

Research Title: *Sustainable Development and England's Residential Construction Industry: A Critical Analysis of Positive and Negative Interactions with SDGs 9 and 11*

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1.0 Introduction

The housing crisis across the United Kingdom, particularly in England, has triggered economic, societal and environmental policy reform to deliver greater volume, better quality, and safer homes that are fit for the future. However, the industry remains in paradoxical struggle between its current need for greater affordable housing, and its long-term vision to achieve high-quality sustainable homes delivered by accountable and competent individuals. This implies that the residential construction industry in England is simultaneously an enabler and barrier to achieving sustainable development.

The concern is not simply that residential construction projects are unsustainable in achieving both the current need and the long-term vision; rather that the existing socio-technical structure of industry often reproduces unsustainable outcomes despite instilling new technologies and policies designed to improve sustainability.

Accordingly, this paper analyses the above dilemma in relation to global sustainable development goals (SDG) 9, industry, innovation and infrastructure; and 11, sustainable cities and communities. This paper investigates this dilemma and aims to exploit how the external factors that drive the residential construction industry interact with the corresponding sustainable delivery goals set out by the United Nations (n.d.).

Thus, this presents the following primary question which is further disseminated into four supporting questions that this paper will investigate:

Primary research question

1. *To what extent does the UK residential construction industry support and inhibit the achievement of SDG's 9 and 11, and how effective are policy and industry responses in any addressing any evident conflicts?*

Supporting research questions

1. *How does residential construction in England contribute positively to SDG 9 and SDG 11?*
2. *What environmental, economic, political, and social factors of residential construction inhibit achievement of these SDGs?*
3. *How far does current and devolved policy interventions in the UK address these conflicts?*
4. *What does the evidence suggest about the capacity and structure of the existing residential construction industry to support transitioning towards more sustainable outcomes?*

Through critical analysis of the construction industry's driving forces and role in satisfying the mandated SDGs, a meaningful evaluation of the framework of the industry can be exhibited to

determine whether delivery through the current framework remains sufficient in achieving both short and long-term niches of SDGs 9 and 11. This would be underpinned through appreciation of the complexities or ease of introducing systemic socio-technical transformation within the current industry to attain these environmental, social, and economic sustainability goals.

2.0 Conceptual & Theoretical Framework

To analyse SDGs 9 and 11 in relation to the construction industry, a conceptual and theoretical framework model is essential to understand how the industry functions, responds and adapts to external economic, environmental, and social factors.

Thus, Figure 1 has been developed to conceptualise the English residential construction industry's factors which enable or constrain it in achieving SDGs 9 and 11. The dualism of factors such as material consumption and modern methods of construction (MMC) still creating unsustainable construction waste is of particular importance. This emphasises that the existing socio-technical structure of industry remains unsustainable regardless of the technological advances of construction practices.

Figure 1 underpins the dichotomy between what policy intends to achieve based on reported data and outcomes through how the industry responds and manages these expectations. It is evident that changes within the construction industry are often reactive and become diluted by developers through repeat issues and rework, despite technological advancement and procedural refinement (Farmer, 2016). This fundamentally diminishes the purpose of case studies, consultations, and regulatory reforms that set out to challenge the holistic framework and habits within the industry.

Geels (2011) challenges this understanding through analysis via a multi-level perspective lens. Geels (2011) argues that socio-technical changes to the wider landscape e.g., a push towards net-zero carbon emissions; allow further niches of innovation to be exploited which propagates technological advancement, and growth of a new framework. Although Geels (2011) outlines a linear view to better analyse socio-technical growth on a macro-to-micro scale, these advancements often fall short in addressing the existing framework in the construction industry due to the deep rooted 'race to the bottom' mindset instilled within organisations (Hackitt, 2015). This restricts the industry's ability to overcome its embedded dualism and partiality towards economic growth, as opposed to social and environmental growth.

Gibbs and O'Neill (2015) oppose the linear relationship outlined by Geels (2011) between niches and regime transformation within the construction industry; outlining that transformation barriers are layered through devolution of governance, operational and geographical constraints, and tightening of prescriptive regulatory compliance barriers. Figure 1 demonstrates this and allows a relational

analysis of these as factors as ‘barriers’ e.g., MMC is further hampered by a lack of recognised system and product testing methodologies despite regulatory reform; thus, preventing the industry to meaningfully grow despite technological advancement.

