 2020). Whilst a significant amount of these emissions is linked to major economic growth for many countries, there is a global consensus that if current emission rates continue, there is a genuine threat of early extinction.

To counter this, many governments have implemented legislation regarding energy production and the reduction of emissions (Nachmany et al, 2015). In a UK context, the Climate Change Act was enacted in 2008. This was the world's first legally binding climate change target: a 38% reduction in greenhouse gases from the 1990 baseline by 2020, rising to an 80% reduction by 2050 (Climate Change Act 2008), which has since extended to a 100% reduction (Climate Change Committee, 2022). Emission reductions are clear in some sectors – figure 1 shows that emissions produced from manufacturing in the UK have experienced reductions, whilst emissions from electricity, gas, steam and air conditioning have also experienced reductions since 2012 (ONS, 2021). Although transport and storage emissions have slightly increased, the UK Government and local authorities have reacted by committing to bans for emission vehicles and implementing low emission zones (DfT and BEIS, 2020; GOV.UK, 2022; TfL, 2022).

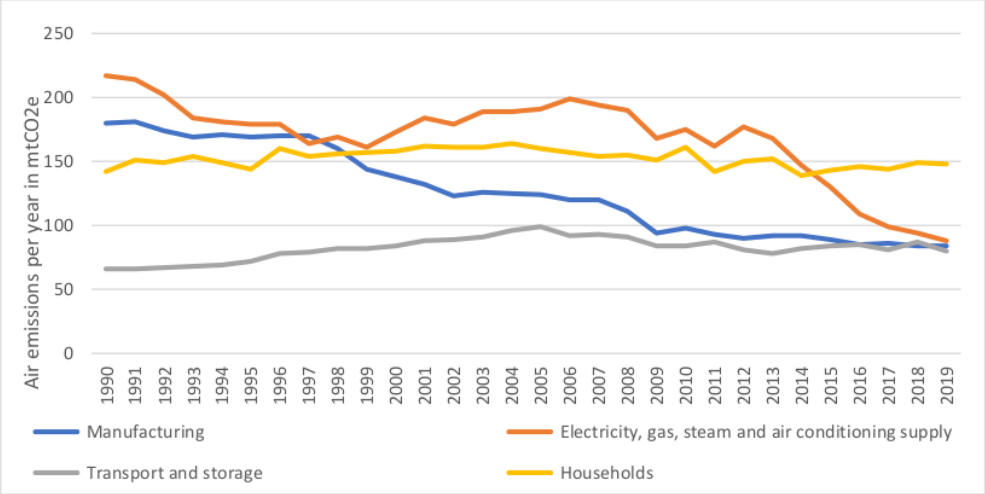

Figure 1 - UK Greenhouse Gas Emissions for the Four Highest Sectors, 1990 - 2019. Source: ONS (2021)

Households are the highest source of emissions in the UK, and data shows that emissions are also higher in 2019 than they were in 1990 (ONS, 2021). Although this can be partially attributed to a rise in the number of households (ONS, 2022), energy consumption and emissions for UK homes need to be reduced significantly in order to achieve net-zero by 2050. Whilst new buildings *can* be built to a low or zero-carbon standard – this is not compulsory despite previous considerations (DLUHC, 2021; Parliament. House of Commons, 2016) – the vast majority of existing buildings do not meet a low carbon standard. Considering new homes add less than 1% a year compared to the existing housing stock (Power, 2008), this would account for 27.82 million homes according to 2021 statistics (ONS, 2022). Therefore, improving the existing housing stock by retrofit is the only legitimate answer to achieve net-zero.

The emission of GHG by households is historic (Warde, 2007). According to Palmer and Cooper (2013), 91% of UK households use gas for their central heating. This presents another problem: there is early evidence suggesting that households prefer using gas boilers due to familiarity, reliability and lack of trust in energy-efficient alternatives (Haynes, 2022). The other aspect of reducing emissions is by improving the thermal envelope (the heat control layer) of the building. Whilst this is a more popular alteration to existing homes than heating alternatives, insulation improvements still remain low at 5% peak market delivery in 2012 (Climate Change Committee, 2019). It is clear that current retrofit uptake (of any kind) is very low.

The importance of addressing this issue is eclipsed only by the size of the task. It is clear that the UK government is committed to a net-zero future. Despite its documented importance, residential retrofits are completely at the household's discretion; a problem when UK culture appears to be somewhat opposed to capital expenditure, especially on retrofit infrastructure (Cotterell and Adam, 2012). Therefore, questions must be posed: what is the public's opinion on retrofitting, what can be done to improve public opinions, awareness, and, ultimately, the uptake of residential retrofitting?

1.2 Research Aim and Objectives

This dissertation seeks to investigate public opinions on retrofitting their homes and any emerging trends. This includes the level of awareness about retrofitting, identifying the most important reasons for and against retrofitting their homes and whether these reasons differ depending on the age of a household's property. This includes (but is not limited to) lowering fuel bills, improved thermal comfort and reduced environmental impact; cost (and whether this is successfully mitigated by grants, VAT exemptions, etc.), disruption and complexity. Another focus of this research is to identify why retrofit take-up is low. There is already a plethora of empirical and theoretical studies on multiple aspects of retrofitting and environmental behaviours. However, opinions and awareness levels of retrofitting have received relatively little attention from academia.

To achieve the aim of this research, the following objectives have been devised:

1. What are the current issues with UK residential retrofit legislation and policy?
2. What is the current state of public awareness and opinion regarding retrofitting homes to decrease energy demand and reduce carbon emissions?
3. Are there different inclinations toward retrofitting houses between people living in homes from different construction eras?
4. What are the drivers for improving public opinion and uptake regarding residential retrofitting?

1.3 Research Structure

Chapter 2 will critically review existing literature on residential retrofitting, public environmental behaviours and UK retrofit policy. Chapter 3 will present the research methodology; this will include an analysis of the study area, research conducted and justification of the methods selected. The findings of this research will be shown in chapter 4. Following this, a discussion

of the results found, identified limitations of the study and the scope for future study will be presented in chapter 5. Lastly, chapter 6 will present the conclusions and implications of this research.

2. LITERATURE REVIEW

2.1 UK Residential Retrofitting

The term '*retrofit*' is widely used in the construction industry. In a broad scope, it can be defined as alterations to a building to improve building performance, either in energy terms or other aspects (ASHRAE, 2019). Baeli (2013) further defines retrofit as an approach seeking to introduce new materials, products and equipment in order to reduce the energy use of a building. In practice, this is often focused on two alterations: changing the existing building fabric, such as additional insulation; and changing or introducing new technologies, such as building heating systems (Fisk et al., 2013). Although these definitions differ vis-à-vis the scope of alterations, they both list a reduction in energy consumption as the main result.

However, it is important to note that whilst this is correct, there are other key benefits associated with retrofitting such decarbonising key sectors, especially the household sector in the context of this research (RICS, 2020). This has led some academia to coin the term '*green retrofit*', which specifically looks at carbon emissions and environmental impact (Jagarajan et al., 2017). There is also improvements in indoor comfort and reduced energy costs associated with retrofitting (Traynor, 2019); arguably, this is a key benefit which may have a significant impression on consumers regarding retrofit uptake. This is also suggested by Gram-Hanssen (2014), stating policy could explore and exploit other motivations than what is economically advantageous – especially for deeper retrofits.

The 'deepness' of a retrofit project is directly correlated to expenditure; items such as improved windows and doors and energy-efficient lighting are relatively low cost compared to components such as internal/external insulation, floor insulation, technological components (heat pumps, MVHR units, photovoltaic panels, thermal panels) and airtightness membranes (Baeli, 2013). These components are more expensive due to purchase and installation costs, and often result in higher disruption to occupants. However, deeper retrofits typically result in lower energy consumption over simple retrofits.

Retrofitting has increased relevance in a UK context due to the existing housing stock being renowned as one of the oldest in Europe (BEIS, 2021; Piddington et al, 2020). There is an inherent relationship between older buildings and poorer environmental performance due to traditional building methods and older technologies, evidenced in table 1. For this reason, some retrofits will achieve low-carbon status in one intervention, whereas many will require multiple stages (Fawcett and Topouzi, 2020). However, whilst this makes heritage buildings a prime concern for achieving a net-zero housing stock, designated heritage buildings are protected by planning policy and legislation (Wise et al, 2021), limiting the scope for applicable

retrofit techniques. Undesignated buildings can be protected by local planning policy, but residents are often keen to protect the heritage values of their homes (Herrera-Avellanosa et al, 2019), also limiting applicable techniques. Retrofitting appears to come second to the protection of older buildings if it negatively affects its character – an approach that allows sympathetic retrofitting is required for these buildings to reduce their energy consumption.

Variable group	Coefficient	Estimate	Odds ratio (x likely)	Standard Error	LCI	UCI
Intercept		0.068	1.07	0.002	1.065	1.075
Property age	Reference: 1930 to 1982	-	-	-	-	-
	Pre-1900	-1.324	0.266	0.004	0.264	0.268
	1900 to 1929	-1.266	0.282	0.004	0.28	0.284
	1983 to 2011	1.872	6.502	0.002	6.476	6.528
	2012 onwards	5.288	197.87	0.011	193.464	202.376

Table 1 - Odds ratios of a home having an EPC rating 'C' or higher by construction year. Source: ONS, 2022.

There is a general consensus that retrofitting the existing housing stock is cheaper than rebuilding new stock (Baeli, 2013). There are also environmental sustainability benefits associated with retrofitting (Meles et al., 2022), such as less embodied carbon – a retrofit approximately has a 65% reduction in embodied carbon compared with a new build (LETI, 2020). This, coupled with the strong impetus on owner-occupation in the UK since the financialisation of housing and prolonged government pursuance vis-à-vis home ownership rather than reliance on the state for housing (Lowe, 2011), means the need for a retrofit to meet net-zero is the responsibility of the property owner, not the government. This presents an issue, as some of the drawbacks of retrofitting – such as cost, inconvenience and scepticism – are major concerns for the British public (DEFRA, 2008).

Contrastingly, Brounen and Kok (2011) found that houses labelled as more energy-efficient attract a price premium, meaning that consumers are likely to benefit from higher property resale values if they retrofit their homes to a higher environmental standard. It is important to note, however, that it is unclear whether the additional resale value will amount to the cost of a retrofit – especially as one documented retrofit to Passivhaus standard cost £60,000 in 2016 (de Selincourt, 2019) and there are retrofit projects involving pre-1918 buildings which have exceeded £100,000 (Baeli, 2013). Contrary to Brounen and Kok, there is also evidence that better EPC ratings have a negligible effect on price negotiations (Laine, 2011), however better energy standards may have a greater effect on prices if they demonstrate significantly lower energy consumption.

2.2 Public Environmental Behaviours

A large amount of public perception around environmental behaviours is based on positive motivators such as individual benefits and, according to Shove (2009), what is socially normal and being a part of something. There is further theoretical evidence which reinforces the impact of social influence. Two pioneering theories on environmental behaviour presented 'subjective norms' – the social pressure of a behavioural alternative times willingness of compliance – as a foundation to instigate behavioural change (Klockner, 2013) by changing intentions (Ajzen, 1991) or even personal norms (Schwartz and Howard, 1981, cited in Klockner, 2013). Conversely, there are also barriers or drawbacks such as force of habit, scepticism and external constraints (cost, for example) (DEFRA, 2008).

Schwartz and Howard's 'the norm-activation-theory' and Ajzen's 'theory of planned behaviour' also mention perceived behavioural control – a self-perceived measure of how easy or difficult it is to perform a behavioural alternative (Sparks et al, 1997) – as a factor influencing environmental behaviour. The significant investment associated with retrofitting is likely to be perceived as a difficultly by the vast majority of the British public, especially due to aforementioned aversity for capital expenditure, in addition to other difficulties associated with retrofitting such as planning constraints, project complexity and a lack of consultants, contractors and specialists (Jagarajan et al, 2017).

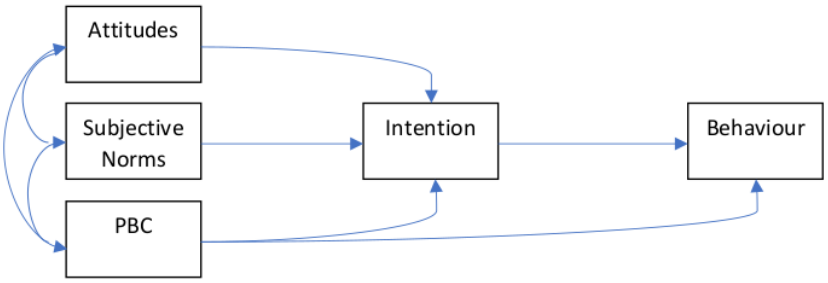

Figure 2 - The Theory of Planned Behaviour Model. Source: Ajzen, 1991.

