Are Green Buildings Ready to Support Occupant Health? Aligning with the WELL Building Standard

JAYAKODI, J.A.D.K.S.[1*], MADHUSANKA, H.W.N.[2] AND JAYASURIYA, S.[3]

[1,2] *Department of Facilities Management, University of Moratuwa, Sri Lanka*
[3]*RMIT, Melbourne, Australia*
Corresponding Email: jayakodijadks.25@uom.lk

Abstract. Building healthiness is a critical concern in modern society as people increasingly value the quality of life. However, the adoption of health-oriented building certification remains limited even in green buildings, despite the proven greater capability to become a healthy building. Hence, this study aims to explore the capability of green-certified office buildings to meet the requirements of health-oriented building certifications, aligning with WELL v2 Standard. The systematic literature review procedure was adopted in this study, and the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines were followed as the methodological basis. A bibliometric analysis was conducted using R Studio and Biblioshiney software, and subsequently, a manual content analysis method was used to synthesise the literature findings. The bibliometric outcomes reveal a constant growth in academic publications, while research trends are moving towards more holistic and technology-driven areas. Further, literature synthesis demonstrates that green building features provide a significant contribution to enhancing building healthiness, while aligning with the WELL concepts in multiple pathways. However, a further study focused on an empirical evaluation, along with the exploration of the underlying reasons for this limited adoption, will be conducted as the next step of this study.

Keywords. *Building Healthiness, Healthy Buildings, Green Buildings, WELL Building Standard, WELL Certification*

1. INTRODUCTION

The building healthiness has emerged as one of the critical concerns in contemporary built environment discourse due to modern lifestyle patterns. According to the United States Environmental Protection Agency (2025), people spend approximately 90% of their time indoors, with a substantial portion in workplace settings. Mahnoor et al. (2025) claimed that suboptimal building health performance leads to different health concerns, including headaches, dizziness, fatigue, and tiredness. Further, this causes sick building syndrome, which is characterised by a set of non-specific symptoms that occur only within a particular building and cannot be attributed to any defined disease (Nimlyat et al., 2023). Previous research emphasised that building healthiness is more critical in office buildings because of high occupancy and long exposure (Nimlyat et al., 2023). Further, Bhoir & Sinha (2024) claimed that building healthiness directly affects employee productivity, psychosocial well-being, employee retention, and organisational performance in office facilities.

Accordingly, to regulate the building health performance, a few building standards and benchmarking schemes have been developed (Ildiri et al., 2022). Notable examples include the WELL Building Certification and the Fitwel certification. These certification systems aim to provide recognition and validation of building healthiness and serve as proof of acceptable livability and comfort conditions (Sari et al., 2024). Previous studies demonstrate that green buildings (GBs) have a greater potential for being a healthy building than conventional buildings (Mirzaei et al., 2020; Fu et al., 2021; Grzegorzewska & Kirschke, 2021; Alabor et al., 2024; Ifechukwu Gil-Ozoudeh et al., 2024). Further, by

https://doi.org/10.31705/ICFMF2026.23

reviewing both environmental sustainability and healthiness-related building certification systems, it is evident that there are strong synergies that support promoting environmental sustainability while simultaneously enhancing occupant health, comfort, and productivity (Andalib *et al.*, 2024). Accordingly, developed countries such as the United States and China are at the forefront of this transition towards integrating both sustainability and health-focused certification systems, reflecting a growing commitment to environmentally responsible and occupant-centred design (United Nations Environment Program, 2025). In contrast, developing countries have made comparatively limited progress, often constrained by financial barriers, regulatory gaps, and resource limitations (Ebekozien et al., 2022; Taherkhani, 2023; Rudahinyuka, S., 2024; Alabi et al., 2025). Overall, exploring the global adoption rates, health-oriented certifications have been adopted comparatively less than sustainability-oriented certifications, such as LEED and BREEAM. Notably, even green buildings demonstrate limited motivation to pursue these health-oriented building certifications despite their proven capabilities compared to conventional buildings. Hence, as the initial step of addressing this critical concern, this paper aims to explore "To what extent can existing green buildings meet the requirements of health-oriented building certifications, aligning with the WELL Building Standard?" Accordingly, the aim of this research is to explore the capability of green-certified office buildings to meet the requirements of health-oriented building certifications, aligning with WELL v2 Standard, through synthesising insights from the existing literature. To achieve this aim, three research objectives were formulated: (i) To review the evolution of academic publications and key research themes in the intersection of building healthiness and green office buildings, (ii) To identify the impact of green buildings on building healthiness, and (iii) To develop a literature-based framework on the WELL Building Certification alignment of green-certified office buildings.

2. LITERATURE REVIEW

2.1 The WELL BUILDING STANDARD

A healthy building can be defined as "Human-oriented living and working environments where humans' physiological and psychological needs are satisfied" (Xie & Gou, 2020). Poor building healthiness can cause various health concerns related to the sick building syndrome, which is a situation where employees experience discomfort and health issues linked with staying in a particular building (Nag, 2019). Accordingly, to regulate the adoption of healthy buildings, different international and local health-oriented building standards and certification schemes have been established. A few examples of these standards include the Fitwell Standard, which was jointly developed by the U.S. Centers for Disease Control and Prevention (CDC) and the U.S. General Services Administration (GSA), and the WELL Building Standard, which was introduced by the International WELL Building Institute (IWBI). These certifications regulate the impact of building conditions on the occupant's health and well-being, thereby providing recognition of their health-centric performance. Among these standards, the WELL Building Standard has emerged as the most prominent, supported by the highest global adoption rate since 2021. According to Hartke (2025), there were only 500 million WELL-certified square feet, and it has grown into 6 billion square feet within 5 years, representing a twelvefold increase.

Initially, the WELL Building Standard was introduced in 2014, and the latest WELL v2 version was introduced in 2018 as a pilot study. The WELL v2 version comprised 102 optimiation features, which were categorised under 10 concepts: Air, Water, Nourishment, Light, Movement, Thermal comfort, Sound, Materials, Mind, and Community. Compared to the WELL v1 version, Material, Sound, and Community are newly added WELL concepts to enable a more holistic coverage of health aspects in the built environment. Further, the latest version offers more flexibility by reducing the high number of mandatory preconditions from 41 to 24.

