Cambridge Centre for Housing & Planning Research

Tackling the housing crisis through digital technologies and offsite manufacturing

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CCHPR

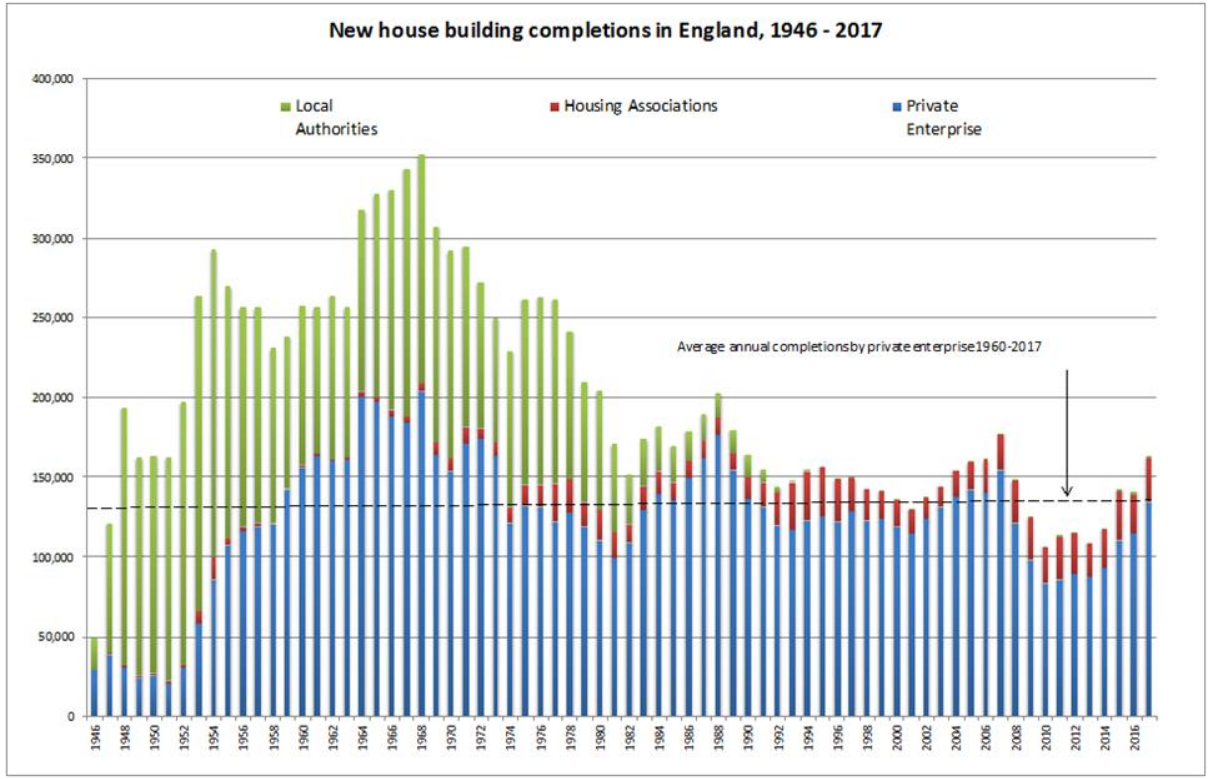
- The Cambridge Centre for Housing and Planning Research University of Cambridge Department of Land Economy
- Centre for Digital Built Britain – a partnership between the Department of Business, Energy & Industrial Strategy and the University of Cambridge
- Construction Innovation Hub
- Deliver a smart digital economy for infrastructure and construction for the future, and transform the UK construction industry's approach to the way we plan, build, maintain and use our social and economic infrastructure

Housing in a DBB

- Housing sits at the heart of many wider social issues, and it will sit at the heart of the development of a Digital Built Britain (DBB)
- Delivering DBB is not simply about technological solutions to make supply and maintenance more efficient, although this is important
- It is also about understanding how those solutions and efficiency gains interact with wider social policy issues to address housing inequalities in the UK

UK housing crisis – new build supply

- Lack of supply
- Few house builders
- Lack of innovation



UK housing crisis – management and maintenance

- Ensure that existing housing is safe to live in, and of a decent standard
- One third of PRS homes are considered non-decent (DCLG, 2017)
- Impacts health and wellbeing: 15 million people in the UK live in poor housing
- Cost: poor housing conditions are the source of 70% of NHS costs (NHBC, 2018)
- NHBC pays out £85m pa to rectify defects in new build homes
- Impact on safety
- Hundreds of buildings are using the aluminium cladding responsible for the Grenfell fire
- Hackitt Report highlighted the need for a ‘golden thread’ of detailed data and information for built assets (2018)

Construction industry challenges

- Farmer's 2016 review of the UK construction labour model was dramatically titled *Modernise or Die: Time to decide the industry's future*
- Low productivity
- Not embracing the potential of technology
- Problems of future workforce capacity, ageing workforce, low level of new entrants, deep and recurring recessions
- Lack of collaboration and improvement culture, which prevents organisations from scaling up, sharing risks and creating more business plan certainty
- Lack of R&D and investment in innovation

