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Integrating energy efficiency into private home repair, maintenance and improvement practice in England and Wales

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Integrating energy efficiency into UK private home repair, maintenance and improvement practice

Abstract

The energy performance of housing is a crucial element in plans for climate change mitigation, future energy supply and addressing energy poverty. The age of the UK housing stock, and its slow rate of replacement, indicate that attention needs to be focussed in particular on improving existing homes, a high proportion of which are private owner occupied. Thus, the improvements necessary to achieve carbon reductions will require both large scale investment and likely lead to significant disruption. The thriving home repair, maintenance and improvement market, delivered largely by small building trades companies and sole traders, offers practical opportunities and a potential route to market for such improvements. Set against the context of high level strategic targets, this paper draws on qualitative research at the micro level and presents a framework for the changes that will be needed to enable this to happen in practice, as well as insights into current practice and the existing regime in which the industry operates. Through application of a multi-level perspective to this socio-technical challenge, the work identifies the levels at which such changes should occur, and uses the results to develop and identify key weaknesses and solutions to enable change.

Keywords

Retrofit, energy efficiency, homeowners, socio-technical, building tradespeople, existing homes, micro-enterprises.

Introduction

The pressing need to take action to mitigate climate change is reflected in UK legislation, where the Climate Change Act (H M Government, 2008) obligated the UK to 80% cuts in greenhouse gas emissions by 2050. The legislation allowed for subsequent target alterations, and the target was raised to 100% in 2019, following the UK Committee on Climate Change's advice (Committee on Climate Change, 2019); reflecting indications of a

faster acceleration of climate change than previously estimated (Intergovernmental Panel on Climate Change, 2018). Slow progress and lack of effective policy are noted as regards the buildings sector, and the need for action on home energy efficiency was highlighted (Committee on Climate Change, 2018, Committee on Climate Change, 2019). The residential sector is central to mitigation scenarios, accounting for c. 22% of UK greenhouse gas emissions (Statistical Release: National Statistics, 2019) and 30% of UK final energy consumption (Department for Business Energy and Industrial Strategy, 2019).

The slow replacement of the housing stock means that the focus must be on improvements to existing homes, but the extent of renovation required to deliver significant carbon reductions presents barriers such as cost and disruption. A high proportion of UK homes are in private ownership, so decisions are made by individual homeowners (mainly owner-occupiers).

It is argued here that an opportunity is presented by the demand led home Repair, Maintenance and Improvement (RMI) industry, such that energy efficiency measures might be embedded here, marginalising both costs and disruption to households. This article presents the findings of research which aimed to develop an understanding of the operation of this market in practice in England and Wales, and to produce recommendations for change to support and enable realisation of such opportunities. Using a grounded theory approach, the research focusses on the views and experiences of the building tradespeople involved directly in RMI delivery, and builds from this base a theory for change that is grounded in practice.

Background

The need for action to reduce carbon dioxide emissions to mitigate climate change is the key driver for improved home energy efficiency. A further relevant context is provided by its potential impact upon occupant health and well-being: with lower income households living in energy inefficient homes unable to afford adequate heating, described as 'fuel poverty'

and recognised as a matter for national concern by the UK Fuel Poverty Strategy (H M Government, 2001) and subsequent reviews (Committee on Fuel Poverty, 2020).

The benefits of improved energy efficiency are multiple: reduced risk of debt, a comfortable home and better health chances; as fuel poverty closely correlates with excess winter deaths, cardio-vascular illness, respiratory and mental health problems (Koh et al., 2012). The link is clearly established, therefore, between home energy performance improvements and reducing both fuel poverty and carbon emissions. The question is how to achieve it in practice, especially in the context of existing homes.

Within a complex policy mix that has attempted to drive domestic energy efficiency over the past 20 years (Bergman and Foxon, 2020, Kern et al., 2017), the main regulatory mechanism to drive building energy efficiency remains as the application of increasingly stringent Part L: Conservation of Fuel and Power of the Building Regulations , which is largely focussed on new homes. A recent consultation on proposed revisions to these regulations in England in October 2019, proposed an interim standard and pushed the zero carbon ambition to 2025, 9 years later than originally planned (Ministry of Housing Communities and Local Government, 2019a). A significant consequence of this delayed strengthening of regulation for new homes is that even recently constructed homes will require retrofit of energy efficiency improvements to achieve 2050 efficiency targets. This, in the context of the very slow rate of replacement of the housing stock, with less than 200,000 new homes built per year over the past 10 years (Ministry of Housing Communities and Local Government, 2019c). It has been estimated that 80-85% of UK homes in 2050 have already been built (Brown et al., 2020), highlighting the need to make significant improvements to existing housing, and to accelerate this rate of retrofit.

With regard to improving existing homes, the focus of both government programmes and commercial markets has tended to be on those single measures that can deliver the quickest financial returns (Bergman & Foxon, 2020). The majority of which has focussed on the

homes of those in receipt of social benefits, suffering from fuel poverty and those occupying social and public housing (Bergman & Foxon, 2020). This has led to the uptake of a limited selection of measures, such as replacement gas boilers, cavity wall and loft insulation. This excludes some of the measures that could have the most significant impact on home energy efficiency, such as solid wall insulation (Pearson and Jaksch, 2016). It is typically through walls that the most heat is lost from the home, and there are around 7m homes in the UK where the construction precludes cavity insulation: walls with narrow or no cavities (Department of Energy and Climate Change, 2014).

A more holistic approach is required to achieve the full potential for carbon savings in existing homes (Rogers et al., 2015). The complex and inter-related range of measures will include insulation of solid walls and other building elements, improved management of ventilation requirements, low carbon heating systems and renewable energy microgeneration (Boardman et al., 2005). However, while technical solutions can be optimised by treating the house as an integrated whole, this is not always possible in practice, as the majority of renovation happens on a step by step basis over time, when it can be afforded, and allowing for occupation during building work (Fawcett and Mayne, 2012).

