

Healthy Building Movement

Interview Report 1.0

Healthy Buildings: Barriers, benefits and future priorities

By Enver Muftić, Piet Eichholtz, Hailin Zheng, Marcel Loomans, Kimberly Afamefuna, Marcel Schweiker

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Highlights

- Health is still treated as an added value rather than a core performance metric.
- Healthy buildings are shaped as much by user behavior as by building design.
- The strongest barriers are organizational and financial.
- Evidence linking healthy buildings to productivity remains underutilized in investment decisions.
- Certification schemes raise awareness.

1. Introduction

The built environment is a vital part of our lives, as most of our time is spent sleeping, working, and attending to other matters indoors. However, it remains unclear how buildings impact human wellbeing and health. Currently, the meaning of healthy buildings is becoming more complex as performance indicators vary widely across regions and information may be asymmetric among stakeholders (Liu et al., 2023). We conducted semi-structured interviews to obtain an overview of how different stakeholders define healthy buildings. In addition, we sought to understand how their organization implements this definition in practice and the challenges it faces.

In building design and operation, energy efficiency and indoor environmental quality (IEQ) goals frequently clash (Jain et al., 2019). Stakeholders involved at different stages of the building life cycle also face financial consequences as they navigate between these goals. In addition to the funds required for a building with a traditional engineering design, healthy buildings require upfront investment in technical installation and healthy materials (Palacios et al., 2020). Therefore, we investigate how interviewees navigate trade-offs among cost, energy efficiency, health, and safety.

The strategies for achieving high IEQ and building user happiness may conflict with efforts to improve energy performance, given the current trend toward low-energy, sustainable building design. For instance, highly insulated and airtight new buildings built to higher energy requirements have problems with overheating and air quality (increased levels of particular volatile organic compounds (VOCs)) (Jain et al., 2019). As a result, these IEQ factors can affect how occupants perceive their indoor experience and satisfaction. In the interviews, we try to understand how organizations measure occupant experience and outcomes, as well as how they incorporate the feedback into new and existing projects.

This report summarizes interviews conducted by HBM partners to provide an overview of current practices related to Healthy Buildings. These interviews helped identify how different stakeholders engage with the concept of Healthy Buildings, what challenges and best practices exist, and where opportunities for improvement lie.
The interviews covered a range of perspectives along the building development and use chain, including investors, architects, building managers, janitors/facility staff, and building construction companies. All the participants had some knowledge or experience with the

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Healthy Buildings concept. This experience helped ensure that the discussions were informed and focused, as these stakeholders are likely to have reflected on the topic and to be interested in it. The 9 interviews (questions provided in the Appendix) were conducted via online Teams meetings lasting approximately 30-60 minutes to allow for focused discussions. Each interview was performed by one interviewer. In total three different interviewers performed the interviews. All meetings were recorded and transcribed in Teams, and later summarized using Copilot. Note: all summaries were reviewed by the interviewers to ensure they are authentic and consistent with the actual interview

2. Results

2.1. Background and Context

The goal of background- and context-related interview questions was to understand the interviewee's professional background, role, and connection to the topic of Healthy Buildings. The background information of the interviewees is summarized in Table 1. Overall, the roles of the sampled participants can be broadly summarized as investors, architects, building managers, janitors/facility staff, and building construction companies. Moreover, experience in the respective positions ranges from 3 to 30 years, and the specific relation to buildings is summarized in column 4 of Table 1. The buildings and projects the interviewees are involved with cover a wide range of real estate subsectors: Residential, retail, hotels, healthcare, offices, and education. The main stakeholders are tenants, clients, and property managers of the respective buildings. Lastly, familiarity with the concept of "Healthy Buildings" ranges from somewhat familiar to high, with knowledge of building physics, concepts, and labels used in practice.

Table 1

Interviewee Overview Table

ID	Current role	Years of experience	Relation to buildings	Main building/project types	Main stakeholders and users	Familiarity with Healthy Buildings
1	ESG Manager at a Dutch real estate investment company	25	Reporting, advising, and ensuring ESG performance across investment products.	Residential, senior living, retail, hotel, and office.	Residential and senior living tenants	Familiar with concepts such as BREEAM, WELL, CO_2, and indoor climate considerations.
2	Technical manager at a Dutch real estate investment company	10	Oversees maintenance, improvements, and compliance with internal quality standards	Residential and senior living	Residential tenants and property managers	Familiar with the concept and they consider it, but not the central organizational focus

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			of developed and purchased assets			
3	Head of a university real estate management department	30	Responsible for maintenance, new construction, renovations, and campus-wide strategy of all buildings	Educational buildings and offices	Students and academic staff	Background is in building physics, which informs their understanding of thermal comfort, acoustics, and indoor environmental quality.
4	Engineering director	10	Designing and manufacturing of building services. Active in professional associations	Mainly offices, some residential	General (clients)	Development and application of technologies that determine IEQ, particularly ventilation, filtration, air distribution, and climate ceilings
5	Acoustics and building physics consultant at a large consultancy firm	8	Design consultancy on building physics and the indoor environment.	Mainly non-residential, such as offices, hospitals and educational	Clients and users	Company expert for the topic of 'Healthy Buildings'. professional motivation lies in designing from a human perspective: health, comfort, and well-being are central to her work.
6	Architect at a large architectural firm	25	Designing complex buildings	Primarily buildings in the healthcare sector, including offices, and high-tech industry (e.g. ASML).	Clients	In the design projects, health—encompassing physical, mental, and social aspects—is a central design principle
7	Consultant for the built environment, mainly for BREEAM certification	3	Consulting, certification, and advising on sustainability and health-related building aspects	Office and utility buildings, some larger residential projects	Project managers and commissioning companies	Familiar mainly through BREEAM and certification systems
8	Architect with professional experience in practice and academia	24	Architectural practice, research, teaching	Elderly housing, care homes, day clinics, disability-related housing, healthcare-related designs	Older adults, people with disabilities, care users, staff	Strongly engaged with Healthy Buildings through research, teaching and interdisciplinary collaboration
9	Architect and head of the building services department at a bank	30	Responsible for conversions, technical infrastructure, security systems, and renovation-related questions	Administrative buildings, mixed-use residential/commercial properties	Employees, work building occupants, residents	Aware of the concept but described familiarity as basic and not deeply specialized
10	Senior location/facility manager	25	Responsible for the daily operation of multiple education buildings at a Dutch university.	Educational buildings and offices	Students and academic staff	Somewhat familiar as well-being and health of occupants is important, although, the main focus is to make sure that the buildings are operational.

