SASBE 2025 aims to encourage the international exchange of innovative ideas between researchers from academia and industry. In addition to knowledge dissemination, the conference offers a valuable platform for professional networking, particularly benefiting university professors, graduate students, and postdoctoral researchers.

Research Article/ Review Article/ Perspective Article

EMBEDDING NET-ZERO IN CONSTRUCTION: EXPLORING CLIENT–CONTRACTOR PRACTICES AND COLLABORATION

Ahmed Al-saaddy[1], Shabnam Kabiri[2], Eugene Mohareb[3]

University of Reading
Correspondence: a.a.l.al-saaddy@pgr.reading.ac.uk

Abstract

This research addresses a critical gap in the built environment: the human and collaborative factors that contribute to successful net-zero construction. While the technical and economic aspects of net-zero are well-documented, the day-to-day collaborative practices and inter-organisational dynamics that translate these goals into project reality remain underexplored. Drawing on Practice Theory, this study seeks to understand how the interactions, routines, and shared understandings of clients and contractors shape net-zero project outcomes.

To achieve this, a qualitative research approach was employed, involving semi-structured interviews with a diverse group of professionals from both the client and contractor sectors involved in net-zero construction projects in the UK. This methodology was designed to provide rich, nuanced insights into the practical realities of their working relationships.

Findings suggest that successful collaboration is not defined by formal contracts alone, but is profoundly influenced by informal practices, trust, and the development of shared values and emergent learning across project teams. Key challenges identified include misaligned definitions, no stander routine to be followed, and a lack of effective knowledge exchange.

In conclusion, this research provides a novel theoretical contribution by applying Practice Theory to identify and analyse specific collaborative mechanisms and their implications for sustainable construction. The findings are highly relevant for enhancing project management strategies and fostering a collaborative culture. Future research could extend this practice-based lens to examine how these dynamics evolve over a project's from planning phase to delivery.

Keywords: Net-Zero Construction; Collaboration; Practice theory; Project Management

Highlights

- Client engagement is the strongest driver for achieving net-zero construction goals.
- Informal practices and trust impact the formal contracts in shaping net-zero outcomes.
- Cost perceptions and contractors' knowledge remain a critical barrier to consistent net-zero delivery.

1 Introduction

Climate change is one of the most pressing global challenges, demanding urgent action across all sectors. The Intergovernmental Panel on Climate Change (Lynn & Peeva, 2021) stresses that limiting global warming to 1.5°C requires transformative change, particularly in carbon-intensive industries such as construction. The building and construction sector is responsible for 36% of global energy use and 37% of energy-related CO_2 emissions (UNEP, 2024). If current practices persist, emissions could double within 15 years (UNEP, 2020), underscoring the need to align the industry with the Paris Elizabeth Agreement's net-zero targets (UNFCCC, 2015).

Research on sustainable construction has been primarily focused on technical aspects such as design innovation (Cruz Rios et al., 2021), low-carbon materials (Kazemian & Shafei, 2023), and the use of digital technologies like Building Information Modelling (BIM) (Myint & Shafique, 2024) to develop solutions for net-zero. While valuable, these approaches do not capture the practices of project delivery. Research on previous initiatives to improve an 'agenda' has demonstrated that the success of an agenda heavily depends on practices on the ground in construction projects and the interactions between several project participants. Example of such agendas are the implementation of environmental management and BIM (Gluch 2009 and Kabiri 2015). In the specific context of carbon footprints, Arogundade (2024) demonstrated that the targets are often undermined by misaligned ambitions: clients prioritise long-term sustainability, whereas contractors emphasise cost and risk reductions.

With a specific focus on the interaction between clients and contractors, this research uses Practice theory (Schatzki, 1996; Shove et al., 2012) to explore how project practices influence net-zero implementation. The study aims to identify key routines, assess barriers and enablers, and offer recommendations to strengthen client-contractor interactions, which, in effect, will lead to practical contributions for accelerating net-zero transitions in construction. The ultimate aim is to make suggestion through which client contractor interactions turn into collaborative practices so that net-zero targets are being implemented successfully in construction projects.

2 Theory and Concepts

This chapter defines the core concepts of net-zero carbon within the context of construction projects, using a practice-based approach.

