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Citation for published version:

Gooding, LM & Gul, MS 2017, 'Enabling a self-sufficient energy efficient retrofit services sector future: A qualitative study', *Energy and Buildings*, vol. 156, pp. 306-314. <https://doi.org/10.1016/j.enbuild.2017.09.072>

Digital Object Identifier (DOI):

[10.1016/j.enbuild.2017.09.072](https://doi.org/10.1016/j.enbuild.2017.09.072)

Link:

[Link to publication record in Heriot-Watt Research Portal](#)

Document Version:

Publisher's PDF, also known as Version of record

Published In:

Energy and Buildings

Publisher Rights Statement:

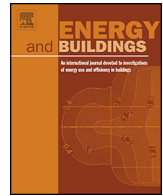
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Enabling a self-sufficient energy efficient retrofit services sector future: A qualitative study



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ARTICLE INFO

Article history:

Received 31 March 2017

Received in revised form 29 August 2017

Accepted 25 September 2017

Available online 29 September 2017

Keyword:

Retrofit Green Deal Energy Efficiency Retrofitting Services (EERS) Sector

ABSTRACT

The Energy Efficiency Retrofitting Services (EERS) sector has over the past five years undergone unprecedented change. Firstly, the introduction of the Green Deal saw the provision of national domestic energy efficiency measures placed in the hands of the private retrofit industry, which had previously been accustomed to government financial and administrative assistance. Then, secondly, when the implementation of the Green Deal failed, with limited uptake and unattractive finance arrangements, the EERS sector, was left without any policy provision to enable increased levels of retrofit. Furthermore, this uncertainty in government assistance is compounded by the lack of long term government planning, now that the UK's process of departing from the EU common market has commenced.

Therefore, moving forward from this point, the need to generate an EERS sector which is capable of being self-sufficient outside of a policy incentive scheme is a priority. This research provides insight from EERS sector practitioners as to the barriers presently in place halting progress towards self-sufficiency, and suggested strategies to remove these limitations. Key findings suggest policy presence within the retrofit industry has created complacency, meaning training and heightened professionalism towards generating and retaining business is important. In particular the importance of quality marketing methods and customer care strategies are considered key. This skills enhancement also needs to be focused upon in terms of producing an industry where individuals can train and enter a professional and achieve a lifelong, rewarding career. Customer habits and types also need to be understood more widely by practitioners, with the concept of general home improvements, being linked to energy efficiency measure installment, being a key central strategy in need to adoption.

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1. Introduction

To reach the UK's target of reducing domestic property carbon emissions by 80% by 2050 from 1990 levels [1–3], the housing stock within the UK needs energy efficient measures retrofitted at a significant scale [4]. Retrofit policy strategies have in the past adopted a strategy of focusing on 'low hanging fruit' retrofit measures, or 'easy-wins' to enhance property efficiency, loft insulation being one key area [5]. The effect of this strategy choice upon the Energy Efficiency Retrofitting Services (EERS) sector, is that property improvements have yet to be completed to any significant level [6–9]. This differential between energy savings which are realised and the potential savings which could be gained as it caused a considerable UK housing performance gap [10,11].

To reduce the above mentioned gap and to grow the numbers of installed retrofit measures, in early 2013 the UK government

opened the Green Deal (GD) loan scheme to provide funds for energy efficiency improvement measures, to assist home owners and tenants in reducing residential carbon emissions [12,13]. The GD was situated at the head of the 2013 coalition government's political approach, with the scheme being labelled 'flag-ship'. This highlighted the intention that policy makers were situating policies which aimed at generating economic progress alongside environmental prioritisation, at the forefront of governance.

During the GD's operational period, reliance upon the EERS sector for retrofit scheme delivery was high. This reliance was viewed as a route to promote retrofit whilst minimising public purse demands. This choice in delivery route was considered important, due to an estimated half a million retrofits needing to be completed annually, to reach the 2050 carbon reduction goal [14]. The task to increase the level of retrofit activity sufficiently, has been detailed as too large for the EERS sector to manage [15,16]. Reasoning for this belief is that the sector has previously been categorised as a subsector of the more general construction industry [15]. This effectively means that the EERS sector has been thought of as disjointed

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and emergent [17], with companies in general being considered small and restricted in geographic coverage.

This study relates to the fact that industry growth to enable retrofit at scale is key to ensure significant carbon saving levels and investigates how the sector can become self-sufficient, outside of policy intervention. This paper firstly details EERS sector key characteristics, along with barriers facing practitioners, to enable retrofit growth. Secondly, this paper presents the methodological approach employed here, followed by a documentation of key themes present within EERS sector practitioner interviews in relation to barriers to growth to retrofit, and strategies which could generate a self sufficient EERS sector.

2. Background

The first area to be considered to enable an outlining of background information is the characteristics of the EERS sector itself. This is important as it influences the types barriers which could limit the level of retrofit completed. Significant heterogeneity levels within the construction industry mean typifying different industry areas is a difficult task. Energy efficient retrofit for instance, requires many parties within the supply and implementation chain, with businesses and individuals operating both solely within the EERS sector, and as also part of the more general construction industry. The level of changeability and adaptability required to deliver retrofit measures, means many EERS sector parties are involved in more traditional conventional construction as well as low carbon, energy efficiency projects [18,15].

