EUB
SuperHub

European Building Sustainability performance and energy certification Hub

D4.1 – Mapping of stakeholder interaction and identification of market actors' needs

This project has received funding from the European Union's H2020 research and innovation programme under Grant Agreement No. 101033916.

Project no. 101033916

Project acronym: EUB SuperHub

Project title: European Building Sustainability performance and energy certification Hub

Call: H2020-LC-SC3-B4E-4-2020

Start date of project: 01.06.2021.

Duration: 36 months

Deliverable title: D4.1 – Mapping of stakeholder interaction and identification of market actors' needs

Due date of deliverable: January 2023

Organisation name of lead contractor for this deliverable: University College Cork – National University of Ireland, Cork (*PARTNER NUMBER 9*)

Name of author(s)	Organization
Niall Dunphy	*University College Cork - UCC, Ireland*
Lauren Quinlivan	*University College Cork - UCC, Ireland*
Breffní Lennon	*University College Cork - UCC, Ireland*

Dissemination level		
PU	Public	PU

Document History

History			
Version	Date	Reason	Revised by
01	31/05/2023	Draft	UCC
02a	06/06/2023	Review	HM
02b	19/06/2023	Review	iiSBE Italia
03	19/06/2023	Final	UCC

Table of contents

Executive summary 8
1. Introduction 9
1.1 Background and context 9
1.2 Purpose and structure of the document 9
1.3 Structure of the document 10
2 Methodology 11
2.1 Research philosophy 11
2.2 Methods of data collection and analysis 12
2.2.1 Literature review 13
2.2.2 Interviews 15
2.2.3 Surveys 16
2.2.4 Thematic analysis 16
3 Value chains 18
3.1 Value and value chains 18
3.2 Identifying and mapping stakeholders 20
3.3 Hubs of activity model 21
3.4 Understanding real estate value chains 23
4 Survey 27
4.1 Survey implementation 27
4.2 Survey Results 27
5 Interviews 33
5.1 Interview planning and implementation 33
5.2 Insights from Interviews 33
5.2.1 Building Users 33
5.2.2 Building Owners/Occupiers 36
5.2.3 Professionals 37
6 Conclusions and recommendations 41
6.1 Conclusion 41
6.2 Recommendations 43
7 References 45
Appendix 1 – Participant Briefing Document 52

Appendix 2 – Consent forms 54
Appendix 3 – Survey Questionnaire 56
Appendix 4 – Interview schedule 60

Table of figures

Figure 1: Generic Value Chain (Porter 1985, 45) 19
Figure 2: Porter's Value System (Porter 1985, 35) 19
Figure 3: Illustration of the Hubs of Activity model mapping the lifecycle of a construction project (Dunphy et al. 2013, 38) 22
Figure 4: Cafferata and Mari's real estate value chain model (cited in Ricciotti et al. 2020) 24
Figure 5: Denniston & Kim's (2008) real estate value chain model of five segments 24
Figure 6: Selected real estate value chain representations 25
Figure 7: Selected construction value chain representations 25

List of tables

Table 1: Real estate functional segments and stakeholder 26

Project partners

Partner number	Acronym	Partner name	Country	Country code
1	**GEO**	Geonardo Environmental Technologies Ltd	Hungary	HU
2	**HM**	Hochschule für angewandte Wissenschaften München	Germany	DE
3	**iiSBE**	International Initiative for a Sustainable Built Environment	Italy	IT
4	**UNI**	UNI – Ente Italiano Di Normazione	Italy	IT
5	**EIV**	Energieinstitut Vorarlberg	Austria	AT
6	**FeliCity**	Felicity-Tools Informatikai Szolgaltato Kft	Hungary	HU
7	**CaR**	Calabria Regione	Italy	IT
8	**CSTB**	Centre Scientifique et Technique du Bâtiment	France	FR
9	**UCC**	University College Cork	Ireland	IE
10	**EIHP**	Energetski institut Hrvoje Požar	Croatia	HR

Abbreviations

BER	Building Energy Rating (used in Ireland)
EBVS	European Business Valuation Standards
EE	Energy Efficiency
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Certificate
EVS	European Valuation Standards
GHG	greenhouse gas
IVS	International Valuation Standards
IVSC	The International Valuation Standards Council
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
LCC	Life Cycle Cost
nZEB	nearly-Zero Energy Building
PVT	Planning and verification tool
RICS	Royal Institution of Chartered Surveyors
TEGoVA	The European Group of Valuers' Associations

Glossary

Selected terms commonly used in real estate and mortgage marketplace:

Appraisal	A professional analysis used to estimate the value of the property.
Asset	Anything of monetary value that is owned by a person or company. Assets include real property, personal property, stocks, mutual funds, etc.
Assessed Value	Typically, the value placed on property for the purpose of taxation
Assessor	A public official who establishes the value of a property for taxation purposes
Condominium	A unit in a multiunit building. The owner of a condominium unit owns the unit itself and has the right, along with other owners, to use the common areas but does not own the common elements such as the exterior walls, floors and ceilings or the structural systems outside of the unit; these are owned by the condominium association. There are usually condominium association fees for building maintenance, property upkeep, taxes and insurance on the common areas and reserves for improvements.
Comparable	A property deemed by the valuer to be similar to the one being valued
Cost approach	A valuation approach which provides an indication of value based on the economic principle that a buyer will pay no more for a property than the cost to obtain a property of equal utility, whether by purchase or by construction, including the cost of sufficient land to enable that construction. It will often be necessary to make an allowance for obsolescence of the subject property compared with a brand-new equivalent one.
Depreciation	A decline in the value of a house due to changing market conditions or lack of upkeep on a home

Income approach	An approach that provides an indication of value by converting future cash flows to a single current capital value
Income property	Real estate developed or purchased to produce income, such as a rental unit
Market approach	A valuation approach where the valuation is produced by comparing the subject property with the evidence obtained from market transactions that fulfil the criteria for the relevant basis of value
Market Value	The current value of your home based on what a purchaser would pay. An appraisal is sometimes used to determine market value. The estimated amount for which the property should exchange on the date of valuation between a willing buyer and a willing seller acting independently of each other. after proper marketing wherein the parties had each acted knowledgeably, prudently and without being under compulsion
Property	Land and buildings on, below or above ground including pipes, cables and other equipment connected thereto
Real estate	Land and all things that are a natural part of the land (*e.g.,* trees, minerals) and things that have been attached to the land (*e.g.,* **buildings** and site improvements) and all permanent building attachments (*e.g.,* mechanical and electrical plant providing services to a building), that are both below and above the ground

Executive summary

A key goal of Work Package 4, titled Stakeholder involvement and social acceptance studies of EUB SuperHub, is to collect the views and opinions of stakeholders and end-user communities on the project's methodology for novel assessment and certificate design currently being developed in the digital platform. In addition, identifying and characterising market actors' roles and needs across scales in both the building certification and assessment value chains, while also developing an appreciation of public perceptions and acceptance of current market-based and official energy performance certificates (EPCs), inform the approach taken for this work package.

To achieve this, three complementary tasks frame the body of work undertaken to address these objectives. This deliverable presents on the outcomes of the first of these tasks, a mapping of stakeholder interaction with energy performance certificates regimes across Europe (drawing from experiences in BG, CH, IE, FI, FR, MK, PT, and UK). It also identifies the expressed needs of market actors in response to how those regimes have been rolled out to date. It examines how existing EPC regimes have affected key stakeholders' expectations of, and the perceived efficacy, arising from the role out of future EPC regimes. Consequently, the experiences of stakeholders in the real estate market value chain(s) already inform their perceptions of the usability and marketability of current EPCs and assessment schemes, at both the individual building & district scales.

To better understand these value chains, this deliverable utilises the Hubs of Activity model (after Dunphy *et al.* 2013) developed, refined, and successfully deployed in the UMBRELLA[1] FP7 and NewTREND[2] H2020 projects. Using this model and building on partners' previous work characterising building and construction value chains, the deliverable focuses on several key actors identified in the eight European countries, mentioned above. This work involved a mixed-methods approach comprising surveys and semi-structured interviews, which was then followed by an in-depth thematic analysis of the resultant transcripts. Recruitment involved engaging with representative organisations for actors in the value chain, most notably real estate evaluators, but also architects, building owners, building managers, and renters. Together, and in-depth analysis of this collected data was used to map and better understand the interactions of key actors along the value chain, as well as the interests, drivers, and motivations influencing their engagement with existing EPC regimes.

This deliverable is the first of three complementary reports examining the public engagement and social acceptance of EPCs and their pertinence to the EUB SuperHub platform.

[1] CORDIS fact sheet https://cordis.europa.eu/project/id/314343
[2] CORDIS fact sheet https://cordis.europa.eu/project/id/680474 | Project web site http://newtrend-project.eu/

1. Introduction

1.1 Background and context

Achieving sufficient energy efficiency developments to buildings across the EU necessitates significant changes in how the built environment is observed. There is a requirement to take a more holistic view of buildings, based on an in-depth understanding of societal trends and the dynamics driving the marketplace. Accordingly, energy performance assessments and certificates of buildings need to evolve to reflect the technological development and the needs of the society. Moreover, within the EU, they must be consistent throughout the Member States.

The EUB Superhub project arises from the premise that the next generation of energy performance certification should take advantage of the impending era of big data, where buildings can be observed with ever increasing levels of detail via a larger number of stakeholders, and with ever increasing amounts of available information on the operational use of buildings. The project supports the evolvement of the building certification process in the EU through the development of a scalable methodology to view, assess and monitor the buildings throughout their lifecycle. Consequently, this methodology proposes to capture some of the more complex aspects of the construction sector, such as embedded energy and related costs.

1.2 Purpose and structure of the document

The work presented in this report has been undertaken as part of a work programme devised for Work Package 4 of the EUB SuperHub project, titled '*Stakeholder involvement and social acceptance studies of EUB SuperHub*', which aims to address the following objectives:

- explore the views and opinions of end-user communities and key stakeholders on the EUB SuperHub methodology, specifically the unique assessment and certificate design to be implemented in a digital environment.
- identify and characterise the roles and needs of market actors throughout value chain(s) which deliver building- and district-level building certification and assessment.
- examine public understandings and social acceptance of the current market-based and official certificates.

The objective of this report is to identify the real estate market actors' needs and to develop an understanding of stakeholder interaction. Specifically, it aims to define the role, needs and objectives of the real estate market value chain(s) regarding the usability and marketability of the EPCs and assessment schemes, at both the individual building & district scales. To understand these value chains this task will utilise the Hubs of Activity model (after Dunphy *et al.* 2013), developed, refined and

successfully deployed, in previous projects[3,4]. Using this model and building on partners' previous work characterising construction value chains, relevant key actors will be identified and characterised. Information on interactions within the value chains will be collected through a mixed-methods approach involving *e.g.,* surveys and semi-structured interviews, with thematic analysis of resultant transcripts.

1.3 Structure of the document

This deliverable, '*Mapping of stakeholder interaction and identification of market actors' needs*', has been produced through an in-depth review of the relevant literature coupled with extensive stakeholder engagement activities. The report is structured in the following manner:

1. Introduction: provides an overview of the EUB SuperHub project, including background and contextual information.
2. Methodology, details the methodological approach to data gathering as part of the project, referring to the use of surveys, interviews, and thematic analysis procedures.
3. Value Chains: an exploration of the relevant literature relating to value chains and key stakeholders involve in construction and real estate.
4. Survey: introduces the survey conducted as part of the study and provides an overview of the results.
5. Interview: presents the interviews undertaken within the study and provides an account of the insights emerging from the engagements.
6. Discussions, recommendations, and conclusions: summarises the key findings of the report, forwards recommendations and outlining their significance to the overall project.

[3] UMBRELLA: Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation (FP7 Programme 2012-15, Grant Agreement # 314343).
[4] NewTREND: New Integrated Methodology and Tools for Retrofit Design Towards a Next Generation of Energy Efficient and Sustainable Buildings and Districts (H2020 Programme 2015-18, Grant Agreement # 680474).

2 Methodology

2.1 Research philosophy

The aim of the research contained in this report was to develop an understanding of the role, needs and objectives of the real estate market value chain(s) regarding the usability and marketability of the EPCs and assessment schemes, at both the individual building & district scale. This section outlines the methodological approach adopted for this research, outlining what Crotty (1998, 3) refers to as "*the strategy, plan of action, process of design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes*".

All research, especially that involving study of the social world, is inherently based on certain assumptions[5]. These include:

- *Ontological* assumptions: on the nature of reality – what is the nature of what is being studied?
- *Epistemological* assumptions, on the nature of knowledge – what is the best means of inquiring about the world?
- *Methodological* assumptions, on how to obtain knowledge – what is the best way to group methods to provide a coherent approach?

Considering ontological and epistemological issues are key to research design. The particular set of assumptions adopted by researchers – whether explicitly[6] or by default – establish a paradigm (or worldview) under which the research will be conducted (Morgan & Smircich 1980, 491–492).

The research being undertaken is essentially about appreciating the understandings, perceptions, attitudes and practices that coalesce with real estate value chains, as they are relevant to energy performance certification and building assessment. These is fundamentally the study of social phenomena. While many would argue for objectivist approaches in the social sciences, we agree with Charmaz's critique (2003, 83) that such deductive quantitative approaches tend to reduce "qualities of human experience to quantifiable variables". Rather viewing the world as a social construction (one that is subjective to observers and/or negotiated within groups) that needs to be interpreted, we adopt a social-constructivist epistemic view of knowledge. The following section outlines the data collection and analysis methods chosen to realise this approach.

[5] Even in the dominant (seen by many as the only legitimate) scientific (hypothetico-deductive) method on the nature of the world, how we perceive it, and our ability to describe and interpret it (see *e.g.,* Hammond & Wellington 2013).

[6] For example, Weinberg (1995) observes that most scientists do not understand the scientific method, rather they just do – he compares it to someone riding a bicycle, saying "*if they think too much about it they are likely to fall off*".

2.2 Methods of data collection and analysis

The research represented in this report takes an *anti-foundationalist ontology* – holding that (social) reality does not exist independently of the observer and a *constructivist epistemology* – holding that the socially constructed world needs to be interpreted. Mindful of the rich, thick data required to appropriately explore this topic and appreciate the informants' contributions a qualitative methodological approach has been adopted for this work. The term 'qualitative' suggests an emphasis on the "*qualities of entities and on processes and meanings*" (Denzin & Lincoln 2005). This form of research can be thought of a means of qualifying *i.e.,* describing, illuminating, explaining, and/or exploring the object of study (Bearman 2019). Ritchie & Ormston (2013) suggests qualitative research can have a variety of functions including *e.g.,* contextual – describing the nature of what exists; explanatory – discovering the reasons of what exists; evaluative – evaluating the effectiveness of what exists; and generative – generating theories for what might exist. Although aligned to come extent with all of these functions, the research in this report perhaps best fits within the contextual function, in that it seeks to describe and understand the existing nature of real estate value chains, with an element of generative function, in so far as it seeks to explore needs and requirements regarding the usability and marketability of the EPCs and assessment schemes, which would include what might be called prospective perspectives.