The following Table 01 provides a comprehensive understanding of the WELL Building Standard under ten (10) WELL concepts with their primary focus and intended outcomes.

Table 1 - Overview of the WELL Building Standard

WELL Concept	**Primary focus**	**Intended outcomes**
Air	Maintaining healthier indoor air quality conditions throughout the building's life cycle.	• Reduce long-term and short-term health concerns associated with inhalation exposure to indoor air pollutants.
Water	Achieving quality water distribution and management throughout the building premises.	• Enhance occupant hydration. • Reduce health risks due to contaminated water. • Ensure adequate sanitation and hygiene through effective water infrastructure, operation, and maintenance.
Nourishment	Enabling healthier foods as the easiest choice.	• Promote the healthiest diet patterns and minimise the consumption of highly processed foods.
Light	Maintaining optimum indoor lighting conditions.	• Ensure visual, mental, and biological health through maintaining optimum lighting conditions.
Movement	Promoting daily physical activities and reducing sedentary behaviour.	• Reduce premature mortality and chronic diseases caused by physical inactivity.
Thermal comfort	Ensures the optimum thermal comfort that meets individual preferences through improving HVAC system design and control.	• Enhance occupant health, well-being, and productivity by ensuring individual thermal comfort.
Sound	Maintaining optimum acoustic comfort parameters with the aim of enhancing occupant health and well-being.	• Reduce hearing impairments and other health concerns associated with over-exposure to noise. • Promote occupant productivity, memory, and focus by providing an acoustically comfortable workplace.

Materials	Eliminate human exposure to potentially harmful material-related contaminants.	• Minimise health risks due to hazardous products and materials during building construction, furnishing, operation, and renovation.
Mind	Promotes occupants' psychological health, incorporating organisational policies, programmes, and design strategies.	• Promote occupants' cognitive and emotional health.
Community	Improving inclusivity, access to healthcare, and accommodating diverse population needs.	• Promote people engagement and belongingness while establishing a culture of health.

Source: The WELL Building Standard

3. Methodology

This study explored the potential of green-certified office buildings to fulfil the requirements of health-oriented building certification systems through a systematic literature review. According to Denyer & Tranfield (2009), a systematic literature review can be defined as a structured methodology for identifying existing literature, synthesising evidence, and presenting findings to establish knowledge and investigate research gaps within a specific domain. Accordingly, this research followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines to conduct the systematic review.

Accordingly, the literature search was conducted in the Scopus database to identify the key publications related to building healthiness and green office buildings. In this regard, the search was limited to titles, keywords, and abstracts and the used search string was: TITLE-ABS-KEY ("green building" OR "green certified building" OR "sustainable building" OR "building sustainability" OR "sustainable built environment" OR LEED OR BREEAM OR "Green Star" OR GBCSL) AND TITLE-ABS-KEY ("healthy building" OR "building healthiness" OR "well building" OR "WELL building standard" OR "WELL certified" OR "WELL certification" OR "occupant health" OR "employee health" OR "health" OR "occupant wellbeing" OR "employee wellbeing" OR "wellbeing" OR "occupant comfort" OR "employee comfort" OR "comfort" OR "sick building syndrome" OR "indoor environmental quality" OR "indoor air quality" OR "thermal comfort" OR "visual comfort") AND TITLE-ABS-KEY ("Office building" OR "Office" OR "Office environment").

From the initial search, the Scopus database identified 3012 documents, and it was further refined based on the PRISMA guidelines. The article screening was conducted in two phases. In screening 01, articles were limited using several criteria, such as: year range: 2016 – 2025; Source type: Journals; Document type: Articles; Language: English, and restricting some irrelevant subject areas. Accordingly, the excluded subject areas were computer science, mathematics, physics and astronomy, agriculture and biological science, biochemistry, genetics and molecular biology, veterinary, and neuroscience. In screening 02, 10 irrelevant articles were excluded based on the title and abstract, thereby resulting in 732 articles selected to include in the bibliometric analysis. A bibliometric

mapping of the selected articles was conducted in terms of the evolution of academic publications and key research themes using the R Studio and Biblioshiney software, to identify the current research frontiers in this domain as a basis for this research. Figure 1 further illustrates the article selection procedure for the bibliometric analysis.

