What motivates building repair-maintenance practitioners to include or avoid energy efficiency measures? Evidence from three studies in the United Kingdom

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1. Introduction

Homes must become more energy efficient to meet the UK policy target of net-zero CO_2 emissions by 2050 [1]. The UK residential sector alone accounts for 22% of end-use greenhouse gas emissions, a contribution which has changed little over the last 15 years [2].

The UK Industrial Strategy Construction Sector Deal [3] set an ambition to halve the emissions of new buildings by 2030, through developing innovative energy and low carbon technologies. The strategic agenda on construction is focused on new-build, with particular interest in modern technologies such as robotics, artificial intelligence, off-site and modular construction methods. However, evidence demonstrates that while UK strategy has tended to focus on new build, the primary problem lies elsewhere. An estimated 87% of existing residential building stock is expected to be in use in 2050 [4]. To meet the legally binding target of net zero CO_2 emissions by 2050 [1], energy efficiency measures are required on 25 million existing homes throughout the UK [5]. This is already technologically achievable: for example, high performance insulation and window systems are readily available. But how can essential stakeholders be engaged to deliver the steep decarbonisation required?

Focusing on how to engage key actors in the domain of energy-efficiency retrofit, the paper offers a novel theoretical contribution, applying an established framework from the field of behaviour change. We first briefly present an overview of the repair, maintenance and improvement sector. We consider relevant policy initiatives and review previous research in this area, before examining how energy efficiency fits within the sector. We then outline the background to the theoretical framework, COM-B (Capability, Opportunity, Motivation, Behaviour) [6] and provide a short explanation. After presenting the method and findings of the empirical study, the Discussion section considers the implications, forming the basis for recommendations in the Conclusion.

1.1 The repair-maintenance-improvement sector

The construction sector in Great Britain is composed primarily of micro and small enterprise builders and tradespeople: 77.1% (1.7 million) are self-employed or work in businesses employing fewer than 50 people, and 39.9% (926,000) are sole operators [7]. Work on the existing housing stock, referred to as Repair-Maintenance-Improvement (RMI), constitutes 17% of construction output [8]. RMI work includes all forms of construction and maintenance activity on existing homes, from window replacement to adding extensions. Factors relating to energy efficiency are not typically a primary objective of RMI work [9] and the individuals already making a living within repair and maintenance may not see benefit in expanding to cover energy-related retrofit. Innovating in the technologies and techniques used in order to ensure homes and buildings become more energy efficient can be a risk for a sole tradesperson or small-to-medium enterprise (SME) who, by contrast, understand well the products they install on a regular basis [10, 11]. In sum, the core actors in the sector may not be motivated to engage with the actions necessary to deliver zero-carbon homes.

Previous research on domestic energy retrofit has tended to focus on policy [12], technology [13] and performance [14]. The people involved have been less well-served in academic studies. While there has been more attention paid to householders and building occupants in recent years [15-17], the practitioners themselves have had relatively little focus. There are exceptions, such as a valuable contribution to the literature that distinguished intermediary roles from that of 'middle actors' [18], shifting the focus from intermediate organisations involved in policy implementation [19] towards individual practitioners. Some of the few studies which have investigated RMI or retrofit professionals include a study of the perspectives of building performance evaluation practitioners in the UK [20], an investigation of attitudes and approaches of practitioners in the sector in Ireland [21] and barriers to retrofit for the fuel poor in the UK [22]. However, the studies did not clarify if their

research participants were drawn from the micro- and small-enterprises which characterise the sector nor did they draw on established theory.

The role of these SMEs, and micro-enterprises in particular, has been largely neglected in policy development debates. Further, their voices are rarely heard and they are often considered to be beyond the reach of policy [23]. This invisibility has been noted too regarding heating engineers, one of the important groups of practitioners influencing domestic refurbishment and often operating as sole traders or in micro-firms [24]. Today's RMI actors are crucial to the delivery of energy efficiency in the residential building stock but are not well-understood or represented. Nonetheless, builders are a main source of information for householders on possible retrofit options [25, 26] and finding a trusted builder has been found to be a prerequisite for many householders before undertaking retrofit activity [27]. There is evidence too for the effectiveness of shared learning between domestic heating installers and homeowners, particularly where the installers are certified and receive regular information from the certifying organisation [24]. Despite this, previous policies have failed to introduce vocational training schemes for builders, tradespeople and others to equip them with the necessary knowledge relating to energy efficiency. Although the Federation of Master Builders, a body representing the interests of small and medium-sized construction firms, has been involved in guidelines on delivering sustainability in new homes, more generally, UK government policy has been criticised for inhibiting skills development [28]. For example, in 2015, the 'Each Home Counts' review was launched to consider issues concerning consumer advice, protection and standards in relation to UK home energy efficiency and renewable measures. Its recommendations to government touched on certification and quality standards, consumer trust and improved training [29]. However, its remit was consumer-focused and did not address the perspectives, attitudes or knowledge needs of the actors who will deliver energy-efficient retrofit. A previous policy package intended to stimulate demand for energy-efficiency refurbishment of UK homes, the Green Deal, was launched in 2013 but closed in 2015 due largely to its failure to attract demand from householders [12]. Many installers who had registered as Green Deal accredited installers then exited the scheme, leading to the collapse of the residential energy efficiency market in the UK [18]. Energy-efficiency programmes are necessary to deliver the government commitment to zero-carbon by 2050 [30] but a lack of trust from builders' prior experiences or lack of incentive to become involved may demotivate and result in the essential actors working against the desired outcomes.

Policy has long recognised the need for substantial change in the construction industry but current industrial strategy for the sector forms part of a wider agenda to advance technological innovation, particularly for new-build projects, as opposed to repairing and maintaining existing buildings. However, focusing too heavily on technology can miss the crucial component of human engagement. Complementary to technological advancement, research is needed on why and how organisations, and the individuals within them, innovate or adopt new technology or policy. Within this space, and of major importance for RMI and retrofit for energy efficiency, we must understand more about why people in small firms choose to do the work they do. Ultimately the transitions that are needed will come down to human decision-making and action [31] and the behaviour of these essential actors will either move towards or away from the changes needed.

