The future of UK housebuilding

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THE FUTURE OF UK HOUSEBUILDING

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UK housebuilding has evolved since the Second World War into a diverse and complex industry, continually trying to respond to multiple demands for quantity, quality, environmental sustainability and affordability. Drawing on several reviews of the industry history, current status, challenges being faced and drivers for change, this report discusses a number of UK housebuilding scenarios for the next 10 to 20 years, in order to provoke deliberation and encourage more strategic thinking within the industry and amongst policy makers, as part of a pan-industry movement towards a more sustainable future.

• Despite the significance of housing supply to the national economy and general well-being, UK housebuilding has long been associated with a lack of supply, fragmented industry structure, overall risk-averse attitudes, a general reluctance to innovation, skills shortages, a slow take-up of sustainability and a less-than-responsive planning system. These features, coupled with the recent sharp economic downturn, impose significant challenges for the industry, today and in the future. Opportunities for delivering good-quality, affordable and sustainable homes do exist, in parallel with a number of inter-connected drivers for change around the aspects of political, socio-cultural, technological and environmental development.

• The future scenarios for UK housebuilding incorporated here show the variety of inter-connected pathways along which the housebuilding industry could progress over the next 10 to 20 years. They are not presented as preferred futures, or indeed as aims and recommendations for Government or industry, but instead are held up to inspire deliberation and imaginative thinking regarding the variety of futures that may lie ahead. In addition, together with the associated debate and discussion, they point to the potential cause-and-consequence of impacts tomorrow due to the choices taken today.

• Notwithstanding the complexity of the wide-ranging factors, issues and trends impacting upon the scenarios, the future of housebuilding is likely to be largely driven by the combination of Government policy on sustainability, legacy of the economic downturn, and the rapid evolution of innovative technology in the short- and medium-term. The current policy is markedly focused on the introduction and implementation of the Code for Sustainable Homes and achieving Zero Carbon Homes in a few years time, which at the time of writing is still set for 2016. These innovative technologies are multi-faceted, encompassing offsite production, modern methods of construction (MMC), renewable energy and microgeneration, new materials, and ICT. In the longer term, the future of UK housebuilding is likely to be driven by a more complicated profile of forces including demographic shifts, policy evolutions and climate change. Some issues such as increased global competition (in particular the consequent foreign entries to the UK market), and aspects of sustainability other than energy (such as water, waste and ecology), are likely to become increasingly dominant.
• We see few changes in the future to the dominance of private housebuilders regarding new homes completions in the UK. The structure of the industry, however, is likely to become more diverse, with more specialist firms working within sustainability, zero carbon, and innovative technologies (for both construction and renewable energy). The sector is very likely to see the coupling and de-coupling of housebuilding and manufacturing, as has appeared previously in its history. The benefits of the increased industrialisation of the housebuilding process will continue to become more recognized and accepted by consumers, builders, regulators, lenders and policy-makers. Land use planning, unless with dramatic changes, will continue acting as a determinant force, driving housebuilding organisations in relation to their house type designs, technology and innovation take-ups.

• The future nature and form of UK housebuilding will no doubt remain heavily reliant on land use planning, the national (and as has recently been seen, the global) economy and the variability of the housing market. However, consumer preference, technology and wider sustainability issues will play increasingly important and dominant roles. Nevertheless, the debates regarding the future discussed here highlight the potential uncertainties associated with the future, together with the potential impacts of the decisions that we make today.

• Whereas many forward-thinking industry practitioners are able to identify current (and near future) important issues and events, they are often poor at acknowledging the interdependencies between these issues, or identifying their potential consequences. Housebuilding is also a classic example whereby this conservatism is further exacerbated by the need to operate within strict industry and Government codes and regulations, which can often stifle creative and futures-orientated thinking. Exploring and debating the future can therefore be useful in extending practitioners’ forward thinking, help facilitate communication amongst stakeholders, and enhance understanding of the context within which their strategic decision making takes place. Whilst looking ahead systematically, housebuilding stakeholders, including the Government and consumers, need to ensure that they are sufficiently adaptable and responsive to keep up with, if not capitalise on and take advantage of, the rapidly-forming futures that lay ahead.

Beneficiaries of a move towards the long-term perspective would not only be clients, society and the public (where it is a ‘no-brainer’ in terms of sustainable development) but also the housebuilding sector itself, which needs to better prepare for its own future, through the creation of a more informed and forward-thinking industry, accumulating and capturing the knowledge of its diverse participants, in order to stimulate innovative and creative thinking.
Houses are homes for people. More than any other consumer product, housing influences how people feel, how people behave, and how people live as a society (Housing Forum, 2002). The significance of housing supply has been highlighted in the Barker Review (2003:1), “Housing has profound and often unappreciated impacts upon our lives. It directly affects our quality of life, our health and well-being. Housing also affects our national economic well-being: the rate of economic growth and our prosperity”.

The significance of a sustainable housing supply to the country has been emphasised in a series of recent UK Government policy documents during the past decade (e.g. DETR, 2000; ODPM, 2003, 2005; CLG, 2007, 2010a). They claim that people who are decently housed have a stronger sense of security and place. Decent housing strengthens communities and provides a better setting in which to raise families. It improves health and educational achievement and provides a long-term asset that can be passed on to future generations (ODPM, 2005). However, the housing supply in the UK has been on a downward trend since the 1960s. The Housing Green Paper (CLG, 2007) set the target of housing supply to 240 000 new homes per annum by 2016, an annual target that the industry has still yet to reach and which still seems overly optimistic.

In the face of the current economic recession, housebuilding is facing a significant challenge to survive, let alone to deliver housing supply in the quality, quantity and sustainability as claimed in the policies.

The Government, in the Housing Green Paper (CLG, 2007), has made significant commitments to achieving sustainable homes, with a marked focus on delivering all new homes to be zero carbon by 2016, as outlined in the recent UK Low Carbon Transition Plan (TSO, 2009). Housing has a key role to play in reducing the UK’s greenhouse gas emissions, as over three quarters of the energy is used for domestic space and water heating, which accounts for 13% of the UK’s greenhouse gas emissions. The role of housing is therefore crucial if the UK is to ever meet its targets of a 34% reduction by 2020, compared to a 1990 baseline, and a 80% reduction by 2050 (HM Government, 2009).

Nevertheless, the demands over the coming decades will be unlikely to change – if anything they will intensify. Climate change, demographic change and the demand for housing are all leading to a fundamental shift in the expectations placed on the supply of housing of quality, quantity, locality, affordability and sustainability. There is an urgent need to think more strategically, in order to address the challenges, as summarised in the Housing Green Paper (CLG, 2007), “more homes to meet growing demand; well-designed and greener homes; more affordable homes to buy or rent”.

Whereas many forward-thinking industry practitioners are able to identify current (and near future) important issues and events, they are often poor at even acknowledging interdependencies, never mind identifying the potential consequences (Goodier et al., 2010). Most expert ‘thinkers’ stay within their sphere of knowledge, and have poor relative appreciation of advances in related areas. This conservatism is often exacerbated, with housing being a classic example, by the need to operate within strict industry and Government codes and regulations which can often stifle creative and futures-orientated thinking. Identifying and exploring the future helps to extend practitioners sphere of thinking, to facilitate communication amongst key stakeholders, and enhances understanding of the context within which their strategic decision making takes place.

Beneficiaries of a move towards the long-term perspective would not only be clients and the public (where it is a ‘no-brainer’ in terms of sustainable development) but also the housebuilding sector itself, which needs to better prepare for its own future, through the creation of a more informed and forward-thinking industry, accumulating and capturing the knowledge of its diverse participants, in order to stimulate innovative and creative thinking.

Within the context outlined above, this report aims to explore the future nature and form of UK housebuilding over the next 10 to 20 years with the purpose to encourage strategic thinking and provoke debate on the future of housing in the UK. The report reviews the current status of housebuilding, identifies the current key challenges and opportunities facing the industry in relation to the delivery of housing of quantity, quality, environmental sustainability and affordability. It then discusses the drivers for change and the potential future nature and form of housing, presenting strategic thinking based on expertise, existing knowledge and insights of the authors and others.
2.1 A Different Perspective

Although a significant amount of research on housing seems to be continually conducted, the potential contribution of futures research and methods to the debate seem not yet to be fully realised. Burke and Hulse (2009:326), in their recent work on Australian housing, note that futures studies have “relied heavily on expert analysis,” and this has been the case in several UK examples, e.g. RIBA’s Building Futures (2004) and RICS’ The Future of Housing (Barlow, 2000).

There certainly seems to be a paucity of dedicated futures research in housebuilding given the importance housing has in terms of society, well-being, employment and the wider economy (Guthrie et al., 2010). Where scenario building has been used it is often the economic issues that dominate over most others, which is maybe not surprising given the recent economic downturn, which was felt particularly quickly, and deeply, by the housebuilding sector. The relatively low levels of inclusive (i.e. involving diverse stakeholders) futures research in housebuilding fail to account for the wider set of influencers and drivers that all work together to impact upon the housebuilding industry.

In addition, there is arguably a need for a more nuanced use of foresighting in combination with other relevant empirical research to avoid replicating existing wisdom and consequently neglecting wider, more divergent thinking (Guthrie et al., 2010, Goodier et al., 2007). Futures thinking permits us to contemplate things that might otherwise be overlooked; to pose questions such as, how will we be living and building in the years to come? They prompt us to consider whether the conditions we know today will become radically different. Familiarising ourselves with extreme uncertainty and greater complexity, in the shape of increased numbers of future possibilities, does not come easy to a traditionally short-sighted industry such as housebuilding, incumbents of which pride themselves on solving the problems of today.

However, it does help enable the exploration of how alternative visions of home owner desires, industry actions, policy interventions and other important factors might variously shape the housebuilding sector in the future. In addition, by considering the interconnectivities of these factors a more holistic understanding of the influences on housing demand and supply can be achieved, through which potential interventions to reconcile them can potentially be identified.
03 UK Housebuilding Background

The history of UK housebuilding since the Second World War has demonstrated significant changes to its market, structure and form of building, as well as being the subject of a significant number of Government and expert reviews and studies.

There have been three housing market booms since the end of the Second World War, which were the mid-1950s to the early 1970s, the early 1980s to the early 1990s and the late 1990s to the late 2000s (Welling, 2006a; OFT, 2008). During the last boom, UK house prices had been rising for 10 years, and started to fall from autumn 2007 as a result of the world financial crisis and the resultant recession. Since spring 2009, there have been signs of a partial recovery in the housing market, with growing prices by January 2010 by 10% from the spring 2009 trough (Ball, 2010a).

In parallel with the housing market changes, there have been remarkable evolutions to the structure of the supply side of the UK housebuilding industry, which were reflected in the transition from the local housebuilders of the 1930s, through the regional diversification of the 1960s, to the national housebuilders of late 2000s (Welling, 2006a). A consequence of that was the increasing contribution to new-build housing by private housebuilders since the 1950s, reaching an overwhelming dominance (over 80%) since the mid-1980s (Callcutt, 2007).

The changes of the market and structure of the industry have certainly influenced the evolution of the forms of housebuilding, which suggests a paradigm of changes from conventional site-based methods towards a more dynamic combination of methods involving a greater use of offsite production technologies, industrialised techniques and systematic building philosophy (see e.g. Gibb, 1999; Girmscheid and Scheublin, 2010; Gann, 2000). Marked examples supporting this paradigm include the use of precast concrete panelised systems in the 1950s and 60s (Glass, 2000), timber framed construction in the 1970s, and a range of offsite production technologies including modular building, volumetric preassembly, non-volumetric preassembly and subassembly and components (Gibb, 1999) following the recommendations by Egan (1998) which were further expanded to include some innovative on-site methods of construction under the banner of modern methods of construction (MMC) (ODPM, 2003).

There has always been interest in housebuilding from various parties and there have been many Government-commissioned reviews of housing and housebuilding. The Barker (2003) Review was set up to review issues underlying the lack of supply and responsiveness of housing in the UK and particularly to consider the role of competition, capacity, technology and finance of the housebuilding industry and the interaction of these factors with the planning system and the Government's sustainable development objectives. The Final Barker (2004) Report sets out a series of policy recommendations: a need to integrate economic considerations into the planning system, and a need for better means of assessing the costs and benefits of development and land use. This Review pinpoints that in the past quality of service to consumers and considerations of sustainability, design and innovation have been secondary to the desire to secure land. The need for an adequate supply of good quality new homes claimed in the Barker Reviews has been a recurring theme of Government policy, e.g. in the Sustainable Communities Plan (ODPM, 2003), its follow-up five year plan (ODPM, 2005) and the Housing Green Paper (CLG, 2007). However, as the Callcutt Review (2007) argued, these reviews and policy statements have generally focused on the public interest in adequate supply of homes to meet people’s needs and wider sustainability objectives, whilst none has looked specifically at housebuilding from the housebuilders’ point of view. Within such context, the Callcutt Review (2007:3) was commissioned “to examine how the supply of new homes is influenced by the nature and structure of the housebuilding industry, its business models and its supply chain, including land, materials and skills”.

At almost the same time, the Office of Fair Trading (2008) published a market study report of UK homebuilding, which investigated the extent to which consumers have power to drive competition, the level of consumer protection and redress, and the extent and nature of competition in the housebuilding industry. In the face of the financial crisis and economic recession, the Government published the Pre-Budget Report 2009 (HM Treasury, 2009), setting out a range of measures to support housebuilding activity in the downturn by providing additional funding to stimulate housing development in the near term and boost capacity in the housebuilding industry, and look to identify measures to promote a strong and diverse housebuilding sector in the long term. Coupled with the strategy for tackling the downturn was the policy for delivery low carbon economy. The Low Carbon Construction Innovation and Growth Team published their emerging findings (HM Government, 2010) from assessing the strengths and of opportunities for the UK construction industry in a low carbon economy and consider how the UK can be a world leader in the sector. To inform Government policy developments on housebuilding as announced in both the Pre-Budget Report 2009 and the Low Carbon Construction Innovation and Growth Team Report, CLG commissioned research (Ball, 2010) to look specifically at the issues affecting the responsiveness of housing supply in England and identify challenges for the industry and propose actions for Government to consider. This research particularly examines the impact on housebuilding of the economic and financial crisis since spring 2007, which expands the spectrum of the earlier Barker and Callcutt Reviews.
Following the introduction and background of UK housebuilding provided in the preceding sections, this section reviews the current nature of the industry in terms of its structure, ways of production and business models, and the dynamics shaping that. This review leads to the identification of the challenges and opportunities for the industry, which are subsequently discussed.

4.1 Fragmented Industry Structure with Dominance by Large Firms

Private housebuilders have been the largest contributor to supply of housing in the UK since the 1960s, and dominated the market since 1980s with almost 90% market share of new homes built in the country (Figure 1).

However, they are not a small homogeneous group, but a very large and diverse collection of companies. The National House Building Council (NHBC), the UK's leading warranty and insurance provider for new homes and covers around 80% of new homes built in the UK, maintains a register of around 18,000 builders. However, just under 200 firms of that produce more than 50 homes per year (Barker, 2003) and less than 50 housebuilders built more than 500 dwellings annually during the past 20 years (Calcutt, 2007). According to the statistics in the Private Housebuilding Annual (Wellings, 2006b), the top 100 housebuilders contribute around two thirds to the housing unit completions by the industry as a whole. The industry is also geographically fragmented with many strong regional players and national firms, formed around sets of regional operations (Barker, 2003). This is largely because successful land acquisition is crucial to housebuilders, which requires a good knowledge of local housing markets and local planning requirements.

The structure of the housebuilding industry highlights the importance of large companies in delivering housing supply and the significance to take up (or not) of innovative technologies and the wider sustainability agenda. We see this feature as unlikely to change dramatically in the future, due to the nature of housebuilding process and business models in the UK, which are reviewed below.

