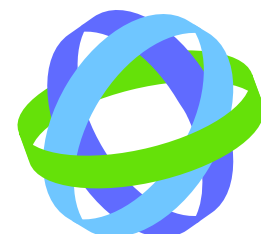


# Health, Wellbeing & Productivity in Offices

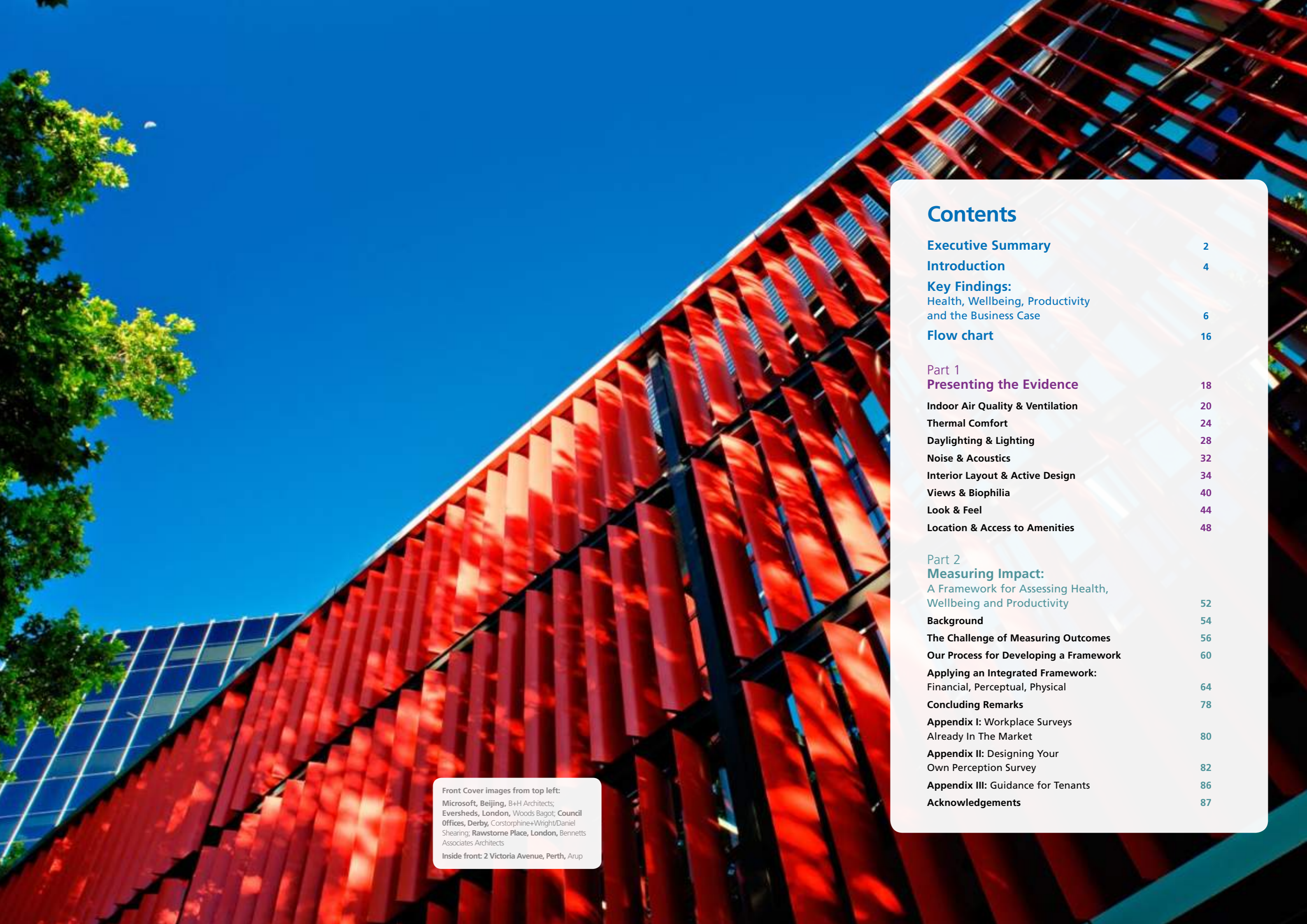
The next chapter for green building

September 2014

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## Executive Summary



Santos Headquarters, Adelaide, GBC Australia

It has long been considered the ultimate yet seemingly out of reach test of the business case for green building: if the human benefits of green building could be reliably quantified this would prove beyond all doubt the ROI for investing in building green.

After all, staff costs, including salaries and benefits, typically account for about 90% of business operating costs. Therefore what may appear a modest improvement in employee health or productivity, can have a huge financial implication for employers – one that is many times larger than any other financial savings associated with an efficiently designed and operated building.

This report does not claim to put this argument completely to rest, but it does put forward the best and latest information on the building design features that are known to have positive impacts on the health, wellbeing and productivity of office building occupants and points to financial implications where possible.

Further – and what distinguishes this report from other similar efforts – it provides a high-level framework for building owners, occupiers and their advisors to start tracking the impacts of buildings on employee health, wellbeing and productivity in order to use that information in financial decision-making.

In other words, it sets the groundwork for businesses to begin to answer this tantalizing question as to the true payback for building green.

### The relationship between office design and office users

Teams of experts from around the world were assembled to investigate a range of office design factors, from indoor air quality, thermal comfort and daylighting, to acoustics, interior layout, views and biophilia. The impacts of location and amenities were also considered.

The evidence was compiled, debated and synthesised. Overwhelmingly, research clearly demonstrates that the design of an office has a material impact on the health, wellbeing and productivity of its occupants.

While to many this may sound obvious and goes without saying, it does need saying, loud and clear, because this evidence is not yet translating at scale into design and financing decisions, certainly not in all parts of the globe.

By presenting the evidence in a clear and concise way, this report aims to build momentum and give real estate executives some of the ammunition and communications tools needed to change this.

**Staff costs, including salaries and benefits, typically account for about 90% of business operating costs.**

**This report proposes a simple, high level framework for measuring organisational outcomes and relating those back to the physical features of buildings and employee perceptions.**

### Measuring Impact: how does my building impact my people?

One of the key barriers to incorporating considerations of building impacts on occupants into business decisions has been confusion around what to measure and how.

This report proposes a simple, high level framework for measuring organisational outcomes and relating those back to the physical features of buildings and employee perceptions. Many organisations are already sitting on a treasure trove of information that, with a little sifting, could yield immediate improvement strategies for their two biggest expenses – people and places, and the relationship between the two.

By encouraging businesses to do this for themselves in their own buildings, we hope to make the business case argument personal and verifiable.

### Healthy, productive...green?

We have addressed very transparently the ways in which strategies to maximise health, wellbeing and productivity outcomes are compatible with (and even enhanced by) strategies to minimise energy and resource use. It seems there is often a 'virtuous circle' of good design that works for both people and planet, for example maximising daylight, enabling user control and designing in biodiversity.

However, there are also some contradictions and challenges as well as the win-wins, particularly in hot and humid climates. This shows the importance of ongoing product and systems innovation to increase energy efficiency and improve the experience for occupiers; and the need for the real estate sector to help drive grid decarbonisation through installation of renewables and community-scale low carbon solutions.

In any case, the report findings undeniably affirm that buildings can maximise benefits for people, and leave the planet better off as well. Low carbon, resource efficient, healthy and productive – fundamentally, this is about higher quality buildings.



AZV Erdinger Moos, Munich, Architektur Werkstatt Vallentin/Tomas Riehle

## Introduction

“We shape our buildings, and afterwards our buildings shape us”

Winston Churchill



Microsoft, Beijing, B+H Architects

### Background to the report

In 2013, WorldGBC reported on ‘The Business Case for Green Building’. One chapter, that stimulated a high degree of interest, highlighted some of the research which demonstrated that green buildings could enhance health, wellbeing and productivity for their occupants.