2.1 Defining Key Concepts

This paper draws on two key concepts central to understanding practices in achieving net-zero construction. The first is net-zero *carbon*, commonly defined as balancing greenhouse gas (GHG) emissions with equivalent removals, resulting in no net increase of atmospheric carbon (IPCC, 2022). In construction sector, this encompasses reducing emissions across project phases through the use of low-carbon materials, energy-efficient designs, and innovative technologies (UNEP, 2020). This paper will focus on the project from planning phase to project delivery, it will not discuss the operation and demolition side.

And the second core concept is the concept of practices which refers to routinised behaviours combining bodily activities, materials, competencies, and meanings (Shove et al., 2012). In construction, this includes decision-making routines, use of digital modelling, or negotiation of

sustainability targets. By situating net-zero within the lens of practice theory, the ultimate aim is to explore the current practices and eventually suggest a set of routinised practices that are shaped by shared meanings, competencies and materials. This is called collaboration (Olivier Coutard & Elizabeth Shove, 2024; Panakaduwa et al., 2025).

2.2 Existing Theories and Frameworks

Evaluating theories such as Institutional theory (Dimaggio & Powell, 2021) or Stakeholder theory Freeman & et.al(1984) shows that they often overlook the micro-level practices that determine how new practices are enacted. However, Practice Theory (Reckwitz, 2002; Schatzki, 1996; Shove et al., 2012) allows the analysis of routinised behaviours, competencies, and shared meanings. For the specific context of this research, the strength of practice lens lies in uncovering if and how sustainability is co-constructed through daily project practices, making it particularly suited for studying client-contractor collaboration. While less developed in construction research than institutional or stakeholder perspectives, Practice Theory provides a more granular understanding of how net-zero ambitions are embedded, or resisted, in project delivery processes.

2.3 Knowledge Gaps and Research Opportunities

Research emphasises governance instruments, technological options, and procurement levers as the primary means to decarbonise the built environment. Systematic and scoping reviews highlight policy, incentives, and standards as external drivers, alongside diffusion of green building technologies and informed design decisions (Darko et al., 2017; Giesekam et al., 2016; Pomponi & Moncaster, 2017). At project level, life-cycle accounting and material substitution (e.g., cementitious replacements; timber/steel trade-offs) are routinely positioned as “first-order” strategies for embodied-carbon reduction, supported by digital tools and EPDs (Giesekam et al., 2016; Pomponi & Moncaster, 2017). Parallel work in construction management underscores the role of collaborative procurement and supply-chain coordination in enabling these moves yet typically frames collaboration instrumentally—as a vehicle to implement predefined technical measures (Xue et al., 2018).

While the above advancements are important, they tend to treat delivery as the linear application of tools and rules. This leaves a blind spot around the day-to-day social organisation of projects the interactions, negotiations, and situated decisions through which carbon goals are enacted (or diluted) on sites and in design or planning stages meetings. Empirical energy research using practice theoretical perspectives shows that outcomes hinge on how meanings, materials, and competences are configured in routine action, not just on formal targets or technologies (Foulds et al., 2017; Gram-Hanssen & Georg, 2018). Translated to construction, this suggests that carbon accounting, material “choices,” and procurement clauses cannot travel so far without attention to the lived practices of client–contractor teams, subcontractors, and consultants how they interpret carbon “costs,” reconcile trade-offs, and build shared understandings and routines under time/cost/quality pressure.

3 Research Method

The methodology adopts a qualitative research design, chosen to capture the lived practices of clients and contractors in achieving net-zero construction goals. Data collection involves semi-structured interviews with participants, using purposive sampling. For the purpose of this paper, three project participants were interviewed. They are contractors side project managers, sustainability managers, and contractors branch head manager. Guided by Practice Theory, interview questions map onto materials, meanings, and competencies. Thematic analysis with open and axial coding, supported by NVivo 14, is used for data interpretation. Ethical considerations such as informed consent, confidentiality, and secure data storage are fully followed. Limitations include potential bias and language barriers, mitigated through reflexivity and transparency. A methodological framework figure No.1 below illustrates the research process. The process begins with the identification of the problem within current industry practices, specifically the challenges of embedding net-zero targets in construction projects. To address this, the framework incorporates an appropriate theoretical lens, namely Practice Theory, to critically engage with the research problem. The framework then integrates insights from the existing literature to establish a foundation for examining prevailing routines, interactions, and mechanisms between clients and contractors toward net-zero.