Hence, this concept exposes the need of a ‘trade-off’ mechanism within the construction industry to feasibly satisfy all three domains of sustainability to achieve SDGs 9 and 11.

Accordingly, this paper will look to critically analyse the relationships between the following relevant SDG 9 and 11 targets and socio-technical transitions within the construction industry:

- SDG 9 – *resilient infrastructure, sustainable industrialisation, technological advancement, and innovation (United Nations, n.d.).*
- SDG 11 – *housing, sustainable urbanisation, transport, environmental impacts, resilience, and planning (United Nations, n.d.).*
- Socio-technical transitions – *systems, regimes, niches, policy, and innovation.*

This will allow empirical analysis to establish whether sustainable transformation of residential construction can be achieved solely through further technological optimism or regulatory reform or whether sustainability outcomes emerge from detailed interactions between wider factors such as: technology, industry structure, policy implementation, market conditions, skills, geographical location and professional practices.

The Residential Construction Industry & SDG 9 & 11 Nexus – Conceptual Framework

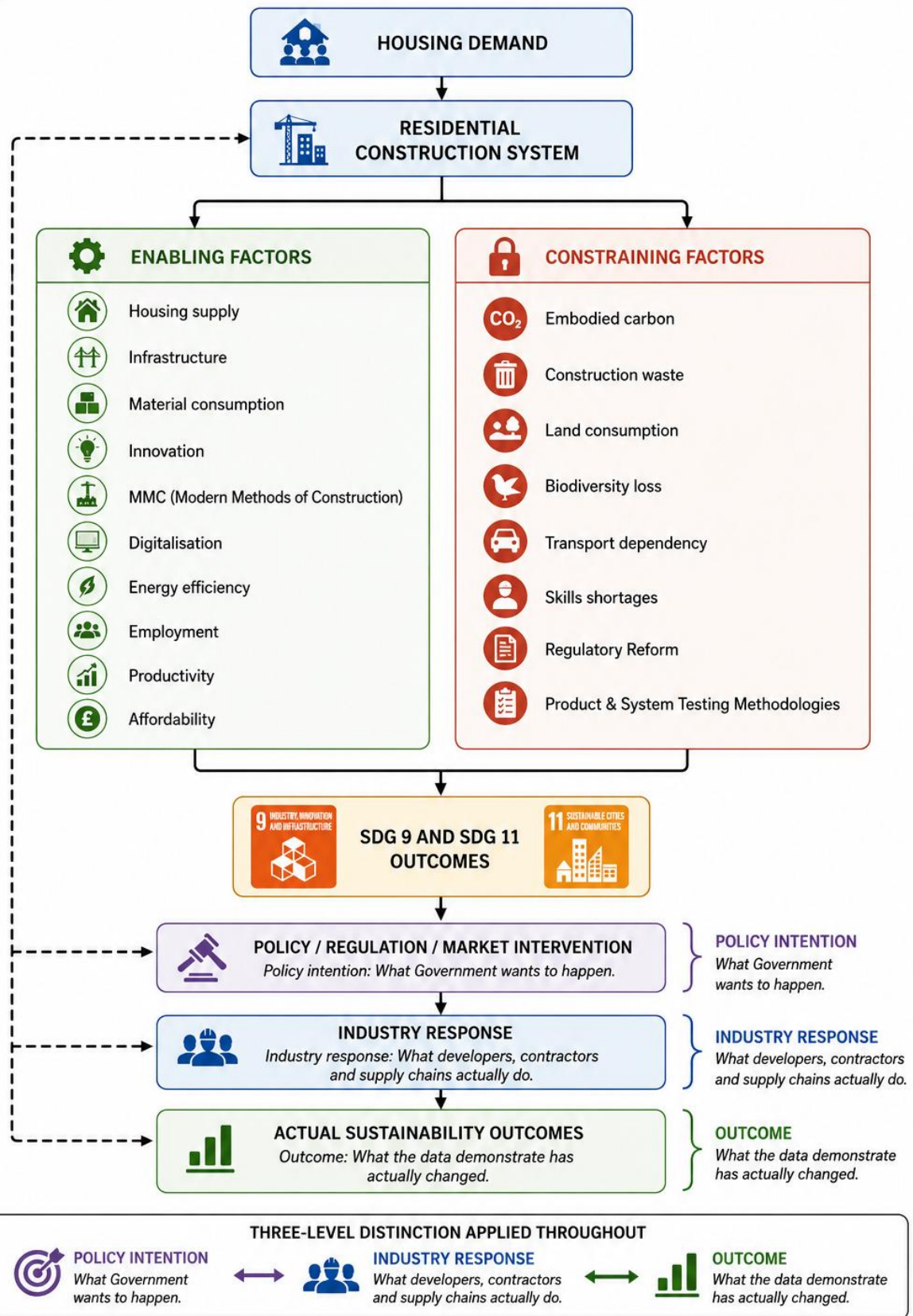


Figure 1. The Residential Construction Industry & SDG 9 & 11 Nexus – Conceptual Framework