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2.2. Concept of Healthy Buildings

To start off, how would you personally define the term "Healthy Buildings"?

The following section establishes how the interviewees define and conceptualize "Healthy Buildings." Some interviewees distinguished between a personal and professional definition. As one participant explained, for them a healthy building is, "Where it is nice to stay, where it is nice to live, where you have the feeling to be outside as well as inside at the same time with a nice temperature and a nice climate within the building" (Interviewee 1). On the other hand, Interviewee 3 defines the concept as, "a building which does not affect the health of users… or it could be also defined perhaps as a building which stimulates a healthy way of living." Similarly, Interviwee 10 explains that buildings should not make occupants sick, and that the indoor environment should preserve their well-being or even facilitate it. Others, such as Interviewee 4, primarily assume health and safety (i.e., "the indoor environment should not affect occupants' well-being or life expectancy"). Adding to this, the notion that "This definition establishes a higher standard than current regulatory requirements." Interviewee 5 takes it one step further, stating that it should not only protect health but also promote it. Furthermore, that interviewee remarks that we should acknowledge all types of users/target groups (old, young, people with diverse needs or sensitivities). Such a holistic definition is also found with Interviewee 6. He defines health beyond the standard indoor environmental quality, including, for example, safety and security. As for the latter, he provides an example in an extreme context where healthy buildings also serve to protect against external threats (e.g., bombs). Interviewee 7 defines healthy buildings in terms of both physical and social aspects, including airflow, daylight, relaxation, and space for people to interact. Interviewee 8 avoids describing the building itself as "healthy" or "unhealthy" and instead describes it as an environment that can support healing, recovery, and well-being. Interviewee 9 defines the concept more practically, focusing on buildings in which people feel comfortable living or working.

When you think about "healthy" aspects of buildings, what aspects come to mind?

In terms of aspects of healthy buildings, the interviewees mention factors, such as temperature, humidity, sunlight, acoustics, and air quality. With Interviewee 4, who is active in ventilation, as an example, priorities may not always be aligned. Moreover, others also refer to accessibility, building layout, materials, spatial clarity, opportunities for physical activities, access to daylight, and colors of the environment. Interviewee 1 emphasizes that these factors depend on the purpose of the building: "Depends on if it is my house, then I have other standards than where I work." Similarly, while Interviewee 2 mentions that, "we design buildings that we call assisted living", and Interviewee 3 believes that healthy buildings are "buildings which stimulate a healthy way of living… by taking the stairs instead of elevators." It is clear that what is healthy might not be true for both a senior living residence and a school or an office building. These points are also raised by Interviewee 5, extending the variation in target groups to people in general with diverse needs, including, for example, neurodiversity. For Interviewee 6, key design aspects associated with healthy buildings include: -Daylight access and spatial orientation; -Acoustic quality, identified as the most persistent challenge; -Spatial clarity and circulation, essential for reducing stress and improving collaboration; - Variety of spatial types, accommodating different user needs; -Environmental and landscape integration, particularly in healthcare settings; -Social

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interaction and encounters, as drivers of well-being. Interviewee 7 mentions ventilation, daylight, relaxation, and greenery, both outside and inside the building. Interviewee 8 emphasizes room climate, natural ventilation, changing temperature zones, the ability to open windows, and occupant control. Interviewee 9 mentions daylight, suitable materials, heat protection, cold protection, general comfort, and coziness. Besides the already mentioned indoor air quality and use of colors, Interviewee 10 emphasizes use of non-toxic materials (e.g. paint, interior elements), and the presence of plants.

2.3. Applying Healthy Building Principles in Practice

How do you or your organization currently incorporate this definition into your workplace and projects?

When it comes to incorporating what interviewees define as healthy buildings into their workplace and projects, there seem to be common drivers of integrating the definition into practice: certification and regulation. For residential assets, Interviewee 2 mentions the use of Besluit bouwwerken leefomgeving (Bbl, former bouwbesluit), which is the minimum standard for buildings in the Netherlands (Rijksoverheid.nl, 2025). Moreover, Interviewee 2 emphasizes that their organization goes a step further: "We add on top of the bouwbesluit an additional document that makes our buildings a little bit better than bouwbesluit." Similarly, Interviewee 1 mentions the use of GPR for residential assets, where a score of 6 on a 10-point GPR scale coincides with the minimum building standard, bouwbesluit (BouwAdviesNL, 2019). On the other hand, BREEAM is used for commercial real estate, where health is embedded as one component within the certification framework (Interviewees 1 and 3). Interviewee 7 also incorporates healthy buildings mainly through certification practice, especially BREEAM. Their work is primarily focused on certification, standards, and planning. Furthermore, Interviewee 3 says that, "we encourage designers, architects and consultants to adopt a process of thinking BREEAM." Therefore, the goal is not necessarily to obtain the points that will give the certificate; rather, it is to change how they approach building design and management. This line of thought is copied by Interviewee 6, who observes that systems such as BREEAM and WELL are valuable for raising awareness but not as definitive benchmarks of building quality. Interviewee 4, given his role as a supplier, foremost wants to provide what is asked for. However, in an advisory role, guidance can be given, e.g., to assure higher ventilation rates. For Interviewee 5, as a design consultant, the clients' wishes are most important. However, a client rarely knows what exactly constitutes a "good [red. healthy] building." Through so-called ambition workshops early in the process, the discussion is started on what the client actually wants, also with respect to health. Interviewee 8 incorporates the topic mainly through architectural education, research, and health-related design projects, including elderly housing, care homes, clinics, and disability-related housing. Interviewee 9 describes a more project-based approach, especially through renovation, technical infrastructure, and the redevelopment of existing bank and mixed-use buildings. Interviewee 10 explains that their organization applies the definition indirectly through related principles, such as sustainability and occupant comfort.

