

## WHITE PAPER

# Healthy Buildings: The Changing Culture of Construction

### Introduction

In October 2019, IM&M and iDAC Solutions co-hosted a roundtable at the Ritz in London to discuss the issues and opportunities around healthy building construction. The roundtable discussion was wide-ranging, covering healthy buildings from an individual, internal viewpoint to a macro perspective covering government policy, industry infrastructures and design team roles and processes. This report gives an overview of the conversation, highlighting the drivers, issues and opportunities around the changing culture of construction, alongside a definitional framing around healthy buildings and three inspirational case studies.

### What is a healthy building?

In the broadest sense, a healthy building is one that considers the impact of its environment on those spending time in it. On average, people spend 90 per cent of their time in buildings and building operations therefore represent a significant opportunity to reduce energy consumption and carbon emissions and create healthier places for people.

The building sector has been identified as one of the key sectors in need of transformation in order to achieve climate targets such as the Paris Climate Agreement to limit global warming to below two degrees centigrade. [Worldwide, buildings account for 36 per cent of global final energy use and 39 per cent of energy-related carbon dioxide emissions](#) (including upstream power generation).<sup>1</sup> The global average building energy intensity per unit of floor area therefore needs to be at least 30 per cent lower than current levels (World Green Building Council, 2018).<sup>2</sup> Set against this, the world is expected to build 230 billion square metres in new construction over the next 40 years – the equivalent of adding the city of Paris to the planet every week.<sup>3</sup> [The improvement of new and existing buildings is therefore a critical priority in tackling climate change.](#)

It is equally a health concern. With most of our time spent indoors, the buildings we occupy are therefore a crucial determinant of both physical and mental health. Unhealthy buildings even result in a distinct medical condition, known as Sick Building Syndrome (SBS). Scientific evidence on the links between buildings and health has grown substantially in recent decades, covering a wide range of potential risks including inadequate heating, ventilation and air quality, moulds, volatile organic compounds (VOCs) etc.

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<sup>1</sup> <https://www.worldgbc.org/sites/default/files/2018%20GlobalABC%20Global%20Status%20Report.pdf>

<sup>2</sup> <https://www.worldgbc.org/sites/default/files/2018%20GlobalABC%20Global%20Status%20Report.pdf>

<sup>3</sup> <https://www.env-health.org/wp-content/uploads/2018/05/Healthy-Buildings-Briefing.pdf>

Beyond simply preventing us from becoming sick, [there is also a growing body of evidence that suggests that buildings can actually enhance wellbeing and productivity](#). As people are an organisation's greatest asset (and expense), if their performance is impacted by the spaces that they occupy, this creates a direct and powerful connection between healthy buildings and the overall bottom line. In this context, even a one per cent rise in productivity could have a significant impact on organisational success. This is known as the 3/30/300 rule.<sup>4</sup>

The World Green Building Council conducted an extensive multi-disciplinary literature review that investigated a range of office design factors from indoor air quality, thermal comfort and daylighting to acoustics, interior layout, views and biophilia. The compiled research clearly demonstrated that the design of a space has a material impact on the health, wellbeing and productivity of its users.

**Some of the key evidence can be summarised as follows:**

**Indoor air quality:** This can be indicated by low concentrations of CO<sub>2</sub> and pollutants, and high ventilation rates. Research suggests that productivity improvements of 8-11 per cent are not uncommon as a result of better air quality.

**Thermal comfort:** Studies suggest that even a small level of control over thermal comfort can have an impact on productivity. Research has also found a 6 per cent fall in staff performance when a workplace is too hot and 4 per cent when too cold.

**Daylighting and lighting:** Several studies have indicated productivity gains as a result of proximity to windows, with views offering a connection to nature thought to be the most significant factor. Research also suggests that workers with proximity to a window get more sleep.

**Biophilia:** A wide body of research points to the wellbeing benefits of a biophilic approach to building design, thought to be the result of an instinctive bond to nature.

**Noise:** Research has identified up to a 66 per cent drop in performance as a result of unwanted noise distractions.

**Interior layout:** There are a wide range of interior aspects that influence wellbeing and productivity, including density and configuration of workspaces and access to breakout and social space.

