

Towards Closing the Housing Gap in the UK: Exploration of the Influencing Factors and the Way Forward

Authors

Emmanuel Itodo Daniel, Olalekan Oshodi, Daniel Dabara, Nenpin Dimka

Abstract

Purpose: Housing provides constructed space for human activities. Literature indicates that housing impacts wealth, education attainment and health outcomes, among others. Due to its contributions to society, it is essential to develop and implement strategies that address the housing shortage experienced in most cities across the globe. The study aims to unpack the factors affecting housing production in the UK and chart the way forward.

Methodology: In addressing the study's aim, an interpretivist approach was adopted, and semi-structured interviews were conducted with eighteen experienced professionals. Data were collected across the four nations of the United Kingdom (England, Wales, Scotland and Northern Ireland).

Findings: The results indicated that the opportunistic behaviour of stakeholders is one of the main factors affecting housing production in the study area. Also, modern construction methods, collaborative practices, government intervention and affordable housing schemes were identified as key strategies for addressing housing production factors.

Implication: The study identified strategies for mitigating housing production issues that provide a focal point to all stakeholders keen on filling the housing shortage gap and improving productivity to channel their resources and effort accordingly.

Originality/value: This study is one of the first to empirically analyse the influencing factors on the housing gap in the UK from the perspective of the supply-side, to provide information that could lead towards closing the said gap.

Keywords: Housing shortage, modern methods of construction, lean construction, supply-side of housing, UK

Introduction

Housing plays a vital role in society. Several organisations (such as Shelter Scotland, 2018; and United Nations, 2019) have recognised that housing is one of the fundamental rights of humans. Despite its importance, the current housing stock in most cities across the globe is insufficient. For instance, about 20% of the world's population has been reported to lack access to adequate housing (UN-Habitat, 2017). Also, estimates show that housing deficits in the USA, Australia and South Africa are 2.5 million, 250,000 and 2.1 million homes, respectively (Khater et al., 2021). This information suggests that the housing shortage is a global problem that requires concerted effort. To address the shortfall in the UK, the government is determined to deliver 300,000 new houses per year. However, this goal has not been achieved for over five years and still counting (House of Common, 2019).

Scholars have examined the insufficient current supply of housing from different perspectives. Gurran and Whitehead (2011) examined factors that contribute to housing production by focusing on the influence of planning on affordable housing. White and Nandedkar (2021) frame housing production as a crisis and try to understand how land supply issues and the planning system affect it. Similarly, Huang et al. (2015) explore the influence of land policies on housing supply. Vargas Walteros et al. (2020) examined housing supply and demand from the perspective of economic indicators, such as housing prices, housing sector wages etc., in the context of developing countries. Olanrewaju and Woon (2017) conclude that numerous

criteria affect housing production, including non-financial factors such as location. These studies show various factors that affect the housing supply.

An understanding of these factors provides vital information for developing strategies focused on improving the process of housing production. According to Gu et al. (2015), most studies on housing have concentrated on factors related to the 'demand side' and housing markets (e.g. land supply). Consequently, the 'supply side' aspect of housing has been relatively underexplored. The 'supply side' refers to the construction industry, e.g., the role of different stakeholders and the processes used to deliver housing. Gu et al. 2015 argued that to address the housing supply problem holistically, it is essential to understand the factors that affect the operational delivery of houses.

Additionally, previous housing studies seem to adopt a quantitative approach using a dataset from secondary sources. For instance, Gu et al. (2015) explore the factors that determine housing supply in Shanghai, China using quantitative methods, while Gurran and Whitehead, (2011) quantitatively compare housing supply data between Australia and the UK. Similarly, Huang et al. (2015) explored the factors that determine the housing supply in Hong Kong using available quantitative data, while De Vries and Boelhouwer (2005) examined the factors that influence the housing supply in the Netherlands using published quantitative data. All these approaches limit the exploration of the issue from the stakeholders' perspectives and views.

Given the identified gaps in the previous housing studies. The current study seeks to expand our understanding of the current issues affecting housing production with particular attention to the supply-side issues using an interpretive approach. Specifically, the study seeks to answer these two questions: Q1: What are the current issues confronting housing production in the UK; Q2: How can these issues be addressed or minimised?

Literature Review

Global Perspective on Housing and Factors influencing it

The literature on housing production has highlighted several factors influencing it. For instance, Dowall (1998) suggested that the government need to make more land available to develop residential housing. Sivam (2003) showed that land policy, lack of synergy among statutory agencies, lack of resources needed to procure infrastructure, and mismatch between demand and supply are the problems associated with the delivery of housing projects in Delhi, India. The factors affecting the delivery of housing projects in Papua New Guinea include finance, bureaucracy, outdated policies, the capacity of the construction sector, the cost of inputs and the attitude of construction workers (Ezebilo, 2020). In contrast, Bradley and Sparling (2017) highlighted the effect of planning policies on housing production in England. These studies (Sivam, 2003; Bradley and Sparling, 2017; Ezebilo, 2020) suggest that the factors influencing the delivery of housing projects are many and tend to vary from country to country. An understanding of the context-specific factors is essential for the development of strategies to overcome them. These factors are summarised and presented in Table 1.

Insert Table 1 here: An overview of factors affecting the delivery of housing projects

Various problems affecting the delivery of housing projects have been identified in previous research. The factors presented in Table 1 suggest that many studies have focused on the 'demand side' problems, such as land supply and the planning administration process. These problems are external to the construction sector, i.e., industry stakeholders have little or no control over these issues. Despite the importance of addressing 'demand side' factors, the supply side problems which emanate from the construction industry also influence the

outcomes of projects. For instance, shortage of workers, which is due to ageing workforce, significantly increases the cost of construction (Karimi et al., 2018). The construction sector can address labour shortage by providing funded training programmes. Thus, the current study seeks to unearth the 'supply side' problems affecting the delivery of housing construction projects in the UK.

Social and Affordable Housing in the United Kingdom: A Review of Recent Developments

Over the years, the UK government has been trying to address the economic inequalities in society. According to the Office of National Statistics (2022), the median monthly pay for London (Westminster) and Manchester for September 2022 was 3244 pounds and 1971 pounds, respectively. The government provides social housing to support low-income families to address this imbalance. Due to sales through the "Right to Buy" scheme and a decline in investments in new builds, the share of social housing available to renters reduced from 32% to 18% between 1981 and 2008 (Department of Communities and Local Government, 2009). Also, changes in the funding model have made housing associations the leading providers of social housing (Whitehead, 2007). Due to the impact of housing on the community's well-being, there have been calls for reforms in the social housing sector in the UK. The outcomes of empirical studies provide evidence to support the development of robust policies for addressing societal problems.