There is a substantial range of qualitative research methodologies in use at present, and the approach chosen to answer a particular research question will depend on the specific details of the research. Some qualitative methodologies have a particular focus[7], many of the more useful approaches are so-called generic qualitative methodologies, those which are "*…not guided by an explicit or established set of philosophic assumptions in the form of one of the known qualitative methodologies*" (Caelli, Ray, & Mill 2003, 4). These genetic approaches can be said to epitomise qualitative research by aiming "*... to discover and understand a phenomenon, a process, or the perspectives and worldviews of the people involved.*" (*Ibid.,* 3). In realising the research presented in this report, a mixed-methods approach was adopted. This involving the use of several methods for the gathering and analysis of data. The objective of the approach to capture a diversity of insights, and not necessarily representative or generalisable results[8]. The methods and techniques used to collect and analyse the data for the research include:

- A literature review to explore existing knowledge (and emerging concepts).
- In-depth interviews to provide so-called rich, thick data, analysis of which offers valuable in-sights.
- Surveys to capture perspectives and opinions from a (relatively) large number or people.
- Thematic analysis to make sense of the collected data involving describing, interpreting and theorising the resultant transcripts and records.

[7] For Instance, Grounded Theory, which seeks to build theories (see *e.g.,* Corbin & Strauss 2014), Ethnography, which focuses on culture (see *e.g.,* Reeves *et al.* 2008).
[8] Although the use of different methods does offer a degree of cross verification.

2.2.1 Literature review

A fundamental component of any research is a review of literature pertinent to the study topic. A literature review comprises the collection and synthesis of previous research (Baumeister & Leary 1997; Tranfield *et al.* 2003), which enables the systematic exploration of existing theories, practices, and general knowledge of the topic being examined (Webster & Watson 2002). The literature review is commonly treated as a precursor to 'real' work, while it is of course an integral and important part of research. Moreover, we concur with the argument that reviewing literature can be a worthwhile research method (in its own right), generating new knowledge and insights by building on that which already exists (Webster & Watson 2002, Torraco 2005).

The guidelines for conducting a literature review will differ depending on the type of review being carried out[9]. Snyder (2019) denotes three broad categories of literature review are denoted, namely, the systematic, semi-systematic and integrative review. Each offers significant potential for addressing research questions, given the right circumstances. The integrative or critical review was the approach adopted for the purpose of addressing this research question on the concept of stakeholder interaction and market actors' needs within the real estate value chain. The emergence of new theoretical frameworks and perspectives tend to be the result of integrative literature reviews that have effectively assessed, critiqued, and synthesised the literature (Torraco 2005).

The seven-task framework proposed by Fink (2010, 5), and summarised below, is used as a guide for conducting the literature review (in an iterative fashion) set out in this report.

- Selecting a research question to orientate the review. In this research, the over-arching research question concerns the role, needs and of objectives of the real estate market value chain(s) regarding the usability and marketability of the EPCs and assessment schemes. While this is quite a broad topic, it does serve as a focal point for the study.
- Choosing bibliographic databases and other literature sources. This task relates to the selection of bibliographic databases and other sources of literature. In addition to physical UCC library catalogue, the primary sources of literature used for this research were bibliographic databases which were either freely accessible or made available through university subscriptions. The primary commercial databases utilised were Science Direct, SCOPUS, and JSTOR. In addition, and notwithstanding some legitimate criticisms, Google Scholar was used as a complementary database, not least due to the power of its search algorithms[10].
- Picking search terms and combinations. The databases were queried using Boolean keyword searches (*i.e.,* based on Boolean logic limited to two values.), where combinations of words and phrases using Boolean operators 'and', 'or', 'not' to search for relevant material. Such searches are flexible and allow for sophisticated searches. Examples of some initial search term

[9] Examples of current literature review guidelines include those for systemic reviews and meta- analysis (*e.g.,* Davis *et al.* 2014; Liberati *et al.* 2009; Moher *et al.* 2009), and narrative and integrative reviews (*e.g.,* Baumeister & Leary 1997; Torraco 2005; Wong *et al.* 2013).

[10] Google Scholar was only used as a supplementary source and in full knowledge of its shortcomings.

combinations employed include: 'buildings' AND 'selling' AND 'energy certificate' OR 'building assessment'; 'real estate' AND 'value chain' OR 'stakeholders'. In addition to such databases searches, literature which may have been missed through the database search were found through what might be termed a snowballing strategy comprising: 'backward snowballing', literature listed in bibliographies of papers identified through keyword searches; 'forward snowballing', literature that has cited the identified papers; and relationship 'snowballing', articles recommended by the bibliographic databases based on relevance scoring.

- Employing practical screening criteria *e.g.*, availability, language, year of publication; are applied to "*identify a broad range of articles that may be potentially usable in that they cover the topic of interest, are in a language you can read, and are in a publication you respect and can be obtained in a timely manner*" (Fink 2010, 59). This is the first of two screening which involves applying screening criteria to reduce the amount of identified literature to a (more) manageable amount.
- Adopting methodological screening criteria *e.g.*, methodological approach. This second screening steps in conjunction with the first acts to "ensure the review's efficiency, relevance, and accuracy" (*Ibid.*). This screening focused on: research methodological background; apparent quality and rigour of the work. The outcome of these iterative screening steps was a pruning of the literature to a reasonable amount – small enough that it was practical to review, yet comprehensive enough that there were no glaring omissions.
- The sixth step comprises the actual review of the selected and collected literature. This involves a time-consuming iterative process of reading, annotating, organising, summarising, and analysing. Typical approaches used by reviewers include focusing on 'abstracts first' and reading the full article later, or reading each piece of literature suggested in full, which can be rather time-consuming, yet thorough (Snyder 2019). The collected literature was entered into Mendeley Desktop, a reference management software which enabled a more effective literature review, by providing for more efficient reading, notetaking and organisation of documents.
- The final step is the synthesise of the research being undertaken and production of the review[11]. The objective being the production of something readers will find interesting. Bem (1995) notes that "*(a)uthors of literature reviews are at risk for producing mind-numbing lists of citations and findings that resemble a phone book – impressive case, lots of numbers, but not much plot*". The objective of this literature review is to explore perceptions of those involved in real estate value chains around energy certification and building assessment. In doing so it aims to produce a review that is "*original, perceptive and analytical*" (Jesson & Lacey 2006).

[11] There are various standards and guidelines which address literature review structuring and reporting for different types of review including *e.g.,* systematic narrative reviews (Wong *et al.* 2013), systematic reviews and meta-analyses (Liberati *et al.* 2009), and integrative reviews (Torraco 2005).

2.2.2 Interviews

Interviews have long been recognised as a significant tool of the social sciences, they facilitate analysis of spoken words, report on unique and detailed views and perspectives, and invite interviewees to speak in their own voice. They are a very common research tool, used to capture experiences and ascertain the attitudes, perceptions, and inner feelings. Kvale (1983, 174) defines an interview as "*an interview, whose purpose is to gather descriptions of the life-world of the interviewee with respect to interpretation of the meaning of the described phenomena".* Gill *et al.* (2008) suggests that there are perhaps three fundamental types of interviews[12], as outlined below.

- Unstructured interviews are open-ended, with predetermination of neither the questions nor answer categories. They begin with an open-ended questions and subsequent questions follow from the responses provided.
- Semi-structured interviews are those that allow the topic to be defined in a general sense. They comprise several key questions but provide for areas of particular interest (to the interviewer or interviewee) to be explored in more detail if desired.
- Structured interviews are essentially verbally administered questionnaires. They are characterised by predetermined questions and have no scope for follow on questions.

The primary instrument adopted for gathering the information in this research is the semi-structured interview. This form of interview is considered to be particularly appropriate where the research has a predetermined focus (Bryman & Bell 2011), not least because they promote discovery and enable probing. Thus, semi-structured interviews were seen as offering the most effective means of capturing opinions, experiences and practices of actors within real estate value chains, regarding energy performance certificates and building assessment. With semi-structured interviews, an interview schedule, comprising a list of questions (or topic areas) is prepared in advance to guide the conversation to those areas most relevance to the research. The objective is to understand the informant's point of view, rather than extrapolate findings to make generalisations. The interview is treated as a conversation and the researcher tries to build a rapport with the informant. Questions may not be asked exactly in the same order or in the precise language contained in the schedule, and if deemed necessary interviewees may be asked additional questions for clarification and to explore new points of interest as they arise (Bryman & Bell 2011).

Semi-structured Interviews are interactive by nature. This is a key advantage over other methods allowing researchers to push for clearer, more complete responses, or to dig deeper into emerging topics of interest, all the while ensuring that mutual understanding has been achieved (Dörnyei 2007). Interviews are thus considered an effective tool for intensifying the depth of understanding of the phenomena or topic under examination. The selection process for the interviewees as part of this research was precise and purposeful, and adhered to the research questions.

[12] In practice, interviews can be said to form a continuum, with the unstructured interviews being closer to observation, with structured interviews closer to questionnaires.

2.2.3 Surveys

A survey is a research method in which questionnaires[13] are used to gather information from a specific set of respondents, analyse these data and therefrom draw conclusions.[14] Simply put, survey research can be described as "*the collection of information from a sample of individuals through their responses to questions*" (Check & Schutt 2012, 160). Research strategies for survey work may be qualitative (*e.g.,* open-ended questions), quantitative (*e.g.,* questionnaires with numerically rated items) or a mixture of both (Ponto 2015). They are typically employed within the social and psychological sciences as a means of examining human behaviour and attitudes (Singleton & Straits 2009).

Survey research has been carried out in various formats for decades, ranging from informal interactions on the street corner, for example, to using audio-visual and digital survey instruments as part of more complex rigorous studies, reflecting the depth and range of survey work in terms of research aims, recruitment and sampling strategies, administration methods, and data collection instruments (Ponto 2015).

Advancements in technology over recent years has led to a surge in the popularity of online surveys (Schonlau *et al.* 2002). Use of the internet in this way is ideal for any research strategy looking to take advantage of the flexibility, global reach, convenience, low administration costs, easy follow-up, controlled sampling and question diversity (Evans & Mathur 2005). Within this research an online survey was used a means of collecting information on individuals' personal relationships with energy and their building's performance, their knowledge of the EPC programme within their country, as well as their perceptions of the EUB SuperHub platform.

2.2.4 Thematic analysis

'Making sense' of qualitative data (*e.g.,* interview data) typically involves an iterative process of describing, interpreting, and theorising. Thematic analysis is one of a number of qualitative research techniques used to analyse textual data, with the goal in this scenario being to illuminate themes that may be present throughout (Forman & Damschroder 2008). Thematic analysis involves a systematic process of structuring, coding, elucidating meaning, and theorising, all of which contribute to a development framework through which a theme is uncovered or emerges (Saldaña 2013; Zhang & Wildemuth 2009). The qualitative interview data gathered throughout this report is analysed using thematic analysis.

As a concept, thematic analysis evolved from the work of Gerald Horton (1975), who introduced it as a method for investigating implicit, tacit themes and structures beyond what was already clearly obvious. Thematic analysis shares its roots with another older, quantitative method of content analysis (Smith 2000). However, its key advantage over content analysis is in the ability to incorporate the

[13] The questionnaires may be self-administered, *e.g.,* online surveys or in the past postal surveys, or administrated by the data collector, in which case it corresponds to an extreme structured pole of the interview continuum mentioned in Footnote # 12 on page 15.

[14] Survey refers to the research process of data collection, aggregation, and analysis, while questionnaire or survey can be used interchangeably for the data collection tool used as part of the method.

subtleties and intricacies presented by phenomenological experiences. Where researchers wish to uncover and analyse patterns of meaning in a dataset, illustrating the most significant themes present, thematic analysis remains a commonly used approach (Braun & Clarke 2006). Joffe (2012) defines 'theme' as it relates to thematic analysis as 'a specific pattern of meaning found in the data' which may be obvious, in the form of manifest content, or more subtle, generally referred to as latent content; thematic analysis tends to draw on both explicit and implicit content in its deduction of the latent meanings behind sets of manifest themes (Joffe & Yardley 2004). Both deductive (theoretical ideas brought to the research by the researcher) and inductive (the raw data itself) themes are also scrutinised as part of thematic analysis, which enables the examination of preconceived aspects stemming from theories, as well as retaining an openness to the emergence of new concepts that may prove revolutionary in terms of knowledge on the research topic (Joffe 2012). Theme development as part of thematic analysis generally follows a four-phase process, according to Vaismoradi *et al*. (2016).

2. Initialisation. The first step unsurprisingly involves the transcription of data and taking down of detailed notes based upon what is observed by the researchers; these are reread several times and useful quotes which effectively capture the trend in participant's perspectives are highlighted.

3. Construction: The similarities and differences between quotes are compared throughout the construction phase, all of which are coded based upon their ability to address aspects of the research (Vaismoradi *et al.* 2016). Labels are assigned to clusters of codes that appear similar.

4. Rectification: Theme begins to emerge and evolve as part of the rectification phase whereby the analysis process is reassessed numerous times, with researchers attempting to distance themselves from the data at times in order to retain sensitivity to it and reduce the chances of premature or incomplete analyses.

5. Finalisation: This final phase is the point at which theme development culminates in a narration by the researchers which illustrates and connects various themes using a 'storyline' that answers the research question in a holistic manner. The storyline aspect of theme development – which may itself prove infinite – is helpful as a means of reassuring researchers and readers as to when the point of theoretical saturation has been reached, the factor underpinning the finalisation of data collection and analysis within qualitative research disciplines (Vaismoradi *et al.* 2016).

While some researchers prefer to carry out thematic analysis manually, others favour the assistance of computer packages, such as NVivo. However, even with the use of such software analysis remains very much in the hands of the researcher. This software does not automate the analysis but rather facilitates organization and visualisation of data.

Thematic analysis has demonstrable utility in exploring the perceptions and attitudes of people, particularly how these reflect and/or inform the respective interests, drivers, and motivations that go on to influence their activities within the value chain. Accordingly, it was selected as the means of analysing and interpreting the qualitative data gathered during this task.