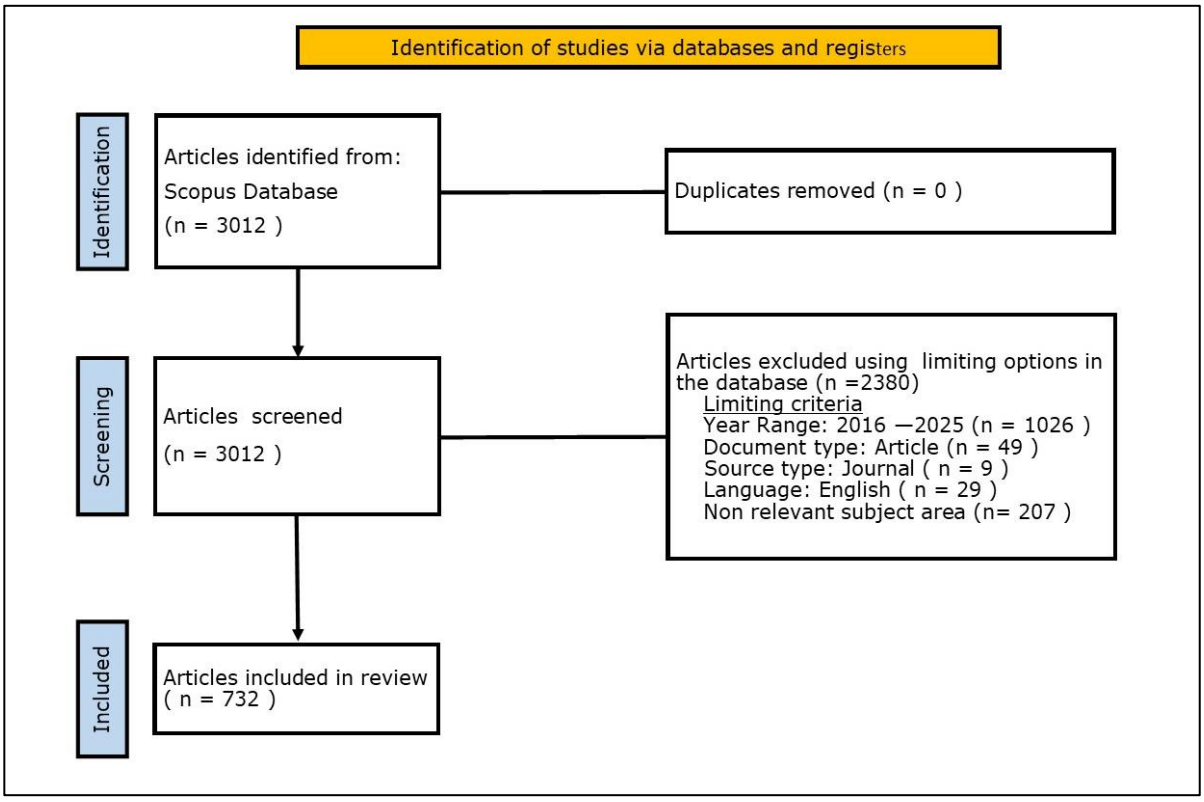

Figure 1 - PRISMA methodology

Subsequently, manual content analysis was employed to synthesise literature findings and develop the literature-based framework representing the WELL certification alignment of green-certified office buildings. To enhance the credibility and feasibility of the review process, the selected articles followed a rigorous screening procedure. Initially, 104 articles were identified from the previously selected 732 articles based on the title, and it was further reduced to 37 articles following an abstract based screening. Finally, the selected 37 articles were comprehensively reviewed using the manual content analysis, and an inductive thematic analysis approach was adopted systematically to synthesise the literature. The title and abstract based article screening ensures the inclusion of studies supports with direct relevance to green building features and their impact on occupant health and well-being.

4. Results

4.1 BIBLIOMETRIC OUTCOMES

4.1.1 Evolution of the number of journal articles published in the intersection of healthy buildings and green office buildings

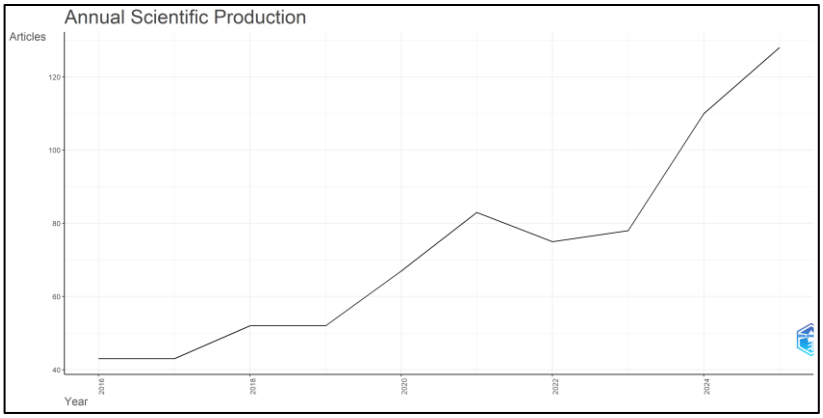

Figure 2 - Evolution of the number of journal articles

Table 2 – Annual scientific production

Year	Articles
2016	43
2017	43
2018	52
2019	52
2020	67
2021	83
2022	75
2023	78
2024	110
2025	128

The Figure 02 along with the Table 02 illustrates the annual scientific production in the intersection of healthy buildings and green-certified office buildings from 2016 – 2025. The chart shows a clear and consistent growth of the academic publications over time. In the early stages from 2016 to 2019, volume of publication is comparatively steady, ranging from 43 to 52. A noticeable increment in research output is observed after 2020, largely driven by the heightened attention to indoor environmental quality and occupant health following the COVID-19 pandemic. However, the research output shows a relatively stable pattern with minor fluctuations in the period of 2022 – 2023. Subsequently, the most significant growth is evident in the 2024 – 2025 period, where the number of publications increased sharply, reaching the highest levels within the study timeframe. Overall, the trend highlights a progressive evolution in this research domain, suggesting that the intersection of green and building healthiness has evolved into a prominent and emerging research area, attracting greater scholarly attention in recent years.

4.1.2 Thematic evolution

Figure 03 represents how research themes have evolved in this domain over time. The thematic evolution analysis was conducted using the “Biblioshiny” interface of the "Bibliometrix” package in RStudio. Author keywords were used to construct the thematic evolution network and set the minimum keyword frequency threshold as 05 to ensure robustness in capturing emerging trends in previous publications. To analyse publication trends over the past decade, five time slices were defined based on the evolution of the number of journal articles published and key external factors, particularly the COVID-19 pandemic, because it highly impacted the research output according to the evolution of publications. Accordingly, the time periods were established as 2016 – 2019: pre-COVID-19 period, 2020 – 2021: pandemic-affected phase, 2022 – 2023: pandemic recovery phase, and the last two years (2024 and 2025) were considered individually to capture the emerging research theme closely.