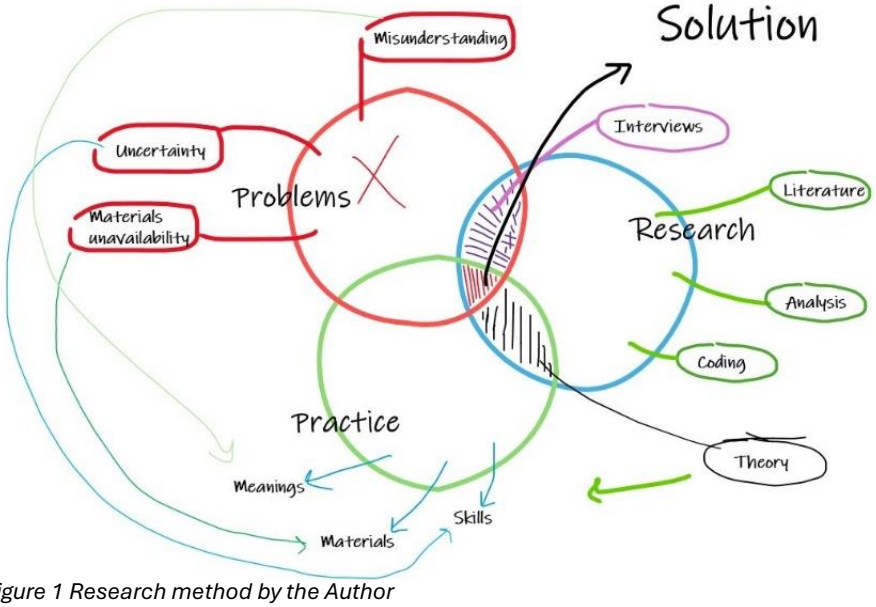

Figure 1 Research method by the Author

4 Key Findings and Discussion

Thematic analysis of interview data generated five dominant themes that capture the practical enactment of net-zero ambitions within construction projects. These are lack of unified definitions of net-zero contractual and structural drivers, reconfiguration of decision-making logics, practices of collaboration and negotiation, and barriers and contradictions in implementation. Together, these themes reveal how net-zero requirements are operationalised at both organisational and project levels, while also illustrating the tensions that arise in everyday practices (see Table 1).

4.1 Contractual and structural drivers:

The perspectives underscored that net-zero imperatives are embedded contractually rather than framed solely as aspirational commitments. For the government client, carbon reduction targets were written into procurement documentation, establishing embodied carbon thresholds as non-

negotiable criteria. Similarly, the contractor's project director described net-zero as "a contractual obligation to achieve a certain level of embodied carbon per square metre." Such contractualisation was reported to shape all subsequent design and delivery activities, creating a structural baseline for compliance.

Contractual embedding of net-zero targets confirms prior arguments that sustainability is increasingly driven by client requirements (Arogundade, 2024; Musonda et al., 2025; Newcombe, 2003; Parkin et al., 2016). Yet the data suggest that contractualisation alone does not guarantee successful implementation. Rather, obligations function as "materials" within practice assemblages (Shove et al., 2012), setting boundaries that are then enacted through situated competences such as subcontractor training, carbon monitoring, and collaborative workshops. Without these competences, contractual clauses risk remaining symbolic rather than transformative. Net-zero was frequently interpreted as more than a contractual obligation "It's the right thing to do … the industry needs to respond" (Project Director).

4.2 Lack of unified definition of net-zero:

Interviewees demonstrated varying definitions for net-zero reflecting differing professional perspectives:

- A branch project manager defined it: *"activities that aim towards overall carbon reduction… whether in oxide form or otherwise."*
- The Project Director framed it: *"Reduce emissions as much as possible and offset the remainder."*
- A sustainability manager described a structured approach: *"We use carbon offsets… from our scope 1, 2, 3 emissions."*

These divergent meanings highlight how net-zero is interpreted through multiple perspectives economic, compliance-driven, or environmentalist. Practice theory posits that meanings underpin practice, misalignments can cause breakdowns in collaboration (Shove et al., 2012). Clarifying shared definitions strengthens coordinated action, a finding supported by recent literature on sustainable construction collaboration (Connaughton & Collinge, 2021).