Research Method

Interpretivism is the epistemological position adopted to understand the current issues influencing housing production. This means the study develops an understanding of the current housing production issues by qualitatively aggregating and interpreting the key stakeholders' views on housing delivery. Unlike the quantitative approach, this study focuses on understanding the phenomenon from the participant's perspective, not the meaning presented in the literature alone. Various scholars (such as Creswell and Clark, 2011; and Maxwell, 2013) have affirmed that qualitative research methods allow a study to go beyond issues established in the literature and uncover new evidence. Previous studies of factors influencing housing production tend to be more quantitative (Gu et al., 2015; Gurran and Whitehead, 2011; Huang et al., 2015; De Vries and Boelhouwer, 2005). However, the qualitative interview data collected in this study fill this gap and uncover factors that were poorly reported in previous research.

Data Collection

To understand the issues confronting housing production in the UK. A preliminary literature review was conducted to understand the current debate around housing delivery. Data were collected across the four nations of the United Kingdom (England, Wales, Scotland and Northern Ireland). As shown in Table 2 majority of the organisation are based in England but also operate in the other nations of the United Kingdom. The participants for the study were purposively drawn from client, contracting, developers and consulting organisations, as shown in Table 2. Purposive sampling was adopted because it allows the study to answer the research question (Campbell et al., 2020). The study targeted vital stakeholders that are associated with housing production. The participants occupied various positions and had different titles within the organisations, such as Technical Director, Contract Manager, Site Manager, Managing Director and Process Improvement Manager, among others, as shown in Table 2. Table 2 shows that eight participants had 19-30 years of experience, whereas nine had 6-12 years of experience. It is worth mentioning that stratified sampling was not used in selecting the research participants. Rather the researchers used the purposive sampling technique, as mentioned earlier.

Insert Table 2: Respondent Demography

Table 2 also reveals that the professionals interviewed had valuable experience in the construction industry. For example, some of the current technical and managing directors started their careers as bricklayers, carpenters, and site supervisors who subsequently rose across the ranks to attain their current position. Also, they have worked across the four nations of the United Kingdom. This means the research participants would share their real experiences (firsthand) on the housing sector's issues.

In-depth semi-structured interviews were conducted with the identified stakeholders. The semi-structured interview gives stakeholders the freedom to share their experiences and views (Bryman, 2016). A semi-structured interview was chosen in contrast to a questionnaire survey that set the tone of how respondents should answer the question (Bryman, 2016). The interview question was open-ended, and they consisted of three main sections. The first section focuses on the background information, while the second explores housing production issues. The last section asks questions on measures to adapt to mitigate the problems. The semi-structured interview is open-ended because participants are more comfortable answering open-ended questions (Aberbach and Rockman 2002). Also, semi-structured interviews allow two-way communication between the researcher and the respondent, allowing the respondent to ask for clarification if required. More importantly, such conversation could lead to the emergence of new information and relevant themes.

All the interviews were conducted during the Covid-19 pandemic, precisely between January and May 2021. The University's research ethics approved the research instrument, project definition, and consent form before data collection. Prospective research participants were identified via their LinkedIn profiles, Twitter profiles and suggestions by professional colleagues in the industry. This approach was adopted due to the national restrictions associated with the outbreak of Covid-19. The project definition form that gives an overview of the project and consent was shared with the prospective respondents. All research participants gave their permission by signing the consent form. The aim and purpose of the research were explained to the participants, and they were informed that they could withdraw from the interview at any time. All interviews were done virtually via MS Teams and were recorded. The essence of the recording is to allow for verbatim transcription of the information and ensure that no part of the data is missed (Harvey, 2011).

The interviews continued until a saturation point was reached. Saturation is achieved when no new information emerges from the interviews (Urquhart, 2013). However, according to Saunders et al. (2018), we have different situations: theoretical saturation, inductive thematic saturation, prior thematic saturation, and data collection saturation. The saturation point adopted in the current study was data collection saturation which Sanders et al. (2018 p.1897) define as "the degree to which new data repeat what was expressed in previous data". The data collection saturation became apparent in the interview with the 17th and 18th respondents, and the data collection was stopped. Eighteen interviews were conducted, as shown in Table 2.

Data Analysis

The interview recordings were marked with identifiable codes such as participant numbers and titles. For example, P01- Technical Director (means participant one and the person's job title is Technical Director). All the interview recordings were labelled in that order before the verbatim transcription. This was done to ensure that there was no mix-up while transcribing the interview recordings. The transcribed interviews were analysed using a combination of inductive and deductive tools, known as abduction (Linneberg and Korsgaard, 2018; Miles and Huberman, 1994). This suggests a cyclic examination of the current housing production issues

in the UK with existing theories and literature on housing delivery (Dubois and Gadde, 2002). According to Dubois and Gadde (2002), the inductive approach generates theory by engaging with the data. The deductive method entails using theory to make meaning out of the data. Abduction provides the simplest explanation for all observations that emerge from the data.). The inductive and deductive approach was adopted in interrogating the data because it enables the study to offer new theoretical insights via the collected empirical data and confirm how the current housing production in the UK aligns with existing literature/theories. According to Linneberg and Korsgaard (2018), both approaches allow the study to see newly-emerging issues in data while remaining at par with existing theories.

Coding and Thematic Analysis Process

Bruan and Clarke (2006) identified six processes for analysing qualitative data: (1) Familiarising yourself with your data, (2) Generating initial codes, (3) Searching for themes, (4) Reviewing themes, (5) Defining and naming themes, and (6) Producing the report. The current study applied these processes.

1. *Familiarising yourself with your data*: The 18 interviews conducted were transcribed verbatim. The first author read through the transcribed interviews twice. Interview participants' information, such as role, years of experience etc., was noted and highlighted in green colour. In contrast, statements that aligned with the research questions are highlighted in yellow.

2. *Generating initial codes*: At this point, interesting statements were highlighted in yellow and were denoted by one or two words that explain what the highlighted statement connotes. For example: "*planning department understaffed*", "*lengthy approval process*", "*planning requirements*", "*difficulty in getting subcontractor to use digital tools*", "*quality issues*", "*delay as a result of design iteration*", "*lack of understanding of other peoples trade*", "*logistical issues*"; and "*damage due to transport*, among others. This was done for all the transcribed interviews. At the end of the process, over 60 factors were coded.

3. *Searching for themes*: Related codes identified in phase 2 were grouped to create an encompassing theme such as "*planning approval issues*", "*opportunities behaviour*", "*site operational issues*", and "*use modern methods of construction*", among others.

4. *Reviewing themes*: At this point, other research team members validated the identified themes and sub-themes (Silverman, 2013), and they were also subjected to examinations by external involved experts in housing production (see Hayfield and Huxley, 2015). Some of the experts participated in the interviews. The contradictions identified in coding were sorted through deliberations to ensure that the results fit the data collected and the theoretical constructs that addressed the research questions. A map to demonstrate the themes and sub-themes was then created.