This is an issue that has been rising rapidly up the agenda for the global real estate market. However, that report made clear that further work was needed to translate promising academic research into information that can inform business decision-making. Amongst other findings, it suggested that despite evidence of its impact, improved indoor environmental quality has not been a priority in building design and construction, and resistance remains to incorporating it into financial decision-making.

The 2013 report also highlighted the uncertainty over which green building features or combination of features have the greatest impact on health and productivity; and noted the difficulty in turning productivity metrics into meaningful financial metrics.

### Aim of this report

This report is an attempt to build momentum on the topic of health, wellbeing and productivity. It does not set out to solve all of the challenges laid out in the 2013 report, but we hope it helps to provide a framework for doing so.

It is aimed at a mainstream, non-technical real estate audience who are rightly eager to understand the business benefits of greener, healthier buildings. It is not primarily aimed at sustainability professionals, but we hope it will be used by them in their discussions with clients, colleagues and customers.

**Part 1** summarises the relationship between features of office building design and the health, wellbeing and productivity of occupants, and assesses the extent to which strategies to maximise benefits to occupants are complementary to strategies to reduce energy and resource use.

The intention is to increase understanding in the real estate sector, of both the relationship between building and user, and the financial impact of that relationship. The extent to which ‘green building’ drives better outcomes for occupants is tackled in a very transparent and honest way, which does not shy away from highlighting the contradictions and challenges as well as the win-wins. This approach also enables us to show where additional research and further innovations in office design are required.

**Part 2** is intended to provide office owners, managers and occupiers with greater clarity on the measurement of health, wellbeing and productivity in the workplace, and the challenges and opportunities in translating outcomes into financial metrics. This includes practical suggestions on how to go about measurement in a consistent and robust way. In due course it is hoped this will lead to better, more consistent data, and more evidence to inform investment and design decisions.



AZV Erdinger Moos, Munich, Architektur Werkstatt Vallentin/Tomas Riehle

An exhaustive process of evidence gathering has been carried out.

### Process and scope

This is a complex issue, so to retain focus this report deals only with offices, and is concerned with both new and existing ones. On occasion, research is cited from non-office sectors where we think there is relevance. Similarly, the findings have resonance beyond just the office sector.

An exhaustive process of evidence gathering has been carried out, informed by a project team which was able to draw on over 50 industry and academic experts from across different disciplines, sectors and locations. Wider outreach was conducted at particular points throughout the process, including webinars that reached another 100 people, and detailed surveys of HR professionals that engaged another 25 stakeholders.

In our review of primary research, we have tried to distinguish between meta-analyses and single studies. Where we have highlighted a single study, it is because we are confident it is robust, or that it represents a larger body of work. Where a statement is presented as ‘fact’, it has not been done lightly, and every aspect of the report has been the subject of significant discussions between experts in this field.

### Terminology

The terms health, wellbeing and productivity are used to attempt to encompass a whole range of related and complex issues. Health encapsulates physical and mental health, while wellbeing hints at broader feelings or perceptions of satisfaction and happiness (although it could be said is very closely related to having positive mental health). Productivity tends to be used to refer more explicitly to business-oriented outputs, and in the research we have reviewed, it includes a number of different task performance-related metrics. However, productivity is directly affected by health and wellbeing, so delineating between the three is not easy, and not always that helpful. Typically, we have simply mirrored the vocabulary used in the research we have assessed, and therefore any very specific interpretation of the terminology comes with that caveat. The terminology is more fully explored and explained in the early chapters of Part 2, and the diagram at the end of the key findings chapter should also be helpful in gaining a broad overview.

### Brief acknowledgements

A special thanks goes to our corporate sponsors JLL, Lend Lease and Skanska.

This report has also been made possible by efforts of partner Green Building Councils, and in particular to the time dedicated by the GBC project team. All of those involved are fully credited in the acknowledgements at the end of the report.

## Key Findings: Health, Wellbeing, Productivity and the Business Case



A healthy, happy workforce is a vital component of a productive, successful business in the long-term.

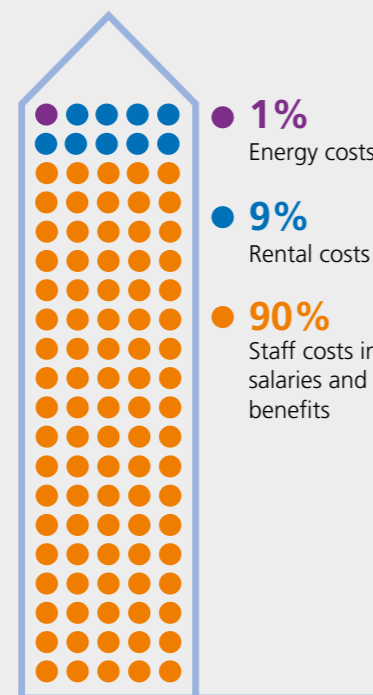
### The significance of health, wellbeing and productivity for businesses

There can hardly be anything more important than our own health and wellbeing, and that of our loved ones. For most employers meanwhile, a healthy, happy workforce is a vital component of a productive, successful business in the long-term.

Staff costs, including salaries and benefits, typically account for about 90% of a business' operating costs (as the diagram shows). It follows that the productivity of staff, or anything that impacts their ability to be productive, should be a major concern for any organisation.

Furthermore, it should be self-evident that small differences can have a large effect. What may appear a modest improvement in employee health or productivity, can have a significant financial implication for employers. This equation is at the heart of the business case for healthy, productive offices, to which we return at the end of this chapter.

#### Typical business operating costs<sup>1</sup>



#### 10% Variation

A 10% variation applied equally to each cost has a far from equal impact

**+/- 0.1%**

Energy costs

**+/- 0.9%**

Rental costs

**+/- 9.0%**

Staff costs



Angel Building, London, AHM

Costs of ill-health vary by sector and country, and are rarely comparable, but the impact is clear:

- The annual absenteeism rate in the US is 3% per employee in the private sector, and 4% in the public sector, costing employers \$2,074 and \$2,502 per employee per year respectively<sup>2</sup>
- Poor mental health specifically costs UK employers £30 billion a year through lost production, recruitment and absence<sup>3</sup>
- The aggregate cost to business of ill-health and absenteeism in Australia is estimated at \$7 billion per year, while the cost of 'presenteeism' (not fully functioning at work because of medical conditions) is estimated to be A\$26 billion<sup>4</sup>.

### Relationship between the office building and its users

It is the impact of the workplace – the office building – on the workforce, which is at the heart of this report.

There is overwhelming evidence which demonstrates that the design of an office impacts the health, wellbeing and productivity of its occupants. For many readers, that will sound so obvious it almost goes without saying. But it does need saying, loud and clear, because this evidence has not yet had a major influence on the mainstream real estate sector, and is not yet translating at scale into design, finance and leasing decisions, certainly not in all parts of the globe.

Furthermore, our understanding of the health, wellbeing and productivity implications of office design is deepening, aided by advances in technology and a growing awareness amongst a small number of enlightened developers, owners and tenants. For instance, it is increasingly clear that there is a difference between office environments that are simply not harmful – i.e. the absence of 'bad' – and environments that positively encourage health and wellbeing, and stimulate productivity.

Evidence is summarised on the following two pages, although care has to be taken to apply this in local geographical contexts. What has been clear throughout is the importance of climatic and cultural differences to design and the working environment.

**There is overwhelming evidence which demonstrates that the design of an office impacts the health, wellbeing and productivity of its occupants.**

**Key Findings: Health, Wellbeing, Productivity and the Business Case**



Elizabeth II Court, Winchester, Bennetts Associates

### Summary of evidence

**Indoor Air Quality:** The health and productivity benefits of good indoor air quality (IAQ) are well established. This can be indicated by low concentrations of CO<sub>2</sub> and pollutants, and high ventilation rates. It would be unwise to suggest that the results of individual studies, even meta-analyses, are automatically replicable for any organisation. However, with this important caveat, a comprehensive body of research can be drawn on to suggest that productivity improvements of 8-11% are not uncommon as a result of better air quality.