Figure 1 Permanent dwellings completed, by tenure, UK

Source: CLG Live Table 241 (1949-2008) and Table 211 (2009, estimated by multiplying the first three quarters’ data by a coefficient of 4/3)
4.2 Housebuilding Process and Business Models

The housebuilding process generically includes all the activities of bringing forward developable land to create finished and maintained dwellings. For one-off producers (e.g. self-builders), the flow nature of development and production will be limited to one site only. However, for repeated builders, housebuilding activities will be part of a continuous process, likely with several or many similar tasks taking place at different sites. Such repeatability of activities determines the housebuilders’ land-banking strategy and mass production approach in order to maintain business continuity, mitigate market risks, and improve process efficiency for minimised costs.

Ball (2010:46) mapped the housebuilding process in a series of principal activities centred on four broad ranges, i.e. ‘project conception and evaluation’, ‘land preparation’, ‘building construction’, and ‘marketing and sales’. Within the context of optimising the use of offsite production technology, Pan (2006) outlined four principal stages of the housebuilding process in typical large private organisations, i.e. land acquisition, pre-site, on-site and post-site. Pan also mapped these four stages and their sub-stages in alignment with the phases provided in the ‘Process Protocol’ (Kagioglou et al., 1998) (Figure 2).

However, there is a general lack of research into the housebuilding process and roles that stakeholders play. Further research into this area should help improve understanding for improving process efficiency and integrating supply chains in the long term.

Business models are identifiable according to the parts of the overall housebuilding process that firms undertake and the roles they play in that. Following the call for improving quality and efficiency of housebuilding highlighted in the Egan Report (1998) and Barker Review (2003), many studies have explored housebuilding business models and their implications on housing supply and the uptake of innovation. Venables et al. (2004) claimed that large housebuilders normally take the role of developing and building houses, some being supported by in-house design teams and partnered with their manufacturers and suppliers, whilst some others have no construction capability and sub-contract the entire construction process. This situation complicates what is already a very fragmented sector. The inevitable corollary of this is that there is little sharing of knowledge and good practice and hence the take-up of offsite technologies has been inhibited within the sector. Barlow et al. (2003) suggested that the business focus on eliciting profits from the development of land and the management of finance during this process rather than the actual construction process itself appears to be another factor inhibiting housebuilders’ take-up of offsite. This is in part due to the fact that land prices have a major impact on the final out turn costs, representing up to 50% of total costs in some areas (Egan, 1998). Housing developers have been criticised that they have not done enough to drive down build costs, which have risen significantly (ODPM, 2005). It has been claimed that there was a tendency for housing developers to ‘land bank’ by holding back the release of land or not delivering on planning permissions in order to take full advantage of market conditions and maximise profits (Ball, 2010). This however prevents the delivery of increased housing numbers quickly when prices rise (Barker, 2003).
The Callcutt Review (2007) identifies four business models in UK private housebuilding:

- The ‘current trader’ business model, which consists of a cycle of land acquisition, development and outright sale, followed by the vast majority of housebuilders, where the housebuilder retains no long term interest in the property.

- The investor model, which denotes that developers retain a long term interest in a developed site, which may consist of housing for rent or the retained portion of shared ownership sales. Therefore, the developer trades a proportion of the up-front development profit for the opportunity of long-term revenues and future capital growth. Yields are likely to be relatively smaller than under the current trade model, but more secure.

- The self-build model, which is related to both the individual owner who builds the dwelling or contracts to architects, builders and other suppliers as needed. This sector contributes 15,000 to 18,000 homes per year, roughly 10% of total production.

- The RSL (Registered Social Landlord) build-for-sale model, which aims to create mixed communities in which the social and market sale homes are indistinguishable. Due to funding requirements, RSLs are more likely to focus on quality and sustainability, and to welcome innovation, although unlikely to be able to match the major housebuilders experience in delivery.

The more recent CLG Review (Ball, 2010) describes five types of housebuilders:

- Classic private housebuilders, the most popular, operate in an integrated model, including activities from project conception and evaluation, land preparation, building construction, and marketing and sales.

- Residential developers, undertake land development and dwelling sales, but neither building nor design. Instead, they let out build or design and build (D&B) contracts.

- Land developers/housebuilders denote separated land development and housebuilding, i.e. land developer buys land, ensures broad planning approval, adds infrastructure and sells sub-divisions, but housebuilder builds and sells.

- Variants include land developer/residential developer and investor developer. The former is sub-divided land bought by a developer that lets out a build or D&B contract. An investor developer buys land, conceives a project, lets out D&B contracts, holds completed development as investment e.g. student housing.

- Self builders, which typically build as owner-occupier, using land purchased ‘raw’ or from a land developer, and full- or part-letting out of design and build.

The diverse and overlapping nature of the business models and housebuilders listed above will not change overnight, whilst their significance to housing supply in a longer term may be subject to Government policy for land supply, as well as sustainability and market changes. The requirement of good knowledge of local housing markets and planning helps explain why mainstream construction firms tend not to diversify into housebuilding (Barker, 2003) and why there are so few overseas firms active in the UK (Ball, 2010). Most housebuilders in the UK operate on the ‘current trader’ model or as ‘classic private housebuilders’. Standard house designs are generally adopted, although configurations will vary substantially depending upon the site and geographical area, which has a significant implication on the take-up of innovation. This nature of the UK housebuilding business and process imposes a unique risk profile, which is explained as follows.
4.3 Overall Risk-averse Attitudes

The Callcutt Review (2007:180-181) identifies that the risks in relation to housebuilding are associated with the following areas:

- Running out of land. A developer will ideally require around 18 months to 2 years before land on new sites can be brought into production, which in reality is seldom achieved. Failure will force a builder either to buy ‘oven ready’ sites at very high prices or to try and increase volumes from existing outlets which will necessitate price discounting;

- Cost overruns. The increasing complexity of construction and development has made building cost control more difficult;

- Failure to assess market demand correctly. Putting the wrong product on a development will significantly affect sales proceeds and may require significant discounting to achieve sales;

- Failure to assess the future market. The housing market is very difficult to assess and many economic forecasters have made predictions that have been wrong. Managing for uncertainty is a key part of the builders’ business and the financial policies, investment strategies and business processes of housebuilders are orientated towards fast reaction to adverse changes in the market;

- Generic product failure. A single component failure, design fault or poor quality workmanship can and often does affect more than one dwelling, meaning potentially expensive rectification works.

This risk profile expands the two types of risk identified by Barker (2003), which particularly influence housebuilding business, i.e. market risk from house price volatility where a 1% shift in house price can increase or reduce profit by up to 8%, and site-specific risk associated with land acquisition, gaining planning permission and construction. These risks partly explain why the housebuilding industry is reluctant to make long-term fixed commitments.

The risk profile of housebuilding is also generally recognised in the CLG Review (Ball, 2010) which however suggests housebuilding itself, compared to land development, has a lower profile of risks. The two provided reasons in support of that suggestion appear less convincing. The first one is ‘the technologies used in housebuilding are generally well-known and repeatedly used in thousands of other instances’. This reason may be applicable to traditional housebuilding, e.g. traditional masonry, but not to the range of offsite production and modern methods of construction (Ross et al., 2006; Pan et al., 2008). The many offsite and modern methods, although having seen an increasing take-up in industry practice (see HCA, 2010), are still largely perceived less trialled and risky (Goodier and Gibb, 2007; Pan et al., 2007). In addition, there is also an increasing awareness of taking up renewable technology (see e.g. NHBC Foundation, 2008) in delivering sustainable homes, many of which are new to UK traditional housebuilding. The other provided reason is ‘the tasks can be well specified and monitored as work goes along’. This claim, again, is valid to traditional contexts but underestimates the complexity of and difficulty with performance monitoring and measurement following the increasingly stringent environmental performance standards, e.g. the Code for Sustainable Homes (CfSH) (CLG, 2007) and Site Waste Management Plan (DEFRA, 2007).

Therefore, the risk profile associated with modern housebuilding in the UK has become more complicated than that traditionally perceived of land and market risks, but exists in a more dynamic and diverse form combining areas of planning (land-supply), market, technology, environment and building processes. This trend probably explains the observation made in the Callcutt Review (2007:181), “after more than 15 years’ steady growth in house prices, conservative risk-averse attitudes still prevail and are probably justified. The City still regards housing as relatively high risk because of its inherent unpredictability and requires a high premium on its use of capital”.

4.4 General Reluctance to Innovation

Generally speaking, construction is not innovative enough (Egan, 1998; Cripps, 2003; BERR, 2008). This is the same in the housebuilding sector. The Barker Review (2003) suggests that, in the housebuilding industry, production techniques are inefficient and there is a reluctance to innovate and adopt offsite manufacture and other innovative production techniques/MMC. In turn, this restricts the builders’ ability to ‘ramp-up’ production to cope with market demands. The industry has been characterised as comprising: low levels of responsiveness to demand; a cautious approach to investment in brownfield development; and low levels of innovation (Barker, 2003). Concerns with housing built by MMC are held by a wide range of industry players (POST, 2003).
The Callcutt Review (2007:29) refers to ‘sharply divided’ opinions on utilising offsite and MMC, “its advocates point out that MMC techniques are already in common use for commercial buildings without any obvious loss of performance or amenity to users. Critics point out that, by comparison with traditional methods, it requires considerable up-front investment in manufacturing plant which offsets the savings from faster construction times, and is likely to leave MMC as an uncompetitive option until demand has greatly increased”. The Review also acknowledges that enough new homes, particularly for RSLs, are being built using MMC to offer solid experience of the advantages and limitations, in construction and in use. There is no significant barrier to adopting MMC if it can be demonstrated as a cost-effective alternative to traditional methods.

The recent CLG Report (Ball, 2010) also claims that innovation in housebuilding is relatively slow and, typically, path-specific. Innovation does occur quite extensively in a wide variety of areas, including process management, marketing, customer interfaces, finance, project and product mixes, site layouts, internal designs and fittings. However, many occur in what can be termed the ‘development’ rather than the direct ‘building’ part of the housebuilding process. This has had an effect on progress towards the construction of more energy-efficient housing because this programme pushes the industry towards altering the way in which it has traditionally built homes. The economic downturn has added to the general reluctance to innovation due to the cuts where R&D budgets are often picked. A lower level of new housing output also reduces opportunities to experiment and to innovate. The lower level of innovation and general reluctance to innovation raises a fundamental issue within the industry with the movement towards zero carbon homes (CLG, 2007).
The housebuilding industry faces significant challenges, some being long-standing while others emerging from, or being triggered by, the economic downturn. Some factors, such as changing demographics, are in the domain external to housebuilding, and others, such as increased standards and legislation, originate more from within the sector itself (Harty et al., 2007). It is assumed that external, macro drivers, such as climate change, will define, configure or constrain the possible forms of the housebuilding sector in the future, but without much consideration of how these might intersect with internal dynamics, such as the organisation of the sector, or the skill requirements of the housebuilding process. This also questions the abilities of housebuilding firms and practitioners to intervene and influence the processes of change – what actions can be taken by firms and other stakeholders, for example, to influence the overall volume of offsite within the industry? Or to readdress the industry’s paucity of trained workers? Or even take into account the problems of a changed future climate in decades from now?

Internal and external influences can also be seen as effects, as well as causes of change. Government policy might be introduced for a specific, primary reason, such as a need to reduce waste on construction sites, or might come about as a result of wider forces, for example zero carbon homes as a response to climate change. Increased use of ICT could be a driver, pushing housebuilders towards greater reliance on and use of ICT for design and construction. It could however, also be utilised as a response to an economic imperative, such as the need to lower costs, compete globally, or solve particular problems, such as coordinating a range of construction projects.

Ball (2010) summarised the challenges from the housebuilders’ perspective as: a lack of viable sites; a high and growing regulatory burden related to land-use planning and wide-ranging regulations including zero carbon homes; finance problems with both house-buyers’ mortgages and development finance; and a loss of capacity in the industry associated with skills of trades, professions and managerial, firm competences and supply chains. This section examines all these challenges, with the purpose to highlight implications on the supply side of the industry.

5.1 Housing Under-supply and Mismatch in Nature

The number of annual dwelling completions in the UK since the Second World War reached the peak (425 830) in 1968, but had been on a steep downward trend until the early 1980s when entering into a fluctuant plateau around 200 000 (Figure 1). In 2001 the construction of new houses (173 770) fell to its lowest level since the Second World War. Over the ten years to 2002, output of new homes was 12.5% lower than for the previous ten years (Barker, 2003). Despite a gradual increase from 2001 to 2007, the number of housing completions dropped dramatically in the face of the downturn since autumn 2007, with the annual completions in 2009 estimated below 150 000 (Figure 1).

At the same time, a significant rise in the number of households in the UK has been reported. DETR (2000) indicated a forecast increase by 3.8 million between 1996 and 2021 (based on 1996 statistics), equivalent to around 150 000 each year. Barker (2003) and ODPM (2005) suggested that there will be 39 000 more new households formed in the UK each year than previously thought, i.e. up from the estimate of 150,000. The Joseph Rowntree Land Enquiry (Barlow et al., 2002) suggested that around 225 000 new homes will be needed each year in England alone to meet the demand arising from demographic changes and other needs up to 2016. According to the latest CLG Live Table, the number of households in the UK has been projected to gradually increase, from the current 27 million to 33 million by 2031 (Figure 3).

Population growth, changing patterns of household formation and rising incomes are all fuelling demand for homes (Barker, 2003). Albeit the many and slightly varied sources, the increasing trend of households is doubtless, which underlines an urgent need to build more homes for the current and future generations.
Not only has the volume of output not responded to meet demand, but the nature of housing being produced does not meet the needs of consumers and society as a whole (Barker, 2003). The population is projected to continue rising and the average household size is decreasing. One-person households accounted for 19% of overall households in 1971, but that share increases to 33% by 2010 (Figure 4). However, in some regions and localities there is a mismatch between the nature of the houses available and what is required to meet the needs and aspirations of that area.

Houses account for 82% of dwelling stock in England, while the split between houses and flats in new-build in recent years has presented a trend towards equilibrium, reaching 50/50 in 2008/2009 (Figure 5). Despite the fast growth of high density smaller one and two-bedroom flats within individual blocks in the first decade of this millennium (Figure 5), high-rise apartment buildings are very unlikely to attract future attention of both supply and demand sides following the economic downturn (Knight Frank, 2009).

Figure 4 Household estimates and projections by household type, England

![Figure 4 Household estimates and projections by household type, England](source)

Source: CLG Live Table 402

Figure 5 New build completions by dwelling type, England

![Figure 5 New build completions by dwelling type, England](source)

Source: CLG Live Table 254, Chart 254a & 254b
5.2 The Economic Downturns

Over the past forty years there have been four downturns in which real house prices fell nationally, i.e. in the mid-1970s, the early 1980s, the early 1990s and recently from autumn 2007 to spring 2009. The nature and extent of the downturns reflect many factors, such as macroeconomic fluctuations, interest rates, regulatory and tax changes and shifts in credit conditions as identified by Ball (2010), which should cover wide-ranging factors in political, economic, socio-cultural, technological, environmental and legislative aspects. Wellings (2006a) provided detailed analysis of impacts on housebuilding of the first three downturns, while Ball (2010) compared the housebuilding responses to the recent recession with those to previous downturns.

ConstructionSkills (2009) suggested that the private housing sector has suffered most in the latest downturn, taking the level of activity down to below that seen in the depths of the 1990s recession in real terms. In theory a much higher level of funding in the 2008–2011 Affordable Housing Programme (AHP) should have delivered increasing output in the public housing sector. However, social housing providers have been hit by stricter lending conditions, both through their ability to access funds directly from private lenders, and through income generation from sales of units under low cost home ownership schemes. Delivery through section 106 agreements also became problematical as the number of private developments where social units could be sited dried up (ConstructionSkills, 2009).

