1-1-2014

Group self-build housing: The potential to deliver zero carbon homes

Emma Elizabeth Heffernan
Plymouth University, Plymouth UK, eheffern@uow.edu.au

Wei Pan
University of Hong Kong

Xi Liang
University of Edinburgh

Pieter De Wilde
Plymouth University, Plymouth UK

Group self-build housing: The potential to deliver zero carbon homes

Abstract

The UK Government has stated that self-build homes are likely to be more affordable, energy efficient and innovative than standard market housing. However, there is little academic research to support these assertions. In addressing this gap in knowledge, this paper reviews the literature relating to the pros and cons of self-build housing, with a focus on energy efficiency. The paper explores expert opinions on the suitability of self-build housing as a development model for the delivery of zero carbon homes. The research employed a Policy Delphi study using three rounds of questionnaire surveys to gather data iteratively from a heterogeneous panel at a national level in the UK. The experts believed that the self-build sector was well placed to deliver high quality, energy efficient homes. The findings indicate a belief that group self-build homes are likely to be more energy efficient, affordable, high quality and meet the needs of the occupants than open market housing.

Keywords

potential, housing:, homes, self-build, carbon, group, zero, deliver

Disciplines

Engineering | Science and Technology Studies

Publication Details

Heffernan, E., Pan, W., Liang, X. & De Wilde, P. (2014). Group self-build housing: The potential to deliver zero carbon homes. In L. Jankovic (Ed.), Zero Carbon Buildings Today and In the Future 2014: ZCB2014 (pp. 181-188). United Kingdom: Birmingham City University.

GROUP SELF-BUILD HOUSING: THE POTENTIAL TO DELIVER ZERO CARBON HOMES

Emma Heffernan[1], Wei Pan[2], Xi Liang[3] and Pieter de Wilde[1]
[1]School of Architecture Design and Environment, Plymouth University, Plymouth, UK
[2]Department of Civil Engineering, The University of Hong Kong, Hong Kong, China
[3]Centre for Business and Climate Change, Business School, University of Edinburgh, UK

ABSTRACT

The UK Government has stated that self-build homes are likely to be more affordable, energy efficient and innovative than standard market housing. However, there is little academic research to support these assertions. In addressing this gap in knowledge, this paper reviews the literature relating to the pros and cons of self-build housing, with a focus on energy efficiency. The paper explores expert opinions on the suitability of self-build housing as a development model for the delivery of zero carbon homes. The research employed a Policy Delphi study using three rounds of questionnaire surveys to gather data iteratively from a heterogeneous panel at a national level in the UK. The experts believed that the self-build sector was well placed to deliver high quality, energy efficient homes. The findings indicate a belief that group self-build homes are likely to be more energy efficient, affordable, high quality and meet the needs of the occupants than open market housing.

INTRODUCTION

In 2011, the Building Societies Association (BSA) commissioned research to determine the potential demand for self-build housing (BSA, 2012). Their study identified that 53% of their respondents would be interested in self-building. However, over recent years, only around 10% of new homes in the UK have been delivered through self-build methods of procurement (Department for Communities and Local Government – DCLG, 2011; RIBA, 2009). Exact figures for self-build activity in the UK are not available, as no data on procurement route is collected by DCLG. The number of self-build homes is therefore estimated based on Her Majesty's Revenue and Customs (HMRC) data on VAT reclaims by self-builders. The small proportion of self-build and domination of speculative housing development in the UK is exceptional in comparison to other developed countries (DCLG, 2011; NaSBA 2008). Indeed, in many European countries, around half of the new homes are delivered through self-build. It is commonly agreed that the housing needs in the UK are failing to be met, either in quantity or quality (Brown et al., 2013; Griffith, 2011). Within their 2011 Housing Strategy, DCLG (2011) stated that '*custom* [self-build] *housing can make a stronger contribution to economic growth. By making it easier for ordinary people to build their own homes, there is the potential to deliver wider benefits of affordable, greener and innovatively designed homes*' (p.14). They also announced their aspiration to double the size of the self-build housing sector over the coming decade.

The National Self Build Association (NaSBA) (2014) has identified seven routes to self-build (Table 1). The routes encompass a spectrum of involvement in the process by the 'self-builder'; from involvement in every aspect of planning, design and construction to procuring those services from professionals and doing so either individually or as part of a group.

