Beyond drivers and barriers: a theoretical framework addressing the engagement of UK construction practitioners in retrofit for energy-efficiency

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Keywords: Motivation, Repair-Maintain-Improve (RMI), Sustainable behaviour, Zero-carbon.

Abstract

To meet statutory carbon reduction targets in the UK, a radical transformation of existing building stock is needed. To achieve this, engagement of the practitioners involved in the Repair-Maintain-Improve (RMI) subsector – small builders and tradespeople - is essential. Previous attempts at investigating this topic have been atheoretical, presenting lists of drivers and barriers. Such lists are frequently arbitrarily categorised, limiting their usefulness to programmes of change. This study makes a novel contribution by applying an established model of behaviour change, the Capability, Opportunity, Motivation – Behaviour (COM-B) model, to a data set of 31 interviews with RMI practitioners in the UK. COM-B proposes that behaviour results from individuals possessing the capability to take action as well as the opportunity and the motivation to do so. The analysis identified capabilities including knowledge and co-ordination of people and resources; opportunities including state action and customer demand; and motivations including pride in work, maintaining a viable business, and co-worker and customer relationships. Recommendations are presented on the implications for policy. For successful transition to zero carbon homes, initiatives are needed to address the multiple factors which determine engagement in energy-efficient retrofit: capacities, opportunities and motivations.

INTRODUCTION

UK homes must become highly energy efficient in order to meet the revised UK Climate Change Act (2008, 2019) which targets 100% reduction of carbon emissions by 2050 against a 1990 baseline. The UK domestic sector accounted for 36% of final energy consumption (ONS, 2015). The Construction Sector Deal, part of the UK's Industrial Strategy, set an ambition to halve the emissions of new buildings by 2030, through developing innovative energy and low carbon technologies (HM Government, 2018). However, the primary problem with energy-efficient homes does not lie with new-build. An estimated 87% of existing residential building stock is expected to be in use in 2050 (Boardman, 2007). Energy efficiency measures are required on 25 million existing homes throughout the UK to meet

the target set in the Climate Change Act (2008, 2019) (Davies & Oreszczyn, 2012). This is already technologically achievable but a major shift in ways of working is needed.

Work on existing housing stock, referred to as the Repair-Maintenance-Improvement (RMI) sector, contributes a financial value of £28.8bn, that is, 17% of all construction activity in Great Britain (ONS, 2020b). The sector is conducted primarily by micro-enterprise builders and tradespeople: 41% of workers in construction registered for value-added or employee tax are self-employed or work in businesses employing fewer than 10 people (ONS, 2020a).

Improving energy efficiency, also referred to as conducting retrofit activities, encompasses upgrades to building fabric, heat provision, power, ventilation, passive cooling (Committee on Climate Change, 2019) as well as changing user controls. For example, fabric measures, as a recommended first priority, can include greater insulation to walls and roofs, more efficient windows, improving air tightness; heat provision usually means replacing lower-efficiency boilers and moving away from gas or oil fuelled systems, such as with heat pumps; or boosting water heating with solar thermal. Power can include provision of photovoltaic solar technology or other micro-generation technologies for electricity provision.

RMI work includes all forms of construction and maintenance activity on existing homes, from roof repair to building a new extension. The RMI sector is not typically driven by energy-related factors (Wilson, Crane, & Chryssochoidis, 2015) and the individuals already making a living within repair and maintenance may not see benefit in expanding to cover energy-related retrofit, that is, the essential actors may not be motivated to engage with the actions necessary to deliver zero-carbon homes.

Low carbon builders and retrofit installers are often considered to be beyond the reach of policy (Owen, Mitchell, & Gouldson, 2014) due to the size and capacity of their organisations. For example, the Green Deal, launched as a flagship policy in 2013, failed to engage fully with existing small businesses (Rosenow & Eyre, 2016), and the 'Each Home Counts' review (Bonfield, 2016) was consumer-focused and did not address the perspectives, attitudes or needs of the actors who are essential to delivery of energy-efficient retrofit.

Most academic research has also overlooked these practitioners. Studies on retrofit have focused on technology (Steadman et al., 2014) and performance (Webber, Gouldson, & Kerr, 2015). In the relatively few studies involving stakeholders, attention has been paid to building performance evaluation practitioners (Swan, Fitton, & Brown, 2015) and householders (Long, Young, Webber, Couldson, & Harwatt, 2015). While Fylan et al. (2016) included contractors in their focus groups examining barriers to energy efficiency retrofit, it was not clear if these participants represented the micro- and small-enterprises which characterise the sector, and their experience and knowledge was not foregrounded.