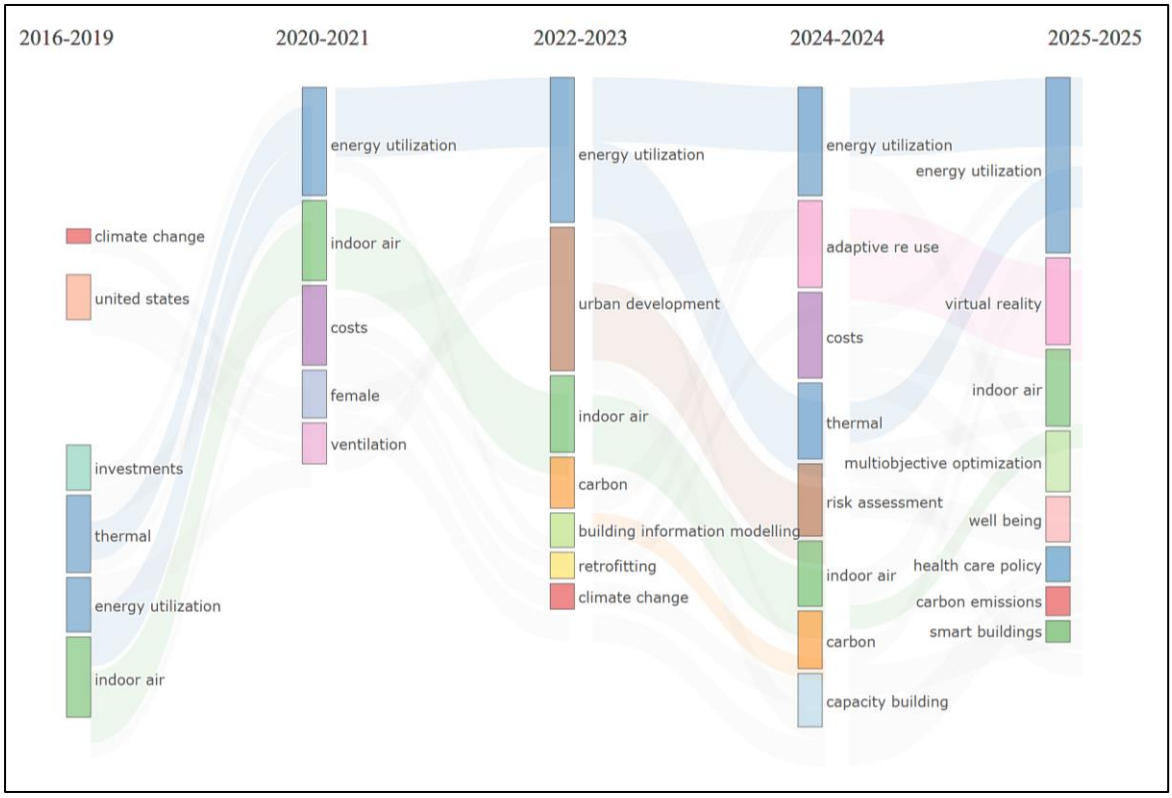

Figure 3 – Thematic evolution

Accordingly, during the 2016 – 2019 period, the research landscape is primarily focused on the core areas of building sustainability and healthiness, including climate change, energy utilisation, indoor air quality, and thermal comfort. Further, the analysis demonstrates that similar research themes persist during the 2020–2021 period. However, the 2022 – 2023 phase marks a transition towards more integrated and technology-driven approaches, such as urban development, carbon emissions, retrofitting, and building information modelling. In the 2024 – 2025 period, this transition expands more into diversified and multidisciplinary areas, such as adoptive reuse, risk assessment, capacity building, virtual reality, and health care policies. Overall, this thematic evolution suggests a clear progression from energy- environment focused research towards a more holistic and human-centred approach, where occupant health, digital technologies, carbon management, and integrated building strategies play increasingly important roles.

4.1.3 Co-occurrence analysis of keywords

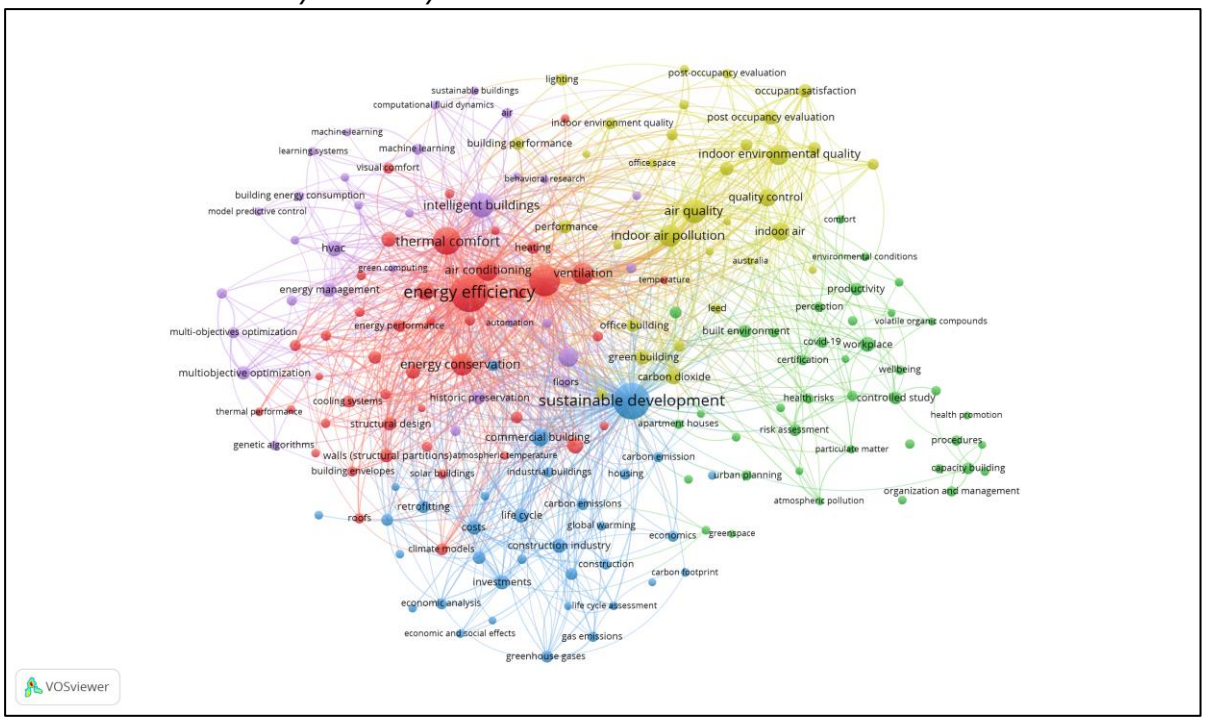

Figure 4 – Keyword co-occurrence

The figure 04 represent the keyword co-occurrence network on the intersection of building healthiness and green office buildings that was generated using the VOSviewer software. The unit of analysis was selected as the author keywords to identify the frequently used terms by the authors in this research domain. Accordingly, this visual mapping highlights 05 main research thematic clusters that are indicated in different colours with a strong interconnection between them. The keywords with the highest occurrence are represented by larger nodes, indicating their central importance in the field.

