

A Review of Model Building By-Laws for Incorporating Sustainable Construction Material Utilisation in Zimbabwe

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Abstract

Environmental challenges associated with the use of traditional construction materials are widespread in Zimbabwe. Despite the existence of sustainable construction materials, the failure to migrate from the traditional Model Buildings by-law of 1977 has stagnated the promotion of strategic interventions. Hence, the study determined pertinent modifications to the Model building by-laws that could allow for the utilisation of sustainable construction materials—the interpretivist philosophy employed semi-structured interviews. Purposive sampling was applied to solicit views from construction professionals, academics, and relevant local government officials with sustainable construction experience. Suggested modifications include the generation of modern by-laws with relevant, sustainable material specifications, design-related and adopting green building principles or methodologies. A comprehensive stakeholder engagement was recommended to ensure that any modifications are practical and implementable. Using sustainable construction materials requires a policy intervention incorporating a comprehensive stakeholder support framework from manufacture to material disposal. The paper highlights modifications required to the model-building by-laws for integrating sustainable construction material utilisation in Zimbabwe. This is valuable to all stakeholders in the construction industry as it aligns with the Sustainable Development Goals of climate action and responsible production and consumption. The main limitation was the exclusive use of a qualitative approach. However, the exploratory nature of the study supported the approach.

Keywords: Building regulations, Model building by-laws, Sustainable construction materials, Zimbabwe

1. Introduction

According to the United Nations Sustainable Development Agenda (2020), sustainable development is an advancement that meets the needs of the present without compromising the ability of future generations to meet their own needs (United Nations, 2020). In addition, at the core of sustainability are three elements: economic growth, social inclusion, and environmental protection. Hence, sustainability aims to ensure that every development allows the availability of resources to everyone, meets human rights and basic needs, and consumes natural resources at a rate at which they can replenish themselves to guarantee balanced ecosystems. Sustainable construction is a subset of sustainable development concentrating on managing a healthy built environment based on resource-efficient and ecological principles (Baloi, 2003). The built environment shapes the context of most human activities and takes up a significant percentage of any economy; moreover, construction leaves behind environmental and carbon footprints (Brennan, 2014). The construction industry has an enormous impact on the economy, environment and health of a nation as it is the leading universal user of materials and one of the significant primary energy-consuming sectors contributing significantly to atmospheric emissions (Demir & Dogan, 2020). However, due to urbanisation and globalisation, environmental deterioration and

resource depletion have increased, leading to the need to alleviate resource depletion (Mathiyazhagan et al., 2019). Moreover, the amplified consciousness of global environmental threats such as climate change has led to additional interest in low embodied carbon building materials for the provision of sustainable buildings (Agyekum et al., 2022). Sustainable construction has been observed as the solution, requiring sustainable materials. This is because sustainable construction materials have zero impact on the environment and are reusable and recyclable (Onyegiri & Ugochukwu, 2016), which results in benefits across the economic, social and environmental dimensions of sustainability (Eze et al., 2023).

However, incorporating sustainable construction materials to achieve a sustainable built environment is low in developing countries, such as Zimbabwe, and they need help with the extensive adoption. Chari and Chiriseri (2014) noted that sustainability principles must be factored into procurement decisions within both private and public entities in Zimbabwe. According to the Global Climate Risk Index (2021), Zimbabwe was among the world's ten most affected countries by climate change in 2019 (United Nations Climate Technology Centre and Network (CTCN), 2022), a significant result of unsustainable construction practices. Due to this, Altuma and Ghasemlounia (2021) relay that, as the construction industry continues

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to grow, it is essential to use innovative technology and creative ways of choosing construction materials to conserve resources. According to Eze et al. (2023), more studies are needed on adopting sustainable construction materials in Africa, beyond Nigeria.

Therefore, this study suggested modifications to the Model building by-laws to incorporate sustainable construction material utilisation in Zimbabwe. Sustainable construction materials are environmentally friendly and minimise environmental difficulties such as disparities in the ecosystems, pollution, greenhouse gas (GHG) emissions and other issues that develop from conventional building materials, which are hostile to the ecosystem, unsustainable and harmful to the environment (Eze et al., 2021). It is critical for policymakers to create a robust and sustainable economy (Mathiyazhagan et al., 2019). The following sections consider the literature review, methodology, results, discussion, and the study's conclusions.

2. Literature Review

This section concentrated on the study's theoretical framework and the role of Model Building By-laws for incorporating sustainable construction material utilisation, as suggested by previous studies.