3 Value chains

3.1 Value and value chains

The central objective of any business is to deliver value to their customers. This can be thought of as providing a product or service with a specific combination of benefits[15], compared with to the associated acquisition costs (Morrissey *et al.* 2014). Of course, the value that a prospective customer will place of a particular product of service is entirety subjective and as Bowman & Ambrosini (2000, 2) comment based on their "*beliefs about the goods, their needs, unique experiences, wants, wishes and expectations*". Zeithaml (1988) defines customer-perceived value as the consumer's overall assessment of the utility of a product based on what is given and what is received[16].

Value propositions are assemblages of features of products and services offered to meet customers' needs. Lanning & Michaels (1988, 5) in their paper of the same name argue that 'a business is a value delivery system'. They suggest that a successful business required the formulation of a value proposition and development of a system to deliver it to customers. This early conceptualisation contrasted the product orientation of many traditional approaches, with value delivery focus of more successful companies. Indeed, it's not unknown for a company to provide a product or service to customers for many years without knowing its true value proposition and only learning what the customer actually wanted when a change was made which impacted on the proposition.

The concept of the value chain initially emerged from the literature on business management. Value chains were first conceptualised by Porter (1985), a generic schematic representation of which is provided in Figure 1. Five primary activities - inbound logistics, operations, outbound logistics, marketing and sales, and services - as well as other supporting activities (firm infrastructure, HR management, technology development, procurement), are described.

[15] In whatever way the customer so defines.

[16] Reflected in Therodore Levit's observation that "*People don't want to buy a quarter-inch drill. They want a quarter-inch hole*" (Christensen, Cook, & Hall 2005).

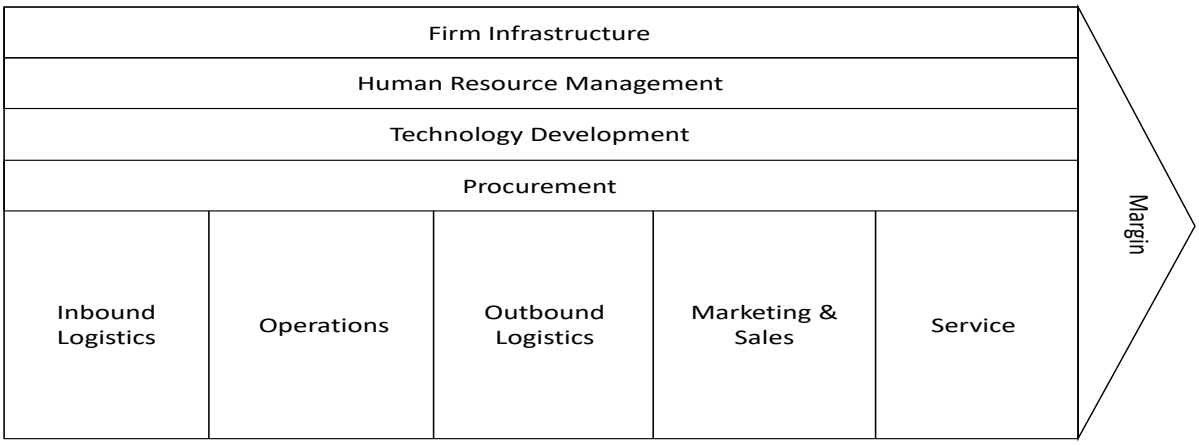


Figure 1: Generic Value Chain (Porter 1985, 45)

The value chain concept describes "*the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use*" Kaplinsky (2001, 4).

Of course, a value chain is not a discrete entity, other actors in any given company's value chain will also have value chains – and the company's products or service will itself become part of the buyer's value chain. These interlinked value chains form what Porter termed value systems (1985, 34) as illustrated in Figure 2 below. Porter's original work on distinguished between those activities which occur within a company and those that occur externally – retaining the term value chain for internal activities and using 'value system' for those external activities. This distinction has mostly been dropped in contemporary understandings of value chain.

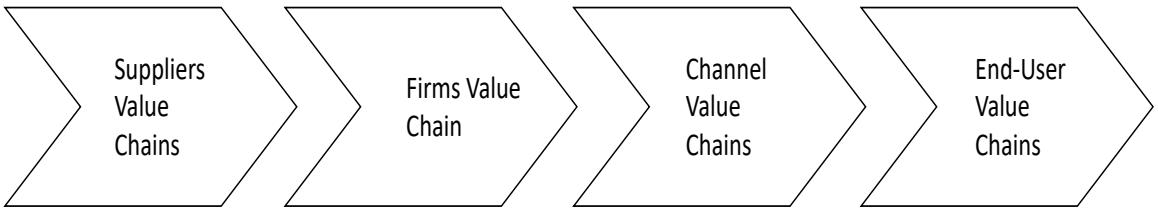


Figure 2: Porter's Value System (Porter 1985, 35)

Value Chain Analysis (VCA) deconstructs the stages followed by a product throughout its lifecycle, from the start of production to the final sale and beyond. The analysis may consider suppliers or distributors of the product also, particularly where these represent linkages of critical significance between the different organisations that form the chain (Rieple & Singh 2010). The concept of the value chain has,

over time, retained its value as a framework for the analysis of the strengths and weaknesses of an organisation (Stabell & Fjeldstad 1998). Its most common application remains as a strategic management tool, used by companies to enhance their competitive advantage, typically through increasing the efficiency of their internal operations, as well as the efficiency of other actors in the industry-wide value chain (Dahlström & Ekins 2006). A fully completed value chain analysis provides for a 'big picture' of a product (Kaplinsky & Morris 2012), enabling the examinations of the linkages between and amongst the product's various activities. It also demonstrates a framework that may be applied to analyse competitiveness in value chains, its inherent nature and determinants (Rich *et al.* 2011). The distribution of value as it relates to participant stakeholders may thus be mapped and explained through VCA (Purnomo *et al.* 2009), which may also be applied to compare various sub-sectors within the chain by examining each link individually (Macfadyen *et al.* 2012).

3.2 Identifying and mapping stakeholders

A stakeholder is generally described as one who has a stake in a project. Several leading definitions exist to describe this concept, including Freeman's broad attempt which classifies stakeholders as individuals or groups who either affect, or are affected by, a project (Freeman 1984; Mitchell *et al.* 1997; Olander 2007). Stakeholder theory further expands on these definitions dividing actors into different groups according to certain attributes, such as their power to impact the project, potential interest in it and legitimacy, as well as the reverse – the project's own power over, interest in, and potential impact on, each actor.

Thus, the concept of the stakeholder has been defined in numerous ways, as "*primary or secondary stakeholders; as owners and non-owners of capital or owners of less tangible assets; as actors or those acted upon; as those existing in a voluntary or an involuntary relationship with the firm; as rights-holders, contractors, or moral claimants; as resource providers to or dependents of the firm; as risktakers or influencers; as legal principals to whom agent managers bear a fiduciary duty*" (Mitchell *et al.* 1997, 853). Three attributes in particular – power of influence, urgency or claim, and legitimacy of relationship – are the defining characteristics of a stakeholder (*Ibid*.). Stakeholders may emerge as directly linked to a project, they may be external to a project, or indeed they may be 'invisible' (Bourne & Walker 2005).

In the literature, the most commonly identified approach for identifying actors associated with the energy efficient buildings sector remains descriptive (Currie *et al.* 2009) and the application of the Hubs of Activity model is another example of this approach. This stakeholder identification process can be understood in a variety of ways, first looking at generic stakeholders and then focusing in on those types of actors relating to the context of the particular study (Mathur *et al.* 2007). Another approach is to use a small number of initial stakeholders to locate different stakeholder classes, typically within a project or company environment (Mitchell *et al.* 1997).

In this vein, a structured and iterative approach was applied to stakeholder identification for this study. Key stakeholder groups of relevance to energy performance certification building assessment were identified through brainstorming workshops in which a number of techniques were used, including:

rapid ideation, round-robin brainstorming and mind mapping. This process was realised informed by the *Hubs of Activity* model for energy efficiency buildings stakeholders (after Dunphy *et al.* 2014, and discussed in Section 3.3) and by the discourse on real estate value chains (discussed in Section 3.3, see *e.g.,* Ricciotti *et al.* 2020). This stakeholder identification process was further enriched through discussions with participants at the local advisory teams (LATs) within the project.

Once the target stakeholder category groups were finalised, prospective participants (from these groups) were contacted and invited to contribute through interviews or surveys. The individuals were initially reached through partner networks, social media outreach and subsequently through so-called snowball sampling, where participants are recruited through previous participants.

3.3 Hubs of activity model

Taking a lifecycle perspective on energy renovations and energy efficient buildings, Dunphy *et al.* (2013) developed the 'Hubs of Activity' model within the UMBRELLA FP7 project[17], which focused on business model innovation for high performance buildings. In realising this task, they worked to identify the stakeholders in an energy efficient building project and to understand their relationships. They found it use to disaggregate the building project into generic stages and distinguish the activities that take place during each stage.

Drawing on a broad-based review of the literature, including approximately twenty different models of the building life cycle, Dunphy *et al.* (2013) identified six stages in the life cycle of a generic building namely:

1. Upstream activities – those that occur before the construction, and which ensure the construction project is provided with the materials, energy, equipment, etc. required to realise the project. The scale of upstream activities associated with any given construction project can be quite significant *e.g.,* raw material extraction, manufacture, transport, *etc*.
2. Initiation & viability check – centred on the project promoter, usually the owner of the building or proposed building. *e.g.,* original proposal, making business case, *etc*.
3. Design & planning – activities associated with the design and planning of the building (or renovation) *e.g.,* designs, building plans, project plans, *etc*.
4. Construction & installation – site works and support activities that realise the building works *e.g., a*ll site activities.
5. Operation & maintenance – phase where occupiers and end-users can have a significant influence on outcomes *e.g.,* use and upkeep.
6. End-of-life including downstream activities – associated with the end-of-life of the building (or part of the building). Often disregarded, they can have a significant contribution to lifecycle performance *e.g.,* deconstruction, reuse, recycling, disposal, *etc*.

[17] UMBRELLA: Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation (FP7 Programme 2012-15, Grant Agreement # 314343). https://cordis.europa.eu/project/id/314343

Although the stages are numbered one to six, this are not intended to be interpreted as strictly sequential, as activities around buildings are not necessarily always linear and chronological. Buildings, over their lifecycle will move both backward and forward through stages and indeed they may go through stages several times *e.g.,* building are designed, built, occupied, sold, then perhaps subsequently redesigned, extended, refurbished, reoccupied and so forth. For any given construction project, life cycle impacts are also highly inter-dependent, as one phase can influence one or more of the others. In Figure 3 shown below, the model is represented in a circular format to illustrate a circular lifecycle thinking approach, where both the buildings, and/or its components can be used, reused, up-cycled many times:

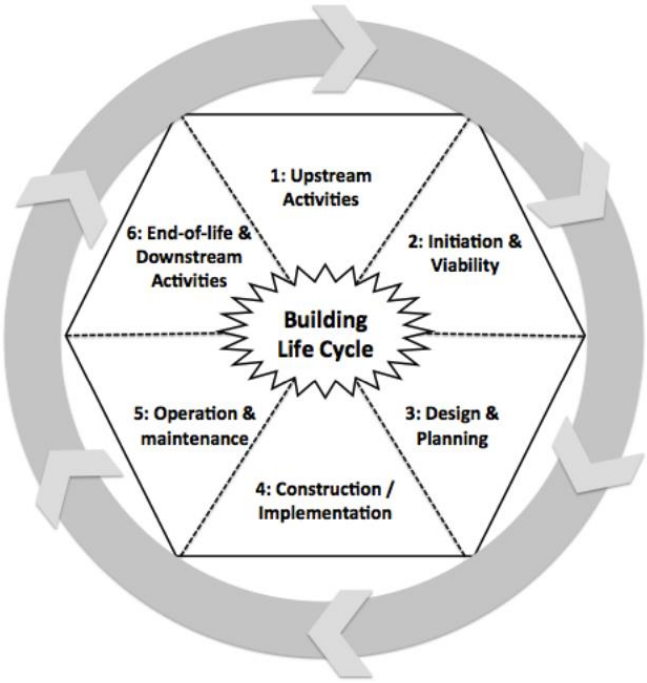


Figure 3: Illustration of the Hubs of Activity model mapping the lifecycle of a construction project (Dunphy et al. 2013, 38)

The construction industry has not been the subject of much investigation by the value chain literature. That which does exist tends to be centred around large construction companies and the emphasis placed on issues like market share and profit generation. The evaluation of the value created across business relationships – such as those characteristics of the construction industry, for example – has been impeded by the lack of systematic investigation into this arena (Walter *et al.* 2001). Furthermore, the construction industry lacks clear producer and consumer roles, with the actual use of a building as a product proving far more complex than that of the typical single-manufactured products, to which value chain analysis is normally applied.

The Value Chain approach has many recognised limitations, including the fact that the exact definition of 'value' remains contested in the literature; value is often framed in terms of profit; the approach frequently proves ineffective at recognising and analysing the linkages between firms and between value chains; alternative business models are not considered as part of the sequential and fixed nature

of the value chain model; and the approach itself remains inappropriate for application to certain businesses, such as those operating in the service industries. Unsurprisingly, should a building be retrofitted, this process may prove problematic for application to the conventional value chain model.

Nevertheless, categorising value creating activities in this manner assists in the identification of stakeholders and provides a framework for the analysis of stakeholder relationships, power flows, drivers, conflicts, and potential synergies. Key to understanding such value configurations is recognition of different measures of success - each stakeholder will have their own ideas of what they want out of a project and of what constitutes success (for them). These differing perceptions of value help shape stakeholder interactions within value chains and across the lifecycle of a project.

3.4 Understanding real estate value chains

Cafferata and Mari (2015) consider that there are three functional segments (comprising collections of actors and activity) involved in the real estate value chain (analogous in many ways to the hubs of activity discussed in Section 3.3).

- The first group of activities and actors are those relating to the planning, developing and financing of a real estate project.
- The second group of activities and actors are those associated with the management of the property during the construction and commissioning stage.
- The third and final group are those activities and actors relevant to the management of the facility including *e.g.,* "*legal services and real estate brokerage, supporting the sale/rental of a building, together with all those maintenance services needed for its proper functioning*" (Ricciotti *et al.* 2020).

Cafferata and Mari's understanding of the real estate value chain is illustrated in Figure 4 below. The main actors across the value chain are indicated in the lightly shaded boxes, namely: investors and financiers in the asset management stage, construction firms in the second stage and real estate brokers, buyers and users in the final stage. Services providers are indicated by the green outline, activities are shown in the blue dashed outlined box.