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What factors currently hamper the development or implementation of healthier buildings in your workplace and projects?

The main issue, stated by Interviewee 5, is that in current practice 'health' is not regarded as a mandatory issue, but more as an 'extra'. For specific sectors such as healthcare and high-tech industry, according to Interviewee 6, health already is considered as important, also in terms of productivity support and reduction of absenteeism. Currently, challenges are costs associated with health-related standards such as WELL certification, apart from the fact that they do not always align with practical project realities and depend on subjective interpretation by assessors, according to Interviewee 6. Interviewee 7 also identifies cost as a central barrier, especially when clients are only willing to pursue certification if it is financially supported, for example through subsidies. Nevertheless, Interviewee 5 states that a healthy building without such certification doesn't necessarily need to cost much more. Furthermore, integrating new standards within existing buildings is less straightforward, and there is unfamiliarity among potential clients with modern building design requirements. From a building development and renovation perspective, due to a limited budget, there is a trade-off between healthy building aspects and other project requirements such as aesthetics, sustainability, and functional demands. As Interviewee 5 notes, a link between construction costs and future personnel costs is not yet made (e.g., absenteeism due to the indoor environmental quality is not yet put in the equation). Moreover, Interviewee 3 notes that this is especially the case with old buildings, "We got some buildings which are 60 years old, which have been renovated every 20 or 25 years. But we know that the HVAC systems, the thermal insulation, do not allow us to proceed to the highest level of a healthy environment." Interviewee 9 similarly describes existing buildings as a limiting factor, since healthy and sustainable measures can be considered during renovation but cannot always be fully implemented due to technical and financial constraints.

On the other hand, developers might not be familiar with all the BREEAM requirements, which causes delays and additional costs (Interviewee 1). Furthermore, once the building is developed, the tenants might use the building sub-optimally. Some ventilation systems are not designed to work appropriately when the windows are open. However, when it gets hot, the tenants open the windows, which increases the temperature even more (Interviewee 2). Similarly, people might want to open the shades to have natural sunlight and a view of the outside environment even though this behavior increases the inside temperature, which could negatively impact their health due to overheating of the space. Therefore, Interviewee 2 argues that there is a need for innovation that tolerates real-world user behavior. Along these lines, Interviewee 5 argues the need for better explaining how a building works to its users. The building may be well designed, but actual use largely determines its performance. Commissioning of the building systems is an important parameter and, in reality, is at the 'just below the complaint level', hampering optimal (healthy) performance. Monitoring, surveys and aftercare are means to ensure that the building delivers what is promised. These tools also will help overcome resistance by new users of buildings, as they often exhibit resistance to new working environments, particularly due to perceived loss of control. They furthermore tend to focus on practical issues such as insufficient storage space and acoustic discomfort at reception areas and in open spaces (Interviewee 6). Interviewee 8 also points to institutional routines and assumptions about hygiene, practicality, and workflows as barriers, particularly in care-related and healthcare-related buildings.

Lastly, the current regulation mainly focuses on energy efficiency with a limited focus on the healthy indoor environment. In line with these remarks, Interviewee 4 notes that in his experience health comes into play indirectly, arising from complaints or operational issues, which then inform improvements in system design (e.g., quieter air handling units, optimized duct systems). A critical design principle is system integration (e.g., misalignment between ventilation systems and duct design often leads to problems such as noise, draught, or insufficient airflow). In addition to these notions, Interviewee 4 addresses several issues that reflect current practice (for ventilation) as it comes to healthier buildings: Costs are a main driver, and seem the single incentive for design decisions unless explicitly requested by the client; Legislation is not up-to-date to acknowledge the importance of good indoor air quality (red. IEQ, health in general). Interviewee 9 adds that healthy buildings are still less familiar and less structured than sustainability, making the concept difficult to communicate or "sell" in practice. Overall, Interviewee 10 provides concise answers that address many barriers raised by others, including financial constraints, knowledge gaps, and a lack of opportunities to redesign existing buildings.

Do you feel that you have access to sufficient information, tools, or institutional support to address these challenges?

On the one hand, Interviewee 3 believes they are well informed due to internal experts and access to consultants. In addition, they feel that they have access to institutional support as a result of a strong network with Dutch universities and national ministries. Similarly, Interviewee 2 finds that the current tools used in practice, such as BREEAM, provide clear guidance, and that internal KPI's help structure and address expectations and challenges. On the other hand, Interviewee 2 feels that there is a lack of regulatory guidance on healthy indoor environments and that there are limited solutions when it comes to balancing between intended design and real-world usability. Interviewee 4 concurs with the previous remark, while also promoting existing (Dutch) instruments such as the Program of Requirements suite and the indoor climate certification system. Interviewee 5 is a design consultant and is aware of the possibilities. It is the future user (client) that needs to be informed, stating the health-related requirements wanted and educating them on how to use the building best. From a regulatory point of view, Interviewee 5 argues for more explicit health-related regulations, similar to sustainability. In the same line, subsidies or other incentives for healthy buildings should be developed. A focus on health outcomes is also advocated by Interviewee 6. Certification systems are not the way ahead. Interviewee 7 refers to existing certification frameworks as useful tools, but also stresses that ambitions need to be clear from the beginning of a project. Interviewee 8 mentions the need for more convincing reference projects, data on long-term benefits, and stronger collaboration between architecture, medicine, and related fields. Interviewee 9 emphasizes clearer communication, more tangible examples, and simple, target-group-specific resources for practitioners and decision-makers. On the contrary, Interviewee 10 feels well-supported when new buildings are planned as specialists are involved, and the organization prioritizes long-term sustainability over short-term cost savings.