Within the literature, different terminologies are used when discussing self-build housing. Barlow et al. (2001) stated that the term 'self-build' is disliked by many as it is seen to be 'down-market' and fails to encompass the broad spectrum of the sector. Duncan and Rowe (1993) introduced the term 'self-provided' as an alternative to self-build, to encompass both those who undertake the labour themselves and those who employ a contractor to do so; the same terminology was also adopted by Parvin et al. (2011). The Housing Strategy (DCLG, 2011) introduced the term 'custom build' to replace the term 'self-build'. NaSBA (2014) have since made a distinction between the two terms, classing routes 1-5 as self-build and routes 6 and 7 as custom build. (see Table 1). For the purpose of this paper, the term 'self-build' is used. This is defined here as any form of housing where the first occupants of a new home are involved in its production; either by arranging for its construction or being involved in building it themselves to some degree (all routes in Table 1). The emphasis here is on forms of self-build procurement involving a group of homes (three or more) rather than individual homes (routes 4, 5 and 7 within Table 1). The reason for the group focus is, in part, the political support for the sector and also because the group scale appears to offer further benefits which warrant exploration.

Successive governments have expressed an intention for zero carbon homes to be a mandatory standard in the UK from 2016. However, in the Queen's Speech 2014, an announcement on exemptions from the standard was made (Pearson, 2014).

Table 1: Routes to self-build (after NaSBA, 2014; Wallace et al., 2013)

ROUTE TO SELF-BUILD		CHARACTERISTICS OF ROUTE
1	Self-build-one-off	Individuals undertake most or all of the design and construction themselves
2	Contractor built-one-off	Individuals manage the design process and select a contractor to undertake most or all of the work
3	Kit homes	Individuals engage a kit manufacturer and work with them on the design and construction plan. The specialist manufacturer supplies and erects the house with the self-builder responsible for providing the slab. Either the kit manufacturer or the buyer 'finishes' the property
4	Independent community collaboration	Self-builders work with others to acquire a site; split it into plots; and organise the design and construction of their own home
5	Supported community self-build group	A social landlord or independent self-build organisation helps individuals learn the skills to build a group of homes together
6	Developer built one-off	An individual finds a developer with a site and a design acceptable to them, which is then built out by the developer
7	Developer/contractor led group project	A developer/contractor organises a group and builds the homes; often the self-builders finish them off

Announced in 2007, originally the standard was ambitious, requiring not only the emissions from regulated energy (for heating, cooling, hot water, ventilation, auxiliary services and lighting) to be accounted for, but also those from unregulated energy (for cooking and plug-in appliances such as TVs and hairdryers) (DCLG, 2007). In the face of concern from the UK construction industry and with the ongoing global financial crisis, the definition has been amended to include only the emissions from regulated energy. It is anticipated that the zero carbon homes standard will comprise three elements for compliance: a Fabric Energy Efficiency Standard (FEES); on-site energy generation using low or zero carbon technologies (Carbon Compliance); and 'Allowable Solutions'. Allowable solutions provide for an element of local, near or off-site carbon offsetting, such as a community renewable energy scheme (Zero Carbon Hub, 2011).

There is conjecture within the literature that the housing market has failed to respond to increasing consumer demand for low energy homes (Lovell 2005, Peterman et al. 2012). There is also consensus that the housebuilding industry has a tendency to stifle innovation (Lovell 2005, Goodchild & Walshaw 2011) due to a number of reasons including a lack of financial incentives; and the fact that, due to its scale, the momentum of the volume housebuilding industry creates inertia.

Osmani and O'Reilly (2009) sought to identify drivers for and barriers to zero carbon homebuilding from the housebuilders' perspective. Legislation was found to be both the strongest driver and the most significant barrier. In a recent study examining perceptions across the broader housebuilding industry as to what both drives and prevents the delivery of zero carbon homes, barriers and challenges themed around the nature and culture of the housebuilding industry were identified by the interviewees (Heffernan et al., 2012). The current business model of the industry, being dominated by the volume housebuilders, was identified as a barrier.

Since the Government pledged their support for the group self-build sector there has been an increase in academic research in the area; however, the literature remains limited. This gap in the literature, combined with the evidence of the failure of the volume housebuilding sector to meet the housing demand in quantity, quality or improved energy efficiency provide the justification for this research. The aim of this paper is therefore to contribute a better understanding of the potential for group self-build housing to advance the delivery of zero carbon homes and sustainable communities. The objectives of this paper are to:

1. Identify the pros and cons of group self-build housing;
2. Examine the suitability of the group self-build sector for delivering zero carbon homes.

LITERATURE REVIEW

Why self-build?