A further but marginal decline is projected for output in 2010 but over the whole of the 2010 to 2014 period UK construction output is expected to average 1.7% growth each year (ConstructionSkills, 2009). However, the balance between public and private work will change. As economic conditions improve, stabilisation and then recovery are expected for the private housing, although the timing of the upturn will vary across markets. In contrast, the public sectors are facing expenditure cuts in constraining growth in public debt (see the Pre-Budget Report (HM Treasury, 2009)). There are signs of rising levels of both mortgage approvals and loans in recent months, while these indicators are not returning to what would be considered ‘normal’ levels. Lending conditions still remain tight.

Gallent (2009) suggested that the present crisis is likely to change the distribution of development, with housebuilders focusing their efforts on bringing forward the most profitable sites nationally and regionally, and turning away from those with significant physical or planning constraints locally. Although such impacts may well be short-lived, the effect on lender and borrower behaviour may be more fundamental. The crisis looks likely to bring long-term changes to the banking system which may reduce access to mortgage credit. At the same time, borrower behaviour may alter. Perhaps enthusiasm for home ownership will be stifled. There is a strong likelihood that the second home and buy-to-let markets may shrink, taking a significant slice off the overall demand for housing.

This report does not set to review the previous arguments, but discusses the implications of the downturns on the future of housebuilding and consequently challenges facing the industry. This discussion draws on the patterns identified and conclusions provided by Ball (2010:32-3).

- The four steep collapses of UK housebuilding during the past 40 years demonstrate the cyclical nature of the housing market.
- Such fluctuations in the housing market have affected housing supply, in both quantity and nature, whilst such effect has been interacted by many other factors. There has been a general downwards trend of housing supply since the 1960s and such supply is generally low responsive to increases in price.
- Ball (2010) observed that, “in each of the downturns, housing starts began to fall well before house prices: by as much as 18 months to two years earlier ... Housing output recovered, at least partly, well before house prices did in the early two slumps; whereas in the current recovery the two have been rising together, at any rate during the last nine months of 2009”.
- The uncertainties of the housing market as a consequence of the downturn influence housebuilders’ decisions. Profitability in general in a downturn is lower than it in a boom. Therefore, the organisations’ perceptions of risks weigh heavier on their decision practice. Accordingly, there are constraints on access to developable land and finance, coupled with reduced production capability and skills during the recession.

Within the context outlined above, housebuilders are less likely to make longer, more strategic commitment to housing supply. They will be more cautious when addressing the risks associated with land development, building processes and housing sales.
5.3 Land Supply and Planning

Planning shapes the places where people live and work, and is supposed to play a key role in supporting the Government’s wider social, environmental and economic objectives. However, many studies of planning and land supply have highlighted that the process of planning applications for housebuilders is lengthy and costly. Barker (2003:10) criticised that the underlying constraint on housing is the supply of land. The Callcutt Review (2007:32) reports paradoxical views on planning: “There is much public debate about the supply of land. The development industry and its advocates complain that the planning system releases too little land, and that its release is slow and unpredictable. The industry’s critics assert that developers do not take full advantage of the available land, preferring to profit from land value inflation with the minimum of effort given to actually building houses”.

The Killian Pretty Review (2008), drawing on research into 64 individual case studies of major developments, reveals that over half encountered substantial problems such as significant blockages and delays during the processing of their planning applications. NAO (2008) reviewed the case history of 100 major residential applications (i.e. developments of more than ten homes) approved in 2006-07 by 11 Authorities. The percentage of major residential planning applications decided within the targeted 13 weeks has improved from 37% in 2002–03 to 67% in 2007–08. The time taken to approve however, was, on average, over 25 weeks. In addition, the average time taken for the whole process, from pre-application discussion to the start of construction, was almost 98 weeks on average in the NAO case studies. Securing a reduction in the total time taken requires action from both authorities and applicants.

Ball (2010) measured the ‘development control’ periods, i.e. the time taken between a site having a full planning application submitted and then subsequently gaining planning permission, of over 900 sites in 45 local authorities, and found that:

- development control is a high cost process for all parties
- determination of planning permission for development that actually occurs takes far longer than the 13 week planning application target in most cases, with a median of 30 weeks and a mean of 43 weeks
- there is substantial variation in the time sites take to pass through development control. Much of the difference in times takes place within each local authority, so uncertainty and time variability seem inherent in development control practices. Slow and uncertain development control leads to large increases in housebuilders’ land banks and limits start-ups of new housing providers

- a limited number of factors affecting the variability of development control time can be identified. Development control time increases substantially with the size of the development as measured by the number of dwellings, but is not affected by other features of schemes. Larger projects take longer to process through development control but less time per dwelling built. Trophy (prestige) projects tend to go through development control faster than others, as does social housing. Development control takes longer in more affluent localities and where there are hung councils. Development control slows when there is a surge of applications
- development control bottlenecks are likely to slow housebuilding recovery and any further desired increases in housebuilding once recovery has occurred.

A common finding of the many studies and reports outlined above is that the planning system restricts land supply and acts as the most significant barrier to housing supply.

5.4 Climate Change

One of the main challenges facing housebuilding in the near and far future is how the impact of climate change will affect our built environment – both the need to reduce our carbon emissions (mitigation) and to cope with it (adaptation). The UK Government is committed to tackling climate change and has an ambitious long-term goal to reduce carbon emissions by 80% by 2050. With the domestic sector accounting for around a quarter of the UK’s carbon emissions, and the built environment overall responsible for nearly half, it is clear that we will need to drastically adjust the way we design, build and use our homes, as well as modify the way we live. Climate change will cause the UK to become warmer, winters will become wetter, summers will become drier and relative sea levels will continue to rise around most of the UK’s shoreline (UKCIP, 2005, Porritt et al., 2010). Adapting to this changing climate will impact on the design, construction, location, cost and operation of all new homes and other buildings in the next few decades.

Wetter winters are expected to increase by up to 15% by the 2020s and by up to 25% by the 2050s. The number of cooling degree-days (to a base temperature of 22 deg C) in London already shows an increase over 1976–1995 of around 20, rising to around 60 (CIBSE, 2005), and is expected to increase by 200% in the south east of England by the 2080s (UKCIP, 2005).
5.5 Slow Take-up of Sustainability

To become more sustainable as an industry and a country will mean changing and adapting our lifestyles, moving towards less energy intensive domestic practices, and seeking alternative technological solutions.

CLG launched the CfSH in December 2006, which has since become the most significant policy framework for environmental sustainability in housebuilding. The method is based on BRE’s EcoHomes version of the BREEAM methodology adapted to relate closely to Building Regulations and Government policy. The method sets mandatory minimum standards against energy, water, construction and household waste, materials and lifetime homes that relate to key Government targets and policies. It has six potential star ratings. Since October 2007, Level 6 has required a net zero carbon solution. However, concerns exist over its practicality as it precludes any use of community or off-site based energy systems. The definition of zero carbon is still in consultation (CLG, 2008; 2009a).

Given the scale of the challenge, every attempt should be made to reduce any unnecessary risks and uncertainties. A lack of appreciation of the technical details pose a threat to the achievement of targets and puts substantial costs and risks on the housebuilding industry, because they have to invest considerably ahead of time in land acquisition, planning applications and in the increasingly demanding technologies required to meet rising targets. Levels of housing investment may be significantly affected, because of the rising costs and continuing uncertainties. Many sites are currently of marginal or negative financial viability. Any increase in costs or risks worsens further their potential profitability. In consequence, despite apparently high house prices, new build margins are often insufficient to absorb rising costs and risk. It would be unfortunate if that were to happen on environmental grounds. Code level 3 already creates substantial changes in the way that homes are built and improves their sustainability. Policies to increase new build sustainability represent a major challenge to the private housebuilding industry. Implementation to date has raised a variety of issues related to costs, uncertainty, a lack of co-ordination between tiers of Government, technical challenges and risks, and consumer understanding and acceptability. The recession has also affected the programme because far fewer dwellings have been built, so that experience has not grown as fast as was originally planned and the resource base and supply chains are more limited than they would otherwise have been (Ball, 2010).

The current take-up of the CfSH is low, with overall 17,401 CfSH certificates issued at design stage and 4,883 issued at post-construction stage, during the period from April 2008 to March 2010. The vast majority of the certificates (90%) were issued for the code level 3 (Figure 6). These dwellings designed or built to CfSH only represent a very small proportion of the new build homes in industry.

![Figure 6 CfSH certificates issued, England, Wales & NI, Apr 2008–Mar 2010](source: CLG Live 260)
Nevertheless, the records of CfSH certificates issued at both design and post-construction stages over the two-year period indicate an increasing trend of taking up the scheme in housing supply (Figure 7 and 8). This seems attributable to the increasing requirements of local planning authorities for CfSH to demonstrate commitment to superior environmental sustainability, largely for social housing. It is also verifiable by the dominance of certificated issued for the code level 3 (Figure 6). However, the take-up of CfSH in speculative housing is believed to be much lower than in social housing. In face of the downturn, the take-up of CfSH is very likely to continue relying on social housing, until the building regulations move closer towards the requirements in CfSH or if CfSH becomes mandatory.

**Figure 7 CfSH certificates issued at design stage, England, Wales & NI**

![Figure 7 CfSH certificates issued at design stage, England, Wales & NI](image)

Source: CLG Live 260

**Figure 8 CfSH certificates issued at post-construction stage, England, Wales & NI**

![Figure 8 CfSH certificates issued at post-construction stage, England, Wales & NI](image)

Source: CLG Live 260
5.6 Concerns on Zero Carbon

Policies relating to zero carbon homes are having a significant and growing impact, which will constitute a major change in building regulations, and is leading to significant changes in building technologies and site practices (Ball, 2010). Concerns still exist however, over what zero carbon is, with Housing Minister Grant Shapps rescinding from the Government’s pre-election promise to get the definition of zero carbon finalised “within weeks” of getting into office (Building, July 2010).

The NHBC Foundation Report (Davis and Harvey, 2008), drawing on a survey of over 100 UK housebuilders, found that a firm commitment among UK housebuilders to tackle issues of climate change: however, there is concern at the considerable challenge of meeting both the Government’s ambitious sustainability targets and delivering a significantly higher volume of affordable and appealing homes. The level of knowledge and understanding among the industry is variable: only 15% correctly identified that homes built to current building regulations do not even meet the requirements of Code Level 1, with 65% believing that the homes they are currently building already achieve Code Level 1 or above. The research also shows that housebuilders vary widely in their approach to tackling the zero carbon objectives: however, there is a widespread reluctance to build speculatively to higher than mandatory levels, due to a belief that customers simply will not pay the premium involved. The research reveals that many housebuilders have serious concerns about whether microgeneration and renewable energy technologies can deliver the energy generation requirements of the Code. Housebuilders fear that homeowners may not accept the required new technologies and could choose to retrofit carbon intensive appliances and systems, which would ultimately undermine the zero carbon objectives. There are further concerns that failure to maintain the new systems and technologies adequately may expose homeowners to health and safety risks. The research indicates a demand for greater clarity on issues around onsite and offsite green generation. In addition, there is considerable concern at the lack of consistency of requirements among local and central Government bodies and a lack of clear central leadership. It is feared that this may seriously inhibit the industry achieving the low and zero carbon objectives and the required increase in output.

Estimates for the additional build costs involved were mainly in line with Government figures, but slightly lower for Code Level 6 where fewer informed responses were provided, a point itself not completely encouraging. Housebuilders strongly believe that the additional costs will need to be financed by reductions in land values and this raises concern that landowners may not be willing to sell land at significantly lower prices. This could lead to shortages in land supply, fewer homes being built and heightened affordability problems. Davis and Harvey (2008) found that 25% of housebuilders studied have been asked by local authorities to build to higher levels of the Code ahead of the nationally agreed dates. There was near-unanimous agreement that homeowners’ interests would be better served if all local authorities worked to the same nationally agreed dates.

5.7 Skills Shortages

The perception that skills shortages represent a challenge to housing supply has been highlighted in a series of studies. Such skills shortages have exacerbated due to the skills lost to the industry during this recession.

The Housing Green Paper (CLG, 2007) states the challenge that “To deliver the Government’s ambitions for housing growth, higher environmental standards and better places to live, we need enough skilled workers. However, recruitment and retention difficulties in key areas, as well as skills gaps, present significant obstacles”.

Barker (2003) reported that over 80% of firms find it difficult to find bricklayers, plasterers and carpenters, and wages for skilled craftsmen are increasing faster than in the economy as a whole. Without changes in labour productivity or automation, even modest growth in output could lead to a requirement for around 70 000 further employees in the housebuilding industry. A more substantial expansion of output would increase this still further, possibly up to 280 000 people. The workforce available to the construction industry is shrinking and the demand for skills required for profitable construction increasing (Constructing Excellence, 2004). Construction companies are operating in an increasingly competitive environment for skilled labour. New working relationships, through partnering, and changing technologies require new skills (Housing Forum, 2004). The housebuilding sector even experiences a more acute skills supply problem than construction in general (ibid). It suggests that employment issues, an ageing workforce, new skill sets, the increased use of labour from overseas and the emphasis on MMC continue to challenge the housebuilding industry. The Government’s agenda for increasing the supply of housing to meet the projected demand, and for the renovation of the existing stock, means that the need for a larger and more skilled workforce is more important now than ever before (Housing Forum, 2004).
The Office of Government Commerce (OGC)’s 2005–2015 Construction Capacity Study (Deloitte, 2006) concludes that while general labour and skills shortages in the construction sector have been alleviated since the expansion of the EU, the UK construction industry is not expected to face significant capacity constraints up to 2015. However, it does identify skills gaps in certain trades and significant skills shortages in specific professional disciplines, particularly, leadership, project management, and specific aspects of design.

ConstructionSkills (2009) predicted that construction should begin its long and slow recovery in 2010, but even by 2014 output is still likely to be well below 2008’s level. In a recession, falls in employment tend to lag falls in output as employers try to hold on to experienced and skilled staff for as long as is practicable. However, this means that a recovery in output does not immediately mean a rise in employment. ConstructionSkills (2009) predicted that employment in the industry is likely to continue to fall until early 2011 by over 400,000 from its peak in 2007 (a 15% decline), and then begin to pick up to 2014 by 93,000 (a 4% increase), but this will still leave employment in the industry over 250,000 below its 2007 peak. For employment in the UK construction industry to match the level of output growth forecast between 2010 and 2014, on average, nearly 48,000 new entrants will be needed each year (ConstructionSkills, 2009).

The Academy for Sustainable Communities’ report ‘Mind the Skills Gap’ (ASC, 2007) concludes that England faces a significant shortage of qualified professionals with the necessary skills to deliver sustainable communities between now and 2012. Ball (2005) however concluded that whilst training is important in expanding the industry, skills shortages are unlikely to represent a barrier to expansion. He notes that there is sufficient resource movement into and out of housebuilding at the margin to affect availability, quality, cost and market competition. However, like Barker, he concludes that there is a need to take a long-term view of potential labour and training requirements. He argues that labour requirements of increased housing production will be offset by potential productivity gains to be improved via:

- economies of scale from higher production
- innovation, including take-up of modern methods of construction (MMC)
- as a benefit from a smoother, more predictable planning process
- as a result of larger builders taking a greater share of the market.

However, the Callcutt Review (2007), having acknowledged Ball’s argument about potential for the housebuilding industry to improve its productivity, critiques that Ball’s (2005) estimate is of a net requirement for labour and skills, but in fact more may be required to offset the competing demands of other major construction projects and the risk that skilled workers from Eastern Europe may be less available in future.

The Barker Review (2006) of land use planning notes that planners were in short supply and that Councils faced difficulties in recruiting and retaining qualified staff. The Callcutt Review (2007) also reports on the paucity and unreliability of skills in local Government planning departments. This was partly addressed by the Planning White Paper (CLG, 2007b) which sets out how Government has made a significant investment to build capacity in local authorities and the planning sector, and to address the shortfall in the number of new entrants to the profession.