Business strategies within the sector cover a variety of routes, including the design and production of properties and retrofit schemes, low carbon materials and technology application, energy efficient measure maintenance and behavioural change facilitation. Businesses and individuals carrying out these processes include persons in both the private and public sectors; comprising government bodies, construction businesses, contractors, architects, designers, suppliers and engineers [15,17]. Existing research shows [17,19] the majority of EERS sector businesses operating are small to medium sized (SMEs), with fewer than 10 employees. This tendency for smaller operations is also existent within the general building development and maintenance industry [14], conducive with the fact that the heterogenic nature of building projects means that projects are completed on an individual basis, and bundling of schemes is very difficult to achieve.

These constrictions discourage larger companies from sector participation, due to economies of scale being difficult to generate, with projects needing significant management and organisation expenses [20]. Significant levels of sector disintegration and dispersal may also limit bigger business involvement [15]. Current strategies to combat this disintegration include cooperative style collections of SME retrofit companies; cases include South East England based RetrofitWorks, and the national independent business group named SNUG [21]. These validate that a percentage of the supply chain recognises modifications to business formation are required to boost retrofit activity levels. This EERS sector, via the GD was enlisted with the task of implementing the 2012 Coalition government's domestic property improvement incentive. Operational up until mid-2015 [22,23], the GD intended to permit home owners the option to retrofit properties with energy efficiency measures, minus the requirement of upfront capital for improvement payments, via the pay as you save loan mechanisms. Loan repayments were intended to be produced via on bill payments once the property is benefitting the occupants by creating a financial saving in terms of running cost [24]. The GD utilised 'the Golden Rule' to guarantee that the cost of energy savings generated post improvement, was not a lesser amount than the measure's repayments [25].

In design therefore, the scheme was also aimed at shielding consumers from energy price volatility, and therefore enhancing energy security [26]. This focus on consumers, also aimed at producing a vibrant market for businesses, offering low carbon economy growth, along with fuel poverty reduction. Via the assignment of policy delivery responsibility upon the private EERS sector, the GD displays an intention of liberalisation and energy sector deregulation [27]. This independence for businesses to grow and prosper was consequential from the acknowledgement that the energy efficiency measure market could expand from £8.25bn in 2007 [28,p. 31] to a possible £58bn by 2013.

The GD was anticipated to have a significant impact by 2020, through the delivery of 14 million property improvement schemes [29]. However, in reality the GD significantly fell short, in failing to achieve any notable outcome. In practice approximately 6000 schemes of work per year were carried out under the Green Deal, meaning only around 14,000 properties were retrofitted overall, throughout the policy's operational timeframe (January 13–March 16) [30]. Moreover, in contrast to forerunner policies, the GD generated substantively lower carbon savings. Per year, the predecessor policies of the Carbon Emissions Reduction Target (CERT) and the Community Energy Savings Programme (CESP) provided approximately 68 MtCO₂ of savings DECC, 2010, compared to 0.4 MtCO₂ of savings which the GD generated [31,23]. The limited level of GD impact shows that recent policy is not offering an advantageous operating climate for businesses.

Furthermore, since the GD's waning, a subsequent policy has yet to materialise, further highlighting the need for action within the sector itself. Therefore the EERS sector needs to increase retrofit levels within the retrofit companies which have developed during the previous policy schemes and may have foundations within the traditional construction and maintenance commercial models [14]. These organisations have the potential to deliver retrofit increases, even if it is in a piecemeal way [21]. Linked in with this concept is also the need for increased training of EERS sector practitioners, to ensure that the new comers to the construction industry or those developing from traditional building practitioners are able to provide a highly professional delivery of high performing retrofit project in an effective timescale. Therefore, what is deemed important is that without policy assistance, is that these commercial entities need to develop means in which operations, training and finances can be managed, and a sustainable growing business can result.

2.1. Research approach

The EERS sector within the UK can be considered a problem solving industry, both in term of the tasks completed on a day to day operation and also in terms of business profit production strategies. Consequently, during the GD's operation, EERS sector members were involved in producing a wide variety of business models adept at delivering the incentive loan system in a lucrative manner. In order to detect the key factors which were successful about these commercial strategies, and also to identify the features of the retrofit businesses which could enable EERS sector self-sufficiency external to policy assistance, it is essential to assess views of the EERS sector members. To enable this research into individual views, semi-structured interviews are utilised to allow access to detailed information regarding strategies for retrofit businesses success, and suggestions of how to function without policy incentive input. Due to the point that this research is by its nature investigative; any claim of comprehensiveness is not made [32]. Instead the focus here is on establishing an understanding of a sample of experientially informed strategies to enable retrofit.

2.2. EERS sector sample group

In assessing barriers inhibiting the EERS sector and possible strategies enabling operations external to policy schemes, the priority of this research is to evaluate practitioner experience. This focus on gaining insight from on the ground source has been selected due to the following reasons;

- In formalising practitioner standpoints, via research investigation and documentation, viewpoints can be brought together and contribute to data grounded within field experience [33].
- Theories and notions of change are understood thoroughly within active operational environments, characterised by problem solving [34,35]

The selected snowball sampling method was chosen due to its ability to produce a sample group utilising networks within the sector, without any prejudice regarding participant role or position. Therefore, it focused on generating a sample which could bring together a large array of experiential anecdotes, which are used to offer an investigative research position. This strategy aims to use prior contacts to commence the generation of a sample group. This means that initial participants can be used, who are known, and whose experience and knowledge is known, this then influences the type of subsequent individuals who are connected to the initial sample. The benefit of this method is that it enables more control of the type of sample produced, and it also offers an insight into the types of connections which occur within the EERS sector, highlighting how networks of practitioners operate. However, a key point to acknowledge is that due to the selected nature to which participants are gained, the researched population is chosen due to its adequate level of knowledge and experience, and not necessarily its representativeness of the overall population [36].