Upon the analysis, "sustainable development" is located at the centre of the network, appearing as the highly connected node, indicating the conceptual foundation that links multiple research themes. Its strong connections with other terms such as energy efficiency, indoor environmental quality, carbon emissions, green buildings, and health risks indicate that the field recognises sustainability as a multidimensional concept incorporating both environmental and social aspects.

The red cluster is mainly associated with energy-related themes such as energy efficiency, energy conservation, heating, thermal comfort, and architectural design. This cluster demonstrates one of the dominant focus areas in green building research over the years. Further, the "indoor air quality" related cluster in yellow colour represents the health-oriented dimension in this field of study. Accordingly, it relates to topics such as

indoor environmental quality, indoor air pollution, occupant satisfaction and post-occupancy evaluation, etc. Additionally, the purple cluster centred around "Intelligent buildings" and the green cluster related to "Workplace" also indicate strong relationships with others, indicating the collaborative approach in the healthy-green office buildings research paradigm.

4.2 IMPACT OF GREEN OFFICE BUILDING FEATURES ON HEALTH-ORIENTED BUILDING PERFORMANCE

The concept of green buildings (GBs) has emerged, mainly focusing on mitigating the ecological impact raised by the conventional building construction practices (L. Jiang, 2023). To achieve this aim, GBs are equipped with various features, such as natural lighting and ventilation, passive design features, renewable energy consumption, greenhouse gas emission reduction, and waste management. However, scholars proposed various categorisations for the features of green buildings based on different arguments. For instance, Nurick et al. (2015) identified GB features under four categories as (i) energy efficiency, (ii) indoor environmental quality, (iii) water and waste management, and (iv) materials, while Xue, Gou and Lau (2016) categorised GB features as (i) natural ventilation, (ii) daylight and view quality, (iii) green space, and (iv) programs and amenities. Accordingly, this study divided green building features into four distinct categories based on previous literature to improve the ease of understanding and further analysis. Those categories are: (i) Environmental and energy performance, (ii) Water efficiency and hydrologic management, (iii) Indoor environmental quality (IEQ), and (iv) Sustainable infrastructure and amenities.
The following section discusses the impact of green building features on the building health performance under these categories.

4.2.1 Green building features related to the environment and energy performance.

Building materials are generally considered a principal aspect of green buildings, which provide a great contribution to reducing environmental impact. When considering its impact on building healthiness, Mannan and Al-Ghamdi (2021) have identified indoor materials as one of the sources for indoor air pollution, which leads to various health concerns such as throat irritation, wheeze, bronchial obstruction, and asthma. However, Piracha and Chaudhary (2022) also discussed how the buildings and building materials that can absorb air pollution are used in a variety of cases in Italy. Further, Adela Călătan & Dico (2022) discussed innovative masonry bodies made with clay and some other natural materials with the ability to regulate indoor humidity and stabilise indoor temperatures by storing heat during warm periods and releasing it during colder periods. In terms of energy optimisation, integrating renewable energy, energy storage systems, and energy-efficient design are the most common green building features. Relating energy efficiency to building healthiness, Wallner et al. (2017) conducted a study with a field study of passive houses (super energy-efficient buildings) in Austria. However, the results indicate that energy efficiency does not directly impact the occupant's health and well-being. In contrast, Ortiz et al. (2020) stated that energy-efficient retrofitting leads to health risks related to the respiratory system, skin, and eyes, in some circumstances. Smart building technologies, including Internet of Things (IoT), Artificial Intelligence (AI), and machine learning, facilitate real-time monitoring and real-time interaction with external and internal conditions, such as climate and indoor environmental quality (Aldakheel et

al., 2023). Ogundiran et al. (2024) further described that these technologies are beneficial to enhance building healthiness, in terms of regulating thermal comfort and indoor air quality (IAQ) control, HVAC control, indoor temperature prediction, energy management, and energy consumption prediction. Responsive systems are another innovative feature of modern green buildings, which automatically respond to their indoor and outdoor environmental conditions without any human intervention. Carlucci (2021) highlighted that its significant contribution towards indoor environmental comfort and energy efficiency leads to the rapid adoption of these technologies around the world, while improving health.

4.2.2 Green building features related to water efficiency and hydrologic management.

Rainwater harvesting can be identified as one of the most common methods for sustainable water usage in buildings. The results of a study that was conducted in Bangladesh, to investigate the suitability and acceptability of water collected through rainwater harvesting, show that overall water quality is at a quite satisfactory level according to country-specific standards (Rahman et al., 2014). However, Gwenzi et al. (2015) stated that the water quality of rainwater harvesting is often assumed to be safe; some studies have shown that atmospheric pollutants, roofing materials, and issues in rainwater storage and conveyors directly influence this. Even though recycling water is one of the most common sustainable practices in green buildings, its healthiness is still debatable. Further, studies have shown that recycled water is more acceptable for non-potable purposes (Phiri et al., 2023).

4.2.3 Green building features related to indoor environmental quality (IEQ)

Indisputably, built environment interaction with nature profoundly improves occupant health, well-being, and productivity. A study that was conducted to explore the short-term effects of natural view and daylight shows that it helps to reduce stress, fatigue, and sick building syndrome (SBS). However, it further mentioned that daylight did not positively affect lighting perception, though the visual window influenced thermal comfort (Y. Jiang et al., 2022). Woo et al. (2021) further emphasised the significance of daylight and restorative views on the physical and emotional well-being of building occupants. Chen et al. (2019) claimed that natural ventilation has the potential to enhance the indoor air quality (IAQ), ensuring lower indoor carbon dioxide and volatile organic compound (VOC) concentrations. In contrast, it further stated that it can cause increasing indoor pollution through outdoor sources in some circumstances. Another study conducted by Z. Lei et al. (2017) reveals that natural ventilation contributes to improving the IAQ, while declining thermal comfort in some weather conditions.