The literature has shown that the motivations both for individuals to self-build and for activity within the self-build sector to be encouraged are numerous. One reason the sector is currently receiving support from the Government is that it is seen as a potential resilient supply of housing (Wallace et al., 2013; Barlow et al., 2001; Parvin et al., 2011; Brown et al., 2013). The self-build sector continues to build homes in times of economic uncertainty because, unlike speculative housing, homes are built to live in rather than for immediate sale (Parvin et al., 2011). The Callcutt (2007) Review asserted that the primary concern of speculative housebuilders is to '*deliver profits for their investors, now and in the future*' (p.6). As a result, in times of recession, the level of activity in the UK housebuilding sector is significantly reduced as the housebuilders ensure that only profitable schemes are delivered. The self-build sector has thus been identified as a means of diversifying the supply of new homes in the UK and addressing this issue at a time when the required

volume of new housing is not being delivered (Brown et al., 2013). It is also recognised that the self-build sector is better able to make smaller and more difficult to develop sites viable (*ibid*).

Another advantage identified within the literature is that self-build housing improves choice for homeowners (Wallace et al., 2013; Griffith, 2011; Barlow et al., 2001; Parvin et al., 2011; Brown et al., 2013). Both Parvin et al. (2011) and Wallace et al. (2013) refer to a home's 'use-value'; by building a home that meets the needs of the occupants, the level of satisfaction with the home is significantly increased (Parvin et al. 2011). Similarly, self-build is also recognised as producing homes of a higher quality (Miles and Whitehouse, 2013; Barlow et al., 2001; RIBA, 2009). Although, further research into the quality of self-built homes has been called for (RIBA, 2009). Barlow et al. (2001) report from the findings of a Building Link survey that '*getting more for their money*' either in terms of quality or quantity was a significant motivation for many self-builders. Brown et al. (2013) discuss long-term affordability within their chapter on added value. They state that cost savings of 20-30% on build cost can be achieved through self-build models of procurement. Further, they suggest that cost savings of group self-build projects can be even greater.

Group self-build schemes offer the additional benefit of building a community as a direct result of the process of building homes (Brown et al., 2013; Wallace et al., 2013). Falk and Carley (2012) suggest that co-housing and self-build should be encouraged as a way of building a sense of community in new developments.

Barlow et al. (2001) propose that self-builders often incorporate technical innovations within their homes. They suggest however that what some self-builders consider a technical innovation may in fact simply be an enhancement to the specification. An example they cite in this regard is that of improved levels of insulation as a means of enhancing the energy efficiency of a home. Enhanced energy efficiency is cited by many as a benefit of self-build homes (DCLG, 2011; NaSBA, 2011; Brown et al., 2013; Parvin et al., 2011). Because self-builders have a long-term interest in the home they are building, decisions which impact on both the capital cost and the running costs of a home can be considered on a whole-life basis. Therefore, investing in enhanced energy performance becomes a sensible option for a self-builder (Parvin et al., 2011). This view is reinforced in many of the recent reports on the self-build sector; for example '*their* [self-builders] *homes often have small carbon footprints*' (NaSBA, 2011: p.17) and '*Many people who build their own homes are very committed to the Green cause. The vast majority will install additional insulation and many are very keen on modern environmentally friendly ways of generating energy*' (NaSBA, 2008: p.12). The same report suggests that '*Self build homes are greener. An extra 25,000 self build homes would save around 100,000 tonnes of CO2 per year*' (*ibid*: p.4) However, these assertions appear to be based on anecdotal evidence. Wallace et al. (2013), in reporting the findings of an Office of Fair Trading report identifying the Code for Sustainable Homes as a burden for self-builders, propose that environmental ideals may not be a priority for all self-builders. A recent qualitative study of Danish co-housing (Marckmann et al., 2012) found that the self-builders were very focused on the inclusion of sustainable technologies, and to a lesser extent on the sustainable everyday practices of the residents. However, the environmental consequences of the size of their homes was not discussed, and yet, the floor area of a dwelling has been found to be a significant factor in the overall heat consumption of a home (Gram-Hanssen, 2011). There is a propensity for individual self-build homes to be large detached dwellings, which has a negative impact in the broader sense of sustainability; as a less dense form of development, more likely to be car dependent (Dol et al., 2012). Therefore, although individual self-builders may focus on the improved energy performance of their home, there also needs to be a broader consideration for the scale and nature of the development; this is perhaps more feasible with group forms of self-build where environmental sustainability has been found to be a common aim (Wallace et al., 2013).