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How do you balance or navigate trade-offs between occupant health/well-being and other design or operational priorities such as energy efficiency, safety, or cost? And what trade-offs do you encounter?

When it comes to balancing and navigating trade-offs between occupant health/well-being and other design or operational priorities such as energy efficiency, safety, or cost, there seems to be a consensus among interviewees that there is no clear guideline. As Interviewee 3 acknowledges, "There is no formula which tells us, okay, in this case, you have to invest in more ventilation." Moreover, while BREEAM helps structure trade-offs, the final decision relies on professional judgment, which might vary by project and stakeholder requirements. In addition, decisions are made based on experience and constant updates to internal standards (Interviewee 2). Nevertheless, in the end, costs and energy efficiency take precedence over other aspects (Interviewees 1 and 2), though other aspects might be prioritized depending on the project requirements (Interviewee 3). For Interviewee 4, the trade-off is with the client, but guidance can be given to aim for better performance levels than regulatory requirements, and the integrated design process supports the development of good and working design solutions. Also, Interviewee 5 leaves the decision to the client. However, by providing the client with more information on the interaction between the indoor environment and health, governmental incentives, and so on, they can make a more informed decision. For Interviewee 6, given the building sector he is active in, there is already a sound awareness about the potential of a healthy building, though sustainability is still recognized as an important topic. One may conclude that they go hand in hand. Interviewee 7 similarly describes certification as a way to structure higher performance ambitions, for example by going beyond the Dutch building decree for aspects such as ventilation. However, implementation still depends strongly on whether clients are willing to pay for these measures or can justify them through subsidies. Interviewee 8 points to trade-offs that are specific to care and healthcare-related buildings, where hygiene, workflows, short distances, and cost pressure often dominate design decisions. In this context, architectural quality and user well-being may be treated as secondary to functional and operational requirements. Interviewee 9 describes trade-offs mainly in the context of renovation and existing buildings. Here, healthy and sustainable solutions are considered only where possible, because technical limitations, building age, and increased construction costs restrict what can be implemented. Similar to others, Interviewee 10 shares the view that navigating trade-offs is complex. Nevertheless, they emphasize that safety is always the top priority and that cost considerations also play a major role, especially during procurement and design phases.

From your perspective, what have been (if at all) the financial costs or benefits of implementing healthy building features?

The interviewees acknowledge that financial costs and benefits of healthy building features are difficult to quantify. The investors (Interviewee 1 and 2) in our sample also report that there is no direct financial benefit to the value of the building as a result of healthy building features. Furthermore, it is more costly to develop a healthy building as more expensive systems and features need to be implemented, which increase the investment cost without increasing the value of the property. Therefore, the investment in healthy buildings is driven by other factors and not financial return, as supported by Interviewee 1's claims, "It is more

our own motivation that we want or our investors want to have a healthy building. Otherwise, it would not pay off to have a healthy building versus a not healthy building." Similarly, Interviewee 7 describes healthier or more sustainable measures as financially difficult when they go beyond minimum requirements, for example when higher standards increase costs. In this case, subsidies can make certification-related measures more feasible. Nevertheless, Interviewee 3 recognizes that healthy buildings might improve mental health, concentration, productivity, and increase the reputation and quality of the institution, which are real benefits that are difficult to quantify financially. Interviewee 8 also refers to benefits such as reduced stress, better care conditions in health care facilities, and improved quality of life, but does not frame these as directly measurable financial returns. On the other hand, as an example, Interviewee 4 mentions that relatively modest additional investments (e.g., ~10%) can yield substantial benefits (e.g., up to 30% energy savings, up to 30% noise reduction). According to Interviewee 5, as stated earlier, a healthy building without certification does not necessarily have to be more expensive. This is certainly the case if the financial experts/clients realize that 90% of organizational costs are personnel costs, compared to 1% energy costs. So, investing in health creates real value through productivity gains and reduced absenteeism. This means that, where possible, investment budgets (construction costs) should be linked with returns (HR and facilities). Interviewee 6 states that healthy buildings support productivity and reduce absenteeism, thereby generating significant economic benefits. Conversely, interviewee 10 finds it difficult to quantify the financial impact of healthy building features. However, they mention that improved building quality has contributed to increased student enrolment.

2.4. Occupant Experience and Outcomes of Healthy Buildings

To what extent do you think that the building environment affects occupant (e.g., employee/tenant) comfort, satisfaction, well-being, health, and productivity?

With regard to tenant comfort, satisfaction, well-being, and productivity, across all interviews there is agreement that the built environment affects these outcomes. Interviewee 3 argues that as soon as you enter the building, the indoor environment is the first thing you notice and that it starts to affect you, "just by entering the building and feeling there is some kind of damp indoor air, a lot of noise, a lack of outside view, that is really the first impression you get in a building, which affects you." Moreover, the institution gets a lot of positive remarks due to the use of wood in a lot of their materials, which also emits a pleasant odor to the occupants (Interviewee 3). Interviewee 8 also emphasizes the influence of buildings on stress, orientation, self-determination, healing, and quality of life, particularly for older adults and people with disabilities. Similarly, Interviewee 10 believes that building environments significantly influence comfort, satisfaction, and well-being, and notes that in older buildings, hard materials create echo and noise, whereas newer buildings use damping materials that make them more pleasant. Interviewee 9 describes the effect of buildings as partly unconscious, noting that people may feel better in a well-designed building even if they cannot fully explain why.