4.2.4 Green building features related to Sustainable infrastructure and amenities.

The concept of biophilic design emerged to incorporate the essence of nature into the architectural and built environment practices (Tekin et al., 2025). Research is evident that biophilic design has an impact on indoor environmental quality in terms of different aspects, including thermal comfort, indoor air quality, acoustic comfort, and lighting (Aljamily et al., 2025; Gomes et al., 2025). A study conducted to explore the impact of biophilic design on health and well-being, with Singapore and China case studies, reveals that workplace biophilic design features are moderately effective for enhancing occupant

health and well-being (Q. Lei et al., 2022). Regarding the impact of green roofs on building healthiness, Piracha & Chaudhary (2022) stated that green roofs reduce the urban heat island (UHI) effect through absorbing sunlight. Additionally, green roofs can be identified as a potential strategy to control storm runoff and reduce urban air pollution.
Accordingly, these findings demonstrate that GB features have a strong impact on the healthiness of the building. This implies that, although the adoption of building healthiness certification remains limited compared to GB certifications, green-certified buildings have a greater potential to achieve healthy building certifications than conventional buildings (Alabor et al., 2024; Fu et al., 2021; Grzegorzewska & Kirschke, 2021; Ifechukwu Gil-Ozoudeh et al., 2024; Mirzaei et al., 2020).

4.3 LITERATURE-BASED FRAMEWORK ON WELL ALIGNMENT OF GREEN-CERTIFIED OFFICE BUILDING

Figure 05 shows the developed literature-based framework that represents the WELL alignment of green-certified office buildings, through a mapping between green building features and WELL concepts. However, the literature doesn't present the WELL alignment of green building features. Hence, these alignments were established by reviewing and comparing the impacts of green building features with the primary focus and intended outcomes of each WELL concept. Accordingly, the framework was developed by synthesising the literature-based findings on the impact of green building features and WELL building standards.

Accordingly, the framework consists of the green building features that were identified from the literature, under 04 categories, including environmental and energy performance, water efficiency and hydraulic management, indoor environmental quality, and sustainable infrastructure and amenities. Further, these green buildings have been divided into two as solely green building features and common features for green buildings and healthy buildings. Subsequently, these common features were mapped with the WELL v2 concepts, demonstrating the alignment of green-certified office buildings with the WELL standard.

The literature-based framework illustrates that green building features have a strong relationship with WELL concepts, demonstrating the high potential to pursue WELL building certification. Accordingly, the WELL air, mind, and thermal comfort concepts are highly interconnected with green building features. However, it also demonstrates some gaps in green buildings to align with a few WELL concepts, such as community. Overall, green buildings demonstrate greater potential to align with the WELL Building Standard than conventional buildings, although a few gaps remain.