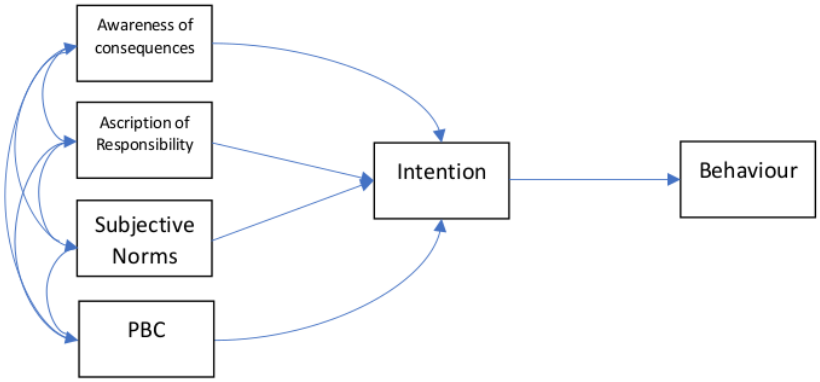

Figure 3 - The Norm-Activation Theory. Source: Schwartz and Howard, 1981

Another aspect of public environmental behaviour is the need for attitudes to change. According to Milfont and Schultz (2018), the paradigm of ABC – 'A' for attitudes which drive 'B' behaviour 'C' chosen by individuals (Shove, 2009) – is dominant in environmental policy, implying that attitudes are arguably the biggest factor. This is reinforced by Ajzen (1991) as he found that personal considerations tend to overshadow social pressure. However, Klockner (2013:1036) highlights the importance of perceived behavioural control, stating that 'a feeling of self-efficacy is at least as important as creating a positive attitude'.

Whilst there is arguably more awareness for individuals to be environmentally conscious than ever – especially amongst younger ages (NatCen, 2018) – the general attitudinal factor vis-à-vis environmental attitude is the more difficult, time-consuming or expensive a behaviour is, the weaker effect attitudes have (Black, Stern & Elworth, 1985). This is reinforced by Diekmann & Preisendörfer (2001), who found attitudes are a bigger determinant for environmental behaviour in low-cost domains compared to high-cost domains. Therefore, to create the required environmental behavioural change to achieve net-zero, many have argued that solely individual behaviour change cannot tackle climate change in society (Uzzell, 2008, cited in Shove, 2009, p.1282) and that environmental behavioural change is better tackled through government-led intervention (Darnton, 2004).

If there were to be any shift of stance from this, the appetite for embedded state-citizen responsibility needs to increase (Shove, 2009). However, there is evidence of change from a consumer perspective. Nash et al (2017) found climate-relevant behavioural spillover may be intensified by highlighting changing aspects of people's lives, such as weather and temperature anomalies – this alone can increase climate change concerns, especially as UK temperature and weather warning records were recently broken due to exceptional heatwaves (Met Office, 2022). However, there is evidence to suggest consumers simply prefer existing energy options, suggesting a recognition that if components are in a satisfactory state, the reasoning for change is insufficient (Dinner et al, 2011). It is therefore important how energy efficiency options are portrayed and presented to consumers; Nash et al (2017:9) describe how "communication confidence and highlighting additional benefits" can provide means for behavioural change, as well as relating climate change to everyday life situations.

Retrofit literature is also saturated with the theory of occupant behaviour in homes. A cogent statement by Gram-Hanssen (2014) explains that homes do not consume energy, but it is the occupants with different technologies and practices that determine energy consumption. This is echoed by Ben and Steemers (2014:120), stating that "occupant behaviour plays a major role in determining building energy use" and the impact of behavioural change exceeds the impact of physical improvement. The difficulty with ascertaining ways to assess and improve

occupant behaviour in an environmental context is the vast amount of determinants, which varies from anything related to social and economic factors (education and energy costs) to behaviour and activities of occupants (Berg et al, 2017).

However, there is empirical evidence that negative spillover effects can occur if people feel one behaviour compensates for another (Nash et al, 2017). Hamilton et al (2016, cited in Shove, 2018, p.780) found evidence that people with better-insulated properties are more inclined to 'take back' thermal comfort rather than actively reducing their energy consumption. This is echoed by Ben and Steemers (2014:129) who state that a backfire may occur if low-energy users are "triggered" by energy efficiency increases leading to higher energy demand. There is also evidence to suggest that smaller retrofits in combination with behaviour variations have a greater impact on energy reduction than larger retrofits – especially in the case of less energy efficient or heritage buildings (Harrestrup and Svendsen, 2015). Therefore, it is crucial that user occupants are engaged with vis-à-vis their energy use to take advantage of retrofit benefits.

2.3 UK National Retrofitting Policy

There is an argument that UK policy still lacks proactivity vis-à-vis residential retrofitting. Policymaking for retrofitting has evidently had limited success, with the energy-efficient retrofit rate in the UK averaging between 1% and 3% (Zhang et al, 2021). The involvement of NGOs regarding the promotion of retrofitting by the UK government demonstrates the need of many stakeholders to be involved. Additionally, Zhang et al (2021) states that streamlining and coordinating with multiple stakeholders via regulation and policies is essential. Stakeholder concerns act as a main focus for policy instruments as they provide information from different sources and perspectives, and provide expert advice for policy measures to be created (Shen et al, 2016). In the context of the UK retrofit policy, the policy instruments have influenced assessment and disclosure, direction and command, research and service, and financial incentive aspects (Zhang et al, 2021).

For example, the direction and command aspect of policy instruments has been widely utilised by the UK government, especially in recent years: the government's net zero goal by 2050 resulted in a confession that the vast majority of the UK's 27 million homes will need to be virtually zero carbon (BEIS, 2021). This is a strong statement; nevertheless, there is still no regulation or requirement to retrofit existing homes, or even a national retrofit strategy. The National Retrofit Strategy, published by the Construction Leadership Council, is the only document created to strategise mass retrofitting (Construction Leadership Council, 2021). However, the document is created by an NGO and is not endorsed by the UK government. According to Fogarty (2021, cited in Kimpian, 2021), the rate of retrofit take-up needs to be

circa 20,000 homes per week to achieve net zero by 2050, however, there is “no standard in place” to achieve this.

Assessment and disclosure instruments for UK retrofit policy are limited. EPCs are only required for the sale and letting of properties, meaning a significant portion of properties are not energy audited and therefore do not identify any retrofit opportunities. The number of EPCs issued for a new dwelling, sale or rental significantly outnumbers non-mandatory EPCs over a prolonged amount of time (see figure 4), meaning most households do not assess their own homes. There is also criticism that EPCs are not eminently helpful for retrofitting their homes and homeowners need practical advice regarding retrofit options relating to everyday life, including savings accrued (Gram-Hansen, 2014).

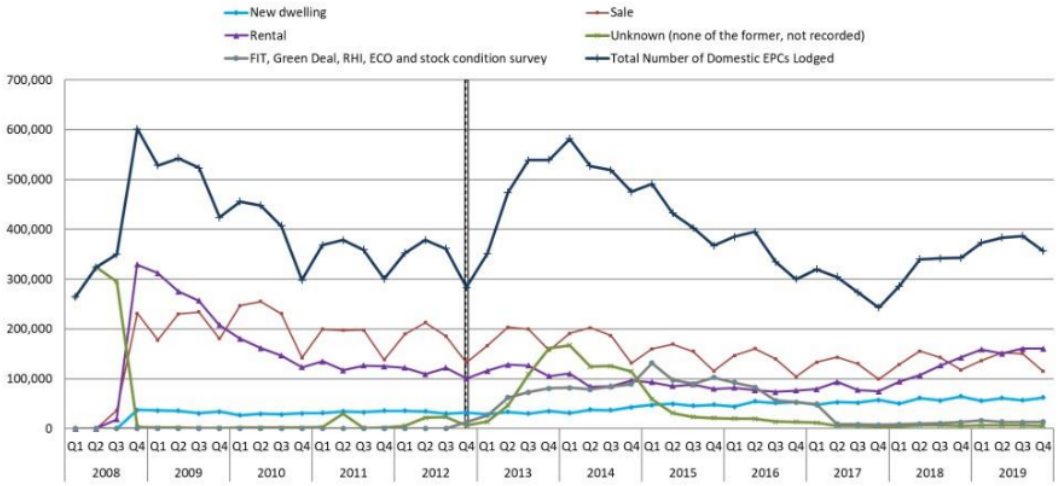

Figure 4 - Number of EPCs Lodged by Reason, 2008 to 2019. Source: MHCLG, 2020

Whilst literature suggests EPCs fall short as a tool to assess and guide retrofits, evidence suggests that consumers trust the information on an EPC (Christensen et al, 2014) and the identified savings can entice owners to invest in improving energy efficiency (Olaussen et al, 2017). However, Burman et al (2014) found there can be a discrepancy between assessed (EPC) performance and actual energy performance, Therefore, it can be argued that a restructuring of the EPC SAP is needed to include more diverse retrofit information to benefit the consumer vis-à-vis retrofitting, as well as greater accuracy in assessment to reduce discrepancies. Other energy standards to model building performance are available – such as PHPP (Passivhaus Trust, 2022) – however these are seldom used outside of deep retrofit projects.

Financial incentives have been utilised in retrofit policy in recent years. According to a United Nations’ Sustainable Development Goals report in 2021, substantial investment is the only way to achieve energy efficiency targets. This argument is reinforced by Ruparathna et al

(2017), stating financial incentives embedded in retrofit policy are essential to implement mass take-up. Past funding has been allocated to initiatives for local authorities (to enable investment in social housing and low income families) and for property owners. There are also some initiatives which are currently in force; a list of applicable initiatives is available in Appendix B. The level of funding these initiatives have allocated varies: the "Sustainable Warmth Competition" offers £350 million, whilst the "Boiler Upgrade Scheme" offers £450 million over three years and is part of a £3.9 billion project (King, 2021). However, boiler upgrade schemes present the issue that current policy targeting decarbonisation have focused on low carbon energy supply and less importance on 'fabric first' (Saffari and Beagon, 2022); especially when a fabric first approach is considered best practice (Jackson, 2015). Although exact levels of annual funding are unavailable, estimations extend to £23 billion per annum required to improve domestic homes (Kelly, 2009). There is also evidence to suggest that funding cuts in the early 2010s resulted in reduced insulation take-up rates (Shankleman et al, 2022), providing further indication that funding is essential to increase retrofit take-up.

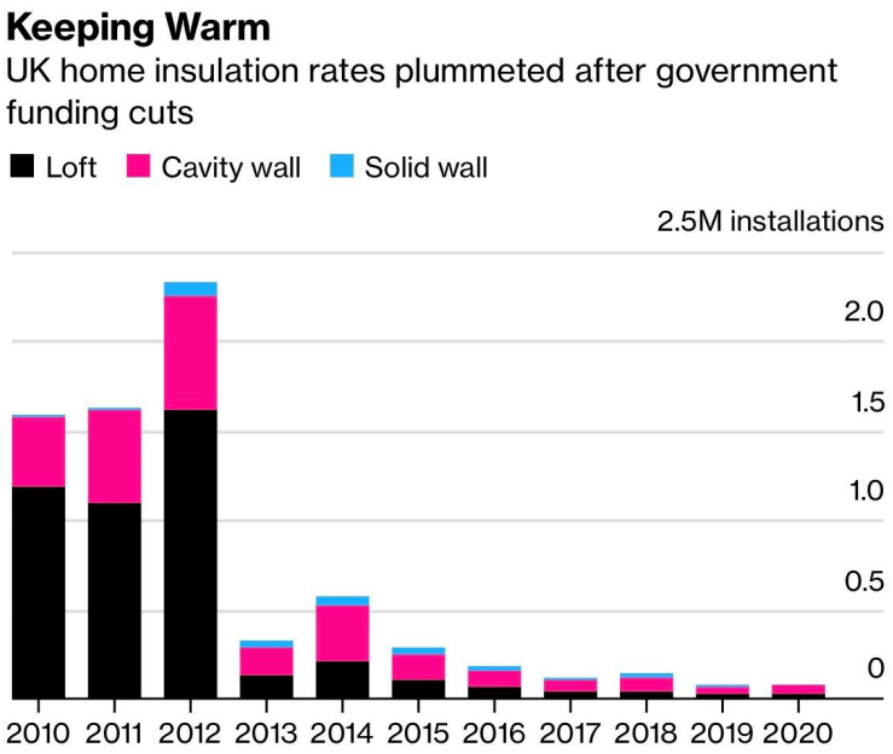

Figure 5 - Insulation Take-up Rates. Source: Shankleman et al.