Housebuilding requires a wide variety of skills, from the planners, valuers and surveyors, to the architects and designers, to the labourers, craftsmen and site managers, to the marketing professionals and lawyers, and very few of these skills are required only by housebuilders (Callcutt, 2007). Indeed, many are shared with the wider construction industry, and many, particularly among the professional skills, are shared with other business and public activities well beyond construction.

The evidence reported in the previous studies suggests that the housebuilding industry is likely to undergo a prolonged period of low activity with a contracting workforce and low levels of recruitment. However, replacing or re-gaining a well trained, productive construction workforce is certainly a significant challenge.
Despite the challenges faced by the housebuilding industry discussed above, there also exist a number of drivers for change, which cover socio-cultural, political, technological and environmental aspects.

6.1 Changing Patterns of Consumer Demand and Preference
The changing patterns of consumer demand and preference are mainly reflected in the number and nature of households, as well as their attitudes to sustainability.

The number and nature of households have been discussed early in this report. Indeed, the increasing demand for more new-build housing is doubtless, whilst the nature of future housing, e.g. size and type, may also be driven by other factors. Gallent (2009) suggested that demographic and economic drivers could have a profound impact on consumer behaviour. Migration, for instance, will import new social attitudes (particularly towards borrowing, owning a home and forming a household), while the current economic crisis may reduce confidence in financial institutions and create a new aversion to risk. Attitudes towards the countryside and ‘rural lifestyles’, for example, have shaped the planning system and resulted in an intolerance to development in rural areas. ‘Urban renaissance’ of central locations and the glut of apartment development in the late 1990s and into the 2000s are also examples. Attitudes in the 21st century may diverge from those of the 20th, especially if migration transforms the country’s socio-economic profile, introducing a new mix of attitudes and aspirations.

Another example of impact of consumer preference on housebuilding is the major setback of large precast concrete panel systems due to the Ronan Point collapse in 1968. It had been proven that actual structural failures were due principally to poor understanding of materials technology, poor workmanship and a lack of quality control on site. However, in the public’s perception, precast concrete in housing has become unfortunately associated with 1960’s ‘social engineering’, resulting in ill-matched housing types and social groupings, and ‘social malaise’ of high-rise dwellings (Glass, 2000).

In terms of sustainability and zero carbon of future homes, the consumers are generally less concerned but hold a generally prudent attitude to its practicality and financial viability, which offers opportunities for change. The NHBC Foundation Report (Davis and Harvey, 2008), drawing on over 500 interviews and ten focus groups with homeowners across the UK, observes that four out of five homeowners believe that the plans for homes to be zero carbon at 2016 are desirable. However, less than one third believed this date to be realistic. The Report also finds a significant lack of awareness and understanding of the 2016 targets and a widespread reluctance to accept the potential lifestyle changes associated with low and zero carbon homes. There is also a marked preference for the appearance of conventional new homes as opposed to the low carbon homes currently being built. The research suggests that the most effective means of engaging homeowners in the drive to reduce energy use would be to focus on the cost savings that would result. There is currently considerable resistance to homeowners meeting the increased construction costs of the higher levels of the code, principally because of a lack of demonstrable payback on investment.

There is increased interest in self-sufficiency amongst many consumers, and the term “self-sufficient communities” often appears in publicity for new developments, although currently can only truly be applied to communities which are more geographically isolated like small island nations, regions or cities. However, such communities and principles will become increasingly important in the future due to increased microgeneration and renewable energy, natural degradation, economic uncertainty and social instability (Rydin, and Goodier, 2010). As Martino (2009) argued however, to be truly successful they should be considered within the broader context and larger ecosystems if they are to sustain.

The way we purchase homes in the future could also change. Prefabricated offsite houses might never be actually repaired or renovated on site, but instead form part of a disposable sealed unit that is removed and replaced as a stock item, and designed for a pre-determined lifespan. Customers in the future are likely to be able to order their modular homes online, as well as design their home themselves using a ‘kit of parts’ on interactive design websites. Toyota Homes in Japan have been doing this for several years, and in the UK Rapyd Rooms, by Buildings for the Future Ltd, and Ecospace’s ‘configurator’ allow the potential buyer to specify their design online, together with a guideline price.

This will have subsequent follow-on implications for many trades and small businesses, which currently rely heavily on ongoing home maintenance requirements for employment. Factory produced homes are also likely to be increasingly imported and exported in accordance with international standards.
Case Study
‘Off-the-shelf’ single modular housing units

Figure 9 Cub home at BRE Innovation Park, UK
(photography@MarcusPeel, 2010)

Cub homes, from Cube Housing Solutions Ltd, are available in 51m², 102m² and 153m², and can be ready to move into just 12-16 weeks after placing an order (Figure 9). This modular off-the-shelf housing solution is certified to Code Level 5 and covered by NHBC Building Control Type Approval. They can be linked together and stacked up to 3 storeys high. Prices start from £88 500 for a one bedroom home, and one is available to view at the BRE Innovation Park. A similar principle is Ecospace, which provides extra rooms in your garden starting from £10 000 for the ‘WorkPod’ option. Enquiry to completion generally takes around 12 weeks, typical installation time is five days, and modules can be used for offices, playrooms, gyms and guest bedrooms. A self-contained whole house with bathroom and kitchen is also available, which starts from around £30 000. EcoHab, and PAD are further examples of individual unit designs, as is Rapyd Rooms, by Buildings for the Future Ltd.
Recycled shipping containers have provided a starting point for many modular accommodation designers, in the UK and abroad. Examples include the Verbus system for hotels.

Eco Modular Living Ltd provide a two storey mid terraced, two bed, one bathroom home to Code Level 4, made using a containerised housing/housing system which are factory fitted-out and delivered to site (Figure 10). My Space Pod also produce a low cost, modular system accommodation for students, budget hotels and temporary housing, made from recycled shipping containers. They are designed for small plots of 1000m²–2000m², over levels of four or five storey high to provide the intercommunicating complexes of 100 to 250 pods, with the further options to add on more accommodation when needed.

The systems shown above can be joined together to form a larger structure, a principle fully utilised in the Container City concept. Several developments have already been successfully installed in various parts of the UK for homes, classrooms, studios, sports halls, community centres and offices (Figure 11).
6.2 Policy of Housing Supply, Planning and Sustainability

The overall context and the under-supply of housing underline the need to build more affordable and sustainable homes in order to meet the needs of housing demand and the economy. Such policy focus has been reflected in the series of Government policies during the past decade, which include, for example, the Planning Policy Guidance Note 3 (PPG3) (ODPM, 2000), the Sustainable Communities Plan (ODPM, 2003), the Five-year Plan (ODPM, 2005), the Housing Green Paper (CLG, 2007), and the new Planning Policy Statement 3 (PPS3) (CLG, 2010a). The new PPS3 was published on 9 June 2010 which underpins the delivery of the Government’s strategic housing policy objectives. A principal aim of this PPS3 is to underpin the Government’s response to the Barker Reviews and the necessary step-change in housing delivery, through a new, more responsive approach to land supply at the local level (CLG, 2010a).

According to this new PPS3, Local Planning Authorities should set out in Local Development Documents their policies and strategies for delivering the level of housing provision, including identifying broad locations and specific sites that will enable continuous delivery of housing for at least 15 years from the date of adoption (CLG, 2010a). Implementing the planning policy however is essential. A recent survey (CLG, 2010b) reveals that conclusions on five-year housing land supply have been identified for 39.2% (132) of the 337 local planning authorise in England. 61.4% (81) of that cohort were found to have a five-year housing land supply. A significant number of authorities do not have a single five-year housing land supply calculation based on their entire administrative area.

The new PPS3 highlights a key objective that Local Planning Authorities should continue making effective use of land by re-using land that has been previously developed. The national annual target is that at least 60% of new housing should be provided on previously developed land. When identifying previously-developed land for housing development, Local Planning Authorities and Regional Planning Bodies will, in particular, need to consider sustainability issues as some sites will not necessarily be suitable for housing. The evolutionary change of the policy and planning context will undoubtedly drive the housebuilding industry to think more about the ways in which they deliver housing supply. The lengthy and costly process of achieving planning approval and uncertainties associated with that process influence the supply of housing. Within this context, housebuilders are likely to hold land supply in reserve and constrain their level of output. It is understandable for housebuilders to hold substantial stocks of land in order to ensure continuous volume production while attempting to mitigate market and regulatory timing risks. Kickstart funding, designed to give impetus to stalled mixed

tenure projects should benefit both the public and private sectors in the short term. As of the end of November 2009, nearly £360m had been allocated under the programme across 136 projects delivering nearly 10,300 new homes (ConstructionSkills, 2009). As the private housing sector recovers from a very low level, its annual average growth rate over the 2010 to 2014 period is projected to be 8%, higher than the sector’s long-term average rate of 5% (ibid.).

The policy framework of housing supply, planning and sustainability drives the housebuilding industry to review their way of working and seek more effective and efficient approaches to delivering high-quality, sustainable housing in a more productive manner.
Drivers for Change

6.3 Increasingly Stringent Environmental Standards

Environmental standards in housing, both regulatory and voluntary, are becoming more and more stringent, in order to address the increasingly significant environmental issues such as climate change, resources, pollution, ecology and population.

In recent years, the most visible evidence of climate change has come in the form of flooding. The cost of flood protection per home can be expensive, at up to £53,000 (Environment Agency, 2007:13). There is already a clear imperative from the Environment Agency (2007) to build in the right place, away from the floodplain and areas where water quality is already threatened wherever possible. There are already over 4.5 million people at risk of flooding in England and Wales, and this number should not grow. As the weather patterns become more extreme and unpredictable, homes need to be built to be more resistant to natural disasters. In flood risk zones, homes need to be built on high ground or on stilts and flood-resilient designs must be used (ODPM, 2005, Goodier et al., 2008). Good design is key: single storey dwellings and basements should be kept to a minimum, door thresholds raised, and services raised above the potential flood. Anti-backflow valves should be fitted, and plasterboard and large glass patio doors and windows avoided. Homes should be designed to allow for easy drainage and quick drying.

The availability of adequate water supplies may also prove to be a significant constraint on new housebuilding. Among the predicted effects of climate change are higher average temperatures and changing patterns of rainfall, which will exacerbate any shortage of water supply. Water purification and distribution have a significant energy cost and, as discussed below, some potential water saving measures also consume energy. Average household demand for water has increased by half over the past 25 years and continues to increase year on year (Callcutt, 2007). The bathroom designs of today could represent relics of a more indulgent age as water could become a luxury the planet can’t afford to waste (Arup, 2005). The priority will be saving water and our homes will be tailor-made to re-use and recycle all of the water used in the house. At the same time, green-roofs and roof gardens are likely to become more popular, to aid water gathering, help minimise flash flooding, and reduce the urban heat island effect.

Options range from improving water use efficiency, e.g. using water-efficient fittings like low-flush or dual-flush lavatories, to reinforcing supply through recycling. The most promising water recycling measures are rainwater collection and grey-water recycling, which have potential to deliver significant water savings, but need proper and active maintenance to eliminate households’ health risk. The Government policy statement (DEFRA and CLG, 2007) set out a twin-track approach comprising: amendments to Building Regulations to set a whole building performance standard for the water efficiency of new homes, and amendments to the Water Supply (Water Fittings) Regulations to set new performance standards for fittings. The policy statement notes concern that tighter standards will be needed in future, in order to combat increasing water shortages particularly in water stressed areas. The Callcutt Review (2007) believes that a plan needs to be developed, similar to the timeline for zero carbon, to deliver improved water efficiency in new homes.

Case Study

Floating homes

Figure 12 Floating homes in Germany
(photographer/copyright Klaus Frahm)

The future may also not be restricted to homes on the land. Homes and buildings that float on water are already available in Germany and other countries, and can form a stylish and efficient way to live (Figure 12). Floating Homes GbmH offer 4 different sizes with living spaces from 114m² to 225m². AquaDomi is similar in principle, but is more of a houseboat of the future, based on flexible modules which allow you to create your home exactly the way you want it.
Recent research (Pan, 2010a; CLG, 2009c) provides evidence demonstrating the improving airtightness of UK new-build dwellings. Dwellings built using offsite produced panel systems are generally associated with superior air permeability test results, normally lower than 5m³/(h.m²), which requires rethinking of ventilation strategy of the dwelling, hence leading to extra cost concerns. A balance between airtightness (addressed via Part L) and ventilation (addressed via Part F) is to be maintained. Also, regarding the impact of climate change on building, Tian et al., (2010) predicted that by the 2050s the mean annual cooling energy for buildings in South England climate conditions will have increased by 135% while the mean annual heating energy will have decreased by 40% relative to the current situation. These findings strategically question the current policy focus on heating but not cooling, which may expose future dwellings to significant energy risks.

Due to warmer climate conditions summertime heat gains need to be limited as far as possible, and mechanical cooling avoided if possible. Solar shading, reducing the density or power output of lights and machines, and providing the ability to reduce ventilation to minimum levels during hot periods of the day can all be employed (CIBSE, 2005, Porritt et al., 2010).

Housing energy consumption can be reduced with thermal insulation, airtight structural details, high-performance windows, ventilation, and heat and cold recovery systems (Roberts, 2008). Insulation prevents houses from losing heat, but in hot weather this can increase the risk of overheating, hence sources of heat within the house need to be minimised. Solar shades and houses built with extended overhangs will be used and lifestyle patterns used in Mediterranean climates might become more common. Occupancy sensors are generally accepted as an effective energy saving technology, and will become more user-sensitive and advanced in the future. Gas-filled triple-glazed windows and intelligent insulation, which can automatically adjust to the external temperature to control the heat indoors, are all likely to be available, if not compulsory. Internal gains, particularly electronic goods, are often a significant component of space heating. Light emitting diode (LED) lighting, vacuum insulated panels in cold appliances, and consumer electronics, all have potential to contribute to reducing the internal heat gain of houses and buildings (ECI, 2005).

Regulation can be raised to achieve major changes, but this must be at a pace that the majority of the industry can deliver. Voluntary codes and standards provide a means of encouraging industry leaders and innovators to go further and faster. The varied building performance assessment methods, e.g. BREEAM and the CfSH in the UK and their counterparts worldwide (see Atkinson et al., 2009), are particularly re-shaping the decision thinking of housebuilders and homebuyers (see e.g. Osmani and O’Reilly, 2009).
Drivers for Change

6.4 Code for Sustainable Homes
The CfSH assesses the sustainability of a home by awarding points in nine design categories (CLG, 2009d), including:

- Energy and carbon dioxide (including insulation, electric lighting, heating, domestic appliances)
- Materials (responsible sourcing of construction and finishing elements)
- Ecology (protection or enhancement of site habitats)
- Waste (household recycling facilities, site waste management, composting facilities)
- Pollution
- Health (specific room daylight factors, sound insulation, Lifetime Homes)
- Water (internal and external potable water consumption)
- Surface water run-off
- Management (Home User Guide, site information, Considerate Constructors Scheme).

Achieving Level 1 for energy and water (a 10% improvement over 2006 Building Regulations) must involve investment in higher thermal insulation, improved fabric air permeability, and the use of flow reducing or aerating taps throughout. To rise to Level 3, a home needs to be 25% more energy efficient compared to Part L 2006 and so on until zero carbon is reached at Level 6. It should be noted that, unlike Part L, the Code for Sustainable Homes covers a much broader range of sustainability issues than energy efficiency alone.

The Code for Sustainable Homes should offer a new direction to housebuilders for delivering sustainable building standards. It will also encourage house buyers to use their purchasing power to acquire a more sustainably-built home in the long term. However, the implementation of the code is currently with a strong focus on energy, which may expose the built environment to risks associated with other important aspects of sustainability.