3.0 Methodology, Criteria & Limitations

3.1 Methodology

The study will employ a critical integrative review of secondary qualitative and quantitative evidence.

This will comprise of the following derived from the conceptual framework in Figure 1:

Quantitative:

- Office for National Statistics (ONS) – Building Completions in 2026
- Building Research Establishment (BRE) – Benchmark Waste Data 2026
- Government Data Collections & Consultations – Affordable Housing, Private Housing, Quality of Housing.
- Housing Statistics – Political Targets (Required v Achieved)
- Published Industry Data – Whole Life Carbon Assessments (WLCA) & Circular Economy

Qualitative

- Regulatory Policy – Building Safety Act, Future Homes Standard, Housing Standards.
- Peer-reviewed Literature – Regulatory Reform, Skills Shortage,
- Professional Bodies’ – Statements, Bulletins, Technical Notes etc.
- Impact Studies – Government analysis of policy reforms and recommendations
- Case Studies

The variety of sources above will support in allowing relational analysis between the residential construction industry and SDGs 9 and 11. This will allow meaningful gaps and recommendations to be developed to the primary and secondary research questions established.

The above will allow an integrative review of literature to provide a comprehensive interpersonal understanding of the interaction between policy, industry, and outcomes as prescribed within figure 1. This approach provides a nuanced gap analysis through correlations or disconnections between the theoretical, attitudes and beliefs; to the empirical, live data collection and measured output. Through this, critical underpinning of synergies and trade-offs required can be exploited via a enriched and non-linear multi-perspective lens (Geels, 2011).

To note, the above sources vary in their epistemological stances which will allow meaningful comparison and dissemination of data as a part of this integrative review. This is key to ensure that an ethically unbiased and factual assessment is presented within the findings of this study (Marabini, 2022).

3.2 Criteria

This study will employ the following stringent boundaries via the sources and mechanisms considered of qualitative and quantitative data within section 3.1:

Inclusion Criteria

- **Scope:** Studies will address the English construction industry and its intersection with SDG 9 (i.e., green infrastructure, technological innovation, sustainable materials) or SDG 11 (i.e., sustainable urban housing, reducing environmental impact). However, due comparison to other countries may be referenced for comparative analysis as appropriate where relevant to processes, systems, and niches.
- **Geographic Focus:** Research will be set entirely within England to reflect the specific regulatory frameworks. Consideration of the thematic alignment may allow increase of scope to the United Kingdom or otherwise, only as appropriate; to develop comparative analysis.
- **Study Design & Publication Type:** To be in line with the qualitative and quantitative sources as detailed in section 3.1.
- **Timeline:** Literature published between 2010 and the present – to note, SDGs were introduced within 2015 (United Nations, n. d.).
- **Language:** Studies published in English language only.

Exclusion Criteria

- **Out of Scope:** Studies focusing generally on SDGs 9 and 11 without a specific, primary focus on the physical construction sector or its supply chain (e.g., digital innovation in automobile or banking, or programs not relating to the built environment).
- **Geographic Misalliance:** Research focusing on global construction trends, developing nations, or regions outside the UK, as their building codes, socioeconomic factors, and climates differ significantly unless relevant for comparative critical analysis.
- **Outside of Timeline:** Literature published prior to 2010, as it lacks the modern context of the SDG framework and construction practices instilled through primary and secondary legislation.

3.3 Limitations

This study considers the UK as a broad analytical scope with England as the principal policy case. Hence, there is specific references to English devolved approaches where policy divergence materially affects the analysis to sustain the scope of this study.

This study is wholly based on the analysis of secondary data. Therefore, it must be acknowledged that whilst relationships can be derived, a full relation assessment to determine the related triggers can be deemed premature. An example of this could be a noticeable increase in housing output over the past 10 years, however, the trigger may not necessarily be a singular policy reform during this period. This is because the industry is governed and measured by technology, framework, policy, market conditions, skills, geographical location and professional practices.