2.1. Theoretical framework: Diffusion of Innovation Theory (DOI)

Widén (2006) states that the Diffusion of Innovation Theory (DOI) is built on well-established sociology, psychology, and communication theories. In addition, diffusion is regarded as the process by which innovation is communicated over time through specific channels among the members of a social group. Further, the construction industry differs from other industries in that innovation depends upon adoption or implementation and problem-solving based on organisational learning. Four critical aspects make up DOI: innovation, communication channels, time and social systems through a five-staged innovation process comprising knowledge, persuasion, decision, implementation, and confirmation (Tran et al, 2020). Unfortunately, the project-based nature of the industry, short-term relationships and decentralised organisational structures do not foster learning, meaning the adoption of innovation is subject to evaluations of individuals in the same context as opposed to scientific studies (Widén, 2006). Tran et al. (2020) remark that under DOI, the external social and political contexts are considered critical factors in influencing the adoption of innovation and, in this case, sustainable materials. To achieve sustainable building by-laws, there must be cooperative effort amongst interrelated units that include developers, designers, contractors, subcontractors, suppliers, government and users or clients.

2.2. Modern Building By-laws for the adoption of sustainable construction materials

Among the various planning tools that include development plans, town planning schemes, and building by-laws, the building by-laws are the most effective in shaping the built environment and achieving sustainable development (Chirisa, 2014). Regulatory barriers that prevent adopting sustainable materials are also prevalent in developed countries, resulting from unsuitable and non-comprehensive by-laws (Hoxha & Lecaj, 2023). However, Mogaji et al. (2024b) identified the importance of government regulations in advancing the adoption of innovative building materials. Including sustainability in the by-laws without specifying conformity guidelines for sustainable materials does not motivate their adoption in construction practice, but ends at an experimental level.

In Zimbabwe, the Ministry of Local Government and Housing published the Model Building By-laws in 1977 according to the Urban Councils Act Chapter 214, section 183 and Section 83A of the Rural Councils Act (Chirisa, 2014). The document covers structural design, foundations, masonry, walling, and construction of miscellaneous materials. These include that building by-laws often contain clauses that do not enable the adoption and implementation of sustainable construction materials. In addition, there is also a general need for more regulatory testing and inspection requirements for sustainable construction to ensure law enforcement. Also, green labelling of building materials, green building technologies and sustainable buildings where they have been applied is critical. Including the labelling in drafting by-laws will make consumers easily identify sustainable products and technologies. Noted deficiencies in the existing Model building by-laws include the absence of sustainable construction materials and the by-laws' rigidity, lack of alternatives to traditional materials, a lack of information on the sustainability of included materials, and inadequate reference to sustainable designs.

In Kosovo, it was noted that spatial planning laws were silent on goals such as sustainable design, cities, infrastructure, and construction to ensure rational economic use of land (Hoxha & Lecaj, 2023). Fini and Akbarnezhad (2019) support the promotion of responsible procurement of materials by considering their economic, environmental and social impacts. However, this can only be achieved if the necessary technical support systems have been established and operationalised. In addition, Nasier (2021) argues that the major constraint is that the selection of sustainable construction material must be practical, specific and aligned with budget needs. Hoxha & Lecaj (2023) highlight constraints concerning by-laws that align with Mogaji et al. (2024a)'s findings about lack of awareness and knowledge, and lack of end-user involvement. As such, Kylili (2017) advocates for the increased use of

sustainable construction materials by promulgating well-supported policies. This also means that materials are to be labelled based not only on their structural or mechanical performance but also on their energy performance, carbon footprint, health effect, thermal performance, indoor comfort effect, and environmental effect. To guarantee enforcement of labelled materials in practice, by-laws should include tax levies and information for end users on labelled materials (Hoxha & Lecaj, 2023).

3. Research Methodology

This study adopted an interpretive philosophy and a qualitative research design method to review the model-building by-laws for incorporating sustainable construction material utilisation in Zimbabwe, like a study by Hoxha and Lecaj (2023). The researcher applied expert sampling (Saunders et al., 2016) to solicit views from local authorities, government officials, researchers, and green building experts, as these were individuals with known or demonstrable experience and expertise in the area. When soliciting consultant views, the sampling technique was a type of quota sampling termed heterogeneity sampling. The basics of this technique include all opinions or views, and therefore, representation was not about proportions but views or ideas. The critical aspect of this technique is to get varied consultants instead of several consultants, aiming for diversity through concept mapping.