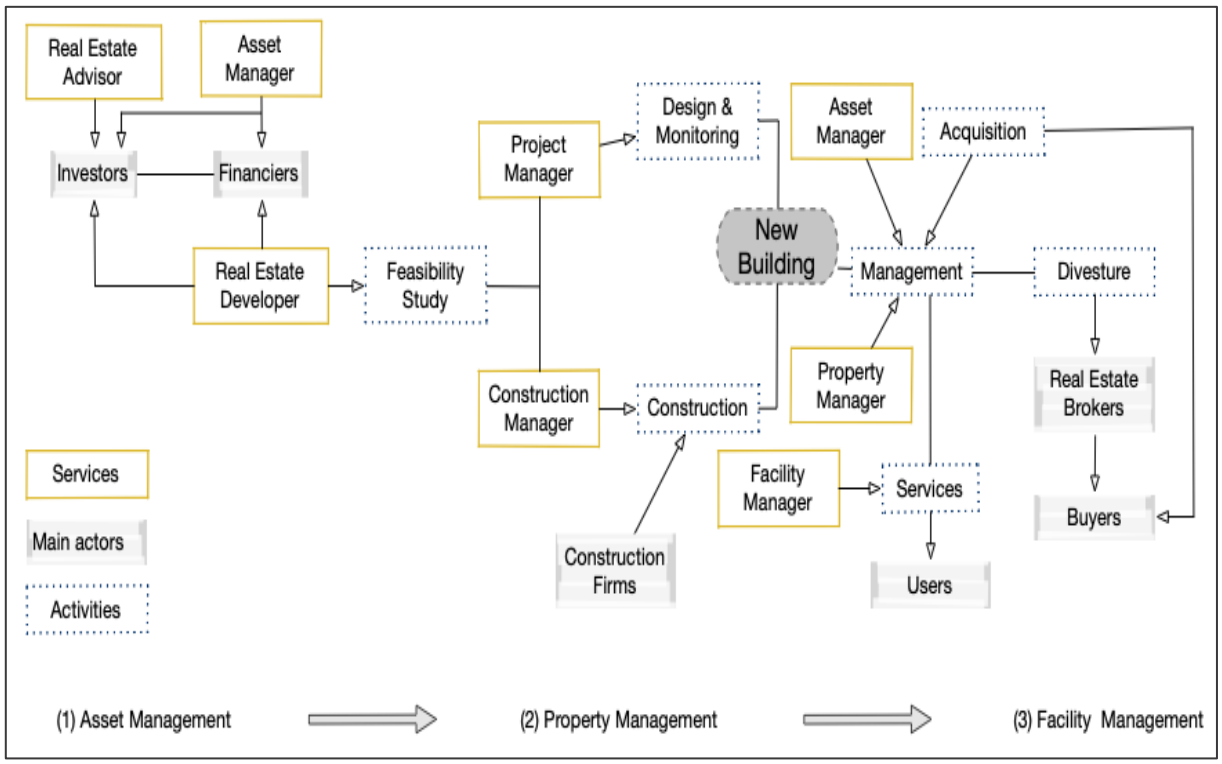


Figure 4: Cafferata and Mari's real estate value chain model (cited in Ricciotti et al. 2020)

An alternative view is forwarded by Denniston and Kim (2008) who divide the real estate value chain into five functional segments, *viz.,* ownership and development; finance and debt; property sales, leasing and management; Construction; and tenant use as shown in Figure 5 below.

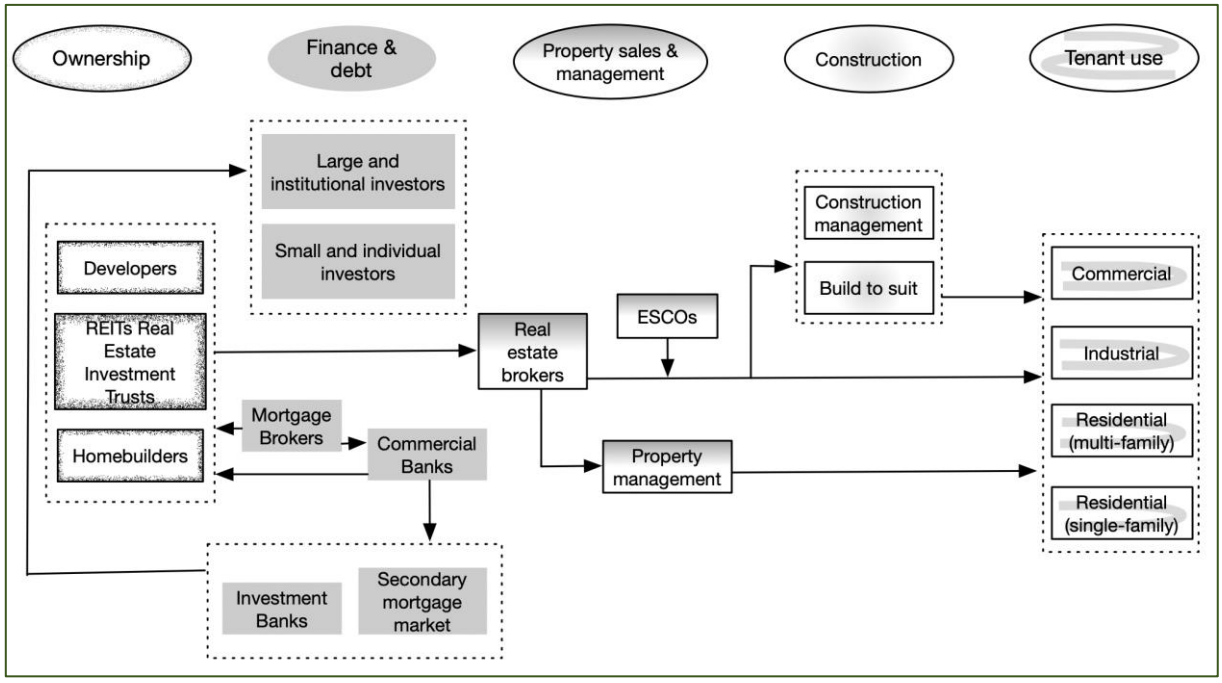


Figure 5: Denniston & Kim's (2008) real estate value chain model of five segments

Figure 6 below presents a summary a number of representations of the real estate value drawn from the literature. In each case the description forwarded is examined and the language used parsed to enable comparison between the models.

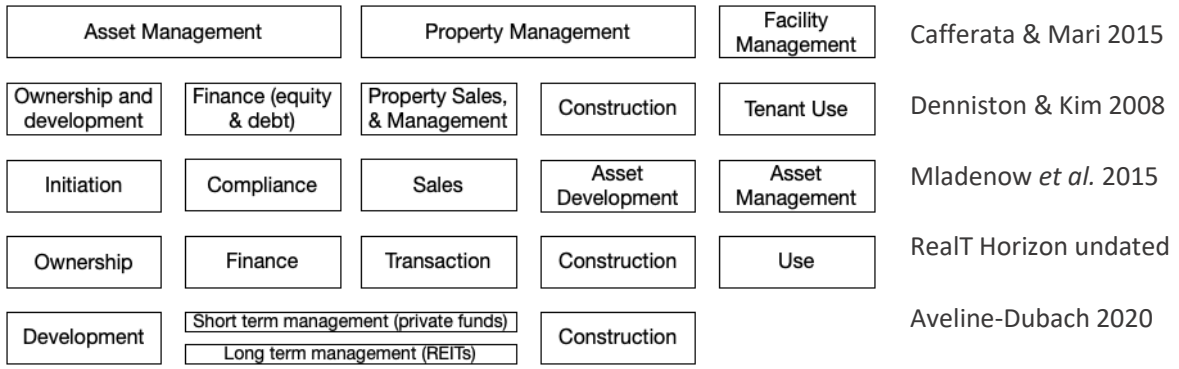


Figure 6: Selected real estate value chain representations

In many respects the real estate value chain can be considered parallel to, and somewhat overlapping with the construction value chain – albeit many value chain analyses of real estate focus on financing, while this is typically not explicitly considered in construction analyses. The selected construction value chain summaries shown as Figure 7 below illustrate the overlap between the two and suggests that they could perhaps be considered explorations of the same phenomenon through different lens.

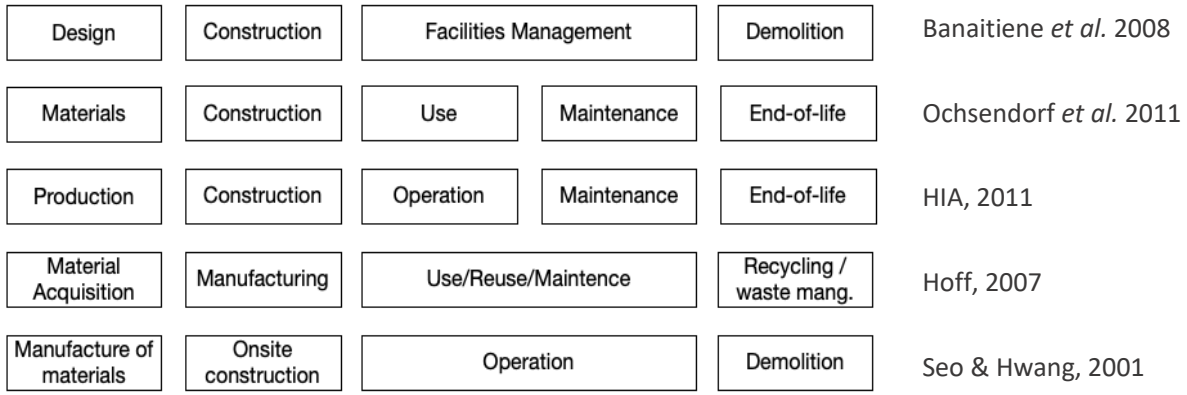


Figure 7: Selected construction value chain representations

Drawing from these analyses and informed by the stakeholder engagement reported in subsequent sections, key stakeholders for energy performance certification and building assessment can be identified for the relevant functional segments as shown in Table 1 below.

Functional segment	**Key stakeholders (for EPC)**	**Other stakeholders**
Asset management	Building Owners Developers	Banks Investors Grant providers Planning authorities
Operation	Owner-occupants and tenants Facility managers	Staff Customers Visitors Sub-letters
Construction (renovation)	Architects Engineers Energy assessors	Building contractors Project manager Building control
Property sales & management	Real estate valuers	Banks Investors

Table 1: Real estate functional segments and stakeholder

4 Survey

4.1 Survey implementation

The questionnaire[18] is probably one of the most common tools for collecting data, particularly social data comprising biographical information, attitudes and perceptions of a given topic. The prevalence of the questionnaire in the social sciences suggests they are rather easy to design and use. However, this is not the case and the degree of training and experience needed to conduct a 'good questionnaire' can be considerable. How a questionnaire is designed, presented to the individual completing it, and the structure and tone of the questions being asked can have a very significant impact on the relative success or failure of the survey work being done. Therefore, considerable effort goes into creating a good questionnaire that "collects the data that answers your research questions and attracts a sufficient response rate" (Rowley, 2014, 308).

Consequently, the development and implementation the questionnaire was designed to complement the in-depth semi-structured interviews that ran in tandem to the survey work. Early in the design process the decision was made to conduct the survey online, rather than in-person, as it would reach citizens across a broader range of countries across Europe and even beyond. After a rigorous and lengthy ethics approval process, consortium members were invited to share the online survey across their social and professional networks. Given the broad spectrum of experience the survey is designed to capture, task leaders also shared it with other H2020 consortia with a view to leveraging knowledge from cognate projects. The questionnaire was made available online from late October 2022 onwards. Once the questionnaire was completed the research team instigated a campaign across various social network platforms including Twitter, LinkedIn, and Facebook, sharing the link to the survey and inviting people to participate. The results from this effort are presented in the next section.

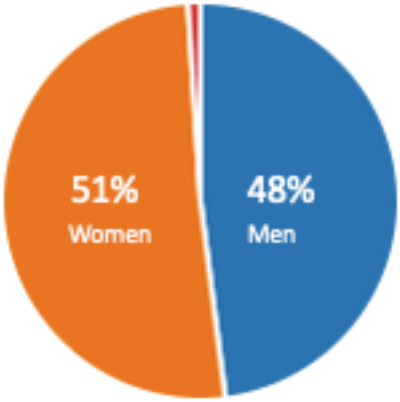
4.2 Survey Results

There were 100 responses to the survey from eight European countries, namely: Austria, Bulgaria, Finland, France, Germany Ireland and Italy.

[18] Please see Appendix 3 of this document to get an appreciation of its structure and the line of questioning taken.

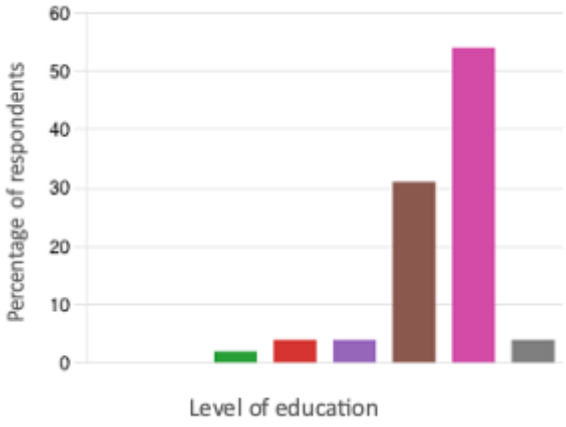
1. Gender: There was an approximately even split between men and women responding to the survey.

Woman	48
Man	51
Non-binary	0
Prefer not to say	1



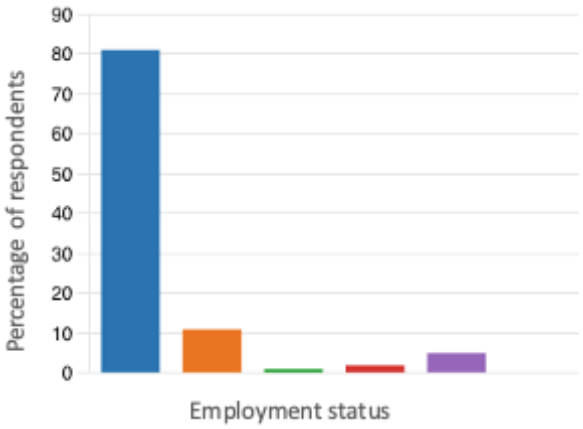
2. Education: Respondents were educated, with over half having had postgraduate education and an additional 31% with tertiary education. This bias towards an education is expected given the topic of the survey.