4.3 Reconfiguration of decision-making logics

Net zero imperatives were found to expand conventional decision-making frames. The contractor described how all design choices, such as structural frame selection, were evaluated not only on cost and performance but also on carbon efficiency, assessed through comparison matrices and "crib sheets." Clients confirmed the expectation that contractors should present low-carbon alternatives with supporting data.

the reconfiguration of decision-making logics, from the traditional project "triangle" to a "diamond" incorporating carbon, reflects a shift in the meanings attached to construction practices. This supports recent work that calls for carbon to be treated as a core performance criterion (Pomponi & Moncaster, 2017; Röck et al., 2020). However, the findings also show tensions between client and contractor perspectives. For instance, during review the client perspective with a contractor project manager interview illustrate clients often view carbon in quantitative terms (headline figures, compliance thresholds), and contractors emphasise qualitative trade-offs such as buildability and

lifecycle adaptability. Such divergences illustrate the multiplicity of meanings attached to net-zero, a theme well-documented in practice-based scholarship (Nicolini, 2012), where consensus must be actively produced rather than assumed.

4.4 Practices of collaboration and negotiation

Collaboration emerged as a central mechanism for embedding net-zero. Both client and contractor narratives stressed the importance of early-stage engagement, joint workshops, and iterative dialogue around materials, design, and operational strategies. For example, ‘’we'd have a specific session where we'd bring the structural engineer in and they talk through the steel frame, timber frame, concrete frame, traditional, whatever. and we'll break it down and just explain what the right reason is’’ (Project Director, tear one contractor).

The centrality of collaboration corroborates studies emphasising the importance of trust and joint problem-solving in sustainable construction (Ahsan Kabir et al., 2024; Connaughton & Collinge, 2021; Opoku & Ahmed, 2014). Yet this research adds nuance by showing how collaboration is operationalised: through co-produced decision matrices, open discussions of cost–carbon trade-offs, and structured training of subcontractors. These findings support the proposition that collaboration is not merely relational but procedural, enacted through specific practices that align actors’ routines and competencies.

4.5 Persistence of Barriers

Despite these positive practices, several barriers were identified. The most recurrent one was the perception that carbon efficiency inevitably increases cost, a belief held by parts of the supply chain and occasionally reinforced by higher upfront costs for innovative materials. For instance. a contractor countered this by emphasising efficiency gains “if I am going to want to target net-zero on this project, it has to also tie to cost efficiency as well.” and lifecycle carbon value and acknowledged uncertainty of these extra (carbon) actions on the carbon efficiency of the project.

Also, the interviewee highlights the competence lack. They choose the role of a carbon conscious project manager as the main lack in working force which need more investigations about the best practices to have adequate carbon conscious project manager.

Another barrier concerned uneven competence across subcontractors “It can be really difficult to get carbon information, they’re not well versed, a lot of back and forth” (sustainability manager) Some of whom lacked familiarity with sustainability documentation such as Environmental Product Declarations (EPDs) which aligned with (Ohene et al., 2023). This required additional training and auditing, placing further demands on project management resources. Moreover, participants highlighted broader contradictions: while clients and tier-one contractors champion net-zero, global political shifts and inconsistent regulatory environments undermine confidence in its necessity (KATHERINE SUGAR et al., 2022), leading to ambivalence among some stakeholders beyond the clients and the contractors.

The persistence of barriers, such as cost perceptions, uneven subcontractor knowledge, and global political ambivalence reinforces critiques that net-zero transitions are fragile and contested (Geels et al., 2023). From a practice theory perspective, these barriers emerge when elements of practice (materials, competences, meanings) fail to align. Addressing such misalignments requires not only

technical fixes but deliberate efforts to reshape shared understandings and develop new competencies across the supply chain.

4.6 Two different Routines:

The interviews showed two different routines to tackle net-zero in construction projects. First a contractor, strictly follows the contractual procurement documents guidance, yet meeting the criteria at their absolute minimum threshold. These are, for example, installing only the minimum required insulation, and basic renewable energy systems. Their practice is shaped by institutionalised routines, focusing on compliance rather than experimentation. In contrast, the second contractor, integrates additional measures, advanced energy modelling, smart building systems, and occupant behaviour engagement, to exceed net-zero standards. The second contractor practices are informed by evolving norms and professional know-how, seeing sustainability as embedded in daily construction practices rather than a checkbox.