**Thermal comfort:** This is very closely related to IAQ, and indeed separating out the benefits is difficult. However, the relationship is clear, with research demonstrating that thermal comfort has a significant impact on workplace satisfaction. Suggesting a general rule about the size of productivity gains is not a robust exercise because of the importance of specific circumstances and the lack of comparability between studies. However, studies consistently show that even modest degrees of personal control over thermal comfort can return single digit improvements in productivity. The importance of personal control applies to other factors too, including lighting.

**Daylighting & lighting:** Good lighting is crucial for occupant satisfaction, and our understanding of the health and wellbeing benefits of light is growing all the time. It can be difficult to separate out the benefits of daylight – greater nearer a window, of course – from the benefits of views out of the window. Several studies in the last decade have estimated productivity gains as a result of proximity to windows, with experts now thinking that the views out are probably the more significant factor, particularly where the view offers a connection to nature.

**Biophilia:** The rise of biophilia, the suggestion that we have an instinctive bond to nature, is a growing theme in the research. A growing scientific understanding of biophilic design, and the positive impact of green space and nature on (particularly) mental health, has implications for those involved in office design and fit-out, developers and urban planners alike.

**Noise:** Being productive in the modern knowledge-based office is practically impossible when noise provides an unwanted distraction. This can be a major cause of dissatisfaction amongst occupants.

**Interior layout:** Noise distraction relates closely (although by no means solely) to interior layout. There are a whole range of fit-out issues that can have an effect on wellbeing and productivity, including workstation density and configuration of work space, breakout space and social space. These factors influence not just noise but concentration, collaboration, confidentiality and creativity. Many companies instinctively know this and regularly engage in exercises to optimise layout. However, the research that informs this remains less quantifiable and needs to be further developed.

**Look & feel:** The same could be said about research around office 'look and feel', which is seen as superficial by some, and yet should be taken seriously as having a potential impact on wellbeing and mindset – both for occupier and visiting clients. Look and feel (and interior layout), being highly subjective, is something which is likely to be experienced differently by people of different age, gender and culture.

**Active design & exercise:** A guaranteed route to improved health is exercise. This can be encouraged by active design within the building, and access to services and amenities such as gyms, bicycle storage and green space, some of which may be inside the office building or office grounds, or in the local vicinity. There is not a huge amount of research on the link between exercise and office-based productivity, although that which does exist suggests a lower number of sick days for those who cycle to work.

**Amenities & location:** The local availability of amenities and services are increasingly recognised in research as being important for occupiers. Childcare in particular can be the difference between working and not working on a given day, and in the relatively few studies that have tried to quantify it, the financial impact for employers has been significant.

## Key Findings: Health, Wellbeing, Productivity and the Business Case



## We may need to move beyond green, to sustainable buildings.

### Healthy, productive...green?

The evidence summarised above (covered in more detail in the full report), spans a large range of factors associated with an office's physical environment. It has suggested a strong causal relationship between design and occupant health, wellbeing and productivity, without so far mentioning 'green building'.

There are reputable, robust studies that suggest the green design features of buildings lead to healthier, more productive occupants. Often, 'green' equates to a feature which enables low carbon or energy efficient operation of the building such as daylighting or natural ventilation. Indeed, in many cases there does seem to be a virtuous circle of good design that works for both people and planet.

However, it is far too simplistic – and potentially damaging – to suggest that low carbon and resource efficient buildings are automatically healthier and more productive for occupants, and we need to be honest about that. There are plenty of win-wins (for people and planet) and there are some tensions. A few of both are highlighted below.

**Users in control:** Putting trust in the occupier and putting them at the centre of design, including personal control over their indoor environment, can reap rewards in terms of satisfaction, productivity and energy performance. This encourages users to work with the grain of their building and vice versa. There is also evidence that occupants are more forgiving and willing to work in a greater range of temperatures in a 'green building'.

**Maximising daylight:** This is not without challenges (solar gain, glare etc) but daylight has the potential to provide the necessary light levels for a productive, stimulating environment, while reducing reliance on electric lighting. This just cannot be done in offices with a very deep floor plate, which is a challenge to the status quo in many markets. However, electricity use for some lighting is inevitable, and further innovations in low carbon lighting design will be crucial.

**Passive design...up to a point:** Where the benefits of fresh air and good thermal comfort can be provided by natural ventilation and passive design (or mixed mode systems), there is a clear win-win for occupier and energy use. In many regions of the world, there is probably scope for passive techniques to be used more frequently than at present. However, we have to recognise that in some climates, high outside temperature (both in the day and at night) and humidity simply make some conditioning of air inevitable.



1 Silo, Cape Town, Arup/Michael Groenewald & Allan Gray

There are insights to be gained from this analysis, particularly in respect of lighting, air quality and thermal comfort:

1. Ongoing product and systems innovation is crucial to both increasing energy efficiency and improving the experience for occupiers. This appears to be happening apace but could be further driven by clients.
2. The real estate sector needs to better engage in the process of grid decarbonisation and community-scale low and zero carbon solutions. This includes the need to embrace appropriate on and near-site renewables, which are becoming more efficient and more cost-effective and yet are still viewed by some in the industry as undesirable or a diversion.

What drives green building – conducive to healthy, productive occupiers – is quite simple:

1. Good design (such as passive solutions, shading, and natural ventilation where possible).
2. Good construction (new technologies, innovation, smart controls).
3. Good behaviour (appropriate clothing, adaptability and engagement with systems).
4. Good location (enabling low carbon commuting and easy access to services and amenities).

Green building is now a truly global movement, and, partly through the use of green building rating tools, is helping to drive change in markets all around the world, increasing demand for low carbon, resource-efficient building products and services. However, it could be argued that green building professionals and advocates – i.e. we, ourselves – have not been as attentive to the needs of building occupants as we should have. Symptomatic is the development of most green building rating tools, which started with environmental impacts (energy, water, waste etc) and have incorporated more socio-economic measures in due course – but perhaps not quickly enough.

This complex relationship between health, wellbeing, productivity and 'green building' points to a need to reinterpret – some might say rescue – the term 'green' from an association purely with the environmental movement; or we may need to move 'beyond green' to talk much more about sustainable buildings. Either way, the goal should be buildings that maximise benefits for people, and leave the planet better off as well. Low carbon, resource efficient, healthy and productive - really what we are talking about is higher quality buildings.

## Key Findings: Health, Wellbeing, Productivity and the Business Case



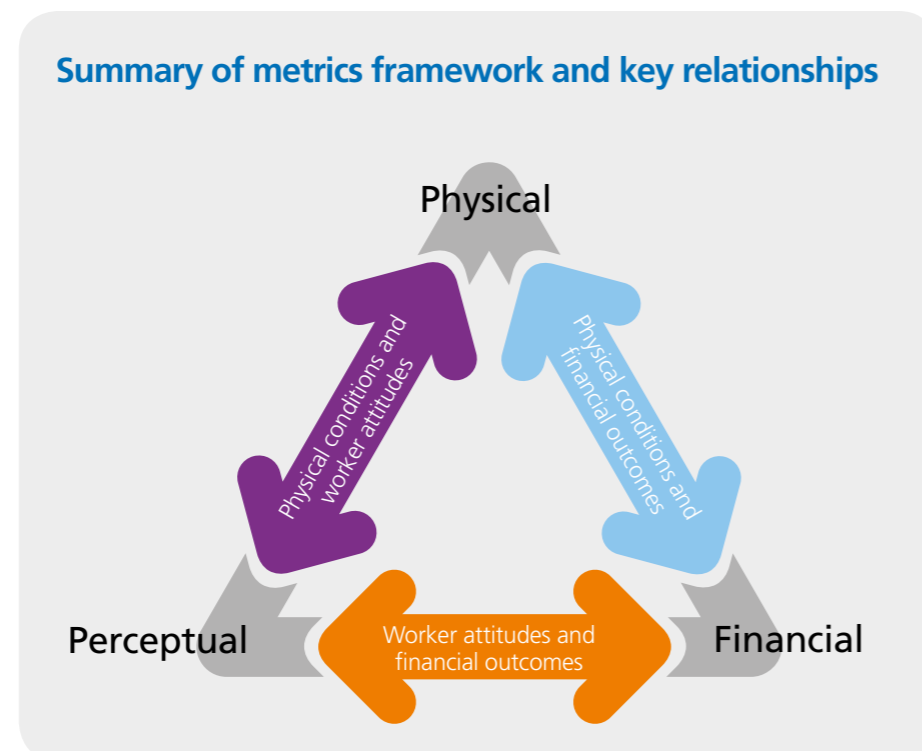
### Measuring impact: a framework for assessing health, wellbeing and productivity