5. *Defining and naming themes*: In the discussion of the result, a brief introduction and description were provided for each main theme, while the sub-themes were subsequently introduced.

6. *Producing the report*: In discussing the result, relevant extracts from the interview transcripts were inserted to support the theme discussion.

The core themes that emerged from the study are presented and discussed in the results and discussion section.

Result and Discussion

This section discusses the result that emerged from the analysis of the qualitative interviews. The themes fall under the factors influencing housing production and how they could be mitigated.

Factors influencing housing production in the United Kingdom

Five broad themes emerged from the data analysis on the factors influencing housing production in the UK. The themes are *supply chain management, opportunistic behaviour, skill and operational issues, land matters* and *demand and supply*. The factors are discussed below.

Supply Chain Management (SCM)

The factors that deal with the management of the critical stakeholders in the construction phase of housing production are classified as supply chain management (SCM) factors in this study. The sub-themes that fall under the SCM are discussed below.

Coordination and communication between trades and professionals

The study found that managing the different trades and stakeholders involved across the different construction project phases is among the factors influencing housing production in the UK. Some of the respondents stated that: *"There's a lot of different trades and they're often not working for the same company; they're working for different companies, so they don't always have the one goal in mind of making sure that this is built to a very high standard for the customer"* [P10]. P05 also echoed this position where they pointed out that the interfaces between all the different trades and the management of the other stakeholders can be challenging to coordinate in a traditional environment. Input is required from various professions to deliver housing that meets the customer's requirements. Using multiple trades and suppliers to provide a product or service is not common to housing production alone; other sectors do likewise.

Construction management scholars are now exploring using technology, such as Blockchain, to enhance supply chain management in the construction industry (Tezel *et al.*, 2020; Wang *et al.*, 2020). However, the nature of the supply chain in the construction industry is fragmented, and the one-off nature of construction projects makes it difficult to manage (Tezel *et al.*, 2020). For example, one of the respondents stated, *"There is this sort of lack of communication if you like, or poor communication and management. So, reviewing that would address this supply chain fragmentation with the off-stream players"* [P04].

Using (Ball and Harloe, 1992) theory of "Structure of Housing Provision" (SHP), we could say that the various trades and professionals are among the social actors that are involved in the housing production process. An understanding of the dynamics between these actors is vital for the effective coordination of the process of housing production. However, such coordination will be challenging to attain or achieve where the relationship between these trades is driven by an adversarial rather than a collaborative contracting model.

Understanding other trade's work and trade-required skills

The study found that when the tradespeople do not understand the task of other trades involved in the housing production process, it will affect the housing production. Some of the respondents stated that:

"In the refurbishment, you need to have a holistic understanding of the whole building. And if you don't understand it, then you won't be able to deliver it, and that will go down from the trades doing the work-, so if you're doing your first fix carpentry in a property, knowing what

a plasterer will or won't be able to get over after he lives you alone, all the way through to, kind of, the surveyors who are looking at the buildings and identifying fire risks inside the building" [P09].

The above statement shows the importance of teamwork and collaboration among the actors involved in housing production. It also shows the importance of developing a shared understanding of housing production. This means that those involved in housing production should not be narrow-minded and avoid the "Silo" approach. According to Pasquire and Court (2013), a common understanding is essential to achieve flow in the production process. However, when the required skill is missing, the production process cannot achieve flow. One of the respondents stated, *"Trades need to get prior knowledge, and skills to complete their tasks to a good quality, which allows for no setbacks in the program stage is important" [P15].* This shows the need to engage the people with the right skills for housing supply to avoid a setback.

Logistics Planning and Management

The study reveals that the logistics process influences the housing production process. Many suppliers and component suppliers are involved in the housing production process. One of the respondents stated: *"Where you might have several building elements and components coming from different parts of the world, sometimes, or different parts of a country, it is quite difficult to properly ensure that the right planning is in place to ensure that all of those elements and components are delivered to site when they are needed" [P03].* Logistical consideration is an essential factor to consider in housing production. According to McGeorge (2010), logistic management in construction projects encompasses the movement and handling of building components, materials and resources required for on-site work. However, logistic planning and management are more complex in traditional projects where design is separated from the construction. Akinici *et al.* (1998) assert that balancing the contention between space and time for effective logistic management in a construction project is essential. However, the inability to balance space and time in logistic management in housing projects could lead to material being delivered to the site when it is not needed. Thus, this situation leads to double handling on-site and contributes to poor performance of projects. To address this issue, technologies and techniques (such as offsite construction and virtual reality) can be used to enhance construction site logistics (Cheung & Ng, 2019)

Opportunistic behaviour

Opportunistic behaviour is the exhibition of self-interest tendency by a party, individual or organisation at the expense of the other parties in the transaction (Laan *et al.*, 2011). The factors categorised as opportunistic behaviour in the current study are the action taken by the different stakeholders involved in housing supply to satisfy their interest at the expense of the other stakeholders. These factors are discussed below:

Developer Selfish Interest and Quest for more profit

The study reveals that the goal and target of housing developers in the UK is not to close the housing gap but to make more profit for themselves. The study found that developers' opportunistic behaviours, such as protecting their interests, influence housing supply in the UK. Some of the respondents stated that: *"But developers, I think, would have to, sort of, be forced into thinking about housing shortages, because as far as the developers are concerned, their drive is not to bridge the gap between the demand for housing and what is built. Their drive is, really, what sort of house they can build, how much they can sell it for, what area they are building it in and the sort of customer they can attract" [P16].*

“So, those are, like, the private developers, I don't think it works, at least like I said before the private developers are working to their own initiatives and pressures and for their own interests for the most part” [P11].

The study also shows that some top developers create artificial land scarcity. The leading developers have the means of acquiring most of the available lands. However, they will not be ready to develop the land even when there is a demand for housing in the areas. They would rather wait until the land value goes up before they build to earn more profit. For example, other respondents stated: *“And until the value of land goes up high enough for a developer to start thinking of developing” [9].* The study also found that private developers are driven to make more profits at the expense of meeting the needs of their prospective customers. The study reveals that some developers are unwilling to quickly sell their property to the private sector, even when the houses are completed. Thus, creating artificial housing scarcity to sell at a higher price. Some respondents stated: *“They are looking at profit, you know, what they can sell in a particular area. Not necessarily the volume but how much they can sell it for” [P16].* This shows that the housing supply problem is not due to the lack of land alone, as reported by previous studies (Owusu-Ansah et al., 2019; Yan et al. 2014; Huang et al. 2015). But opportunistic behaviours that have now been institutionalised among top private housing developers in the UK also influence the housing supply. Further evaluation of the comments of [P16] and [P11] shows that the leading housing developers are the significant influencers of housing supply as they decide the type of housing, location and their target customer without necessarily considering the national interest or goal. For instance, the UK government has set a target of delivering 300,000 houses per year, but this target has not been achieved (Housing, Communities and Local Government Committee, 2019).