On the contrary, Interviewee 2 recognizes that overheating is the major source of complaints in the buildings they lease and that this affects tenant satisfaction scores. Nevertheless, due

to housing shortages, this does not affect occupancy rates, and the dissatisfaction only has a qualitative effect and not a financial one. Other organizations, while aware of the potential impact on health, satisfaction, and well-being, do not measure these outcomes as they rent out buildings and do not directly communicate with the tenant (Interviewee 1). Similarly, Interviewee 7 recognizes the relevance of comfort, well-being, and productivity, but does not describe outcome measurement as part of everyday consultancy practice. Interviewee 5 indicates that their company measures satisfaction through surveys and questionnaires, supplemented with monitoring of the indoor climate. Interviewee 4 assumes that people might adapt to unfavorable conditions, not knowing that a condition may be much better. Directly referring to the problem of draught, noise, etc. helps in creating awareness.

To what extent can occupants control their own indoor environment (e.g., lighting, temperature, privacy)?

In general, common areas, such as lecture halls (Interviewee 3), older buildings (Interviewee 3), and fixed systems (Interviewee 1), allow for less or no control to occupants. However, individual spaces, for instance, residential homes (Interviewee 2), and newer offices (Interviewee 3), allow for full or limited control of temperature, blinds, indoor lighting, and ventilation. Interviewee 7 also describes occupant control over heating, cooling, and ventilation as important, especially because centralized systems in older buildings can reduce usability and comfort. Interviewee 8 strongly emphasizes the ability to open windows and regulate one's surroundings. Interviewee 9 also notes that users may still want operable windows even when measurements indicate acceptable indoor conditions. Nevertheless, more control does not always lead to better outcomes, as occupants often misuse the autonomy and disrupt the main climate system, and that increases complaints (Interviewee 1). Moreover, Interviewee 2 gives an example: "if you have a really hot day and you open up the windows and doors, which is a very natural response, but you are letting all the warmth inside the house." Therefore, the interviewee argues that there should be ongoing education of tenants on how to properly use the newer systems. Interviewee 1 says that they get more complaints on indoor climate in buildings that allow for individual control than for those that are regulated by a central system. Overall, there seems to be a trade-off between individual control and centrally managed systems. While the autonomy might increase satisfaction, due to a lack of knowledge, it could produce an unpleasant indoor environment, which in turn reduces comfort and well-being. While Interviewee 5 does not address a single building, in their design they aim for sufficient flexibility and control options (such as operable windows or adjustable thermostats). These come with the remarks that a clear explanation should be given of its operation, it should be well maintained, and, especially in offices, it should be taken into account when changing the floor plan. Interviewee 6 implicitly refers to control options by stressing the importance of accommodating different user needs. Similarly, Interviewee 10 emphasizes that autonomy is considered essential for well-being and that individual spaces offer control over external shutters and the ability to adjust room temperature by 1-2°C.

What methods or indicators do you find most useful for understanding occupant experience and outcomes? To what extent do you currently track or assess these human-centered outcomes among occupants? Do you gather occupant feedback over time, and if so, in what way?

The methods used to understand and track occupant experience could broadly be categorized into satisfaction surveys and direct compliments and complaints. The surveys are conducted annually, where climate satisfaction is one of the survey items (Interviewee 1). The occupants can rate their satisfaction on different topics on a ten-point scale as well as provide qualitative comments and feedback (Interviewee 2). Moreover, Interviewee 2 says that there is an increase in complaints, which he believes is the result of the change in the climate of the Netherlands: "In the last few years you can see an increase in dissatisfaction about the indoor environment, and it is, I think, mainly because it is getting a lot warmer in the Netherlands compared to a few years ago." Besides surveys, the occupants report issues through property managers (Interviewee 2) and helpdesk notifications (Interviewee 3). In addition to surveys, monitoring and aftercare should be considered according to Interviewee 5. It is not only about installing good technology, but also ensuring proper use and actively involving users and creating awareness. Also, Interviewee 6 shares that post-occupancy evaluations are conducted. However, he notes that he lacks a standardized methodology for measuring user experience in its full meaning. In practice, such evaluations depend on budget, client requirements, and building type. Interviewee 7 similarly does not describe systematic tracking of human-centered outcomes in daily practice. Interviewee 8 mentions possible indicators such as sleep, blood pressure, stress or nervousness, medication use, and orientation, but also notes that these are not yet routinely integrated into architectural practice. Interviewee 9 mainly refers to informal feedback, user reactions, complaints, and direct dialogue about whether spaces feel comfortable and function well. Interviewee 10, besides surveys on occupant comfort, also mentions grading of building-related aspects, which help track performance.

Do you act upon occupant feedback and the outcomes you measured over time, and if yes, how? Can you provide an example of a specific change that was implemented based on this kind of input?

Acting upon occupant feedback and measured outcomes is a part of the interviewees' organizations' agenda to improve the satisfaction of the occupants. The approach differs depending on the severity of the issue and the organization's ability to resolve it (Interviewee 3). For example, a complaint about the lighting is often caused by broken light bulbs, which can easily be resolved. While other issues might require external support, as Interviewee 3 gives an example: "If you get some marks about, well, let's talk again about thermal comfort, then it's always not quite sure what the issue is. So if we get a remark in that category, then it's automatically transferred to our contractor." Furthermore, some issues are forwarded to the property manager of the specific building for action (Interviewee 1), or property managers contact tenants with low scores to understand their issues (Interviewee 2). Interviewee 1 mentions how action was taken, "We do have one building, one senior living building where we are on the top floor. We had a lot of complaints about it, and there are some air conditioners installed up there." However, there are cases where the organization cannot resolve issues due to other factors taking precedence. During the energy crisis,

temperatures were lowered by 1°C campus-wide, leading to an increase in thermal discomfort complaints (Interviewee 3). Overall, these examples show a willingness to invest in comfort improvements when issues persist. Interviewee 6 notes that sometimes problems can only be solved when the building is in use, after occupancy, as they then can be more accurately assessed and dedicated interventions appliedInterviewees 9 and 10 also describe feedback as something that can lead to practical technical adjustments, particularly regarding indoor climate settings. Interviewee 8 gives the example of wooden flooring in a care setting, where initial concerns about hygiene and maintenance were overcome in the implemented design.