In sum, the findings and discussion demonstrate that achieving net-zero requires more than policy or contractual mandates. Contractors described the need to work closely with architects and subcontractors to trial low-carbon materials, while clients emphasised the requirement for measurable evidence of carbon reductions. These accounts demonstrate that progress depends on the ongoing negotiation of priorities and alignment of practices across organisational boundaries. This practice-based perspective extends existing literature by revealing how net-zero is enacted in everyday project work, where collaboration, competence-building, and shared purpose are as critical as technological innovation.

Table 1: Linking definition, contractual, organisational and collaborative dynamics to meanings, materials, and competences: A thematic analysis

Initial themes (first-level coding)	Elements of social practice theory	Confirmed themes	Sub-themes (second-level coding)	Meanings, Materials, Competence
Sustainability clauses in contracts, procurement pressures, compliance requirements	Background knowledge, rules, states of emotion	Definitions, Contractual and structural drivers	- Client-driven carbon targets. - Procurement frameworks. - Reporting obligations. - Definitions	Meanings: Definitions Symbolic weight of contracts and compliance expectations. Materials: Procurement frameworks, KPIs, carbon calculators. Competence: Legal/managerial ability to operationalise clauses.
"Design decisions dictated by lowest cost"; "Carbon data not always available at early stages"; "Commercial pressures override environmental aims"	Decision logics; Know-how	Reconfiguration of decision-making logics	- Early-stage design trade-offs. - Life cycle carbon assessments - Adaptive decision-making under uncertainty	Meanings: New logics of valuing carbon alongside cost. Materials: LCA tools, cost databases, design models. Competence: Professional judgement; capacity to handle incomplete data.
"Workshops to align contractors and clients"; "Collaboration only works with trust"; "Knowledge sharing	Motivational knowledge, collaboration, states of emotion	Practices of collaboration and negotiation	-Trust-building practices. -Cross-disciplinary workshops.	Meanings: Norms of cooperation, reciprocity, and shared responsibility. Materials: collaborative contracts, meeting spaces.

sessions between trades"			- Informal knowledge-sharing. - Client–contractor alignment mechanisms	Competence: Negotiation skills, facilitation, technical knowledge-sharing.
"Subcontractors not engaged"; "Carbon reduction costs questioned"; "Inconsistent data from supply chain"; "Resistance to change"	Barriers; Motivational knowledge; States of emotion	Barriers and contradictions in implementation	-Subcontractor disengagement. -Cost resistance. - Data inconsistency. -Skills barriers to new practices.	Meanings: Conflicting priorities (cost, safety vs carbon). Materials: Inconsistent datasets, rigid procurement/safety systems. Competence: Gaps in subcontractor skills, uneven carbon literacy.

5 Conclusions

This paper set out to explore how collaboration between clients and contractors influences the delivery of net-zero construction projects, with particular attention to practices across the planning, design, and execution stages. Drawing on Practice Theory, the research highlighted how meanings, materials, and competences converge to shape everyday decisions that ultimately determine project outcomes.

The findings confirm that client influence is driver of net-zero ambitions alongside with contractors by sharing carbon decisions. Where clients set explicit requirements and show strong engagement, contractors and consultants are compelled to embed low-carbon practices across project stages. Conversely, when clients lack clarity or commitment, sustainability goals risk being sidelined in favour of cost or time efficiencies.

The analysis also revealed that achieving net-zero relies not only on technical tools and material choices such as HVO fuel, carbon monitoring platforms, embodied carbon software, and innovative design methods—but also on competences and skills. Subcontractor engagement, digital literacy, and sustainability knowledge among project teams emerged as critical for translating ambition into practice. However, gaps remain in subcontractor readiness and in balancing cost against carbon savings.

Importantly, interaction is enacted through practices rather than formal frameworks alone. Informal workshops, iterative design discussions, and supply chain dialogues were shown to be central in aligning expectations and resolving conflicts. Yet barriers such as inconsistent data from subcontractors, voluntary standards, and differing interpretations of "net-zero" continue to hinder progress. Building trust, aligning client–contractor priorities, and embedding sustainability into everyday practices will be essential to transform net-zero from contractual ambition into lived project reality.