According to Zhang et al (2021), research and service is the fourth aspect of policy instruments influencing retrofit policy, involving increasing awareness and providing technological support. The GOV.UK website features a number of documents providing guidance to households about multiple aspects of retrofitting, including guidance on heat pumps and related installers, and information regarding smart meters (BEIS, 2021;2022). However, the most recent retrofit guidance – Retrofit for the Future – was released in 2014 and is therefore outdated. There are also concerns that environmental policy and guidance are expressed in an exclusively technical manner and should be formulated easier to be taken on board by consumers (Spaargaren, 2003). Guidance (e.g. internal insulation, solid floor insulation) is largely technical and created for practitioners, however there is a distinct lack of retrofitting professionals and it is estimated that 500,000 new professionals are required to tackle the challenge of mass retrofitting (Construction Leadership Council, 2021).

3. METHODS

3.3 Research Methodology

This research adopted a mixed methodological approach. As this research is looking to gather representative views from the public, a selected method for this research is a survey. According to Nardi (2015) and Cresswell & Cresswell (2018), surveys are ideal for providing large amounts of data about attitudes and opinions, which is a fundamental aspect of this research. Contemporary opinions are sought after, further warranting a survey method as they capture current data. An internet survey was chosen due to cost, convenience for respondents, the amount of resources available, and practicality for a large sample (Ponto, 2015). Covid-19 risk and other risks associated with face-to-face contact for the researcher and respondents were also eliminated.

The survey was devised into certain sections, identifying the following: information about the respondents' property, including the type, age and tenure of their property; respondents' knowledge of retrofit components and if they had previously considered a retrofit; knowledge of government policy or incentives for retrofitting; respondents' most important benefits, drawbacks and drivers for retrofitting; and respondents' opinions on funding retrofit projects and the potential legal requirement of retrofitting. Many questions utilised a Likert scale to gauge opinions on valued importance of retrofit factors. The survey was also pilot tested by academic professionals before opening to identify potential areas of improvement (Andrews et al, 2003).

A case study was also utilised to determine a study area. The use of a case study has benefits such as manageability and practicality (Gerring, 1962). This, coupled with a survey, also has significant time and cost benefits as conducting this research on a wider geographical area would require significantly more time and resources. A case study strategy is also described to be a worthwhile way of exploring existing theory (Saunders et al, 2019), which is also suitable when cross-analysing current behavioural theory. Photographs of Letchworth properties were also utilised to present the differing property types and eras.

The sample was originally conducted by visiting random organisations and businesses in Letchworth to distribute survey leaflets. However, this originally did not gather enough responses to ensure valid results. Therefore, the sampling method used was convenience and snowball sampling; the researcher engaged with representatives from multiple organisations and community groups active in Letchworth Garden City and asked individuals to forward the survey to their contacts. This ensured a greater response from residents of Letchworth and

responses were received from people with varying interests, aiding the representativeness of responses.

A predominately quantitative approach was utilised for this research. Quantitative methods focus on gathering generalised numerical data across groups of people to explain a particular circumstance (Muijs, 2010), making it ideal to identify awareness and opinions for this research. However, some questions allowed a qualitative response, such as 'state your reasonings' or 'other'. This was inserted to increase validity of some answers (Millard-Ball and Kim, 2020) (some responses listed very similar answers which were categorised into existing answer choices), to provide insight into the reasonings for certain answers to questions without overcomplicating the survey and to potentially identify some aspects undiscovered in literature.

The data obtained by the survey responses was analysed by descriptive statistics. Some questions were analysed using mean averages, standard deviation and standard error to identify opinions and the spread of opinions. Questions without a Likert scale were analysed using graphics. Cross-tabulations were utilised to identify trends within variables; this was especially important to address objective 3, as responses from older properties could be cross-examined with responses from newer properties. These analytical methods have been selected to help prove or disprove relevant environmental behaviour theory as they give definitive evidence on the importance of factors persuading and dissuading environmental change in the form of retrofitting, and identify differences in trends between older and newer housing.

3.4 Study Area

Letchworth Garden City was selected as the study area of this dissertation. Created in 1903, Letchworth Garden City is heralded as the world's first garden city, following principles established by Ebenezer Howard: the advantages of town and country, yet free from the disadvantages of either (Howard, 1898). In 2020, Letchworth had an estimated population of 34,308.

Uncommonly, alterations to most properties in Letchworth require consent from LGCHF, abiding by a Scheme of Management (LGCHF, 2022). Due to Letchworth's inception in the early 1900s, is it estimated that near half of the existing housing stock is of pre-war construction (Transition Town Letchworth, 2013). This, coupled with a gradual population increase between 1911 and 1971, means that the vast majority of the housing stock in Letchworth was built between the 1900s and 1970s, with some increased housing development in recent years (Lichfields, 2019). This large age variance (some examples are presented in figure 6 and 7) and much of the existing housing stock being able to potentially

benefit from a retrofit due to their older age makes Letchworth an applicable case study to investigate opinions of retrofitting and any property age related differences.

Figure 6 - Examples of Letchworth's Housing Stock.

Figure 7 - Examples of Letchworth's Housing Stock.

3.5 Limitations of the Methodology

Although the methodology is justified in its selection, there are certain limitations. Whilst the survey focused on highlighting opinions and awareness of retrofitting, it could be argued that qualitative data collection could have given a better ability for people to share the justification for their views (Crotty, 1998). However, it would have been difficult to achieve a high number of responses due to time constraints. A quantitative method also allowed the analysis of the perceived level of importance. The sampling method employed may also involve a level of bias. Ideally, this could have been reduced by employing a different research method and sampling. However, it was deemed that a higher number of responses was preferable and outweighed any potential bias. More time and resources may have allowed for a different sampling method. Although the case study selected for this research gives good insight for properties from different eras due to their varying construction age, it cannot be truly representative of public opinions and awareness for a wider area (i.e. Hertfordshire, East of England or England) due to varying demographics. Different demographics could affect opinions, potentially warranting further research.

3.6 Ethical Considerations

All ethical considerations were analysed under five core principles (Biggam, 2021). The purpose of the research was stated before data was collected and all respondents gave their consent to participate in the survey. To protect respondents' confidentiality without compromising data accuracy, respondents were asked to provide the first 4 characters of their postcode; this enabled verification of their residency in Letchworth without compromising anonymity. Any respondents were able to withdraw from data collection at any time. Adequate risk assessments were conducted before data collection to ensure the safety of respondents and the researcher. Finally, there were no known personal connections to any individuals who completed the survey.

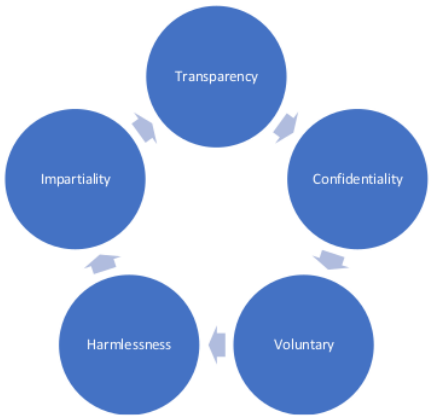

Figure 8 - Five Ethical Considerations. Source: Biggam (2021).

4. FINDINGS

4.1 Introduction

Overall, 122 survey responses were received. However, after verifying respondents' first four characters of their postcode as required at the start of the survey, two responses were recorded as not residing in Letchworth Garden City. Therefore, these responses were deemed invalid and discounted from the results. This means 120 responses were utilised for analysis.

4.2 Findings

Question 3 asked respondents about the tenure of their residing property, giving respondents the choice between owner-occupation, privately rented, socially rented or shared ownership. Respondents overwhelmingly selected owner-occupation, with 107 votes in total. Private and social renting answers were limited in comparison, with 4 and 9 respondents respectively. Shared ownership recorded no respondents. The number of social rented residents who responded is much lower compared to the 2011 census, which recorded a much higher percentage of homes in Letchworth that are socially rented (31%) (Lichfields, 2019). Therefore, the results of this survey can be considered under-representative of this tenure. Whilst privately rented data in Letchworth is still slightly under-represented, this is comparatively lower at 10% from the 2011 census.

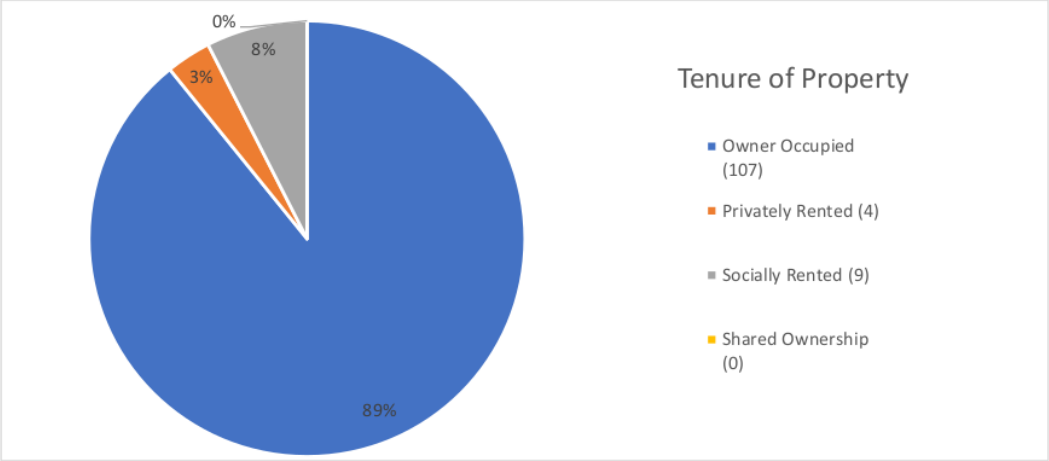

Figure 9 - Pie Chart of Responses to Question 3: Property Tenure.

Figure 10 relates to the construction age respondents' properties. Whilst this data on its own is raw, it will relate heavily to analysis later in this chapter and provide critical data to answer objective 3. If respondents were unsure of the construction year of their property, they were encouraged to utilise CDRC Mapmaker Dwelling Modal Age data to submit an answer (Consumer Data Research Centre, 2022). The most picked answer for construction age by

respondents is 1900-1919 (46). This finding is expected considering Letchworth's inception in 1903 which led to significant housing development in these two decades. The number of responses stating they resided in other decades drops successively, eventually showing significantly less responses for 1980-1999 and 2000 onwards. Again, this is largely in agreement with housing studies in recent years, as limited residential development occurred between 1971 and 2010 (Lichfields, 2019).

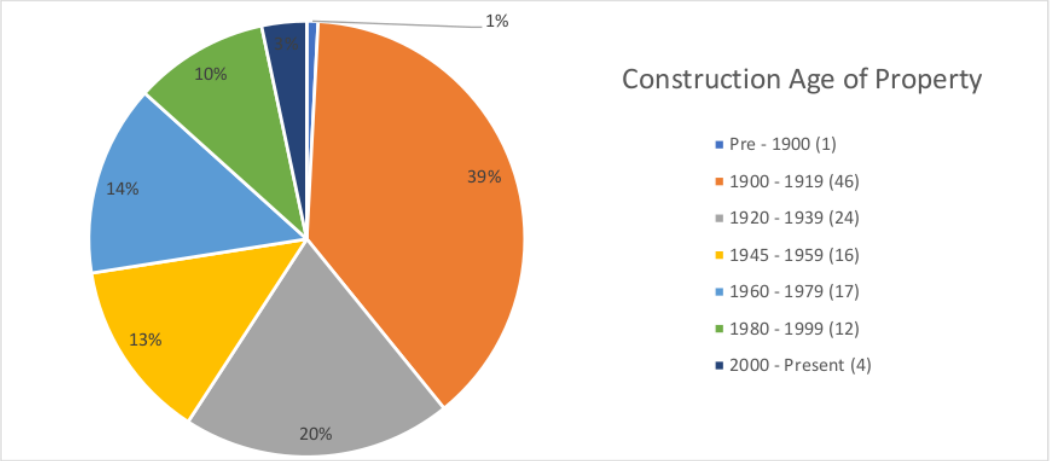

Figure 10 - Pie Chart of Responses to Question 4: Property Construction Age.

Question 6 was the first question of the survey to ask respondents about their knowledge regarding residential retrofitting. The question listed components that are, according to literature, often used in retrofit projects. Respondents were asked to place these listed components into one of three categories: 'I have not heard of this component', 'I have heard of this component' and 'I understand the purpose of this component, thereby testing respondents' awareness and knowledge of these components. Energy-efficient lighting and double/triple glazing window and doors received the most 'I understand the purpose of this component', with 114 and 113 responses respectively. This is perhaps unsurprising due to the availability and low cost of lighting. Replacement windows and doors have also been in practice for decades (Matthews, 2016). Various types of insulation were indicated as having generally high levels of awareness and knowledge by respondents, with roof insulation having the highest and floor insulation the lowest. Interestingly, MVHR units and airtightness membranes were recorded as having low awareness relative to other components. Respondents were asked to state other renewables; the majority of responses listed wind generation, although there were tokenistic mentions of battery storage and water storage.