House Builders Dominated by Larger Developers.

The study reveals that the UK housebuilding sector is dominated by the more prominent housebuilders, preventing the small house builders from joining the housing supply to meet the customer's needs. Some of the respondents stated that:

“And then, I think there's also the industry being entirely dominated by just a particular sector grouping of people. So, the room for, for example, the people who the housing builders. It is difficult for newer entities to come and enter that space” [P11]

“So, you're relying, I think to deliver the housing shortage that we have, you are relying almost solely on the big housebuilders. They have a role to play, but I think I don't know how they can do it alone” [P17].

In the 1980s, 40% of the housing supply was provided by the smaller housebuilders in England, but they now offer only 12% (Federation of Master Builders, 2021). At the same time, the giant housing developer is responsible for the remaining delivery (Federation of Master Builders, 2021). However, some respondents argued that the more prominent housebuilders alone could not supply the number of houses required in the UK. This is because the more famous house builders are smaller in number. Despite this, the few more prominent top developers win most housing development projects. The implication of the current arrangement on housing production in the UK is that the few more prominent housing developers now decide, control, and monopolise how housing is supplied to satisfy their individualistic interests. According to Dong et al. (2015), when people's opportunistic behaviour goes unnoticed and no sanction even when detected, they will be encouraged to continue. Therefore,

the activities of the top housebuilder must be regulated. On the other hand, small housebuilders should be strengthened and supported to enhance the housing supply in the UK.

Mismatch in Housing Supply

Another critical factor influencing housing production in the UK is demand and supply. The participants in this interview pointed out that developers are more concerned with providing buildings with higher demands in the market, thereby relegating 'need' to the background. One of the interviewees stated that *"so, the house providers will not be providing these houses based on need, it's based on the ability to purchase the houses, yes? So, it's not the wishes of the people that are considered"* [P07]. Furthermore, on the other hand, an interviewee observed that *"It's a supply issue, isn't it? At the end of the day, if you release more land in the right places. And the issue, I suppose is, it's got to be in the areas where there is the demand"* [P08]. The mismatch between supply and demand has been challenging for many developed and developing economies. This can be seen in similar studies, which posited the duo as critical factors to housing production. These issues were glaring in China (Yan et al., 2014), Hong Kong (Huang et al., 2015) and England (McGuinness et al., 2018).

Skill and Operational Issues

This study's findings revealed that many skills and site operational issues affect the delivery of housing projects in the UK. The issues mentioned by interviewees include skills shortage, logistics, the unattractiveness of the sector to young people, low uptake of digital tools and quality, among others. One interviewee stated, *"I think it's probably labour shortages. Which I think is due to budgets. As a quantity surveyor, we bid for projects. And basically the lowest bid gets the job."* [P02]. Also, another interviewee mentioned that *"the coordination of basically managing that between all the different trades is, kind of, the biggest challenge I would guess"* [P05]. These interviewee excerpts broadly support the work reported in previous studies that focused on housing production. For instance, research by Steinberg (2007) and Kim et al. (2020) showed that labour shortage led to an increase in the cost of construction projects through changes in labour costs.

Multiple stakeholders are involved in construction projects; as Interviewee [P05] described, managing the interface between the works carried out by each stakeholder can be difficult. Interface problems in construction projects have been linked to unstable user requirements, lack of coordination among stakeholders, and the procurement process (Yin et al., 2014; Sha'ar et al., 2017). These interface problems create conflicts among project stakeholders, affecting the project delivery process. This finding suggests that ineffective interface management leads to a situation where resources are expended on processes that do not add value to the housing project.

Lack of skills issues to develop unused land was also identified as an influencing factor *".... We don't know how to build on those plots of land because we have lost that skill set now"* [P09]. As earlier observed, regardless of whether the land is insufficient, the housing supply in the UK could be revolutionised with the right policies and the right skill set in the industry. An earlier observation supports this assertion by Ndinda (2003) in South Africa.

Land Matters

The participants provided five (4) variables they believe influence housing production in the study area concerning land matters. These concerns include land availability for development

and planning issues, conservation and restriction on land, and demographic effects on land value issues.

Land availability and planning issue

Regarding land availability and planning issues, one of the interviewees said, "*Our main issue, I suppose, is land availability*" [P08]. Furthermore, Interviewee [P06] posited that "*local planning authorities still do want very traditional-looking buildings, you know, and that is very difficult to get away from*". These assertions corroborate the position of some scholars in the literature. For example, Dowall (1998) noted the dire need for land availability to bridge the gap between housing supply and demand. Yan et al. (2014) recorded a similar finding in China. Concerning planning issues, it was pointed out that there is a need for the government to look into the current policies to review the same (especially the seemingly outdated ones) in favour of planning policies that address modern realities to improve housing production in the UK. Considering planning issues to support building upwards (higher stories) to conserve and maximise space use could be a way out. Another planning-related issue observed was that there are too many stakeholders or interests in the planning process. For instance, Interviewee [P08] observed, "*you've got quite a lot of people feeding into that process. Like you'll have the Ecological department, you'll have the Highways, you'll have the local people as well, and you find the parish councils and people feeding into the process. So there is a lot of people to appease*".

Unused land

Interviewee [P11] observed that "*in some cases where there is land, especially in urban built-up areas, there are a lot of constraints making any development there incredibly unviable*", pointing to the fact that land restricted for conservation purposes is an influencing factor in housing production. In addition, the demographic effect on land value was also identified as a factor in the housing supply in the UK. This was buttressed when Interviewee [P11] "*like where we are right now, our land value is quite low and the demographic here in terms of everything from ethnicity to profession. Yes, all of those things that play a role in, you know, how much people are going to earn and therefore how much they are going to be able to expend on housing*".

Strategies and way forward to overcome the factors confronting housing production

When asked for the strategies or way forward towards combating housing production mismatch, the participants pointed out a number of strategies. The themes that emerged include the *use of modern construction methods, Government interventions, collaboration and supply chain management, affordable home schemes and production process improvement on site*. The themes are discussed below.

Use of the modern method of construction and production process improvement on site

Duncheva et al. (2020, pp.3) define the modern construction method (MMC) as all the approaches that aim to optimise the construction process to obtain better products in less time. This could include offsite construction, lean construction, BIM, and simulation. In this study, the factors that align with this definition were categorised as MMC.

Use of an offsite Construction approach

Some respondents suggested that addressing the current issues confronting the housing delivery offsite construction approach should be explored. Offsite construction is a process where a building or an infrastructure facility component is wholly or partly complete in a controlled environment such as a factory and delivered to the site for installation (Arif and Egbu, 2010). Offsite construction approach includes modular, volumetric, penalised, component and subassembly, and hybrid systems. Some of the respondents stated that: "*I mean, I would favour and would like to see more modular construction going on because I just think you can control the outcomes a lot better as I said whether it speeds things up, on bigger schemes, undoubtedly*" [P01].