There is an important difference between showing how things are related and showing how things are relevant. The question that really matters to most executives is this: How does *my* building impact *my* people?

We have proposed a way for office owners and occupiers to directly engage with this agenda, using a simple framework for measuring organisational or financial 'outcomes', perceptions of the workforce and the physical features of the office itself. As the diagram suggests, it is the relationship between these three elements that is of most interest.

A key objective in developing the framework is to set in place a process which encourages more data collection by more businesses in more common ways.

#### Summary of metrics framework and key relationships



Bournville Place, Birmingham, Cundall

#### Financial (or organisational)

1. Absenteeism: Number of days (or hours) of absence due to illness annually.
2. Staff turnover/retention: Percentage of regular, full time employees leaving employment in a given year.
3. Revenue breakdown: Revenue per division/department/team, per building/building zone, and/or per employee.
4. Medical costs: Expenses associated with providing medical insurance or medical care to employees annually.
5. Medical complaints: Incidents of reported/documented medical complaints resulting from the physical work environment or work activity.
6. Physical complaints: Number and type of complaints of physical discomfort associated with the work environment (e.g. temperature, glare, noise).

#### Perceptual

The financial or organisational metrics above are concerned with measuring objective indicators. What they can miss are important underlying attitudes about the workplace that can be harder to quantify but can have significant impacts on human performance.

An effective perception study tests a range of self-reported attitudes to gain insight into health, wellbeing and productivity in the workplace. The answers that workers provide can contain a wealth of information for improving office performance.

#### Physical

To test the premise that the physical design and operation of your office affects the health, wellbeing and productivity of office workers, you need to gather information about the physical office environment itself.

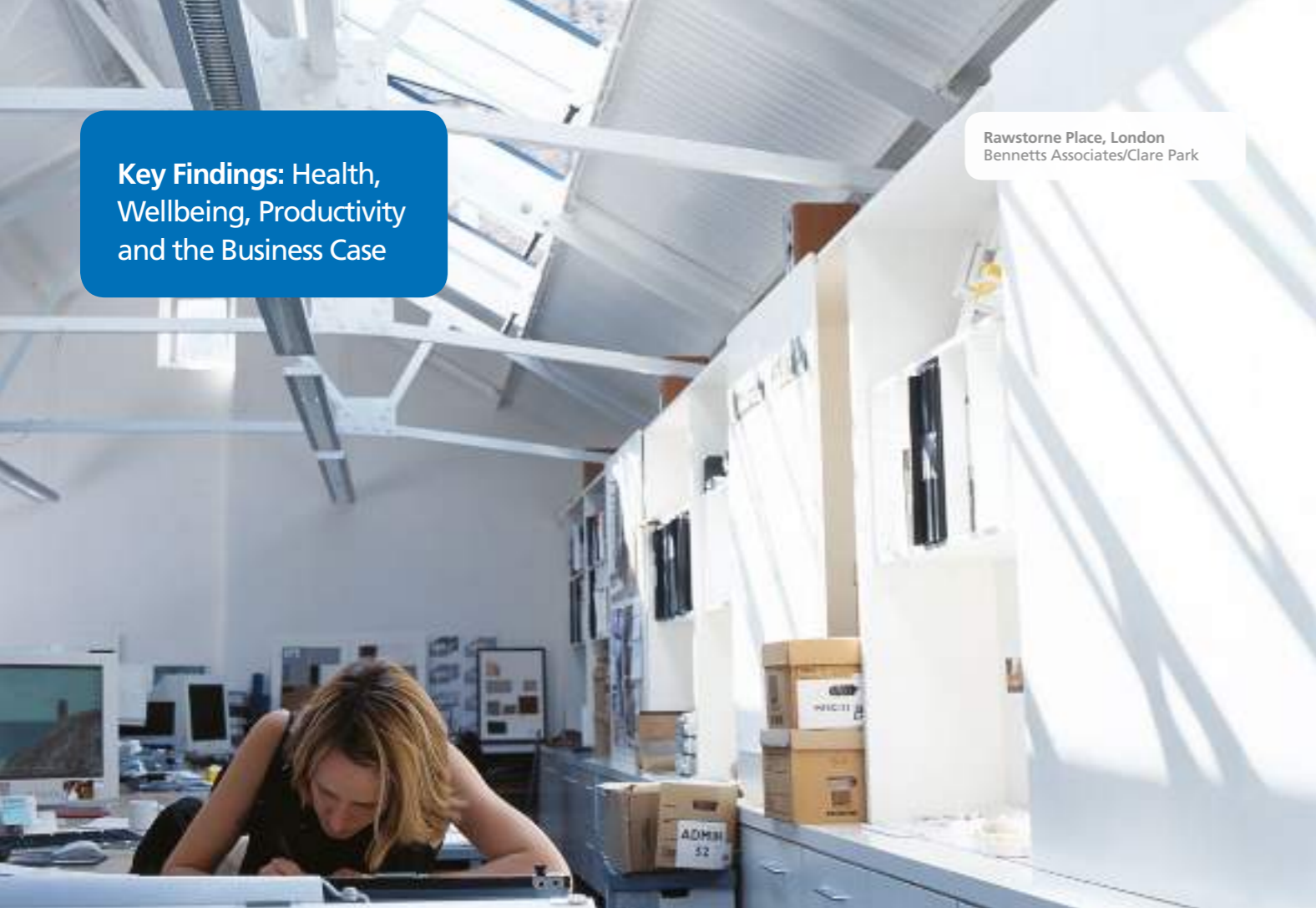
Some of this can be done with very direct measures (illuminance, pollutants or temperature for example), others are more a case of evaluation (views outside or quality of amenities, perhaps). The extent to which this can be done 'in-house' or requires external expert support varies and is changing as new tools come to the market.

One of the most exciting developments in this area is portable and wearable technology. This has the power to measure physical conditions and human impacts in real time. At the time of this study they are just beginning to go mainstream. It looks likely that these devices will substantially expand our understanding.



## Key Findings: Health, Wellbeing, Productivity and the Business Case

Rawstorne Place, London  
Bennetts Associates/Clare Park



### In the next few years will we start to see the rise of the Chief Wellbeing Officer?

#### Practical applications and the business case

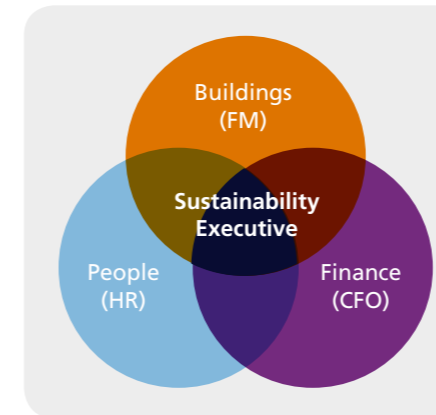
We believe that plenty of relevant data already exists, but organisations need to implement more systematic collection for that data to be useful. In particular, the data tends not to be thought about in terms of place – i.e. it is often not gathered on an office-by-office basis.