Funding
The authors did not receive any external funding

Data Availability Statement
Data will be made available on request

Conflicts of Interest
The authors declare no known conflict of interest that has appeared to influence the work reported in this paper

References

Ahsan Kabir, M., Hasan, M. M., Hossain, T., Ahnaf, A., & Monir, H. (2024). Sustainable energy transition in Bangladeshi academic buildings: A techno-economic analysis of photovoltaic-based net zero energy systems. *Energy and Buildings*, *312*, 114205. https://doi.org/10.1016/J.ENBUILD.2024.114205

Arogundade, S. (2024). *MOTIVATING CONTRACTORS' BEHAVIOURAL CHANGE TOWARDS REDUCED CONSTRUCTION CARBON FOOTPRINT*. https://doi.org/10.25448/LBU.25545775.V1

Connaughton, J. N., & Collinge, W. H. (2021). *Trialling a new approach to interdisciplinary collaboration in UK construction: A projects-as-practice analysis*. https://doi.org/10.1080/01446193.2021.1933558

Cruz Rios, F., Grau, D., & Bilec, M. (2021). Barriers and Enablers to Circular Building Design in the US: An Empirical Study. *Journal of Construction Engineering and Management*, *147*(10), 04021117. https://doi.org/10.1061/(ASCE)CO.1943-7862.0002109/ASSET/1214F943-1289-44F8-AE08-8FAD3FE19C15/ASSETS/IMAGES/LARGE/FIGURE4B.JPG

Darko, A., Chan, A. P. C., Gyamfi, S., Olanipekun, A. O., He, B. J., & Yu, Y. (2017). Driving forces for green building technologies adoption in the construction industry: Ghanaian perspective. *Building and Environment*, *125*, 206–215. https://doi.org/10.1016/J.BUILDENV.2017.08.053

Dimaggio, P. J., & Powell, W. W. (2021). THE IRON CAGE REVISITED: INSTITUTIONAL ISOMORPHISM AND COLLECTIVE RATIONALITY IN ORGANIZATIONAL FIELDS. *The New Economic Sociology: A Reader*, 111–134. https://doi.org/10.2307/2095101

Foulds, C., Robison, R. A. V., & Macrorie, R. (2017). Energy monitoring as a practice: Investigating use of the iMeasure online energy feedback tool. *Energy Policy*, *104*, 194–202. https://doi.org/10.1016/J.ENPOL.2017.01.055

Freeman, & R.E. (1984). *Strategic Management: A Stakeholder Approach - R. Edward Freeman - Google Books*. https://books.google.co.uk/books?hl=en&lr=&id=NpmA_qEiOpkC&oi=fnd&pg=PR5&ots=62dnF2LbPN&sig=ORmgXrIDqEZAkM5bzr5mMiFgdlE&redir_esc=y#v=onepage&q&f=false

Geels, F. W., Sovacool, B. K., & Iskandarova, M. (2023). The socio-technical dynamics of net-zero industrial megaprojects: Outside-in and inside-out analyses of the Humber industrial cluster. *Energy Research & Social Science*, *98*, 103003. https://doi.org/10.1016/J.ERSS.2023.103003

Giesekam, J., Barrett, J. R., & Taylor, P. (2016). Construction sector views on low carbon building materials. *Building Research & Information*, *44*(4), 423–444. https://doi.org/10.1080/09613218.2016.1086872

Gram-Hanssen, K., & Georg, S. (2018). Energy performance gaps: promises, people, practices. *Building Research & Information*, *46*(1), 1–9. https://doi.org/10.1080/09613218.2017.1356127

IPCC. (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability | Climate Change 2022: Impacts, Adaptation and Vulnerability*. https://www.ipcc.ch/report/ar6/wg2/

KATHERINE SUGAR, TEDD MOYA MOSE, COLIN NOLDEN, MARK DAVIS, NICK EYRE, ALBERT SANCHEZ-GRAELLS, & DAN VAN DER HORST. (2022). *Local decarbonisation opportunities and barriers: UK public procurement legislation*. https://doi.org/10.5334/bc.267

Kazemian, M., & Shafei, B. (2023). Carbon sequestration and storage in concrete: A state-of-the-art review of compositions, methods, and developments. *Journal of CO2 Utilization*, *70*, 102443. https://doi.org/10.1016/j.jcou.2023.102443

Musonda, I., Zulu, S. L., Zulu, E., & Kavishe, N. (2025). Understanding clients' role in community stakeholder participation and influence on infrastructure sustainability—a stakeholder theory lens. *International Journal of Construction Management*, *25*(4), 419–427. https://doi.org/10.1080/15623599.2024.2331862