A further barrier to transition in this sector lies in tenure: the majority of UK homes are privately owned, with the last combined UK statistics indicating owner occupation at around 63% and private rentals at 19% (Ministry of Housing Communities and Local Government, 2019b). The motivation of these homeowners, as decision makers for action on their own properties, for getting RMI (Repairs, Maintenance and Improvements) works done does not necessarily conform neatly with the government targets for reducing carbon emissions: more likely concerns are the need for repairs, making the home more comfortable, usable or attractive in the sale or rental market. RMI, thus, typically involves either reconfiguration and extension, adding extra space or rooms; or modernising, such as the popularity of new

kitchens and bathrooms, both of which can be key areas for making changes affecting home energy use (Maller and Horne, 2011).

This consumer-led market is significant in size, with the category of Repair and Maintenance (R&M) work in private housing in Great Britain valued annually at around £5.8bn (2019), based on data from firms registered for employment taxes and VAT, and not including the additional element of 'improvement' (Office for National Statistics, 2020). The total value of work is likely to be considerably higher, as work undertaken by self-employed tradespeople with turnover below the VAT threshold is also excluded, representing a significant proportion of the over 900,000 self-employed people notes as working in construction in 2018 (Office for National Statistics, 2019b).

Given the financial and disruption barriers involved for homeowners, achieving a step change in household energy renovation faces significant challenges. It is argued here, as it has been elsewhere (Energy Saving Trust, 2011, Maller and Horne, 2011), that this market provides practical opportunities for the inclusion of energy improvements alongside the other building works which home owners need or want, as well as the potential for offering stand-alone energy improvements as part of the tradesperson's portfolio. These could include, for example: installation of thermal insulation when a roof, wall or floor is renovated; specifying high efficiency alternatives when replacement systems or units are needed; such as heating, cooling and hot water systems and windows (Maby, 2019). These 'trigger point' opportunities often occur at key stages, such as when people move into a new home (Energy Saving Trust, 2011, Building Performance Institute Europe, 2016).

Homeowners considering RMI works typically contact building tradespeople in order to discuss the scope of work to be undertaken and as such these actors could play an influential role in influencing the homeowners' decisions about what work goes ahead, potentially raising awareness of the opportunities for energy improvements (Janda and Parag, 2013, Wade et al., 2016, Maby, 2019). The UK RMI market is, however, a highly

fragmented industry, dominated by micro-enterprises and sole traders (Killip, 2011), who tend not to be members of associations or membership bodies, apart from those required to operate in particular trades (Maby and Owen, 2015). As such, an understanding of their views and working practice can be difficult for policy-makers to access, especially as relatively little research has been done to investigate this context further (Janda and Parag, 2013, Wade et al., 2017). 2019 data shows that 265,254 (81%) of the 325,736 construction firms in Great Britain had 3 or fewer employees, which highlights the predominance of very small businesses in this industry. The 0.5 million people employed by these firms represented 38% of the 1.36m employed in construction in Great Britain (Office for National Statistics, 2019a). 72% (by value) of R&M work was done by firms with less than 10 employees and 55% by firms with less than 5 employees (Office for National Statistics, 2020).

The qualitative research undertaken here aimed to fill this gap in knowledge, building upon the views and experience of micro-enterprise building trades, this work sought to build a bottom-up picture of how the industry could be enabled to deliver the home energy improvements needed to deliver national policy goals. A theoretical framework for the transformation of this industry is presented and recommendations for change are proposed at all levels of the system within which they operate; from local and regional support for their activities through to national policy and regulations. This research identifies and proposes evolution at all levels in order to enable an increase in the delivery of home energy improvements, through the market opportunity presented by mainstream RMI activity.

Method

The research approach adopted was that of 'grounded theory', broadly defined as the discovery of theory from data, which differs from the traditional focus of verification of hypotheses (Glaser and Strauss, 1967). Key to this approach is that the theory developed is

firmly grounded in what is actually occurring in practice in the particular field of activity (Charmaz, 2006, Bryant and Charmaz, 2007, Glaser and Strauss, 1967). It is practical rather than abstract, and aims to address real practical needs (Denscombe, 2011). This approach was selected for several reasons. Firstly, because it lends itself to the development of practical solutions of relevance to the research participants. Secondly, it is appropriate for a topic previously under-researched: where the perspective of the RMI building tradespeople remains largely missing from retrofit research literature, where the focus tends to be on technical solutions, government policy or household priorities and behaviour. Thirdly, a grounded theory approach employs theoretical sampling, selection of groups based on their relevance for the further development of emerging categories, up to a point of data 'saturation', that enable the discovery of theory, rather than a fixed pre-planned sample (Glaser and Strauss, 1967). This approach to sampling is useful in working within a fast changing and disaggregated industry, where research participants may themselves experience significant change during the course of the research.

The main source of data was 57 semi-structured interviews, carried out in two phases. Additional data was obtained through two discussion groups, engaging a further 21 participants, with two interviewees joining the second group. The total number of research participants was 78, of which 40 were building tradespeople. Noting that building trades do not operate in isolation, a sample was included of other key actors with whom tradespeople connect in the course of their work, such as builders' merchants and suppliers, trade associations and building control professionals, while the discussion groups provided the opportunity to test the findings with policy professionals with a national perspective. An overview of research participants is provided in Table 1.