Industrial Strategy

- Industrial Strategy emphasises the need for a shift from conventional housebuilding towards more innovative approaches if the crisis is to be tackled (HM Government, 2018)
- Government's vision to transform construction into

  > *"a sector that can build new homes in weeks – and even days – rather than months; that can deliver new buildings at a third of the cost; that can provide affordable, energy efficient homes" (p.3).*

- Places digital technologies, e.g. Building Information Modelling (BIM) and offsite manufacturing (OSM), at the centre of solutions

OSM and BIM

- OSM is a manufacturing-based approach involving the production of components of buildings (e.g. foundations, roof cassettes, walls, floors, kitchen and bathroom units), or whole (modular) units of a dwelling, in a factory for installation in their final positions on a site
- BIM is a 3D model-based process – it uses digital tools to more efficiently plan, design, construct and manage buildings and infrastructure

Potential benefits?

- To build at scale, at speed, sustainable, future-proofed
- Faster build programme
- Fewer defects, higher quality
- Easier to ensure buildings meet quality assurance standards
- Address the skills shortage
- Fewer labourers and increased productivity

Potential benefits?

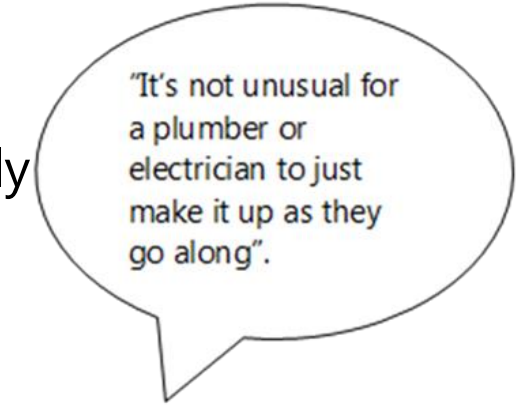
- Cost advantages from economies of scale
- Improved health and safety
- Reduced disruption to the local community
- Improved sustainability
- Creating more regional jobs away from large conurbations
- Provides a ‘golden thread’ of information needed for effective management and maintenance of housing

Constraints on uptake - financial

- Lack of robust evidence to support investment decisions
- High cost of investment
- Lenders prefer ‘tried and tested’, perceived risk has a cost
- Long term benefits accrue over building life cycle
- Build cost is only a proportion of costs
- Confident innovation will be commercially rewarding

Constraints on uptake – industry structure

- Current house builder business models - no incentive to build faster or at scale, risk of lower prices and profits
- Fragmented but flexible supply chain - able to accommodate late, on-site, design alterations
- But OSM will require a paradigm shift towards more collaborative procurement routes, highly coordinated design processes and early-stage design finalisation
- Low levels of coordination and complex, highly localised supply chains - barriers to BIM are found across the multiple supply chains found in housing construction
- Nature of construction procurement restricts collaboration between client and supply chain



Constraints on uptake - organisational

- Resistance to change among individuals and leaders
- Absence of strategic vision
- Lack of innovation 'champions' within organisations
- Require organisations to develop relevant new capabilities in order to support their deployment
- Employees' resistance is linked to fears of job or status loss, and to a lack of understanding about the new technologies
- Digital and manufacturing skills shortages across the whole supply chain - lack the digital literacy to use BIM, training can be time-consuming and expensive

Constraints on uptake - public

- Demand side constraints inhibit the wider use of OSM in the UK - consumers' negative view of housing built using OSM
- Mistrust of 'prefab' housing lingers from the Post-War housing boom – poor quality, demolitions
- Cultural preference for traditionally built 'bricks and mortar' homes still exists, reinforcing the belief that OSM-produced houses are somehow inferior
- Policy – 2016 BIM Mandate on government construction, not housing

Boosting the uptake of BIM/OSM

- Lessons from the 2016 BIM mandate for the construction industry could provide some guidance in rolling out a directive tailored specifically for the housing sector
- Increasing awareness of OSM and BIM from exemplary housing projects
- Provide an evidence base to demonstrate immediate and long-term benefits
- Innovation champions
- Digital upskilling

Concluding thoughts

- Wider constraints on housing supply and quality – use of existing stock, housing as a financial asset, land supply, the planning system, NIMBY-ism
- But OSM and digital innovation are part of the solution
- Preference for conventional construction methods contributes to current home-building rates being half of the 300,000 homes required annually – worse after the current pandemic

Concluding thoughts

- Need to address the key organisational, regulatory, industry and individual related constraints holding back the uptake of these innovations in the housing sector

- If the reliance on conventional construction techniques for housing continues once the Covid-19 pandemic is over, the supply gap can only worsen – alongside the negative impacts of poorly built and badly maintained housing

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