According to Saunders et al. (2016) and Hennink et al. (2017), a minimum of four and a maximum of 24 interviews are deemed sufficient for an exploratory study. In addition, interviews must be done until saturation is achieved. While the study targeted at least four interviewees, interviews were conducted till saturation was achieved, that is, when no additional information on strategies was forthcoming. To achieve this, 20 potential interviewees were requested to participate. Interviews were done over 90 days at different times, in different situations and settings, and with respondents from various backgrounds, increasing the reliability of the results. Member checking was undertaken to ensure the validity of the study. The interviewees were asked to confirm their transcribed contribution. Data analysis was done using thematic analysis, a method for systematically identifying, organising, and offering insight into themes or meaning patterns across a dataset (Braun and Clarke, 2012). The process involved familiarising with data associated with modifications to the Model building by-laws, coding interesting interventions of the data, generating a theme map, defining themes, and finally producing the report relating to the research question and literature (Vaismoradi, 2013).

4. Findings and Discussion

4.1. Response rate and Profile of respondents

Interview invitations were sent to 20 respondents, and 16 were successfully conducted via phone calls and virtual meeting platforms. This gave an interview response rate of 80%. According to Hennink et al. (2017), 16-24 interviews are adequate to achieve meaning saturation for an in-depth understanding of issues. Therefore, the response rate achieved is acceptable for this study. The profile of the respondents is shown in Table 1. Regarding educational qualifications, the analysis shows that 75% of the respondents had postgraduate qualifications, whilst 25% had an Honours degree. In terms of experience, 31.25% had more than 20 years of experience, followed by those between 16-20 years and 6 to 10 years, and only 6.25% had 0-5 years of experience. The percentage distribution was ideal because there were diverse perspectives from diverse professional backgrounds, as Burton (2021) echoed.

4.2. Modifications to Zimbabwe's Modern Building By-Laws (MBBL)

Interview participants were requested to suggest ways that they felt the local Model Building By-Laws could be altered to increase the adoption of construction materials. The extracted themes included the position that the Model Building By-Laws (MBBL) of 1977 were unsuitable and non-comprehensive to achieve sustainable construction goals that needed more comprehensive consultation. The other themes included adopting a mandatory approach for incorporating sustainable construction materials in every design and applying a green rating system to aid material selection within the by-laws. The theme and categories are discussed hereafter.

4.2.1. Generation of a modern MBBL with relevant, sustainable material specifications

There is consensus that the MBBL document aligns with modern-day construction practices. MBBL should address challenges that may not have existed when they were formulated in 1977. In addition, the by-laws must address current concerns as highlighted by Interviewee 2 and 13.

Interviewee 2: by-laws should speak to climate resilient infrastructure.....

Interviewee 13: Model Building By Laws must be revised and modernised to adapt to current trends, standards and practices in the construction sector.

These views align with Hoxha and Lecaj (2023), who argue that planning laws must adapt to current

Table 1: Demographic profile of respondents

Interviewee	Level of education	Experience	Organisation	Position
1	Bachelor's degree	8	Green Building Council	Chief Executive Officer
2	Master's degree	20	Scientific Research Centre	Chief Executive Officer
3	Professor	38	Research Consultancy firm	Chief Executive Officer
4	Masters Urban Planning	11	Architectural firm	Chief Executive Officer
5	Bachelor's degree in engineering	11	Architectural firm	Projects Manager
6	Master's: Energy Engineering	4	Research Consultancy firm	Environmental Engineering/Sustainability Consultant
7	Bachelor's degree	10	Non-profit community-based organisation.	Co-founder, project development/training
8	Masters in Architecture	7	Architectural firm	Energy and Sustainability Auditor
9	Professor of Urban and Regional Planning	17	University	Pro Vice-Chancellor, Academic Affairs
10	Professor of Architecture	40	Architectural firm	Principal Architect
11	PhD Construction Management	21	University	Dean
12	Masters of Architecture	15	Architectural firm	Principal Architect
13	MSc Water Resources Engineering and Management	19	Civil Engineering Firm	Manager
14	Masters of Architecture	15	Entrepreneur	Director
15	Masters of Architecture	9	Architectural Firm	Director
16	Bachelor's degree	10	Ministry of Local Government and Public Works	Acting Deputy Director, Architectural Services

trajectories of sustainability development. MBBL should specify material performance instead of specifying materials to allow flexibility. Some interviewees emphasised that by-laws should speak to climate-resilient infrastructure and alternative materials, encouraging their exploration as an addendum. Respondents suggested that minimal bureaucratic processes and procedures should be included within an addendum for approval and adoption of sustainable materials. Implementation and reference to addenda are critical (Chirisa, 2014). However, such addenda must be well supported by progressive policies (Kylili, 2017).