Table 1: Overview of research participants

Category	Interviews	Round table discussions	Total participants
<i>Building trades</i>			
general builder	21	3 (+1 interviewee)	24
plumber/heating engineer	7		7
electrician	2		2
carpenter/joiner	3		3

bricklayer	1		1
painter/decorator	1		1
roofer	1		1
insulation installer	1		1
Other			
trade associations	4	(+1 interviewee)	4
planning/building control	3		3
architects	1	2	3
Self-build homeowner		1	1
training professionals	4		4
merchants/suppliers/manufacturers	8	1	9
academics/consultants/researchers		8	8
public sector policy professionals		3	3
related services/advisers		3	3
Total	57	21 (+2)	78

(Maby, 2019)

Interviews were transcribed in full and qualitative coding approaches employed; whereby initial codes were subsequently grouped into focussed themes related to the research aims.

The first phase of the work investigated standard practice within the RMI industry, by seeking the views of a range of building tradespeople, merchants and suppliers, with the main focus on building tradespeople; how they find their customers; and how decisions are made about the work that will be done. This led to investigating the extent to which they include energy improvements in what they offer, whether they advise the customer on this issue, and the typical customer response, any barriers to delivering energy improvements, and where they would find help and information were it to be needed.

The second phase of research sought to identify recommendations for change that might enable an increase in the quantity and quality of application of energy improvement measures by RMI building trades. Building on the findings of the first phase, interviews focussed in particular on the role of the general builder in the specification and managing of practical delivery of home energy improvements within RMI, and how individuals have learned to do this. In addition to general builders themselves, the views of construction training professionals and suppliers of energy efficiency products and materials were sought.

Gaining access to building tradespeople to interview was largely achieved through the use of social and neighbourhood contacts, asking them to suggest other potential research participants, as busy tradespeople were found to be generally unreceptive to interview requests from a stranger, without introduction.

This approach ensured that the sample was relatively mainstream and without a clear bias towards specialists in 'green' technologies, although a degree of bias towards self-selection inevitably existed in that the research was introduced as being about energy improvements. It also meant, however, that the geographical scope was relatively limited, with more than half of interviewees based in the same region as the researcher's domicile, on the English/Welsh borders in the counties of Monmouthshire, Herefordshire and Gloucestershire. Mitigation of the risk of a rural/small town or other geographical bias to the results was sought by checking against 23 interviews from further afield, including West Yorkshire, London and Birmingham, enabled through a collaboration with Leeds University and through formal industry networks: the Federation of Master Builders and the Association for Environmentally Conscious Building. 11 further interviews were with organisations with a wider geographical remit: trade associations, manufacturers and training colleges. The round table discussions provided the opportunity to discuss emerging results with other researchers, programme managers and policy professionals and were organised as informal discussions to encourage open debate: the first as a networking session with building professionals as part of a conference, and the second as a facilitated workshop where the results of the first round of fieldwork were presented and discussed.

Results

The qualitative data gathered provided key insights into standard practice within the UK's RMI market. This helped to establish if, when and how energy improvements might be included in such work. The findings from both phases of the research are presented below within the four key coding themes that emerged from the first phase of research.

Theme 1: Informal local networks as standard working practice

Interviews with building tradespeople confirmed the picture of a market characterised by sole traders and micro-enterprises. They also established their preference for working as locally as possible, for practical, economic and personal reasons, with local roads, construction materials and styles, suppliers, and planning and building control authorities known to the tradesperson.

'No more than 20 miles now, it's because of the children, it's a balance between the two' [Plumber/Heating Engineer - Monmouthshire]

Another reason, identified here, to work within a particular locality, was the value placed on reputation, and for personal recommendation rather than marketing to get work. As well as saving time, interviewees reported that getting work through individual recommendations and community networks, had higher chances of conversion, when compared to providing multiple competitive quotations to secure work. In some cases, low-cost marketing was placed in a local newsletter.

'Most of our enquiries are word of mouth. We've been in this business for 25 years' [Heating Engineer, Cambridgeshire]

Personal recommendations were not only found to be reassuring for the homeowner, but also perceived to reduce risk of non-payment or difficult customers for the tradesperson.

'I think it's just as important for the builder to vet the customer as for the customer to vet the builder ...' [General Builder, Monmouthshire]

Another insight from these interviews was that these very small businesses were concerned about the risk of taking on employees and were not necessarily motivated by business growth.

'We have employed people in the past, but it's too uncompetitive to employ people. The costs of employing people are massive ...' [General Builder, Herefordshire]

This research established that RMI SMEs feel that staying small offers the flexibility to carry out work alone and minimised the need for pursuit of work to retain employees. More complex projects were still undertaken, through collaborative working with other building tradespeople within informal local networks. Here, customers typically liaise, initially with one building tradesperson, who then brings in others, as needed. An RMI building project might thus involve several trades, including building services as well as construction, with micro-enterprises providing a wide range of work, from minor repairs, new kitchens or bathrooms, and renovations, including loft conversions, extensions or whole house renovations. This confirmation of the range of work and flexibility of approach affirmed that RMI indeed offers the potential for embedded delivery of the full range of energy improvements, alongside the necessary skills to deliver them.

'I work with a plumber...and very often perhaps there's a brickie or a carpenter, and everyone knows each other....because back in the 70s or 80s there used to be one big company and they used to employ everybody...' [Electrician, Herefordshire]

Theme 2: How decisions are made about the work to be done

This research reinforced the concept that building tradespeople tend to be the first people that homeowners approach when they are considering building work, and so can be influential both in providing advice about options and in developing the detail of such work. Interviewees noted that their influence was enhanced by having a good local reputation and being recommended by other customers.