In fact, many organisations are sitting on a treasure trove of information that, with a little sifting, could yield important immediate improvement strategies for their two biggest expenses – people and places, and the relationship between the two.

This is less difficult than it seems. It requires a different way of thinking and working rather than a great deal of extra, expensive data capture. Facilities managers, for example, are likely to have a wealth of data about the building itself, its physical features and even some outcome metrics – such as physical complaints. Likewise, HR departments are already in possession, in many cases, of data about worker attitudes as well as performance data – absenteeism, medical costs, retention, etc. And, of course, the CFO or finance director will be well aware of revenue and related financial metrics.

The sweet spot in this agenda is where the circles on buildings (FM), people (HR) and finance (CFO) overlap, and yet so few businesses take advantage of this rich space. This represents a huge missed opportunity.

If we better understand the relationship between the office, people and organisational performance, the potential for practical application is significant. This includes due diligence on new space, rent review on existing space, fit-out guidance on refurbished space, and so on. A better understanding of how buildings impact people should drive improvements in the workspace, which may be one of the most important business decisions to be made.



At the start of this key findings chapter, we highlighted the importance of staff costs for a typical business. Through our research process, it became clear that there was no ‘magic formula’ for ‘proving’ the business case. What we have done is demonstrate quite clearly the physical office environment (and indeed its location) has an impact on the health, wellbeing and productivity of staff. We have also shown that there are tools available to help make this as relevant as possible for individual organisations.

It is down to those individual organisations, and their advisors, to apply these findings to their own circumstances. That means considering your own operating costs, and the impact that small improvements in productivity would have across the organisation as a whole. Think again about the diagram on the opening page of this chapter. What is the financial value of even a single-digit improvement in productivity, or a small reduction in absences in your organisation, compared to savings on energy costs or even rent?

There is clearly an opportunity for organisations to begin to think differently and use their physical premises for competitive gain. This is true from investors right through to occupiers, whether companies are trying to command a higher price for a high-performing building or looking to take the kind of space needed to help drive business success. The method we suggest could be used, in part or in whole, by all kinds of actors in the industry who want to understand the issue better and get the best from their buildings.

Finally, what role for the sustainability executive? They should perhaps have the keenest interest of all. The forward-thinking sustainability professional could be viewed as having a role in helping to get all three sets of actors above to start thinking and working together. There is even an argument for suggesting health, wellbeing and productivity should be synonymous with sustainability. In the next few years will we start to see the rise of the Chief Wellbeing Officer?

Surely, in the long-term, those who do not engage with this agenda will suffer as a result. Those companies who take seriously their employee health, wellbeing and productivity, will prosper.

### More information

#### Footnotes

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AZV Erdinger Moos, Munich  
Architektur Werkstatt Vallentin/Tomas Riehle

# Health, Wellbeing & Productivity: Flow chart

### The physical office environment

The office environment is made of up several factors, which can be measured or evaluated in numerous ways.

#### Indoor air quality & ventilation

- Pollutants, including VOCs
- CO<sub>2</sub>
- Aroma
- Ventilation rate or fresh air
- Moisture content

#### Lighting & Daylighting

- Quantity
- Quality
- Glare
- Daylight
- Task type

#### Biophilia & views

- Connections to nature
- Views outside

#### Thermal comfort

- Indoor air temperature
- Mean radiant temperature
- Air velocity
- Relative humidity
- Clothing
- Activity

#### Noise & acoustics

- Background noise
- Privacy & interference
- Vibration

#### Look & feel

- Design character & brand ethos, including colour, shape, texture & art
- Cultural, gender & age sensitive design

#### Interior layout & active design

- Workstation density
- Task based spaces & ergonomics
- Breakout spaces and social features
- Active design

#### Location & access to amenities

- Access to amenities
- Transport
- Quality of public realm

### Ultimate aims

Maximised Return on Investment (financial evaluation based on life cycle costing – capital & operational) for all strategies designed to benefit occupants and improve productivity:

- Lower employment cost per employee, including reduced absence costs
- Higher staff retention and reduced costs of staff turnover
- Greater ease of high quality recruitment, lowering recruitment costs and adding value
- Greater productivity of staff on core tasks, e.g. deadlines met, sales made etc.
- Optimised green building ratings resulting in higher value/lower risk/ improved reputation
- Reduced occupant complaints via 'Help Desk' and other similar feedback systems, leading to reduced costs
- Increased company revenue

### Occupant health outcomes

The physical office factors influence the health of occupiers (health outcome) which can be measured or evaluated.

#### Health

- Headaches
- Eye strain/damage
- Skin irritation
- Infections
- Fatigue
- Seasonal Affective Disorder
- Asthma & breathing disorders
- Stress & depression
- Other physical complaints, e.g. back ache
- Other serious disorders, including cardio-vascular etc.

### Occupant wellbeing and perception outcomes

Health is an important element of wellbeing, but an occupant's sense of wellbeing is also comprised of their perception of numerous factors, including how productive they think they are:

- Perceived physical health
- Perceived psychological health
- Perceived productivity
- Perceived office environment
- Perceived organisational culture

### Organisational or financial outcomes

The office environment can have a direct impact on occupant productivity, in which health and wellbeing is often a compounding factor. This 'outcome' for the organisation can be measured or evaluated in the following ways (not exhaustive), all of which have financial implications for the employer.

#### Productivity

- Absenteeism
- Presenteeism
- Staff turnover/retention
- Revenue
- Medical costs
- Medical complaints
- Physical complaints
- Task efficiency & deadlines met

### Design, refurbishment or fit-out strategy

With the aim of enhancing or incorporating:

- Indoor air quality & ventilation
- Thermal comfort
- Lighting & daylighting
- Noise & acoustics
- Interior layout & active design
- Biophilic design & quality views
- Look & feel
- Access to amenities

Strategies to maximise beneficial outcomes for office occupants will have a capital cost implication, ranging from negligible to high, depending on the strategy and the stage in the building lifecycle.

#### Examples:

- Following active design principles in a new build office = no/low additional cost
- Reconfiguring an existing office to maximise task-based spaces = medium cost
- Retrofitting an existing, occupied office with new façade to improve daylighting = very high cost

With thanks to Ashak Nathwani, University of Sydney

Part 1:

# Presenting the Evidence





## Indoor Air Quality & Ventilation



### Case study: Turkish Contractors Association

Location: Ankara, Turkey

The office building for the Turkish Contractors Association in Ankara was designed to showcase sustainability practices its members wished to promote. The 5,500m<sup>2</sup> building uses labyrinth technology, an innovative solution to ventilation and cooling needs in climates that are hot in the daytime, but cooler at night. This is combined with an active thermal slab cooling system. Air is first drawn through the labyrinth before being preconditioned and supplied to the building through the thermal slab systems which make up the individual floor plates. Chilled beams deliver the final required air conditioning. This combined system significantly reduces the energy required to both heat and cool the building while ensuring occupant comfort.

*With thanks to project engineers Atelier 10 and Avci Architects*

### Overview

Air is a basic human need of course, but the quality of that air is vital. Just as we instinctively feel that 'sea air' or 'country air' is cleaner and fresher than the air in our cities, so the air quality in our places of work varies, and can have a significant impact on health and resulting productivity.

Office occupants can be exposed to a range of airborne pollutants that typically include chemicals, micro-organisms and particles originating from sources both within and outside the building.

Ozone, offgassed volatile organic compounds (VOCs), allergens and asthmagens make for a veritable cocktail of potential pollutants that may come from building materials, carpets, finishes, cleaning products, office equipment and traffic; while the carbon dioxide exhaled by office workers themselves can be detrimental when left to amass in high concentrations.