**Active design:** Exercise is a guaranteed route to better health; this can be encouraged through building design and access to services and amenities such as gyms, bicycle storage or green space.

**Amenities:** Healthy offices can be viewed as those with access to public transport, safe bike routes, parking and showers and a range of healthy food choices.

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<sup>4</sup> <https://www.jll.co.uk/en/trends-and-insights/workplace/a-surprising-way-to-cut-real-estate-costs>

This evidence starts to point to a compelling business case for making healthy buildings a priority.

### **A note on Smart Buildings**

Smart buildings also need to be included in this discussion; a healthy building isn't necessarily smart, but it helps. The benefits of smart buildings are commonly viewed as falling into sustainability, productivity, talent, wellbeing, brand and cost control.<sup>5</sup>

While smart building definition is a continuing journey as the technologies develop, an academic framework around smart buildings defines them as:

'Smart Buildings are buildings which integrate and account for intelligence, enterprise, control, and materials and construction as an entire building system, with adaptability, not reactivity, at the core, in order to meet the drivers for building progression: energy and efficiency, longevity, and comfort and satisfaction. The increased amount of information available from this wider range of sources will allow these systems to become adaptable and enable a Smart Building to prepare itself for context and change over all timescales.'<sup>6</sup>

There are various ways in which this relates to smart buildings. IoT sensors provide data analytics that combine real time and predicted information, monitoring environmental aspects such as air and light, communicating with the BMS to increase fresh air or report faults. Provision of facilities such as coffee, healthy food and bathroom servicing can be targeted based on real-time utilisation and occupation density. This results in improved sustainability credentials through energy efficiency and improved environment management.

### **The Roundtable discussion**

The Roundtable event was focused on healthy buildings - what they are, the need for change, and key opportunities. [The three facets of this question that were discussed revolved around environmental sustainability, smart buildings, and spaces that are good for the people who occupy them.](#) Broadly, the group agreed that a truly healthy building requires us to look at all of these facets - and to consider them over the passage of time to ensure that a building is healthy both through construction and its entire life cycle. The questions of how we work more efficiently, source materials, lower the carbon footprint, have the building work more efficiently in the future and support the wellbeing of the people within it have to be evaluated in this context, not simply in the planning and construction.

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<sup>5</sup> <https://workplaceinsight.net/an-overdue-attempt-to-connect-smart-buildings-with-smart-people/>

<sup>6</sup> Buckman, Mayfield, Beck. 2014. 'What is a Smart Building?'. *Smart and Sustainable Built Environment*, vol. 3, 2, pp. 92-109

## The Drivers of Change

Beyond the need to reduce carbon emissions, several factors behind the drive towards healthier buildings were identified, with both financial and people-focused decision making featuring in the discussion. At a simple financial level, there are cost-saving benefits to organisations, although [the group identified a need for additional research and clearer information into the potential payback time of new technologies when persuading companies to implement them](#). In addition to the financial benefits, there is a reputational advantage; while difficult to quantify, this can be viewed as a potentially significant benefit to organisations seeking to present a positive and forward-thinking face to the world. New lease accounting terms were also seen as effecting change, with the new requirements around valuing leases over their lifetime and placing them on the balance sheet driving organisations to look more critically at their occupancy in order to reduce the balance sheet impact.

This reduction of corporate real estate portfolios was viewed as being enabled by broader changes in the way that people are working, with increasingly mobile worker populations meaning that organisational space is often under-utilised. This means that the overall need for buildings could be reduced if corporate assets are utilised more efficiently. In order to do this, organisations will need to understand how their people are working - where, when and who with. New sensor and occupancy technologies are crucial in this regard, providing increasingly granular data into patterns of movement that enable strategic real estate decisions to be made. Ultimately, the most zero carbon building is one that isn't there.

On the people-focused side, the need to attract and retain talent in a competitive global market was seen as being key, particularly given the current focus on the environmental agenda within younger generations who will be coming into the workforce. This also plays into the need to make buildings smart, as employers will need to meet high expectations around seamless connectivity and experience in order to attract the best talent. Our need to connect was viewed as a reason why mobile working won't mean doing away with corporate real estate entirely; ultimately, we need to come together at least some of the time.