Once initial interview data was produced and transcribed, initial coding of interview scripts took place, which in turn enabled theoretical sampling to occur, influencing the formation of the subsequent group interviews. In uniting these two successive sampling methods, a general category recognised in the snowball phase can be inspected in greater detail to 'elaborate on its various manifestations' [37, p. 83]. This staged nature of investigation made certain that further participants could deliver clarification and expansion of themes which were emergent [36]. In using this grounded theory purposive sampling a strategy which is in depth, an evaluative nature is produced [38]. Additionally, it does not limit the sample group in terms of geography, but instead focuses on respondent experience and knowledge. While in the main participants were based in the England's North West and Scotland, multiple respondents operate nationally. The differing levels of business area offers a key understanding of the varying roles EERS sector participants carry out, and the sorts of networks they function within.

2.3. Data collection

In total twenty three semi-structured interviews were conducted over the phone (lasting between 30–60 min), and six group interviews based within the UK which were carried out at the premises of differing EERS sector business, across the north of England and the central belt of Scotland. These were conducted by an experienced researcher over a 6 month period, with individual and group sessions comprising of differing participants. This offered an opportunity for individuals to consider the concepts emergent from individual interviews, to enable triangulation to ensure individual interview theme validity, but to also develop some concept to produce well advanced suggestions for EERS sector strategies into the future.

Table 1
Profession details of interview participants.

Profession	Frequency
Retrofit training provider	3
Property assessor and advisor	1
Green Deal installer	5
Green Deal provider	1
Government official	2
Retrofit supply chain manager	5
Retrofit material supplier	6

The interviews were considered adequate in number, due to the fact it enabled a detailed engagement with respondents, establishing rewarding relationships addressing in depth the research area. In this sense, a smaller sample offers deeper investigation into a theme, and delves into the various subtexts of a concept [39]. Moreover, the eventual interview number occurred due to 20 individuals being interviewed in the initial sample size. This minimum interview number was decided upon due to influences from previous EERS sector investigations [40,41,21], this strategy follows the notion of the 'wisdom of the elders' [42], or the idea that sample sizes can be chosen via prior research indications. This 20 session sample was then subsequently followed by three stopping interviews, which ensure via stopping criterion that saturation of data has taken place [43]. Details of the type of participants who took part within these interviews are presented within Table 1.

From these 23 interviews, key concepts emergent from the data via coding, were then taken to group interview sessions. These interviews were theoretically sampled groups, to ensure that those involved would be able to offer detailed discussion on these emerging subjects [32]. This staged development of themes lead to the production of EERS sector suggestions as to how businesses could prosper and grow without policy intervention. Between 2 and 5 participants took part within these sessions, with a focus upon developing suggestions for on the ground action to enable sector self-sufficiency. This strategy is considered important to generate greater levels of certainty within the sector and to promote high rates of progress in future proofing the UK housing stock [44].

To produce well-conceived suggestions as to how the sector should operate into the future, group interview respondents were allowed the opportunity to converse freely their opinions and via dialogue refine in depth, their reasoning's. Due to individual's sharing experiences from operating within the EERS sector, permitted a nondirective interviewer approach. This semistructured manner permitted a group dynamic whereby individuals could interpret others' responses and take part in a discussion emergent from the group's combined opinions. However to guarantee coverage of all themes generated from the coding of the previous individual interviews, the session leader encouraged the coverage of three major areas; the groups experiences, their opinions of barriers to the EERS sector, and their views of how the sector could evolve into the future to enable self-sufficiency. All sessions followed a similar questioning route, the key themes of which are highlighted in Table 2.

3. Results

The qualitative data was analysed using QSR NVivo [45] to generate an efficient, reliable method to categorise differing text, and to enable effective cross referencing between data generated by differing methods. A framework was utilised to permit the iterative modification of data as analysis and themes developed. This reflects the need for the fine tuning of data interpretation over time. The coding framework was developed by using the data and also the key objectives of this research. Therefore, firstly barriers to EERS sector self sufficiency are detailed, followed by the differing strategies

Table 2
Interview questioning themes.

Characteristics of the EERS sector.	Characteristics of business related to; <ul style="list-style-type: none"> - Income generation streams. - Industry growth and profit levels. - Supply of properties. - Innovations. - Formation of practitioner networks. - Levels of competition. - Differing types of businesses involved in the delivery chain.
Market conditions and policy	Level of EERS sector success, related to; <ul style="list-style-type: none"> - Perceived levels of retrofit activity. - Viability of present strategy into the future. - Key barriers related to end users, and the customer base (influence by interview and literature review findings, Tables 3 and 4). - Barriers related to business set up and formation of the supply chain. - Main barriers to growth into the future.
Suggested improvements	Identification of changes which could be made to the industry to aid development, including factors related to; <ul style="list-style-type: none"> - Specific areas in need to attention. - Strategies used if policy assistance was unavailable. - Areas in need of prioritisation.