Barriers to self-build

Availability of suitable land has been identified as the primary barrier to self-build in the UK (NaSBA 2011). However, Barlow et al. (2001) suggest that perceptions of the difficulty of acquiring land outweigh the reality of the situation. The rising value of land is cited as a barrier to entry to the self-build market for all but the most well-off households (Griffith 2011). Through an analysis of the socio-economic characteristics of typical self-builders, Parvin et al. (2011) draw the conclusion that possession of capital (both financial and individual) is a key requirement to self-build. However, they postulate that by self-building in groups, the need for capital is reduced and thus the threshold for entry to the self-build market is reduced. Further, they suggest that by working as a group, a number of the potential barriers to self-build can be more easily overcome. The identified benefits of group self-build include: sharing costs of land, construction and professional fees; pooling knowledge and skills and potential sweat equity trading; reduced individual risk through aggregation; and savings on construction overheads by operating as a single client (*ibid*).

In 2001, Barlow et al. reported that '*Until relatively recently, finance was seen as a major barrier to the development of the self-build sector in the UK. This is, however, changing*' (p.30). They proceed to state

that the risks of lending to self-builders are low and that a number of lenders have developed their self-build business to meet current demand. However, ten years on, NaSBA (2011) identified lending and finance as barriers to self-build; citing risk and perceived risk of lending to self-builders as an issue, in particular during the construction phase. They also cite lack of demand for self-build finance as an issue. In a group self-build situation, the financial barriers are seen to remain, but can be different to those for individual self-builders (Wallace et al. 2013). The finance for group self-build appears to be a more specialised market, therefore offering less options for borrowing. The group is also reliant on each individual member obtaining the necessary finance.

Further barriers to self-building cited within the literature include legislation, such as the planning process and building control (NaSBA, 2011; Barlow et al., 2001) and the self-build industry itself which is disparate by nature (NaSBA, 2011).

Summary

The review of the literature has identified that the benefits of self-build are numerous. However, much of the literature is based on individual self-build models and much less on the group self-build methods of procurement. A common message from all of the recent reports on the self-build sector in the UK is that research evidence is now growing, but the evidence base remains insufficient (Wallace et al., 2013; Parvin et al., 2011; Brown et al., 2013). Whilst the literature generally supports the assertion that self-build homes tend to be 'greener' and more energy efficient, research in relation to the potential of group self-build to deliver zero carbon homes is absent. Therefore, although energy efficiency is the foundation of the zero carbon homes standard, research focusing on zero carbon and self-build housing is warranted. The literature on zero carbon homes identified that there are multiple barriers to their delivery in operation (Osmani and O'Reilly, 2009; Heffernan et al., 2012). However, research has suggested that alternative models of housing procurement to speculative housebuilding may provide ways to overcome these barriers.

METHODOLOGY

In examining the suitability of group self-build for the delivery of zero carbon homes, a Policy Delphi study was conducted to explore the opinions of the professionals and experts within the self-build sector. The Policy Delphi method is an iterative research process in which data is collected from the same research participants in a number of successive rounds. Within this study, online questionnaires were used to collect data over three rounds, a suitable number for a Policy Delphi study (Paraskevas and Saunders, 2012). The benefits of using Delphi, over the group techniques it was designed to replace, are that it avoids the need to gather a large number of busy experts in one place at the same time; and it allows for the quasi-anonymity of participants. Hence, it potentially offers more honest responses than other group processes (Delbecq et al. 1975) and allows all participants to make an equal contribution to the discussion, avoiding the potential for one participant to dominate the group.

The unique characteristics of Policy Delphi are that it employs a heterogeneous group of participants; the participants will have knowledge and experience in the subject area but are referred to as 'informed advocates' (Paraskevas and Saunders 2012); the method typically produces rich qualitative data (Turoff, 1975; Paraskevas and Saunders, 2012; Landeta, 2006). The participants in a Policy Delphi will not be expected to be knowledgeable about all aspects of an issue; this is why the heterogeneity of the sample group is important (Paraskevas and Saunders, 2012). Policy Delphi does not seek to reach a consensus; it seeks as broad a range of views as possible (Turoff, 1975).

The sample group comprised professionals within the housebuilding sector and experts in self-build housing. Purposive sampling was used, as is typical of the Delphi method. Participants were selected from the following categories: public sector; specialist groups/experts; housing associations; private developers; designers; contractors and financial institutions. The data was collected between June and September 2013.