The various health implications associated with poor indoor air quality – from respiratory problems to infections to irritants – have been the subject of research for a long time and are well established. But as we better understand the impacts, so our understanding changes on what is considered acceptable or desirable.

Design strategies that ensure good air quality are a pre-requisite for a healthy and productive working environment. Although both are important, there is distinction between ensuring a supply of fresh air through ventilation, and stopping pollutants at source by minimising the 'offgassing' of materials, both of which are discussed below.

### Highlights: Key research

Seminal research in 2003 identified 15 studies linking improved ventilation with up to 11% gains in productivity, as a result of increased outside air rates, dedicated delivery of fresh air to the workstation, and reduced levels of pollutants<sup>5</sup>.

A meta-analysis in 2006 of 24 studies<sup>6</sup> – including 6 office studies – found that poor air quality (and elevated temperatures) consistently lowered performance by up to 10%, on measures such as typing speed and units output. This analysis appeared to demonstrate that the optimum ventilation rate is between 20 and 30 litres/second (l/s), with benefits tailing off from 30 up to 50l/s. This is significantly higher than minimum standards required, which are typically between 8-10l/s (although these vary considerably by country).

Similarly, in a 2011 lab test which mimicked an office, a range of office-related tasks were carried out with the presence of airborne VOCs. Increasing ventilation from 5l/s to 20l/s improved performance by up to 8%<sup>7</sup>.

Reduced absences may also be a key indicator of the benefits of good indoor air quality for businesses. Short term sick leave was found to be 35% lower in offices ventilated by an outdoor air supply rate of 24 l/s compared to buildings with rates of 12 l/s in a 2000 study<sup>8</sup>. The same study estimated the value of increased ventilation to be \$400 per employee per year.

CO<sub>2</sub> levels are one way to measure air quality, and can occur as a result of poor ventilation. High CO<sub>2</sub> levels have been found to impact tiredness or decision-making in a number of studies<sup>9</sup>. One recent lab-based study using simulated decision-making tasks showed CO<sub>2</sub> having a significant detrimental impact (11%-23% worse) at 1000 parts per million (ppm) compared to 600ppm, despite 1000ppm being widely considered acceptable<sup>10</sup>.

### Design strategies: going for green

#### Increasing fresh air

Outdoor air renews oxygen for breathing and dilutes pollutants. Increasing ventilation rates to the sorts of levels suggested in some of the key research above provides a real challenge for designers, if it is not to lead to significantly increased energy usage. The decision whether to naturally ventilate, provide air conditioning, or a mixed-mode system is a complex one, and relates closely to thermal comfort (covered in the next chapter).

Air conditioning and ventilation systems can provide fresh air rates above those required by the prevailing local standard. This is recognised by dedicated credits for increasing fresh air rates in many green building rating tools. However, this must be balanced with strategies for mitigating any associated increase in energy demand to ensure a balanced approach.

There are many experts who argue that in appropriate climates, a mixed-mode system allows for optimal outcomes for both occupants and energy use. A comprehensive analysis by Carnegie Mellon<sup>11</sup> concluded that natural ventilation or mixed-mode conditioning could achieve 0.8 - 1.3% savings on health costs, 3 - 18% productivity gains, and 47 - 79% in HVAC energy savings, for an average ROI of at least 120%.

As global temperatures climb and urbanisation continues apace in rapidly developing countries, one of the absolutely key challenges for designers of green, healthy buildings is how to ventilate and cool offices in warm climates without a massive increase in energy use. It points to a clear need for further innovation in design and ever more efficient systems that minimise energy use.



Elizabeth II Court, Winchester, Bennetts Associates

### Cross-cutting issues

#### Ceiling heights

The greater the height available above the occupants' breathing zone, the greater the space available for 'stratification', i.e. temperature gradient, which is beneficial for both natural ventilation and low level air supply/displacement ventilation. This also impacts cooling strategies, and users' perception of space through the 'look and feel' (see later chapter).

#### Materials

Volatile organic compounds (VOCs) are chemicals commonly used to produce building materials, furnishings, fittings, adhesives and sealants. The familiar smells of a freshly painted room or newly installed carpet are all from VOCs and your instinct to open a window is correct. While some VOCs and other toxins do not have a noticeable odour, these smells are generally telltale signs that less than healthy chemicals are in your midst. It can take months or years for the compounds to completely 'off-gas' and these chemicals can persist long after their smell fades.

There are long established links between building materials and human health, from the formaldehyde found in particle board to the asthmagens found in some kinds of paint, flooring and interior finishes. Fortunately, products such as low and no-VOC paint and green certified furnishings and other fit-out components are available in many markets. Environmental Product Declarations are an important element of transparency. The well-considered selection of healthy finishes and furnishings goes hand-in-hand with adequate ventilation rates to ensure good indoor air quality and should be implemented as part of any sustainable fit-out and ongoing purchasing program.

CIEM, Zaragoza, CIEM

## Indoor Air Quality & Ventilation



### Limiting pollutant sources

Rather than simply diluting pollutants, it may be more effective and energy efficient to reduce pollutants at source. Strategies to minimise the sources of pollutants include dedicated exhaust ventilation to print rooms, photocopiers and laser printers (that emit ozone) and the specification of low and zero emission carpets, finishes and adhesives. (See 'cross-cutting' box for more information.)

There is also good evidence to support the indoor air quality benefit of certain indoor plants, which scrub specific pollutants from the air, when located in the breathing zone of office workers<sup>12</sup>. However, in a well ventilated building, the benefits of plants are mostly limited to their psychological and aesthetic values<sup>13</sup> (See Views & Biophilia chapter for more on plants.)



### More information

#### Useful links

<http://www.avciarchitects.com/cdn/media/company/brochure/AVCIARCHITECTS-2014.pdf>

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CAFOD Head Office, London, Black Architecture



### Viewpoint

"The road towards a New Sustainable Architecture has turned out to be a long and bumpy one and I believe that, while we have increased the amount of rhetoric, we have yet to achieve the paradigm shift that is required to address the growing environmental concerns of our age.

Academics and architects specialising in sustainable design are advocating a radical change to the building design process, placing the needs of building occupiers at the epicentre of the process and then shaping schemes that create healthy environments which promote wellbeing and enhance performance. This radical philosophy challenges the design of every element of a project; ensuring that each decision will have a positive impact on users. Orientation, form, layout, envelope performance and fenestration of buildings will be reconceived; shaping a new user centred, sustainable architecture.

Fresh air for ventilation should be introduced at low level, rather than from above, as warm, stale, moist air stratifies at ceiling level and will pollute fresh air before it reaches occupants. Ventilation can also play a significant role in improving indoor air quality within the zone occupied by people, through the adoption of low level fresh air inlet pathways.

At our Romero House project for CAFOD an underfloor displacement ventilation system delivers fresh air which is drawn in from the sheltered rear of the building. The flat concrete slab ceiling construction allows the air to flow up the atrium with waste energy recovered before it is discharged to the atmosphere. This low pressure and low energy solution is part of a mixed-mode conditioning strategy which allows mechanical ventilation to be shut down and high level windows opened by the building's users when climatic conditions outside allow; predominantly spring and autumn.

While the current interest in user centred design is a new phenomenon, it is only recently that technology has offered us the ability to divorce the design of building from the conditioning of its interior. In countries like the UK, many of our historic buildings built before this era still perform well and have proved to be both flexible and robust. User centred design offers a compelling alternative to the current obsession with style and iconography, delivering buildings that create value by enhancing the environment that people occupy, closing the performance gap and ultimately completing the social, economic and environmental circle required to achieve sustainable development."