Previous work on the people involved in domestic energy efficiency has applied Actor Network Theory to study heating engineers [11]; argued for the critical influences of practitioners as 'middle actors' [32]; investigated the innovation potential for small construction firms [33]; used community of practice theory in an ethnographic study of heating engineers [24]; and investigated the situated creativity of building practitioner teams involved with an innovative retrofit programme [34]. Valuable insights were generated in these studies which took the individual or small firm as the unit of analysis, but the area still remains under-investigated. In particular, advancement of further theoretical understanding is necessary to facilitate the development of the field [35]. Both sociology and psychology offer broad theoretical approaches to understanding why people may become engaged with energy efficiency retrofit. Social practice approaches to energy transitions have

generated new understanding of societal patterns but one criticism of the social practice perspective has been the omission of the essential human condition of caring about events and outcomes [36]. In addition to external factors which can enable or prevent action, people choose how to respond within a context because they care about the consequences of actions, events or experiences which have a bearing on what matters to them [22]. Within the context of interest here, we need to understand the factors influencing the people working in RMI. We need to understand what, in general, they care about in their work, what they are capable of achieving and what opportunities are open to them. These internal and external factors guide the work they choose to do and therefore their likelihood to engage with or to ignore the improved technology and standards in home energy efficiency. As such, their motivations, capabilities and opportunities are important factors influencing whether or not energy efficiency in the existing residential sector can be transformed.

1.2 Theoretical framework

As a theoretical framing, COM-B (Capability, Opportunity, Motivation, Behaviour) is proposed as an appropriate lens with which to explore how RMI practitioners approach their work. First elaborated by Michie and colleagues [6], the model has been presented to the UK Government [37] and applied widely in health, physical activity and environmental behaviour domains, including energy use. The model represents development of the meta-theory of Motivation-Opportunity-Ability which originated in theories of work performance [38] and has been used to investigate many aspects of behaviour, including organisational innovation [39], consumer behaviour [40] and knowledge management [41]. While some psychological theories of motivation focus wholly on internal factors, COM-B recognises the importance of factors both within and external to the individual. Internal factors including physical and psychological resources (such as strength and knowledge respectively) constitute Capability. Those aspects of the external context which facilitate specific action are encompassed by Opportunity and this includes both physical and social environments. Opportunity and Capability contribute directly to behaviour in the model but, critically, also to Motivation. Motivation is the impetus to perform a behaviour and encompasses not only conscious processes such as planning and decision-making, but also automatic processes such as habit and emotion-guided choices. The latter are frequently overlooked in perspectives on the individual actor in business, who is often painted as wholly rational, in instrumental pursuit of self-interests [42]. A motivational approach recognises multiple objectives and the concept of equifinality, that is, that many driving factors can result in a desired behaviour [43]. The approach posits motivation as the driving force which determines what people do and how they do so, from the possibilities of all of the things they could do [6]. COM-B then offers a model of behaviour that recognises multiple factors within the person and within their environmental context which actuate and guide the actions taken.

Previous work on factors which help or hinder engagement with retrofit has typically been atheoretical. Many studies have categorised factors as ‘barriers’ and ‘drivers’ [44]. While such studies can provide context-specific insights, the approach is theoretically insubstantial – definition of what constitutes a barrier “is both confused and contested” [45:vii]. The absence of a theoretical foundation leads to lack of clarity on the core concepts: is a barrier the absence of a driver or are they conceptually different? In contrast, COM-B defines its core concepts and positions individuals as agentic, goal-oriented decision-makers who are committed to multiple outcomes.

In the current study, the COM-B framework is applied to the individuals in micro-enterprises and SMEs – the builder, tradesperson or other construction professional - active in the RMI market. Within the few studies that have involved these hard-to-reach actors, described above, to our knowledge, none have taken a theory-led approach to individual capabilities and motivations, as well as contextual opportunities. This study aimed to address the questions: Why is this individual involved in this sector? What is important to them in their work? The research questions were

targeted broadly on RMI, instead of a narrower focus on retrofit or energy efficiency work. Broader research questions were appropriate for several reasons. The existing sector will – of necessity - form the basis for delivery of future policy. For a sector which needs to transform, the knowledge, skills and much of the resourcing will need to come from the current actors who will engage (or not) in alignment with their more general capabilities, opportunities and motivations. Introducing or extending the level of energy efficiency retrofits in most cases will be an extension of the work they are already doing. Finally, in contrast to common academic perspectives, practitioners, as well as householders [46], may not distinguish between general RMI work and retrofit.

2. Method

To examine individual and contextual factors, data on lived experience were required and a qualitative approach was appropriate. The dataset was an aggregation of three qualitative datasets, collected independently in different parts of England by different research teams, but with very similar intent: to gain practitioner perspectives on what drives builders' and tradespeople's actions in construction projects to deploy technology and techniques for greater sustainability or energy efficiency. It has been proposed that the sample size of qualitative studies should provide adequate information power to address the research question, where information power derives from five attributes: study aim, specificity of sample, use of established theory, quality of interviews, and analytic approach [47]. With a focused aim, specific sample, established theory, good interview quality, and cross-case analysis, in addition to triangulation across the three datasets, we are confident that sufficient information power was achieved from the total of 31 interviews.

For each of the three datasets, the method of data collection was a semi-structured interview, carried out by a single researcher, and each study was approved by the relevant ethics body of the researcher's institution. In each of the three studies, sampling was purposive, seeking to capture the views of construction practitioners, and participant recruitment was through a mixture of expanding personal networks and snowballing the sample. This draws attention to another aspect shared by all three studies – the positionality of the researcher. In all cases, the researcher had connections into the construction industry that extended beyond their academic work, meaning that the studies benefitted from the researchers' ability to access practitioners' perspectives. The total number of interviews conducted was 31 (Study A - 20, Study B - 5, Study C - 6). The interviews were conducted in London and adjacent counties (Study A), North Lincolnshire and Bristol (Study B), and West Yorkshire (Study C) and no systematic differences by location were found during analysis. The interview schedules included questions on: type of work (A, B, C), relationships such as subcontracting or joint working with others in the sector (A, C), motivation for the work/particular jobs/particular technologies (A, B, C), customer and market demand (B, C), sources of information or knowledge (A, B, C), and future changes to encourage sustainability or energy efficiency (A, B, C). All interviews were recorded with permission and transcribed verbatim.