Panellists were asked to answer open-ended questions in the round one questionnaire. The responses to the questions were qualitatively analysed using NVivo9. NVivo was employed within this research study for its benefits in handling large amounts of data in a time efficient manner; the turnaround time between rounds being an important factor within a Delphi study (Keeney et al., 2006). From each of the original questions, a series of statements was developed for the round two questionnaire. Against each of these statements, the panellists were asked to indicate their level of agreement using a six point likert scale. It is common in policy Delphi studies not to provide a neutral option on a likert scale in order to force the respondents to express an opinion. Panellists were also asked for reasoning for their responses.

The questionnaire for the third round sought to review the responses to some of the questions with the lowest level of consensus from the previous round. de Loe's (1995) definition of consensus was used (Table 2). A series of questions were posed again to the panellists, the group response from the previous round was also provided. Respondents were asked to review their response from the previous round in light of the group opinion. They were also asked to provide reasoning for their response in order to try to ascertain a reason for the dissensus.

Table 2
Levels of consensus (Source: de Loe, 1995)

CONSENSUS LEVEL	DEFINITION
High	70% in one agreement category or 80% in two contiguous categories
Medium	60% in one agreement category or 70% in two contiguous categories
Low	50% in one agreement category or 60% in two contiguous categories
None	<60% in two contiguous categories

RESULTS

Response rates of 33% (23/70), 74% (17/23) and 88% (15/17) were achieved for rounds one to three respectively. The number of invited panellists varied from round to round as only those who participated in the preceding round were invited to take part in the subsequent round. The decrease in numbers of responses can be explained by the iterative nature of the research method and the sample group being comprised of busy professionals. However, there was a high level of commitment from the panellists, with increased response rates as the rounds proceeded.

Pros of group self-build

In the first round, panellists were asked to identify the pros of group self-building as a development model for zero carbon homes. From the responses, six themes were identified: energy efficiency; affordability; quality; innovation; sustainable communities; and meeting the needs of occupants. Energy efficiency and sustainable communities were the themes identified most often by the panellists. Under the theme 'energy efficiency' the following benefits were identified:

- Occupants would have a better understanding of the home energy system;
- Ability to specify higher standards of energy efficiency;
- Sharing information and awareness about zero carbon;
- Lifestyle choice;
- Stimulate demand for zero carbon / energy efficient homes.

Under the theme 'sustainable communities', the following pros were identified:

- Resilient, less transient community;
- Sustainable lifestyle (e.g. Car sharing, food growing);
- Shared energy systems;
- Variety – more interesting urban design.

When identifying pros under the theme of 'affordability', panellists considered both affordability during procurement and affordability in operation. Benefits such as economies of scale in construction; access to funding/finance available only to the group self-build sector; and lower running costs were identified. The ability to procure a tailored design; increased satisfaction; and greater input into specification and materials were all identified under the theme 'meeting the needs of the occupants'.

Statements were developed from each of the themes identified in the responses to the round one questionnaire; panellists were asked to indicate their level of agreement using a Likert scale. For each statement, in addition to a count of the responses, the level of consensus and mean are shown, the mode is also highlighted in bold for each. The closer the mean rating is to 1.0, the stronger the level of agreement with the statement (Table 3; Figure 1). It has been argued that data from Likert-type categories can be treated as interval variables; although this has been the source of much debate within the literature (Bryman, 2012). For the purposes of this paper, the data is treated as interval variables and as such the means are presented. The statement with both the lowest mean and the highest level of consensus is 'Group self-build or custom build is more likely to meet the needs of the occupants'.

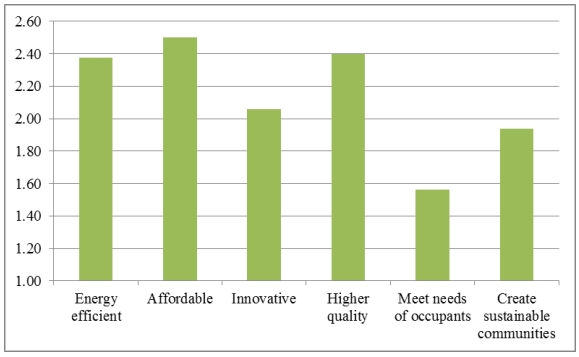

Figure 1: Round 2 responses – Pros of group self-build (mean ratings: 1=strongly agree; 2=agree)

Table 3: Round 2 responses – Pros of group self-build (counts)

GROUP SELF-BUILD OR CUSTOM BUILD IS MORE LIKELY TO…	STA	A	SOA	SOD	D	STD	C	MEAN
be energy efficient	1	**10**	3	2			M	2.38
be affordable	1	**8**	5	2			M	2.50
be innovative	5	**6**	**6**				M	2.06
be of a higher quality	2	**6**	**6**	1			M	2.40
meet the needs of the occupants	7	**9**					H	1.56
create sustainable communities	**7**	4	4	1			L	1.94