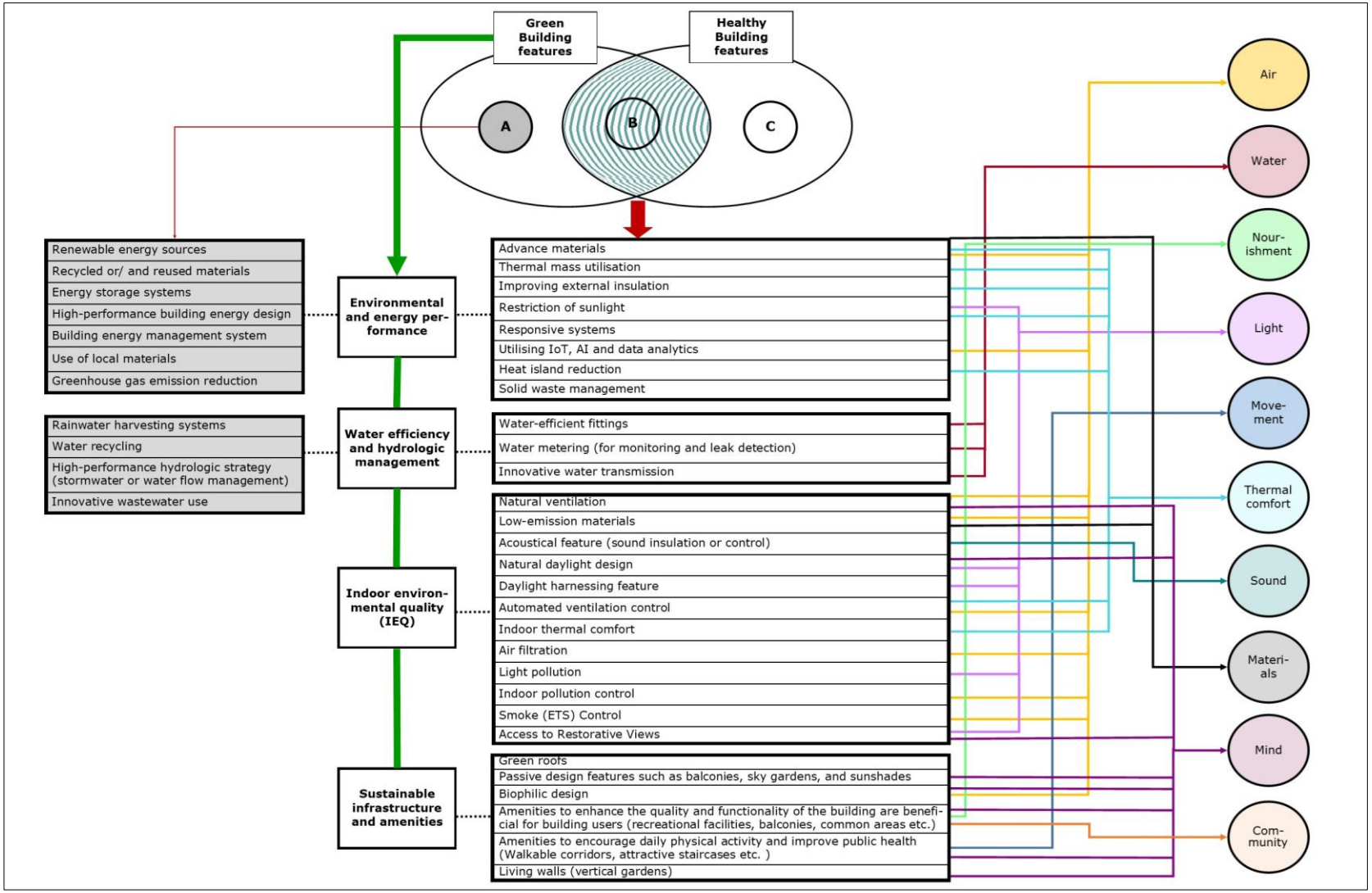

Figure 5 - Literature-based framework on WELL alignment of green buildings

7. Conclusion and Way forward

Although building healthiness is a critical concern, the adoption of health-oriented building certification remains limited. Further, even green buildings are not encouraged despite the proven higher potential of green buildings than conventional buildings to become healthy buildings. Hence, this study explored this critical gap, exploring the capability of green-certified office buildings to meet the requirements of health-oriented building certifications, aligning with the WELL v2 Standard, through a systematic literature review approach. Accordingly, bibliometric analysis reveals that there is a constant growth in academic publications in the intersection of building healthiness and green office buildings. Further, thematic evolution illustrates that current research frontiers are not focusing on core research areas but also expanding into more holistic and technology-driven areas. The results of the content analysis demonstrate immense synergies between green buildings and healthy buildings. Moreover, synthesising these literature findings, a framework has been developed to represent the WELL alignment of green office buildings, as the key outcome of this study.

Even though the findings reveal a greater potential of green buildings to align with WELL certification, the studies focused on empirical evaluation of this potential remain limited. Hence, this study can be further expanded into an empirical evaluation to strengthen the impact of findings. Hence, an empirical evaluation along with the exploration of underlying reasons for this limited adoption can be proposed as the next stage of this study.

8. References

Adela Călătan, G., & Dico, C. (2022). Environmentally Friendly Building Materials with Beneficial Potential for Indoor Air Quality. *Athens Journal of Technology & Engineering*, *9*(4), 305–320. https://doi.org/10.30958/ajte.9-4-3

Alabi, A. S., Alabi, O. A., Adebakin, T. E., & Alayande, B. T. (2025). Revisiting literature on building quality of healthcare facilities between developed and developing countries: scoping review. *International Journal of Building Pathology and Adaptation*. https://doi.org/10.1108/IJBPA-11-2024-0241

Alabor, O. Z., Anyanechi, H., & Onyekwere, W. C. (2024). The Impact of Green Building Design on Indoor Air Quality and Occupant Experience. *African Journal of Environmental Sciences and Renewable Energy*, *16*(1), 203–215. https://doi.org/10.62154/ajesre.2024.016.010403

Aldakheel, J., Bahrar, M., & El Mankibi, M. (2023). Indoor environmental quality evaluation of smart/artificial intelligence techniques in buildings – a review. *E3S Web of Conferences*, *396*, 01101. https://doi.org/10.1051/e3sconf/202339601101

Aljamily, Z., Boules, B. H. E., & Fathy, H. (2025). Biophilic Design and Indoor Environmental Quality -Thermal Comfort- in Public Libraries. *JES. Journal of Engineering Sciences*, *0*(0), 0–0. https://doi.org/10.21608/jesaun.2025.380412.1497

Bhoir, M., & Sinha, V. (2024). *Employee well-being human resource practices: A systematic literature review and directions for future research*. *Future Business Journal, 10*(1), Article 95. https://doi.org/10.1186/s43093-024-00382-w

Carlucci, F. (2021). A Review of Smart and Responsive Building Technologies and their Classifications. *Future Cities and Environment*, *7*(1). https://doi.org/10.5334/fce.123

Chen, J., Brager, G. S., Augenbroe, G., & Song, X. (2019). Impact of outdoor air quality on the natural ventilation usage of commercial buildings in the US. *Applied Energy*, *235*, 673–684. https://doi.org/10.1016/j.apenergy.2018.11.020

Denyer, D., & Tranfield, D. (2009). Producing a systematic review. In D. A. Buchanan & A. Bryman (Eds.), *The Sage handbook of organizational research methods* (pp. 671–689). Sage Publications.

Ebekozien, A., Ikuabe, M., Awo-Osagie, A. I., Aigbavboa, C., & Ayo-Odifiri, S. O. (2022). Model for promoting green certification of buildings in developing nations: a case study of Nigeria. *Property Management*, *40*(1), 118–136. https://doi.org/10.1108/PM-05-2021-0033

Fu, Y., Wang, H., Sun, W., & Zhang, X. (2021). New Dimension to Green Buildings: Turning Green into Occupant Well-Being. *Buildings*, *11*(11), 534. https://doi.org/10.3390/buildings11110534

Gomes, M. I., Barreiros, A. M., Pinto, I., & Rodrigues, A. (2025). Improving Indoor Air Quality in a Higher-Education Institution Through Biophilic Solutions. *Sustainability*, *17*(11), 5041. https://doi.org/10.3390/su17115041

Grzegorzewska, M., & Kirschke, P. (2021). The Impact of Certification Systems for Architectural Solutions in Green Office Buildings in the Perspective of Occupant Well-Being. *Buildings*, *11*(12), 659. https://doi.org/10.3390/buildings11120659

Gwenzi, W., Dunjana, N., Pisa, C., Tauro, T., & Nyamadzawo, G. (2015). Water quality and public health risks associated with roof rainwater harvesting systems for potable supply: Review and perspectives. *Sustainability of Water Quality and Ecology*, *6*, 107–118. https://doi.org/10.1016/j.swaqe.2015.01.006

Hartke, J. (2025, August 11). *Six billion square feet and counting: The healthy building movement moves into overdrive*. 3BL Media. https://www.3blmedia.com/news/six-billion-square-feet-and-counting-healthy-building-movement-moves-overdrive

Ifechukwu Gil-Ozoudeh, Obinna Iwuanyanwu, Azubuike Chukwudi Okwandu, & Chidiebere Somadina Ike. (2024). The impact of green building certifications on market value and occupant satisfaction. *International Journal of Management & Entrepreneurship Research*, *6*(8), 2782–2796. https://doi.org/10.51594/ijmer.v6i8.1466

Ildiri, N., Bazille, H., Lou, Y., Hinkelman, K., Gray, W. A., & Zuo, W. (2022). Impact of WELL certification on occupant satisfaction and perceived health, well-being, and productivity: A multi-office pre- versus post-occupancy evaluation. *Building and Environment*, *224*, 109539. https://doi.org/10.1016/j.buildenv.2022.109539