Furthermore, the latest ONS dataset for UK building start and completions was last updated in July 2026 and there is a disclaimer that does make clear that this dataset does not capture every housebuilding project (ONS, 2026).

Lastly, this study recognises the constraints highlighted within the literature and datasets interrogated which in turn supports the development of recommendations and research gaps within section 6.0.

4.0 Literature Review

4.1 Empirical Baseline / Context

To provide an empirical baseline of the study for a critical literary review, the industry's stakeholder structure, residential housing output and shortfall, and government devolution and policy reform will be scrutinised against SDG 9 and 11. This will consider the methodology and limitations set out within section 3.0.

4.2 Residential Construction & SDG 9 - Positive & Negative Interactions

4.2.1 Innovation

SDG 9.4 and 9.b considers the research and development of technology in domestic and developing countries, with an aim to achieve greater manufacturing diversification whilst improving resource efficiency and reproducibility (United Nations, n.d.).

Key examples of this within the last 15 years have been the rapid progression of designing for manufacturing and assembly (DfMA), Building Information Modelling (BIM), and product and systems engineering. These collectively have supported a push towards MMCs that support a design-and-then-build ethos to attain leaner production and reduce on operational and material wastage (RIBA, 2021).

The RIBA (2021) make clear that DfMA approaches do have an increased cost due to the nature of construction processes necessitating earlier design engagement, benchmarking, manufacturing and off-site storage, holistic system testing, and on-site delivery management. Consequently, clients often do not consider in procurement the benefits of these aspects in incurring reductions to the project programme, lifecycle costs, and a higher quality and electronically documented design, manufacturing, installation and testing record (RIBA, 2021). This is reinforced by an independent study undertaken by KPMG of the Leadenhall Office Building in England, which identified that a 6-month reduction in project programme was achieved through the employment of DfMA and MMC which incurred a 7% reduction in project costs, equating to £36 million pounds (KPMG, 2016). Accordingly, in a climate where 565,000 homes every annum need to be delivered by 2040 to overcome the growing shortfall, a considerable reduction in project programmes through forms a core mechanism for developers to deliver affordable homes (Hopkins, 2025).

Nonetheless, the culture within the industry, geographical constraints of developments, and preservation of green-belt spaces applies throughout England, which stems the importance and continued specification of traditional construction methods, particularly in suburban and rural areas (Lovell, Smith, 2010). Thus, this highlights that solely economic considerations alone do not drive client procurement habits and expectations, rather they underpin wider dogmas and constraints which remain prevalent in the construction industry.

Thus, this raises the query on whether innovation has transformed the residential construction system or simply improved selected components of it dependent on social and environmental constraints. This technological optimism within urban areas allows reflection that the social and environmental considerations of England as a wider country appears to be lacking in the implementation of DfMA approaches, thus, contributing to the further backlog in affordable housing.

4.2.2 Productivity and Industrialisation

Interlinked with innovation progression, SDG 9.1 and 9.2 considers sustainable industrialisation through manufacturing practices delivering both economic and social development and growth (United Nations, n. d.). This is key to ensure manufacturing practices support increased productivity to overcome the housing shortfall in England whilst not contributing to further fragmentation of communities, and skill and labour shortages within the construction industry (Valence, 2017).

DfMA practices support a leaner reproducibility framework with mediated standardisation in quality, design functionality, procedural application. However, the UK Building Regulations prescribed have evolved over the years from supplementary guidance into stringent performance-oriented set of requirements that demand approval (Meacham, 2010). A key example of this is the introduction of the

Building Safety Act 2022 applicable to buildings above 18 metres in height or 7 storeys, requiring detailed specifications of all building works prior to conception, commencement and completion of any construction activities across three gateway approval junctures. This is in conjunction with a planning framework which prioritises the preservation of communities and rurality, further limiting the demographic which can be transformed for greater affordable housing. Hence, this has dissuaded developers from pursuing innovative methods which can lead to building regulatory rejection and thus, severe project delays and sunk costs.