Key: STA = Strongly Agree; A = Agree; SOA = Somewhat Agree; SOD = Somewhat Disagree; D = Disagree; STD = Strongly Disagree; C = Consensus [H = High; M = Medium; L = Low]

Table 4: Round 2 responses – Cons of group self-build (counts)

GROUP SELF-BUILD OR CUSTOM BUILD HOUSING	STA	A	SOA	SOD	D	STD	C	MEAN
…has no cons	1	2	2	3	**7**	2	L	4.12
…requires commitment to the process	**11**	5	1				H	1.41
…is difficult to finance	3	**8**	6				H	2.18
Zero carbon is too complex for…	1	1	4	3	**7**	1	L	4.00
Finding sites is difficult for…	**9**	6	2				H	1.59

Key: STA = Strongly Agree; A = Agree; SOA = Somewhat Agree; SOD = Somewhat Disagree; D = Disagree; STD = Strongly Disagree; C = Consensus [H = High; M = Medium; L = Low]

The mean ratings indicate that the panellists were all broadly in agreement with each of the statements in relation to the pros of group self-build as a development model for zero carbon homes.

Cons of group self-build

Panellists were also asked to identify the cons of group self-building as a development model for zero carbon homes. From the responses, six themes were identified: there are no cons; difficult to finance; requires commitment; sites are difficult to obtain; zero carbon is too complex; and group issues. The difficulty of securing finance and group issues were most frequently identified. Under group issues, the following disadvantages were stated:

- Reaching consensus;
- Finding people to collaborate with;
- Different lifestyles.
- More expensive;
- Lack of skills;
- Cultural change required.

The panellists identified issues in relation to securing finance: funding risk for innovative solutions; need for upfront capital; not suitable for the financially insecure; and working with staged mortgages.

Statements were developed from each of the themes identified in the responses to the round one questionnaire and panellists were asked to indicate their level of agreement using a Likert scale. There was a high level of consensus with the three statements with the lowest mean ratings (strongest level of agreement) and a low level of consensus with the two ratings with the higher mean ratings. These results indicate that the panellists somewhat disagreed with the statements 'Group self-build or custom build has no cons' and 'Zero carbon is too complex for group self-build or custom build'. These are therefore not agreed as cons of group self-build.

From the qualitative responses, it was evident that the panellists attributed the group issues to working within a group self-build in general rather than specifically in relation to zero carbon group self-build. Therefore, this issue was not explored any further in the subsequent rounds.

In addition to the themes, a series of other cons were also identified by individual panellists. These were typically either not repeated, and could not therefore be identified as a theme, or they were in contrast with benefits previously identified and panellists had therefore been given the opportunity to disagree and comment should they wish. These issues included:

- Ensuring quality control;

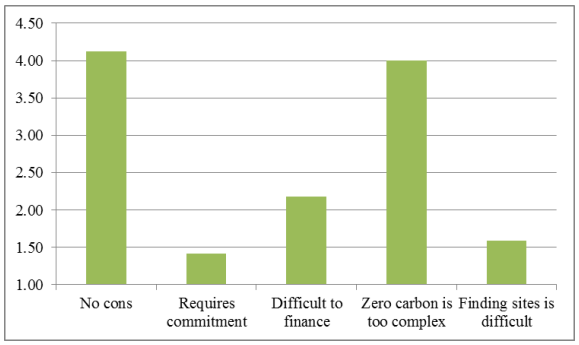

Figure 2: Round 2 responses – Cons of group self-build (mean ratings: 1=strongly agree; 2=agree; 3=somewhat agree; 4=somewhat disagree)

DISCUSSION

Within this study, there was a moderate to high level of consensus across the heterogeneous panel, apart from in relation to some of the postulated cons of self-build. The policy Delphi method does not actively seek consensus as a primary aim, however, where dissensus exists, the reasons for it are explored. There was a low level of consensus for the statement 'zero carbon is too complex for group self-build or custom build housing'. When this was probed in the third round questionnaire, the reasoning provided for agreement with this statement included that '*zero carbon is still complex for all types of developers of housing*'. Reasons cited for disagreeing with the statement included that '*group self-builders and custom housing providers tend to have a good appetite for zero carbon theories*'.