4.2.2. Design-related modifications

Interviewees suggested it be made mandatory for designers to incorporate sustainable building materials and introduce stiff penalties for non-compliance, as alluded to by Interviewee 7.

Interviewee 7:a must for developers to use alternative sustainable materials in the approved plans....

However, the modifications can only be made after testing and approving sustainable materials and technologies. Fini and Akbarnezhad (2019) support such modifications if they are cognisant of the impacts of such sustainable material considerations. This will make it easier for expert construction industry professionals to recommend and construct using sustainable materials. The MBBL were too prescriptive and needed to test and encourage new methods, thus allowing professionals to propose new materials that could be included in standards, as highlighted by interviewees 10 and 3.

Interviewee 10: I find that the Model Building By-laws need to be more prescriptive on how to build. They should have standards that test and encourage new methods. I mean, architects should be allowed to propose new materials after proper testing to include them in the standards and by-laws.

Interviewee 3: So, I think they need to drop the reference to cement altogether and just have things

about performance. Can your material do this? Then you can do this with it.

The general view is that flexibility in terms of designs may be more effective, as designers can add value by selecting alternative materials for their clients. This view is supported by Nasier (2021), who supported practical material selections. In addition, designers must be permitted to implement circular principles in their designs if the material's performance is guaranteed. This approach is reinforced by India's Ministry of Urban Development (2016) through its by-laws that provide for reducing, reusing, and recycling to achieve zero landfills. A recommendation for incentives within the by-laws was suggested for designers and developers, according to Interviewee 12.

Interviewee 12: "In practice, the major issue around practice is compliance with regulations that are set. You need to go back to those regulations, not some annexure or deviation committee. Very few people know about these, and no one is willing to go through all that. Imagine spending three years trying to get your material approved. You will not have the money to build afterwards. Let's fix the regulations. It could be a carrot and stick; you do not have to force everyone, but you can say, "If you protect the environment, you get so many credits or tax rebates." Incentivise the adoption of sustainable materials. There is a need to deliberate at all levels throughout the building chain and reduce the energy demand through adopting sustainable construction materials."

A section is suggested by the respondents that stipulates rewards or incentives for sustainable practices to motivate developers and professionals. Hoxha and Lecaj (2023) supported this notion by highlighting that to guarantee the enforcement of labelled materials in practice, bylaws should include tax levies and information for end users on labelled materials.

4.2.3. The adoption of green building methodologies in MBBLs

Some respondents recommended attention to green building principles, including interviewees 4 and 5. As suggested by Fini and Akbarnezhad (2019), the consideration of the impact of the material on the environment, like carbon footprint analysis and energy efficiency, is pertinent. As such, embodied carbon is measurable and can be easily regulated by local standards. Also, energy efficiency is to be included in the MBBLs with accompanying embodied carbon calculations as a critical material performance criterion.

Interviewee 4: Speaking to energy efficiency in the MBBLs; working on affordable housing building guidelines; availing them of carbon calculations; stakeholder engagements

Interviewee 5: The MBBLs should include embodied carbon, which is measurable, easily regulated by local standards under building performance requirements.....

Other respondents also felt a chapter on sustainable design, with credits on using sustainable construction materials, was necessary, as reported by Interviewee 16. India's Model Building By-laws of 2016 contain green buildings and sustainability provisions, which encompass sections on provisions and applicability, sanction provisions, and various green rating system guidelines (Ministry of Urban Development, 2016). However, Hoxha and Lecaj (2023) revealed that including sustainability in the by-laws without specifying conformity guidelines for sustainable materials would not motivate their adoption in construction practice but rather ended at an experimental level.

Interviewee 16: A green building code may also be formulated, adopted and enforced as an addendum to the Model Building By-laws.

Along with this, there were supposed to be affordable housing building guidelines and public building guidelines that speak to the use of sustainable materials, so that the government led from the front. This is a practice supported by Hoxha and Lecaj (2023) in that the inclusion of green labelling in drafting by-laws makes consumers easily identify sustainable products and technologies. In India, all buildings on plot sizes above 100m² are to comply with green norms and requirements while using the listed rating systems (Ministry of Urban Development, 2016). Associated with this, the importance of training construction professionals on green building principles and technologies and the need for research and standardisation of green building materials is paramount.