6.5 Zero Carbon Homes
The Government policy statement ‘Building a Greener Future’ (CLG, 2007) set out a target for all new homes to be zero carbon from 2016 with a progressive tightening of the energy efficiency building regulations by 25% in 2010 and by 44% in 2013. Since then, this aim has been further developed and defined, along with wide debate about the definition of zero carbon, particularly around the eligibility of ‘offsite renewables’ (see UK GBC, 2008; CLG, 2009a).

In July 2009, following a public consultation on the detailed definition of zero carbon homes (CLG, 2008) a three step approach to reaching the zero carbon homes standard was confirmed (see CLG, 2009a), based on:

- a high level of energy efficiency in the fabric and design of the dwelling
- ‘carbon compliance’ – a minimum level of carbon reduction to be achieved from on-site technologies; and
- ‘allowable solutions’ – a range of measures available for achieving zero carbon beyond the minimum requirements.

Ball (2010) stated that Government has recognised some of these concerns, as shown in the Pre-Budget Report 2009. A need to recognise flexibility in the zero carbon definition in consultation with the sector is now accepted. There is now a need to provide certainty in terms of a workable zero carbon definition, which should allow the necessary flexibility (e.g. offsite solutions) to maximise cost effectiveness. Close consultation with the sector will need to be a key part of this process. The Pre-Budget Report 2009 introduces the establishment of a national baseline for regulatory costs to manage and mitigate the cumulative impacts of any new requirements, as noted above, whilst supporting the Zero Carbon Homes policy. Delay in introducing Life Time Homes was offered as a first step. This exercise is challenging. Considerable effort will be needed to reduce the uncertainties and costs and to gain acceptance by all stakeholders.

The NHBC Foundation Report (Davis and Harvey, 2008) reveals that builders are cautiously optimistic about their ability to build a home with the required levels of water conservation and airtightness. However, this confidence is undermined by doubts as to whether homeowners will accept some of the lifestyle constraints these measures will impose. Housebuilders do not believe that Code Level 6 homes can be built profitably by 2016, which could have serious consequences for the Government’s objective of increasing the number of houses built each year by more than 50% per annum.

Progress towards zero carbon homes is being made through two distinct policy routes: the Code for Sustainable Homes and Part L of the Building Regulations. Such progress will be incremental. Percentage improvements are stipulated in Part L, with a significant increase in 2010 and another planned for 2013. So, the target time for all new housing reaching an energy efficiency standard corresponding to code level 6 (‘zero carbon’ homes) has been set for 2016, which is less than six years away, with substantial stepped increases in regulatory requirements in the interim. Already, new homes are achieving a considerably reduced carbon footprint. The recent CLG survey of builders (Ball, 2010) identified a range of views from acceptance, enthusiasm, or acquiescence in relation to zero carbon.
However, there was a broad consensus on a variety of concerns about implementation and the consequences for housebuilding. They related to:

- **Cost**: Progress to Code Level 6 is expected to significantly raise build costs, although it is hoped that component prices will fall as volumes rise.

- **Limited impact on prices**: Customers are currently not prepared to pay a price premium for the homes at a higher ‘Code Level’, so that it represents a cost to house builders without an offsetting revenue increase.

- **Uncertainty**: Building technologies, the costs of using them, and the durability and maintenance costs of new equipment are all subject to a high degree of uncertainty.

- **Consumer resistance to new technologies**: Customers often did not use, or replace, facilities introduced to meet emissions targets and switched to older, less energy-efficient technologies e.g. lighting.

- **Extended build times**: Innovative techniques can extend build times, with a cumulative impact on supply, and project risk.

- **Funding difficulties**: Lenders are more wary of providing development finance when projects involve a higher level of technical risk.

- **Varying practices between local authorities**: Some local authorities choose to move beyond current national requirements, and may also impose idiosyncratic site or design sustainability requirements.

Despite the varied perspectives and concerns, zero carbon homes agenda will no doubt shape the future of housing supply in the UK.
Drivers for Change

6.6 Offsite Production and Modern Methods of Construction (MMC)

It is generally accepted that the housebuilding sector feels that it is being squeezed between the economic downturn and increasing Government demands to build more houses, build them quicker and build them to higher standards, e.g. increased space and better environmental performance. Offsite production and MMC have been promoted as part of the solution to addressing these challenges (Lawson et al., 2010).

A brief history

Offsite construction systems are not new in housebuilding. Precast concrete panelised systems were used in the 1950s and 60s (Glass, 2000), timber framed construction in the 1970s, and a range of offsite production technologies including modular building, volumetric preassembly, non-volumetric preassembly and subassembly and components were used in the 80s and 90s (Gibb, 1999). This was expanded further following the recommendations by Egan (1998) to include some innovative on-site construction methods under the banner of ‘modern methods of construction’ (MMC) (ODPM, 2003).

Concepts and definitions

Offsite construction is the manufacture and pre-assembly of components, elements or modules before installation into their final locations (Goodier and Gibb, 2007). It includes component and sub-assembly, non-volumetric pre-assembly, volumetric pre-assembly, and modular building (see Gibb, 1999). Modern Methods of Construction (MMC) is the term used by the UK Government (ODPM, 2003) to describe a number of innovations in housebuilding, initially as a mechanism for funding for social housing, but having evolved as a banner of innovative offsite and on-site techniques for improving quality and efficiency of housing supply. Most offsite methods may be considered to be MMC and the vast majority of MMC techniques are covered by the offsite categories. On-site MMC techniques include examples such as thin-joint blockwork, insulated formwork, brick slips and tunnel form construction. Many other terms exist, including ‘offsite’, e.g. offsite construction/fabrication/manufacturing, ‘pre’, e.g. pre-assembly, prefabrication, ‘modern’, e.g. modern methods of housebuilding and ‘building’, e.g. system/non-traditional/industrialised building (Pan, 2006, Lawson et al., 2010, Ross et al., 2006).

Offsite take-up in housebuilding

Despite the use of offsite technologies in UK housebuilding being recorded back to post First World War (see Harrison et al., 2004), the extent of such technologies usage has been seldom recorded. However, at least a quarter of the Government-funded new-build homes since 2003 were constructed using at least some offsite techniques (Housing Corporation, 2003) reported that nearly half of the surveyed builders, developers and social housing organisations claimed to have used offsite manufacture in the last ten years whilst the usage within most firms was less than one-quarter of their unit completions. The majority of the firms used panelised construction, but less than one-fifth utilised volumetric approaches. A recent survey of the leading UK housebuilders by Pan et al., (2008) confirmed that the level of overall application of offsite in housebuilding was low. They also found that the extent of offsite utilisation for apartments was slightly higher than for individual houses and that some highly documented offsite techniques, including complete modular building, bathroom/toilet and kitchen pods and flat packs, plant modules, and complete wall panels, actually only applied currently to a very limited extent in housing. Although more than half of the participating housebuilders were planning to increase their use of offsite (by volume) by around one-fifth on average, these firms were still concerned about the risk associated with the use of offsite, particularly more complicated volumetric and complete modular techniques. The findings of these surveys substantiate the perception of an overall growth of offsite usage in housebuilding, but the nature and extent of offsite practice also reflect the real and perceived barriers to a wider take-up of such technologies (see Pan et al., 2007; Goodier and Gibb, 2007). This is partly due to the traditionally slow uptake of technological innovation in housebuilding, and arguably concurs with the view of ‘construction as a low tech, low innovating sector’ (Harty, 2008).

Pan et al., (2008) examined the strategies of large housebuilding firms with regard to their current and future use of offsite technologies. Their results indicated that more than two thirds of the responding firms considered the incorporation of offsite into their basic house design, whilst the rest left the incorporation of offsite to fairly late stages, such as detailed planning application and pre-construction. Many respondents explained that the early incorporation of offsite into their basic house design mainly applied to volumetric systems, modular building and some more advanced panelised systems. Offsite components, sub-assembly and some open panelised systems were often considered at later stages.

Housebuilders, building new houses for private sale, are more reluctant to adopt MMC (apart perhaps from timber frame, which itself is often debated whether it is actually a MMC). They value cost and time savings too, but alongside other factors. House buyers have traditionally been resistant to MMC, possibly influenced by memories of post-war prefabs, system build houses of the 1960s, and Ronan Point. Housebuilders also need to manage the pace of build-out to maximise profits from a site; sheer speed may be relatively less important.

There is less resistance to the use of MMC for flats. In many cases a developer will pre-sell a proportion of the flats in a development before making a start on works, but the flats may not be occupied, or the remaining flats sold, until the block is substantially complete. Therefore, speed of construction is more critical than in low rise developments, and the cost and speed advantages of MMC weigh relatively more heavily.
Opportunities introduced by taking up offsite and MMC

It has been widely documented that both offsite and MMC technologies offer potential for reductions in cost, time, defects, health and safety risks, labour requirements and environmental impact and a corresponding increase in quality, build times, predictability, whole life performance and profits (e.g. Gibb, 1999; Housing Forum, 2002; Venables et al., 2004, Barker, 2003; HCA, 2010).

MMC potentially offers a new business model for an offsite manufacturer wishing to diversify into housebuilding or vice versa, thus taking profits from a fully vertically integrated business model which incorporates every element of the process from site development to manufacturing. However, the Callcutt Review (2007) warns of such diversifications by arguing that the ‘current trader’ business model of housebuilding is very different from manufacturing, with quite distinctive opportunities and risks. MMC may also be adopted by existing housebuilders as an alternative to traditional building techniques. They may buy in the MMC products from suppliers, or set up their own manufacturing divisions and aim for full vertical integration. Nevertheless, the Callcutt Review (2007), referring to evidence that at least two major housebuilders have recently closed their in-house divisions, views the business models are distinct and not easily merged provided. Integrated supply chains may address the conflict. As the MMC market matures, housebuilders may feel more confident about outsourcing production of MMC components from independent manufacturers.

There has recently been significant growth in MMC housebuilding in some parts of the market. The Housing Corporation has actively promoted its use: 48% of all grant funded work in the 2004–2006 national affordable housing programme involved one of the prescribed MMC techniques. This reflects a difference in business models: RSLs have a constant supply of tenants, and want their new homes ready for occupation as soon as possible.

**Case Study**

**Modular building system**

**Figure 13 Spacebox accommodation in the Netherlands**

Spacebox is a lightweight modular building system from The Netherlands for semi-permanent and permanent solutions, with Gainsgrove Ltd owning the exploitation rights for Spacebox in the UK and Ireland (Figure 13). Currently, approximately 1000 Spacebox units have been placed at several locations in The Netherlands. Each unit is built up with five composite panels, consisting of a fire resistant material, a Resol® foam core and a very smooth polyester exterior finish. Total panel thickness is 88mm for walls and 110mm for floors and ceilings. The units can be connected horizontally or vertically in any desired combination and it is possible to produce and erect up to 10 units per day. Life expectation of units is 30–60 years, depending on specification.
Drivers for Change

In April 2005 the Design for Manufacture (DfM) Competition was launched to create more high quality, sustainable, efficient and cost effective housing developments through the use of a range of construction systems and technologies. The challenge was to build homes with a construction cost of £60k, at 2005 prices, and a minimum space requirement of 76.5 m² gross internal floor area alongside a demanding set of design and quality standards. Six housebuilding consortia turned their designs into real schemes on one or more of the 10 Competition sites identified by HCA. DfM set out to challenge and disprove the assumption that lower cost means lower quality. The DfM Competition did not specify MMC but challenged housebuilders to utilise whichever construction systems and technologies they believed would help them achieve the aims of the Competition. Interestingly, all housebuilders elected to use MMC systems. After the competition the HCA (2010) concluded that MMC has the potential to:

- reduce the time for on-site construction, due to more factory based production
- reduce build costs through reducing time spent on site and by improving efficiency
- reduce the amount of material used and wasted,
- improve health and safety; and
- enhance the living experience for residents.

However, the majority of housebuilding is still based on a traditional, well-proven approach: on-site construction using traditional materials, construction techniques and trades. Offsite construction is gaining ground but it is still only used for a small number of developments, is thought of as innovative, and there is little experience of the systems and how to use them. The DfM Competition has begun to address the barriers by engaging and supporting volume housebuilders. Key actions recommended from the DfM Competition (HCA, 2010) include:

- education of the public and planners
- continuing and long term testing, information gathering and dissemination of performance
- training and development of housebuilders and suppliers; and
- agreement with warranty providers, insurers, mortgage lenders, policy makers and regulators on how to address issues.

Future of offsite and MMC

There is nothing to stop housebuilders from adopting MMC if they feel it is a cost-effective alternative to traditional methods. Enough new homes, particularly for RSLs, are now being built using MMC to offer solid experience of the advantages and limitations, in construction and in use. It is possible that MMC’s competitive position may strengthen with the zero carbon agenda: MMC homes are capable of achieving high standards of energy efficiency (CLG, 2009), and further experience may show this to be a worthwhile competitive advantage.

The majority of innovative or MMC in housebuilding are employed in the construction of high rise apartment buildings. Their use in more traditional development is more limited and driven by contractual or planning requirements rather than cost effectiveness. In recent years, under-investment in capital by many suppliers and reluctance on the part of housebuilders to commit to unproven building systems has resulted in a low rate of commercially driven take-up of MMC (Callcut, 2007).

Other than in multi-storey developments where innovation is more acceptable (partly due to their more repetitive style or design), prefabrication therefore remains a minor feature, but this is likely to adjust in the years ahead. One factor that will drive the move towards prefabrication will be the need to achieve higher environmental standards, which are likely to be harder to achieve using traditional methods of construction on site. With the move towards zero carbon, quality of build and tolerances will become more critical; achieving the necessary standards of installation with the existing subcontractor base may well become less cost effective, especially in a more rigorous regulatory environment (Callcutt, 2007).

The housebuilding industry supply chain is currently facing a number of important strategic questions and developments:

- will the increasing importance of quality installation justify a move into ‘supply and fit’ on a much wider scale than at present?
- will the delivery of cost effective energy efficiency be best delivered through prefabrication, pre-assembly and/or more MMC?
- will the building products supply industry anticipate the impact of the timetable for implementing levels 3, 4 and 6 of the Code for Sustainable Homes with capital investment and pricing policies designed to capture this anticipated future demand?

Much will depend on the industry’s confidence in the Government’s resolve to press forward with its environmental policies against predictions of an adverse impact on volumes and prices (Callcut, 2007).
Case Study
Modular housing in the UK

Spaceover has pioneered the concept of extendable and affordable housing using fully modular construction for its 78 unit project in Harlow, Essex, which achieved an Eco-Homes Excellent rating and a Code for Sustainable Homes 3-star rating. The project uses extendable building forms for 2, 3 and 4 bedroom houses and for 1 and 2 bedroom apartments in 2 to 4 storey configurations. A total of 177 house modules and 72 apartment modules were installed at a maximum rate of 10 per day. The modules are fully fitted out in one of Spaceover’s licensed assembly plants and so the finishing work on site is limited to foundations, cladding, roofing and service connections.
Drivers for Change

6.7 Sustainable and Renewable Technology

The increasing use and popularity of renewable energy and microgeneration is being driven by the move towards zero carbon homes, the increased price of energy, and the home-owners increasing interest and believe in sustainability. Schemes can exist either on an individual single unit (home) basis, or as part of a wider collective of either units (e.g. a block of apartments) or an area (e.g. small village or town). Indeed, energy generation may become a community activity with smaller, local substations supplied with energy generated by community or co-operative wind turbines, solar panels or CHP.