'Certain people know exactly what they want...others are not really sure and are looking for advice from people in the trade like me...' [Electrician, Gloucestershire]

'I am in quite a good place generally because I am recommended... I am pretty sure they are fairly comfortable that I am not doing it just so that I can make as much money as I can' [Carpenter/Joiner, Herefordshire]

The building tradespeople interviewed were generally aware of the multiple benefits of energy efficiency improvements, for comfort and energy bill savings, as well as environmental impact. They were less confident, however, in their ability to convince the homeowner to accept additional costs for such measures, where these were not required by regulations.

'When I do my quotes, I try to explain that the energy efficiency measures I have included will decrease their heating bills... and increase their comfort...but... other builders won't be quoting for [this]..., and I may not get the job as a result' [General Builder, Monmouthshire]

This highlighted the importance of Building Regulations, as a key driver for ensuring that homeowners do not simply choose the cheapest option in such situations.

'If the Building Regs insist on a certain level of insulation, then...anyone doing a quote will know that' [General Builder, Monmouthshire]

'Intervention, simple and powerful like Building Regs...and you can crank it up over time' [National chain of Building Merchants]

The value of independent advice was noted: confirming for the homeowner the specific measures and the potential comfort improvement and financial, carbon and energy savings that they could expect. Subsidies and financial incentives were discussed, but were perceived by the interviewees as providing limited opportunities for them to engage, creating market instability, without lasting benefit.

Interviews indicated that the building tradespeople would also benefit from access to trusted sources of information advice, and Building Control was suggested as a potential source.

While it was recognised that suppliers of materials and products are not independent of commercial bias, the provision of free training on the use of such products was perceived as beneficial, together with access to site-specific advice from these sources, where necessary.

Theme 3: The key role of the general builder

Where a homeowner has a specific small task to commission, it might be anticipated that they would contact the relevant tradesperson for that job, such as an electrician, a plumber, or a roofer. In practice however, many jobs are more complex, and may involve several of the distinct and defined trades. The Federation of Master Builders, however, notes that the most commonly used category in their search engine is that of 'builder': who offers a wide range of building services, and can manage a project which involves more than one trade. This role, might be referred to as a 'general builder' and its importance was further emphasised by the findings of this research.

'I've done everything from the groundwork to the drainage to the footings, the brickwork - except for the plumbing and electrics....it's basically whatever job comes along' [General Builder, Worcestershire]

It is often assumed that a building professional such as an architect, architectural technologist or surveyor is engaged in renovation projects, to provide the design, but also sometimes the detailed specification and project management. While this was confirmed to an extent by this research, interviews with general builders revealed that in the typical domestic RMI job, they may themselves carry out some or all of these tasks, complementing, or even in the absence of, the architect's role. This can include not only the coordination of the work on site, and ongoing liaison with the homeowner, but also the design and specification, and obtaining necessary planning permissions and building control approvals.

There are both decision-making responsibilities and financial risks associated with taking the lead in all or some of the roles indicated above. Financial risks or cash flow difficulties could arise from a customer holding back payment, or from paying for materials, labour or sub-contractors in advance of receiving payment from the customer. In some cases there could

also be penalties for late completion. A variety of arrangements were found to be employed in practice to share risk and at least some of the responsibility, such as each tradesperson working under direct contract to the customer rather than being sub-contracted to the general builder, and requiring that customers pay the supplier directly for materials. In some cases the homeowner may choose to project-manage the work themselves.

Interviews with builders identified the particular problems associated with renovation work on older buildings, where some details (or the extent of potential problems) may be unknown until the work is underway. This highlights the need for a broad range of building skills, knowledge and on-site experience to deliver effective energy efficient solutions, as well as on-going communications between various actors. The contribution of the 'general builder' in domestic RMI work to this kind of problem solving – and to providing the continuity from customer liaison, design and specification, through to project management and completion - can be significant.

"I think people are quite relieved to find a builder who can not only do the work but can also talk about possibilities.... the way I like to work is with a continuous dialogue with the client because I'm fully aware that as a building grows then ideas change..."
[General Builder, Monmouthshire]

Theme 4: Training and qualifications

The fourth theme that was identified in this research centred around how those undertaking the RMI role, and in particular the role of the general builder, have gained the necessary knowledge and skills, both to identify the opportunities for energy improvements within RMI work, and to deliver them in practice. This required exploring the extent to which low carbon renovation is addressed within training. Through interviews it was established, however, that there is no clear educational pathway or qualification for the domestic RMI general builder in the UK, despite its apparent central role to a large proportion of RMI projects. Indeed, the

general builders interviewed had developed the necessary skills and knowledge, in a number of ways:

- initial training in a construction trade, evolving into general builders to meet demand, finding themselves bringing together other trades, to form teams for particular jobs;
- renovating their own homes and consequently being asked to do the same for others; *'I needed to build an extension at home...and then my next door neighbour said to me could you build me one?... And a neighbour over the road said could you do me one? And then a neighbour round the corner...'* [General Builder, Cheshire]
- bringing transferable skills from previous professions, including engineering or project management;
- working for their family's building business, at a time when more substantial local building businesses employing all the trades had been able to thrive (anecdotally, referred to as prior to the 2008 'crash'); deliberately following several trades in order to learn the holistic business.

'...back 20 years, when my father was in charge...I was an apprentice... and we had one or two carpenter apprentices and two bricklayer apprentices, he trained them to work like he wanted them to. [holistically]' [General Builder, Worcestershire]

Interviews with trade associations and training professionals confirmed a lack of provision for the domestic RMI "general" builder, working within the complex context of existing buildings, as well as the wider skills required by those establishing and running small businesses, despite the majority of subsequent employment being found in the latter market.