Within that context, we address the gap in understanding these critical actors - people working in in RMI who may choose to engage with or to ignore the improved technology and standards in home energy efficiency. This understanding is vital to effective policy, knowledge dissemination and ultimately transformation of the sector. Previous work on factors which may help or hinder engagement with retrofit has typically been without theoretical foundation. Many studies have tended to categorise factors as 'barriers' and 'drivers' but without clear definition of what these terms mean: is the lack of a driver a barrier, for example? Further, the idea of a barrier carries the assumption that the removal

of the barrier will automatically trigger a behaviour, but human and organisational actions, especially in a domain as multi-faceted as RMI, are far more complex. A system of interlocking factors – regulations, incentives, motivations, competition, markets, skills, and more – determine outcomes. As a theoretical framing, COM-B (Capability, Opportunity, Motivation, Behaviour) is proposed as an appropriate lens through which to explore how RMI actors approach their work. First elaborated by Michie et al. (2011), the COM-B model has been applied widely on health and physical activity (Keyworth, Epton, Goldthorpe, Calam, & Armitage, 2020; Smaliukiene, Labutis, & Juozapavicius, 2020) as well as in environmental behaviour domains (Gainforth, Shields, Atkins, Jackson, & Michie, 2016).

Unlike many psychological theories of motivation, which focus wholly on internal factors, COM-B recognises the importance of factors both within and external to the individual. Personal factors including physical (such as strength) and psychological resources (such as knowledge and skills) constitute Capability. Those aspects of the contextual setting which facilitate specific action (such as incentives) are encompassed by Opportunity. 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 conscious processes such as planning and decision-making and automatic processes such as habit. COM-B then offers a model of behaviour that recognises multiple factors within the person and their environmental context which actuate and guide the actions taken. In addition, interventions for behaviour change can be identified which align with the relevant factors of influence, and policies can be identified which align with the interventions.

In the current study, the COM-B framework was applied to individuals - the builder, tradesperson or other construction professionals - active in the RMI market. The analysis 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 rather than a more narrow focus on retrofit or energy efficiency work 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 capacity, motivations and their contextual opportunities. Introducing or increasing the level of energy efficiency into RMI work in most cases will be an extension of the work they are already doing. Thus the multiple factors driving their current work were examined in order to build understanding of relevant capabilities, opportunities and motivations for engagement in energy-efficiency retrofit.

RESEARCH METHODOLOGY AND METHOD

The dataset comprised three qualitative subsets, collected separately and independently by different research teams but addressing a very similar research question: what drives the engagement of construction practitioners involved in RMI with processes and technologies which can deliver greater sustainability and/or energy efficiency?

In each case, data collection proceeded via semi structured interview. The method was chosen to gather a rich and broad dataset on what matters to RMI practitioners in their everyday professional activities. All three studies received ethical approval from an appropriate ethics body. Participant recruitment began with contacts from the researchers' personal networks and proceeded through a snowballing process. Sampling was purposive

and sought practitioners in micro-enterprises or small-to-medium enterprises (SMEs) who were active in the RMI sector. In total, 31 interviews were conducted (Study A 20, Study B 5, Study C 6). Our final sample size of 31 was well above the number of 17 which has been suggested as necessary for data saturation (Francis et al., 2010). The interview schedules included questions on: project type and mix (A, B, C), supply chain relationships (A, C), motivation for involvement in the sector and with particular technologies (A, B, C), customer and market demand particularly for more sustainable solutions (B, C), access to information and knowledge (A, B, C), and a potential future sector with greater sustainability or energy efficiency (A, B, C). All interviews were audio recorded with participant permission and subsequently transcribed verbatim.

Participants

The participants were primarily sole traders (15) or working in SMEs (16) (see Table 1). Almost all had an original trade but many combined roles or played different roles on different projects. Several combined a trade and project management for a given project (10), carried out design and project management in addition to their trade (2) or were involved in materials supply as well as design and project management (3). All worked on residential projects, and many also worked on non-residential such as schools, retail and commercial jobs. Many operated fluidly with respect to supply chain positioning, being primary contractor on some projects and sub-contracting on others. Most used a varying network of co-workers, involving smaller or greater numbers of others as sub-contractors on projects as needed.