Less than primary	0
Primary	0
Lower secondary	2
Upper secondary	4
Post-secondary, non-tertiary	4
Tertiary	31
Post-graduate	54
Other	4



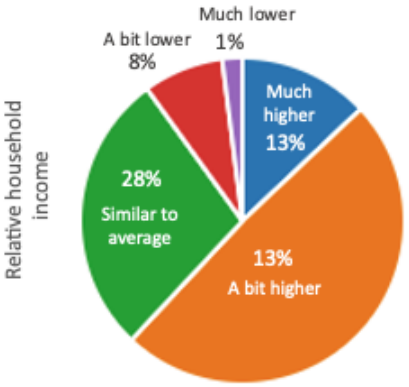
3. Employment status: Some 92% of respondent were employed, 5% retired, 1% in unpaid work, and the remaining 2% seeking employment.

Paid employed	81
Self employed	11
Unpaid work	1
Seeking employment	2
Retired/pensioned	5
Illness / disability	0



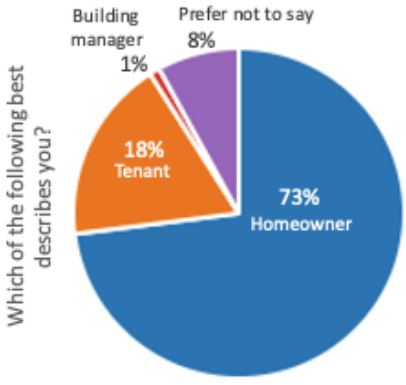
4. Relative household income: the income level of respondents was mostly higher than average for their country. Just one in ten of those competing the survey said their income was less than average, while almost half estimated they were a bit higher, and 13% said their income was much higher. This is in keeping with the professional profile of the respondents.

Much higher	13
A bit higher	49
Similar to the average	28
A bit lower	8
Much lower	2

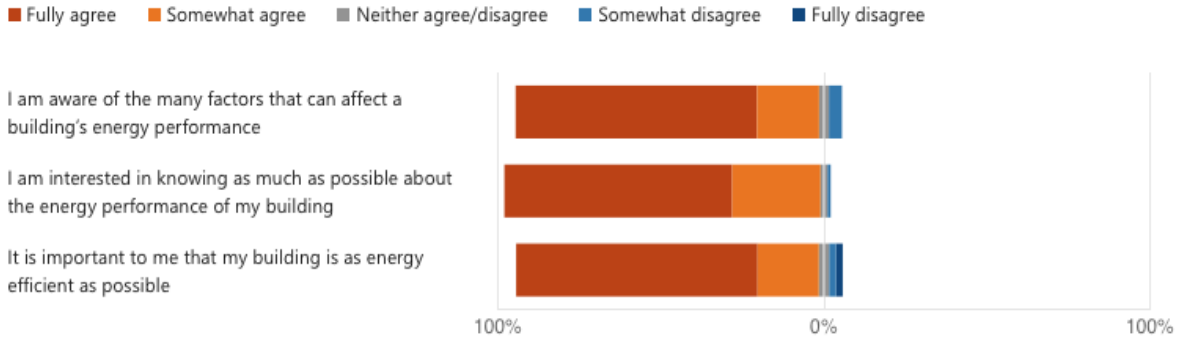


5. Role self-identification: The responses to this question are quite interesting. Although we know from context that many of those completing the survey are involved in some way in real estate, yet they self-identified in relation to their home ownership status rather than their professional role.

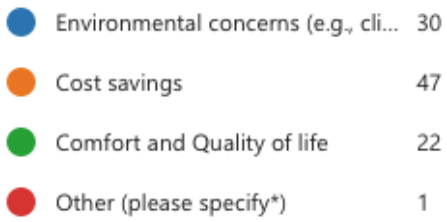
Homeowner	73
Tenant	18
Real estate investor	0
District/Building manager	1
Prefer not to say	8

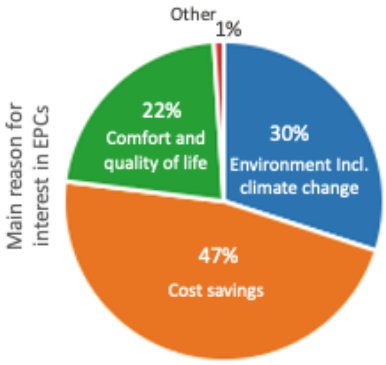


6. Awareness of energy performance: most respondents agreed that it was important for buildings to be energy efficient. They claimed awareness of the factors that impact a building's energy performance, and said they were interested in knowing more. These are quite positive results. However, there may be response bias with perhaps some giving the answer they felt was expected.

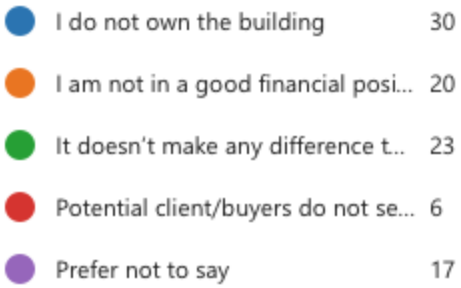


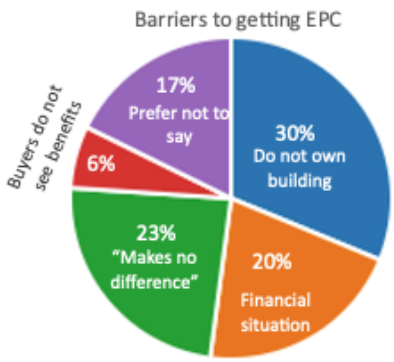
7. Interest in building energy: just under half of respondents said their interest in building energy arose from cost considerations, one-fifth cited comfort and quality of life issues. Interestingly, a full 30% of those completing the survey claimed that environmental concerns (including climate change) were to the fore of their mind in thinking about household energy. While some of this may be response bias, the high proportions of non-cost reasons are reflective of relative economic privilege of respondents.



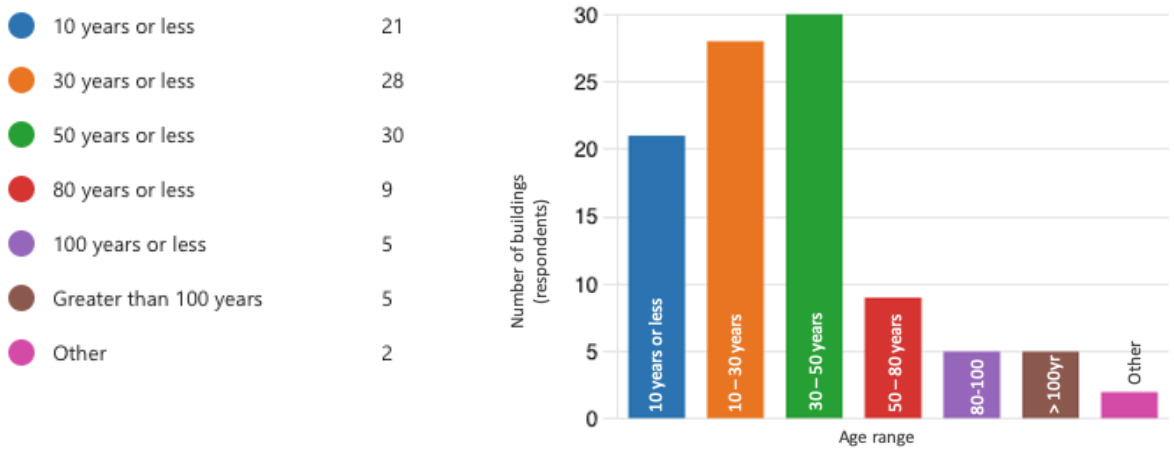


8. Barriers to getting an EPC: there was a good spread of perceived barriers to the respondents get energy performance certification. 30% did not own the building and so it was not something for them. One in five respondents said that their financial situation did not permit it. Almost a quarter stated that having an EPC doesn't make any difference to them, indicating that they didn't see the benefits. Finally, 17% preferred not to provide an answer – indicating perhaps some ambivalence to EPCs.

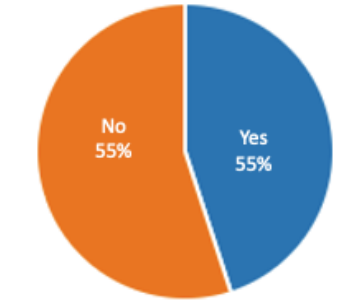




9. Building age: almost 80% of respondents' buildings were over 10 years' old, with half over 30 years.

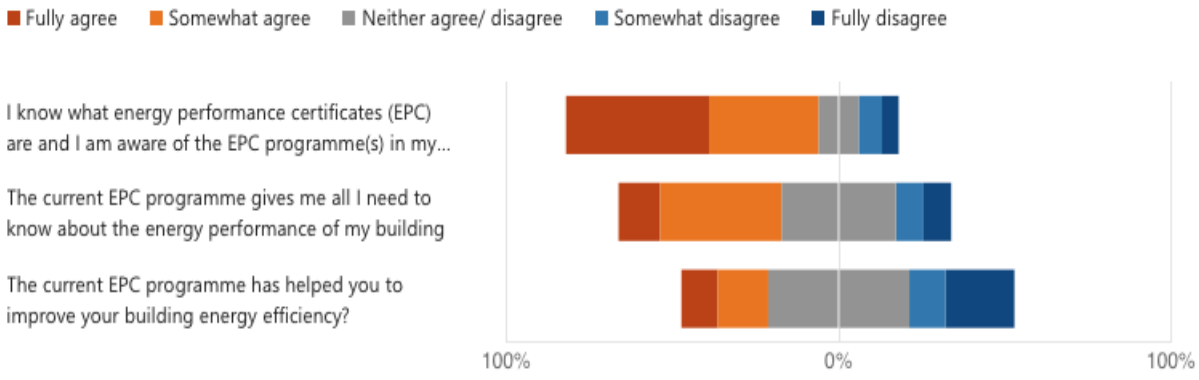


10. Refurbishment need: Some 45% of respondents reported that their buildings needed energy renovation.

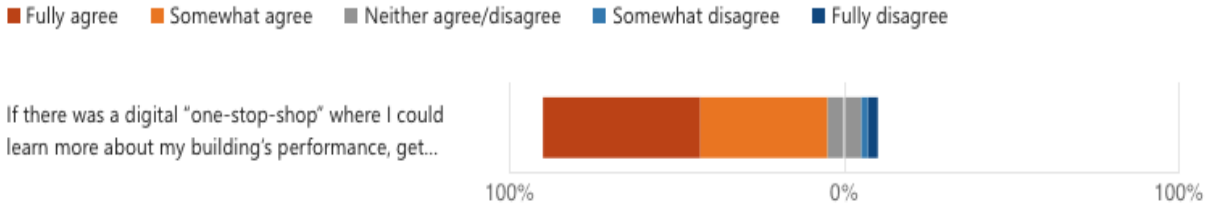


Does your building need a lot refurbishment / renovation to improve its energy efficiency?

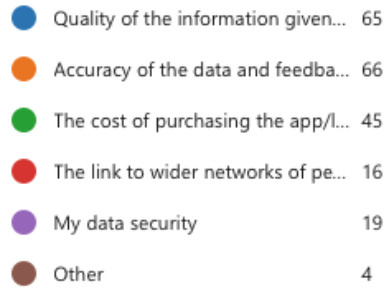
11. Energy performance certificates: there was reasonably good awareness of EPCs, over three-quarters of respondents agreed (fully or somewhat) that they knew what they were and that they were familiar with EPC programmes in their country/region. Yet – less than half were satisfied that the current EPC programmes give them all the information they need about the energy performance of their building, and only one-quarter said that the current EPC programme helped them to improve their building's energy efficiency.



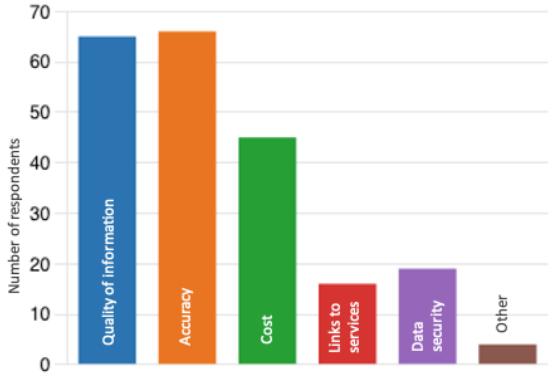
12. Digital 'one stop shop': there was quite a degree of interest shown in the idea of a digital one stop shop for building energy performance. Nearly half of respondents agreed that they would use it, while a further almost 40% agrees partially indicating at least an openness to the idea.



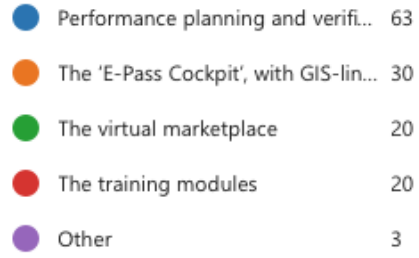
13. Main consideration for online platform: respondents were most concerned with data quality with almost two-thirds stating that the quality of the information given, and the accuracy of the data and feedback provided to clients are keys considerations for the platform. Cost always emerged as an issue of note with 45% saying that the cost of the platform would be a consideration.



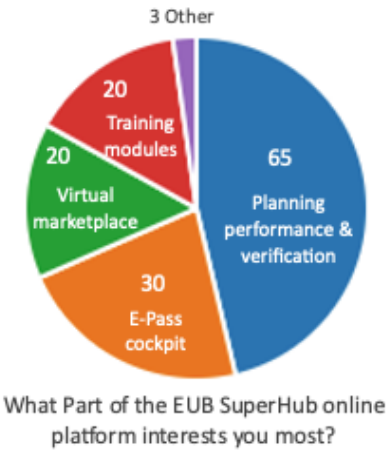
Note: multiple answers were possible.



14. EUB SuperHub Platform components: When ask which element of the platform would be of particular interest, six out of ten respondents selected the *Performance Planning and Verification*, with 30% interested in the *E-Pass Cockpit with GIS-linked EPCs database.* One-fifth of respondents expressed interest in each of the *Virtual marketplace* and the *Training modules.*



Note: multiple answers were possible.



What Part of the EUB SuperHub online platform interests you most?

5 Interviews

5.1 Interview planning and implementation

Building on the characterisation of the key stakeholder groups in Section 3.2, prospective interviewees were identified. A landscape exercise was undertaken by University College Cork to provide a familiarity with actors filling the identified roles in the countries of interest. Building on this and using partners' networks and contacts from the project local advisory teams (LATs), an initial long list of prospective interviewees was prepared. Over time, this list was reviewed, and a short list containing the most relevant prospects was developed. Prospective interviewees were contacted informed about the study and invited to participate.