Developing a theoretical framework

Having undertaken this primary research, a review of relevant theoretical literature identified the socio-technical transitions approach as of particular relevance, as it takes into account social and organisational as well as technical factors (Killip et al., 2013, Gibbs and O'Neill, 2014, Tweed, 2013). Building on the analysis of socio-technical processes for moving 'green entrepreneurship' from niche to mainstream (Gibbs and O'Neill, 2014), this research took as

the innovation or 'niche' the potential for integration of energy improvement measures into RMI work. It was observed by Gibbs & O'Neill that businesses do not operate in isolation, but within a socio-technical framework, that is impacted upon by both 'regime' and 'landscape' level influences and constraints (2014). This was reflected in the insights developed here, that enabled a picture to be developed of the localised system in which RMU tradespeople operate. This was found to consist of overlapping informal social networks, through which they get their work and collaborate with other trades, as well as suppliers and merchants. The regime level of influence is identifiable in part as the regional implementation of Building Regulations and Planning, in which RMI business operates, both of which are enforced at local authority level. Another core aspect of the 'regime' highlighted here is the system of training and qualifications. Overlaying these, and impacting upon both regime and niche levels, is the landscape of national regulation and policy.

These insights led to the adoption of a multi-level perspective (MLP) to socio-technical transitions to develop the theoretical framework for this research (Gibbs and O'Neill, 2014, Kivimaa and Martiskainen, 2016). The local system in which RMI building trades work, the regulatory (and qualifications) framework for the industry, and the national policies which direct and influence these align clearly within the three levels identified in work on strategic niche management (Geels, 2004, Geels and Schot, 2007) as:

- Micro-level (niche): the commonest source of new ideas and practices
- Meso-level (regime): encompassing forces, typically resistant to change
- Macro-level (landscape): trends and events, providing the context in which change may be helped or hindered

Transitions literature points out limitations to the use of the MLP approach, such as that it does not necessarily illustrate the power relationships in the way that the levels influence each other (ibid). These relationships might be better understood by describing the business dynamics in interactions between levels (Geels, 2010). This was reflected in the views of

building tradespeople during interviews, indicating that their scope for action is directed and constrained not only by customer demand, but also by policy and regulation – so that while innovation may be bottom-up, power relations remain top down.

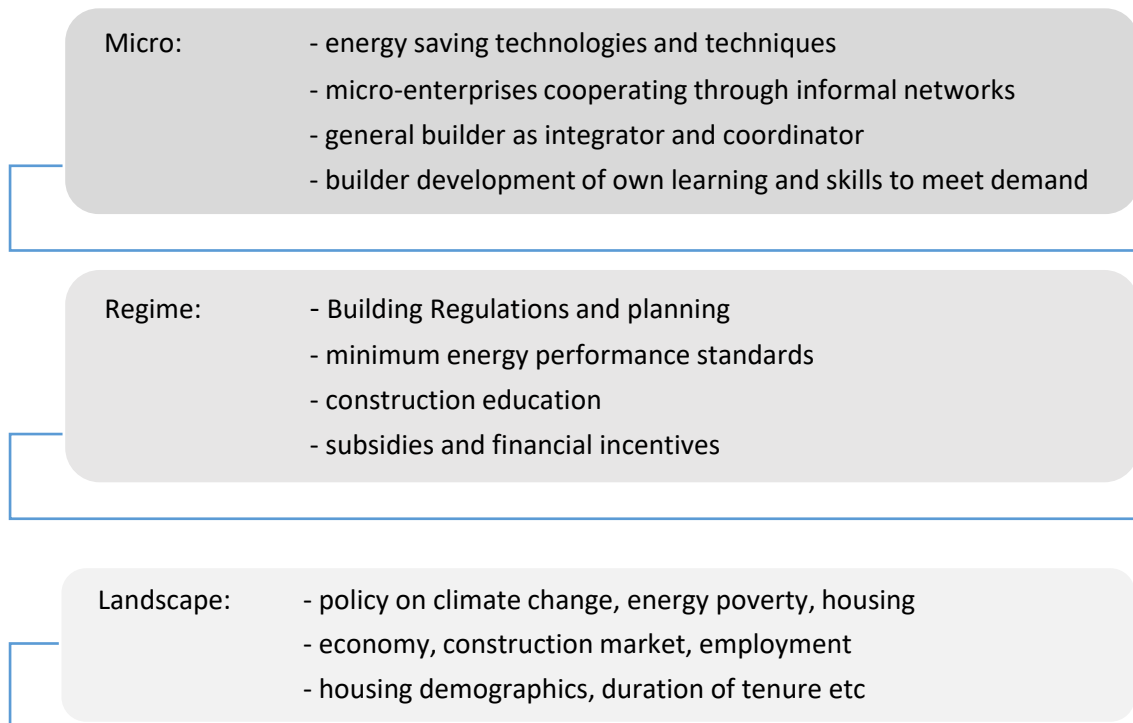
A departure from previous analysis of green entrepreneurs as innovators is that where the mainstream building industry was seen as 'regime' by Gibbs & O'Neill (2014), the findings of this research support an argument for categorising RMI micro-enterprises rather as micro-level innovators: adaptable and responsive to change, creating new business structures in response to economic insecurity and market changes, and actively problem-solving in their everyday work. The RMI industry under consideration here is therefore seen to differ fundamentally from larger companies engaged in new housing developments.

Home energy improvements within RMI: current practice

Applying this approach to analysing the topic, the key innovation proposed at the micro level is the embedding of energy improvements within RMI. As noted above, an innovation already introduced, as indicated by this fieldwork, is the shift from building businesses employing several trades to micro-enterprises working through informal networks to bring together the trades required for each job. A further innovation is the evolution of the multi-tasking role of the general builder to fulfil the need for project coordination and integration of the different trades, alongside the different ways in which general builders have gained the knowledge and skills necessary for this role in the absence of a specific, formal educational pathway.