Table 1. Characterisation of Participants

Company Size		**Trade**	
Sole trader	15	General builder	10
1-10 employees	12	Heating engineer/plumber	5
11-25 employees	2	Electrician	4
Over 50 employees	2	Bricklayer	3
		Plasterer/decorator	2
		Joiner	2
		Other	5
Total Participants	**31**		

Data Analysis

Data analysis was conducted using template analysis, a form of thematic analysis. With template analysis, an initial thematic structure may be devised and applied to the data. As analysis proceeds, additional themes may be added and the original themes may be amended or deleted (Brooks, McCluskey, Turley, & King, 2015; King, 2004). We began with a three-part structure (Capability, Opportunity, Motivation) with six, eight and seven subthemes respectively, derived from the literature. The template was applied incrementally and the analysis proceeded in stages. In each stage, two researchers coded the themes for each case of a small set, typically five. The themes were discussed by all three researchers which enabled greater clarity of meaning for each theme, and the

template was revised by adding more subthemes. When all 31 interviews had been thematically coded, the template was simplified by deleting unused themes and aggregating similar themes. A total of 35 themes were identified (Capability 10, Opportunity 15, Motivation 10). To aid presentation, each was categorised on its prevalence across the participants: High where the theme was noted in over 20 participant accounts, Medium where the theme was noted in between 10 and 20 accounts, and Low where the theme was noted in fewer than nine accounts.

RESEARCH RESULTS

Table 2 summarises the themes and their categorisation as High/Medium/Low incidence. While there are valuable insights to be explored in the patterns of medium and low incidence themes, space precludes detailed discussion and the paper focuses on the high incidence themes. Table 3 presents a summary of the high prevalence themes, and indexes the extracts used in the text discussion below. Pseudonyms are used to protect anonymity.

Table 2. Summary of Themes

Theme	H/M/L	Subthemes / Explanation
Capability		
Knowledge	H	(High incidence themes discussed in text below)
Manage and coordinate people and resources	H	
Individual characteristics	M	Problem-solving; resilience
Opportunity		
State action	H	
Markets and customer demand	H	
Innovation and diffusion	M	Technical feasibility; compatibility with existing systems and processes
Networks and relationships	M	Knowledge in supply chain; network trade associations; local availability; peer norms
Reputation	M	
Education and training	L	
Access to finance	L	
Motivation		
Pride in outcome	H	
Customer care and satisfaction	H	
A viable business	H	
Working relationships	H	
Personal commitment	M	Personal commitment to energy efficiency and/or environmental sustainability
Co-benefits	L	Comfort, warmth, avoidance of damp
Waste	L	Avoiding waste; recycling

Table 3. Summary of High Prevalence Themes and Sample Quotations

Theme	Extract	Sample Quotation
Capability		
Knowledge	1	*What I take pride in is that we had a Georgian house, 300 year old … four storeys with four adjoining owners in the middle of Kensington, worth about five million quid and we excavated about 500 cubic metres of soil below and we kept the house up and we didn't have any health and safety issues* [Ollie]
Manage and coordinate people and resources	2	*My role mainly is joining up the dots, getting the team to put the frame up there on time, making sure the frames arrived on time, sorting out the finances of it all, that kind of thing* [Kal]
Opportunity		
State action	3	*A lot of this stuff we don't really think of energy efficiency, it just becomes the norm with the building regs and requirements…it's just this is what we have to do now to reach certain U values, certain criteria, so you don't really think of it as being green* [Alan]
	4	*The worst thing and one of the most common things we hear is, it's alright, we're just building to regulations, as if that is the zenith of... building regulations is where most people should start, not end* [John].
Markets and customer demand	5	*I think on your high end building work down south, you know, in the big cities or out in the country and you're building these bigger homes and EE [energy efficient] homes, that's more of an elitist job if you like…there is certainly no call for it in Scunthorpe* [Alan]
Motivation		
Pride in outcome	6	*I am foolishly keen on doing it the right way* [Mark]
	7	*I like seeing things done properly* [Eddie]
Customer care and satisfaction	8	*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]
	9	*Building a relationship with the customer and making sure that I'm listening to what the customer wants, there's no point in me building something that they don't really want* [Andy]

A viable business	10	*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* [Vinnie]
	11	*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]
Working relationships	12	*…decent blokes and nice people which is good for me, otherwise I don't know if I could do it* [Matt]

Within the Capability theme, references to knowledge occurred in almost all cases. There was extensive evidence of the technical knowledge that the practitioners brought to their work. In Table 3 Extract 1, the practitioner describes a high complex and technically challenging project on a heritage building located in a dense and high value urban area. He references the presence of adjoining neighbours, not only a technical challenge but also one of managing relationships and establishing trust. In passing, he mentions health and safety issues, pointing to knowledge on regulations as well as effective management and control of people, machinery and resources on a constrained site. The analysis showed that the practitioners knew not only what to do but how to do it: how to approach a problem, how to avoid problems developing and how to solve problems when they arose. Two of the participants specialised in PassivHaus and described it as "*only insulation and air tightness"* [Kal] while acknowledging the practical challenges.