England has pushed for greater DfMA solutions on construction projects through incentivisation to housing associations and local councils via the funding schemes such as the Greater London Authority (GLA) grant scheme. Kim and Widanage (2024) argue through an independent study of a project that there is significant evidence to reflect that adoption of DfMA practices up to 80% labour activity on-site reduction and 50% reduction in build programs. However, Glenigan (2024) have measured that a slow adoption rate between 2017-2023 of 10 to 17%. This reflects that the innovations that have been introduced on individual projects, have been ineffective in attaining macro level change within the industry to drive productivity. Valence (2017) emphasises that this is due to the innate fragmentation of the industry whereby manufacturers and developers alike depend on differentiation and specialisation, varying in size and niche, inhibiting a singular standardised approach from being realised. Furthermore, Rizai et. al (2020) further reinforces this fragmentation through a study into the attitude of leading professionals within the English construction industry, illustrating views that a one size fits all approach is impractical given no two projects are inherently the same.

As a critical comparison, Singapore also instils a DfMA approach towards Building Regulations that encourages prefabricated innovation through government incentivisation for greater urbanisation in established cities and demographics (Farmer, 2016). Singapore has achieved significant traction and growth in productivity and industrialisation as a result of procedural integration. This is evident through growth reported by the Singaporean BCA (2020) of adoption of DfMA practices achieving 31% in 2019 and 68% as of 2024. This is alongside 67% integrated digital delivery with new established job opportunities that focus on specialism of DfMA processes e.g., robotics, specialism and facilities management (Achieve Group, n. d.). This has been attained through supply chain incentivisation of collective R&D practices linked to public housing programmes. Holliday (2000) advises through a study into East Asian social policy that public housing programmes have worked well in Singapore due to the nation's subservient approach to change, oligopoly and political influence, in contrast to England which encourages diversification and fragmentation through its democratic structure.

This infers that innovation is advertised within the social-technical structure of the English construction industry as a transformative measure that can drive greater productivity and achieve industrialisation. However, it is structurally mediated, constrained, and often neglected due to the regulatory barriers, inherent fragmentation of practices for competitiveness, and dogma within the industry which hinders realisation on a macro-level.

4.2.3 Whole Life Carbon Assessment

Construction activities require a significant amount of material supply and maintenance which interacts closely with SDG 9.4, constituting a significant portion of non-renewable waste which contributes heavily towards CO₂ emissions throughout a development's lifecycle (United Nations, n. d.).

However, through sustainability-biased mandates and political drives tightening on waste, energy and water management, the industry has managed to achieve the following reductions between 2016 to 2025 across 4791 project equating to £34bn (BRE, 2025):

- waste per £100,000 project value fell 28%;
- waste per 100m² increased by more than 10%;
- new-build projects generated 36% more waste per 100m² than the average across project types;
- landfill diversion reached 99.5% in 2025.

This indicates a drive and trajectory over the past decade towards greater sustainable practices and infrastructures that promote reproducibility and maximise carbon offset alternatives. Consequently, the industry demonstrates success when measured by landfill diversion (99.5% diversion) and waste relative to monetary project value, yet less successful when measured by waste intensity (10% increase) relative to the physical output of construction. This is reinforced by the study conducted by UKGBC (2026) which highlighted that only a 14% reduction in CO₂ scope 1, 2 and 3 emissions were noted by 2026.

This concern is corroborated through independent committee consultation by the UK Parliament (2022) reflecting a 68% reduction in CO₂ emissions is required by 2030 to meet the 2050 net-zero carbon emission target. In this consultation, the cyclical nature of construction is exposed whereby the inability to re-use buildings through retrofitting. This is coupled with a lack of agency over the need for greener operational construction methods and attainable embodied carbon targets through innovations, conflicting directly with the need for greater housing which demands further material usage.

Thus, whilst construction has demonstrated socio-technical growth in a medium to micro level, there remains significant change required through policy and focus on whole life cycle carbon practices to achieve delivery of sustainable buildings fit for the future to satisfy SDG 9.4.

4.3 Residential Construction & SDG 11 - Positive & Negative Interactions

4.3.1 Housing Supply & Affordability

SDG 11.1 and 11.3 focuses on the provision for affordable housing, regeneration, and integration of urban, sub-urban and rural demographics (United Nations, n. d.). This forms the heart of this study as these SDGs relate to key practices delivered and managed by the construction industry to overcome economic and social constraints. Yet, whilst construction is essential to meet the housing need within England, it does not independently support the attainment of sustainable communities.

Maliene and Mulliner (2011) recognise the gap between sustainable housing requirements being discussed holistically with little regard to addressing the appropriateness of implementation and relationship with individual communities. The concern herein lies in establishing a balance between housing prices, developer costs, and the demand for affordable housing. This engenders a need for a global affordability matrix to drive sustainable and innovative practices (Maliene, Mulliner, 2011).