"So, I think, like, you know, things like more the modern method of construction, like, let's say, prefabrication to begin with, or offsite manufacturing, can be something that can go a long way, you know, in resolving this shortage of housing that we are facing" [P04].

"But yes, obviously we need more houses, building them faster and quicker really is the best, I think the modern method of construction support building housing faster" [P17]

The offsite approach can speed up the housing production process. A whole building could be primarily completed in factory conditions, like the modular system, before moving to the site for installation (Peltokorpi *et al.*, 2018). The techniques also support process standardisation with improved quality (Hermes, 2015). The respondents attest to the impact of using an offsite approach speeding up the housing production process. The advantages of using offsite methods in housing production are not limited to speed alone. It also provides an opportunity to control the final product quality compared to traditional construction since they are made in factory condition, thus reducing the work and minimising time overrun. However, the offsite approach is costly and requires early capital investment (Bildsten, 2011), which may affect its use by smaller house builders. This means smaller housebuilders will need support to adopt the offsite approach. Nevertheless, the offsite approach in housing production will serve as a stimulus to the sectors to adopt other innovative practices in the housing sector, as pointed out by research participant four.

Use of the Lean Construction approach to understand and improve the housing production process

Lean construction is a unique approach to managing construction, and it focuses on minimising waste in the production system and improving value for the end-users (Koskela, 2000). There is a census among scholars and practitioners about applying lean support construction process improvement (Bertelsen & Koskela, 2004; Hermes, 2015). One of the respondents stated that: "*So, a kind of lean-thinking principles that we're now seeing in more than construction and so on that will go a long way in bridging the gap between this upstream and downstream, and the issue of this fragmentation, and ways, if we like, with how we can process this and so on*" [P04].

The respondents believed that using lean construction approaches would help bridge the gap between the upstream and downstream players in housing production. This is because lean construction approaches such as the Last Planner System support collaboration between the stakeholders involved in housing production, thus improving the housing production process (Bildsten, 2011; Daniel *et al.*, 2019). This is crucial when considering the current traditional housing construction approach, where design is separated from construction when the traditional procurement method is used. This is among the contributory factors to the lack of collaboration among the project team.

However, lean construction supports the use of collaborative forms of contracts such as lean integrated project delivery, target value design, and framework agreement, which help bridge

the current divide and build trust among the project team (Daniel *et al.*, 2016). Some of the respondents further stated that: “*So, you can try and streamline the delivery processes by using, say, lean techniques or Last Planner, or whatever, just to try and make things work more efficiently* [P014]. The study found that using lean construction techniques such as the Last Planner System help streamline the construction process as it allows the project team to make a more realistic plan and better understand each other's work or task. Hermes (2015) found that using LPS to deliver housing projects enables each trade on the project to understand the requirement of the subsequent work, especially during the execution phase, thus reducing mistakes and enhancing the final build's quality. Other lean construction techniques that support process improvement in housing production include value stream mapping, just-in-time, visual management, and first-run studies. While techniques such as value stream mapping help understand the construction process, thus eliminating non-value-adding activities and improving the housing production process; Just in time approach ensures that material is delivered only when needed (Arashpour *et al.*, 2016). However, there is resistance to lean construction techniques in the construction industry (Tezel *et al.*, 2018).

It could be argued that a lean construction approach, such as using collaborative contracts, will minimise the fragmentation of the supply chain that dominates housing. In contrast, using lean construction tools such as value stream mapping, LPS, and JIT would improve housing production by eliminating non-value-adding activities.

Component standardisation, review of the building production process

To resolve the problems affecting the delivery of housing projects, the strategies mentioned by interviewees encompass: component standardisation, review of the building production process and "Identify user requirement and building to meet their need". Commenting on strategies needed to improve housing delivery, one of the interviewees said, "*I'm looking at how the overall production of housing is affected. So, when you look at the cost of rework in housing production, that sort of rework is, sort of, fuelling, like, cost and time overruns, you know, quite often*" [P04]. Research has proven that rework negatively impacts construction project cost performance (Love, 2002; Hwang *et al.*, 2009; Yap *et al.*, 2017). Also, a lack of understanding of the client's needs leads to frequent project changes, i.e., rework. Based on the literature and findings emerging from this study, it is evident that rework can be linked to the quality and/or changes suggested by the client.

To address this problem, there is a need for stakeholders to (i) actively engage with end-user and clients during the project briefing process, (ii) use of digitisation tools, such as BIM, has been associated with a reduction in rework and errors in projects (Hwang *et al.*, 2019). The active use of these tools needs to be encouraged, and (iii) the use of prefabricated components for housing construction projects. The increased uptake of BIM and prefabrication facilitate active collaboration among stakeholders and improvement in the quality of construction projects (Hwang *et al.*, 2019). Also, using prefabricated components ensures that repetitive processes can be automated. Automation reduces the need for a large workforce. These strategies can improve the process used to deliver housing projects.

Government interventions

Regarding government interventions, the following salient points were observed: Government legislation favouring housing production, help to buy schemes by the government, regulations to control the activities of developers, lifting borrowing caps for local authorities, and policies on affordable housing and vacant buildings as well.

Interviewee [P02] suggested good legislation regarding the land is put in place *“But I think, legislation, in some form, perhaps as part of acquiring a large plot of land is put in place”*. By the same token, Interviewee [P08] stated that *“The government needs to legislate, to give local authorities the ability to increase the number of development sites that they have within the county”* This buttressed the fact that government legislation could play a significant role in mitigating the housing production challenges in the study area. Furthermore, the suggestion that government intensify its efforts in the Help To Buy Scheme could also mean the production of affordable housing to especially the low-income earners in the society *“so what the government is doing now is making these houses more accessible, and there are schemes such as government Help To Buy for new houses with energy efficiency capabilities”* [P07]. Others opined that the housing shortage could be addressed when the government and local authorities regulate the activities of developers *“So I think a shift in what developers can and cannot do, by the Government or local authorities, is what is going to drive the need to look at housing shortages”* [P16].

Complying with relevant Acts during alteration or offsite adaptation building, policies to build affordable housing by the government and lifting borrowing cap for local authorities were also mentioned as the way forward for bridging the gap between housing supply and demand. Some participants say, *“You have a set of instances where the councils will force the developer to build a portion of what they would consider social housing, whereby the council can use and place people there”* [P16]. Regarding lifting the borrowing cap, Interviewee [P11] has this to say *“So, obviously, we've gone from a situation that has been a lasting situation for a number of decades, where there is a cap on borrowing, there was a cap on how much local authorities were able to borrow, and therefore really limiting the scope for the local authorities to really make any significant dent in terms of housing delivery”*. Another strategy proposed was for the government to postulate policies on vacant buildings *“from what I can gauge, there is a lot of vacant properties nationally. So, perhaps the government should look at a strategy for renovating, letting those out, or making them a saleable house”* [P13]. This could increase, from the supply-side perspective, the number of available housing units in the property market.