The regime level consists, as noted above, of building regulations and planning, alongside financial and fiscal matters that impact upon building renovation decision making. While, the landscape level consists of policies on climate change, housing, energy poverty and their impact on home ownership, duration of tenure, investment in housing by individuals and others. In summary the home energy improvements within current RMI practice can be placed in the context of the proposed MLP framework, as described in figure 1.

Figure 1: Home energy improvements within RMI: current practice



(Maby, 2019)

Discussion

Within the context of this emerging framework for action, the analysis of the results of this research can be seen to draw out some key challenges or weaknesses to the integration of energy improvements into mainstream domestic RMI work in the UK. These are discussed below, highlighting the links recommendations at Micro (**M1, M2**), Regime (**R1, R2, R3 & R4**) and Landscape (**L1, L2 & L3**) levels as summarised in Figure 2.

Driving improvements – making low carbon renovation of homes happen

At the regime level, the gap in policy to achieve the challenging carbon and fuel poverty targets for homes, highlighted in the introduction, was clearly reflected in the responses from interviewees. Building Regulations were seen as key to driving this market, while their manner of implementation, support and enforcement is of critical importance (**L2 - Forward**

plan for tightening regulations in existing as well as new buildings). In practical terms, this means ensuring that every ‘trigger point’ opportunity in the life of a building to make energy improvements is realised (Energy Saving Trust, 2011, Building Performance Institute Europe, 2016). The forthcoming review of the Building Regulations regarding the conservation of energy in existing buildings in England is an opportunity to make sure that this is achieved (with similar requirements under consideration in the devolved nations), and will provide the clarity on minimum energy efficiency targets that the RMI practitioners interviewed here sought, in order to level their market. This will not be an easy task, especially across the UK, with its old and diverse housing stock, requiring this to be informed by “**L1** a national renovation plan to reach zero emissions building stock”. Decisions made in this respect should be part of, and consistent with, an integrated long term landscape level strategy on climate change, with clear interim targets. This is likely also to require the application of (increasingly stringent) minimum energy efficiency standards at relevant points, such as sale and rental (**L2**) (Sunderland and Santini, 2020).

Creating the demand for energy improvements at the regime level (**R1**: *strengthen enabling and enforcement through Building Control and independent advice*), underpinned by a long term strategy at regime (**R1**) and landscape levels (**L2**), would enable the RMI industry and the related supply chain (micro (**M1**: *recognise value of RMI micro-enterprises in local supply chain*) & regime levels), to develop the necessary capacity (**R2**: embed energy improvements into each building trade syllabus and qualifications; **R3**: *raise qualification level that trades move from training to practice*, **R4**: *new qualification for general/master builder tailored to domestic RMI*) to deliver what is needed.

Getting it right: advice, information and quality

Discussions at policy, (landscape) level in recent years have also highlighted concerns about quality in building work (Bonfield, 2016). With regard to energy improvements there are well-founded concerns around creating new problems (while addressing old ones), such as interstitial damp, lack of adequate ventilation, or over-heating (Hansford, 2015, Bonfield,

2016, Building Research Establishment, 2017, Rickaby, 2015) . This tends to raise questions about compliance (by practitioners) and enforcement, likely at the regime level, through building control (**R1**) (Pan and Garmston, 2012). ~~There is also a risk that insufficient focus is given to enabling and supporting an expansion of good quality work that is already taking place.~~ In this context the findings of this research, in particular that RMI building tradespeople tend to get their work through personal recommendation, and as such rely on their reputation for quality and reliability for future work, indicates that quality is already core to their business models (**L3: ongoing communications programme between national and local government, industry, and citizens**). This research emphasised their call for effective enforcement of regulations (regime level: **R1**), leading to a 'level playing field' in which quality cannot be the factor that enables financial undercutting (at the micro level - **M1**).

Improvements in construction training to reflect low carbon renovation needs

This research has also identified potential gaps in the current provision of construction and building services education at the regime level that is likely to present barriers to effective incorporation of sustainability into standard practice (**R2, R3 & R4**). In particular, formal education provision for the building trades appears to be missing the cross-cutting knowledge and skills to deliver the design and specification of renovation projects, as well as the on-site coordination required by holistic low carbon RMI practices (**R4**). This, despite the finding here that such practices are often undertaken by the general builder at present, in the course of holistic RMI work. Were RMI work to mainstream low carbon practices, this would be a matter for particular concern, for example in identifying the appropriate response to the complexities of changes to heat and moisture movement within a building following substantial energy efficient retrofit (**R2**).

Not only is there a gap in this provision for the role of the general builder, but sustainability and low carbon renovation were found not to be comprehensively embedded in construction and building services education for the individual trades (**R2**).

One of the main drivers for the scope of current training is its current funding arrangements, whereby larger construction industry employers have a strong influence on apprenticeships and training; shaping educational remit to fit their commercial priorities, typically focussed more on new build than existing buildings (**R4**). This, despite much of the subsequent employment being in micro-enterprises, typically engaged in domestic RMI. A related issue also raised in the interviews was the length and scope of apprenticeships: one interviewee compared the 7 year apprenticeships existing before the Second World War with the 5 years his father had completed in the 1960s, and his own 3 years in the 1980s. Apprenticeships as short as a few months were reported by a recent review of construction qualifications in Wales (Qualifications Wales, 2018). Others pointed out the tendency for apprentices to leave training at a stage of training inadequate for the complex decision making and sensitivities of low carbon renovation within the context of RMI (**R3**). Similar concerns regarding the limited scope, and inadequacy of such training as a preparation for working life have previously been highlighted in literature (Brockmann et al., 2010a, Clarke et al., 2017, Brockmann et al., 2010b).