A second prevalent capability was that of business management. Good organisational skills were seen as crucial – the ability to get materials and trades and finance all aligned (Extract 2). The subcontracted nature of much work meant having a good network of contacts and maintaining relationships and knowledge of trade skills. The numbers of subcontracted trades tended to vary by project and time and many had in place a panel of trusted subcontractors. Beyond the logistics of co-ordinating these highly flexible relationships, reciprocal trust was seen as important: the builders needed to trust the subcontractors to do high-quality work and deliver on time but recognised too that the subcontractors need to trust them to pay promptly. Maintaining strict control over quality and giving consideration to the motivation of all project members were important. Several described actively developing the relationships and the importance of good skills in managing people: developing strong relationships, understanding how people work, communicating effectively and building trust within work networks.

Turning to Opportunity, that is, the factors external to the actors which influenced their approach to their work: there was an acceptance of legal requirements and of building regulations such as installation of energy efficient boilers. Practitioners described working in preparation for planned changes to regulations and of using the regulations as a source of reference and guidance. There was evidence of belief in the efficacy of the regulations and that they drove norms in the industry (Extract 3). Meeting the regulations was a source of satisfaction of a job properly done although "*there are still a lot of cowboys out there*" [Gavin] who may flout the regulations and, for some, "*the regs are too loose, in my opinion ... ridiculous*" [Kal]. One practitioner saw the risk that regulations constrained aspirations, with a common approach in the sector being to aim for minimum compliance (Extract 4).

Markets and customer demand represented a further opportunity which could encourage engagement with particular technologies, projects or approaches to construction. In many cases, the practitioners followed demand "*My client has whatever they want, if they're prepared to pay for the extra costs of the materials*" [Ash]. However, the risk of following the market was the absence of demand for greater energy efficiency or sustainability (Extract 5). This extract suggests an assumption that pursuit of higher energy efficiency is "*elitist*" and not for the sort of customers he deals with. The mainstream or non-specialist practitioners had seen customer interest in a more energy-efficient boilers as part of improvement works but no demand for more extensive changes. There was some evidence of interest from knowledgeable self-build clients and from homeowners with moisture-related problems, so demand relating to energy efficiency – though limited – arose in a variety of settings. One PassivHaus business had developed their designs ahead of finding clients interested in the offering, and another business was started when the owner had to import products for his own home and then proceeded to import and grow the market for similar products in the UK. These represent examples of innovation, showing the potential within the sector for proactive creation of new products and approaches.

Within the Motivation dimension, pride in outcome was a prevalent theme. For many who expressed pride in their work, their comments related to the satisfaction of doing a good job, of working to the best of their ability and setting high standards (Extracts 6, 7). One said: "*I won't lower my standards to make money on a job*" [Matt], illustrating the relative priority for him of completing work of high quality. The practitioners described attention to detail and to quality of the work. Several also referred to the quality of the materials used as a factor in 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. There was a particular sense of accomplishment in complex or challenging jobs. The participants were also proud of the tangible end product: *"I'm proud that construction is an actual, tangible service and we make stuff*" [Ollie] and 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]. 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.

An equally strong Motivational theme was customer focus. 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. Although there were business benefits, with satisfied customers being prepared to act as reference projects and giving recommendations, personal satisfaction of delivering outcomes that customers praised was strongly in evidence "*the self-satisfaction of loving people being satisfied as well*" [Eddie]. For most, they actively worked to build the relationship with the customer (Extracts 8, 9) and this relates too to the capability discussed above of managing business relationships. Amongst other implications, a strong customer focus meant protecting the customer's money.

The participants' responses showed a prevailing concern with developing and maintaining a viable business as a strong motivation. There was evidence of attention to costs, ensuring low overheads, pricing carefully, trying to avoid borrowing, considering the impact of having to charge VAT on profit and of the extra expenditure involved in taking on employees. Perhaps surprisingly, relatively few of the participants prioritised profit for its own sake. In

the example in Extract 10, for this practitioner, profit is "*a big thing*" but nevertheless, there is also the motivation of "*a sense of achievement*". This is not to suggest that businesses and individuals in the RMI sector are not motivated by profit: however, it shows that financial rewards are only one of many motivations. Earning enough to live on was a fundamental driver but was also linked to customer satisfaction, personal satisfaction in quality of work and maintaining good relationships with other industry professionals.