Collaboration and supply chain management.

Another theme that emerged is collaboration and supply chain management. Here, participants opined that the following could mitigate the housing production challenges in the study area: collaborative working with SME designers and manufacturers, a collaboration between the stakeholders on the project, early involvement of all parties, and clients to coordinate all the teams involved in the delivery of housing collaboratively and building right homes in the right places. To buttress the importance of collaboration among relevant stakeholders, Interviewee [P08] shared an experience where collaboration yielded the desired success *“I employed him on that job to work with me as a project manager, and we basically brought in all the sub-contractors ourselves and managed them on the ground, and we had an architect that we used on the site in conjunction with the client”*. Furthermore, Interviewee [P06] corroborated this by sharing a similar experience *“So, from a housing project, the one in Shrewsbury was quite ground-breaking in a number of ways because we worked as a team. At the time, I worked with an SME, as a director SME design manufacturer of facade systems”*. This emphasised the benefits of collaborating with other relevant parties in the building industry. The teams need to be coordinated to achieve desired outcomes in housing projects in the UK. It is also pertinent that housing units should be built in the right places to suit the needs of its consumers. In line with this assertion, Interviewee [P04], stated that *“So, right home in the right place, for*

example, you're looking at, you know, how I will put it? County-by-county or, community-by-community depending on what their needs are".

Affordable home scheme

The next theme that emerged is the affordable home scheme. Here it was opined that priority is given to investments in affordable homes that should be localised. Furthermore, the building of affordable social housing could be encouraged. Interviewee [P04], stated *"I think, it is good and also helpful if we invest in affordable housing to, sort of, prevent homelessness, which will be a good start for me, I think"*. To buttress this point, interviewee [P11], has this to say *"So that even in the most affluent areas of London, affordability isn't considered something that is just for a certain sect, and that, you know, other people within that wider community are able to find something affordable within a development, if it makes sense"*—pointing to the fact that affordability needs to be localised.

Categorisation and discussion of the factors that Influences housing production

Table 2 below categorises the factors that influence housing production in the UK. Out of the 12 factors that were identified, 10 are the 'supply side factors'. Also, the table reveals that the four core themes that emerged from the study three are supply-related factors, while only one is non-supply related. The above evidence suggests that supply-side-related factors are among the top factors influencing housing production in the UK. This is because the supply side deals with the operational issues of housing production. Table 3 reveals that most supply-side related factors involve managing the relationship and behaviour of the various stakeholders involved in housing production. According to Ball and Harloe (1992), understanding the dynamics of the issues associated with the production process and the physical process involved in housing construction is essential in exploring the factors affecting housing production.

However, the inability to manage the relationship among these actors in the housing construction phase and develop a correct understanding of the production process could lead to poor quality of work, rework, time and cost overrun, thus influencing the housing supply. This shows that supply-side factors are interrelated and could impede housing production. For example, Karimi et al. (2018) found that a shortage of workers due to an ageing workforce significantly increases the cost of construction. Furthermore, Table 3 shows that the emergence of land availability and planning issues and unused land confirms that land matters and planning issues still remain a problem for housing provision in the UK. The issue of land and planning is not limited to the UK as it is also glaring in China, Malaysia, Nigeria and Saudi Arabia, among others (Nubi and Ajoku, 2011; Yan et al. 2014).

Conclusion

The current study set out to unearth the factors influencing housing production and mitigate these. It was found that 12 factors (10 'supply-side' and 2 non-supply related factors) influence the housing production process. These factors were classified into four themes; supply chain management, opportunistic behaviour, skill and operational issues and land matters. The strategies for mitigating the factors influencing housing production include: "the adoption of modern methods of construction (MMC)", "government intervention", "collaboration", and "affordable housing scheme". As recommended in previous studies, the findings suggest that increasing land supply alone is insufficient to address the housing shortage problem.

There is a need to address the 'demand side' and 'supply side factors that affect housing production. For instance, the institutionalised opportunistic behaviour of property developers must be addressed through the government's intervention. This goal can be achieved by

enacting legislation to support the growth of small and medium-sized property development firms. The study reveals that using MMC (such as lean construction, offsite and BIM) supports process standardisation, process improvement and collaboration among the key stakeholders involved in housing production. Thus minimising re-work, and time overrun while enhancing the speed of delivery, quality and client satisfaction.

This study contributes to the knowledge and practice of housing delivery in several ways by providing empirical evidence on factors influencing housing delivery from the supply side and strategies for mitigating them. First, the study identified and categorised the supply-side related factors that influence housing delivery which has received less attention from past researchers. It is also interesting to note that previous studies have not reported the *opportunistic behaviour* factors identified in this study. Second, the identified strategies, i.e. *use of the modern construction method, government intervention and collaboration and supply chain management, provide a focal point to all stakeholders keen on filling the housing shortage gap and productivity improvement in housing production to channel their resources and effort accordingly*. The evidence from the current study further supports the current UK government policy decision that encourages the adoption of modern methods of construction to increase house supply to meet the UK yearly housing target.

This study is based on exploratory interviews; a case study approach may unearth more factors influencing housing delivery in the UK. Additionally, the study is based on a qualitative method; as such, the result may not be generalised and should be taken cautiously based on the method used. The study concludes that holistic actions are required by all the major stakeholders, including the developers and the government regulatory agency, to close the housing gap. Although the study is based on the empirical evidence gleaned mainly from the UK, it could be adopted and serve as a lens to direct future improvements to housing supply elsewhere in the world.