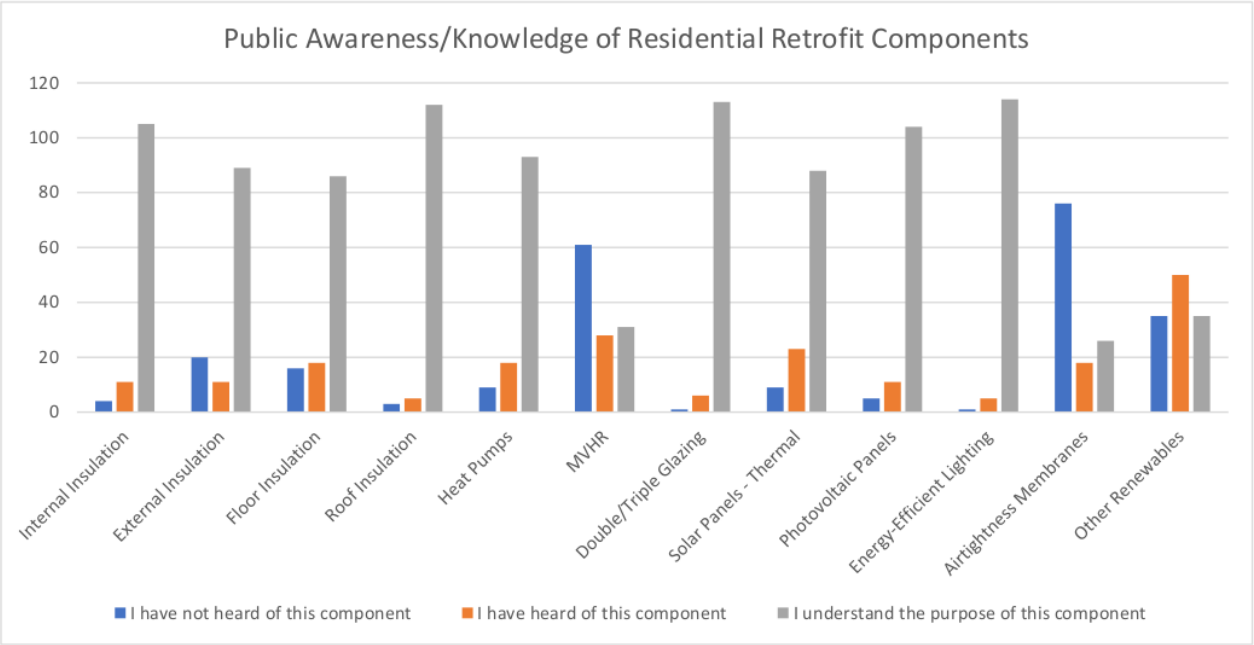

Figure 11 - Clustered Bar Chart Showing Responses to Question 6: Public Awareness/Knowledge of Retrofit Components.

Question 7 aimed to gauge whether respondents were aware of any financial incentives, governmental policy or non-governmental organisations that promote residential retrofitting, asking respondents to answer 'yes' or 'no'. The majority of respondents answered 'no' (77.5%), indicating a lack of awareness. Of those who responded 'yes', there were several comments stating that many of the schemes they knew about have now expired or have run out of funding and therefore had no knowledge of current schemes, potentially revealing a lack of recent financial initiatives or lack of publication. There were occasional remarks regarding their knowledge of the 'Green Deal' initiative, however, one respondent commented saying this was mistrustful as it is a loan rather than a grant. Several respondents referenced a distinct lack of retrofitting strategy from the UK government. There were also several mentions of the recent 'heat pumps' grant initiative. Lastly, there were also some comments from respondents stating they had previously attempted to take advantage of these schemes, but have struggled to gain approval from LGCHF to install various components for their property. It is interesting that these responses listed LGCHF as a barrier for permission, but not the traditional LPA.

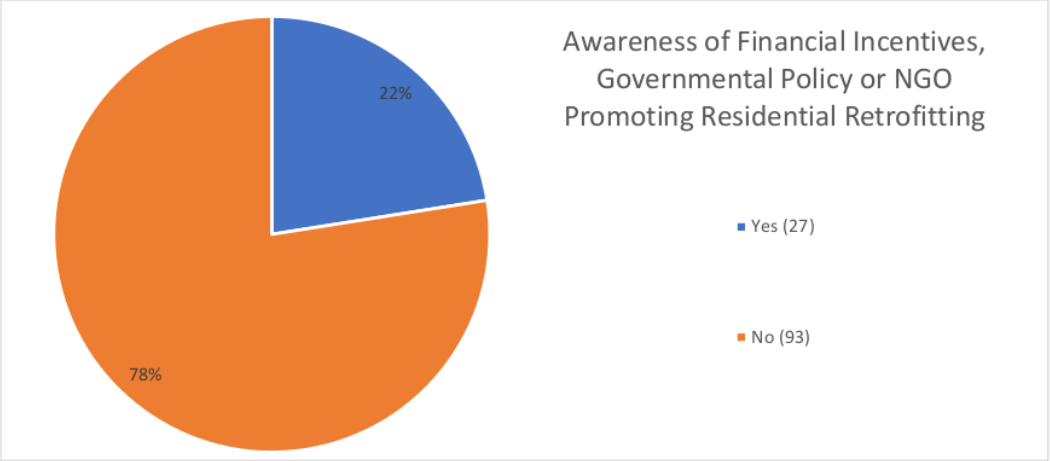

Figure 12 - Pie Chart of Responses to Question 7: Awareness of Incentives and Policy.

Question 9 asked respondents if they had ever considered a retrofit for their home. This question included a significant qualitative element in addition to a quantitative element as it asked respondents to specify what they have installed, what they have considered and the reasoning if they had never considered a retrofit. 45 respondents stated they had done some level of retrofit to their home. By far the most common installations amongst these respondents were upgraded windows and doors, loft insulation and energy-efficient lightbulbs. Cavity wall insulation was often mentioned, but not to the same level as those previously mentioned.

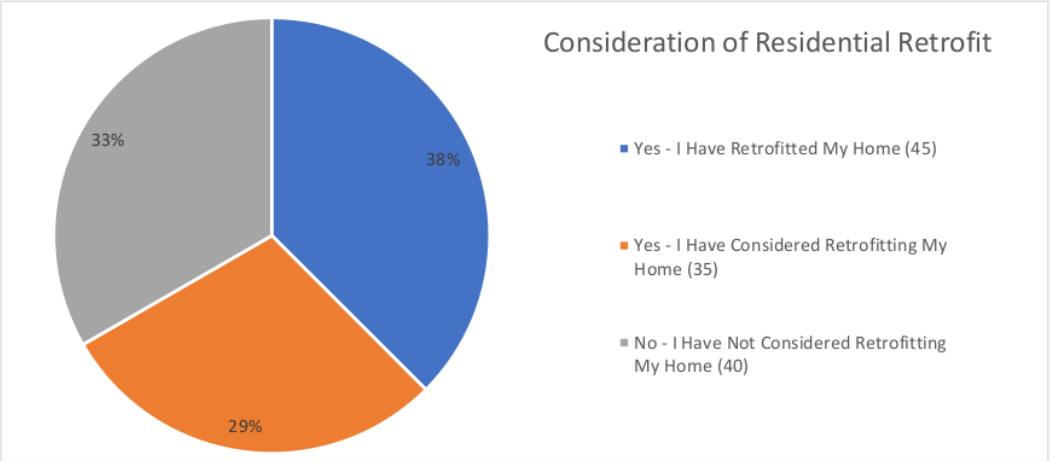

Figure 13 - Pie Chart of Responses to Question 9: Consideration of Retrofit.

There were also mentions of internal/external wall insulation, solar panels (both thermal and photovoltaic), heat pumps and MVHR units, however these were sparsely mentioned (<5 respondents). The majority of respondents who had considered retrofit installations (35) often mentioned components such as solar panels and solid wall insulation. However, these respondents also often cited LGCHF/NHDC restrictions and lack of available grants as

barriers. 40 respondents had not considered any form of retrofit; out of these responses, cost (and not being able to 'reap' the cost), difficulty and LGCHF/NHDC restrictions were most commonly listed as barriers. However, 9 respondents also stated they did not own the property and therefore did not believe it was their responsibility.

Question 10 and 11 aimed to gauge respondents' most and least important benefits and drawbacks of a retrofit. Respondents were asked to answer the importance of a factor using a Likert scale, with 1 being least important and 5 being most important. This data was used to calculate a mean, standard deviation and standard error, as shown in table 2. Upon calculating this, the top three most important benefits all scored a very similar mean. However, indoor comfort scored a lower standard deviation than lower utility bills, meaning respondents voted more commonly around the mean. Better environmental performance had the highest standard deviation of the three most important benefits, suggesting a higher spread of opinions; considering the high mean, this would suggest that more of the sample considered this as unimportant compared to the other three factors. Conversely, this factor also received the highest amount of 'most important' votes by respondents. An increase in building quality and preferring to retrofit over relocate/rebuild also scored similar, however these both had a higher standard deviation at 1.32, suggesting a higher scatter of votes for these factors. The last 3 factors all scored a mean below 3, with being part of a national retrofitting trend considerably the least important. All factors received a low standard error, indicating the mean accurately represented the sample (Carter, 2013).

Factor	Mean	Rank	Std D	Std Err
A	4.27	1	1.10	0.10
B	4.25	2	1.18	0.11
C	4.24	3	1.06	0.10
D	3.63	4	1.32	0.12
E	3.57	5	1.32	0.12
F	2.87	6	1.37	0.12
G	2.86	7	1.23	0.11
H	2.23	8	1.33	0.12

Table 2 - Mean, Standard Deviation and Standard Error of Responses to Question 10: Benefits of Retrofitting.

Table 3 shows respondents' rankings of retrofitting drawbacks. Again, respondents were asked to rank each factor between 1 and 5, with 5 being 'very important'. Cost/investment was the highest scoring factor on average and received the highest amount of '5' votes. Cost associations also link to a lack of financial incentives, which also scored highly amongst respondents. Interestingly, the 2nd, 5th and 11th ranked factors had standard deviations above

1.3, suggesting these factors had a larger scatter of votes. This is especially the case for low consumer appeal, which despite being voted the least important factor on average had more '5' votes than 4 other factors. This suggests that whilst retrofitting appears to appeal to the majority of respondents, there is a considerable number of respondents whom retrofitting does not appeal. When comparing the means of both benefits and drawbacks, there is a general trend showing benefits scored higher overall than drawbacks; this is evidenced by benefits having 3 factors scoring above 4 (none for drawbacks), and drawbacks having 3 factors scoring below 2.5 (1 for benefits). Similarly to benefits, the standard error stayed low for all drawbacks, suggesting an accurate representation of the sample.

Factor	Mean	Rank	Std D	Std Err
A	3.99	1	1.14	0.10
B	3.74	2	1.32	0.12
C	3.68	3	1.20	0.11
D	3.34	4	1.24	0.11
E	3.26	5	1.39	0.13
F	3	6	1.26	0.11
G	2.71	7	1.23	0.11
H	2.51	8	1.11	0.10
I	2.35	9	1.22	0.11
J	2.31	10	1.21	0.11
K	2.09	11	1.37	0.13

Table 3 - Mean, Standard Deviation and Standard Error of Responses to Question 11: Drawbacks of Retrofitting.

Table 4 displays the mean, standard deviation and standard error of benefits ranked by respondents living in pre-war (before 1939) and post-war (after 1945) homes. Upon cross-tabulation, there are some noticeable differences. Firstly, lower fuel bills are not voted as the highest for either pre or post war; however, given it is still the highest ranked overall, this factor still scored highly and is therefore a major consideration. Interestingly, better indoor comfort and better environmental performance both had a two-rank switch for post-war properties, suggesting better indoor comfort is a bigger consideration. The low standard deviation for this factor also suggests a low spread of results, meaning this factor received similar rankings amongst all respondents. Conversely, pre-war properties voted better environmental performance as the most important benefit – although only by 0.03 compared to lower fuel bills. Pre-war properties also voted higher for 'preferring to retrofit' compared to post-war.

Factor	Pre-War					Post-War				
	Avg	S.D	S.E	Rank	Rank Diff to Fig. 18	Avg	S.D	S.E	Rank	Rank Diff to Fig. 18
A	4.24	1.03	0.12	2	-1	4.31	1.19	0.17	2	-1
B	4.27	1.18	0.14	1	+1	4.22	1.19	0.17	3	-1
C	4.14	1.17	0.14	3	0	4.38	0.86	0.12	1	+2
D	3.51	1.41	0.17	5	-1	3.80	1.17	0.17	4	0
E	3.69	1.21	0.14	4	+1	3.39	1.46	0.21	5	0
F	2.83	1.37	0.16	7	-1	2.92	1.37	0.20	6	0
G	3	1.18	0.14	6	+1	2.65	1.27	0.18	7	0
H	2.20	1.32	0.16	8	0	2.29	1.35	0.19	8	0

Table 4 - Mean, Standard Deviation and Standard Error of Pre and Post War Responses to Question 10: Benefits of Retrofitting.