Given the significant attention to the zero carbon homes agenda, low or zero carbon (LZC) technologies are a particularly important group of the many types of sustainable technologies available. LZC technologies recognised by the UK Government’s Low Carbon Buildings Programme (LCBP) may be considered as part of a low or zero carbon emissions solution, a list of which is outlined in the CISH Technical Guide (CLG, 2009):

- Solar: Solar Hot Water, Photovoltaics (PV)
- Water: Small scale hydro power
- Wind: Wind turbines
- Biomass: heaters/stoves, boilers, and community heating schemes
- Combined Heat and Power (CHP) and micro CHP for use with the following fuels: natural gas biomass sewerage gas and other biogases
- Community heating, including utilising waste heat from large scale power generation
- Heat Pumps: Air source (ASHPs) and ground source (GSHP), and geothermal heating systems
- Other: Fuel cells using hydrogen generated from any of the above ‘renewable’ sources.

The NHBC Foundation Report (Davis and Harvey, 2008) however finds that homeowners’ knowledge of microgeneration is limited. Although most are aware of solar panels and wind turbines, there is little awareness of the actual types of technology that builders will need to incorporate to deliver the required energy generation for a zero carbon home. The experience consumers have with microgeneration technology is mostly limited to solar panels on roofs and rechargeable batteries. There is very little knowledge of products like photovoltaics and ground source heat pumps. There is concern among homeowners about the additional costs, the reliability of the technologies and environmental impacts such as noise pollution. However, those owning new homes would, in principle, be fairly interested in purchasing a home incorporating microgeneration. There is huge concern over the practicality of the various microgeneration technologies currently available and particular unease that homeowners could suffer as a result of the hasty introduction of technologies unproven on a commercial scale.

Housebuilders are considering three approaches to microgeneration – for individual properties, at community level and for offsite schemes wired directly into a local distribution system. Property level schemes raise concerns whether the plot sizes required to meet current planning constraints are large enough to accommodate the necessary infrastructure and whether individuals will adequately maintain them. Larger builders are therefore also looking closely at community and offsite schemes, although these will require managing companies and partnerships with energy providers.

Solar water heaters are simple, reliable, and widespread, especially in the warmer climes of Europe, hence are probably the microgeneration technology closest to being commercially viable in the UK (Roberts, 2008). Solar water heaters can provide all of summer demand and around 50% of current year-round demand in an average house. Photovoltaics (PV) are still relatively inefficient, with efficiencies of only around 15 to 20% (ECI, 2005), hence potentially provide great opportunities in the future as their sophistication and efficiency increase. Location and shading however, as well as the temperate UK climate, will always be important. Work is currently undergoing on third-generation PV cells that have potential to yield extremely high efficiencies but be as cheap to produce as thin-film devices. Indeed, a potential ‘benefit’ of climate change in the UK may be higher yields from solar energy, due to longer sunshine hours in summer and mid-seasons.

Biomass boilers can provide space heating for the whole house as well as water heating (ECI, 2005), and are becoming increasingly popular in the UK, as well as being well established in some parts of Europe. Combined heat and power (CHP) units provide heat as the by-product of the generation of electricity, thus using a resource that would otherwise be lost in centralised power generation. For dwellings, the unit is similar to a conventional boiler and is designed as a drop-in replacement for existing systems.

Wind turbine technology is increasingly popular in the UK, but its application at the scale of the home is limited, partly due to the wind being mainly slow and turbulent at roof level in an urban context, so few working systems currently show reasonable output (Roberts, 2008).
While sustainable and renewable technologies act as drivers for change in future housebuilding, they can be a challenge to the industry. Evidence (Cyril Sweett, 2008) suggests that the technology that allows homebuilders to achieve Code Level 6 homes in 2016 will be available. It is not clear, however, whether these products will be well tested and understood. OFT (2008) suggested that homebuilders are concerned about the performance of new technology. New technology poses challenges for homebuilders as they use unfamiliar products and construction techniques. New technologies, however good, if installed poorly can lead to significant consumer detriment and dissatisfaction. There is also the prospect that many of the technologies required to achieve the zero carbon standard will not be available ‘off the shelf’. The Code is of particular concern for smaller homebuilders who do not have the resources to carry out extensive research and development and so will be reliant on off the shelf solutions (OFT, 2008). Therefore, the successful adoption and utilisation of sustainable technologies require housebuilders and developers to manage their internal and external environments in a structured systematic way (Pan, 2010b), and hopefully integrate technological innovation management into their corporate strategy (Dodgson et al., 2008).

For significant progress to be made, the designing in as well as retrofitting of renewable energy sources to houses needs to increase. Issues regarding building regulations, planning obstacles, and skills and supply capacity issues, all need to be overcome. The suitability of each house and its location is also important – one size does not fit all. Shared community – and business-based systems of micro-generation are also likely to develop, with a consequent impact in terms of space, sound and aesthetics. Their impact is also not just physical, but also financial and social, and society’s values, as well as policy and legislation, will need to change if there are to be significant advances.

For renewable energy to be truly successful, advances in energy storage will also be required, with storage capabilities being incorporated into the electricity network at household as well as community or national level (Roberts, 2008 and ECI, 2005). These devices will be capable of smoothing intermittent generation and demand profiles, enabling each generator to operate at maximum efficiency. Storage may range from seconds to a season.
6.8 Advances in Technology and Materials

Advances in ICT such as three-dimensional (VR, CAD and BIM), network and internet, wire-free, sensor and GIS technologies have already revolutionised the design and communication processes involved in the construction of new houses and buildings and rapid developments can already be seen in the design of more intelligent buildings. The next few years and decades are likely to see this technology drastically fall in price and become more accessible to the wider industry, and hence move from being a niche application towards mainstream construction. These should not be seen as isolated technologies however, as changes to existing working practices are likely to be required to take full benefit. ICT will enable greater collaboration and co-operation between parties, moving from supply chains to supply webs/clusters. More educated clients will play a greater role in design and build processes, demanding better performance from service providers. Participants of the processes will see the benefits and added value from having to collaborate with others, heralding the efficacy of partnering and strategic alliance to cure the chronic mishap of adversarialism within the industry.

Developments in new materials are continual, but the future appears to offer significant breakthroughs, such as lighter, smarter and more sustainable materials. Radio frequency identification (RFID) tags will make building components more intelligent and identifiable, biomimetics will introduce building materials that mimic and learn from nature, and limits of nanotechnology know no bounds. Insulation-filled and evacuated windows are now under development and have the potential for energy-efficiency improvement over today’s windows (Roberts, 2008). Evacuated windows have the air removed from between the panes, creating a vacuum, reducing heat transfer, thus lowering the U-value. Other technologies under development will enable windows to alter their transmittance in response to temperature (thermochromic) or light (photochromic) fluctuations. However, the degree to which these technologies will impact upon housebuilding, where simplicity and ease-of-construction are important, remains to be seen.

As our homes become smarter, in turn so will our communities, towns and cities. The influence of smarter cities will hence impact significantly on home designs in the future. It is an increasingly popular term, used by the European SmartCities ranking system to cover smart economy, smart people, smart governance, smart mobility, smart environment and smart living (Pan, 2010c; Rydin and Goodier, 2010), and was defined as a city well performing in a forward-looking way within these characteristics. In the future more and more of our cities, and hence our homes, will in fact need to become smarter, and the principle will also be increasingly applied not just to cities but to smaller towns, communities and villages. The principle does rely however, on the assumption of a reasonably-educated population, which unfortunately cannot be taken as predetermined.
7.1 The Case for Futures Thinking

Futures studies are sometimes perceived as an attempt to foresee the future (Goodier et al., 2010). Prediction is not their purpose however – their usefulness is in helping organisations prepare for an uncertain future by producing possible scenarios and identifying potential risks and opportunities in order to inform strategic decision making (Schnaars, 1987; Godet, 2000). This is the focus of the approach presented here. The process also helps to extend the future-thinking orientation of industry practitioners, thus facilitating intra- and cross-organisational learning and understanding (Goodier et al., 2007).

Pressures to deliver neat outputs and credible conclusions and to translate awkward future uncertainty into a form that is fit for public consumption is a further influence that mitigates against dealing with notoriously unruly realities (Guthrie et al., 2010). Our interpretations and opinions are too often coloured by over-rigid perspectives.

Anticipating the future is increasingly being seen as a useful way to align, direct and improve current organisational strategy. Many future studies and reports have been produced which envision various construction industry scenarios, resulting from technological and socio-economic trends and influences (Harty et al., 2007).

Rapid social, economic and technological developments have provided many threats and opportunities for the housebuilding sector (Soetanto et al., 2007a). The existing *modus operandi* is perhaps no longer sustainable if the companies wish to maintain their competitiveness at either a local, national or global level. Hence, the need to plan more strategically and better foresee future possibilities is more important than ever before. Enhancing organisations’ capacity to foresee and plan for the future is critical if they are to prepare and adapt to emerging trends and eventualities that may lie ahead. Scenarios are a promising tool to generate possible, probable and preferred longer-term futures (i.e. 20–25 years) for organisations (Hiemstra, 2006; Goodier, et al., 2010). Over reliance on economic and financial analysis also tends to unduly focus on “global forces and social convergence, at the expense of exploring the role of ideology and context” (Ronald and Hirayama, 2006:2480).

The multi-layered character of housing markets is increasingly being recognised in terms of new actors, aspirations and ‘needs’ of society (Cole, 2007). The nature of housing calls for solutions which acknowledge that expectations are more complex and that such conditions are unlikely to vanish in the future (Guthrie et al., 2010). Gibb (2007) underlined the need to understand processes and their consequences (i.e. cause and effect) when discussing the future of social housing and delivering relevant policies to reflect the forces at play.

7.2 Future Studies in Construction and Housebuilding

There are a large number of recent future studies oriented towards the housing sectors, such as RICS’s Future of Housing (Barlow, 2000), Guthrie et al.’s Housing Futures (2010), Bates and Kane’s The Future of Housing in New Zealand (2006), and Arup’s Future-Proofing Our Homes (2006). Even greater are those futures reports aimed at wider construction, such as DTI’s Constructing the Future (DTI, 2001), CIRIA’s Adopting Foresight in construction (CIRIA, 1999), ECI’s Future Scenarios for the European Construction Industry (Goodier et al., 2009) and CIB’s Sustainable Development and the Future of Construction (Bourdeu et al., 1999), amongst others. They tend to reproduce, or reinforce, the current rhetoric that the Construction Industry is somehow laggard or less productive than it could be, and therefore in need of some form of improvement. This is a somewhat paradoxical position given the long history of the argument within the sector, together with the recent critiques from Latham (1994), Egan (1998) and Fairclough (2002) reports.

Relatively few examples exist however, of housebuilding companies engaging in futures studies, with companies showing a marked reluctance to plan for the long term due to the relative volatility of the market and a perceived lack of control over factors external to the organisation which dominate (GOS, 2008; DTI, 2001; Egan, 1998; Goodier et al., 2007; Goodier et al., 2010).

Successful long-term (and/or strategic) planning however, is important for the long-term survival of organizations, including housebuilders (e.g. Betts and Ofori 1992; Soetanto et al., 2007a), and involves developing a longer-term plan (beyond the next project), which will shape company characteristics and determine the market in which it is going to operate. Many reasons have been put forward for construction organisations lack of effort in long-term planning (Brightman et al., 1999) – inadequate resource capacities, instability of employment and the unpredictability of the construction market – all of which are particularly pertinent in the housebuilding sector. This problem is increased by the prevalence of small firms in the sector. Fierce competition and the transient nature of construction employment often results in smaller companies struggling to survive, let alone plan for the long term. Hence, their focus is often just on their current projects, as well as winning the next one. If they do plan ahead, then this may have to be aborted due to a need to respond to emerging market demands, hence rendering the whole process less beneficial. In most cases, there is little evidence of a formal process in the formulation of long-term strategies (Brightman et al., 1999, Soetanto et al., 2007a). There is thus little emphasis of housebuilders on the need for long-term planning as its benefits have not been fully and immediately realised.
Housebuilders design and build (and increasingly manage and operate) houses, buildings and associated infrastructure that will be used many decades into the future.

In a context of rapidly changing business, technological and environmental conditions, it can therefore be argued that an understanding of the future should be a fundamental requirement of this sector (Goodier et al., 2010). Some examples do exist, in the form of future scenarios for a place (e.g. Dublin Chamber of Commerce (2004), a technology (e.g. Clarke, 2006), or a sector (e.g. Goodier et al., 2009; GOS, 2008), but are rarely used to inform strategy. This contrasts with other sectors that routinely use scenario planning and other futures techniques to help shape their long-range planning (see Hiemstra, 2006; Eden and Ackermann, 1998. Basic strategic planning is conducted in some housebuilding organisations, but very rarely incorporates any form of futures techniques, and is more likely to rely on SWOT or PESTEL/STEEP type analyses (Brightman et al., 1999; Betts and Ofori, 1992; Guthrie et al., 2010).

7.3 How Scenarios Can Influence Thinking About Housing Supply

A key incentive for conducting future studies in housing is to think about how firms and other stakeholders might respond to a range of potential changes in the future (Harty et al., 2007). It is not really the scenarios per se which are important, but how the scenarios might be used by construction stakeholders today to help inform decisions they may make about their future activities. The effectiveness of scenario generation is located not within the final scenario itself, but within the connections between the present and potential future. In order to make these connections, the relative abilities of housebuilding organisations and professionals to actually alter, mitigate or influence processes of change need to be explored. In order to think about useful strategies for intervention – the bringing about of a positive future or avoiding a less preferable one – the extent to which the sector can influence or intervene in the process of change is centrally important.

It is a weakness of futures-oriented methodologies in general that it is more difficult to imagine a radically transformed future than to extrapolate current trends forward through time (Harty et al., 2007). This also partly explains the popularity of ICT, sustainability, energy efficiency and increased foreign competition within future studies – long-standing interests and issues within construction and society more generally. This also highlights a paradox within many futures studies; they are intended to address the problem of understanding and dealing with a rapidly changing world, but do so with reference to past and current trends and ideas.
7.4 Changing Attitudes to Housing

When we buy homes we expect them to last for 50 or 60 years, or even longer, but how do we know how we will be living and working this long into the future? We need to consider whether the conditions and needs we know today will become radically different. Familiarising ourselves with long-term extreme uncertainty and greater complexity is not something that traditionally comes easily to engineers or designers (Guthrie et al., 2010). However, it does help us to explore how alternative visions of owner needs, industry delivery, policy interventions, technological and cultural development might variously shape the form of housing and homes in the future. Future housing requirements are qualitative and reflect changing aspirations, values, and tastes. A critical uncertainty for the future is whether the UK’s population – possibly in the future comprising a more diverse mix of cultures and backgrounds – will continue to follow this same pattern of attitude to housing, or whether society’s attitudes will change, leading buyers, occupiers and hence suppliers to make different choices. Future patterns of development will be driven by demographic, economic, socio-cultural, political, technical and environmental factors.

It is sometimes stated that there is a scarcity of choice offered to home buyers on a number of issues (e.g. housing design, finish, quality, functions) and that many current ways of working in the housing and construction industries are overly traditional and outdated (Guthrie et al., 2010). In terms of the house itself, the vast majority of future housing stock in the next few decades is already in place now. Whilst advances in technology will mean that the concept of a ‘smart-home’ is commonplace, the nature of the individual households is forecast to continue changing. Viewed in tandem with the diverse modes of living, working and leisure time, it can be seen that our future housing needs to be more flexible and adaptable than it is today. Construction techniques and local regulation will need to acknowledge and enable this increasing flexibility, whilst the suitability (and adaptability) of the existing housing stock will become an increasing factor. ‘Lifetime homes’, originally promoted by the Joseph Rowntree Foundation as an approach to intergenerational and adaptable design, are also important, although the focus and attention has partly been diverted due to the Government emphasis on zero carbon homes (Ball, 2010). Homes could become more adaptable, expanding and contracting in response to the domestic needs. Walls, rooms and even floors could be added or taken away to accommodate three generations as we live longer and land becomes an even more premium commodity. Modular buildings are inherently adaptable and flexible, and can hence have a substantial impact in this area in the future, as well on the refurbishment market (Lawson et al., 2010).
Investigating the Future of Housebuilding

Individual, social and societal related issues, such as education, skill and training, and employment, will all influence homes and housing in the future. Current knowledge is obsolete quicker than ever before, encouraging people to acquire more flexible, softer and transferable skills (Soetanto et al., 2006b). The emphasis will be on creativity, and the balance between hard and softer skills, mainly encompassing people management and technology and innovation-based skills. This in turn however, is also likely to produce an educational underclass, unable to keep up with the educational developments of their time. A continual emphasis on integrated and collaborative working will continue to weaken professional barriers, encouraging a multi-disciplinary and multi-skilled workforce. Long-life employment would have long gone but will be replaced by contract-based tied to regular performance evaluation and measurement. Workers and home owners will increasingly be mobile, adaptable and flexible. Time and space for working are becoming irrelevant. A shortage of skilled workers will remain to haunt the sector in the foreseeable future.