2.5. Reflection and Future Outlook

Looking back, what lessons have you learned from your experience with healthy building initiatives or projects?

The interviews provide a diverse set of lessons learned from the interviewees' experience with healthy building initiatives and projects. Interviewee 1 emphasizes that tenant preferences drive demand for healthy buildings. If tenants want healthier environments, they are willing to pay for them. Otherwise, they will not value or financially support such features. Furthermore, Interviewee 2 stresses the importance of continuous tenant education. Buildings, tenants, and climate conditions change over time, so communication must be ongoing, which will, in the end, improve indoor comfort and reduce misuse of systems. Moreover, Interviewee 3 believes that investing in healthy buildings pays off broadly, even if not financially quantifiable. Healthy buildings enhance the overall quality of the campus through positive user feedback and stable indoor climate. In addition, they support the university's societal mission and give external recognition through awards. Having a different background, Interviewee 4 notes that a significant gap remains between theoretical best practices and real-world implementation. This gap is mainly driven by regulatory, economic, and awareness-related barriers. Interviewee 5 takes the user (client) as the pivotal parameter in creating healthy buildings. Early involvement is essential, setting health ambitions from the outset and onwards. User education is indispensable, as many are unaware of what possibilities a building can offer in terms of a good and healthy indoor environment. Finally, user feedback is important in keeping a building healthy. But complaints alone provide insufficient insight; systematic monitoring and aftercare are needed. Key insights from Interviewee 6 are that: - Buildings and users are inherently complex systems, with strong interdependencies between climate, lighting, acoustics, and work processes; - Indoor climate systems remain difficult to optimize in practice; - Architects must proactively integrate qualitative improvements ("hidden qualities") that are not explicitly requested; - Clients tend to focus more on problems than on successes; and - Cultural context strongly influences building performance; solutions are not universally transferable. Interviewee 7 adds that clear ambitions need to be established from the start of a project and that clients need to understand what is required to achieve healthier buildings. Interviewee 8 emphasizes the need for stronger reference projects, long-term evidence, and interdisciplinary collaboration. Interviewee 9 highlights the importance of clearer communication and more tangible examples, because healthy buildings are still less familiar in practice than sustainability. Lastly,

Interviewee 10 emphasizes that buildings are built for the people who will use them and that their considerations are essential to avoid overdesign.

Finally, what would you recommend to policymakers, designers, financial specialists or building owners who want to promote healthier indoor environments more effectively?

Overall, the interviewees' call to action is to policymakers, designers, and building owners who want to promote healthier indoor environments. There should be a stronger regulatory focus on healthy indoor environments and a better balance between practical building use and energy-focused innovation (Interviewee 2; Interviewee 4; Interviewee 5; Interviewee 6). Also, subsidies for healthy buildings should be considered. The existing certificates such as WELL and BREEAM could be used to introduce a market standard for healthy buildings without adding more complexity with new labels or systems (Interviewee 1). Interviewee 6 even argues for reducing the current fragmentation in standards and labels; there should be a clear and consistent regulatory framework. Alternatively, (in the Netherlands) the Program of Requirements for healthy buildings may be adopted more broadly, similar to schools. As a result, a consistent market standard would improve comparability and support financial recognition of healthy building features. Moreover, the government should lead by example and support non-profit institutions in adopting healthier building practices (Interviewee 3). In addition, regulation pushes lagging institutions to adapt, and it should also encourage or incentivize frontrunners to go beyond the legal requirements. Lastly, there should be a stronger focus by policymakers, designers, and building owners on informing and educating occupants (Interviewee 2). In the design process, according to Interviewee 4, an integrated design approach is crucial to arrive at healthy buildings. Interviewee 6 would prioritize key determinants of well-being (stress reduction, spatial clarity and circulation, acoustic performance, daylight availability). Interviewee 5 adds that we should not be designing for the 'standard person'; design with user diversity in mind. Inclusivity, neurodiversity, and aging are themes to consider. Building owners and facility managers should organize the aftercare, of which structural performance monitoring is a must to allow long-term value creation. They also should be aware of proven economic benefits of healthy buildings, especially in labor-intensive sectors (e.g., healthcare, high-tech). Initial investments are often offset by long-term operational gains (Interviewee 6). At the same time, Interview 5 notes that still more support from research is needed on interaction effects and the link between building performance and health (absenteeism). Interviewee 7 recommends using existing certification systems such as BREEAM, GPR, and WELL more actively to promote healthy and sustainable buildings. Interviewee 8 recommends more interdisciplinary collaboration and stronger recognition that healthy design is not only aesthetic, but also relevant for operation, care, and health. Interviewee 9 recommends clearer structuring of the topic and simple, target-group-specific resources so that practitioners and decision-makers can understand and apply the concept more easily.