Linked to the need to attract and retain, the second people-oriented driver was a shift in focus from efficiency to productivity and a resulting increase in concern for employee wellbeing. [While the dominant driver for corporate real estate has primarily been to drive down costs by focusing on efficiencies, organisations are waking up to the fact that much greater gains can be made by placing more emphasis on human factors such as enhanced wellbeing and satisfaction. While this comes at a financial cost, the potential gains that can be realised are much higher, as identified at the beginning of this report.](#)

## What is holding us back?

While change is happening, the group acknowledged that progress has not been as fast as it could be, identifying a range of inter-linked issues that included industry infrastructures and processes, education and appetite.

The most central issue was viewed as the outdated culture of construction, with too little motivation or incentivisation to change. While many sectors have started to embrace automation and the efficiencies that can be gained through technology innovation, construction was viewed as a 'last bastion' of the lack of automation and efficiency, continuing to use methods and processes that were ill-suited to the demands of a modern global economy. In some ways, it was argued to have gotten worse – after all, what building material is more sustainable than timber?

A universally acknowledged aspect of the deficiencies in existing processes in attaining smart and sustainable buildings was the lack of integration between technology-oriented disciplines and early stage design & construction experts such as architects and engineers. This lack of collaboration between different building disciplines means that modern technological solutions and even simple wireless provision were too often just an afterthought.

The whole group highlighted issues that they'd had in client projects in being brought in too late in the design process to be able to introduce any meaningful level of innovation. In some instances, teams were only selected for smart building projects after the equipment had been chosen or the floorplan completed; trying to backward engineer a smart building is difficult and likely to result in costly design changes later in the buildings lifecycle. In these cases, too many decisions had already been made, significantly limiting the potential to achieve the project aims around smart or sustainable building.

Lack of progress was therefore considered to be largely due to the continued reliance on existing infrastructures, with doubts around the extent to which the construction industry was really concerned with trying to develop new processes and technologies. The difficulty of retrofitting existing buildings – and the existence of large amounts of historic building stock, particularly in countries such as the UK – was also viewed as holding back the move towards sustainable, smart buildings as a whole, with developers and occupiers reluctant to invest in platforms or technologies that would work in their new buildings but not across the whole estate. In some cases, the group's experience was that it was impossible to meet emissions targets in existing buildings, resulting in extremely complex decisions about whether it was better to move into new buildings or continue to work within the constraints of existing stock.

The group viewed this as exacerbated by a lack of knowledge and understanding of both the issues and potential solutions among end users and clients. Even where people might want to make more sustainable decisions, there is not always a clear template for action and the complexity of the issues often leads to confusion. For example, while there has been a significant push towards electric vehicles, there are long-term questions about the sustainability of mining for the materials to produce batteries for them. It also needs to be recognised that people's knowledge and financial limits vary. The lack of wider education in the sector is fuelled by the widespread concern that new technologies will be out of date as soon as the building is complete – or even earlier – limiting a client's appetite for investing in technological innovation.

The lack of appetite to make things better was the final problem raised by the group, with the recognition that, [despite a growing trend towards productivity and wellbeing as a driver, the commercial agenda was still predominant in the absence of clearly quantifiable gains from a new approach](#). The issues around knowledge were therefore seen as being perpetuated by a lack of information sharing in the industry, with companies reluctant to openly share information even in cases where buildings performed well, concerned that they'd lose their commercial edge. This extended to a simple lack of appetite to do better - based on people's perception of the outcomes - for purely altruistic reasons, with many companies reluctant to consider making changes that they felt had predominantly negative financial impacts.

## **A Call for Action**

The discussion then moved on to a call for action around what needs to happen in order to increase the uptake and development of smart and sustainable solutions that will help make our built environment healthier. This included thinking flexibly, creating a combination of policy and demand, new roles and structures, a global approach, and making sense of rich data.