Those who expressed interest in the study were provided with a participant briefing sheet (see Appendix 1) and asked to give their informed consent (see Appendix 2). The participants were interviewed over TEAM video conferencing based on a semi-structured interview schedule (see Appendix 4). Each of the interviews were recorded, transcribed, and subsequently analysed and interpreted through thematic analysis.

There was a total of 21 interviews conducted with informants associated with the real estate value chain. Participants were from six countries namely France, Ireland, North Macedonia, Romania, Portugal, and the UK – offering a good diversity of experience. They came from across the values chain giving voice to the opinions of key stakeholder groups such as: architects, building owners, building users, energy auditors, energy managers, engineers, and real estate professionals. The following section provides key insights emerging from this engagement process.

5.2 Insights from Interviews

5.2.1 Building Users

Respondents' views and opinions of the EPC system in were generally neutral or negative in that they felt the system either didn't affect them very much or they lacked the luxury of engaging with the system due to the current rental market. Most participants described how they were barely aware of the system as it is so poorly advertised, despite understanding that it is an important aspect of a property:

> "*It's never had a particularly positive impact on me. I think the fact that... I'll put it this way.* ***I can't tell you the [EPC] rating of a single house I've ever lived in***." [ESH09]

> "*Yeah, it should be something which is available to all renters as they're viewing an apartment and it should be something which is better advertised, as I know on [accommodation website] it's not a requirement for a lot of adverts that I've seen…Umm, it's a lot of people just unaware of it. It's, it's out there, but* ***unless you own property yourself, you would not be very knowledgeable on the [EPC] system****…it's kind of an afterthought. Like people look at a house*

for the number of rooms, but they don't really consider how much it might cost them monthly in extra expenditure." [ESH02]

Most building users generally had a sound understanding of what the EPC rating of a house was and how this applied to their circumstances:

"*Well, it gives me an indication of how much I can be expecting to pay in bills each month and to sustain a comfortable living condition and it also it highlights building quality as well…**anywhere below that kind of B, C grade I would not consider them at all**. Just because even if the rent was lower, I would still lose it on maintaining the heat and that kind of stuff…*" [ESH02]

While the EPC rating of a house was clearly considered an important aspect of any property for participants, most felt that other factors – such as the "price" and "location" – were of greater importance, as "*given the situation at the moment just finding a house is…*" [ESH07] already an extremely challenging task. This platform was therefore considered **more suitable for "*the buyer's market*" than a rental market** where people are so "*squeezed by the lack of supply*" [ESH07]. The housing crisis in Ireland, and the effect this has on renter's ability to find a house with a good EPC rating was sombrely conveyed throughout the interviews with various building users and painfully revealed by the following interaction:

"…if I ever had the choice between two houses, I would have a preference towards the better [EPC] rating, but it's never really factored in because of the rental conditions" [ESH09]

"***Have you ever had the choice between two houses**?*" [Interviewer]

[Laughs] "*In 2013, yes*" [ESH09]

The suggestion was made by one renter to possibly link the EPC rating with the renting price of a property through a tax incentive or some other means, "*because if you have a lower [EPC] rating then you're gonna spend more on heating…it feels like that would be a useful way of like leveraging [EPC] like to provide more incentives for people to improve general [EPC] ratings*" [ESH07]. The difference in power between landlords and tenants was acutely evident throughout the interview process. Respondents described how landlords would take advantage of many aspects of the EPC system, claiming that a property had a certain EPC rating which tenants couldn't prove despite being in strong disagreement on the matter. They also expressed confusion as to how the system works exactly, "*whether it's actual physical measurements or whether it's based on self-assessment of a, of the building materials*" [ESH07], and how a property may receive a certain rating that doesn't accurately reflect the living conditions within the property:

"*So like currently my place…**on paper it has very positive [EPC] rating, but then this winter…it was very cold due to fittings that would usually be well insulating not being fully airtight just because of the way they're installed**. Umm so that did...That might not have impacted the [EPC] rating, but it would impact how the house maintains heat and the energy I would need to put into maintain a comfortable living condition*." [ESH02]

It was communicated by other respondents that tenants sometimes fear asking anything of their landlord with regard to trying to improve living conditions, as this may result in negative consequences for the tenants themselves:

> "*We did upgrade the oven in one accommodation that I was in because it was very inefficient and very poor. So, we asked the landlady to do it…and she would only agree to do it if we paid for half. So, we paid for half and after we gave her the receipt, she then bumped - literally in the same conversation as us handing over the receipt to her - she then bumped up the rent. But because of the tax benefits of upgrading appliances and things in your rental accommodation as a landlord, they actually then made profit off both the increase in rent and us upgrading the oven*." [ESH09]

Building users typically felt confident that if they chose to make changes to the property, they could carry them out themselves, however participants' responses also conveyed a sense that they either *couldn't* or *shouldn't* directly address issues with the property, because they don't own it:

> "*I think I would feel confident doing small things by myself, but generally I guess we would view it as the landlord's responsibility to. yeah, to to address those issues in the house*" [ESH07]

> "*Umm there are a few things which I have gone to the landlord and landlady about…there would be a few things that I would like to do, but I do not have the ability to do it as it is not my property*" [ESH02]

Participants certainly saw the platform as "*a useful source of information…but as somebody who rents a house and who's probably not gonna repair it…*" [ESH06] the platform lost its appeal and applicability compared to how it might apply to a landlord or someone living in a house long-term:

> "*Like to be honest as a tenant...like for someone just renting, like maybe not. So not...as useful as like the landlord, or like someone that was living in there full time…it certainly is useful and looks really cool, but…for myself, just if I was just renting in somewhere...and I knew it was, I wasn't gonna be there…forever, like I wouldn't really be so concerned about, like, increasing the energy efficiency of the place, but like for like landlords and people living in somewhere full time like 100%. It looks really cool*." [ESH11]

Almost 100% of building users felt that the platform wouldn't be useful for them personally unless they were entering the buyer's market, although most thought the platform looked well, with respondents highlighting certain aspects of it – like the virtual marketplace and planning and verification tool (PVT) – as being particularly interesting. They expressed surprise that something like the Digital Building Logbook "*doesn't exist already*" because "*like…with a car…it's good to know what…changes have been done on it*" [ESH07]. Respondents conveyed a level of scepticism as to how applicable the platform would be for the rental market as things currently stand, noting that "*something like that* ***is only as good as the data in it****. As a renter, I don't really have the ability to contribute to it…and I just don't see what incentive is there for a landlord to put that information in…particularly if it's a poorly rated house*" [ESH09]. This raised the question of whether the platform

could offer "*'renter-friendly' improvements…for people who are renting, whose landlord doesn't particularly get involved in all that*" [ESH02] to improve the quality of their living conditions using temporary, small energy-saving measures. Despite the general feeling that the platform may not prove useful for renters who are not "*in control or…in a position to…leverage or to encourage the building owner to make improvements energy-wise*" [ESH07], having the information was considered to be of some potential use as a means of communicating with a landlord on making a case for improvements to the property. Generally, however, the utility of the EUB SuperHub platform for renters within the current rental market was effectively summarized by one respondent:

> "*So, if at some point in the future there was, say, redundant housing stock sitting there that would incentivise landlords to actually need to market more, and it was more available to me as a renter, then I could really see the value in being able to compare and contrast between two properties or two locations. Whereas* ***right now it's an option between a house that's available or homelessness****. And I mean, no matter how bad your rating is, it's better than a cardboard box*." [ESH09]

5.2.2 Building Owners/Occupiers

One Irish landlord explained that during the period where he was looking for a house to purchase, he discovered that "*most of the properties that we were looking at had a lower energy rating…we had initially been like "Oh like let's look for a place with a better rating" but most of the ones that we were looking at were kind of similar. So, it just became less relevant*." [ESH05]. The EPC rating of the house – and any potential work required of the landlord to raise the rating – became less of a factor in the purchasing decision when all properties appeared equally bad.

The landlord expressed how useful the E-Cockpit may have proved to him when he was initially looking to purchase a property, as a means of establishing the energy efficiency of a building.

…that if it was known to landlords or potential homeowners the difference in cost per year between purchasing an A-rated house and a C-rated house, then maybe the EPC rating would have a greater part to play in influencing purchasing patterns.

He voiced his support for the Digital Building Logbook as a means of tracking changes to a property and supporting purchasing decisions, citing his own experience of having to simply trust the person selling the property that they were being truthful about what had or had not been done to the building:

> "*When we were buying the house…he was like "Oh we put in insulation over here a few years ago" …there's no way for us to verify that unless we…tear down the really well … interior wall that he has,* ***unless we take a section of it apart, we can't verify that****. Umm and like we were just not gonna do that cause then you'd have to put in a whole load of money to fix it up*" [ESH05]

The logging of any changes to a property adds a layer of authenticity to what the seller is stating occurred, which is helpful from both the perspective of the buyer and that of the seller:

> "*…as someone like owning the house like ultimately, you know, we're gonna probably sell it at some point and like we're probably gonna wanna be able to say we did X, Y and Z during you know 2025 and 2030 or whatever, so…it probably sounds useful…to kinda log that*." [ESH05]

Interestingly, the sentiments observed by building users above about needing an incentive to encourage landlords to engage with the platform were also echoed by landlords themselves:

> "*…this looks really good from, you know, the person using it to buy the house, but once you have the house it might be like...you know, what's in it for me?*" [ESH05]

The planning and verification tool (PVT) greatly appealed to the landlords as a means of getting an idea of how much upgrades to the property might cost, or what potential changes could be made in the first place:

> "*…we're gonna have to upgrade our roof at some point and…making that decision like ultimately you're spending money and you wanna know like what is gonna be the benefit from it, so* ***I think the kind of planning tool sounds like super useful****…because like I don't really wanna spend money unless like I see what the benefit is to me or until I have to do it because the roof is falling apart*" [ESH05]

Similarly, the virtual marketplace was considered to be "*intuitive*" and "*a natural follow-on*" [ESH05] from the PVT, though it was emphasized that a large number of people would need to be advertised on it, as opposed to "*just one or two*" [ESH05] solution providers.

5.2.3 Professionals

The definition and understanding building professionals had of the [EPC] system was, unsurprisingly, more comprehensive than that of building users and owners:

> "*It provides an indication of how much energy a particular building is, is expected to use. It's, it's done in a…in a format that is able to differentiate between the different types of buildings and sizes and so forth, and digested down into a, a simplified format that you can present it in a, a kind of a label format for, for the general public they can begin to understand*." [ESH03]

Those interviewed included a number of architects, real estate valuers and professionals involved in the energy auditing and efficiency sectors. The opinions gathered of the BER system, and the angle of the responses to questions, varied widely depending on the profession of the interviewee. One architect and [EPC] assessor from Ireland expressed a level of scrutiny of the system, citing the "*considerable amount of changes and updates to the system from day one, including numerous revisions to practices and procedures and so forth…which suggests that the original format wasn't fully thought out…perhaps by virtue of the fact that it has had to be revised so much…which just draws a question mark as to the original design of the system*" [ESH03]. They described the [EPC] assessment process as "*extremely forensic*" [ESH03], with the result sometimes being that "*a minor error or amendment or change to a small part can have a really big implication*" [ESH03] for the overall [EPC] rating. This view of the national EPC assessment process as "*much too complicated*" and employing

software that is not as "*user-friendly*" as it could be [ESH12] was echoed by energy auditors and technical advisors from eastern Europe (Bulgaria and North Macedonia). Furthermore, it was also outlined the bizarre and complex phenomenon of factors outside the control of the building itself or its owner affecting the [EPC] rating of a property:

> "*…the building energy process and assessment, both for the commercial and domestic, has a number of areas that rely on factors outside the control of the, the let's say the building itself or the owner themselves. So, for example, in a domestic situation in a semidetached house, the building next door is deemed to have the exact same energy use, which is understandable. But yet, if, if next door changes to an office or whatever then that invalidates that person's* [BER rating] *...Similarly in a commercial unit, where the implication's even greater, you have a complex process of not simply the building next door, but perhaps even the rooms of the building and next door…you could have…a large building which has a series of offices or shops or whatever and you could have a, for example, a two story office located in a, in a building and which is sitting adjacent perhaps to offices or shops below, and other buildings next door…And if any one of, of those buildings to which it is adjacent to - be it above, below, behind or whatever - if their function changes or their heating timescale or whatever then that person's BER or EPC or whatever, is is is deemed to be no longer valid. And especially in commercial premises it seems to be…an extreme disadvantage because it it's placing an enormous emphasis on, on activities which the building owner themselves has no, no control…commercial buildings are changing all the time and they move very rapidly, so developers and the owners might have an office building one month and…they'll decide to switch it to a restaurant or a shop or they decide to change it into domestic apartments or whatever, and each time that that is done, everything adjacent…the assessment of those, are deemed no longer to be valid*." [ESH03]

This statement highlighted a greater need for "*a little bit of flexibility*" [ESH03] to the [EPC] assessment process, perhaps expressing the final result more as a range of energy performance rather than a single, concrete estimate. The real estate valuers from Ireland that were interviewed also outlined the importance of the [EPC] system to their profession, particularly from both "*the renting and sales point of view*" [ESH04]. The potential future effects to property valuation brought about by the introduction of minimum standards within the [EPC] system was a point of emphasis for valuers, who described a process whereby "*valuers will actually have to come up with a figure and say, well, if this house stays as it is, this amount of money is going to have to be spent on it in 2033 to bring it up to the standard before such time as it can be rented or sold*." [ESH04]. They considered the system to be structured, though not necessarily structured in the best way possible, due to the lack of enforcement of the system when it comes to the real estate market:

> "*…at the end of the day, you're supposed to have a* [EPC] *certificate before you rent a property, and you're supposed to have a* [EPC] *certificate before you sell a property…Does that happen all the time? It does or it doesn't. I'm not 100% sure whether it does or it doesn't, but probably*

when the sale closes or when the sale property rents, there is one at that particular stage, but it's supposed to be there in the beginning." [ESH04]

This mention of lack of enforcement of the process was backed-up by sentiments conveyed by interviewees from North Macedonia and Portugal, who communicated the need for more regulation of the system and assessment process, as well as the difficulties sometimes encountered by professionals trying to enforce the building laws aiming to ensure sustainability standards. Real estate valuers echoed the sentiments of architects, describing the Irish BER system in its early days as "*higgledy-piggledy*", though this has mostly disappeared from the system over time and the system has become more straightforward in nature. One interesting aspect pointed out by a real estate valuer was that Energy Performance Certificates (EPCs) are not considered to be as important in Ireland as in the rest of Europe due mainly to issues around supply and demand of properties:

"*So, if there's plenty of supply, you're probably in a situation that you can pick and choose between A, B and C ratings, etcetera. But when there isn't a lot of supply, you buy the property if you like the property, and if it's an E, F or a G or something like that well then you just get on with it, but and even* ***if you're renting it and it's it's more than a a D, for instance, you still get on with it because most people are pretty happy to get the property***." [ESH04]

This echoed that statements made by both building users and owners on how the lack of supply influences how they engage with the BER system and its level of importance to them. Even from the perspective of professionals, an EPC was considered to be "*an administrative process, something you do to buy or rent a house. So, there is no true acknowledgement of the benefits of having an EPC, and of the positive impact it can have for us as a society*" [ESH19]. Changes made to a property once it has been bought were frequently about increasing comfort levels, this real estate valuer explained, whereas upgrading one's property rarely seemed to make sense from a financial perspective. As a people who predominantly grew up in the countryside, the Irish appear to "*feel that a bit of a draft and a bit of fresh air is never any harm*" [ESH04] and more modern houses with high BER ratings were less appealing to older generations than one might expect. Based on his experience working in Hungary and other European countries, he believes that EPCs are generally more important to countries with large differences in weather throughout the year, where winter temperatures are very low and summer temperatures high. The narrow temperature range in Ireland means that, from a comfort perspective at least, upping the EPC rating of one's home has not been a common priority of many citizens, though the increase in utility bills in the past year is likely to affect this some bit:

"*…certainly up to the moment when utility bills weren't probably that high, it didn't probably make an awful lot of difference if it's an extra couple hundred euros a year to heat your house, a lot of people didn't pass any remarks...But now obviously that extra couple hundred could have turned into €1000 very quickly, so it obviously will make a difference now, but* ***it's still not going to make that much of a difference because of the supply and demand situation***." [ESH04]

On the other hand, it was pointed out by one Portuguese architect that just because a country seems to consume less energy due to their specific climate, doesn't necessarily mean that they *need* less energy, or that the topic of energy efficiency and sustainability is less important to them. Sometimes the underlying issue may be masked:

> *"…when you think about the energy consumption of a Portuguese household, probably someone from the North of Europe they say "Oh, you are very energy efficient because you don't consume as much", but this is the problem of energy poverty, so* ***we don't consume. It's not because we are comfortable with the temperature of our houses, it's because the energy prices are so high that we just don't use the heating equipment****."* [ESH19]

Professionals' opinions of the EUB SuperHub platform varied, though the vast majority communicated that the platform showed great potential. One interviewee from North Macedonia was so taken with the platform that they asked if it would be possible to trial it in buildings they own. Similarly, an energy auditor from Bulgaria considered the Digital Building Logbook to be extremely useful for his home country where "*most of the buildings…do not have any documentation*" and where having information that is "*so easily accessible*" would be of great importance [ESH12]. Architects emphasised the need for any information supplied to the DBL to be verified and expressed enthusiasm for the help drones may offer this aspect of the platform in the future, likely being able to accurately scan a lot of the external and internal spatial data for existing buildings to verify what remains unknown, and recording any changes made to the property. The challenge, in their opinion, lies in verifying the data of "*what's behind the wall? What's behind the floor?*" [ESH03] and enticing people to offer up that information to the platform so that existing buildings – not just new builds – may be brought along as well through the platform. Similarly, real estate valuers expressed some scepticism as to the amount of information that the platform appears to require, especially given the fact that the likelihood of getting people to input that information are "*none and nil…unless there's a financial reward for to put in the information*" [ESH04]. The technical elements of the platform, it was also pointed out, may prove to be a challenge for those users that are not familiar or comfortable with technology:

> "*…a lot of Irish people aren't tech-minded or tech-orientated or want to have anything to do with tech. Like I know we hear all the banks saying "Everybody wants to go online to do X, Y or Z" but when you have no choice only to go online you have to go online. So, like, you know, it's easy to say everybody wants to go online when you close somebody's branch. Well, what do you do? So, you have to go online*." [ESH04]

Other aspects which could make engagement with the platform more of a challenge may be country specific. One interviewee described how, despite the clear usefulness of the EUB SuperHub platform, it would take time before Bulgarian people would "*be ready to use such a tool*" [ESH12]. Similarly, Irish people's lack of trust may prove tricky for the platform promotors to navigate, according to one interviewee:

> "*…Irish people by nature are suspicious, so you put in information about your property and, lo and behold, the next thing is the Revenue have it and somebody else has it and somebody else*

> *has it and your property tax goes up and your something else happens and you know…not even that people might have anything to hide, but* ***you don't know that you've anything to hide or not until you tell people, and then you know very quickly*** *if you have anything to hide…I think a lot of people won't actually trust it being out there*." [ESH04]

The 3D visual representation of certain aspects of the platform was considered by architects to be interesting and useful, especially for those looking to purchase a property or make changes to a building and who lacked full awareness of where exactly energy was being lost or changes could be made – the PVT was regarded as extremely beneficial in this regard. In terms of the platform's usefulness to a property valuer or real estate agent, it was not considered to be particularly useful for real estate valuers, not contributing anything novel to the profession, though may offer some benefits for real estate agents if the Digital Building Logbook can offer a comprehensive history of the property. The marketability and competitiveness of the platform was brought into question by Portuguese architects who pointed out the existence of these sorts of applications already in existence:

> "*How will this platform merge with other similar tools or compete with them, like one-stop-shops and logbooks that are already implemented in some countries? We are talking about Portugal, but we know they're already implemented in other countries, like for instance Denmark*." [ESH19]

6 Conclusions and recommendations

6.1 Conclusion

Using the Hubs of Activity model[19], a clear distinction could be made between the key stakeholders to whom the EUB SuperHub platform may apply. Key stakeholders were identified as either professionals – *i.e.*, those involved in building energy efficiency in some capacity *e.g.*, architects, engineers, energy assessors, real estate practitioners, *etc*. – and non-professionals, or those who do not operate within this arena as part of their work. The platform, which is being designed to facilitate inputs from architects, engineers, energy assessors, and software developers, can understandably be seen as somewhat biased towards the expertise of professionals working in the various technical domains of building energy efficiency. Therefore, the identification of these key stakeholders proved an obvious outcome when applying the Hubs of Activity model. The second category of key stakeholders identified included those non-professionals who may lack the skills necessary to fully engage with the platform in the same manner as those for whom building energy efficiency is their area of expertise. These non-professionals, or 'everyone else', were further categorised based upon the level of power or influence they held within the real estate market, or the ease with which they may be able to influence changes to the structure of a building. This led to the distinction between building owners/occupiers and building users, who typically comprised landlords/homeowners and tenants, respectively.

[19] And informed by the treatment of real estate value chains in the literature.

Building users invariably lacked the same level of power as building owners/occupiers, which led to differences in how each type of non-professional stakeholder could be expected to engage with the EUB SuperHub platform. The results from the interviews showed that professionals generally viewed the platform in a positive light and mainly expressed concerns related to technical aspects or data collection challenges; on the other hand, while most building owners and users considered the platform to be very interesting, they also believed it to be somewhat inapplicable for them. Interviews thus highlighted several important challenges the platform will face in terms of its application and usability. While all projects face technical and data collection challenges to some degree, those posed to the EUB SuperHub platform are at the mercy of volatile power dynamics at play within the real estate market, which in Ireland, in particular, is strongly apparent. This observation was not surprising: the "*landlord-tenant problem*" has been well-documented in Ireland (*e.g.*, see O'Toole 2023; Palmer & Walls 2017; Petrov & Ryan 2021), contributing towards the continued underinvestment in energy efficiency by landlords. Contractual agreements typically designate the tenant as the party responsible for utility bills, meaning landlords will not benefit from investments in energy efficiency measures in the form of reduced utility bills, leaving little incentive as to why they should. This is commonly referred to as the "*efficiency problem*" (Petrov & Ryan 2021). The statements made by building users are supported by research undertaken by Petrov & Ryan (2021) highlighting the interplay between the landlord-tenant problem and the current rental market in Ireland. Based on their findings the researchers strongly suggested that within a congested rental market – as is the current case in Ireland – the energy efficiency of a property appears less important to tenants when compared to other features (such as location), and leaves an opportunity for landlords to extract higher rents for less energy efficient properties than would otherwise be possible in a non-congested rental market where they are forced to compete on other rental property attributes, like energy efficiency.

Professionals interviewed communicated on the difficulties of enticing citizens to input the information into the platform in the first place. This concern echoed with statements made by building owners who asked what was in it for them to input this information or indeed engage with the platform at all. The clearest communication of this challenge came through the interviews with building users, typically comprising renters, who expressed real interest in the platform though they felt that it remained unavailable to them given their lack of power to influence or change their living conditions due to the current state of the real estate market. Consequently, while the EUB SuperHub platform may appear '*available*' and open to use by all types of key stakeholders, its true value to all potential stakeholders remains opaque from some, particularly building users. This sentiment occurs despite a clear desire on their part to use it. Also, for some building owners the platform was unenticing, as they could not identify a reason as to why they should make use of it. As is witnessed by Petrov & Ryan (2021), even within a real estate market where disclosure and advertising of energy performance certificates is mandatory the landlord-tenant problem is still evident, suggesting that the problem lies not with the EPCs themselves, but with the market within which they are being used. There is potential for a similar scenario to develop with the EUB SuperHub platform.

The issues identified here with the real estate market are likely to have significant implications for any low-carbon technology or energy efficiency measures trialled and adopted in future. Within a congested market, where landlords are not incentivised and less likely to invest in energy efficiency measures, the effectiveness of future policies addressing energy efficiency challenges may be grossly undermined. Similarly, it is important to note that renters will typically belong to lower-income groups who may suffer disproportionately as a result of future policies. A potential additional utilisation of the EUB SuperHub platform by stakeholders in this cohort could be as a tool for quantifying the extent of challenges they face in the rental property they reside in and to identify the means for which these challenges might be met.

6.2 Recommendations

Based on the findings from our survey and in-depth interviews with building stakeholders, which included real estate valuers, homeowners, tenants, real estate investors, district/building managers, and commercial property owners) we make the following recommendations:

1. Emphasise the contribution that the EUB Superhub platform can make to **improving energy efficiency and overall performance**. Over 92% of participants agreed that these factors were important to them and that it was important to them to have their building as energy efficient as possible.
2. Highlight the positive contribution the platform can make to addressing the **environmental concerns** of stakeholders, **savings on costs**, and improvements to overall **comfort and quality of life**. A large proportion of respondents indicated at least one of these three factors as a main reason for being interested in the energy performance of their building.
3. **Focus on building owners and energy professionals**, when marketing the EUB Superhub platform. 30% of respondents cited not owning the building as a key barrier to getting an EPC or investing in building improvements, while a further 20% indicated that they were not in a good financial position at the moment. Interestingly, a majority of people we engaged with lived in buildings that were 50 years or less and 55% said that their building did not need a lot of refurbishment/renovation to improve its energy efficiency. However, this still leaves 45% who do recognise the need to upgrade. This is the cohort to target.
4. **Localise the marketing** of the platform to match the EPC regime in each country. A majority of stakeholders we spoke to were familiar or somewhat familiar with the EPC in their country, this included non-professionals and tenants. When asked if the current EPC programme in their country provided all they needed to understand the energy performance of their building, under 50% affirmed this statement while the rest either remained neutral or responded negatively. This suggests an opportunity for targeted marketing of the platform highlighting how the platform addresses this gap.

5. **Emphasise the digital "one-stop-shop" component** where one can "learn more about my building's performance, get access to local databases and to market actors dealing with energy efficiency" proved very popular with those we spoke to, with 85% saying they would use such a tool.

6. **Provide reassurance on quality and accuracy** of the EUB Superhub platform data. When discussing the platform, a key priority for stakeholders we engaged with was the accuracy of the data and feedback given to the client, followed by the quality of the information given in the app itself.

7. **Highlight popular components of the EUB Superhub platform**. In our engagements, a majority expressed the most interest in the Performance planning and Verification module, followed by the 'E-Pass Cockpit', with GIS-linked EPCs database, while the virtual marketplace and training modules garnered the least interest (this was still significant, though the performance planning and verification module registered three times stronger with stakeholders).

8. Another factor to consider when marketing the platform is to **emphasise how it will address existing failings with current EPC regimes** in each country. A notable finding from speaking with a number of respondents, particularly in Portugal, is that ongoing efforts there to develop a similar tool to the EUB SuperHub platform are already underway. Where EUB SuperHub might have the most significant impact is in those countries that have not yet embarked on developing a similar tool. Emphasising the benefits of EUB SuperHub platform and comparing it favourably to developments elsewhere in Europe may help to maximise its viability in those countries.

7 References

Ackermann, F., & Eden, C. (2011). Strategic Management of Stakeholders: Theory and Practice. *Long Range Planning*, 44(3), 179–196. https://doi.org/10.1016/j.lrp.2010.08.001

Alshenqeeti, H. (2014). Interviewing as a Data Collection Method: A Critical Review. *English Linguistics Research*, 3(1). https://doi.org/10.5430/elr.v3n1p39

Banaitiene, N., Banaitis, A., Arturas Kaklauskas, A., Zavadskas, E. K. (2008). Evaluating the life cycle of a building: A multivariant and multiple criteria approach. *Omega*, 2008. 36(3): 429 441.

Baumeister, R. F., & Leary, M. R. (1997). Writing Narrative Literature Reviews. *Review of General Psychology*. 1(3), 311-320. https://doi.org/10.1037/1089-2680.1.3.311

Bem, DJ, (1995). Writing a Review Article for Psychological Bulletin, *Psychological Bulletin*. 118(2), 172-177

Bourne, L., & Walker, D. H. T. (2005). Visualising and mapping stakeholder influence. *Management Decision*, 43(5), 649–660. https://doi.org/10.1108/00251740510597680

Bowman, C., & Ambrosini, V. (2000). Value Creation versus Value Capture: Towards a Coherent Definition of Value in Strategy. *British Journal of Management*, 11(1), 1–15. https://doi.org/10.1111/1467-8551.00147

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Bryman, A., & Bell, E. (2011). *Business Research Methods* (third edition). Oxford, UK: Oxford University Press.