3. Discussion

3.1 Concept of Healthy Buildings

Interview responses reveal two central themes in definitions of Healthy Buildings: buildings should not harm occupants' health, well-being, and safety, and they should actively promote healthy living. Interviewees emphasize subjective measures such as comfort, a pleasant and relaxing indoor environment, as well as technical criteria such as lighting, air flow, acoustics, and safety. In addition, some interviewees underscore the importance of encouraging healthy behaviors, such as stair use and spaces that promote social interaction. These perspectives frame health not only as the absence of risk (e.g., poor air quality, overheating) but also as a design that gives opportunities for positive behaviors (e.g., social interaction, use of stairs).

Many interviewees distinguish between subjective experience (comfort, feeling safe and relaxed) and more objective, professional frameworks associated with building physics and certification systems such as GPR, BREEAM, and WELL. In practice, in Healthy Buildings, these labels serve as proxies for quality and provide structured criteria. However, interviewees acknowledge that these systems do not fully capture the holistic, context-specific notion of health described.

3.2 Applying Healthy Building principles in practice

Applying healthy building principles in practice is largely dependent on the role of the stakeholder in the building life cycle, the client's demands, and the life cycle of the building (new construction or refurbishment). Many interviewees describe implementing healthy building principles through regulatory minimum standards or BREEAM and WELL certification design guidelines, where health is a component of the certification framework. Some organizations use certification not only to obtain a label but also to influence the mindset of designers and consultants. Others focus on delivering what clients request, though they guide and advise on aspects that can make a building better (e.g., to ensure higher ventilation rates).

Several interviewees emphasize that health is rarely treated as a mandatory requirement and that trade-offs among health, well-being, energy efficiency, and safety are usually made based on professional judgment, experience, and internal standards. Cost considerations and energy performance frequently take precedence, although project-specific ambitions may alter these priorities. Challenges are particularly pronounced for existing and older buildings, where outdated HVAC systems, poor insulation, and technical constraints restrict the feasible level of healthy environment improvements. Thus, navigating these trade-offs is a context-dependent process shaped by client expectations and the practical limitations of existing buildings and budgets.

Some interviewees express confidence in their access to expertise, institutional networks, and established tools such as BREEAM or internal KPI frameworks, which they view as providing sufficient practical guidance. Nevertheless, others highlight that the regulation should be

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more explicit on healthy indoor environments as it is with sustainability. In addition, future users must be better informed and educated on how to use buildings best. Collectively, practitioners recognize the value of existing tools and expertise but simultaneously identify systemic gaps that hinder the mainstreaming of healthy building practices.

The interviews reveal that financial considerations remain a significant barrier to a broader implementation of healthy building features. Participants consistently report that the economic benefits of these measures are difficult to quantify. Consequently, decisions to implement healthier environments are often driven by organizational values or long-term strategic objectives rather than immediate monetary returns. Several interviewees also emphasize potential financial benefits, including improved well-being, increased productivity, reduced stress, and enhanced care conditions. Although these outcomes are widely acknowledged, they are not easily incorporated into conventional cost-benefit analyses. Some interviewees suggest that aligning construction budgets with organizational outcomes, such as personnel costs or absenteeism, can shift financial viability. Lastly, subsidies and incentives could support the adoption of higher standards when these exceed regulatory requirements.

3.3 Occupant experience and outcomes

There is broad agreement that the built environment plays a meaningful role in shaping comfort, satisfaction, well being, and productivity. The influence of buildings is also seen as extending to stress, orientation, autonomy, and overall quality of life, particularly for vulnerable groups. At the same time, dissatisfaction often emerges around issues such as overheating and noise. Some organizations do not systematically measure comfort or well being outcomes, especially when they do not interact directly with tenants. Others rely on surveys, indoor climate monitoring, and direct feedback from occupants. While occupant experience is acknowledged as important, systematic tracking is still limited and varies widely across organizations. Nevertheless, organizations show a clear intention to act on occupant feedback, though the extent and speed of action depend on the nature of the issue and the resources available. Examples show that persistent issues can lead to tangible interventions. At the same time, external factors can constrain what organizations can do. Several participants emphasize that some problems only become apparent after occupancy, making post occupancy adjustments essential to improving comfort.

Across the interviews, a clear pattern emerges regarding the role of occupant control in shaping comfort and indoor environmental quality. Common areas and older buildings offer limited or no user control, whereas newer offices and residential settings provide more options for adjusting temperature, lighting, or ventilation. However, greater autonomy does not always lead to better outcomes. Some organizations report more complaints in buildings with individual control than in those with centralized regulation, as users may unintentionally disrupt smart building systems, resulting in discomfort, inefficiency, and increased complaints. Organizations increasingly aim to provide flexible control options, but these must be accompanied by proper education, maintenance, and consideration of changing layouts.

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3.4 Reflection and future outlook

Interviewees emphasize the importance of integrating health considerations early in the design process, organizing “ambition workshops” with clients to clarify expectations for healthy buildings, and fostering interdisciplinary collaboration among architects, engineers, managers, and users. Several participants view certification and labels primarily as tools for raising awareness and establishing a common language, rather than as definitive measures of building quality. Recommendations for policymakers, designers, and financial actors include strengthening regulatory baselines, aligning standards more closely with practical realities, and creating incentives or support mechanisms to make investment in health-promoting features financially attractive.

Looking forward, interviewees call for improved information, tools, and institutional support to address current barriers, including clearer guidance on affordable healthy design choices, more nuanced strategies for upgrading existing building stock, and enhanced collaboration across sectors. There is also an implicit demand for frameworks that integrate Healthy Buildings with broader agendas such as ESG reporting, energy transition, and aging population, positioning health as a core pillar rather than an optional addition.