Much of the literature focused on the individual self-build sector as, until recently, the group self-build sector in the UK has been seen as a niche market (BSA, 2012). Despite this, the findings presented in this paper support many assertions and the findings of previous research on self-build. For example, the panel identified themes of energy efficiency; affordability; quality; innovation; sustainable communities; and meeting the needs of occupants in terms of the pros of group self-build, all of which had emerged from the literature (NaSBA, 2011; Wallace et al., 2013; Barlow et al., 2001; Falk and Carley, 2012; Parvin et al., 2011). However, within the themes, some new benefits were identified; under the

theme of energy efficiency, the panel were able to identify two benefits which had not previously been identified. These were the ability to share information about and awareness of zero carbon; and stimulate demand for zero carbon. Both of these benefits could serve to address some of the barriers to zero carbon homebuilding identified in previous research such as lack of demand for zero carbon homes and lack of awareness of zero carbon (Osmani and O'Reilly, 2009; Heffernan et al., 2012). A key barrier to zero carbon homebuilding previously identified was the poor knowledge of the occupants in terms of how to operate building services efficiently; this would be much less prevalant with self-build homes.

From the first round qualitative data, five themes of cons of group self-build housing as a development model for zero carbon homes were identified. Through the second round questionnaire, the panel supported only three of the themes: difficult to finance; requires commitment; and sites are difficult to obtain. None of these cons are insurmountable; the recent flurry of activity in independent group self-build schemes is indicative of the fact that groups can find sites; acquire finance; and form a commited unit to take projects forward. Indeed, these group schemes also commonly have sustainability at their core (Wainwright, 2013). Whilst the panellists were broadly in agreement that group self-build housing is more likely to create sustainable communities, one panellist raised a note of caution over the potential self-selectivity of the group self-builders, leading to a narrow demographic within the group and questionable social sustainability. However, this has to be tempered against the views from the literature which suggest that group self-build lowers the threshold for entry to the self-build market and indeed home ownership (Parvin et al., 2011).

Whilst doubts were raised by some individual panellists with regard to the capabilities of self-builders, there was moderate consensus that group self-build would typically deliver homes of a higher quality than those delivered by speculative developers.

Acquiring finance was cited as a potential con. However, in the literature, there were divergent views on this point (Barlow et al., 2001; NaSBA, 2011). The fact that the Lloyds Banking Group commissioned the Centre of Housing Policy at The University of York to carry out research into the self-build market (Wallace et al., 2013) would suggest that the financial sector is preparing itself for an upscaling in the self-build sector.

CONCLUSIONS

This paper has reviewed the literature on self-build housing and, through a Policy Delphi study, examined perceptions of the suitability of group self-build for zero carbon homebuilding. The results of the review suggest there is insufficient research into the group self-build sector, with a gap in knowledge of group self-build and zero carbon homes.

The research into perceptions of the suitability of group self-build as a development model for zero carbon homes has identified and elucidated a number of themes of pros and cons. The pros include: energy efficiency; affordability; quality; innovation; sustainable communities; and meeting the needs of occupants. The cons include: difficult to finance; requires commitment; sites are difficult to obtain. However, it has been argued that none of the cons for the development model are insurmountable. It has also been demonstrated that a number of the pros of group self-build could serve to overcome the barriers to the delivery of zero carbon homes as identified in previous research.

The recommendations that arise from this paper are that further research into group self-build and its potential to deliver zero carbon homes should be undertaken. In particular, there is a dearth of research around the perceptions and experiences of group self-builders, their motivations, the barriers they face and how they are influenced by existing policy support. This further research could aid in the development of policy and industry support for this burgeoning sector.

ACKNOWLEDGEMENTS

The research on which this paper reports is part-funded by the European Social Fund (ESF project number 11200NC05) through the Combined Universities in Cornwall. The authors would like to thank all of the respondents for their time and input and Cornwall Council and Cornwall Sustainable Buildings Trust for their support.

REFERENCES

Barlow, J., Jackson, R. and Meikle, J. (2001) Homes to DIY for: The UK's self-build housing market in the twenty-first century. York: Joseph Rowntree Foundation.

Brown, S., Cerulli, C., Stevenson, F., Ash, C and Birkbeck, D. (2013) Motivating Collective Custom Build. Sheffield: The University of Sheffield School of Architecture.

Bryman, A. (2012) Social Research Methods. 4th edn. Oxford: Oxford University Press.

BSA (Building Societies Association) (2012) Lending information for self build in the UK, London: BSA.

Callcutt, J (2007) The Callcutt Review of housebuilding delivery. London: DCLG.

Delbecq A.L., Van de Ven A.H. & Gustafson D.H. (1975) Group Techniques for Program Planning: A Guide to Nominal and Delphi Processes, Glenview, Illinois: Scott, Foresman and Co.