People will continue to become more individual, independent and self-sufficient, reducing the size of typical households. Increasing personal mobility will create a more multi-race, multi-religion, and multi-cultural society. A fast-paced world will induce many people to think ‘not enough time’. The notion of ‘play hard and work hard’ will become increasingly relevant. Lifestyle and social issues (e.g. individualism and the growth of single parents) will downsize houses and accommodations. Houses will be more intelligent, flexible, adaptable and environmentally efficient, resulting from changing attitude and regulations.

The pervasive and ubiquitous nature of technology in our lives and homes over the last two decades has produced an “anywhere, anyhow, anytime” attitude, especially amongst young people and in business. Over the past 20 years we have seen exponential growth in the use of microwaves, home PCs and other electrical appliances in the home, to the extent that almost everyone has them. More recent technologies in the home such as plasma screens, wi-fi, and smart metering are likely to follow a similar path over the coming decade or so. However, this technological advancement is not wanted, or kept up with, by everyone. There is therefore potential for a disenfranchised minority who may resent and increasingly resist this form of modern living. It is therefore possible that communities will emerge which are a sanctuary or haven from the 24/7 forever-connected world. A technological underclass is another possibility. Whether we choose to fully embrace ICT as individuals however, is unlikely to prevent the saturation of ICT into our lives.

In addition, as our homes become ever more sophisticated, varied and high-tech, with smart meters, solar panels, and advanced insulation and ventilation systems, the less able home owners will not be to conduct their own house repairs, renovations and domestic ‘odd jobs’. However, the increased demand for homes designed for adaptability, will make it easier for the new generation of home owners to reconfigure their dwellings as and when required, or indeed, order a new replacement.

Housing design will have to further evolve to incorporate the different needs of differing stakeholders. The briefing, planning and design process will therefore need to include a broader range of stakeholders of the present and future, where the public acceptance of the design is critical.
Many examples exist in the past of housing designs that were not commercially successful, but which we can draw upon to help give us an idea of how housing may develop in the future. Many used new materials of the time (e.g. plastics), and also new approaches to construction such as automation and mass production. However, many failed to consider the very traditional views of the majority of the home-buying public and hence the majority never went beyond isolated examples and into mass production.

The Monsanto House of the Future (also known as the Home of the Future) was an attraction at Disneyland in California, USA from 1957 to 1967 and was one of the first designs made entirely out of plastic. Innovations of the time included insulated glass walls, picture telephones, plastic chairs, microwave ovens and speaker phones (Figure 17).

Built out of stamped sheet metal, Buckminster Fuller’s Dymaxion House sat on a central pillar containing all of the utilities and services (Figure 18). It was designed to heat and cool naturally, had a diesel generator for power, and was light enough to be air lifted anywhere. Designed and developed during the mid-1940s they were factory-manufactured kits, assembled on site, and intended to be suitable for any site or environment and to use resources efficiently. An additional design consideration was ease of shipment and assembly. The Dymaxion House was therefore ahead of its time in many ways in terms of sustainability and automation.
A scenario can be described as a storyline comprising a range of interconnected and uncertain future events and their possible consequences (Goodier et al., 2010). They are often used to support decision making in which some of the parameters and issues are uncertain or poorly defined (Godet, 2000). Scenarios are not about predicting events or determining the most likely scenario, but developing several credible stories of the future that describe how the environment in which an individual or organisation lives or operates may develop, given certain future events, trends or developments.

Scenarios are one way of addressing the unreliability of prediction by the description of a number of possible futures (e.g. Godet, 2000; Eden and Ackermann 1998; Goodier et al., 2010, Goodier et al., 2007). Many scenario building processes and frameworks exist, with the origins being traced back to Shell’s energy scenarios in the 1960s and 70s. For scenarios to be informative and useful to practitioners, and/or to hope to give a plausible (and credible) account of the future, it helps if there is a relationship with current conditions and practices i.e. if they are grounded in the reality of the present. Without an appreciation of events that have preceded the situation, it would be difficult for the scenarios to be connected to the strategies generated (Harty et al., 2007).

Scenarios can provide a framework by which to develop and evaluate corporate strategies, hence the notion of a ‘test drive’ or a ‘wind tunnel’ of strategic decisions. However, there is little evidence of this within housing and construction organisations, who are predominantly short-term and reactive in their outlook but generally able to respond quickly to changes in their business environments. Little evidence therefore exists for the use of (or need for) traditional long-term scenario planning in housing and construction (Brightman et al., 2007; Goodier et al., 2007).

The scenarios presented here were developed via a series of short, focussed, one-off multi-organisational workshops using causal mapping, inter-connected pathways and participant plenary session to produce alternative future scenarios around a common theme (Goodier and Soetanto, 2010; Goodier et al., 2010). The process was designed to create causal maps which could illustrate the ‘cause and effect’ relationships between the factors and outcomes (usually articulated as events), beginning in the present day, set against a rudimentary time line of 10 to 20 years, hence facilitating a debate and the identification of possible future pathways.

8.1 The Scenarios
The scenarios presented here have been grouped into three main themes. The first two describe single ‘expert’ visions of the future of housing supply 10 to 20 years into the future, and the possible pathways that may lead us to this envisioned future. They contrast with the third scenario, also 10 to 20 years into the future, which is more divergent, illustrating more pluralistic visions that have arisen from being developed during a mixed group discussion of housing stakeholders. The scenarios illustrate how varying issues of concern lead to differing trajectories and consequently multiple future possibilities associated with an envisioned future. These scenarios, together with others, have been reported by the authors elsewhere (Guthrie et al., 2010).

8.2 Scenario 1: The Future of Housing Provision
The need for more new homes in the UK has never been more critical than today – 200 000 houses per year need to be built, to help provide 5 million new households over the next 25 years. In addition, if current homes typically last 100 years then to replace the existing stock (of 24–29 million) also needs 266 000 constructed per annum. Assuming low levels of immigration, 34 000 units are also needed to accommodate immigrants. In total, 500 000 new houses are required every year. The unprecedented rise of house values in the UK has been a major pre-occupation of the nation over the last few years, with the low cost of borrowing encouraging people to buy their own properties. Currently, approximately 70% of the population own their home, with a considerable number of first time buyers waiting to put their feet on property ladder. Indeed, the £3.5 trillion value (and £1 trillion in loan) in private homes is projected to steadily increase.

One reason for this increase is the failure to meet the demand for homes. Before the recession, around 100 to 200 thousand homes were built every year; giving a shortfall of 300 to 400 thousand per annum. This explains why there is such a buoyant market due to the long-term under supply, with little prospect that this under-supply is going to be alleviated.
This shortage of housing causes overcrowding in the most populated areas of the country (particularly in the SE of England), whereas a surplus evolves in the North. Prices continue increasing in the long term. Homes get more dilapidated, but are also worth more. Investors and foreign speculations enter the market to do business. In around 5 years time, Japan and China begin to sell modular homes via the internet, ready to be shipped to Britain. The London 2012 Olympics add more pressure to available accommodation and at the same time on the cost of housing. Lack of affordability leads to people squatting on farmland as a last resort. Indeed, the farmers acquiesce with this situation given that agricultural subsidies are no longer being paid. Concerns over political repercussions continue to grow. Political pressure mounts and the market begins to show signs of increasing volatility, and a housing market crash threatens. Continued economic instability, and political and economic unrest, prompts the Government to act. They scrap and redefine the planning regulations. But now the challenge is even greater with 2 million homes to be built per annum by the year 2026.

Scenario reflection

In spite of the difficulties being experienced in the housing market at the time of writing, there remains a need for more homes to be built due to many years of under supply. This message is dominant in this scenario, as well as being evident in the others. Government efforts to increase the numbers of houses being built, even prior to the financial crisis, however were looking as insubstantial as ever. A key driver of activity revolves around acquiring land with permission to develop on. Consistent conditions of under supply (Barker, 2004) continue to perpetuate the producer/consumer imbalance within the sector. Gibb (2007) pointed out that some commentators seem reconciled to the unaffordability and volatility of the private housing market being a given. This first scenario however, illustrates how this landscape could potentially change.
Future Scenarios for Housebuilding

Figure 19. Scenario 1: The future of housing provision

- Need to build 500,000 houses every year from 2006
- 240,000 homes for new household growth (5 million/25 years)
- If homes last 100 years then stock (24-29 million) needs 266,000 per annum
- Assuming very low levels of immigration: add 34,000 for immigration

Concerns:

- Cost of building low
- Investors panic and market collapse
- E10 trillion to E20 trillion collapse??

Key actions:

- London Olympics 2012
- CPRE, CABE, OPT, Greenpeace attacked
- Investors speculate on housing
- Foriegn speculation on British housing

Events:

- More overcrowding
- Pressure to ease housing costs mount
- Squatting for farmland has to happen
- Government fails on housing issue
- The false market in land crashes
- Land prices collapse and planning is scrapped
- Britain begins to build again
- But now we need 2 million homes pa

Barrier:

- Accumulated shortfall of 6.2 million homes
- farmer joining with squatters
- The false market in land crashes
- Land prices collapse and planning is scrapped
- Britain begins to build again
- But now we need 2 million homes pa

Barrier (associated problem):

- Volume house builders sell fewer homes for more
- Government fails on housing issue
- No subsidy on redundant tenement
- Common Agriculture Policy (CAP) scrapped
- No subsidy on redundant tenement
- Series of political crisis

Key:

- Event/Issue
- Barrier (associated problem)
- Action (can be controlled)
- Cause - effect

- UK population of 27.5 million
- 24 million household in 2006
- Planning restricts land supply
- GDP £1.2 trillion approx
- £3.5 trillion in private homes
- £1.0 trillion in home loans
- 70% of population own a home
- 190,000 homes built per year in British
- Fail to build 500,000 homes pa
- More overcrowding
- 310,000 shortfall each year
- Volume house builders sell fewer homes for more
- Homes get more delapidated but are also worth more
- Government fails on housing issue
- No subsidy on redundant tenement
- Common Agriculture Policy (CAP) scrapped
- Event/issue
- Barrier (associated problem)
- Action (can be controlled)
- Cause - effect

- UK population of 1 million
- 29 million household in 2030
- Not much more built on
8.3 Scenario 2: Factors Influencing the Future of Housebuilding and Supporting Infrastructure

This scenario contains two inter-connected future pathways; the first describes how full housing supply is achieved in 20 years time, and the second how failure to invest results in a major housing shortage in the future.

**Scenario 2A: Houses for all**

The political will is currently present, so too a readiness to invest. Funds are allocated directly to energy generation, large scale building programmes and for education, including training Engineers and Architects. More training investment in trades also has a beneficial impact on infrastructure. Further investment means improvements in infrastructure and in the maintenance of that which exists. Education is highly developed giving broader, more open vision and provides greater possibilities than ever before. The willingness to invest in education leads to the use of imagination, new building methods, increased efficiency, and new types of housing. The use of imagination is broader than invention; it involves not just incremental innovation, but also that which is radical, unexpected and never before thought of or utilised. People trained in the trades are essential for building houses, thus it is not sufficient to have imagination alone. This fundamental need combined with an ageing population means migrant (skilled and labourers) workers are necessary to actually do the (building) work; they in turn require places to live which increases the diversity and demand of housing types. Political issues shape environmental thought, driving new technological advances. Climate change also directly influences the emergence of new technology in order to deliver greater energy efficiency. These factors lead to increasing diversity of housing options, multiple-occupancy, use of prefabrication, leading to the delivery of housing for all in 20 years time.

**Scenario 2B: Less is not more**

Political will exists, but money is scarce and little progress is made. There is a failure to invest in education, infrastructure and building. There is also a corresponding lack of imagination. This dearth of imagination leads to under-investment in infrastructure, education and building, compounding the negative effects. Consequently there is insufficient access to vital resources, water and power, together with skills shortage, particularly felt in the housebuilding and civil engineering sectors. Climate change, lack of investment and the influence of environmental change conspire to restrict peoples’ movement and constrain the availability of labour. Strict immigration controls and changing demographics (such as an ageing population) further influence the diminishing availability of professional skills and labour. An increasingly massive shortage of housing in the long term therefore develops.
Future Scenarios for Housebuilding

Figure 20. Scenario 2: Factors Influencing the Future of Housing and Supporting Infrastructure

Key:
- Event/Issue (no control)
- Barrier (associated problem)
- Action (can be controlled)
- Aim/Objective/Goal

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<th>Event/Issue</th>
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<td>Political will</td>
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<td>Lack of investment in infrastructure, education, building</td>
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<td>Insufficient access to water</td>
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<td>Lack of imagination</td>
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<td>Improved infrastructure and maintenance of existing infrastructure</td>
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<td>More training in trades</td>
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<td>Investment in education</td>
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<td>Trained engineers and architects</td>
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<td>Use of imagination – new building methods, increased efficiency, new type of housing</td>
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<td>New reservoirs</td>
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<td>Increase in migrant workers</td>
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<td>Influence of environmental thought</td>
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<td>Climate change</td>
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<td>Strict immigration controls</td>
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<td>Wider range of housing types: prefabricated housing, high-rise, multi-occupancy</td>
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<td>Changing demographic – aging population</td>
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<td>Insufficient power</td>
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<td>Skills shortage (building/civil engineering)</td>
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<td>Use of imagination – new building methods, increased efficiency, new type of housing</td>
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<td>Wider range of housing types: prefabricated housing, high-rise, multi-occupancy</td>
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<td>Massive shortage of housing – less is more</td>
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<td>Willingness to invest</td>
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<td>Political will</td>
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8.4 Scenario 3: Energy Efficient Homes

The three interconnected scenarios presented here outline pathways to the delivery of energy-efficient homes for all in 20 years time.

Scenario 3A: Home office heaven

A combination of the depletion of fossil fuels and an increased focus on sustainability strongly influence public opinion regarding energy efficiency. These factors alter the way people want to live and work, with a consequent greater emphasis on the home and a resistance to the accepted norm of travelling from home to the office. Due to continued rapid developments in ICT technologies such as virtual conferencing, the office-home hybrid becomes increasingly common, thus enabling transport costs to be reduced and congestion to be alleviated. Smart power management of electrical devices becomes commonplace and leads to a whole new era of more energy efficient products, creating an even greater extent of mobile and home working. In addition, there is a move towards more local and community energy production which in turn leads to an average 25% reduction in net energy consumption for each new dwelling by the year 2026.

Scenario 3B: Tougher targets

Increased awareness of climate change drives the need for higher environmental standards, causing new legislation and regulation which in turn drives the emissions targets even lower. These tougher targets are also influenced by the introduction and development of strict waste management planning, emerging from the need for higher environmental standards and the concomitant legislation. These tougher targets also spur the development and uptake of smart power management devices and drives further the interest in energy efficiency. Further into the future, the lower emissions targets also influence the development and use of more energy-efficient and less-wasteful construction materials, which are influential in reaching the target reduction in energy consumption.