2.1 Participants

All the participants were men, were experienced in construction, and were sole traders or working as part of small firms. They operated within networks of other sole traders and SMEs, mostly offering a core trade but also carrying out roles which were flexible depending on project needs. In many cases, they combined roles including a trade and project management (10), a trade, project management and design (2), and supply, project management and design (3). All participants worked on domestic construction projects, and many also worked on commercial projects on occasion. The networks showed both stability, in terms of often working with the same people, and fluidity, in reconfiguring as necessary to deliver a project.

Table 1. Characterisation of Participants

Total	**31**

Company Size	
Sole trader	15
1-10 employees	12
11-25 employees	2
Over 50 employees	2
Primary business	
A trade	24
Supplier	3
Project manager	1
Technical advisor	1
Designer	1
Developer	1
Trades	
General builder	10
Heating engineer/plumber	5
Electrician	4
Bricklayer	3
Plasterer/decorator	2
Joiner	2
Other	5

2.2 Data Analysis

Template analysis was used as the analytic approach. Template analysis is a form of thematic analysis which permits both structure and flexibility [48]. A set of themes derived from the academic literature forms the template against which the data are analysed initially. The template can be refined throughout the process of analysis [49]. We began with a three-part structure (Capability, Opportunity, Motivation) with six, eight and seven subthemes respectively. As recommended by Brooks et al. [49], we applied the template to a first set of three interviews, one from each of the original studies. Each interview was coded independently by two researchers. The codes were discussed, meanings clarified and recorded and the template was revised. Where appropriate, subthemes were identified to provide more granular interpretations of themes. Analysis proceeded to the next set of interviews, again drawing on data from all three studies, with independent coding by two researchers, discussion and revision of the template, and this staged process continued until all 31 interviews were coded. Considering the motivation themes, we found some that applied to work-in-general, that is, any work the practitioners took on; some that applied specifically to energy-efficiency work; and some themes in which the motivation expressed was *against* greater energy efficiency. We extended the COM structure to include Demotivation for these themes and discuss this in more detail in the Findings and Discussion below. On completion of coding of all interviews, 80 subthemes had been identified. The template was then trimmed by deleting unused themes, clustering subthemes under higher order themes while keeping note of the distinctions they demonstrated, and aggregating similar themes. Finally, to refine further for presentation, themes derived from three or fewer participants (that is, 10% of the total) were deleted. The final coding comprised 39 themes (Capability 10, Opportunity 15, Motivation 10, Demotivation 4).

In order to present our argument and supporting data in adequate depth, we have chosen to focus on motivation below. We provide a short summary of capabilities and opportunities at the end of Section 3, and these topics are explored in depth in another paper [50]

3. Findings

A total of ten themes were identified in our data under the overarching theme of motivations, subdivided into motivations for work-in-general, and motivations for energy efficiency, and four under demotivations for energy efficiency. These are summarised in Table 2. Energy efficiency is a subset of work-in-general, so motivations for work-in-general also apply to energy efficiency work. Of the motivations, four were clustered in a single theme of autonomous motivations. One additional theme related to waste of materials and was omitted from the discussion here in order to focus on energy efficiency. The cluster and remaining five themes will now be discussed in turn, followed by the four themes within demotivations for energy efficiency. For each theme, an indication is given of its prevalence: high – theme is referenced in over 20 of the 31 accounts, medium – referenced in between 10 and 20 accounts, low – referenced in fewer than 10 accounts. Extracts are presented below to support the analysis and for transparency. Attribution is to pseudonyms to protect participant confidentiality.

Table 2. Summary of motivation themes

Theme	H/M/L
Motivations for work-in-general	
Autonomous motivations	
Pride in outcome	H
Variety	M
Challenges	M
Working independently	M
A viable business	H
Positive working relationships	H
Customer satisfaction	H
Waste of materials	L
Motivations for energy efficiency	
Personal commitment to energy efficiency	M
Co-benefits of energy efficiency	L
Demotivations for energy efficiency	
Perception of increased cost	M
Lack of confidence in technical standards	M
Habit, custom and practice in construction	M
Perceived burden of compliance	M

3.1 Motivations for work-in-general

3.1.1 Autonomous Motivations

Four themes comprised autonomous motivations: pride in outcome (High), variety (Medium), challenges (Medium) and working independently (Medium).

Many participants spoke of their pride in their work. For many, pride came from the satisfaction of doing a good job, of working to the best of their ability and setting high standards. A number described their focus on doing work correctly and well: "*I like seeing things done properly*" [Eddie]. In declaring "*I am foolishly keen on doing it the right way*" [Mark], the participant appeared to acknowledge that a determination to do things right may conflict with other objectives but he was nevertheless persistent in pursuing his high standards. One mentioned what appeared to be a regularly-repeated principle: "*You do things two ways, you either do them right, or you do them*

again" [Vinnie] and this notion that high quality work meant not having to revisit a job after completion was one indicator of quality that several practitioners mentioned. They spoke of attention to detail as part of the quality of the work. Several also referred to the quality of the materials used as a factor in high quality, prideful work. One gave an example of walking away from a job rather than doing it as the customer wanted which he believed was wrong. Others said that they set their standard based on what they would want to see in their own home. There was a particular sense of accomplishment in complex or challenging jobs. The participants were also proud of the material end product: *"I'm proud that construction is an actual, tangible service and we make stuff*" [Ollie]. Starting from scratch and delivering high quality, physical outcomes gave a "*buzz*" [Stan]. The longevity of the built product was a source of pride: "*knowing that you've put something in that's going to last 30/40 years*" [Gavin]. For some, the pride derived from work outputs was more important than profit or time taken: "*I won't lower my standards to make money on a job*" [Matt]. Some attributed this care to personal responsibility: "*when the job is yours, you're an individual tradesman, you'll take the pride and do it better*" [Jonty]. This quotation illustrates a sense of identity that related to the pride in work: high quality work was an important aspect of how they saw themselves, as practitioners in RMI and perhaps even as people. Although some participants noted that they knew of people in construction who would cut corners, use cheaper materials or take less time than needed, they emphasised their pride in the work they produced as a central motivation and source of satisfaction for them in their business.