**Paul Hinkin, Black Architecture**

# Thermal Comfort



## Viewpoint

It is so completely satisfying and rare when attacking and solving an employee area of complaint enables you to simultaneously reduce cost. This was our experience when we discovered half of the calls to our real estate problem line were reports from employees of being “too hot” or “too cold”. These calls required customer service reps spending time recording, ticketing, dispatching and following up in an attempt to resolve the complaint. These call center costs are of course all in addition to the largest expense involved, i.e. the loss of productivity as the reporting employees take the time (away from customers) to report the problem and then find a sweater or discard a jacket.

In the midst of rapid growth and several acquisitions, by changing our design specs for new construction (and refurbishments when possible) to enable individually controlled temperature by just a few degrees, the frequency (and cost!) of these calls began to decrease significantly. Understanding and reacting to the data available to us and consulting with design partners to fix the problem at the front end of the design process made all the difference.

**Mark Nicholls**  
Retired Bank of America Real Estate Executive

## Overview

Whether it is perceived to be too high or too low, temperature – or more accurately, thermal comfort – is a hot topic in the workplace.

The thermal environment is comprised of air temperature, surrounding surface temperatures, air speed and humidity. A person’s perception of thermal comfort depends on their metabolic rate, clothing, and personal preference.

Within a certain temperature range – e.g. between 16 and 24 degrees C<sup>14</sup> – there are not the same direct risks to health that poor air quality brings. In fact, studies have shown that humans are remarkably adaptable to temperature in a way that they are not, for example, to air quality<sup>15</sup>.

However, that does not mean that thermal comfort is not important for occupants – far from it. Although measuring the productivity impact of thermal parameters is problematic, most studies suggest that moderately high temperatures are less tolerated than low<sup>16</sup>, and there is a very large body of work that demonstrates the perception of thermal comfort has a significant impact on workplace satisfaction<sup>17</sup>.

User control over thermal comfort is a key factor. Where occupants are able to adapt to their thermal environment by adjusting clothing, varying air speed across their bodies or adjusting blinds, then wider variations in temperature can be tolerated.

## Highlights: Key research

An analysis in 2006 of 24 studies on the relationship between temperature and performance indicated a 10% reduction in performance at both 30C and 15C compared with a baseline between 21C and 23C<sup>18</sup>, leaving little doubt as to the impact thermal comfort has on office occupants. A more recent study in a controlled setting<sup>19</sup> indicated a reduction in performance of 4% at cooler temperatures, and a reduction of 6% at warmer ones.

A 2007 study analysed the capital cost, energy cost and indoor air quality benefit through health and productivity improvements of six heating, ventilation, and air conditioning (HVAC) strategies for the Australian climate and market. It concluded that displacement ventilation, with circulation of 100% fresh air, was the optimal choice for maximising indoor air quality and thermal comfort, while minimising energy costs. It was estimated this option added AUS\$248/m<sup>2</sup>/year in value for tenants<sup>20</sup>.

# 4%

Reduction in performance at cooler temperatures.

# 6%

Reduction in performance at warmer temperatures.



## Cross-cutting issues

### Personal Control

Put simply, if an office worker has more control over their environment, they tend to be more satisfied as a result<sup>21</sup>. One study found that individual control over temperature (in a 4°C range) led to an increase of about 3% in logical thinking performance and 7% in typing performance<sup>22</sup>. Another suggests up to 3% gains in overall productivity as a result of personal control of workspace temperature<sup>23</sup>.

This does not only apply to temperature. A 2006 study<sup>24</sup> tested effectiveness of adjustable desk-mounted personalized air supply devices on perceived air quality. Greater satisfaction with air quality was reported with desk-mounted devices despite ventilation rates being the same. Similarly, providing individuals with personal control over light levels with dimmers in offices can lead to improvements in satisfaction and mood<sup>25</sup>. Subsequent research added comfort, improved motivation, and greater ease of task performance to this list of benefits<sup>26,27</sup>.

## Design strategies: going for green

Thermal comfort is essential for a happy and productive office occupier and can be enhanced by providing control and adaptability to occupants and by addressing the thermal environment beyond just air temperature. Of course, heating and cooling strategies have major implications for energy use.

### Adaptive Comfort

An ‘adaptive’ model allows temperatures to drift down in winter and up in summer, resulting in lower energy consumption and longer periods when natural ventilation can be employed for cooling in mixed mode ventilated buildings. But for the benefits of adaptive comfort to be realised, users must have direct control of their environment. This is readily achieved in a cellular office where individuals have ownership of an operable window but problematic in open-plan environments. Some user control may be provided in air-conditioned environments through user adjustable floor ventilation or task air systems that provide individual ventilation through the desk.

One of the most rapidly developing areas of research and innovation is in wireless sensor technology, which enables sophisticated monitoring and logging of temperature, humidity and lighting (also picked up in the next chapter). Going even further, digital technology is likely to become embedded more and more in building structures; equipment; and even our clothing and person through wearable technology. This is bringing high-tech personalisation of the indoor environment much nearer.

Perhaps one of the simplest innovations is not in technology, but in working practice, through encouraging office workers to dress comfortably and casually. In Japan, the government has run the CoolBiz campaign every summer, explicitly aimed at reducing electricity consumption used for cooling in offices. Workers are encouraged to wear light, breathable clothes, and to ditch the stuffy suit jackets and ties. Facilities managers are encouraged to allow office temperatures to rise as high as 28 degrees, (a temperature which needs higher air velocities to be acceptable).

### Control of thermal environment

Most office buildings specify requirements for the control of the air temperature only. Thermal comfort can be improved and energy consumption lowered, by providing attention in the design to the active control of radiant temperatures too. Like traditional heating radiators, chilled ceilings are one solution that provides heat exchange through both radiative and convective processes. This has the benefit of providing better thermal comfort and a more efficient way of generating and transporting cooling. This means that in summer slightly higher air temperatures can be tolerated when radiant temperature is lower, and vice versa in winter. For naturally ventilated buildings, night purge ventilation can pre-cool exposed thermal mass. This provides radiant cooling benefit to the occupant for the following day, further enhancing comfort perception at times of warmer air temperatures.

As with ventilation, strategies will be highly dependent on climatic circumstances, the difference between daytime and night-time temperatures and the aspect of the building. For illustration, in some climates humidity is a major challenge, which requires an offices’ fresh air intake to be dehumidified and pre-cooled. Hong Kong, with relative humidity usually over 70% and often even higher, is one such example. Here, the most forward-thinking developers, encouraged by the Hong Kong Government, are installing innovative systems that enable energy used in humidity control to be used to heat water for apartments or laundry services.

Council Offices, Derby, Corstorphine+Wright/Daniel Shearing

## Thermal Comfort



### Case study: Atrium 1

Location: Warsaw, Poland

Atrium 1 is a modern green office building, designed and developed with the ambition of being the most resource efficient building in Central and Eastern Europe.

The building is equipped with the developer Skanska's Deep Green Cooling™ (DGC) solution, which uses the relatively constant annual ground temperature under the building to provide cooling during summer and to pre-heat incoming air during winter.

The DGC system includes 50 boreholes, 200m deep. The pipes are part of a water-filled closed-loop system that supplies the building's chilled beams and the Air Handling Units via a heat exchanger. The building also uses a 400 kW free cooling system when the outdoor temperature is around 5°C, which uses 10% of the energy of the conventional cooling system. The DGC and free cooling systems together meet almost the entire cooling requirements of the leasable area, the remainder being provided by regular chillers.

The south and west-facing façades have external blinds that are controlled by light sensors and the Building Management System (BMS) to avoid excessive solar heat gain and reduce the need for cooling. Cooling is delivered through energy efficient chilled beams, which have no moving parts, which reduces maintenance costs.

*With thanks to project developers Skanska*



## Viewpoint

We can design a world-leading sustainable building and fill it with clever cutting-edge technology, but if the building's occupants prefer to alter the air-conditioning rather than put on a jacket, it won't be a sustainable building.