Jiang, L. (2023). Environmental Benefits of Green Buildings with BIM Technology. *Ecological Chemistry and Engineering S*, *30*(2), 191–199. https://doi.org/10.2478/eces-2023-0019

Jiang, Y., Li, N., Yongga, A., & Yan, W. (2022). Short-term effects of natural view and daylight from windows on thermal perception, health, and energy-saving potential. *Building and Environment*, *208*, 108575. https://doi.org/10.1016/j.buildenv.2021.108575

Lei, Q., Lau, S. S. Y., Yuan, C., & Qi, Y. (2022). Post-Occupancy Evaluation of the Biophilic Design in the Workplace for Health and Wellbeing. *Buildings*, *12*(4), 417. https://doi.org/10.3390/buildings12040417

Lei, Z., Liu, C., Wang, L., & Li, N. (2017). Effect of natural ventilation on indoor air quality and thermal comfort in dormitory during winter. *Building and Environment*, *125*, 240–247. https://doi.org/10.1016/j.buildenv.2017.08.051

Mahnoor, Fernando, N. G., & Rathnaweera Patabandige, H. S. B. (2025). *The Impact of Indoor Air Quality in Higher Education Institutions* (pp. 239–258). https://doi.org/10.1007/978-981-96-3086-8_12

Mannan, M., & Al-Ghamdi, S. G. (2021). Indoor Air Quality in Buildings: A Comprehensive Review on the Factors Influencing Air Pollution in Residential and Commercial Structure. *International Journal of Environmental Research and Public Health*, *18*(6), 3276. https://doi.org/10.3390/ijerph18063276

Mirzaei, N., Kamelnia, H., Islami, S. G., Kamyabi, S., & Assadi, S. N. (2020). The Impact of Indoor Environmental Quality of Green Buildings on Occupants' Health and Satisfaction: A systematic review. *Journal of Community Health Research*. https://doi.org/10.18502/jchr.v9i1.2574

Nag, P. K. (2019). *Sick Building Syndrome and Other Building-Related Illnesses* (pp. 53–103). https://doi.org/10.1007/978-981-13-2577-9_3

Nimlyat, P. S., Inusa, Y. J., & Nanfel, P. K. (2023). A Literature Review of Indoor Air Quality and Sick Building Syndrome in Office Building Design Environment. *Green Building & Construction Economics*, 1–18. https://doi.org/10.37256/gbce.4120231961

Nurick, S., Le Jeune, K., Dawber, E., Flowers, R., & Wilkinson, J. (2015). Incorporating Green Building Features and Initiatives into Commercial Property Valuation. *Journal of Sustainable Real Estate*, *7*(1), 21–40. https://doi.org/10.1080/10835547.2015.12091873

Ogundiran, J., Asadi, E., & Gameiro da Silva, M. (2024). A Systematic Review on the Use of AI for Energy Efficiency and Indoor Environmental Quality in Buildings. *Sustainability*, *16*(9), 3627. https://doi.org/10.3390/su16093627

Ortiz, M., Itard, L., & Bluyssen, P. M. (2020). Indoor environmental quality related risk factors with energy-efficient retrofitting of housing: A literature review. *Energy and Buildings*, *221*, 110102. https://doi.org/10.1016/j.enbuild.2020.110102

Phiri, L., Etale, A., & Thatcher, A. (2023). Reclaimed water systems in office buildings: Perceptions of building facilities managers. *Human Factors and Ergonomics in Manufacturing & Service Industries*, *33*(2), 201–211. https://doi.org/10.1002/hfm.20977

Piracha, A., & Chaudhary, M. T. (2022). Urban Air Pollution, Urban Heat Island and Human Health: A Review of the Literature. *Sustainability*, *14*(15), 9234. https://doi.org/10.3390/su14159234

Rahman, S., Khan, M. T. R., Akib, S., Din, N. B. C., Biswas, S. K., & Shirazi, S. M. (2014). Sustainability of Rainwater Harvesting System in terms of Water Quality. *The Scientific World Journal*, *2014*, 1–10. https://doi.org/10.1155/2014/721357

Sari, M., Dewantoro, S. F., Berawi, M. A., Susilowati, S. I., & Fiani, C. (2024). *A Comparative Analysis of the Standards in Healthy Building Rating Systems*. 453–464. https://doi.org/10.1007/978-3-031-70431-4_34

Taherkhani, R. (2023). Barriers to green building implementation in developing countries: the case of Iran. *Environment, Development and Sustainability*, *26*(11), 28389–28421. https://doi.org/10.1007/s10668-023-03816-7

Tekin, B. H., Izmir Tunahan, G., Disci, Z. N., & Ozer, H. S. (2025). Biophilic Design in the Built Environment: Trends, Gaps and Future Directions. *Buildings*, *15*(14), 2516. https://doi.org/10.3390/buildings15142516

U.S. Environmental Protection Agency. (2025). Indoor air quality. U.S. Environmental Protection Agency. https://www.epa.gov/report-environment/indoor-air-quality

Wallner, P., Tappler, P., Munoz, U., Damberger, B., Wanka, A., Kundi, M., & Hutter, H.-P. (2017). Health and Wellbeing of Occupants in Highly Energy Efficient Buildings: A Field Study. *International Journal of Environmental Research and Public Health*, *14*(3), 314. https://doi.org/10.3390/ijerph14030314

Woo, M., MacNaughton, P., Lee, J., Tinianov, B., Satish, U., & Boubekri, M. (2021). Access to Daylight and Views Improves Physical and Emotional Wellbeing of Office Workers: A Crossover Study. *Frontiers in Sustainable Cities*, *3*. https://doi.org/10.3389/frsc.2021.690055

Xie, X., & Gou, Z. (2020). *From Green to Healthy Buildings: A Comparative Study of the USA and China* (pp. 79–107). https://doi.org/10.1007/978-3-030-24650-1_5

Xue, F., Gou, Z., & Lau, S. (2016). Human Factors in Green Office Building Design: The Impact of Workplace Green Features on Health Perceptions in High-Rise High-Density Asian Cities. *Sustainability*, *8*(11), 1095. https://doi.org/10.3390/su8111095