There are some noticeable differences regarding the ranked importance of retrofit drawbacks between respondents living in pre-war and post-war properties. Respondents living in pre-war properties listed the possibility of requiring permission/notification as the most important drawback, overtaking cost/investment. Conversely, post-war properties ranked this factor as 4th most important. Whilst negatively altering building characteristics also experienced a small rise in importance for pre-war properties, the standard deviation for this factor is high at 1.41, meaning there are some respondents who ranked this factor as very important and some who ranked it lower. The mean ranking for this factor is also noticeably different between pre-war (3.55) and post-war (2.83) properties, suggesting a significant difference in perceived importance.

Factor	Pre-War					Post-War				
	Avg	S.D	S.E	Rank	Rank Diff to Fig. 19	Avg	S.D	S.E	Rank	Rank Diff to Fig. 19
A	4.02	1.10	0.13	2	-1	3.93	1.21	0.17	1	0
B	4.08	1.07	0.13	1	+1	3.24	1.49	0.21	4	-2
C	3.58	1.21	0.14	3	0	3.84	1.18	0.17	2	+1
D	3.24	1.19	0.14	5	-1	3.49	1.31	0.19	3	-1
E	3.55	1.41	0.17	4	+1	2.83	1.25	0.18	5	0
F	3.23	1.16	0.14	6	0	2.67	1.33	0.19	6	0
G	2.61	1.18	0.14	7	0	2.86	1.31	0.19	7	0
H	2.50	1.03	0.12	8	0	2.53	1.23	0.18	8	0

I	2.34	1.21	0.14	10	-1	2.37	1.25	0.18	9	0
J	2.37	1.23	0.15	9	+1	2.22	1.19	0.17	10	0
K	2.07	1.38	0.16	11	0	2.12	1.38	0.20	11	0

Table 5 - Mean, Standard Deviation and Standard Error of Pre and Post War Responses to Question 11: Drawbacks of Retrofitting.

For question 12, respondents were asked which party should be responsible for the cost of a retrofit. Respondents were able to select multiple parties if they felt the cost should be shared. The highest voted party was UK government, however there was also a high amount of votes for the owner of the property. From this, it is clear that the majority of funding should come from a mixture of owner and government. Local authority also received a significant amount of votes, suggesting that some respondents may expect all levels of government to help offset retrofit costs. 'Tenant of property' only scored 6, showing that the majority of respondents do not expect tenants to cover costs. 5 respondents voted 'other', all citing differing reasons such as housing associations, the community and LGCHF.

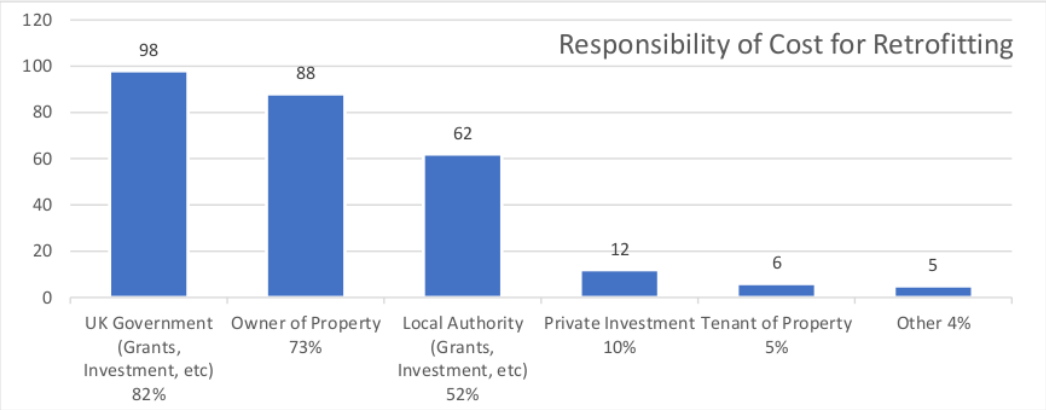

Figure 14 - Bar Chart of Responses to Question 12: Responsibility of Cost for Retrofitting.

Question 13 asked respondents to rank drivers for retrofitting between 1 and 5, with 5 being very important. The top four voted drivers on average were only separated by 0.08, suggesting these four drivers hold similar levels of importance. However, the two drivers associated with reducing the cost of a retrofit project have a low standard deviation compared to increasing climate change concerns, suggesting that respondents have less agreement on the importance of climate change concerns. The implementation of stricter building restrictions is not seen as a hugely significant driver for respondents. However, public support regarding retrofitting and seeing friends, family or neighbours retrofitting their homes is considered as an even less important driver.

Driver	Mean	Rank	Std D	Std Err
A	4.06	1	1.09	0.10
B	4.02	2	1.17	0.11
C	4.01	3	1.22	0.11
D	3.98	4	1.12	0.10
E	3.62	5	1.16	0.11
F	3.33	6	1.24	0.11
G	2.89	7	1.28	0.12
H	2.05	8	1.18	0.11
I	2.04	9	1.14	0.10

Table 6 - Mean, Standard Deviation and Standard Error of Responses to Question 13: Retrofitting Drivers.

The final question of the survey asked respondents if retrofitting should be made mandatory in the future. Respondents were given the opportunity to state their reasonings for their answers, offering a qualitative element. Whilst the actual voting by respondents is very close – just 4 votes separate the highest and lowest voted answers – the vast majority of yes, no and 'I'm not sure' respondents who stated their reasoning referenced the issue of cost and the need for external funding from the government. There were also mentions of problems with retrofitting protected buildings and current new build properties should be built to a stricter standard. Finally, people voting 'yes' often stated that it must be legal otherwise the uptake will not be great enough, and people voting 'no' often stated that it should be encouraged but not enforced.

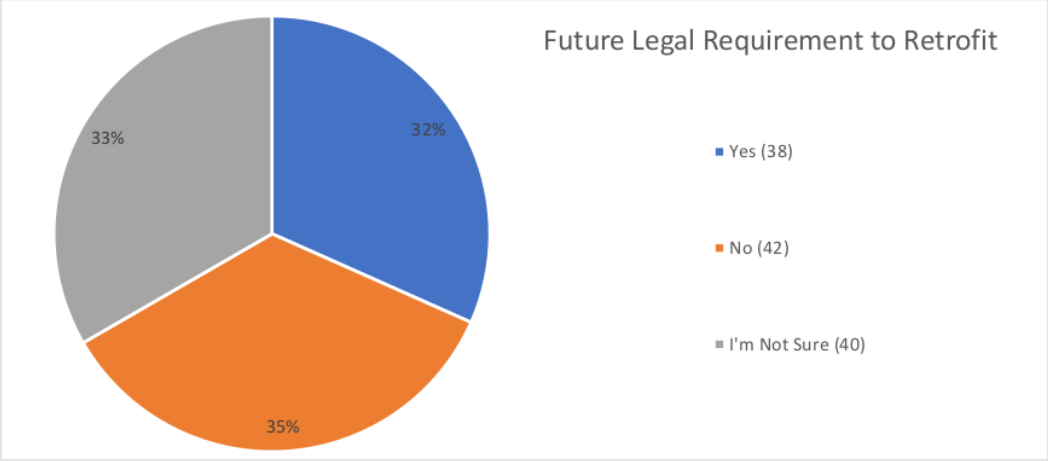

Figure 15 - Pie Chart of Responses to Question 14: Should Retrofitting Be a Future Legal Requirement?

5. DISCUSSION

5.1 Objective 1

Objective 1 sought to identify the issues with UK retrofitting policy and legislation. The literature review identified some level of retrofit policy which has been enacted in the UK. However, their effectiveness was questioned by the level of funding provided so far and the amount estimated to be required by academia (Kelly, 2009); the level of funding available and utilised by the public is almost certainly vastly below these estimations. Although EPCs were referenced as an inadequate assessment tool for retrofitting by the likes of Gram-Hansen (2014), there were occasional remarks from respondents stating that they had used an EPC to assess and make improvements to their homes on a low-level retrofit scale. This would be in agreement with Christensen et al's (2014) findings that people trust EPCs. However, as a slim minority of respondents (4 in total) referenced EPCs, it is tough to state from this research whether trust and adopted information from EPCs is currently anything more than trivial. To enable consumer confidence in EPCs, some reform to enable further accessibility and identification of retrofit opportunities for existing homeowners would be beneficial.

There is evidence of recent retrofit policy increasing the awareness of components. Heat pumps are a relatively new technology compared to floor insulation, external insulation and thermal solar panels. Despite this, heat pump awareness and, more importantly, knowledge of its purpose was voted higher by respondents. The recent policy implementation and financial incentives associated with heat pumps from the UK government is a rare example of policy directly influencing retrofitting component awareness. However, there are other components that are still widely unknown, namely MVHR units and airtightness membranes.

The general lack of awareness of financial incentives and governmental policy as identified by question 7 is stark. The uptake of the aforementioned heat pump grant and the general availability of grants were also questioned by respondents, stating they were aware of previous policy/incentives but many of these are now unavailable. This is a concern as it creates mistrust and confusion amongst consumers about grants, especially as this research identified financial incentives as one of the most important drivers from a consumer perspective. This importance was echoed by Ruparathna et al (2017) in the literature review.

The literature review identified that direction for retrofitting is partially there as shown by commitments to net-zero by 2050. This is also recognised in the survey, as a significant number of respondents stated that retrofitting should be made mandatory in the future to achieve net-zero. However, the absence of a retrofitting strategy from the UK government is still seen as a significant problem and one which was noticed by some of the respondents for

question 7 of the survey. Overall, the lack of awareness is currently a major signal that retrofit policy is weak and is a barrier to implementation. This, coupled with no retrofit strategy means there is little top-down direction for retrofitting, present the two biggest issues with UK retrofitting policy.

5.2 Objective 2

As aforementioned, the awareness of most retrofitting components – apart from MVHR and airtightness membranes – is high. Whilst these two components are mostly associated with deeper retrofits, previous government retrofit guides stated that 35 out of the 40 retrofit homes were fitted with MVHR units (Technology Strategy Board, 2014), suggesting that airtightness is a significant issue for many existing homes. Therefore, this component can be considered as critically underappreciated.

The amount of people that have retrofitted or considered retrofitting their homes is also high, representing two-thirds of the sample size. However, respondents' elaboration on this question identified that the components retrofitted were oftenones associated with lower-level retrofits (easier to install and less expensive components). The number of respondents stating they had considered or implemented components associated with a deeper retrofit was comparably very low. The rationality behind these responses, and those who had not considered a retrofit, was mostly down to cost, difficulty and planning restrictions, according to the research conducted. This research, therefore, agrees with Black, Stern & Elworth and Diekmann & Preisendörfer in that the attitude toward retrofitting exists, but difficulty and cost mean these attitudes hold inferior importance in enacting behavioural change.

The three highest-rated benefits found in this research were lower fuel bills, better environmental performance and better indoor comfort. The second highest-rated benefit is a reassuring point of this research, as it demonstrates that respondents are genuinely concerned about their home's environmental performance in the wider context of climate change. Lower fuel bills holding high importance is likely to be linked to recent news and increasing concerns regarding fuel bill hikes. Traynor's findings – that indoor comfort is a big benefit of retrofitting – is clearly popular amongst respondents. Interestingly, compared to other benefits, this is overlooked and perhaps retrofit policy could use this to an advantage and entice take-up. Although Brounen and Kok found that homes labelled as more energy-efficient attract a price premium, this was not considered as a significant benefit by the public from this research as 'higher property resale values' was low-rated. However, 'being part of retrofitting trends' was the lowest rated, which largely goes against Shove's theory about 'being part of something' being a positive motivator.

Cost appears to be the biggest drawback, which agrees with much of the literature review – especially Cotterell and Adam who stated that UK culture is averse to this. A lack of financial incentives is also linked to the issue of cost, as many respondents are not willing to retrofit their homes if there is no financial assistance. However, the requirement of planning permission and lack of contractors/specialists is also seen as a significant drawback to retrofit projects, which heavily agrees with Jagarajan et al's findings. Although knowledge of components is high, more or better identification of retrofit contractors/specialists are also urgently required for mass take-up. The requirement of planning permission is likely to have been exacerbated because of the case study's unique requirement of dual planning permission in some cases. Although the potential for household behaviour alterations was considered a minor drawback – suggesting occupants are willing to alter their behaviours – it is difficult to ascertain from this research whether this will be put into practice and if issues like 'comfort take-back' as found by Ben and Steemers will limit the effects of mass retrofitting.

Although 73% of respondents stated the owner of the property is at least partly responsible for retrofitting their home, 82% of respondents stated the government is at least partly responsible. It is safe to suggest that the vast majority of people do not expect tenants to fund retrofit projects – with some respondents citing tenants should not be financially responsible for improving other people's property. From these findings, it is clear that significant government intervention in the form of financial incentives is essential to encourage mass retrofit take-up. Whilst attitudes toward environmental change are there, Darnton's point that environmental behavioural change is better tackled through government-led intervention – in this case through financial incentivisation – is accurate in the context of this research.