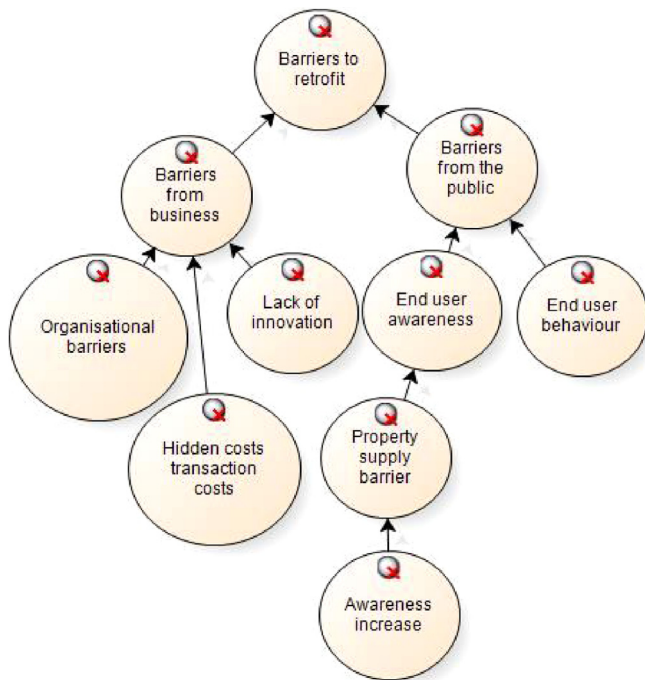


Fig. 1. Barriers to retrofit emergent from interview data.

suggested to promote sector growth external to policy incentive. Points identified are supported by respondent transcript extracts, adding to the validity of conclusions reached here.

3.1. Barriers to EERS sector self sufficiency

Barriers identified within this research are emergent from an extensive literature review ([Tables 3 and 4](#)) [47], along with a triangulation of barrier ideas detailed within both individual and group interviews ([Fig. 1](#)). These barriers therefore are noticeable within research and also via on the ground operation of the EERS sector.

Table 3
Barriers limiting EERS sector demand.

Imperfect information	Consumers often only have limited access to accurate information regarding the market, technology and how their energy use could change Sanstad and Howarth, 1994. Imperfect information can arise in several forms, including insufficient information, inaccurate information, and the fact that information can be costly to acquire Ürge-Vorsatz et al., 2007.
Form of information	Information intake would be increased if information forms were tailored to appeal to a specific section of society Stern and Aronson, 1984.
Credibility and trust	The fact that the level of information intake by end users is dependent on the perceived level of trust that can be placed in the information provider [46].
Inertia	Entrenched routines and habits cause issues of energy inefficiency to be simply ignored Stern and Aronson, 1984.
Bounded rationality	Bounded rationality, is the concept that individuals do not always act rationally. This can cause economically profitable energy efficiency measures to not be undertaken Gillingham et al., 2012. Three things can cause bounded rationality; human's natural irrational behaviour, complex problem solving, and multiple actor disagreement.
Principal agent problem	The principle-agent relationship exists due to a lack of trust between two parties. This mistrust exists due to the characteristics of a relationship or the transaction taking place. The landlord-tenant problem is an example of this as the individual using the energy is not responsible for maintenance and the properties energy efficiency Jaffe and Stavins, 1994.
Building heterogeneity	Building heterogeneity causes three issues to the EERS sector; a need for tailored solutions, a need for investment in research and development of solutions, a difficulty when trying to create economies of scale Jaffe and Stavins, 1994.

Table 4
Barriers inhibiting new enterprise and the growth of existing businesses in the EERS sector.

Hidden costs and access to capital	DeCanio (1998), states that hidden costs, are key factors hampering the growth of businesses. Hidden costs occur in various forms, from the cost of sourcing information, setting up the supply chain, to gaining business contracts [20]. These processes detract from the level of profit achievable and therefore limit investment channels. For a capacity increase in the EERS sector and for new business enterprises to establish there is a need for policy to generate financial conditions limiting the risk to investors, and providing arenas to encourage innovation developments in products and processes Geller et al., 2006.
Organisational barriers	The EERS sector is embryonic in nature, meaning the need to identify niches and predict downstream capacity and potential future competition is important, along with developing innovation, problem solving and an awareness of respective roles within an integrated delivery team. The embryonic nature of the industry means a lack of competition and therefore high prices for high specification products hinders investment, along with the limited economies of scale of product suppliers. Without policy mechanisms to alter this organisational market structure, it will be difficult to create a competitive sector compared to existing more traditional construction and refurbishment markets.

From these barriers it can be appreciated that for a policy to intervene and block limiting forces to expansion, various complex issues will have to be tackled. The first five barriers ([Table 3](#)) described are inherent to human consciousness, the fact that without tailored, transparent, readily available explicit information, from a trust worthy source, demand and industry expansion will

be difficult to generate. The last two barriers (Table 3) are inherent to UK housing characteristics.

The following barriers (Table 4) are factors which have to be considered by all potential businesses when setting up an EERS sector operation, and increasing sector capacity. It is important to appreciate here that these barriers perhaps have a higher impact on the decision making process, as the sector is still emerging and inherently contains a high amount of uncertainty.

Using the findings of these barriers within the existing literature and also the triangulated findings from the interviews, the following synthesised barrier figure has been produced (Fig. 1). This highlights the key aspects which are at the forefront of how the sector operates, and details the barriers which are prioritised by participants, and also already have a foundation within literature.

In a similar manner to literature review data, the NVivo based coding of interview transcripts helped to identify two categories of barriers within the transcript data, barriers from the public and barriers from business as shown in Fig. 1. From this perspective therefore, public barriers are those which occur due to characteristics of the end user population (Tables 3 and 4). In this sense these cannot be directly dealt with by the EERS sector, concepts such as the barrier of a lack of public awareness to increase retrofit. To enable a removal of this barrier, the EERS sector would need to operate with other organisations to generate a societal shift. Instead within this research, the focus is applied to business related barriers, the reasoning being that these barriers are hindrances which EERS sector practitioners can actively tackle external to policy incentive mechanisms, and can be removed via independent EERS sector development. Therefore in addressing these barriers, the option to achieve sector self-sufficiency is higher.