Discussion of building services training and qualifications with interviewees also raised the question of licensing of building trades. The UK's Federation of Master Builders advocate the development of this approach in the UK, alongside a new general builder qualification (**R4**) (Federation of Master Builders, 2018). The key driver for this initiative, informed by studies of implementation in other countries (Pye Tait Consulting, 2014, Pye Tait Consulting, 2018), is to raise quality and professionalism in the building industry, by creating an obligatory control mechanism, which is clear to consumers as well as the industry. A longer-term advantage of such a scheme would be in its provision of a mechanism for continued development on new technologies and products. It would also provide a communication channel between the building industry (micro: **M2**: *acknowledge and support role of general builder as integrator and coordinator*) and statutory authorities (regime – **R4**), which was found by this work to be

lacking at present. A consequence of the latter omission is that there is no systematic way to inform the dispersed industry of changes in Regulations nor the rationale for such changes. In the context of ongoing advice and training in practice, the tradespeople interviewed here highlighted the value of being able to access site-specific advice on the use of retrofit products and materials, as well as free training on the use of different products for more complex works, such as solid wall insulation. Another issue that was raised by interviewees was the importance of supply chain quality and reliability; where the need for confidence in consistent product quality, and access to efficient follow-up advice and replacements when problems arise (**M1**). In this context the potential for the Building Control function to play an enhanced role in providing advice alongside their existing role was proposed (**R1**). Local accessibility for site visits and knowledge of the local vernacular were considered distinct advantages to having this facility at regime or local level, potentially supported by access to databases of local good practice and appropriate technical solutions, in particular with respect to the effective treatment of older buildings (Jenkins and Curtis, 2014, The Society for the Protection of Ancient Buildings, 2014).

Acknowledgement and support for different roles in a renovation project

As a discovery in this research the general builder was found to be carrying out a range of roles including design, site management and energy adviser in many complex RMI projects, typically due to the absence of a built environment professional. This lack of standard practice for the necessary roles within a domestic renovation project at the micro level, can lead to a lack of clear lines of responsibility, with general builders taking on more tasks than are fully understood or acknowledged by customers (**M2**).

This gap has been noted in relation to major renovation work, such as for social housing developments, and has led to the development of the concept of the 'Retrofit Coordinator', along with associated roles, such as Retrofit Designer and Retrofit Adviser, within a new 'Publicly Available Specification' for retrofitting buildings to improve energy efficiency,

launched in 2019 (British Standards Institution, 2018). Although, it should be noted here that the introduction of additional professionals into the typical single home RMI project may not be perceived to be economically viable, the acknowledgement and definition of these multiple roles is useful and confirms the findings of this research. It would seem reasonable therefore to propose that general builders should be able to access the training and resources to enable and support them to effectively deliver their existing multiple role to a high standard (**R4**).

A resource to consider in this context is the RIBA Plan of Work (RIBA, 2013), used for larger projects. A simplified, adapted version of this might be useful for domestic RMI projects, as a checklist to ensure that the different roles and responsibilities are identified and agreed.

Proposals for Future Enhancement

The innovations already noted at **micro**-level are a logical response to the economic landscape and a strength that might be built upon, in order to shift the delivery of effective home energy improvements, from a niche activity to the mainstream, through opportunities provided by the substantial demand-led RMI market. To promote this market transformation, a range of additional potential solutions across the landscape and regime levels can be proposed.

It will be necessary to strengthen the **regime**-level structures within which this industry operates. As regards training and qualifications, proposals include the embedding of low carbon renovation into each of the building trade training syllabuses and qualifications, as well as related professions, including building control. This would also be supported by the raising of the minimum level at which trades typically move from training into practice, to reflect the increased sophistication of technologies and complexity of decision making required for low carbon renovation. A further requirement is to develop a qualification tailored to the requirements of the general builder working on housing and other small and medium