Interviewee 9: Use existing policies, demo structures, for training,...

Interviewee 13: Buy-in from all stakeholders, Increase funding for research in such construction technologies. Increase visibility and marketing of such products. Make sure such materials go through a standardisation process.

Adequate technical support systems are essential if green building principles are to be adopted. Kylili (2017) and Hoxha and Lecaj (2023) allude to the importance of supporting the implementation of green building technologies through enhancing awareness and encouraging competent standardisation processes for practical solutions.

5. Conclusion and Further Research

The review of literature and interviews indicated that the by-laws were limiting, to a large extent, the adoption of sustainable construction materials. As such, recommendations to generate modern MBBL with relevant, sustainable material specifications must be made as part of the key strategies. The other modifications recommended are design-related, including the adoption of green building principles or methodologies in MBBLs. There was insistence that all modifications be made through extensive stakeholder consultations and participation to ensure buy-in to the regulations, which in turn would make implementation easier. A comparison with the literature review supported these suggestions. However, the challenges peculiar to Zimbabwe limit the uptake of these recommendations to bring it up to speed with current global discussions, challenges, and trends. The study contributed pertinent strategies that can be incorporated within the modification of the existing Model Building by-laws so they can drive the sustainable construction agenda. Aligned with the Diffusion of Innovation theory, the study recommends that the Government of Zimbabwe, through the Ministry of Local Government,

Public Works and National Housing, should create a new and updated Model Building By-laws document based on a stakeholder participation programme.

The adoption of any innovations regarding sustainable construction material must be founded on inclusive, well-established communication channels, timeously responded to and have a positive impact on existing social systems. A comprehensive stakeholder-initiated review of the existing model-building bylaws that align with holistic sustainability goals is also recommended. Further studies can examine how these suggested modifications to the Model Building By-Laws align with the available and alternative sustainable construction materials peculiar to the Zimbabwe construction industry. The main limitation was the exclusive use of a qualitative methodology. However, the exploratory nature of the study supported the approach.

References

- Agyekum, K., Adinyira, E., & Oppon, J. A. (2022). Factors limiting the adoption of hemp as an alternative sustainable material for green building delivery in Ghana. *International Journal of Building Pathology and Adaptation*, 40(2), 202–218. <https://doi.org/10.1108/IJBPA-03-2021-0036>
- Altuma, M. I., & Ghasemlounia, R. (2021). Effects of construction materials to achieve sustainable buildings. *SSRN*. <https://doi.org/10.2139/ssrn.3781422>
- Baloi, D. (2003). Sustainable construction: Challenges and opportunities. In *Proceedings of the 19th Annual ARCOM Conference* (Vol. 1, pp. 289–297). Association of Researchers in Construction Management.
- Braun, V., & Clarke, V. (2012). Thematic analysis. *American Psychological Association*. <https://doi.org/10.1037/13620-004>
- Brennan, M. C. E. (2015). *Sustainable construction in the 21st century: An educational perspective on shifting the paradigm* (Doctoral dissertation). Liverpool John Moores University.
- Burton, D. E. (2021). Demographic research: The big picture in research. *ResearchGate*. https://www.researchgate.net/publication/348845012_Demographic_Research_article
- Chari, F., & Chiriseri, L. (2014). Barriers to sustainable procurement in Zimbabwe. *Greener Journal of Business and Management Studies*, 4(1), 14–18. <https://doi.org/10.15580/GJBMS.2014.1.011414006>
- Chirisa, I. (2014). Building and urban planning in Zimbabwe with special reference to Harare: Putting needs, costs and sustainability in focus. *Journal of Sustainable Development in Africa*, 11(1), 1–26.
- Demir, I., & Dogan, C. (2020). Physical and mechanical properties of hempcrete. *The Open Waste Management Journal*, 13(1), 26–34. <https://doi.org/10.2174/1876400202013010026>
- Eze, E. C., Sofolahan, O., & Omoboye, O. G. (2023). Assessment of barriers to the adoption of sustainable building materials (SBM) in the construction industry of a developing country. *Frontiers in Engineering and Built Environment*, 3(3), 153–166. <https://doi.org/10.1108/FEBE-03-2023-0014>
- Eze, E. C., Ugulu, R. A., Onyeagam, O. P., & Adegboyega, A. A. (2021). Determinants of sustainable building materials (SBM) selection on construction projects. *International Journal of Construction Supply Chain Management*, 11(2), 166–194. <https://doi.org/10.14424/ijcscm110221-166-194>
- Field, A. (2014). *Discovering statistics using IBM SPSS Statistics* (4th ed.). Sage.