Delving more deeply into the interview data, key exemplar segments are provided here to highlight key opinions as to the types of barriers practitioner brought to the fore. One key opinion highlighted in interviews was that *for EERS sector growth to occur, organisations need to identify a niche, predict market expectations into the future, and along with identify innovation and streamlined methods of operation, to ensure an advantage over competitors (organisational barrier, Fig. 1)*. Therefore, interview results suggested that an organisational structure which does not offer this, would find profiting from operating within the sector difficult. The example transcript extracts highlight this viewpoint;

'For us a key area we focus on is trying to make sure we're ahead of the curve, attempting to pre-empt change, get our product and process offering right, so we always have the upper hand' (Retrofit advisor and installer).

'As a business, you need to make sure that you are doing things as effectively as possible. Every resource has to be utilised in an optimal manner, only then can you be sure that you are doing your best to quote for jobs cheaper than others, and still come away with a decent margin' (Retrofit installer).

These viewpoints support the opinion that to perform successfully within the EERS sector forward thinking is needed to ensure that resources are deployed effectively and trade continues at a high level into the long term. Participants also stated that it was considered that the present structure is one whereby differing EERS sector business are operating in an outdated manner (organisational barrier, Fig. 1), particularly in reference to client acquisition. This was stated as being of particular relevance to cold-calling or door knocking strategies to gain trade, and even outsourcing client enquiry services. This is typified by this participant statement;

'We need to take a step away from the double glazing salesman style, few people ever have someone knock on their door selling them home improvements, and thought, this seems a quality outfit' (Retrofit property assessor).

Furthermore, currently the fragmented nature means that from an organisation perspective, business are utilising sub-contractors to aid work completion at peak times (organisational barrier, Fig. 1). This fragmentation, also impacts the quality of the industry's organisation, in terms of affecting the quality of the networks formed by multiple businesses, this is highlighted by this respondent statement;

'To increase capacity quickly requires the assistance of subcontractors. The issue with this however, is that there are quality issues, liability issues, and a more complex interaction between client and installer. Plus, what subcontracting shows is that businesses are only acting in a reactive manner to enquiries and contracts' (Government retrofit advisor).

Overall this means that the small business nature of many EERS sector businesses, means they cannot provide a progressive or innovative service to customers, due to resource restrictions (innovation barrier, Fig. 1). Plus, it means that many practitioners are siloed separately from other operatives within the industry, due to these resource restrictions, or indeed being too geographically dispersed, a concept which is detailed in this interview segment;

'The way in which most retrofit operations are quite small means that you are constantly coming up against barrier to growth, because there is little collaborative working between business, because no one has the time or resources to establish meaningful working relationships' (Retrofit training provider).

Also within the barrier of organisational hindrances is that of investment shortages. Respondents commented that due to uncertainty within the sector gaining affordable finance to develop business and service provision was difficult (hidden costs/transaction costs, Fig. 1). Businesses trading therefore within an industry not yet operating at its full potential have a difficult sell to financiers to gain funds to grow retrofit offerings, as shown by this extract;

'We want to grow, I have staff who I want to train and gain more business via different methods, the problem is no one is prepared to invest or stump up any money to let me do this, it catch 22' (Retrofit installer).

Some participants also linked in with the previous point that to grow a business requires high expenditure on transaction costs. Expenses involved in enabling service provision increases, which have to be covered by the business. These costs can range from gaining accreditation and training, to obtaining information regarding business models and market conditions, and from insurances and risk reduction costs, to upscaling operational resources. *These high costs to new businesses or growing businesses mean that providing a retrofit service at a competitive price straight away is improbable (hidden costs/transaction costs, Fig. 1)*. Therefore to overcome this organisational barrier intelligent strategies are required by businesses to limit the impact of these costs on growth, and also the impetus to advancement, as indicated by this statement;

'For us, one main thing we try and do is help business take a business plan and say, how can we get this scaled up and competitively priced fast. It is by doing that, that you can see the retrofit industry growing at any significant rate' (Retrofit training advisor).

3.2. Strategies enabling EERS sector self-sufficiency into the future

Via the appreciation of these barriers to the sector prospering without policy incentive assessment, the following suggestions emerged from interviews as to how the sector could be improved. In particular the suggestions were centred on codes linked to the overall theme of the *retrofit industry into the future* (Fig. 2). Within this

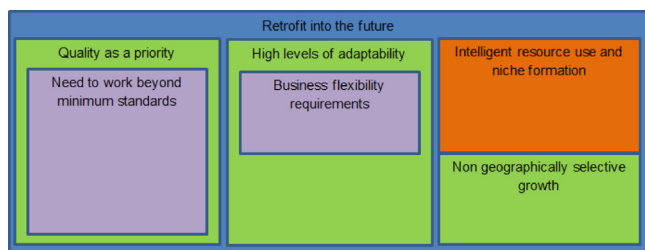


Fig. 2. Nodes for strategies focused on moving the retrofit industry forward.

overall theme, sub-themes are detailed within Fig. 2, and highlight the areas of suggested strategies which were emergent to enable self-sufficient EERS sector growth. Relative sizes of the node areas, refer to the frequency at which these nodes were emergent within the interview data. In this sense the importance of a quality focus and an ability of adaptability were the two areas of priority for the EERS into the future. Within these factors the concept of future proofing properties and working above minimum standards was prevalent, along with the need to be flexible to market changes.