A second source of autonomous motivation was variety. For a number of participants, this specifically included working outdoors, and also being on different sites and travelling to a different workplace each day. Others mentioned the variety of projects and of tasks, and enjoying the range of people they worked with, including clients. While some appreciated common types of projects, they also enjoyed special or flagship projects. This motivation for variety implies that some degree of change is welcome as a central feature of the work of many RMI practitioners.

Several participants described being motivated by the challenges of their job, including "*things you'd never worked on before*" [Jonty] and difficult projects. A few explicitly expressed their liking for a challenge. One carpenter/joiner said:

> *"It's a challenge sometimes…you could hang doors all day long if you wanted to, but that just wouldn't motivate me, it has to be something that's a little bit different, that stretches the grey matter*." [Barry]

The quotation points to a motivation generated by novelty in work which provides a level of mental stimulation and can lead to a sense of achievement. In addition, it showed a desire to keep learning and developing skills, a motivation mentioned explicitly in a small number of other accounts.

A final motivation clustered within autonomous motivations was that of independent working. Kal articulated this clearly: "*I like the fact that I don't really have a boss to deal with, I'm like in control of it, pretty much. Yeah, that's probably the best thing, the freedom of being self-employed*" [Kal]. He recognised some disadvantages, such as how work could spill over into personal time, but was nonetheless highly motivated to control his own work. In general, the desire to have projects under their own control appeared to motivate the participants and to outweigh the disadvantages of responsibility and precarity. The general sense from the data was of voluntary choice by participants to be in control of what they did and how they did it.

3.1.2 A viable business (High)

The participants' responses showed a prevailing concern with maintaining a viable business. There was evidence of attention to costs, ensuring low overheads, pricing carefully, trying to avoid borrowing, considering the impact on profit of having to charge Value Added Tax (VAT) and of the extra expenditure involved in taking on employees. The practitioners tried to buy carefully, looking for low prices from suppliers, not over-buying, and scrutinising waste. The underlying concern for

many was "*I've got to make a living*" [Dave]. However, relatively few of the participants prioritised profit for its own sake. For example, Vinnie said: "*it's mainly a sense of achievement and reward, financial reward is a big thing, if we get it right, we can make a decent living out of it*". Another appeared to rank their motivations in terms of, first, quality of work, then customer satisfaction, satisfaction of other professionals with the project, and finally income and profit: "*It looks good, very high level of finish, customer's happy, architect's happy and you get paid and hopefully, there's enough in it to make it worthwhile doing*" [Thomas]. Other practitioners also described the importance of building their reputation with customers and other sector professionals such as builders' merchants: "*We very rarely let anybody down; I think that's why we get a lot of repeat business and we get a lot of recommendation"* [Pete]. The quotation links repeat business to establishing relationships built on trust.

This is not to suggest that businesses and individuals in the RMI sector are not motivated by profit. Rather, it shows that financial rewards are only one of many motivations. Earning a livelihood was a fundamental driver but was linked to customer satisfaction, personal satisfaction in quality of work and maintaining good relationships with other industry professionals.

3.1.3 Positive working relationships (High)

A separate theme of positive working relationships was identified in the data. Many participants described the importance of good working relationships and the enjoyment of working with people in the industry: "*decent blokes and nice people which is good for me, otherwise I don't know if I could do it*" [Matt]. They acknowledged interdependence with others, complementary skills and co-operation. Teamwork on site was valued as well as strong relationships with other actors in the sector including builders' merchants, architects and building inspectors. Mutual dependence meant that the participants actively sought to build strong relationships. Stan made it explicit: "*We're not only doing construction, we're trying to build a relationship with people*".

Whilst acknowledging poor workmanship in the industry, several also spoke of their respect for people they personally worked with in terms of their knowledge and craft. One participant emphasised how being respected by others was an important factor for him in his job. Others mentioned their loyalty to builders' merchants. Another was clear about his responsibility to his employees:

> *"If you've built a company up for that amount of time, it doesn't really become just about money … it sometimes becomes about the guys that have been working with you for that period of time, keeping them going."* [Charlie]

Relationships with customers were also seen as vital, and some participants described becoming friends with the customers over time. Positive relationships with customers were seen as adding to the enjoyment of the job while poor relationships or difficult customers might be avoided if possible. Thus the relationships that the practitioners formed – with others on site, in the industry more widely, and with customers - contributed to their enjoyment of and motivation for their work.

3.1.4 Customer satisfaction (High)

Customer satisfaction was identified as a further theme. Most of the participants appeared strongly motivated to provide customer care in advance of work commencing and to achieve customer satisfaction on completion of projects.

Many of the participants described how they were "*client-led*" [Mark] and prioritised meeting or exceeding customer expectations above everything else. Most worked to build the relationship with the customer: "*You build up a rapport with a person and you're almost like a psychologist, you have to understand what motivates them, how they tick, as well as being a builder, or a chippie*" [Barry]. Amongst other implications, a strong customer focus meant protecting the customer's money. From the responses, a customer focus meant the practitioners understanding the

customer's financial constraints and recognising the trust placed in them to work on their homes. It also meant taking the customer's perspective. An example given was offering a fixed price contract so that the customer could have certainty on the final cost and variations could be discussed and agreed as necessary. It meant providing high quality work but being prepared to go back to sort out any problems.

The motivation for most participants appeared to come from the satisfaction of making the customer happy: many described customers being very pleased and praising their work, often repeatedly over time. The participants felt appreciated but also experienced "*the self-satisfaction of loving people being satisfied as well*" [Eddie]. Although there were business benefits, with satisfied customers being prepared to act as reference projects and giving recommendations, it was the personal satisfaction of delivering outcomes valued by customers that was more strongly in evidence.