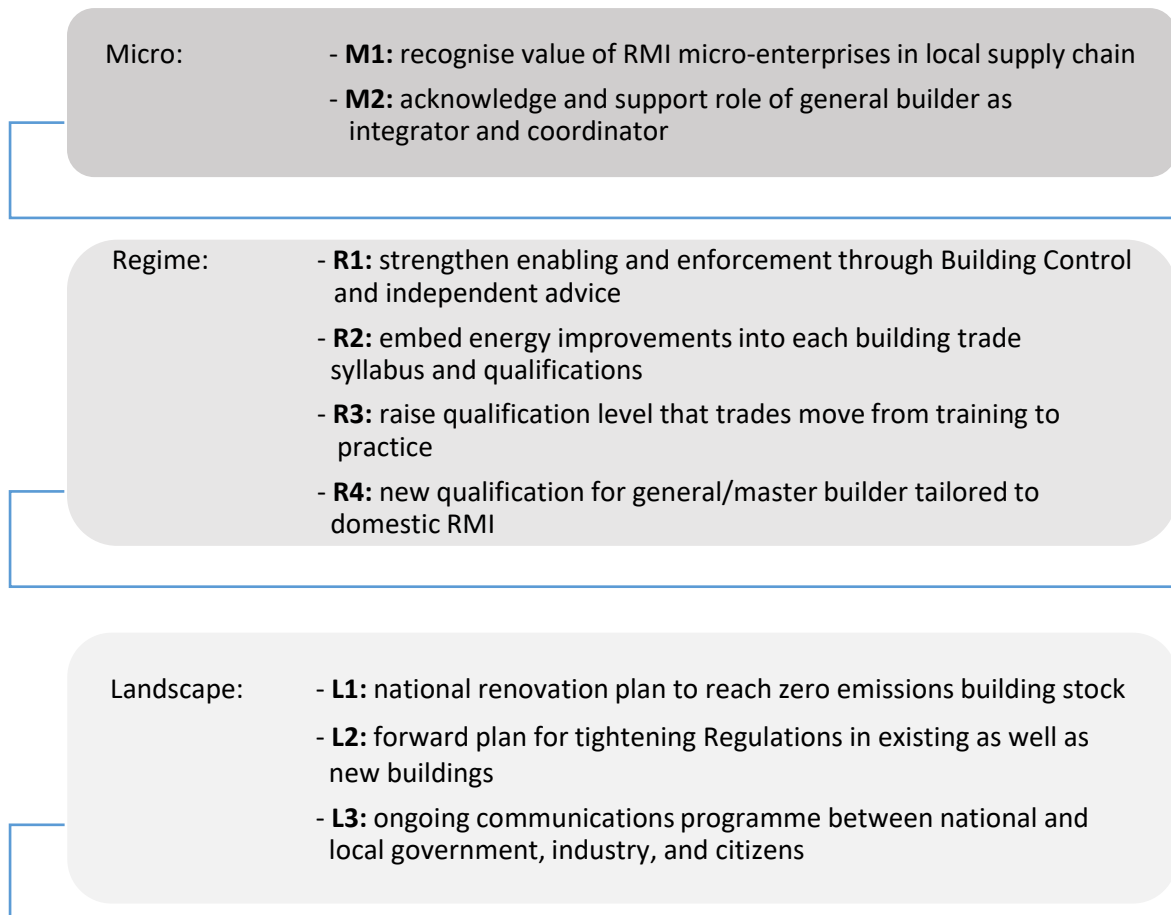
scale RMI. This to include design and specification, project management, and site coordination, all emphasising sustainability.

Another regime-level improvement needed is to strengthen relevant roles at local level, in particular Building Control (Murtagh et al., 2016). This may be linked to the provision of commercially independent expert advice for homeowners as well as building trades. A further regime level intervention could be to address the role disconnect between larger scale initiatives (such as those led by government or energy suppliers) and the localised small businesses that characterise the RMI industry (Genovese et al., 2013). Even the larger businesses engaged in such programmes struggled with the 'feast or famine' effect when programmes ended or changed with ineffective transitional arrangements (Pearson and Jaksch, 2016). Longer term structural financial incentives, however, such as through property taxes, may support the industry more effectively (ibid).

These changes require support at the **landscape** level, such as a forward plan for increasing building regulations on energy performance, in line with a clear pathway to a zero emissions building stock. An ongoing communications programme would ensure awareness and understanding of the direction of travel, as well as the practical implications: between national (and devolved country) government, local government (as enforcers and enablers of the 'regime', as well as the most accessible level to citizens and local businesses), the industry and homeowners.

These recommendations for change are presented in Figure 2.

Figure 2: Recommendations for change: home energy improvements within RMI



(Maby, 2019)

Conclusions

The slow replacement of the housing stock means that making energy improvements to existing housing is essential to achieving the UK's climate and energy targets, as well as addressing fuel poverty. The substantial, demand-led, RMI market, studied here, offers daily opportunities to introduce such improvements. Based on the qualitative data gathered, this research has provided key insights into standard practice within the UK's RMI market, highlighting actions to ensure that such opportunities are realised and aligned across the landscape, regime and local levels of activity.

Theoretically, this was recognised as a socio-technical challenge (Killip et al., 2013, Gibbs and O'Neill, 2014), operating on several levels and a multi-level approach (Geels, 2004,

Geels and Schot, 2007) was adopted to present both standard current practice and recommendations for change. Through the application of the multi-level structure, it can be seen that landscape level targets and drivers can be underpinned by regime level structures and changes to enable the micro level (represented by the RMI building trades) to deliver effectively.

The general builder, typically working at a **local** level, has been found to hold a significant role: in influencing the decisions of homeowners; as well as in developing and even designing the details of the work to be done; bringing together the team of tradespeople needed for each job; and coordinating the work on site. As such, general builders can play a key role in practice in promoting and delivering energy improvements, noting that in this context built environment professionals such as architects are frequently not involved. Researching the perspectives of these micro-level actors has highlighted the importance of the implementation of minimum standards for existing homes, through regime level Building Regulations and improvements in construction education, and a supporting and consistent policy landscape to support the delivery of energy improvements.

Recommendations for change suggested by this research, as summarised in Figure 2, include: the embedding of sustainability in training for each building trade; the creation of a new comprehensive qualification for the general builder, which recognises the role taken in practice; and a strengthening of Building Control facilities, with adequate resourcing and the ability to offer advice on how to achieve the required standards. At landscape level, policy needs to be consistent and long term, with a clear path to a zero emissions building stock, and supported by an effective communications plan between government (national, at devolved nations level and locally), citizens and the industry.

It should be noted that the research presented is qualitative and based on a limited sample of participants, such that the results cannot be quantitatively evaluated. It is also acknowledged that logistics limited the research to those small businesses active at a very

local level. Any resulting regional bias was minimised through review of findings using national scale focus groups.

Further research building upon the work presented here might focus on an investigation of the use of Building Regulations for existing residential buildings and the details of how this might be applied most effectively across tenures and types of building. A second area of interest would be an international review of training and qualifications for general builders, including a skills analysis of the requirements for low-carbon retrofit of residential buildings, as this is likely to be increasingly required in most countries, albeit with variations in the challenges posed according to variations in age and typology of stock. Further, it would be beneficial to investigate the balance between the role of the architect and indeed other built environment professionals, including the emerging energy focussed roles and that of the general builder, in the context of works to existing buildings.

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