4. Limitations

The semi-structured interview approach provides nuanced insights into professional perspectives on Healthy Buildings. However, it also presents limitations that should inform interpretation of the results. First, the sample is small and consists of knowledgeable stakeholders with prior engagement in health and sustainability topics. Therefore, the findings are not generalizable to all practitioners, nor to tenants or other end-users whose perspectives are not directly represented. Second, the use of online recorded interviews conducted via Teams may have limited the depth of discussion in some areas. Third, selection of participants through existing partner networks and based on interviewees' willingness to participate introduced selection bias. Lastly, although recordings were summarized using Copilot and subsequently reviewed by interviewers, the use of AI-assisted summarization introduced an interpretive layer that may have influenced which statements were emphasized.

5. Conclusion

The interviews indicate that the concept of Healthy Buildings has evolved beyond technical requirements and is increasingly understood in a holistic manner that encompasses physical, mental, and social dimensions of health. Practitioners recognize that indoor climate, acoustics, spatial clarity, accessibility, and opportunities for social interaction affect occupant comfort, well-being, and productivity. However, in everyday practice, regulatory requirements and certification systems mainly focus on the technical aspects of buildings.

The results identify several priorities for policy and practice. First, establishing health as an explicit, non-negotiable design and management objective would help shift it from being an added benefit to a core performance indicator. Achieving this goal may require revisiting building regulations, aligning certification criteria more closely with operational realities, and developing research that links investment in healthy features to long-term gains in productivity, absenteeism, and health in general. Second, there is a need to develop more sophisticated measurement systems for occupant experience and outcomes, integrating surveys, sensor data, and feedback mechanisms into continuous improvement processes so that health-related interventions can be evaluated over time. Third, enhanced support for upgrading existing buildings where technical and financial constraints are most significant is essential if Healthy Buildings is to become a systemic property of the built environment rather than a feature of new projects. Finally, it is recommended that stakeholders in the built environment receive education on contemporary healthy building practices and that building users are informed about how to manage existing systems to enhance health outcomes.

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Appendix: Interview Guide

Introduction

Thank you for taking the time to participate in this interview on **"Healthy Buildings"**.
The aim of this conversation is to better understand how workplace professionals define, interpret, and apply this concept in practice, what challenges they face, and how they perceive its outcomes and future development.
The interview will take approximately 45 minutes. Your responses will be treated confidentially and used for research purposes and project communication only. There are no right or wrong answers, as we are interested in your personal experiences and perspectives.

1. Background and Context

Goal: Understand the interviewee's professional background, role, and connection to the Healthy Buildings topic.

1. Could you briefly describe your current role and main responsibilities?
2. How many years have you been active in this field or related industries?
3. How does your work relate to the design, management, or use of buildings?
4. What types of buildings or projects are you mainly involved in?
5. Who are your main stakeholders or users when it comes to building design and operation?
6. How familiar are you with the concept of Healthy Buildings?

2. Concept of Healthy Buildings

Goal: Establish how the interviewee defines and conceptualizes "Healthy Buildings."

1. To start off, how would you personally define the term "Healthy Buildings"?
2. When you think about "healthy" aspects of buildings, what aspects come to mind?

3. Applying Healthy Building Principles in Practice

Goal: Explore how the concept is operationalized and what barriers/supports exist.

1. How do you or your organization currently incorporate this definition into your workplace and projects? Definition given by the partner in question 1.1. Ask the interviewee to reflect both on their own workplace as well as building projects if the latter is applicable.
2. What factors currently hamper the development or implementation of healthier buildings in your workplace and projects? Again ask to reflect on own workplace and (building) projects if the latter is applicable.
3. Do you feel that you have access to sufficient information, tools, or institutional support to address these challenges?
4. If not, what kind of resources, knowledge, or collaboration do you think are missing?

5. How do you balance or navigate trade-offs between occupant health/well-being and other design or operational priorities such as energy efficiency, safety, or cost? And what trade-offs do you encounter.
6. Which of these aspects usually takes precedence, and why?
7. From your perspective, what have been (if at all) the financial costs or benefits of implementing healthy building features?
8. Have these investments made a positive difference? If so, in what ways?

3. Occupant Experience and Outcomes of Healthy Buildings

Goal: Explore how the building environment influences occupant experience and outcomes, and how these relationships are perceived, measured, and acted upon.

Perceptions of impact on occupants

1. To what extend do you think that the building environment affects occupant (e.g., employee/tenant) comfort, satisfaction, well-being, health, and productivity?
2. Can you provide an example where you noticed any changes in these outcomes that you believe are connected to the building environment?
3. To what extent can occupants control their own indoor environment (e.g., lighting, temperature, privacy)?
4. How does this level of control affect their comfort, satisfaction, well-being, health or productivity?

Measuring occupant experience and outcomes

1. What methods or indicators do you find most useful for understanding occupant experience and outcomes?
2. To what extent do you currently track or assess these human-centered outcomes among occupants? Do you gather occupant feedback over time and if so in what way?
3. Do you act upon occupant feedback and the outcomes you measured over time and if yes how? Can you provide an example of a specific change that was implemented based on this kind of input?

4. Reflection and Future Outlook

Goal: Encourage forward-looking and reflective insights.

1. Looking back, what lessons have you learned from your experience with healthy building initiatives or projects?
2. Finally, what would you recommend to policymakers, designers, financial specialists or building owners who want to promote healthier indoor environments more effectively?

Closing

Thank you very much for your time and valuable insights.
Before we conclude, is there anything else you would like to add that we haven't covered but that you feel is important when it comes to Healthy Buildings?

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Want to know more?

Healthy Building Movement (HBM) is an independent knowledge partner for the construction sector. We support stakeholders such as schools, housing associations, healthcare organisations, municipalities, policymakers and project developers in creating healthy, circular and energy-efficient buildings. Our focus is on healthy materials, fresh indoor air, the right light and acoustics, and on comfort and ease of use.

By combining technical knowledge with user experience, we make healthy building clear and achievable — especially for organisations that are not yet actively working on it. The Health Score offers a practical framework to assess health and wellbeing in buildings and to support better decisions from the earliest design stages.

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