5.3 Objective 3

Upon cross-tabulation, respondents living in pre-war homes appear to value better environmental performance higher than respondents on average, especially those living in post-war homes. This was an intriguing finding from the research as it points toward these residents being more environmentally conscious, and they may be more inclined to improve their homes due to older homes having worse EPCs and poorer environmental performance as found in the literature review. Pre-war responses also suggest they place more importance on resale values following retrofit; therefore, Brounen and Kok's logic regarding energy-efficient homes attracting higher price premiums may hold more importance for older buildings with heritage attributes and improved energy efficiency.

The analysis from this research identified that those living in pre-war homes on average place more importance on affecting the characteristics of their properties than those living in post-war homes (0.72 difference on average). The standard deviation for pre-war homes was also

high as well, indicating a higher spread of associated importance. Therefore, further research to ascertain the reasoning for this spread would be beneficial. Residents living in pre-war homes voting 'possibility of needing permission' as the biggest drawback is also significant, as it implies these properties may not only be more likely to require permission for retrofit projects, but it may also mean some of these properties will find it harder to gain permission potentially due to their historic merit. This agrees with Wise et al's findings that the scope for retrofitting heritage and historic properties is difficult due to components affecting the aesthetics of the building. It is also clear that this is a concern for homeowners of these properties, especially as they are limited with retrofitting components they can utilise.

The often double permission required from NHDC and LGCHF poses additional barriers compared to other areas, and respondents often cited that getting permission from LGCHF was harder than the traditional LPA. Although this is often in the interests of Letchworth's heritage, it must be asked whether protecting the heritage value of these properties should be placed at a higher priority than reducing emissions, let alone the other associated retrofitting benefits. One respondent even stated that LGCHF preserves Letchworth like a museum which is not corresponding with Ebenezer Howard's 'forward thinking' idea of a garden city. It is hard to disagree with this statement, given the magnitude of the issue of climate change and the apparency that LGCHF is often opposed to some retrofitting techniques. Therefore, both NHDC and LGCHF must consider implementing a retrofitting strategy for Letchworth which maximises the potential for take-up whilst not significantly detracting from its historical significance and uniqueness. Currently, however, this is a substantial difficulty affecting the perceived behavioural control of Letchworth residents, especially those living in pre-war homes. Therefore, following Ajzen's and Schwartz and Howard's theories, this is directly affecting retrofitting intentions.

5.4 Objective 4

The most considerable drivers identified by this research are associated with lowering the cost of a residential retrofit. However, whilst lowering the overall cost of retrofitting will benefit all parties involved, this research has viewed drivers from the perspective of the consumer. This identifies lowering the overall cost of retrofitting components and introducing more financial incentives as two cost-associated drivers, but they are both differing approaches. Whilst the cost of some retrofitting components is high due to them being relatively new technologies, it is possible if these components are utilised on a more widespread scale, they will become cheaper through economies of scale. However, from this research, it is clear that this cannot be expected to come to fruition through consumer trends only. Darnton's point that behavioural change is better tackled through government intervention could also be true here, as some academics have acknowledged that the government is at its disposal to remove VAT for retrofit

components to entice take-up. In addition to this, government intervention to implement more financial incentives for consumers is also seen as a significant driver by consumers, further reinforcing Darnton's point.

Recent news regarding the cost of living crisis and the expectance of rising utility bills has undoubtedly had an impact on consumer drivers. However, this driver is heavily linked with the issue of cost; Cotterell and Adam's findings about capital expenditure is likely to be exacerbated by higher fuel bills, meaning consumers will be less likely to spend money on retrofit projects if other expenditures are higher. If anything, this places further importance on government intervention in order to encourage retrofit expenditure in a time when other expenses are expected to rise. In this instance, Nash et al's findings highlighting additional benefits to sceptical consumers can produce behavioural change is a very prevalent point here: identifying and promoting lower fuel bills to consumers has the potential to be an attractive driver, especially if fuel bills continue to rise.

It is a refreshing finding of this research to identify climate change concerns as the third most important driver for residential retrofitting. This highlights that benefits and drivers regarding retrofitting go further than just individual benefits, but also consider environmental concerns. Therefore, the attitudes toward environmental behaviours from respondents appear to be strong. However, this research has also identified that the idea of social subjective norms does not seem to hold as much importance. Increases in support/demand, a neighbour retrofitting their home or friends & family retrofitting their homes were found to be comparatively unimportant drivers by respondents, which largely goes against the concept of social pressure as studied by Shove, Ajzen, Schwartz & Howard and Klockner. However, as current retrofit take-up rates are low, it is yet to be determined whether an increased take-up rate and demand would have a greater social influence.

From this research, there is further scope to implement other policies relating to better knowledge and practice. This was voted as a reasonably important driver according to respondents. Following the aforementioned need to implement retrofit policies aimed at financial incentive instruments, there is also an identified need to implement research and service policy instruments to increase awareness of the public and knowledge of practitioners. Zhang et al's research identifying that there was only one research and service retrofit policy instrument in the UK further reflects its current absence and shortcomings. Introducing stricter building regulations was also seen as a reasonably important driver, however, responses to question 14 identified that many respondents either expect mandatory changes to existing buildings to be accompanied with significant financial incentives or do not approve of retrofitting becoming mandatory altogether.

5.5 Limitations and Future Work

The research that has been carried out does have some limitations. The generalisation of pre-war and post-war means that there is a large amount of time between the earliest and latest construction dates classified under these parameters. Whilst this was done to ensure a large sample size for both parameters to increase the validity of results and some relevant literature have utilised pre-war as a way to generalise older housing, the difference in building technology in the post-war category is radically different. Therefore, future work could aim to gather a higher sample size or focus specifically on post-war properties and the differences in opinion within smaller parameters.

Upon identifying the uniqueness of Letchworth and LGCHF, the added requirement of planning permission from the heritage foundation may have resulted in the drawback of requiring planning permission having a bigger impact. Therefore, whilst this research offers good insight into public awareness and opinions of retrofitting, the generalisation of some results cannot be done due to many geographical locations not requiring further planning scrutiny. Therefore, future research could look at focusing on a different geographical location to cross-examine whether any of the results found in this research are significantly different compared to other locations.

6. CONCLUSION

6.1 Summary of Findings and Conclusions

The aim of this research was to identify public awareness and opinions of residential retrofitting in the context of Letchworth Garden City, particularly looking at the differences between construction eras and how retrofitting policy could be revised to improve opinion and awareness.

Through the literature review and empirical findings, this research has identified some critical issues with retrofit policy. The absence of a national retrofitting policy is a fundamental omission of government policy with no foreseeable introduction. Although financial incentives have been utilised in the past, this research has found respondents hold little trust or have little desire to apply for. The public also has concerns about the retrofit service and lack of practitioners, which points to an absence of research and service policy instruments. The lack of awareness of retrofit policy is another cause for concern, as the public is expected to initiate retrofit projects for their own homes but the public is also largely not willing to retrofit their homes if there is no support (financial, service and direction) from the government. There is clearly not enough reach from top to bottom; the public also cannot be expected to instigate significant retrofits at their own expense or direction, and findings from this research have shown the public does not intend to without significant government intervention. As the government has committed to a net-zero future by 2050, this fundamentally must include retrofit policy reform to not only include more financial incentive but support in the form of service and assessments. The fact that few people have taken advantage of schemes and the majority have not demonstrates a problem.

Public awareness of retrofitting is strong in some cases, as many components are not only identifiable by the majority of the public, but their purpose is also understood. The lack of knowledge of MVHR units and airtightness membranes is a potential issue, but something that can be improved through awareness and incentive policy as demonstrated with heat pumps. The amount of people who have retrofitted their homes or considered retrofitting their homes is positive. However, in the context of achieving net-zero in the future, the research has shown these retrofit projects will likely need further retrofitting with more/better components. There is evidence from this research to suggest that a small proportion of people have considered a deep retrofit, and even fewer have completed one. The benefits and issues of cost are often at the forefront of opinions for and against retrofitting; cost drawbacks were largely expected from the literature review, but benefits such as lower fuel bills have been exacerbated by increases in fuel bills. However, other benefits included individual benefits as well as environmental ones in general. The discrepancy between theoretical findings like social

pressure and the research stating this was considered as an unimportant benefit/drawback is an interesting finding of this research.

The literature review identified that those living in old properties (pre-war) may be more willing to protect the heritage value of their property, even if they are not statutorily listed. The empirical findings from this research also agree with this point, as Letchworth residents in pre-war housing voted negatively affecting the building's exterior/interior as a more important drawback compared to post-war residents. The possibility of requiring planning permission was also considered as a more important drawback for pre-war buildings. However, the additional permission required by LGCHF for many properties in Letchworth was an unexpected finding of this research, and poses a rare separate barrier to retrofit. The want to retrofit rather than rebuild or relocate was also found to be more important for pre-war, showing these respondents hold more importance for these buildings. Other differences were not as clear cut: other benefits and drawbacks received differing averages, however the difference in these averages was not as stark as the previously mentioned factors.

The drivers to improve retrofitting opinion and take-up fall mainly at the feet of the UK government. However, this research has identified that attitudes toward retrofitting from a public perspective goes further than individual benefits. Again linking to objective 1 and 2, cost incentives are a significant driver which cannot be overlooked by the government. The appetite for retrofitting may currently be low, but it appears that consumers are not opposed to retrofitting; they are opposed primarily at the financial outlay. Reducing the cost of a retrofit – through any means – is a huge key to driving retrofit take-up and achieving household net-zero.

6.2 Implications

The implications from this research relate to changes in UK retrofitting policy. From Zhang et al's work on retrofitting policy instruments, there is a need for UK government to implement further financial incentives to entice retrofit take-up. This could be through grants for certain components, such MVHR units and/or airtightness membranes as this has been done with heat pumps with some success. Further incentives such as preferential loans or cutting VAT for components could also be utilised. There is also a need for retrofit research and service to be updated to allow increased numbers of practitioners that can provide retrofit services on a wider scale. On a scale specific to this case study, NHDC and LGCHF need to implement a retrofit strategy which enables mass retrofit whilst being sympathetic to the heritage of the

area. Such sympathetic retrofit projects have been completed with high levels of success as demonstrated by Baeli's findings.

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APPENDICES

Appendix A - Reference Letters for Retrofit Benefits, Drawbacks and Drivers

Benefit	Reference Letter
Lower Utility/Fuel Bills	A
Better Environmental Performance	B
Better Indoor Comfort	C
Increase in Building Quality/Durability	D
Prefer to Retrofit Rather Than Rebuild/Relocate	E
Potential To Improve Security	F
Higher Property Resale Value	G
Being Part of a Growing National Retrofitting Trend	H

Table 7 - Benefit Factor Reference Letters.

Drawback	Reference Letter
Cost/Investment	A
Possibility of Requiring Permission/Notification	B
Lack of Financial Incentives	C
Lack of Professional Contractors/Unsure Who to Contact	D
Negatively Altering the Building's Interior/Exterior Characteristics	E
Inconvenience/Disruption for the Household During Installation	F
Lack of Household Knowledge Regarding Retrofitting	G
Potential Alterations to Household Behaviour For New Components Installed to Maximise Benefits	H
Scepticism of New Technology	I
Scepticism of Benefits	J
Low Consumer Appeal	K

Table 8 - Drawback Factor Reference Letters.

Driver	Reference Letter
Lowering the Cost of Retrofitting Components	A
Rising Utility Prices/Cost of Living	B
Increasing Climate Change Concerns	C
Financial Incentives	D
Better or More Support/Advice/Knowledge	E
Introduction of Building Energy Performance Requirements Through Building Regulations	F
An Increase in Public Support/Demand	G
Neighbours Retrofitting Their Home(s)	H
Friends/Family Retrofitting Their Home(s)	I

Table 9 - Driver Factor Reference Letters.

Appendix B - List of Notable Retrofit Financial Incentive Projects and Schemes by UK Government

Initiative	Applicants	Details	Funding	Current or Closed
Social Housing Decarbonisation Fund	LAs and RPs of Social Housing	Social homes improved to EPC C by improving building fabric	£3.8bn from 2019 for ten years	Closed – began in 2021
Green Homes Grant LA Delivery Scheme	LAs	Funds energy efficiency and low carbon heating projects for low income households	£500m	Closed – phase 3 (combined with Sustainable Warmth Competition)
Sustainable Warmth Competition	LAs	Funding to upgrade energy inefficient homes in England	£449m	Closed – began in 2021
Domestic Renewable Heat Incentive (RHI)	Homeowners or private/social landlord	Funding for renewable heating costs (payments over 7 years)	Unknown	Closed – began in 2014
Green Deal	Homeowners or tenants	Assessment of home and finance (funding stopped in 2015)	Unknown	Current
Green Homes Grant	Homeowners, park homeowners, private/social landlord (including LAs and RPs)	£5,000 (£10,000 for households receiving certain benefits) for insulation and/or low carbon heat in addition to windows/doors	£2bn	Closed – began in 2020
Boiler Upgrade Scheme	Domestic and small non-domestic properties	£5,000 grant for air source heat pump or biomass boiler £6,000 grant for ground source heat pump	£450m over 3 years - part of a £3.9bn project until 2035	Current

Table 10 - Notable Retrofit Financial Incentive Projects and Schemes by UK Government. Source: BEIS, MHCLG, DLUHC, MoneySuperMarket, OFGEM.