The ONS (2024) have established that housing prices have significantly surpassed householder income over the last two decades. In recent times, affordability ratios have gradually stabilised in 2025 to overcome the further hardships construed by Covid-19 pandemic (ONS, 2024). Yet, an overall reduction in affordable housing from 20% to 16% between 2000 to 2023 highlights that the country cannot economically keep up with the demand and cost of living (Cromarty et. al, 2024). Cromarty et. al (2024) highlight that planning and regulatory frameworks hinder affordable construction costing and developer incentivisation to satisfy the housing demand within England. Therefore, this supports the systemic nature of cost-cutting exhibited by developers to prioritise economic growth above social and environmental domains (Hackitt, 2018).

This infers that the two matrixes, sustainable construction and affordability, co-exist but have innate mutually exclusive tensions between each other. Hence, attaining sustainable construction impacts the overall cost to developers, which can negatively impact the affordability or quality of developments: both crucial components to achieve sustainable developments.

4.3.2 Sustainable Housing Quality

In conjunction with SDG 11.1, SDG 11.c targets sustainable methods of construction that improve the quality of living. Policy has provided greater focus on a fabric-first approach, sustainable methods of heating and cooling, and long-term building use modelling to make more resilient and sustainable

homes that consider the fitness of homes for the future. This has been achieved through administration of further regulatory changes to the prescriptive Building Regulations and implementation of the Future Homes Standard (FHS) in response to the slow progress in meeting the country's commitment to be net-zero by 2050 (UKGBC, 2026).

The DLHC (2026) outline that the FHS aim to improve energy efficiency and reduce carbon emissions from new dwellings, with new homes designed to be zero carbon ready. However, a critique on existing homes and a pathway to support re-construction or retrofitting remains outside the scope of the FHS through electrical grid decarbonisation. However, in the medium to short-term, this is key to ensure a level playing field of sustainable housing quality and affordable housing pricing is instilled across communities in England. Furthermore, the MHCLG (2026) challenges the impact assessment conducted by the DLHC, labelling that the Future Homes Standard remains "*not fit for purpose*" due to the direct costs to stakeholders equating to £709m alongside a £11.3bn social value drive to support community infrastructure growth.

This significant undertaking alongside wider decarbonisation and preservation of rurality does not consider relaxations to treat micro-organisations different to macro-developers: a key facet of a fragmented industry. Thus, alongside the lack of a re-construction strategy for existing homes; the FHS runs the risk of increasing both upfront costs for developers and homeowners of existing homes. Economically, this runs the risk of further increasing the barriers between affordable housing and individual affordability. This directly contributes to the cyclical nature of the industry, propagating another race to the bottom between developers to achieve competitiveness and maintain profitability (Hackitt, 2018).

4.3.3 Sustainable Communities

Moreover, SDG 11.a, 11.2, and 11.3 targets integration of policy and population with respect to way of living, place of living, and associated infrastructure (United Nations, n. d.). Only 8.6% of England's land has been developed and urbanised due to the presence of green belts, agriculture, preservation orders, and flood plains (DLHC, 2023). Accordingly, a significant land bank of greenfield development remains untouched with the prioritisation on re-construction and re-development of existing brownfield sites. However, construction on brownfield schemes can disrupt newly established biodiversity and contributes further to wastage and material use within urban areas (Theodorou, 2022).

Accordingly, a drive is needed to link sustainable communities on a macro-scale through integration between urban, suburban and rural communities. SDG 11 emphasises that construction should be evaluated through scalability of settlements, not simply the size of an individual dwelling (United

Nations, n. d.). Das (2024) builds on this relationship, describing the delivery, digitisation and integration of cities and rurality as a symbiotic platform for urban sustainability through synergy of the built and natural environment. Theodorou (2022) reinforces the understanding of an environmental trade-off between biodiversity habitats and urbanisation to create novel ecosystems that supports growth of larger communities and ecological development. This is pivotal and conceptualises the socio-technical trade-off required to build sustainable settlements that integrate and balance the need for greater housing, rurality characterisation, and adaptable ecosystems.

4.3.4 Negative Interaction with SDG 9 & 11

The English construction industry employs several practices which creates a cause-and-effect matrix synchronising both positively and negatively with SDGs 9 and 11. An illustration of this has been provided within table 1 below which elaborates on the relational trade-off from construction practices which illustrates construction as the solution and the barrier to achieving SDG 9 and 11. This depicts who benefits from development of each facet, who bears the cost, and the magnitude of change imposed to the socio-technical structure within the industry.