Bryson, J. M. (2004). Stakeholder Identification and Analysis Techniques. *Public Management Review*, 6(1), 21–53. https://doi.org/10.1080/14719030410001675722

Caelli, K., Ray, L., & Mill, J. (2003). “Clear as Mud”: Toward generic qualitative research. *International Journal of Qualitative Methods*, 2(2), 816–819.

Cafferata, R., & Mari, M. (2015). L'evoluzione del settore immobiliare secondo un approccio di filiera. In R. Cafferata (Ed.), *Real estate. Tendenze evolutive del settore* (pp. 9–41). Bologna: Il Mulino.

Charmaz, K. (2006). *Constructing Grounded Theory*. Thousand Oaks: Sage Publications.

Check, J., & Schutt, R. K. (2012). Survey Research. In J. Check & R. K. Schutt (Eds.), *Research Methods in Education* (pp. 159–186). Thousand Oaks and London: Sage Publications. https://doi.org/10.4135/9781544307725.n8

Corbin, J. M., & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative Sociology*, 13(1), 3–21. https://doi.org/10.1007/BF00988593

Currie, R. R., Seaton, S., & Wesley, F. (2009). Determining stakeholders for feasibility analysis. *Annals of Tourism Research*, 36(1), 41–63. https://doi.org/10.1016/j.annals.2008.10.002

Dahlström, K., & Ekins, P. (2006). Combining economic and environmental dimensions: Value chain analysis of UK iron and steel flows. *Ecological Economics*, 58(3), 507–519. https://doi.org/10.1016/j.ecolecon.2005.07.024

Davis, J., Mengersen, K., Bennett, S., & Mazerolle, L. (2014). Viewing systematic reviews and meta-analysis in social research through different lenses. *SpringerPlus*, 3, 511. https://doi.org/10.1186/2193-1801-3-511

Denniston and Kim (2008). *An Analysis of the U.S. Real Estate Value Chain with Environmental Metrics*. Report prepared for Environmental Defense Fund. Durham: Duke University.

Denzin, N. K., & Lincoln, Y. S. (2005a). Introduction: the discipline and practice of qualititative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage Handbook of Qualitative Research* (third edition, pp. 1–32). Thousand Oaks, CA, USA: Sage Publications.

Dörnyei, Z. (2007). *Research Methods in Applied Linguistics: Quantitative, Qualitative and Mixed Methodologies*. Oxford: Oxford University Press.

Dörnyei, Z. (2007). *Research Methods in Applied Linguistics: Quantitative, Qualitative and Mixed Methodologies*. Oxford: Oxford University Press.

Dunphy, N. P., Morrissey, J. E., & MacSweeney, R. D. (2013). Analysis of stakeholder interaction within building energy efficiency market. UMBRELLA FP7 Project: Grant agreement number 314343. https://doi.org/10.5281/zenodo.3479491

Evans, J. R., & Mathur, A. (2005). The value of online surveys. *Internet Research*, 15(2), 195–219. https://doi.org/10.1108/10662240510590360

Fellows, R. F., & Liu, A. M. M. (2008). *Research Methods for Construction* (third edition). Chichester, UK: Wiley-Blackwell.

Fink, A. (2010). *Conducting Research Literature Reviews* (third edition). Thousand Oaks and London: Sage Publications.

Forman, J. and Damschroder, L. (2007), Qualitative Content Analysis. In, Jacoby, L. and Siminoff, L.A. (Ed.) *Empirical Methods for Bioethics: A Primer (Advances*

in Bioethics, Vol. 11), Bingley: Emerald Group Publishing Ltd, pp. 39-62. https://doi.org/10.1016/S1479-3709(07)11003-7

Freeman, E. (1984). *Strategic Management: a Stakeholder Approach*. Pitman Inc.

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: Interviews and focus groups. *British Dental Journal*, 204(6), 291–295. https://doi.org/10.1038/bdj.2008.192

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: Interviews and focus groups. *British Dental Journal*, 204(6), 291–295. https://doi.org/10.1038/bdj.2008.192

Hammond, M., & Wellington, J. (2013). *Research Methods - the Key Concepts*. London and New York: Routledge.

HIA. *Principles of Life Cycle Assessment*. 2011

Hoff, J.L. (2007). *Life Cycle Assessment and the LEED® Green Building Rating System™*. in RCI 23rd International Convention & Trade Show. Phoenix: Roof Consultants Institute

Joffe, H. (2012). Thematic Analysis. In D. Harper & A. R. Thompson (Eds.), *Qualitative Research Methods in Mental Health and Psychotherapy: A Guide for Students and Practitioners* (first edition), pp. 209–223. New York: John Wiley & Sons.

Joffe, H., & Haarhoff, G. (2002). Representations of far-flung illnesses: The case of Ebola in Britain. *Social Science and Medicine*, 54(6), 955–969. https://doi.org/10.1016/S0277-9536(01)00068-5

Joffe, H., & Yardley, L. (2004). Content and Thematic Analysis. In Research Methods for Clinical and Health Psychology (pp. 56–68). Thousand Oaks and London: Sage Publications. https://doi.org/10.4135/9781849209793

Kaplinsky, R., & Morris, M. (2012). *A handbook for value chain research*. Brighton: University of Sussex.

Kavanagh, D. (1998). *Multi-firm, temporary networks: A study of process*. Unpublished Doctoral thesis: Lancaster University.

Kvale, S. (1983). The qualitative research interview: A phenomenological and a hermeneutical mode of understanding. *Journal of Phenomenological Psychology*, 14, 171-196.

Kvale, S. (1996). *InterViews: An introduction to qualitative research interviewing*. Thousand Oaks and London: Sage Publications.

Lanning, M. J., & Michaels, E. G. (1988). *A business is a value delivery system*. In McKinsey Staff Paper (No. 41).

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., Clarke, M., Devereaux, P., Kleijnen, J., & Moher, D. (2009). The PRISMA

Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration. *Annals of Internal Medicine*, 151(4). https://doi.org/10.1136/bmj.b2700

Macfadyen, G., Nasr-Alla, A. M., Al-Kenawy, D., Fathi, M., Hebicha, H., Diab, A. M., Hussein, S. M., Abou-Zeid, R. M., & El-Naggar, G. (2012). Value-chain analysis — An assessment methodology to estimate Egyptian aquaculture sector performance. *Aquaculture*, 362–363, 18–27. https://doi.org/10.1016/j.aquaculture.2012.05.042

Mathur, V. N., Price, A. D. F., Austin, S., & Moobela, C. (2007). Defining, identifying, and mapping stakeholders in the assessment of urban sustainability. In M. Horner, C. Hardcastle, A. Price, & J. Bebbington (Eds.), *Proceedings: SUE-MoT Conference 2007: International Conference on Whole Life Urban Sustainability and its Assessment*. https://dspace.lboro.ac.uk/2134/5202

Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts. *The Academy of Management Review*, 22(4). https://doi.org/10.5465/amr.1997.9711022105

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: *The PRISMA Statement. Annals of Internal Medicine*, 151(4), 264–270. https://doi.org/10.1136/bmj.b2535

Morant, N. (2006). Social representations and professional knowledge: The representation of mental illness among mental health practitioners. *British Journal of Social Psychology*, 45(4), 817–838. https://doi.org/10.1348/014466605X81036

Morgan, G., & Smircich, L. (1980). The case for qualitative research. *The Academy of Management Review*, 5(4), 491–500.

Morrissey, J. E., Dunphy, N. P., & MacSweeney, R. (2014). Energy efficiency in commercial buildings: Capturing added-value of retrofit. *Journal of Property Investment and Finance*, 32(4), 396–414. https://doi.org/10.1108/JPIF-01-2014-0008

Ochsendorf, J., Keith Norford, L., Brown, D., Durschlag, H., Hsu, S.L., Love, A., Santero, N., Swei, O., Webb, A., Wildnauer, M. (2011) *Methods, Impacts, and Opportunities in the Concrete Building Lifecycle*, in MIT Concrete Sustainability Hub Report Series 2011, Cambridge: Massachusetts Institute of Technology.

Olander, S. (2007). Stakeholder impact analysis in construction project management. *Construction Management and Economics*, 25(3), 277–287. https://doi.org/10.1080/01446190600879125

Onwuegbuzie, A. J., & Frels, R. (2016). *7 Steps to a comprehensive literature review. A multimodal and cultural approach*. Thousand Oaks and London: Sage Publications.

Palmer, K., & Walls, M. (2017). Using information to close the energy efficiency gap: a review of benchmarking and disclosure ordinances. Energy Efficiency, 10(3), 673–691. https://doi.org/10.1007/s12053-016-9480-5

Petrov, I., & Ryan, L. (2021). The landlord-tenant problem and energy efficiency in the residential rental market. *Energy Policy*, 157, 112458. https://doi.org/10.1016/j.enpol.2021.112458

Ponto, J. (2015). Understanding and Evaluating Survey Research. Journal of the Advanced Practitioner in Oncology, 6(2): 168–171.

Porter, M. E. (1985). *The Competitive Advantage: Creating and Sustaining Superior Performance*. Washington DC: Free Press.

Project Management Institute. (2008). *A guide to the project management body of knowledge (PMBOK Guide)* (fourth edition). Newtown Square: Project Management Institute.

Purnomo, H., Guizol, P., & Muhtaman, D. R. (2009). Governing the teak furniture business: A global value chain system dynamic modelling approach. *Environmental Modelling & Software*, 24(12), 1391–1401. https://doi.org/10.1016/j.envsoft.2008.04.012

Reeves, S., Kuper, A., & Hodges, B. D. (2008). Qualitative research methodologies: ethnography. *BMJ*, 337(7668), 512–514. https://doi.org/10.1136/bmj.a1020

Ricciotti, F., Cristofaro, M., Abatecola, G., & Mari, M. (2022). Executive profiles and performance of real estate services: Evidence of reverse causality from Europe. *Cities*, 103854. https://doi.org/10.1016/j.cities.2022.103854

Rich, K. M., Ross, R. B., Baker, A. D., & Negassa, A. (2011). Quantifying value chain analysis in the context of livestock systems in developing countries. *Food Policy*, 36(2), 214–222. https://doi.org/10.1016/j.foodpol.2010.11.018

Rieple, A., & Singh, R. (2010). A value chain analysis of the organic cotton industry: The case of UK retailers and Indian suppliers. *Ecological Economics*, 69(11), 2292–2302. https://doi.org/10.1016/j.ecolecon.2010.06.025

Rowley, J. (2014). Designing and using research questionnaires. *Management Research Review*, 37(3), 308–330. https://doi.org/10.1108/MRR-02-2013-0027

Saldaña, J. (2013). *The Coding Manual for Qualitative Researchers* (second edition). Thousand Oaks and London: Sage Publications.

Schonlau, M., Fricker, R. D., & Elliott, M. N. (2002). *Conducting Research Surveys via E-mail and the Web*. Santa Monica: RAND Corporation.

Seo, S., & Hwang, Y. (2001). Estimation of CO 2 Emissions in Life Cycle of Residential Buildings. *Journal of Construction Engineering and Management*, 127(5), 414–418. https://doi.org/10.1061/(ASCE)0733-9364(2001)127:5(414)

Sequeira, D. & Warner, M. (2007). *Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets*. Washington, DC: World Bank Group

Singleton, R. A., & Straits, B. C. (2009). *Approaches to social research* (fifth edition). Oxford: Oxford University Press.

Smith, C. (2000). Content Analysis and Narrative Analysis. In T. Reis & C. Judd (Eds.), *Handbook of Research Methods in Social and Personality Psychology* (pp. 313–335). Cambridge: Cambridge University Press.

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Stabell, C. B., & Fjeldstad, Ø. D. (1998). Configuring value for competitive advantage: on chains, shops, and networks. *Strategic Management Journal*, 19(5), 413–437. https://doi.org/10.1002/(SICI)1097-0266(199805)19:5<413::AID-SMJ946>3.0.CO;2-C

O'Toole, C. (2023). Exploring rent pressure zones: Ireland's recent rent control regime. International Journal of Housing Policy, 1–22. https://doi.org/10.1080/19491247.2022.2155338

Torraco, R. J. (2005). Writing Integrative Literature Reviews: Guidelines and Examples. *Human Resource Development Review*, 4(3), 356–367. https://doi.org/10.1177/1534484305278283

Torraco, R. J. (2005). Writing Integrative Literature Reviews: Guidelines and Examples. *Human Resource Development Review*, 4(3). https://doi.org/10.1177/1534484305278283

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, 14, 207–222.

Vaismoradi, M., Jones, J., Turunen, H., & Snelgrove, S. (2016). Theme development in qualitative content analysis and thematic analysis. *Journal of Nursing Education and Practice*, 6(5). https://doi.org/10.5430/jnep.v6n5p100

Walker, A., & Newcombe, R. (2000). The positive use of power on a major construction project. *Construction Management and Economics*, 18(1), 37–44. https://doi.org/10.1080/014461900370933

Walter, A., Ritter, T., & Gemünden, H. G. (2001). Value Creation in Buyer–Seller Relationships. *Industrial Marketing Management*, 30(4), 365–377. https://doi.org/10.1016/S0019-8501(01)00156-0

Webster, J., & Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, 26(2), xiii–xxiii. https://www.jstor.org/stable/4132319

Weinberg, S. 1995. The methods of science… and those by which we live, Academic Questions, 8(2): 7–13 https://doi.org/10.4159/9780674066403-009

Wong, G., Greenhalgh, T., Westhorp, G., Buckingham, J., & Pawson, R. (2013). RAMESES publication standards: meta-narrative reviews. *BMC Medicine*, 11: 20. https://doi.org/10.1186/1741-7015-11-20

Zeithaml, V.A. (1988), Consumer perceptions of price, quality and value: a means-end model and synthesis of evidence, *Journal of Marketing*, 52(3), 2-22 https://doi.org/10.2307/1251446

Zhang, Y., & Wildemuth, B. M. (2009). Qualitative Analysis of Content. In B. Wildermuth (Ed.), *Applications of Social Research Methods to Questions in Information and Library Science*. Santa Barnara: LibrariesUnlimited.

Appendix 1 – Participant Briefing Document

Holding page for Briefing Document – page 1 of 1

Appendix 2 – Consent forms

Holding page for Consent forms – page 1 of 1

Appendix 3 – Survey Questionnaire

Holding page for Survey questions – page 1 of 3

Holding page for Survey questions – page 2 of 3

Holding page for Survey questions – page 3 of 3

Appendix 4 – Interview schedule

Holding page for interview schedule – page 1 of 4

Holding page for interview schedule – page 2 of 4

Holding page for interview schedule – page 3 of 4

Holding page for interview schedule – page 4 of 4