Reference

- Aberbach, J. D., & Rockman, B. A. (2002). Conducting and coding elite interviews. *PS: Political Science & Politics*, 35(4), 673-676.
- Adegun, O. B., & Taiwo, A. A. (2011). Contribution and challenges of the private sector's participation in housing in Nigeria: case study of Akure, Ondo state. *Journal of Housing and the Built Environment*, 26(4), 457-467.
- Akinci, B., Fischer, M. & Zabelle, T. (1998). Proactive Approach for Reducing Non-Value Adding Activities Due To Time-Space Conflicts. *In Proceedings of Sixth Annual Conference of the International Group for Lean Construction , Brazil*.
- AlQahtany, A.M. (2021). Government regulation and financial support on housing delivery: lessons learned from the Saudi experience. *International Journal of Housing Markets and Analysis*. Advance online publication. <https://doi.org/10.1108/IJHMA-03-2021-0036>
- Arashpour, M., Wakefield, R., Abbasi, B., Lee, E.W.M. & Minas, J. (2016). Offsite construction optimisation: Sequencing multiple job classes with time constraints. *Automation in Construction*, Elsevier, 71, 262–270.
- Arif, M. & Egbu, C. (2010). Making a case for offsite construction in China. *Engineering, Construction and Architectural Management*, 17(6), 536-548.
- Ball, M. & Harloe, M. (1992). Rhetorical barriers to understanding housing provision: What

- the 'provision thesis' is and is not", *Housing Studies*, 7(1), 3-15.
- Bertelsen, S. & Koskela, L. (2004). Construction beyond lean: a new understanding of construction management. *Proceedings of the 12th Annual Conference in the International Group for Lean Construction*.
- Bildsten, L. (2011). Exploring the opportunities and barriers of using prefabricated house components. *19th Conference of the International Group of Lean Construction (IGLC), July 13-15, Lima, Peru*.
- Bradley, Q., & Sparling, W. (2017). The impact of neighbourhood planning and localism on house-building in England. *Housing, Theory and Society*, 34(1), 106-118.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), pp.77-101.
- Bryant, L. (2012). An assessment of development funding for new housing post GFC in Queensland, Australia. *International Journal of Housing Markets and Analysis*, 5(2), 118-133.
- Bryman, A. (2016). *Social research methods*. Oxford: Oxford university press.
- Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D. & Walker, K., 2020. Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing*, 25(8), 652-661.
- Cheung, E.H.L. & Ng, S.T. (2019). Applying Virtual Reality to Improve the Construction Logistics of High-rise Modular Integrated Construction. *Modular and Offsite Construction (MOC) Summit Proceedings*, pp. 76–83.
- Creswell, J.W. & Clark, VLP. (2011). *Designing and Conducting Mixed Methods Research*. 2nd Edition. Sage Publications.
- Damoah, I. S., Ayakwah, A., Aryee, K. J., & Twum, P. (2020). The rise of PPPs in public sector affordable housing project delivery in Ghana: challenges and policy direction. *International Journal of Construction Management*, 20(6), 690-703.
- Daniel, E.I., Pasquire, C. & Dickens, G. (2016). Exploring the factors that influence the implementation of the last planner® system on joint venture infrastructure projects: A case study approach. *IGLC 2016 - 24th Annual Conference of the International Group for Lean Construction*.
- Daniel, E.I., Pasquire, C. & Dickens, G. (2019). Development of Approach to Support Construction Stakeholders in Implementation of the Last Planner System. *Journal of Management in Engineering*, 35(5), [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000699](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000699).
- Department of Communities and Local Government (2009), Housing in England 2007-2008 Available at: www.communities.gov.uk/documents/statistics/pdf/1346249.pdf. (Accessed 14 October 2022)
- De Vries, P. & Boelhouwer, P. (2005). Local house price developments and housing supply. *Property Management*, 23 (2), 80-96.

- Dowall, D. E. (1988). The land and housing market assessment: an important tool for increasing housing delivery in third world cities. *Habitat International*, 12(4), 135-149.
- Dubois, A., & Gadde, L.E. (2002). The construction industry as a loosely coupled system: implications for productivity and innovation. *Construction Management and Economics*, 20(7), 621-631.
- Duncheva, M., Calcagno, C., & Victor Henquel, V. (2020). *Offsite Fundamentals. Centre for Offsite Construction + Innovative Structures*. Edinburgh: Edinburgh Napier University.
- Ezebilo, E. E. (2020). Evaluation of construction, marketing and management in housing delivery by a private developer: evidence from Papua New Guinea. *Journal of Housing and the Built Environment*, 35(3), 957-981.
- Federation of Master Builders (2021). Tackling the challenges faced by England's SME house builders. Retrieved December 28, 2021, from <https://www.fmb.org.uk/resource/tackling-the-challenges-faced-by-england-s-sme-house-builders.html>
- Gu, G., Michael, L. & Cheng, Y. (2015). Housing supply and its relationships with land supply. *International Journal of Housing Markets and Analysis*, 8(3), 375-395.
- Gurran, N. & Whitehead, C., 2011. Planning and affordable housing in Australia and the UK: a comparative perspective. *Housing studies*, 26(7-8), 1193-1214.
- Harding, A., Parker, J., Hean, S. & Hemingway, A. (2018). Supply-side review of the UK specialist housing market and why it is failing older people. *Housing, Care and Support*, 21(2), 41-50.
- Harvey, W.S. (2011). Strategies for conducting elite interviews. *Qualitative research*, 11(4), 431-441.
- Hayfield, N. & Huxley, C. (2015). Insider and outsider perspectives: Reflections on researcher identities in research with lesbian and bisexual women. *Qualitative Research in Psychology*, 12(2), 91-106.
- Hermes, M. (2015). Prefabrication and modularisation as a part of lean construction-Status quo in Germany. *Proceedings for the 23th Annual Conference of the International Group for Lean Construction*, 235-245.
- House of Commons (2019). *Housing, Communities and Local Government Committee Oral evidence: Modern methods of construction*. Retrieved February 6, 2022, from <http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/housing-communities-and-local-government-committee/modern-methods-of-construction/oral/98436.pdf>
- Housing, Communities and Local Government Committee (2019). Modern methods of construction. Retrieved January 29, 2022, from <https://publications.parliament.uk/pa/cm201719/cmselect/cmcomloc/1831/1831.pdf>
- Huang, J., Shen, G. Q., & Zheng, H. W. (2015). Is insufficient land supply the root cause of housing shortage? Empirical evidence from Hong Kong. *Habitat International*, 49, 538-546.
- Hwang, B. G., Thomas, S. R., Haas, C. T., & Caldas, C. H. (2009). Measuring the impact of rework on construction cost performance. *Journal of Construction Engineering and Management*, 135(3), 187-198.