3.3. Moving away from boom and bust nature of the EERS sector

The first group of suggestions is that of moving away from the boom and bust past of the sector, and the fact that many businesses involved with retrofit have operated in line with policy funds, and have rapidly grown to exploit these funds, and ceased trading once the fund stopped. This undulation of retrofit trade levels according to interviewees, promotes limited customer prioritisation, and instead focus is applied to profit margins.

To promote a sector which is detached from this profit centric past, the following suggestions have been made;

- I. Adopting a business strategy which enables alteration to cater for different types of projects. Operating in this manner, is considered to open up the market to different types of retrofit schemes of work, and to also permit the completion of deeper retrofit projects. In not tying a business model to one particular area of retrofit, such as loft insulation, sector companies can work with property owners more effectively to tailor offerings to suit the building and the occupants.
 - 'Flexibility in a business is in my opinion the way forward, you are dealing with buildings which are inherently going to throw up issues, so you have to have an operational strategy which can deal with these issues, and turn them to your advantage' (Retrofit training advisor).
- II. Expanding on the previous point, suggestions related to trading with multiple profit centres, also states that via this route enhanced connections can be made to other businesses within the EERS sector. This network creation is deemed to be a suitable way in which to combat the fragmented nature of the industry at present, and also to focus the sector on quality of service provision (Fig. 2). Furthermore, this pathway fosters flexibility due to the varying roles a business is undertaking, flexibility which is important when considering the high level of problem solving which is present within retrofit schemes (Fig. 2).
 - 'The best way we have found to keep trading, is to say yes to the client, if they want something extra, we say yes and see it as an opportunity to progress and learn, and also make some extra cash' (Retrofit installer).
- III. Availability in relation to finance and resources is the third area of thought connected to promoting a sustainable sector. It is considered that via increased resource provision in terms of training, knowledge and physical operational resources, deeper retrofit will result and organisation barriers removed (Fig. 1).

Retrofit which could ensure the buildings of today will meet the standards of tomorrow across the entirety of the UK (Fig. 2).

3.4. Ensuring high levels of professionalism

The next area of change suggested for the sector to make self-sufficiency possible is that of increasing the level of professionalism within the industry, prioritising customer service levels. With this enhanced service, it is considered that returning trade will become more prevalent, along with confidence in the sector to deliver schemes of work which are good financial investment, further promoting the industry as one which can operate outside of policy assistance. Specific aspects to enable this move towards increased competence in term of end user service are detailed below.

- I. Firstly, businesses are suggested to move towards viewing projects in a longer term manner. This is stated as important for two reasons, firstly in viewing a retrofit project in a full life cycle way, customer service at all stages can be prioritised, along with ensuring that all factors involved in the project work together to ensure maximum energy savings, and secondly in viewing all parts of a project, profit centres can be produced at varying points of a scheme of work. This enhanced financial benefit increased the sustainability of the sector outside of policy incentive schemes.
 - 'Some of the best retrofit projects I have seen, completed to the highest standard, are those where the client and supply chain have made a really worthwhile relationship, where everything has been thought about really carefully, without any consideration for policy' (Retrofit supply chain manager).
- II. In addition linked to the previous point is that with high levels of professionalism and therefore customer service, return business or word of mouth referrals are more likely to occur. With these increased, outdated client acquisition methods such as door-knocking or cold calling will become obsolete.
- III. An increase in professionalism also suggested by respondents to have the potential to remove issue of sub-contractor low quality and protracted project timescale issues. To achieve this, respondents stated a requirement for EERS sector companies to adopt a close working relationship with contractors to ensure that all parties involved within a project are aware of the requirements. This is considered important by some respondents as indicated by the comment given below to enable high levels of professional conduct and to enhance levels of quality delivered, and remove organisational barriers (Fig. 2).
 - 'Using sub-contractors has been a mixed one in my opinion, on the one hand they are great to get jobs moving and completed if time is running out, on the other hand they are difficult to manage really effectively. They have their own way of working which may be different to your own' (Retrofit supply chain manager).
- IV. Client care advances was also stated to be a route to offering deeper retrofit projects, in particular high levels of communication with end users, not only ensures clarity in processes, but also can encourage increased levels of energy efficiency investment to enable boosted number of deep retrofits. Linked to this point is the added level of energy efficiency improvements which could be gained parallel to standard property improvement, with more business niches being established (Fig. 2).
- V. The last suggestion in this section regarding professionalism is the increased use of project managers and/or architects to add confidence and clarity to retrofit projects. It is suggested that with a highly knowledge central managing individual controlling a project, high levels of quality, and sector capability can be pursued.
 - 'In my opinion the value of a good one stop shop for a project cannot be underestimated. At the end of the day, not everyone has

the time or inclination to manage a home improvement project, and therefore, having a great point of contact for the client is massive plus (Retrofit supply chain manager).

3.5. Pursuing high level of retrofit standards and pushing the capability of the sector

The third area of suggested improvement for the EERS sector is that of pushing retrofit expected standards continually upwards, thus promoting the increased capability of the sector and also the expected performance of the EERS sector. To enable this change, the following aspects are considered important to focus on.