Facet	Cause	Effect
Land Use for Housing	Creates greater housing, particularly affordable housing to overcome the current shortfall.	Consumes land, reduces biodiversity, impedes on rurality instilled by sparse communities, impacts local businesses capacity, and may not solve affordability gap and overcome the concern of cost of living.
Creating Amenities for Urbanisation	Creates locality and domestic businesses to support long-term growth of communities	Location growth can create a dependency of vehicles over sustainable methods of transport, disruption to ecological habitats, impact to local businesses and capacity to support.
MMC	Reduces fragmentation and instils greater quality control and digitalisation procedures.	Increases scope for skill gaps, does not tackle operational concerns for delivery, increases upfront costs to developers which is often fed into market rates for housing prices and valuations.

Infrastructure	Increases scope for urbanisation and future expansion of communities to overcome current shortfall.	Impacts transport mechanisms, environmental biodiversity and preservation areas.
Regulatory Reform	Increases expectations of new homes to drive higher standards of construction to meet government targets	increases upfront costs to developers which is often fed into market rates for housing prices and valuations, impacts ability for potential homeowners to secure mortgages, no change to cost of living if mechanisms not instilled for existing homes.

Table 1. The Cause-and-Effect Matrix of the Construction Industry

5.0 Policy & Industry Response

The government has responded to the challenges within the industry as explored in section 4.0 through further policy and regulatory administration to guide the industry towards politicised targets that aim to satisfy SDG 9 and 11.

5.1 Future Homes Standard & Building Regulations

A key legislative enactment comprises of the FHS which aims to ensure new homes are zero carbon ready through a fabric first approach coupled with electricity grid decarbonisation which negates the need of future retrofitting and reconstruction (DLHC, 2026). This is shaped through secondary legislation in the form of approved documents L, F, S & O which encircle improvements to conserving fuel and power, ventilation, electrical charging and sustainable methods of transport, and overheating and cooling of premises.

The industry has responded to the prescription detailed within secondary legislation through specification of improved building fabrics e.g., triple glazing, MMCs, centralised mechanical ventilation systems with heat recovery, and air source heat pumps, to avoid specification of non-renewable alternatives in support of the primary vision (Cousins, 2026). However, whilst the improvements within regulatory standards are notable in the driving better quality housing; these changes implant a higher compliance threshold as opposed to accomplishing a meaningful collaborative transformation that promotes integration and innovation in line with SDGs 9 and 11.

Furthermore, the FHS focuses on the importance of the whole construction lifecycle but lacks due consideration of the presence and impact from embodied carbon which remains a wider challenge

and consideration that legislation alone cannot overcome (Cousins, 2026). The FHS has received criticism of being unsuitable within governance itself as highlighted by the MHCLG (2026) when considering the practical application in relation to scalability, fragmentation, and bottlenecks through reliance over decarbonisation within the existing socio-technical structure.

Consequently, it is apparent that due consideration of the wider environmental and economic impact and feasibility of implementing the FHS is lacking and requires further political review and measurement to ensure that the objectives of SDG 9 and 11 can be harnessed within the forthcoming policy. This also exposes the stark reality of the construction industry whereby even new legislation, which draws upon hurdles and shortfalls of prior legislation; still lacks in precision to adequately tackle the concerns over sustainable development.

5.2 Planning Framework & Regulatory Reform

The introduction of the Building Safety Act (BSA) 2022 and the National Planning Policy Framework (NPPF) aimed for an equal balance in approach to support greater housing output whilst increasing accountability of individuals to challenge the current culture within the industry. The BSA empowers governance through the independent formation of the Building Safety Regulator and their appointed multi-disciplinary team to systematically instil gateways to achieving approval to design, approval to commence, and approval to safely occupy. This is applicable for high rise buildings exceeding in 18 metres in height or greater than 7 storeys. In contrast, the NPPF decentralises power to mitigate concerns over byelaws and local plans which convolute the existing approval framework.

The industry recognises this trade-off in that scheme planning is easier to secure however, long-term delivery becomes frustrated and halted via the overcautious, and risk-averse culture which challenges the construction industry. This fuels a pipeline of future work which is bottlenecked from progression due to the holistic assessments that gateways 2 and 3 demand under the BSA, reducing the pacing of housing delivery.