Myint, N. N., & Shafique, M. (2024). Embodied carbon emissions of buildings: Taking a step towards net zero buildings. *Case Studies in Construction Materials*, *20*, e03024. https://doi.org/10.1016/J.CSCM.2024.E03024

Newcombe, R. (2003). From client to project stakeholders: a stakeholder mapping approach. *Construction Management and Economics*, *21*(8), 841–848. https://doi.org/10.1080/0144619032000072137

Nicolini, D. (2012). Practice Theory, Work, and Organization An Introduction. *OUP UNCORRECTED PROOF-REVISES*.

Ohene, E., Chan, A. P. C., Darko, A., & Nani, G. (2023). Navigating toward net zero by 2050: Drivers, barriers, and strategies for net zero carbon buildings in an emerging market. *Building and Environment*, *242*, 110472. https://doi.org/10.1016/J.BUILDENV.2023.110472

Olivier Coutard, & Elizabeth Shove. (2024). *Chapter 13: Infrastructures, practices and the materiality of daily life: revisiting urban metabolism in: Handbook of Infrastructures and Cities*. https://www.elgaronline.com/edcollchap/book/9781800889156/book-part-9781800889156-23.xml

Opoku, A., & Ahmed, V. (2014). Embracing sustainability practices in UK construction organizations: Challenges facing intra-organizational leadership. *Built Environment Project and Asset Management*, *4*(1), 90–107. https://doi.org/10.1108/BEPAM-02-2013-0001/FULL/XML

Panakaduwa, C., Coates, P., & Munir, M. (2025). Analysis of the UK Homeowners' Practices Prompting Housing Retrofits: A Practice Theory Approach. *Climate Change Adaptation in the Built Environment: Transdisciplinary and Innovative Learning*, 189–210. https://doi.org/10.1007/978-3-031-75826-3_9

Parkin, A., Mitchell, A., & Coley, D. (2016). A new way of thinking about environmental building standards: Developing and demonstrating a client-led zero-energy standard. *Building Services Engineering Research and Technology*, *37*(4), 413–430. https://doi.org/10.1177/0143624415615328/ASSET/IMAGES/LARGE/10.1177_0143624415615328-FIG11.JPEG

Pomponi, F., & Moncaster, A. (2017). Circular economy for the built environment: A research framework. *Journal of Cleaner Production*, *143*, 710–718. https://doi.org/10.1016/j.jclepro.2016.12.055

Reckwitz, A. (2002). The Status of the "Material" in Theories of Culture: From "Social Structure" to "Artefacts." *Journal for the Theory of Social Behaviour*, *32*(2), 195–217. https://doi.org/10.1111/1468-5914.00183

Röck, M., Saade, M. R. M., Balouktsi, M., Rasmussen, F. N., Birgisdottir, H., Frischknecht, R., Habert, G., Lützkendorf, T., & Passer, A. (2020). Embodied GHG emissions of buildings – The hidden challenge for effective climate change mitigation. *Applied Energy*, *258*, 114107. https://doi.org/10.1016/J.APENERGY.2019.114107

Schatzki, T. R. (1996). Social practices: a Wittgensteinian approach to human activity and the social. In *Cambridge University Press* (1. publ.). Cambridge University Press.

Shove, E., Pantzar, M., & Watson, M. (2012). The Dynamics of Social Practice: Everyday Life and How it Changes. *The Dynamics of Social Practice: Everyday Life and How It Changes*, 1–191. https://doi.org/10.4135/9781446250655

UNEP. (2020). *Emissions Gap Report 2020*. https://www.unep.org/interactive/emissions-gap-report/2020/

UNEP. (2024). *Emissions Gap Report 2024 | UNEP - UN Environment Programme*. https://www.unep.org/resources/emissions-gap-report-2024

UNFCCC. (2015). *ADOPTION OF THE PARIS AGREEMENT - Paris Agreement text English*.

Xue, X., Zhang, X., Wang, L., Skitmore, M., & Wang, Q. (2018). Analyzing collaborative relationships among industrialized construction technology innovation organizations: A combined SNA and SEM approach. *Journal of Cleaner Production*, *173*, 265–277. https://doi.org/10.1016/J.JCLEPRO.2017.01.009