3.2 Motivations for energy efficiency

3.2.1 Personal commitment to energy efficiency (Medium)

For many of the participants, although not all, there was evidence of a personal commitment to energy efficiency and to being part of creating a more environmentally-friendly sector. Some expressed it as a preference, a habit of always trying to include more energy-efficient technologies, encouraging customers to consider better approaches, or focusing on building performance. For others, it was a high priority driven by "*a genuine interest*" [Eric], awareness of the huge impact of the sector and of the scale of the challenge of climate change to society. Those who were committed were "*doing it because I believe in it*" [Kal] and because "*it's the right thing to do*" [John]. So the participants showed a range of attitudes to energy efficient construction: deep personal commitment drove some, and others were also motivated to make the changes they felt they could.

3.2.2 Co-benefits of energy efficiency (Low)

A final theme under motivation for energy efficiency was that of co-benefits, where participants referred to benefits beyond lower emissions from sustainability-related actions. Energy-efficient retrofits, including more efficient boilers, additional insulation and zoning of heating systems, meant lower costs to customers. In addition, there were customer benefits in greater thermal comfort. Another benefit cited by some participants was the avoidance of condensation and damp, leading to healthier indoor air quality. These aligned with the practitioners' motivations towards customer satisfaction and seeking to exceed customer expectations.

3.3 Demotivations for energy efficiency

As described above, in analysing the data, we found four themes that offered insights into specific reasons why practitioners would not pursue more energy-efficient RMI. These were not simply an absence of motivation. Rather they were factors which drove behaviour in a different direction than that required for improvement in energy efficiency and we defined these as demotivating factors.

3.3.1 Perception of increased cost (Medium)

For a number of the participants, greater energy efficiency was equated with greater cost. Several believed that customers could not or would not pay extra for more energy efficient work: "*Clients aren't willing to pay for it*" [Ron] is an example of a blanket generalisation around higher prices. Linked to their motivation to ensure customer satisfaction, the perception of increased cost for customers led to negative attitudes to newer energy technologies: *"renewable energy, it's far too expensive for my common man that I work with"* [Eric]. Here, the participant stepped into the shoes of his customer saying "*it's far too expensive".* Consistent with a customer focus, the participant appeared to believe he was proactively protecting the customers' interests, perhaps without consulting the customers.

In some cases, the practitioners had costed up solutions and found them to be more expensive than less energy-efficient alternatives. For example, Alan had priced a heat pump at £15,000 versus £1,000 for a boiler. However, others showed a generalised assumption – perhaps even a prejudice - covering all energy-efficient technologies: "*I don't really agree with renewable energies, it's just too expensive*" [Gavin]; "*everything like that is very pricey*" [Andy]. For some, consideration of approaches that were perceived as more expensive would render them uncompetitive: "*It's quite hard for a company of my size to say 'I can justify spending x amount of money doing this' if no-one else is doing it*" [Ron]. Here the participant positioned energy-efficient technologies not only as expensive but also as non-standard. These generalised attitudes are likely to motivate practitioners to avoid energy-efficient technologies.

A few participants recognised that innovative products tend to be expensive at first, with prices dropping as the technology becomes more accepted, and they saw energy-efficient technologies as being in the early, expensive stages.

3.3.2 Lack of confidence in technical standards (Medium)

The second demotivation for energy efficiency theme was a lack of confidence in technical standards. Some practitioners were against the notion of airtightness: "*I think a lot of it's silly, to be honest anyway, you create air tightness and then you put trickle vents in windows, so what's the idea of that?*" [Barry]. In this extract, the speaker appeared unfamiliar with recent approaches to ventilation, seeing a requirement for trickle vents as contradicting the aim of airtightness. The comment points to cultural challenges: while the concept of air-tightness can be considered fundamental for energy-efficiency in approaches to low-energy homes, it works against prevalent cultural norms in UK building where natural air infiltration has been accepted as an aspect of domestic construction. Barry went on to talk about an oak framed building he had worked on

> *"If the building inspector said 'I want to see air bricks' and all that, I put them in, but they were blanked off behind because an oak framed house, by its general nature, will shrink and it will leak here anyway… so you've got to ignore him 'cos there's plenty of draughts that will blow in there eventually." [Barry]*

Other participants were concerned that importing systems that were supposed to be more sustainable would generate more emissions in transport than using concrete and local labour, or that increasing the volume of insulation material would create more emissions in their manufacture than they would save in use. A few participants expressed reservations that installation of photo-voltaic (PV) panels may not have full structural loading calculations, to account for the additional loading on the roof. Such arguments suggest that the individuals were unconvinced that airtightness, greater insulation or PVs would result in greater benefit than harm. In some cases, such as the quotation from Barry above, the arguments were based on understanding of their craft and from this point of view, newer requirements did not make sense. However, comments such as "*personally we all know that this eco form [Code for Sustainable Homes Level 4[1]] is over the top*" [Leo] and objections to multiple forms of energy efficiency imply that worldview, belief and attitudinal factors are also salient, beyond expertise-based and reasoned arguments. Such generalised perceptions may be resistant to change from simply the provision of more information.

3.3.3 Habit, custom and practice in the construction industry (Medium)

Several participants attributed the slow progress towards greater energy efficiency in buildings to habitual customs and practices: "*people go for the same old thing because that's what we're used to*" [Andy]. Interestingly, these stand in contrast to the motivation of overcoming challenges on the

[1] Code for Sustainable Homes was a national UK certification system, launched in 2006 and withdrawn in 2015.

job, discussed above. This suggests a range of approaches to change, with some individuals enjoying a challenge and an opportunity to learn and change, while others try to avoid novelty. Alternatively, practitioners may be interested in challenges in some contexts or on some projects but not on others. Another participant took that view that "*they won't do it [install PVs on new roofs as standard] because they just fear change"* [Kal]. Others referred to poor practices in general in the industry, including adding to what is in place rather than trying to improve it ("*new radiators on the original pipes*" [Craig]), cutting corners, unreliability and avoiding VAT. One heating engineer noted that there had been little development of condensing boilers in the last decade. The inertia that slows down the introduction of new approaches was described clearly:

> *"People haven't got the time to do a lot of this. I think it's unkind when people say that architects are lazy, but they certainly like to get jobs done quickly and efficiently and quite often that means using what they know. The disruptive influence of trying to introduce something new…then you've got the builder coming back saying, where am I supposed to bloody get this from? … and then the craftsman will say… I've never used that before." [John]*

This extract illustrates the interdependent nature of the industry and the need for many parties to become aligned in order to introduce new technology or approaches: if the architect specifies something new, the builder may not be able to source it. If the builder can procure it, the tradesperson may not have the necessary knowledge to install it correctly or efficiently. Further, the demand for rapid delivery means that all parties are trying to complete the work as quickly as possible. Thus habits of looking for the cheapest or quickest option, and only dealing with "*the same old thing*" will push behaviour away from newer, more energy-efficient ways of working.