- I. Use of Super Homes, or EERS sector deep retrofit schemes, to act as marketing tools, thereby pushing up expected levels of performance, and also making members of the public aware of what the sector is capable of, and also what materials and products are on the market. This enhancement of standards also has the ability to future proof the existing housing stock.
- II. This future proofing is also linked to the stated need for added understanding of building physics within the sector. This sentiment was resultant from the fact that as energy efficiency standards increases, air tightness levels also rise, particularly when building approach or gain Passive standard. This increase in management of air within building also therefore means practitioners need to understand how the physics of a property work, to ensure the living environment remains healthy. A representative quote to express this feeling is given below:
 - *'If you look at the success of some of the really high performing properties out there, the potential PR possibilities in promoting what the retrofit supply can do, has not been followed up and realised. We need to be shouting from the rooftops about what levels of energy efficiency can be produced'* (Retrofit materials supplier).
- III. Standards also need to be increased in relation to how a business operates this in specifically connected to how a business manages its financial position. Reoccurring within the interviews was the concept that business were not managing cash flow optimally in many cases, a concept made worse by the boom and bust nature of the industry which recent policy schemes exacerbated. Consequently, into the future, respondents stated an improvement of how finances of the EERS sector are managed is important.
- IV. The final aspect of improvements to the EERS sector to enable continuing enhancement of the standards obtained by retrofit activity, is that of increasing practitioner training. This was suggested for multiple reasons, firstly as a method of streamlining delivery to ensure project times are not protracted and to promote healthy profit margins for sector businesses. Secondly, it was considered that via added training, more members of the sector could gain roles as project managers and organise full retrofit schemes of work. Not only would this promote quality and process efficiency, but also it could promote the sector as a suitable place for individuals to train and remain in a career for life. Thirdly, with trained personnel internal to the industry, sub-contractors would not have to be relied upon so heavily, combatting against the issue of quality issue when using external personnel, and adding to the level of customer service end users receive.
 - *'Training is a key focus, the retrofit industry has in effect come out of the old building industry, and not the most well regarded industry. So we need to be distancing ourselves from that way of working. It is our opinion that training is the way to do that, create an industry where everyone has a job for life and is*

constantly improving the way they are doing things' (Retrofit Training provider).

All of these factors contributing to higher levels of retrofit, also inherently add to the concept of quality taking a priority (Fig. 2).

3.6. Innovation usage increases

The last area of suggested progress, in which the EERS sector should focus, is that of adopting innovation more readily (Fig. 1). These innovations are stated to be required within both business operations and also within the products and services offered to end users. The reasoning's behind this focus are as follows;

- I. Firstly, the persual of innovations is considered to promote easy wins. These advantages are considered important when considered the added carbon savings an innovation could offer, with potential minimal effort by EERS sector members and end users in term of adoption.
- II. Secondly, these easy wins, could also be accrued via bringing together energy efficiency improvements with standard property improvements. This is deemed to offer added opportunities for carbon saving to occur within the housing stock, and also it aids the production of a societal shift to view energy efficiency as a staple part of housing refurbishment. To produce this however, respondents did view a need to enlist innovative strategies to client acquisition, as end users may be unaware of the energy savings they could generate by enlisting EERS sector assistance.
- III. Connected to the previous point is also the aspect that innovative client recruitment methods, may also open doors to these potential energy saving opportunities. Therefore, attention needs to be paid to the ways in which sector companies interact with members of the public.
- IV. Lastly, innovation is also required in terms of how bundling of projects can occur to offer increased numbers of retrofit projects being completed and therefore carbon savings offered. What is accepted by interview participants here is the acknowledgment that due to high levels of heterogeneity within the UK housing stock, project bundling is potentially very difficult to achieve in a cost effective manner, however advances in process and technology to enable this is considered an important advancement.
 - *'The way in which all properties differ is the main challenge we face, you can't just repeat the way you do things, or assign the same products to a project, you have to really think about how you do things, so the chance of creating economies of scale is impossible at the moment'* (Retrofit supply chain manager).

4. Discussion

Taking the barriers to retrofit at scale identified and the suggested route of EERS sector development, this research now discusses how the recommended changes could promote self-sufficiency, and how the pathway to being independent from policy could be a profitable one. In relation to the suggested strategies for progress, in particular methods to enable easy wins are well positioned to boost innovation. This is linked to the suggestion to increase the level of energy efficiency improvements correlated with standard property refurbishment schemes. In this way a higher number of niches can be created, for enhanced ways in which to enable carbon savings within properties. Furthermore, in looking innovatively at linking energy efficiency with an increasing array of other property interventions, increased ability to bundle projects or improvements could occur.

Linked in with the suggestions of adopting innovate business strategies to enable increased niche development, the concept of

gaining a competitive advantage over other EERS sector practitioners is also well developed within interview feedback. Firstly, innovate client acquisition methods were deemed a primary way in which to gain a competitive advantage. This is related to the concept that to encourage member of the public to tackle property energy consumption, added ability to motivate and engage end users is required. Secondly, a focus on adaptation and flexibility is a suggested component of business which could generate a competitive advantage. For instance, in forming a business which reacts well to work load changes, over reliance upon sub-contractors will not result. In addition, in being flexible to retrofit, client and property requirements can be provided for, with a tailoring of offerings. Thirdly, advantages of competitors can be created by the adoption of efficient processes, procedures which ensure minimal impact upon business operational capital, turnover and profit margins. Furthermore, in streamlining processes involved with retrofit projects from cradle to grave, savings can be passed on to end users, along with reducing project timescales, increase the appeal of retrofit.

Suggested routes forward to limit the negative impact of outdated business operation strategies include the adoption of businesses methods which enable differing project types to be catered for, therefore limiting the boom and bust attitude of some policy implementation business types of the past. This increase in prioritising the sustainability of a business is also linked to the way in which businesses financially managed themselves to ensure longevity of operation. Professionalism of business approach is also linked to the way in which companies view retrofit projects in terms of a lifecycle, identifying multiple locations whereby profit and value can be gained. This is directly linked to the concept that innovative attitudes to client acquisition are needed to ensure that increases in the number of properties being retrofit are realised.