Accordingly, whilst both mechanisms illustrate a balance in supporting and improving the standards of construction projects, due consideration of the overall lifecycle of a development appears to be missed from the forefront of policy which is key to satisfy SDG 9. Moreover, the relaxation of planning jurisdiction threatens the ability to meaningfully satisfy SDG 11 should devolution of powers reduce the importance of local byelaws that preserve the environment and community needs in the interest of greater housing output. A collaborative and stepwise approach between both policies is crucial to achieve a culture of transparency, technical due diligence, and sustainable ethos within the industry that supports settlement, affordable housing and project delivery.

6.0 Recommendations & Research Gaps

This paper has highlighted the paradoxical nature within the construction industry, whereby changes in policy to address the socio-technical structure of the industry coincide, yet also conflict, with overall attainment of SDGs 9 and 11. The key areas which exhibit dichotomy in practice have been summarised below for future avenues of research.

Build More vs Consume Less: The UK needs greater housing output to meet the current population levels. However, the construction lifecycle demands significant material consumption to meet this demand, entrenching an iterative cycle of waste generation that operationally impacts the environment. A key avenue of further study would be the investigation of SDG 11.2 and 9.2 in tandem to develop MMC matrixes that holistically assess the manufacturing, delivery and installation process to determine the long-term impact and benefits for specifying and reusing materials as a part of wider whole life carbon assessments.

More Innovation vs Regulatory Framework: The industry has demonstrated that MMCs do exist and provide benefits on a micro-level with respect to project lifecycle costs and project delivery savings. However, large scale adoption remains inhibited, actively avoided, and expensive to administer upfront due to the innate fragmentation within the industry alongside the changes within the regulatory approval framework. A further avenue of study would be an investigation into whether the new regulatory regime within the UK industry restricts the level of innovation feasible under SDG 9, with meaningful comparisons to delivery frameworks in place within leading countries and related industries.

Regulation vs Transformation: The construction industry has introduced further prescription within secondary legislation as a guide to achieving newer regulatory compliance measurements. Whilst these further increase the minimum standards expected of new buildings, these changes do not appear to reinforce systemic change and a drive towards more performance assessed technical requirements that incorporate and support innovation and wider policy and landscape socio-technical considerations as prescribed within SDG 9 and 11. A further avenue of study would be a study into a new framework that supports technical assessment through justification and technical due diligence of proposals in relation to locality e.g., urban, suburban, and rural; to reinforce the need for growth and accountability in design and construction practices.

Operational Carbon vs Embodied Carbon: There is a clear push to overcome the challenges in energy efficiency to drive attainment of net zero carbon through legislation. However, a lack of consideration of the implications to existing homes and homeowners, coupled by the long-term consideration of embodied carbon; is missing to ensure sustainable cities are achieved by 2050. Accordingly, further

avenues of study could be into the relationship between the economic cost of living implications through a drive to standardise the implementation of the FHS be implemented on both new and existing buildings. This would be further layered with the consideration of whole life carbon assessments through innovation, and product manufacturing to create a relational link to SDGs 9 and 11.

Housing Output vs Sustainable Communities: The need for more homes overshadows the needs for better integrated communities and sustainable infrastructures. However, the practicality of these new homes in relation to the communities they serve is fundamental to ensure they remain affordable, accessible, inclusive, and fit for the future. Thus, a further avenue of study in this regard would entail an assessment of the affordability matrix of new sustainable homes as individual components in relation to their locality, amenities, population demand, and natural habitats. This would ensure that a detailed assessment of the complexities to attain sustainable urbanisation and integration can be achieved in relation to SDG 11.

7.0 Conclusion

The UK residential construction industry makes a substantial but conditional contribution to SDGs 9 and 11. The construction industry's role is indispensable due to housing, infrastructure and technological innovation embodying prerequisites for sustainable communities and resilient economic growth. However, the industry's pre-existing socio-technical regime reproduces resource-intensive, carbon-intensive, and socially uneven outcomes which policy alone cannot fully address. Current policy interventions reflect meaningful progress, particularly in relation to energy efficiency, but evidence from previous policy cycles and current implementation challenges indicates that regulation and technological innovation alone are unlikely to attain systemic transformation of the industry. The challenge is therefore not simply to construct more sustainable dwellings, but restructuring the wider regulatory approval system so that housing quantity, affordability, DfMA, environmental preservation and urban sustainability are considered simultaneously.

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