3.3.4 Perceived burden of compliance (Medium)

In addition to perception of additional cost, there was some evidence of a perception of a bureaucratic burden, not for energy efficiency measures in particular but within the construction sector more generally. Jonty said "*It's gone beyond being realistic about things. Too much red tape, especially in our job"*. His use of the term 'red tape' speaks to a discourse of regulations as unnecessary and constraining. Addressing building regulations, some of which have more direct impact on energy efficiency, Alan found their presentation difficult to grasp:

> *"If you look at some of the building regs [regulations], they're horrendously worded, they're so difficult to understand in some places. I mean, I am educated, I went to school and college, I'm not daft, but sometimes I find it difficult to actually understand some of the stuff that they're actually giving us."* [Alan]

The implications for energy efficiency transformation are that perceptions of additional bureaucracy or regulations that are difficult to interpret for industry actors may result in avoidance of desired change.

3.4 Capabilities

Having described motivations and demotivations in some detail, capabilities and opportunities are now outlined briefly.

Within capability, the themes were clustered into three categories: knowledge (High), business management (High) and individual characteristics (Medium). Knowledge included: (i) capability to access knowledge, through co-workers, manufacturers, builders' merchants, suppliers' websites, and the internet; and (ii) capability to work across trades, including understanding the work of other specialists and, for some, being capable of working in more than one trade. Business management included many examples of capability in managing and co-ordinating people and resources in order to deliver projects, and examples of capability to develop and manage positive business and client relationships. To a perhaps unexpected extent, we found evidence of the importance of skills in

dealing with people, at all points of the supply chain. Two individual characteristics were evident: problem-solving (including anticipating problems and being adaptable) and resilience (including determination, dealing with confrontation and coping with challenges).

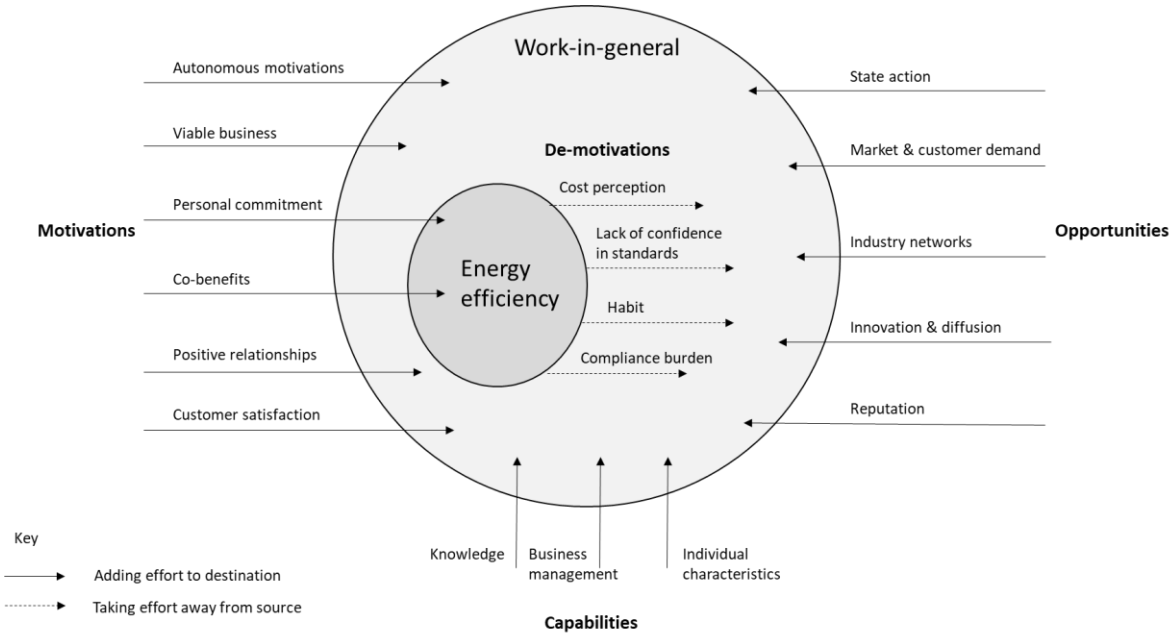
3.5 Opportunities

Within the opportunity category, four clusters and three further themes were identified. The clusters were state action (High), markets and customer demand (High), networks and industry relationships (Medium), and innovation and diffusion (Medium). State action comprised building regulations, grants and national policy on education, and these could facilitate energy efficient RMI where aligned. The practitioners' businesses followed customer demand but they noted limited demand for energy efficiency solutions. The networks through which the practitioners gained work, got answers to questions or access to products were both professional and friendship connections and these often overlapped. In describing products they worked with, the practitioners noted the importance of reliability, technical feasibility, price and buildability. The three stand-alone themes were reputation (Medium), which was intertwined with trust, and education and training for practitioners, and access to finance for their business (both Low). It was notable that market demand, education and finance, which are often the focus of policy, were only part of a much broader landscape of influencing factors.

4. Discussion

Selecting an under-studied group of actors in construction – practitioners involved in RMI – the study applied the theoretical framework of Capability-Opportunity-Motivation-Behaviour in a template analysis of 31 semi-structured interviews. Figure 1 presents a simplified diagram of the overall findings. The discussion below focuses on the findings relating to motivation.

Figure 1 Simplified schematic of main clusters and themes: COMD-B for RMI



The application of COM-B to the domain brings a framing grounded in the psychology of behaviour, which acknowledges a multiplicity of factors guiding behaviour. It addresses the gap in previous research which has emphasised 'drivers' and 'barriers'. Such atheoretical approaches have failed to recognise a 'barrier' as a metaphor for a physical blockage which prevents the course of a flow. The unarticulated implication of the metaphor is that if only the barrier were removed, the flow or behaviour would re-establish the desired course. This disregards the complexity of human, organisational and societal behaviour on which COM-B is based and for which the data here provide empirical evidence.