Appendix C – Survey Questionnaire

Public Opinions of Residential Retrofitting in Letchworth Garden City

1. Welcome

Note: Please only complete this survey if you live in Letchworth Garden City. Responses outside of Letchworth Garden City will not be counted.

This survey is part of a research project titled "Investigating public opinions and tendencies toward residential retrofitting to decrease energy demand and improve environmental performance: an analysis of housing stock in Letchworth Garden City".

Your response will form a key part of this research. This survey will take approximately 10 minutes to complete and all responses will be kept anonymous.

By clicking next page, you agree to your responses being anonymously collected for the purpose of this research and that you live in Letchworth Garden City. If you do not agree, please close this window.

Thank you very much for your time to complete this survey!

Conor Matthews
MSc Student - Housing and City Planning
Bartlett School of Planning
University College London
Email: conor.matthews.21@ucl.ac.uk.

1. Please state the first four characters of your postcode. *

2. Which type of property do you live in? *

- ☐ Detached
- ☐ Semi-detached
- ☐ Terraced
- ☐ End of terrace

- [ ] Flat
- [ ] Bungalow
- [ ] Cottage
- [ ] Maisonette
- [ ] Other (please specify):

3. Please complete this statement: My home is _____ *

- [ ] Owned (mortgage, outright, etc)
- [ ] Privately rented
- [ ] Socially rented
- [ ] A shared ownership
- [ ] Other (please specify):

4. Approximately what year was your home constructed?

If you are unsure, please use CDRC Mapmaker to identify the modal age band for your property. *

- [ ] Pre-1900
- [ ] 1900 - 1919
- [ ] 1920 - 1939
- [ ] 1945 - 1959
- [ ] 1960 - 1979
- [ ] 1980 - 1999

- [ ] 2000 - Present

5. Is your home a listed building or situated in a conservation area? *

- [ ] Yes - Listed building
- [ ] Yes - Conservation area
- [ ] Yes - Both
- [ ] No
- [ ] I don't know
- [ ] Other (please specify):

6. A retrofit is often done by introducing external/internal insulation, better heating/electricity appliances such as heat pumps and solar panels, mechanical ventilation units, etc.

An applicable definition of retrofit can be defined as 'a construction approach involving the action of introducing (retrofitting) new materials, products and equipment into an existing building with the aim of reducing the use of energy of the building' (Baeli, 2013).

Which of these retrofitting components have you heard of and do you understand their purpose? *

	I have **not** heard of this component	I have heard of this component	I understand the purpose of this component
Internal insulation	☐	☐	☐
External insulation	☐	☐	☐
Floor insulation	☐	☐	☐
Roof insulation	☐	☐	☐
Heat pumps (air, ground or water source)	☐	☐	☐

	I have **not** heard of this component	I have heard of this component	I understand the purpose of this component
Mechanical ventilation with heat recovery (MVHR)	☐	☐	☐
Double/triple glazed windows and doors	☐	☐	☐
Solar panels - thermal	☐	☐	☐
Solar panels - electricity (also known as photovoltaic panels)	☐	☐	☐
Energy efficient lighting	☐	☐	☐
Airtightness membranes	☐	☐	☐
Other renewable energy sources	☐	☐	☐

If you know/understand any components not listed above, write them below:

7. Are you aware of any financial incentives, UK government policy, local government policy or non-governmental organisations that promote residential retrofitting? *

☐ Yes (please specify)

☐ No

Comments:

8. Where do you get your information/knowledge on retrofitting (components, techniques, etc) from? Please tick all that apply. *

- [ ] Magazine (online and paper)
- [ ] You work in the construction industry
- [ ] Governmental sources (local and national)
- [ ] Word of mouth
- [ ] Social media posts
- [ ] Newspaper (online and paper)
- [ ] Energy companies
- [ ] Professional construction bodies
- [ ] Non-governmental organisations/charities
- [ ] Academic sources (journals, articles, etc)
- [ ] Other (please specify):

9. Have you ever considered any kind of retrofit for your home? *

- [ ] Yes - I have retrofitted my home (please specify what you have had installed)
- [ ] Yes - I have considered retrofitting my home (please specify what you have considered for your home)
- [ ] No (please state why)

Comments:

10. In your opinion, what are the main benefits that you considered/would consider for retrofitting your home? Rank your answers with 1 being the least important and 5 being the most important. *

	1	2	3	4	5
Higher property resale value	☐	☐	☐	☐	☐
Better environmental performance (i.e. fewer carbon emissions, helping to achieve net-zero emissions, etc)	☐	☐	☐	☐	☐
Better indoor comfort (i.e. warmer home, better air ventilation, etc)	☐	☐	☐	☐	☐
Being a part of a growing national retrofitting trend	☐	☐	☐	☐	☐
Lower utility/fuel bills	☐	☐	☐	☐	☐
Potential to improve security if using thicker glass windows and doors	☐	☐	☐	☐	☐
Preference to retrofit rather than rebuild/relocate	☐	☐	☐	☐	☐
Increase in building quality/durability (including potentially lower maintenance costs)	☐	☐	☐	☐	☐

11. What are the main drawbacks that you considered/would consider if retrofitting your home? Rank your answers with 1 being the least important and 5 being the most important. *

	1	2	3	4	5
Potential alterations to household behaviour for new devices/appliances installed to maximise benefits (using new	☐	☐	☐	☐	☐

	1	2	3	4	5
technology, keeping windows closed, etc)					
Lack of professional contractors/unsure who to contact	☐	☐	☐	☐	☐
Lack of household knowledge regarding retrofitting	☐	☐	☐	☐	☐
Scepticism of benefits	☐	☐	☐	☐	☐
Lack of financial incentives	☐	☐	☐	☐	☐
Cost/investment	☐	☐	☐	☐	☐
Negatively altering the building's interior/exterior characteristics	☐	☐	☐	☐	☐
Possibility of requiring permission/notification from local planning authority	☐	☐	☐	☐	☐
Inconvenience/disruption for the household during installation	☐	☐	☐	☐	☐
Scepticism of new technology	☐	☐	☐	☐	☐
Little to no appeal to you (low consumer appeal)	☐	☐	☐	☐	☐

12. In October 2021, the UK Government outlined a strategy to achieve net-zero greenhouse gas emissions by 2050 as part of the Government's legal commitment to the Climate Change Act 2008. To achieve this, it will likely require the vast majority of existing homes to require some level of retrofit, depending on the building's current energy consumption.

The next three questions are based on the legality of implementing this, who should bear the cost of a residential retrofit and the biggest drivers that would entice you to retrofit your home.

In your opinion, who should be responsible for funding a retrofit of your home? Please tick all parties that should fund/part fund any retrofit.

Please feel free to state your reasons why in the comments box.
*

- [ ] Local authority i.e. councils (through grants, direct investment, etc)
- [ ] UK Government (through grants, direct investment, etc)
- [ ] Tenant of property (if rented)
- [ ] Private investment
- [ ] Owner of property
- [ ] Other (please specify):

Comments:

13. What are the biggest drivers which enticed/would entice you to retrofit your home? Rank your answers with 1 being the least important and 5 being the most important. *

	1	2	3	4	5
An increase in public support/demand	☐	☐	☐	☐	☐
A neighbour retrofitting their home	☐	☐	☐	☐	☐
Lowering the cost of retrofitting materials (removal of VAT, for example)	☐	☐	☐	☐	☐
Better or more support/advice/knowledge	☐	☐	☐	☐	☐
Friends/family retrofitting their home(s)	☐	☐	☐	☐	☐

	1	2	3	4	5
Financial incentives/schemes (current and future)	☐	☐	☐	☐	☐
Introduction of building energy performance requirements through building regulations	☐	☐	☐	☐	☐
Rising utility prices/cost of living	☐	☐	☐	☐	☐
Increasing climate change concerns	☐	☐	☐	☐	☐

14. In your opinion, should the retrofit of homes be made mandatory/legally required in the future to help achieve net-zero?

Please feel free to state your reasons why in the comment box. *

☐ Yes

☐ No

☐ I'm not sure

Comments:

Any further comments?

Appendix D – Additional Information Collected by Survey

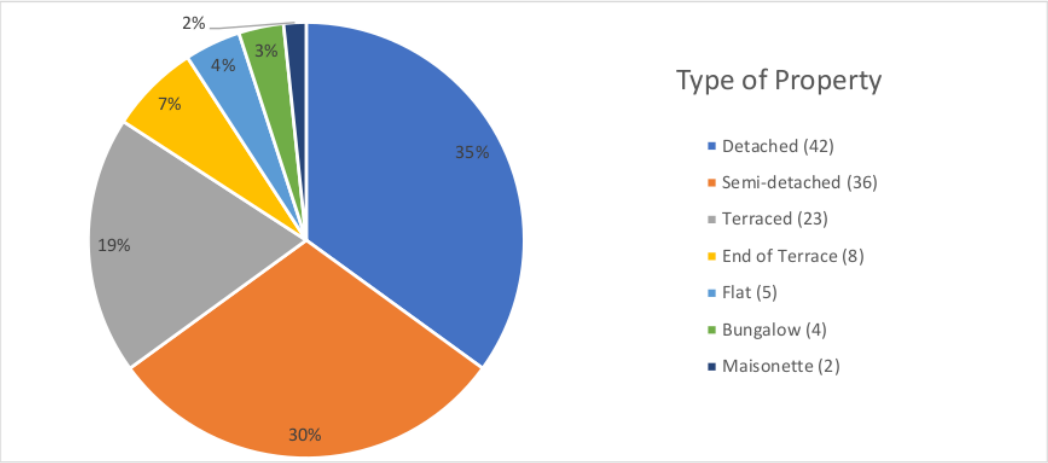

Figure 16 - Respondents' Type of Property.

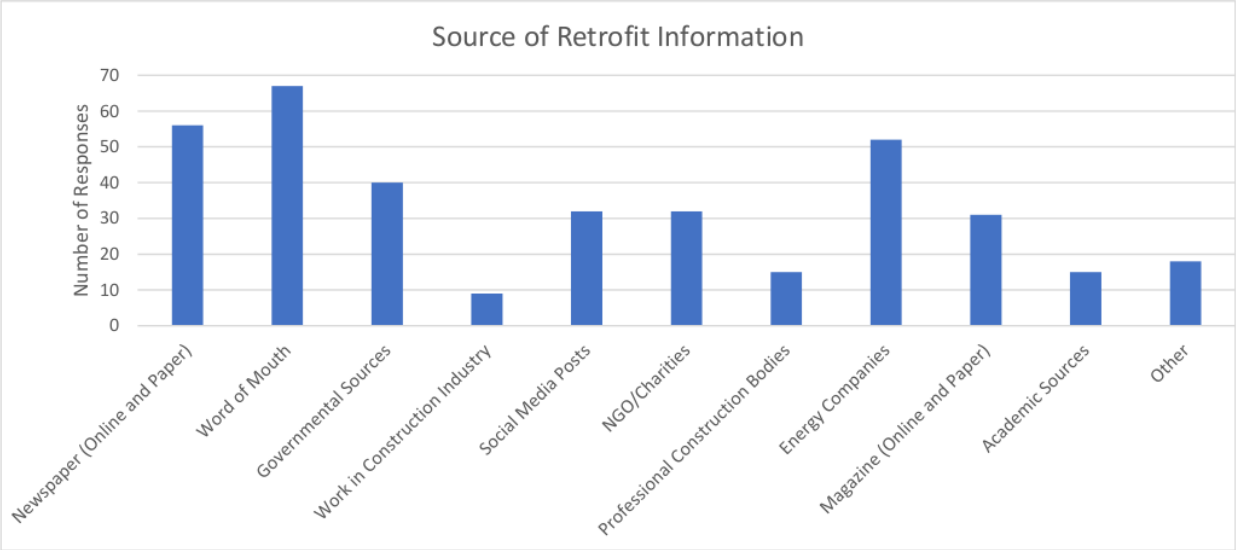

Figure 17 - Respondents' Source of Retrofit Information.

Appendix E – Ethical Clearance Questionnaire

Ethical Clearance Pro Forma

It is important for you to include all relevant information about your research in this form, so that your supervisor can give you the best advice on how to proceed with your research.