- Fini, A. A. F., & Akbarnezhad, A. (2019). Sustainable procurement and transport of construction materials. In *Sustainable construction technologies* (pp. 161–209). Butterworth-Heinemann. <https://doi.org/10.1016/B978-0-12-811749-1.00007-1>
- Government of Zimbabwe. (1977). *Model building by-laws*. Government of Zimbabwe.
- Hanna, E., Gough, B., & Markham, S. (2020). Masculinities in the construction industry: A double-edged sword for health and wellbeing? *Gender, Work & Organization*, 27(4), 632–646. <https://doi.org/10.1111/gwao.12395>
- Hennink, M. M., Kaiser, B. N., & Marconi, V. C. (2017). Code saturation versus meaning saturation: How many interviews are enough? *Qualitative Health Research*, 27(4), 591–608. <https://doi.org/10.1177/1049732316665344>
- Hoxha, V., & Lecaj, V. (2023). Regulatory barriers to implementing sustainable buildings in Kosovo. *Property Management*. <https://doi.org/10.1108/PM-01-2023-0005>
- Kylili, A., & Fokaides, P. A. (2017). Policy trends for the sustainability assessment of construction materials: A review. *Sustainable Cities and Society*, 35, 280–288. <https://doi.org/10.1016/j.scs.2017.08.022>
- Mathiyazhagan, K., Gnanavelbabu, A., & Lokesh Prabhuraj, B. (2019). A sustainable assessment model for material selection in construction industries perspective using hybrid MCDM approaches. *Journal of Advances in Management Research*, 16(2), 234–259. <https://doi.org/10.1108/JAMR-09-2018-0077>
- Ministry of Urban Development. (2016). *Model building by-laws, 2016*. Government of India.
- Mogaji, I. J., Mewomo, M. C., & Bondinuba, F. K. (2024a). Assessment of barriers to the adoption of innovative building materials (IBM) for sustainable construction in the Nigerian construction industry. *Engineering, Construction and Architectural Management*, 32(13), 1–26. <https://doi.org/10.1108/ECAM-01-2023-0040>
- Mogaji, I. J., Mewomo, M. C., Bondinuba, F. K., Aboagye-Nimo, E., & Abraham, Y. (2024b). Drivers influencing the adoption of innovative building materials (IBM) for sustainable construction in Nigeria. *Human Factors in Design, Engineering, and Computing*, 159(159). https://doi.org/10.1007/978-3-031-48278-1_19
- Nasier, S. (2021). Sustainable green materials for new construction. *Materials Today: Proceedings*, 37, 3505–3508. <https://doi.org/10.1016/j.matpr.2020.09.667>
- Onyegiri, I., & Ugochukwu, I. B. (2016). Traditional building materials as a sustainable resource and material for low-cost housing in Nigeria: Advantages, challenges and the way forward. *International Journal of Research in Chemical, Metallurgical and Civil Engineering*, 3(2), 247–252.
- Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students* (7th ed.). Pearson Education.
- Smith, R. M. (2015). *“Green” building in India: A comparative and spatial analysis of the LEED-India and GRIHA rating systems*. Routledge.
- Tran, Q., Nazir, S., Nguyen, T. H., Ho, N. K., Dinh, T. H., Nguyen, V. P., & Kieu, T. S. (2020). Empirical examination of factors influencing the adoption of green building technologies: The perspective of construction developers in developing economies. *Sustainability*, 12(19), 8067. <https://doi.org/10.3390/su12198067>
- United Nations. (2020). *The sustainable development agenda*. <https://www.un.org/sustainabledevelopment/development-agenda>
- United Nations Climate Technology Centre and Network. (n.d.). *Development of green building standards: Zimbabwe*. <https://www.ctc-n.org/technical-assistance/projects/development-green-building-standards-zimbabwe>
- Vaismoradi, M., Turunen, H., & Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing & Health Sciences*, 15(3), 398–405. <https://doi.org/10.1111/nhs.12048>
- Widén, K. (2006). *Innovation diffusion in the construction sector* (Doctoral dissertation). Lund University.