However, we noted a gap in the framework and have augmented the COM-B model in our findings. While we identified motivations in the data that could encourage behaviour towards greater energy efficiency in RMI projects, and these motivations could be in evidence or absent, we also found motivations that could drive behaviour away from incorporating more energy-efficient solutions. In conceptual terms, this points to the directional nature of motivations. An appropriate metaphor may be that of vector forces from physics: motivations are characterised not only by magnitude but also direction. In domains in which there is a desired outcome, such as greater energy efficiency in the current case, positive motivations are required to drive action towards that outcome. However, negative motivations also exist and these differ from the simple absence of positive motivations. They represent impetus to move away from the target behaviour. We termed these as demotivations for energy efficiency and identified four for a COMD-B model for the engagement of RMI practitioners in retrofit activities.

One demotivation was perception of cost. Although in some cases, costs had been evaluated for specific solutions, in several others, the participant made generalised statements which characterised more sustainable technologies as expensive. Similarly, lack of confidence in technical standards appeared to form part of a more general perspective for some participants. This suggested a more general bias although it was not clear if this related to all new technologies or those which aim to reduce environmental impact. Abundant evidence from environmental and political psychology has found an alignment between political ideology and responses to climate change [51] – the findings here may reflect a general worldview of some of the participants. Adopting a definition of a worldview as a paradigm, model or set of beliefs used to interpret one's world, and which motivate behaviour, Dunlap [52] sought to distinguish between an ecological worldview which recognised limits to natural resources from alternative worldviews which accepted anthropocentric control over nature. It is possible that, for some participants, the demotivations for energy efficiency related to a non-ecological worldview. However, it is also possible that the beliefs around cost and technical standards have developed from experience. In either case, such beliefs could lead the practitioners to show a lack of interest in considering more energy-efficient technologies and thereby undermine a client's appetite for such solutions. Potentially, these beliefs in practitioners could lead them actively to dissuade the client from pursuing their interest. Given the evidence for the powerful influence of builders and installers on customers [24], the beliefs of RMI practitioners matter in moving the sector towards greater energy efficiency.

A further demotivation related to habits and ways of working. Participants spoke about how actors in the construction sector appeared to fear change and to prefer working in accustomed ways. This speaks to discourses around construction as a sector that is averse to change [53]. However, this contradicts other evidence here for individual motivations for variety and challenge, and for the ability of the practitioners to reconfigure their project networks as needed to deliver a job. The findings imply that actors in this domain can be willing to learn, may enjoy novelty and feel a sense of achievement in gaining new skills. This is not to suggest that all challenges or constant variety would be welcomed by RMI practitioners. However, it stands as a reminder that generalisations across the sector gloss over or sideline the wide range of approaches and motivations which the large workforce in construction in general, and in RMI more particularly, brings to their daily work.

In terms of interventions to address these demotivations, policy and market action is needed both on the underlying facts such as cost and also on influencing beliefs. While an individual's worldview is difficult to alter, specific beliefs, and particularly the positive or negative attitudes that beliefs engender, are more amenable to change. Marketing boards and suppliers of renewables could focus on showing how costs are decreasing over time, and communicating this more widely to micro-enterprises. Training and education are needed to bring understanding up-to-date on why air-tightness has changed in importance and how it fits with a whole-house approach to energy efficiency, and should be emphasised in GasSafe and other training. Important sources of information for the participants included suppliers and builders' merchants and these could be targeted in campaigns aimed to influence beliefs and thus motivations for behaviour. The findings indicate that RMI practitioners can enjoy variety and challenge. Policy and industry communication, such as that from the Federation of Master Builders or Federation of Small Businesses could leverage multiple motivations to extend engagement in energy-efficient technologies. Reframing the use of newer technologies for energy efficiency as an opportunity for learning, for overcoming a moderate challenge and for trying something new could appeal to the motivations which are important to RMI practitioners.

The motivations noted in the responses were consistent with self-determination theory [SDT; 54, 55]. SDT argues that human motivation derives from three fundamental needs, for competence (to demonstrate to oneself and others that one can cope effectively with one's environment); autonomy (to be self-directed in one's actions); and relatedness (to connect with others). Contexts which satisfy the basic needs lead to higher levels of autonomous motivations, that is, experiencing one's activities as enjoyable and satisfying, and pursuing them on this basis. In contrast, controlled motivations lead to a sense of external or internal pressures to perform the activities. Extensive research in work settings has found that support for the basic needs leads to greater satisfaction, higher commitment and higher quality outcomes [56]. Amongst the motivations of the participants here, pride in outcome and concern with quality of work were primary factors. For most, the notion of doing a good job was paramount. This can be seen as a drive towards competence. This carries two implications for policy: first, it points to the risk that strict regulation can be experienced as controlling and so undermine autonomous motivations: regulations should instead be positioned as the minimum expected; second, it strongly suggests the need for policies to position energy-efficiency as an essential aspect of high-quality RMI work and to associate poor energy-efficiency with low-quality workmanship. Industry bodies could play a key role in disseminating this message.

Maintaining a viable business was an important motivation. This aligned with and extended the conclusions of Janda and Parag [32] who contended that business survival was a strong motivator. 'Survival' could be understood as a simple binary and we argue for a more nuanced concept of 'viability'. Our identification of 'viability' extends the idea of survival into having sufficient space within the business to learn, develop, and take the rewards of time, satisfaction and/or profit that the practitioner may seek. Viability is a multi-faceted driver in which the achievement and pride in a successful business, in delivering high-quality outcomes and customer satisfaction, and in being loyal to staff may feature.

There was little evidence of pursuing profit for its own sake or of pursuing growth, and this contrasts with common assumptions, particularly in policy making, that businesses have profit and growth as primary motivations [57]. While it can be acknowledged that profit and growth may be the primary objectives for some practitioners, the evidence here demonstrates that this is not universal. Policies that address the profit motive alone overlook the multiple factors of concern to practitioners in SMEs and micro-enterprises.