DCLG (Department of Communities and Local Government) (2011) "Laying the Foundations: A Housing Strategy for England". London: DCLG.

DCLG (2007) Building a Greener Future: Policy Statement, London: DCLG.

de Loe, R. C. (1995) Exploring complex policy questions using the policy Delphi, Applied Geography, 15 (1) 53-68.

Dol, K., Lennartz, C. and De Decker, P. (2012) Self-provided housing in developed societies. In, Smith, S. International Encyclopaediea of Housing and Home. Volume 6. Oxford: Elsevier. 310-315.

Duncan, S. S. and Rowe, A. (1993) Self-provided Housing: The First World's Hidden Housing Arm, Urban Studies, 30 (8) 1331-1354.

Falk, N. and Carley, M. (2012) Sustainable urban neighbourhoods: Building communities that last, York: Joseph Rowntree Foundation.

Goodchild, B. and Walshaw, A. (2011) Towards Zero Carbon Homes in England? From Inception to Partial Implementation. Housing Studies, 26(6), 933-949.

Gram-Hanssen, K. (2011) Households' energy use – which is the more important: efficient technologies or user practices? World Renewable Energy Congress 2011, Linkoping, Sweden.

Griffith, M. (2011) We Must Fix It: Delivering reform of the building sector to meet the UK's housing and economic challenges. London: IPPR.

Heffernan, E., Pan, W. and Liang, X. (2012) Delivering zero carbon homes in the UK In: Smith, S.D (Ed) Procs 28th Annual ARCOM Conference, 3-5 September 2012, Edinburgh, UK, Association of Researchers in Construction Management, 1445-1454.

Keeney, S., Hasson, F. and McKenna H. (2006) Consulting the oracle: ten lessons from using the Delphi technique in nursing research, Journal of Advanced Nursing 53 (2) 205–212.

Landeta, J. (2006) Current validity of the Delphi method in social sciences, Technological Forecasting & Social Change, 73, 467-482.

Lovell, H. (2005) Supply and Demand for Low Energy Housing in the UK: Insights from a Science and Technology Studies Approach. Housing Studies, 20(5), 815-829.

Marckmann, B., Gram-Hanssen, K. and Christensen, T. H. (2012) Sustainable Living and Co-Housing: Evidence from a Case Study of Eco-Villages, Built Environment, 38 (3) 413-429.

Miles, J. and Whitehouse, N. (2013) Offsite Housing Review, London: Construction Industry Council.

NaSBA (National Self Build Association) (2008) Self Build as a volume housing solution. Available from: http://www.selfbuildportal.org.uk [Accessed in April 2014].

NaSBA (2011) An Action Plan to promote the growth of self build housing, Available from: http://www.selfbuildportal.org.uk [Accessed in May 2014].

NaSBA (2014) Routes to building your own home. Available from: http://www.selfbuildportal.org.uk [Accessed in April 2014].

Osmani, M and O'Reilly, A (2009) Feasibility of zero carbon homes in England by 2016: A house builder's perspective, Building and Environment, 44, 1917-1924.

Paraskevas, A. and Saunders, M. N. K. (2012) Beyond consensus: an alternative use of Delphi enquiry in hospitality research, International Journal of Contemporary Hospitality Management, 24 (6) 907-924.

Parvin, A., Saxby, D., Cerulli, C. and Schneider, T. (2011) A Right to Build: The next mass-housebuilding industry, Sheffield, University of Sheffield School of Architecture.

Pearson, A. (2014) Government exempts 'small' sites from zero carbon homes target. Available from: http://www.building4change.com/article.jsp?id=2395 [accessed in July 2014].

Peterman A, Kourula, A and Levitt R (2012) A roadmap for navigating voluntary and mandated programs for building energy efficiency. Energy Policy, 43, 415-426.

RIBA (2009) Improving Housing Quality: Unlocking the Market, London: RIBA.

Turoff, M. (1975) The Policy Delphi, in Linstone, H. A. and Turoff, M. (eds) The Delphi Method: Techniques and Applications, London: Addison-Wesley.

Wainwright, O. (2013) The future's communal: meet the UK's self-build pioneers. Available from: http://www.theguardian.com [Accessed in May 2014].

Wallace, A., Ford, J. and Quilgars, D. (2013) Build-it-yourself? Understanding the changing landscape of the UK self-build market, York: Centre for Housing Policy and Lloyds Banking Group.

Zero Carbon Hub (2011) Allowable Solutions for Tomorrow's New Homes: Towards a workable framework, London: Zero Carbon Hub.