- Hwang, B. G., Zhao, X., & Yang, K. W. (2019). Effect of BIM on rework in construction projects in Singapore: status quo, magnitude, impact, and strategies. *Journal of Construction Engineering and Management*, 145(2), [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0001600](https://doi.org/10.1061/(ASCE)CO.1943-7862.0001600)
- Karimi, H., Taylor, T. R., Dadi, G. B., Goodrum, P. M., & Srinivasan, C. (2018). Impact of skilled labor availability on construction project cost performance. *Journal of Construction Engineering and Management*, 144(7), 04018057.
- Khater, S., Kiefer, L. & Yanamandra, V. (2021, May 07). Housing Supply: A Growing Deficit. Retrieved January 29, 2022, from http://www.freddiemac.com/research/insight/20210507_housing_supply.page#:~:text=The%20ongoing%20housing%20shortage%20is,to%203.8%20million%20in%202020
- Kim, S., Chang, S., & Castro-Lacouture, D. (2020). Dynamic modeling for analysing impacts of skilled labor shortage on construction project management. *Journal of Management in Engineering*, 36(1), [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000720](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000720)
- Kroeger, A. & Weber, C. (2014), Developing a conceptual framework for comparing social value creation, *Academy of Management Review*, 39 (4), 513–540.
- Koskela, L. and others. (2000). *An Exploration towards a Production Theory and Its Application to Construction*, VTT Technical Research Centre of Finland.
- Laan, A., Voordijk, H. & Dewulf, G. (2011). Reducing opportunistic behaviour through a project alliance. *International Journal of Managing Projects in Business*, 4(4), 660–679.
- Love, P.E.D. (2002). Auditing the indirect consequences of rework in construction: a case based approach. *Managerial Auditing Journal*, 17(3), 138-146.
- Maxwell, J.A. (2013). *Qualitative Research Design An Interactive Approach*. Third Edition. Sage Publications.
- McGeorge, D. (2010). Managing Construction Logistics. *Construction Economics and Building*, 10 (4), <https://doi.org/10.5130/ajceb.v10i4.1885>
- McGuinness, D., Greenhalgh, P., & Grainger, P. (2018). Does one size fit all? Place-neutral national planning policy in England and its impact on housing land supplies and local development plans in North East England. *Local Economy*, 33(3), 329-346.
- Miles, M.B., & Huberman, A.M. (1994). *Qualitative data analysis: an expanded sourcebook*. 2nd Edition, Sage, London.
- Nadim, W. and Goulding, J.S. (2010), “Offsite production in the UK: the way forward? A UK construction industry perspective”, *Construction Innovation*, Emerald Group Publishing Limited.
- Ndinda, C. (2003). Housing delivery in Nthutukoville, South Africa: Successes and problems for women. *Journal of International Women's Studies*, 5(1), 29-41.
- Nubi, T. G., & Ajoku, C. (2011). Nexus between effective land management and housing delivery in Lagos. *Environment and Urbanisation*, 23(1), 285-303.
- Olanrewaju, A. & Woon, T. C. (2017) An exploration of determinants of affordable housing choice, *International Journal of Housing Markets and Analysis*, 10(5), 703–723.

- Olanrewaju, A. L., & Idrus, A. (2019). What is determining affordable housing shortages in the Greater Kuala Lumpur, Malaysia?. *Property Management*, 38(1), 52-81.
- Office of National Statistics (2022). Earnings and employment from Pay As You Earn Real Time Information, UK: February 2022. Available at: <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/earningsandemploymentfrompayasyouearnrealtimeinformationuk/october2022>(Accessed: 22 October 2022)
- Owusu-Ansah, A. (2014). Modelling the supply of new residential construction in Aberdeen, UK. *International Journal of Housing Markets and Analysis*, 7(3), 346-362.
- Owusu-Ansah, A., Soyeh, K.W. & Asabere, P.K. (2019). Developer constraints on housing supply in urban Ghana. *International Journal of Housing Markets and Analysis*, 12(1), 59-73.
- Pasquire, C. and Court, P. (2013). An exploration of knowledge and understanding – The eighth flow. *21st Annual Conference of the International Group for Lean Construction*.
- Peltokorpi, A., Olivieri, H., Granja, A.D. & Seppänen, O. (2018). Categorising modularisation strategies to achieve various objectives of building investments. *Construction Management and Economics*, 36(1), 32–48.
- Sha'ar, K. Z., Assaf, S. A., Bambang, T., Babsail, M., & Fattah, A. A. E. (2017). Design–construction interface problems in large building construction projects. *International Journal of Construction Management*, 17(3), 238-250.
- Shelter Scotland, (2018). Housing and homelessness statistics. Retrieved February 11, 2022, from https://scotland.shelter.org.uk/housing_policy/key_statistics/homelessness_facts_and_research
- Silverman, D. (2013). *Doing qualitative research: A practical handbook*. SAGE publications limited, London.
- Sivam, A. (2003). Housing supply in Delhi. *Cities*, 20(2), 135-141.
- Steinberg, F. (2007). Housing reconstruction and rehabilitation in Aceh and Nias, Indonesia—Rebuilding lives. *Habitat International*, 31(1), 150-166.
- Tezel, A., Koskela, L. and Aziz, Z. (2018), “Lean thinking in the highways construction sector: motivation, implementation and barriers”, *Production Planning and Control*, Vol. 29 No. 3,
- Tezel, A., Papadonikolaki, E., Yitmen, I. & Hilletoft, P. (2020). Preparing construction supply chains for blockchain technology: An investigation of its potential and future directions. *Frontiers of Engineering Management*, 7(4), 547-563.
- UN Habitat (2017). *Human Rights in Cities Human Rights in Cities*. UN-Habitat: Nairobi
- United Nations (2019). *Guidelines for the Implementation of the Right to Adequate Housing: Report of the Special Rapporteur on adequate housing as a component of the right to an adequate standard of living, and on the right to non-discrimination in this context*, [online] Available from: <https://undocs.org/A/HRC/43/43>.

- Urquhart, C. (2013). *Grounded theory for qualitative research: a practical guide*. Thousand Oaks, Sage Publications.
- Vargas Walteros, C., Novoa Hoyos, A., Arias Ardila, A.D. & Peña Ballesteros, A.S. (2020) Analysis of demand and supply in the Colombian housing market: impacts and influences 2005-2016, *International Journal of Housing Markets and Analysis*, 11(1), 149–172.
- Wang, Z., Wang, T., Hu, H., Gong, J., Ren, X. & Xiao, Q. (2020). Blockchain-based framework for improving supply chain traceability and information sharing in precast construction. *Automation in Construction*, 111, <https://doi.org/10.1016/j.autcon.2019.103063>.
- White, I. & Nandedkar, G., 2021. The housing crisis as an ideological artefact: Analysing how political discourse defines, diagnoses, and responds. *Housing Studies*, 36(2), 213-234.
- Whitehead C. 2007. Social housing in England. In *Social Housing in Europe*, C Whitehead, K Scanlon (eds). London School of Economics and Political Science: London, London; 54–70.
- Yan, S., Ge, X. J., & Wu, Q. (2014). Government intervention in land market and its impacts on land supply and new housing supply: Evidence from major Chinese markets. *Habitat International*, 44, 517-527.
- Yap, J.B.H., Low, P.L., & Wang, C. (2017). Rework in Malaysian building construction: impacts, causes and potential solutions. *Journal of Engineering, Design and Technology*, 15(5), 591-618.
- Yin, S. Y. L., Tserng, H. P., Toong, S. N., & Ngo, T. L. (2014). An improved approach to the subcontracting procurement process in a lean construction setting. *Journal of Civil Engineering and Management*, 20(3), 389-403.