This relates too to customer focus as a further motivation. Customer satisfaction was linked to future referrals for new work and therefore maintaining a viable business but there were additional aspects. This motivation arose from recognition of a job well done, appreciation, respect and trust. The importance of trust in the retrofit sector has been documented in earlier research [16]. There

was self-satisfaction in meeting or exceeding customer expectations and evidence that managing the customer relationship was seen as critical. The customer focus meant taking the customer's perspective but there was evidence that this could tip over into 'protecting' the customer from innovation or enhanced outcomes such as greater energy efficiency. Examples of where the practitioner made assumptions without consulting the customer suggested that, specifically, a concern to save the customer money could prevent them from discussing energy efficiency improvements. In terms of interventions, there is a need to frame greater energy efficiency as in the customers' best interests while recognising the risk of perception of additional cost.

The importance of the relationship with the customer was a particular case amongst a more general, human desire to get on well with people, which speaks to the drive towards relatedness set out in SDT. The participants were motivated in their work by good teamwork, mutual respect, every day banter and a desire to avoid confrontation, where possible. Personal networks were very significant for most – to gain new business, to find expertise to do a job, or to find out more about a technology. Social norms can be effective determinants of pro-environmental behaviour [58]. More generally, there is plentiful evidence that people tend to do as they see others do and as they believe others think they should, that is, people behave in alignment with descriptive and injunctive norms respectively [59]. The data showed that supply chains and practitioner networks in RMI served as sources of information and these should be targeted to harness social norms to drive action towards energy efficiency.

While personal commitment to a more sustainable world was a motivation for some, this was not universal. As noted above in the discussion on demotivations, positive or negative attitudes to energy efficiency may be grounded in a more general worldview. It is worth noting that not everyone shares an ecological worldview or prioritises the need to address climate change. Recognising the range of motivations which drive people in the sector, interventions should address multiple motivations and not depend only on a framing around the environment, in line with evidence that policy support can be enhanced through non-environmental messaging [60]. Finally, the motivation of co-benefits of greater energy efficiency, such as lower costs, greater thermal comfort, and avoidance of damp, indicate levers of persuasion which speak to the practitioners' motivations for customer satisfaction and high quality.

We recognise some limitations in the study. The motivations and demotivations for energy efficiency identified may not form a comprehensive set. Although we did not find regional differences, it is possible that local networks of RMI practitioners and their supply chains may have particular cultures. We encourage other researchers to gather the voices of more RMI practitioners to extend understanding and inform policy.

As well as identifying the set of motivations and demotivations, the analysis also highlighted ways in which motivations are connected, and interdependent. For example, pride in outcomes was closely connected to good working relationships, and maintaining a viable business was intertwined with customer focus. The analysis does not offer a new set of 'drivers' to be ticked off individually, rather a set of closely woven factors which, taken together, encourage or discourage work practices and behaviours which lead to more energy efficient buildings. Although the focus here has been on motivations, the theoretical framing of COMD-B is a reminder that the external landscape of capabilities and opportunities also matters. While we point to specific recommendations in the conclusions, effective policy must consider all aspects of the context in which RMI practitioners operate, in order to maximise the likelihood of transformation.

5. Conclusions

This study of RMI practitioners argues that, to achieve policy targets on energy efficiency in UK homes, policy must start from an understanding of the players who constitute the existing sector. The study applied an established theoretical framework from behaviour change to investigate the multiple factors of relevance, and has proposed an extension to the model to incorporate

demotivations alongside motivations, capabilities and opportunities for energy efficient RMI. Figure 1 depicts the proposed COMD-B model.

Based on the analysis, the following recommendations for policy are made:

- Energy efficiency deployment is not only about profit for the businesses undertaking energy efficiency work. RMI practitioners seek to maintain a livelihood and viable business for reasons of self-satisfaction, customer satisfaction, loyalty to workers, respect from peers and other factors. Policy should recognise multiple motivations, including the importance of future work, availability of skilled workers, scope to enhance existing skills, and impact on reputation in motivating engagement. Input from behavioural specialists could assist a broader and deeper understanding of the sector's practitioners. Similarly, framing energy efficiency only with respect to the environment is inadequate. Policy communications should align energy efficiency goals with RMI practitioners' motivations to remain in business and deliver excellent customer outcomes. A counter-example here is a late 2020 initiative from the UK government offering grants for energy efficiency until March 2021. The six-month initiative was extended to 18 months after only a few weeks as potential customers found it impossible to find accredited suppliers for the work they wanted. The original policy attempt – and potentially the revised policy too - failed to acknowledge the importance of continuity of business for RMI practitioners.
- Practitioners' focus on customer satisfaction can lead to 'over-protecting' the customer from perceived cost. Policies and market interventions need to address not only the cost of higher energy efficiency but the perception of cost. There is a need for dialogue with practitioners to address lack of confidence in technical standards, and, more broadly, to work to change beliefs. The supply chain and industry and training bodies have roles to play here, such as disseminating information on cost, how the cost of technology changes over time, buildability and benefits to customers.
- Pride in work is a strong motivation. Framing delivery of improved energy efficiency as an essential component of high-quality RMI aligns environmental benefits with day-to-day motivation for RMI practitioners. Practitioners can be interested in challenge and learning new skills, and they are influenced by their fellow practitioners. Change could start in industry and training bodies stressing the relationship between energy efficiency and high quality work, customer benefits and reputation. Certification schemes such as the new Green Home Grants scheme, GasSafe, TrustMark and others could require evidence of knowledge of energy efficiency concepts and skills to deliver. Developing social and personal norms can lead to behaviour change: industry bodies could consider training 'influencers', perhaps targeting medium-sized enterprises who may have capacity to undertake training and who can then act as a flagship for change amongst smaller businesses in their networks.

The study examines self-employed, micro-enterprise and SME-based practitioners who are essential for transformation on residential energy efficiency. Greater understanding of the motivations which drive the day-to-day actions of RMI practitioners points to many areas which could be targeted by policy, industry, training and campaigning interventions to move the sector much more rapidly towards the goal of zero carbon homes.

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