A central issue in considering sustainability was identified as the potentially short shelf-life of buildings due to the speed of technological, economic and social change. The need to design buildings that we can only hope will be 'right' in 20-25 years therefore made flexibility a critical concern for all involved. [An important aspect of this was the need for technological solutions to provide enough long-term flexibility for the use of the space to flex without having to make expensive and resource-intensive infrastructural alterations.](#)

One question that arose related to the balance between traditional cabling and reliance on wireless connectivity. Several attendees identified shifts over recent years such as reductions in the number of cabled outlets per desk, the sampling out of high-level services and reliance on enterprise networks for day to day tasks. However, a lack of research into potential issues and the need to guarantee connectivity in the event of failure or insufficiency of wireless alternatives meant an ongoing role for cabling in ensuring long-term flexibility, particularly working at scale. [Given the relatively small cost as a percentage of the total construction, flood wiring the building was seen as the best insurance in terms of minimising the impact of changing configurations in the longer term.](#) The flexibility of the physical space was viewed as something to be improved upon, with 'a long way to go' in terms of how dynamic the space could be. Being able to use built assets more efficiently in order to minimise the amount of space sitting empty would have a measurable impact on total emissions - one potential avenue of inspiration raised was 'small living' residential space, where a single room might support multiple activities through the means of simple physical transformations through the day.

In terms of driving change, there was no single answer, with [the group considering it to require shifts in both policy and demand, creating a top down and bottom up approach](#). At government level, this would require new policies and policing across the globe. In

terms of new construction, this might include enforcing sustainable procurement policies, providing incentives to use renewable energy and regulating building materials using a polluter-pays approach throughout the life cycle of a building. [From the bottom up, clients will need to build these requirements into their briefs, applying pressure to their consultant teams to meet targets. From an end user perspective, if a healthy building becomes part of broad workforce expectations about their workplace, then the drive to retain talent will incentivise organisations to make these demands.](#)

Achieving healthy buildings will require new structures and expertise within the industry, leveraged within a context of integrated design teams that can look at the flexibility and choice of services from the outset of a project, rather than trying to retrospectively rationalise decisions once the floorplate has been completed. Within these integrated teams, new roles are emerging; smart buildings in particular are generating a whole new specialism which needs to be recognised. [This requires consultants to build whole new teams to understand and provide smart buildings to their clients.](#) The kinds of roles that are emerging include Master Systems Integrators – briefly, technology consultants who make sure that all building systems are communicating properly and develop software layers responsible for the integration, aggregation and communication of the building systems. Given the speed of development, building projects which don't draw on this kind of expertise are likely to fall behind very quickly. The group also highlighted the importance of thorough research in order to understand what adds value at scale; financial and practical limitations make it impractical to try to adopt every innovation, so we need to understand what actually adds value at scale.

[While the potential of smart buildings is phenomenal, the group agreed that it can only be realised where the data collected is used intelligently.](#) With thousands of sensors and IoT objects potentially relaying information back to a data lake, distilling it to create usable outputs is critical. One aspect that would greatly simplify this process is the development of a universal language and naming convention. Currently, attendees identified that the lack of naming conventions means that each vendor, developer and engineer is figuring things out differently – BMS engineers in different rooms might call data points by different names and these names might change several times on the path to the cloud. [A common naming convention as close to the device as possible would enable data to be structured and simplified and unbound from specific technology enabling easy ongoing updates.](#) This would facilitate wider communication that allows buildings in the city to communicate much like trees in a forest. In a future in which data is open and shareable, this would allow the best performing buildings to communicate internal data and settings to others creating an unparalleled data set of best practice.

[Finally, the sharing of best practice globally to explore the transferability of new ideas and technologies was seen as an important factor in rapid innovation.](#) While it has been recognised that efforts are not universally being made, countries around the world are experimenting with new ideas that are embedded in their local context; for example, using natural foliage as an air filtration mechanism in China. Biomimicry in particular has been a rich source of inspiration for many years and, while some solutions are likely to be relatively context-specific, information-sharing on a global scale seems the surest way of dealing successfully with the challenges ahead of us. The group also brought forward the

question of raising aspirations. Most targets ask us to aim for carbon neutral; effectively, not to make anything worse. What if we could make it better?

These are not minor issues to grapple with; to realise the potential benefits of healthier buildings for both people and organisations, change will involve deep-running shifts in every aspect of the construction industry. Nevertheless, [the roundtable ended on a positive note with each participant giving a resounding 'Yes' to the question of whether change would, eventually, come.](#)

**Attendees:**

## **Supporting Documents**

**Appendix A** - Resources & References

**Appendix B** - Healthy Building Case Studies