Scenario 3C: Making use of the materials

Driven by the depletion of natural construction materials there is a political and industry drive to improve waste KPI's (also impacted by the focus on higher environmental practices and concerns over climate change). This leads to a greater (and increasingly compulsory) recycled content in construction materials resulting in more energy efficient and less wasteful construction materials, alternative technologies and consequently more innovative construction techniques, all contributing to reduce the net energy consumption for each new dwelling in 20 years time.
Future Scenarios for Housebuilding

**Figure 21. Scenarios 3A, 3B and 3C - Energy Efficient Homes**

- **Scenario 3A:** Home office heaven
  - Depletion of fossil fuels
  - Focus on sustainability

- **Scenario 3B:** Toughest targets
  - Potential drive for house building
  - Climate change

- **Scenario 3C:** Making use of the materials
  - Depletion of natural construction materials

**Key:**
- Scenario 3A
- Scenario 3B
- Scenario 3C

**GOAL:**
- Reduction in net energy consumption
Scenario reflection

The homes envisaged within scenarios 3A, 3B and 3C have predominantly become eco-homes for reasons of self-sufficiency and the need to conserve energy, which is perceived in the future to be increasingly scarce and costly. The requirements for more homes are described as irreconcilable with measures to address climate change unless energy efficiency and waste reduction are improved. Prevailing conditions described are the depletion of fossil fuels, and public opinion on energy efficiency; climate change, increasing environmental standards and changes in ways of working; reduced availability of natural construction materials. These futures all lead to a 25% reduction in energy consumption, but is achieved through differing pathways. No mention is made however, as to how might the increased costs associated with the delivery of energy efficient homes be reconciled with shareholder expectations of profit maximization of construction firms?

Goals for zero carbon homes by 2016 are another example. The April 2007 budget statement outlined tax breaks for zero carbon homes, although as discussed earlier, interpreting what qualifies for the scheme can prove challenging. Whilst in some circumstances the savings to first purchasers might translate into quicker sales for developers and possibly a slight premium on the price, the reality is that the higher costs incurred would not be recouped by the tax advantage on offer. This renders the current inducement to adopt more sustainable housebuilding rather weak and provides an example of how the current industry trajectory appears misaligned with envisioned desired futures. Osmani and O’Reilly (2009:16) called for a “joined up and holistic approach to the zero carbon target, which should be guided by comprehensive and well rounded legislative measures” following their study of house builders into the feasibility of achieving the Government’s aspirations by 2016. They saw the commitment and involvement of material manufacturers, designers, local planning authorities and house builders as essential in order to drive implementation.

What isn’t in the scenarios?

Concepts that repeatedly emerge within a number of the scenarios can be explored; similarly it is also possible to identify issues that are absent (Guthrie et al., 2010). For example, security and resilience did not appear in any of our maps, and health was raised only once. The concept of ‘quality of life’ is interesting if one begins to imagine the meanings that this might have. Depending upon whose perspective – improved and more thoughtful design of homes was viewed as being either, a consequence of the need to conserve resources and therefore minimize energy demand through smart design, or explicitly, as a driver of change directly influencing quality of life for occupants.

Within construction, people tend to be optimistic in the long-term but gloomy in the short-term because they can see the problems ahead (Soetanto et al., 2010). In a similar way the scenarios here typically begin with the need to improve on the existing situation or state. Moving from the existing/current state to the envisaged future will require actions and/or events to take place. The former are mainly strategies (at a company or industry/Government level) which reflects a commonly held belief of a substantial gap between the current situation and the preferred future state which is largely outside an organisation’s control, i.e. a need for revised policy.

What exactly ‘good’ and ‘bad’ futures are, as well as whom they might be good and bad for, can be a matter of debate. A highly regulated and standardised future housebuilding sector may be able to produce environmentally efficient and functionally adequate homes, but what might the impact be aesthetically for the built environment? How can potentially expensive requirements for housebuilding, such as energy efficiency, be reconciled with a perceived need to increase the productivity and profitability of construction work, whilst simultaneously providing cheaper houses for the public? None of the scenarios are wholly positive or negative and as such provoke consideration of who might, or should, benefit from a transformed housebuilding and construction industry of the future.
When looking at the scenarios and analyzing opinions on the future of housebuilding, there is often little detail and definition regarding broad terms such as ‘higher environmental standards’, ‘sustainable development’ and ‘political will’ which are used in the scenarios presented above and are common in a number of recent futures reports on construction (Harty et al., 2007). The environment and sustainability can mean different things to different people, especially when regional, national or global scales are taken into account – sustainability in a developing country will often mean something very different to that in a more mature nation such as the UK.

Different people may envisage differing pictures with varying factors/issues of importance (Soetanto et al., 2006b), and the issues themselves have many facets and dimensions. Some refer to potential events (e.g. London Olympic 2012) and trends (e.g. aging population), specific technologies or tools (e.g. virtual conferencing, prefabrication), processes or practices (e.g. recycling building materials), problems (e.g. lack of imagination), and ideal outcomes or goals (e.g. environmentally efficient houses). In addition, the scope of issues varies from those at an operational level (e.g. building regulations) to those at an abstract or higher level (e.g. sustainability). Some are specific to the UK (e.g. North and South divide), Europe (e.g. ageing population), and global (e.g. climate change).

Thinking about and planning for the future is a complex exercise, and opens up other, perhaps more general debates, such as the tension between the greater use of prefabrication versus the loss of creativity and variety (Harty et al., 2007). Figures vary, but the construction sector accounts for a significant proportion of UK employment, employing over two million people and contributing around 8% of GDP, with an annual output of more than £100 billion. The increasing development and use of technology, is taken for granted, but the potentially more negative implications of this are generally not really considered. Technological advance is inherently seen as a positive process, and that greater use of technology equates to better working practices, although this is not always the case. Although the craft and site based nature of much of housebuilding can be cited as inhibiting the increasing use of technology, industries where technology has made a marked difference such as manufacturing have also demonstrated a massive reduction in the human labour required. This might have made mass-produced goods cheaper, but at the expense of many employees. Within each potential future lies an array of foreseen and unforeseen consequences which could engender resistance to future actions, effectively blocking the path to that particular future. So if linking present and future is the aim, then these sorts of potential barriers need to be considered.

Progression towards an envisioned future is commonly seen to move along an incremental path, and that incremental adaptation is required to keep pace with what changes are occurring. However, given both the array of issues discussed earlier, and the broad impact of some such as climate change, as well as the possibilities for the same factors to produce significantly different outcomes, this assumption does not hold up. Multiple, uneven and potentially discontinuous pathways might lead towards multiple futures, and more radical steps may be required in order to merely survive, let alone perform more effectively and efficiently.

Few futures reports however, offer definitive suggestions of how interested stakeholders should prepare for the future scenarios which they define (Harty et al., 2007). Some go no further than outlining a number of key issues and factors on which future scenarios for the industry are based. Whilst others introduce more specific recommendations for action, there is little substantive guidance provided for housebuilding firms and professionals other than to be aware of and embrace current and future industry trends. There is little analysis of what acting on these trends might mean for them. Some however, are very self evident; the sector’s health and safety record is widely acknowledged to be deficient and future studies are arguably not really needed to recommend that it be improved upon.

9.1 The Challenge of Implementation

New towns and large-scale urban developments, though newsworthy (especially when they are ‘eco towns’), still form only a small proportion of development in the built environment, with the majority being relatively small projects (e.g. a single house or office) designed and built by small regional SME’s, whose can often be resistant to innovation and change (Goodier, 2008). These small developments are then bought by similarly small businesses, individuals or local authorities. In addition, the repair, refurbishment and maintenance sector, again predominately made up of small regional SME’s, still accounts for approximately half of the construction industry. Bringing about change at this large and significant end of the sector is very difficult, time-consuming and costly in terms of educating, policing and monitoring. The housebuilding industry will need higher skill levels and political and fiscal incentives, as well as considerable education and cultural change in order to keep abreast of changes in technology.

Technological innovations are evolving that will help improve the design, construction, and efficiency of new homes. Offsite production and fabrication of components, rooms and buildings is increasingly common and continues to grow. In the longer term, new building materials, including those derived from nanotechnology and biomimetics, promise improvements in strength, durability, weight, energy performance and sustainability unavailable to the designers and engineers of today (GOS, 2008). Advances in ICT have already revolutionised the design and communication processes used in the construction of new homes in the past decade, and significant developments will also be seen in the area of smart and intelligent buildings.
Take-up of these innovative technologies will depend significantly on market factors, in particular the scale of the increased costs and the willingness of occupiers and home owners to pay rents and prices to cover them (see GOS, 2008; Pan and Cooper, 2010). New technologies however, will continue to fall in cost and become increasingly accessible and acceptable over the next few decades. There is potential for the more innovative methods of building, both offsite and onsite, to move from niche, high value applications into more mainstream housebuilding, much as concrete and steel revolutionised construction a century or so ago. In addition, there is a need to ensure that new housing developments are robust against a range of possible changes – in social values, occupiers’ demands, security expectations, energy supply and climate change – which in turn are likely to increase the up-front costs of housebuilding.

Institutional change in the housebuilding and development sectors will also impact the take up of new technologies. There are considerable path dependencies within the housebuilding and development industries as a whole that make change difficult to achieve, particularly within a tight timescale and in difficult economic circumstances (GOS, 2008). The culture is also usually very risk-averse. Furthermore, the majority of new developments are relatively small projects of between one and ten houses, developed and built by small regional SMEs, the majority of which are particularly slow to innovate and change.

An additional key issue is the extent to which the UK housebuilding sector is going to be able to meet the Government’s zero carbon targets (GOS, 2008). Speculative housebuilding assumes that a builder buys land, develops it, and then sells off the dwellings, leaving the builder with no longer-term interest in the site. It can be said that an industry and business model with such short-term interest in long-term development is unlikely to be well suited to delivering zero-carbon housing, the essence of which is to yield no net carbon emissions over the long term (not just at completion). In the future, business models will need to be established which help sustain the developers’ stake in the operational life of developments, possibly even including the designer and builder.

If the UK housebuilding industry does not keep up with these developments and challenges, it will face increased competition from overseas suppliers already experienced in delivering innovative new housing to high technical standards. In comparison to manufacturing, the housing sector is traditionally not seen to be as severely impacted by the shift to low cost economy because the workforce has to be where the building is erected. Even this is changing however, with new complete building systems such as Verbus being manufactured abroad and brought over to the UK in shipping containers.
10 Conclusions

Drawing on a thorough review of existing knowledge, this report has explored the future nature and form of UK housebuilding in relation to the delivery of housing of sufficient quantity, quality, environmental sustainability and affordability. Housing supply is significant to peoples’ quality of life, health and well-being, as well as the economy and prosperity of the country. However, UK housebuilding has long been associated with a lack of supply, fragmented industry structure, overall risk-averse attitudes, a general reluctance to innovation, skills shortages, a slow take-up of sustainability and a less-than-responsive planning system. These features, coupled with the economic downturn, impose significant challenges for the industry, today and in the future. Opportunities for delivering good-quality, affordable and sustainable homes do exist, along with a number of drivers for change, around the political, socio-cultural, technological and environmental aspects.

A number of future scenarios of UK housebuilding have been developed under three themes. These scenarios show the variety of pathways along which the housebuilding industry could progress over the next 10 to 20 years. They are not presented as preferred futures, or indeed as aims and recommendations for Government or industry, but instead are held up to inspire debate, deliberation, and imaginative thinking regarding the variety of futures that may lie ahead. In addition, together with the associated debate and discussion, they point to the potential cause-and-consequence of impacts tomorrow due to the decisions taken today.

Albeit the complexity of wide-ranging factors affecting the scenarios, the future of housebuilding is likely to be driven by the combination of Government policy on sustainability, legacy of the economic downturn, and fast evolution of innovative technology in a short and medium term. The current policy is markedly focused on the introduction and implementation of the Code for Sustainable Homes and achieving Zero Carbon Homes in a few years time (whether this is actually 2016 remains to be seen). This innovative technology is multi-faceted, including offsite production, modern methods of construction, renewable energy, new materials, and ICT. In the longer term, the future of UK housebuilding is likely to be driven by a more complicated profile of forces including demographic shifts, policy evolutions and climate change. Some issues such as global competition, in particular the consequent foreign entries, and aspects of sustainability other than energy such as water, waste and ecology will possibly become increasingly dominant.

It is unsurprising, that when discussing the future with the majority of industry stakeholders, the drivers and trends that preoccupy them are those that are actually affecting housebuilding now, and that current trends such as a move towards more sustainable construction (whatever that might mean) and the increased use of ICT and other new technologies are considered of primary importance (Harty et al., 2007). But they often stop short of getting to grips with the complexities and uncertainties of both the present and the future, or exploring the connections between global, local, construction-specific and more general or macro-level factors.

Industry opinions regarding the future therefore often fail to generate any significantly different advice or recommendations for the industry from those that can be found within the much larger collection of non-futures oriented housing and construction research. Their opinions are often less about the future than the present. This opinion is useful however, as it provides a snapshot of the concerns and visions of industry at a given time and many well known works on the future are in fact (often quite thinly) disguised critiques of their contemporary times.

One issue is clear however. Homes in the future increasingly need to be adaptable to changing ways of living, working and operating. Homes must be able to accommodate varied family configurations over time, taking on organic dimensions according to the numbers of people living in the space at different times, and to more easily reflect changing requirements and priorities of those inhabitants. A desire for homes to actively meet changing needs are required; homes that are self cleaning for time-scarce lifestyles, homes that are outwardly customizable, and are affordable. Increasingly blurred boundaries between work and home and the increasing complexity of peoples’ lives means that future homes will need to imitate this fluidity and be adaptable to changing identities and ways of living.

Housebuilders, stakeholders and policy makers need to re-examine the fundamental assumptions associated with short-term reactive thinking and “explore imaginatively what might be done differently in the future” (Guthrie et al., 2010). The route to more genuinely sustainable futures is dependent upon learning how to deal with complexity more effectively and developing experience in exploring beyond the present. The scenarios presented here reflect the inherent uncertainty and complexity of the sector. The meanings that homes have for people repeatedly emerged as important in shaping behaviours and highlights the need to investigate day-to-day practices in the home, as a key element to understanding the interplay between people and the environments in which they live now and in future. Examination of the increasingly blurred boundaries between work and home life and the evolving landscapes of peoples’ lives is urgently required in order to fully understand the full requirements of any future homes or developments. Homes in the future will need to reflect this required fluidity and be adaptable to changing lifestyles and ways of living. Failing to explore these developing complexities risks condemning “the housing sector to another decade of missing the big picture.” (Maclennan and O’Sullivan, 2008).
We see a less likelihood of changes in the future to the dominant nature of new homes completions by private housebuilders in the UK. The structure of the industry however, may become more diverse, with more specialist firms on sustainability, zero carbon and innovative renewable technologies. It is very likely to see, again in the future, the coupling and de-coupling of housebuilding and manufacturing, as has appeared previously in its history. The benefits of the increased industrialisation of housebuilding will become more recognized and accepted by consumers, builders, regulators, lenders and policy-makers. Land use planning, unless with dramatic changes, will again act as a determinant force, driving housebuilding organizations in relation to their house type designs and technology and innovation take-ups.

The nature and form of UK future housebuilding will no doubt remain heavily reliant on land use planning and the market. However, consumer preference, technology and wider sustainability issues will play increasingly important and dominate roles. Nevertheless, the future scenarios provided in the report highlight the potential uncertainties associated with the future, together with the potential impacts of the decisions that we make today. Whilst looking ahead systematically, housebuilding stakeholders, including the Government and consumers, need to be sufficiently adaptable, responsive, and flexible to keep up with, if not capitalise on and take advantage of, the rapidly-forming futures that lay ahead.
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