You are advised to read though the relevant sections of UCL's Research Integrity guidance to learn more about your ethical obligations.

Submission Details

1. **Name of programme of study:**

   Housing and City Planning MSc

2. **Please indicate the type of research work you are doing (Delete that which do not apply):**

- Dissertation in Planning (MSc)
- ~~Dissertation in City Planning (MPlan)~~
- ~~Major Research Project~~

3. **Please provide the current working title of your research:**

   "Investigating public opinions and tendencies toward residential retrofitting to decrease energy demand, reduce carbon emissions and improve environmental performance: an analysis of existing housing stock in Letchworth Garden City"

4. **Please indicate your supervisor's name:**

   Daniel Fitzpatrick

Research Details

5. **Please indicate here which data collection methods you expect to use. (Tick all that apply/or delete those which do not apply.)**

- ~~Interviews~~
- ~~Focus Groups~~
- Questionnaires (including oral questions)
- ~~Action research~~
- ~~Observation / participant observation~~
- ~~Documentary analysis (including use of personal records)~~
- Audio-visual recordings (including photographs)
- ~~Collection/use of sensor or locational data~~
- ~~Controlled trial~~
- ~~Intervention study (including changing environments)~~
- ~~Systematic review~~

- Secondary data analysis
- ~~Advisory/consultation groups~~

6. **Please indicate where your research will take place (delete that which does not apply):**
   - UK only
   - ~~Overseas only~~
   - ~~UK and overseas~~

7. **Does your project involve the recruitment of participants?**
   'Participants' means human participants and their data (including sensor/locational data and observational notes/images.)

   Yes/ ~~No~~ (Please delete as applicable)

Appropriate Safeguard, Data Storage and Security

8. **Will your research involve the collection and/or use of personal data?**

Personal data is data which relates to a living individual who can be identified from that data or from the data and other information that is either currently held, or will be held by the data controller (you, as the researcher).

This includes:
- Any expression of opinion about the individual and any intentions of the data controller or any other person toward the individual.
- Sensor, location or visual data which may reveal information that enables the identification of a face, address etc. (some post codes cover only one property).
- Combinations of data which may reveal identifiable data, such as names, email/postal addresses, date of birth, ethnicity, descriptions of health diagnosis or conditions, computer IP address (of relating to a device with a single user).

Yes/~~No~~ (Please delete as applicable)

9. **Is your research using or collecting:**
- special category data as defined by the General Data Protection Regulation*, and/or
- data which might be considered sensitive in some countries, cultures or contexts?

*Examples of special category data are data:
- which reveals racial or ethnic origin, political opinions, religious or philosophical beliefs, trade union membership;
- concerning health (the physical or mental health of a person, including the provision of health care services);
- concerning sex life or sexual orientation;
- genetic or biometric data processed to uniquely identify a natural person.

~~Yes~~/No (Please delete as applicable)

10. Do you confrm that all personal data will be stored and processed in compliance with the General Data Protection Regulation (GDPR 2018)? (Choose one only, delete that which does not apply)

- Yes
- ~~No~~
- ~~I will not be working with any personal data~~

11. I confirm that:

- The information in this form is accurate to the best of my knowledge.
- I will continue to reflect on and update these ethical considerations in consultation with my supervisor.

Yes/~~No~~ (Please delete as applicable)

Appendix F – Risk Assessment Form

RISK ASSESSMENT FORM
FIELD / LOCATION WORK

DEPARTMENT/SECTION: BARTLETT SCHOOL OF PLANNING
LOCATION(S): LETCHWORTH GARDEN CITY, HERTFORDSHIRE, UK
PERSONS COVERED BY THE RISK ASSESSMENT: CONOR MATTHEWS

BRIEF DESCRIPTION OF FIELDWORK (including geographic location): SURVEYING RESPONDENTS IN LETCHWORTH GARDEN CITY AND POSSIBLE FACE-TO-FACE INTERACTION TO ADVERTISE SURVEY/OBTAIN RESPONDENTS

COVID-19 RELATED GENERIC RISK ASSESSMENT STATEMENT:

Coronavirus disease (COVID-19) is an infectious disease caused by coronavirus SARS-CoV-2. The virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. Droplets fall on people in the vicinity and can be directly inhaled or picked up on the hands and transferred when someone touches their face. This risk assessment documents key risks associated fieldwork during a pandemic, but it is not exhaustive and will not be able to cover all known risks, globally. This assessment outlines principles adopted by UCL at an institutional level and it is necessarily general. Please use the open text box 'Other' to indicate any contingent risk factors and control measures you might encounter during the course of your dissertation research and writing.

Please refer to the Dissertation in Planning Guidance Document (available on Moodle) to help you complete this form.

Hazard 1: Risk of Covid -19 infection during research related travel and research related interactions with others (when face-to-face is possible and/or unavoidable)

Risk Level - Medium /Moderate

Existing Advisable Control Measures: Do not travel if you are unwell, particularly if you have COVID-19 symptoms. Self-isolate in line with NHS (or country-specific) guidance.

Avoid travelling and face-to-face interactions; if you need to travel and meet with others:

- If possible, avoid using public transport and cycle or walk instead.
- If you need to use public transport travel in off-peak times and follow transport provider's and governmental guidelines.
- Maintain (2 metre) social distancing where possible and where 2 metre social distancing is not achievable, wear face covering.
- Wear face covering at all times in enclosed or indoor spaces.
- Use hand sanitiser prior to and after journey.
- Avoid consuming food or drinks, if possible, during journey.

- Avoid, if possible, interchanges when travelling - choose direct route.
- Face away from other persons. If you have to face a person ensure
that the duration is as short as possible.
- Do not share any items i.e. stationary, tablets, laptops etc. If items need to be shared use
disinfectant wipes to disinfect items prior to and after sharing.
- If meeting in a group for research purposes ensure you are following current country specific guidance on face-to-face meetings (i.e rule of 6 etc.)
- If and when possible meet outside and when not possible meet in venues with good ventilation (e.g. open a window)
- If you feel unwell during or after a meeting with others, inform others you have interacted with, self-isolate and get tested for Covid-19
- Avoid high noise areas as this mean the need to shout which increases risk of aerosol transmission
of the virus.
- Follow one way circulation systems, if in place. Make sure to check before you visit a building.
- Always read and follow the visitors policy for the organisation you will be visiting.
- Flush toilets with toilet lid closed.
-'Other' Control Measures you will take (specify): Taking LFTs before face-to-face interaction

NOTE: The hazards and existing control measures above pertain to Covid-19 infection risks only. More generalised health and safety risk may exist due to remote field work activities and these are outlined in your Dissertation in Planning Guidance document. Please consider these as possible 'risk' factors in completing the remainder of this standard form. For more information also see: Guidance Framework for Fieldwork in Taught and MRes Programmes, 2021-22

Consider, in turn, each hazard (white on black). If **NO** hazard exists select **NO** and move to next hazard section.
If a hazard does exist select **YES** and assess the risks that could arise from that hazard in the risk assessment box.
Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.

ENVIRONMENT	**The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard**
e.g. location, climate, terrain, neighbourhood, in outside organizations, pollution, animals.	Adverse weather. Risk – LOW Getting lost. Risk – LOW Dangerous traffic. Risk - LOW

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

	work abroad incorporates Foreign Office advice
	only accredited centres are used for rural field work
	participants will wear appropriate clothing and footwear for the specified environment
	refuge is available
	work in outside organisations is subject to their having satisfactory H&S procedures in place
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

EMERGENCIES	**Where emergencies may arise use space below to identify and assess any risks**
e.g. fire, accidents	N/A

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

	participants have registered with LOCATE at http://www.fco.gov.uk/en/travel-and-living-abroad/
	contact numbers for emergency services are known to all participants
	participants have means of contacting emergency services
	a plan for rescue has been formulated, all parties understand the procedure
	the plan for rescue /emergency has a reciprocal element
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

EQUIPMENT	**Is equipment used?**	**NO**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any** **risks**
e.g. clothing, outboard motors.	N/A		

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

	the departmental written Arrangement for equipment is followed
	participants have been provided with any necessary equipment appropriate for the work
	all equipment has been inspected, before issue, by a competent person
	all users have been advised of correct use

	special equipment is only issued to persons trained in its use by a competent person
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

LONE WORKING	**Is lone working a possibility?**	**YES**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**
e.g. alone or in isolation *lone interviews.*	Summoning help. Risk – LOW Assault of the researcher. Risk – LOW		

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
	the departmental written Arrangement for lone/out of hours working for field work is followed
	lone or isolated working is not allowed
	location, route and expected time of return of lone workers is logged daily before work commences
X	all workers have the means of raising an alarm in the event of an emergency, e.g. phone, flare, whistle
X	all workers are fully familiar with emergency procedures
X	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

Pre-arranged meetings with organisations and researcher only working in publicly accessible areas in full daylight.

ILL HEALTH	The possibility of ill health always represents a safety hazard. Use space below to identify and assess any risks associated with this Hazard.
e.g. accident, illness, personal attack, special personal considerations or vulnerabilities.	Injury to researcher. Risk – LOW Flare-up of pre-existing medical condition. Risk – LOW

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	all participants have had the necessary inoculations/ carry appropriate prophylactics
	participants have been advised of the physical demands of the research and are deemed to be physically suited
	participants have been adequate advice on harmful plants, animals and substances they may encounter
	participants who require medication should carry sufficient medication for their needs
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

TRANSPORT	Will transport be required	NO		Move to next hazard
		YES	X	Use space below to identify and assess any risks
e.g. hired vehicles	Researcher's vehicle breaking down. Risk – LOW Researcher being involved in a RTC. Risk – LOW			

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	only public transport will be used
	the vehicle will be hired from a reputable supplier
X	transport must be properly maintained in compliance with relevant national regulations
	drivers comply with UCL Policy on Drivers http://www.ucl.ac.uk/hr/docs/college_drivers.php
	drivers have been trained and hold the appropriate licence
	there will be more than one driver to prevent driver/operator fatigue, and there will be adequate rest periods
	sufficient spare parts carried to meet foreseeable emergencies
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

DEALING WITH THE	Will people be		If 'No' move to next hazard

PUBLIC	dealing with public	YES	If 'Yes' use space below to identify and assess any risks
e.g. interviews, observing	Assault of researcher. Risk – LOW Misinterpretation. Risk – LOW Researcher causing offence. Risk – LOW		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	all participants are trained in interviewing techniques
X	advice and support from local groups has been sought
X	participants do not wear clothes that might cause offence or attract unwanted attention
	interviews are conducted at neutral locations or where neither party could be at risk
X	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

Face-to-face interactions arranged in advance or done in a publicly accessible place in full daylight

WORKING ON OR NEAR WATER	Will people work on or near water?	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. rivers, marshland, sea.	N/A		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	lone working on or near water will not be allowed
	coastguard information is understood; all work takes place outside those times when tides could prove a threat
	all participants are competent swimmers

	participants always wear adequate protective equipment, e.g. buoyancy aids, wellingtons
	boat is operated by a competent person
	all boats are equipped with an alternative means of propulsion e.g. oars
	participants have received any appropriate inoculations
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

MANUAL HANDLING (MH)	**Do MH activities take place?**	**NO**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**
e.g. lifting, carrying, moving large or heavy equipment, physical unsuitability for the task.	N/A		

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
	the departmental written Arrangement for MH is followed
	the supervisor has attended a MH risk assessment course
	all tasks are within reasonable limits, persons physically unsuited to the MH task are prohibited from such activities
	all persons performing MH tasks are adequately trained
	equipment components will be assembled on site
	any MH task outside the competence of staff will be done by contractors
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

SUBSTANCES	Will participants work with substances	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. plants, chemical, biohazard, waste	N/A		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk

	the departmental written Arrangements for dealing with hazardous substances and waste are followed
	all participants are given information, training and protective equipment for hazardous substances they may encounter
	participants who have allergies have advised the leader of this and carry sufficient medication for their needs
	waste is disposed of in a responsible manner
	suitable containers are provided for hazardous waste
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

OTHER HAZARDS	Have you identified any other hazards?	NO	If 'No' move to next section If 'Yes' use space below to identify and assess any risks
i.e. any other hazards must be noted and assessed here.	Hazard: N/A Risk: is the risk		

CONTROL MEASURES	Give details of control measures in place to control the identified risks

Have you identified any risks that are not adequately controlled?			
	NO	X	Move to Declaration
	YES		Use space below to identify the risk and what action was taken

DECLARATION		The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.
	Select the appropriate statement:	
X	I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk	
	I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by the method(s) listed above	

NAME OF SUPERVISOR **Daniel Fitzpatrick**

FIELDWORK **5** June 2022

BPLN0039_RQZB0

GRADEMARK REPORT

FINAL GRADE

/100

GENERAL COMMENTS

Instructor

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