Additionally, outdated methods of working can also be combated by the introduction of innovative methods of working, and adopting new advances in retrofit technology, such as smart technologies and integrated working strategies between different EERS sector member. This in turn is suggested to provide a route to future proofing projects, and ensuring properties meet the standards of the future. This means that to achieve this forward thinking attitude, businesses need to stop viewing minimum standards of property performance as satisfactory, instead higher performance levels should be sought wherever possible, this in turn links to generating energy efficiency improvements alongside general property enhancements.

To remove the barrier a fragmented EERS sector presents, the following suggested aspects provide methods to enhance sector capabilities. Firstly, the stated strategy to adopt multiple profit centres means a business can be trained in differing areas, and form a network of practitioners across differing operational areas, limiting reliance upon subcontractors. To enable multiple profit centres, added flexibility in approach is required towards a project to ensure appropriate measures are applied to a particular property. This flexibility in turn, which is suggested to be enabled by increased training provision, particularly within SMEs, could reduce subcontractor reliance via increase business capabilities. The concept of linking energy efficiency improvements to standard upgrades also provide the option to reduce the fragmented nature of the sector, by greater stronger and more numerous links with general construction tradespeople. Furthermore, with a greater focus upon building physics, heightened awareness of scientifically tackling retrofit projects will occur on a more widespread basis. Being involved with local construction supply chain also provides added options of gaining trade, something particularly useful for SMEs, who are geographically restrained due to resource restrictions.

In pushing to be self-sufficient external to government incentive schemes, the EERS sector requires increases in the types and level of finance available to generate business growth, and invest

in innovative strategies and technologies to enable retrofit at scale. Although provision of finance is provided by external EERS sector organisations, such as high street banks, suggestions methods for businesses to best gain finance are to;

- I. Ensuring a high level of streamlining and efficiency of processes, shows to any investor of finance for growth that the business is intelligently utilising its resources.
- II. Increasing business training within an EERS sector company promotes the correct application of funds within a business, and minimises wasted resource.
- III. Innovatively looking at niches within the retrofit market, and identification of new strategies of gaining work, provides an attractive investment opportunity of investors, and therefore aids the growth of the sector.

Transaction costs or hidden costs were suggested as key barriers to EERS sector growth, with the costs associated with the establishment of a sector business or commercial operation as high. This cost in turn was stated to be passed onto the purchase cost of the service or product, therefore limiting the appeal of a new practice, in comparison to a more established traditional method of completing retrofit works. The suggestions for EERS sector self-sufficiency enable the tackling of this issue, by focusing upon streamlining of processes, prioritisation of adaptability and leanness to operation. Moreover, this barriers was considered removable via the injection of finances to promote swift growth of emergent processes or businesses, to assist in the reduction of transaction cost impacts. With added funds, it was considered that new methods of completing works could be upscaled at a rapid rate to enable per unit costs to reduce and appear competitive to prospective end users. This in turn links to the fact that newer retrofit business outfits need to ensure they can guarantee good customer care from the initial sales, enabling a quality reputation establishment.

5. Conclusion

This research has highlighted the barriers that restrict the self sufficiency of the EERS sector and identified factors that enable the sector which can increase the level of retrofit whilst also operating independently of policy incentive measures. The aim therefore is to generate a roster of strategies which could be adopted by sector businesses and practitioners to aid the economic growth and retrofit activity impact on the industry. From the selection of barriers created by businesses, the research has identified that organisationally, the EERS sector needs to develop to remove the limitation of limited training, business capacity and geographical coverage for instance, Furthermore, the lack of innovation within the sector is also a barrier which has been identified, along with the fact that transaction costs linked to business development and growth are hindering change. Furthermore, this innovation does not have to be limited by national boundaries, and indeed countries other the UK may have offerings within their own retrofit sector which could aid the progress of energy efficiency growth. Therefore, this learning across borders and resource sharing has the potential to fasttrack change within the UK. This innovative practice and change to the sector can also be seen as important in other nations, especially those attempting to meet carbon reduction target nationally. The way in which retrofit advancements have the option to offer multiple benefits, or economic growth, employment growth, carbon savings, and better occupant health, to name a few advantages, means that countries should be prioritising changes in this area. Change of increased practitioner training, business strategy and capacity, along with societal want to have retrofit works

carried out in particular has the option to take full advantage of these multiple benefits.

For domestic retrofit within the UK to increase to a significant scale, one area of thought within the community of the EERS sector, is to move away from government incentive policy method of increasing retrofit, and instead focus on the production of a self-sufficient, sustainable industry. This research has identified key barriers limiting the possibility of progress in this manner, and in turn connects suggestions by EERS sector practitioners of future strategies with the barriers they could break down.

Key recommendations are centred on increasing professionalism within the sector; this is reflected by various aspects. Including, the quality of practices carried out by the practitioners, at all stages from client acquisition to project handover, the ability of businesses to manage themselves with integrity and grow financially whilst providing career long jobs for individuals, the competence of the sector to future proof the UK housing stock, and to identify areas for carbon saving at every juncture possible. With this increased professionalism, and strategies enabling it, the key barriers of organisation structure issues, transaction or hidden costs, and minimal product and process innovation can be tackled. With progress in this manner, the prosperity of the sector and growth of retrofit can be anticipated, with an industry fostering high financial and employment opportunity growth.

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