Good working relationships were identified as another important motivational theme. Extract 11 shows how profit became less important than loyalty to employees. Many participants described the importance of good working relationships, enjoying working with the people in the industry (Extract 12). They acknowledged interdependence with others, complementary skills and co-operation: "*it's just working together like that, makes your day much easier because you've got someone who's there helping*" [Nick]. Teamwork on site was valued but also positive relationships with other actors in the sector including builders' merchants, architects and building inspectors. The mutual dependence meant that they 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*". Thus the relationships that the practitioners formed contributed to their enjoyment of and motivation for their work. This included others on site, in the industry more widely, and with customers.

DISCUSSION

The application of a template analysis based on COM-B to 31 interviews with RMI practitioners resulted in 35 themes across Capability (10), Opportunity (15) and Motivation (10). The eight themes with high prevalence (that is, appearing in more than 20 accounts) are presented above (Capability 2, Opportunity 2, Motivation 4). The evidence demonstrates a complex set of factors influencing practitioners' involvement in RMI, including abilities and motivations specific to individuals as well as features of the political and economic landscapes in which they work.

The Motivation dimension had most high-incidence themes, covering intrinsic factors, particularly pride in work, and relationship factors with customers and co-workers. From the perspective of occupational psychology, this finding is unsurprising: experienced meaningfulness at work is long established as a factor in high work satisfaction and effectiveness (Hackman & Oldham, 1975) and social support has been shown to benefit workers' well-being and productivity (Park, Wilson, & Lee, 2004) . What is perhaps surprising is how little research attention has been paid to such fundamental determinants of engagement in key actors in construction. Understanding the basic drivers of motivation is critical so that policy initiatives and attempts within the industry and beyond to achieve transformation to energy efficiency are in alignment with what drives construction practitioners in their day-to-day work. A further motivation was that of maintaining a viable business. This went beyond a profit motive and tapped a sense of achievement in running a successful business and a sense of loyalty to employees. This contrasts with common rhetoric around the objectives of business being the pursuit of profit and growth.

Within the Capability dimension, the most prevalent themes were knowledge and the ability to manage and co-ordinate people and resources. The necessity of knowledge as a prerequisite for change is widely recognised. For example, the Each Home Counts review recommended improved training (Bonfield, 2016). However, the skills pertaining to running a business and project managing from design through operation on site to delivery have

received less focus. Salient questions for greater energy efficiency include: Are specialist skills required and, if so, how available are people with these skills? Is the supply chain and procurement more complex? Does the technology or technique make planning and programming onsite work more difficult? In order for new technologies or processes for greater energy efficiency to become embedded into existing RMI, it is important that project management and co-ordination of workers and resources is not made more difficult.

Within the Opportunity dimension, the practitioners generally noted their support for regulation, for example, through building control. However, they pointed to enforcement as a necessary but frequently lacking complement to regulation. The opportunities presented by customer demand were noted although most participants found little demand for energy-efficiency solutions. This points to the fallacy of expecting market demand to drive greater energy efficiency – practitioners saw little knowledge or demand for improvements which may be intangible. The few examples of practitioners developing or supplying products in order to stimulate demand show one route through which demand could be stimulated.

CONCLUSION

The theoretical contribution of the paper is its application of an established framework on behaviour to the domain of energy-efficiency retrofit. Empirically it demonstrates the value of hearing the voices of participants active in this sector of construction which is of crucial importance to achieving zero carbon goals. The key conclusions are that initiatives to transform current housing to high energy efficiency must consider capabilities, opportunities and motivations of the central actors. Skills and expertise with new technologies and processes must be developed but this can only be done effectively when embedded in the broader, non-technical motivations of undertaking RMI work. The implications of new ways of working must be considered with respect to the skills and abilities needed to manage and co-ordinate such work. Sole traders and micro-organisations have little spare capacity so technologies and techniques requiring significantly additional effort, co-ordination or knowledge are unlikely to be adopted. Regulation can help to drive engagement but will be of limited effectiveness if a robust regime for compliance is not also in place. Market demand for energy efficiency has not happened and initiatives to increase customer interest are needed. Finally, personal motivations should be considered. Successful practitioners take pride in their work, value their working relationships and are committed to maintaining their business. Initiatives on zero carbon should frame energy efficiency as best practice, as an expected offering by competent professionals, and as an essential component of high quality work.

To meet the transformation needed to achieve zero-carbon homes, policy, campaigns and initiatives must understand and address the many factors which determine engagement in energy-efficient retrofit, that is, the capacities, opportunities and motivations of RMI practitioners.

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