True sustainability is found at the 'sweet spot' of good design (passive solutions such as shading, orientation and natural ventilation), good technology (including air-conditioning, automation, and temperature control) and good behaviour (clothing, acceptance of wider temperature ranges and familiarity with systems). Often, good behaviour can be the most elusive to achieve and the hardest to maintain.

In Australia, facilities managers tell us they receive the most complaints about thermal comfort on the hottest days of the year – and these complaints come from people who are too cold because they are not wearing the right clothing for the indoor environment.

We know that thermal comfort is a combination of both physical and psychological factors, and that giving occupants as much control over their environment as possible can widen people's comfort tolerances significantly.

We also know the question of 'who is paying the energy bill' can affect a person's perception of thermal comfort, and explains the vastly different temperature tolerances we observe between home and the workplace. And it's been established that awareness of environmental issues affects a person's tolerance, with people who believe in human-induced climate change more accepting of temperature variations in the workplace than their more sceptical colleagues.

The bottom line? We need to keep in mind that our buildings are for people – and that means helping business users understand the impact of their behaviour and make more sustainable choices.

**Robin Mellon, Chief Operating Officer Green  
Building Council of Australia**

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## Daylighting & Lighting



# 46 mins

More sleep per night on average for office workers with windows.

### Overview

Office lighting must satisfy a variety of needs. We of course need to see the task in front of us, but lighting also affects many other aspects of wellbeing, including comfort, communication, mood, health, safety and aesthetics.

Lighting quality is comprised of a complex mix of light level and spectrum, while the interplay of light and shadow gives a space character and helps the eye to relax and focus. Poor visibility, glare, flicker and lack of control of the visual environment can all affect task performance, whilst visual discomfort may lead to headaches and eyestrain. Light is also vital for maintaining our circadian rhythm.

Overall, the evidence is unequivocal; office occupants prefer access to windows and daylight, which bring consistent benefits in terms of satisfaction and health. However, it is difficult to differentiate between the effects of daylight and the effects of views out of windows. This chapter deals mainly with the former, while the latter is covered in the chapter on views and biophilia.

### Highlights: Key research

A comprehensive study in 2008, conducted measurements of the physical environment and occupant satisfaction for 779 workstations in 9 different buildings, and suggested that lack of access to a window was the biggest risk factor for dissatisfaction with lighting<sup>28</sup>.

A recent study by neuroscientists suggested that office workers with windows received 173 percent more white light exposure during work hours, and slept an average of 46 minutes more per night. Workers without windows reported poorer scores than their counterparts on quality of life measures related to physical problems and vitality, as well as poorer outcomes on measures of overall sleep quality, sleep efficiency, sleep disturbances and daytime dysfunction<sup>29</sup>.

A study in 2011 investigated the relationship between view quality, daylighting and sick leave of employees in administration offices of Northwest University Campus. Taken together, the two variables explained 6.5% of the variation in sick leave, which was statistically significant<sup>30</sup>.

**Office occupants prefer access to windows and daylight, which bring consistent benefits in terms of satisfaction and health.**

### Case study:

## Microsoft MODC



Location: Beijing

The office layout maximizes the use of natural light. Workstations in the open office area are located around the perimeter, and meeting rooms and corridors are placed in the central core areas so as not to impede natural light to the workstations.

The perimeter lighting fixtures are controlled by lighting sensors that switch off lights when daylight can provide more than 300 lux. Meeting rooms have sensors, so that lights are only on when occupied.

The architects designed workstations in 'neighbourhood clusters' to utilise natural light and views, creating an innovative and healthy work environment which fosters collaboration and communication.

*With thanks to project architects B+H Architects*





GPT Head Office, Sydney, Woods Bagot

## Daylighting & Lighting



### Cross-cutting issues

#### Windows and the façade

Windows are the primary interface between the office worker and the external environment and are not only a potential source of daylight and view, but also of sunlight, glare and potential overheating. When operable they can allow the ingress of noise and pollutants, but, when combined with a proven natural ventilation strategy, can mitigate the need for mechanical ventilation and cooling. Achieving the correct balance between all of these factors can be challenging, and costly. The façade represents a significant proportion of the overall cost of a new office block, often around a third of the total construction budget.

**“Beyond Comfort”:** Prof Clements-Croome suggests, opposite, that there is a growing body of research that is distinguishing between conditions that enable ‘comfort’ for occupants and those that encourage ‘stimulation’.

### Design strategies: going for green

Strategies to maximise daylight and produce optimal lighting conditions, while at the same time minimise energy use, are a vital but complex element of sustainable design.

Typical recommendations for task lighting levels in offices are 300-500 lux, which is distinct from general light levels in the office. It has been suggested that higher light levels may stimulate greater productivity<sup>31</sup>, but we must approach this with caution. Providing higher levels of light using artificial light would require significant additional energy use, and skilled lighting designers argue that desktop illuminance of 300 lux is perfectly acceptable.

A common approach is to treat the task, surrounding and background areas separately, with a higher level of light placed on the task, but then lower levels of light placed in the surrounding and background areas. The overall energy effect is a space which typically uses 50% of a blanket lit office floor. Visually the space is also more interesting, although the contrast should not be so great as to produce a cave-like environment.

Regardless of the specific light levels desired, it is abundantly clear that daylighting should be optimised in the first instance, which in theory is a win-win for occupier and energy use. Another advantage of daylight is that it provides the highest levels of colour rendering, in other words it enables an object’s colour to be seen more accurately.

When designing for maximum daylight (and views), designers must evaluate and balance a number of environmental factors, including heat gain and loss, glare control, visual quality, and variations in daylight availability in different seasons and climates. Appropriate interior or exterior shading devices to control glare and reduce solar gain will help provide better visual comfort and reduce the need for additional cooling. Of course, this is far simpler to do for new-build than refurbished property.

However, even when successfully maximising daylight (which can be difficult where urban development is at a very high density in places like Hong Kong for example), clearly electric lighting is also required for some spaces and times of day. Lighting is typically responsible for up to a quarter of an office’s energy use and therefore continuing innovations in lighting design are crucial.

LEDs now offer a real alternative to conventional lighting, with luminaire efficiencies exceeding traditional technology. This will help to reduce energy use for lighting, or help to facilitate higher lighting levels, but without increasing energy demand. Some still worry about reliability and performance, but proponents counter that performance is improving rapidly, and there is no doubt that all major lighting manufacturers are investing in an LED future. LED luminaires from the leading manufacturers now incorporate an element of future-proofing, enabling easy replacement of LEDs, and therefore upgrading of lighting throughout the life of the lighting installation as new technologies emerge.

Innovation in lighting controls is also vital, particularly where that increases personal control (as identified in the previous chapter). Manufacturers are bringing forward lighting systems with fixtures that are fitted with sensors, able to capture data on room occupancy, temperature and humidity. They connect to the IT network and with other building systems such as heating and ventilation. Employees can use smart phones to control the lighting in open plan offices and temperature in meeting rooms<sup>32</sup>.

Derby Council Offices  
Corstorphine & Wright

### Viewpoint

The word ‘comfort’ is perhaps overused. It has a neutral quality. It is usually seen as a pleasant or relaxed state of a human being in relation to their environment. Surely however, that is only part of what we need for concentrating the mind?

Our experience of the environment is the result of an interplay of heat, light, sound and many other factors. Buildings provide a multi-sensory experience. The senses need stimulation to react to otherwise boredom sets in. One response to this type of thinking is the emergence of air systems which give random air pulsations, rather than a steady flow of air, because of its stimulating nature.

Perhaps comfort is a backdrop which needs to be non-distracting, but human beings also need sensory change from the stimuli around them. There is a complex balance that needs to be achieved, and this may provide a growing challenge for designers in the future.

Academic work from the likes of Bluysen (2014), Gou et al (2014) and Barrett et al (2010, 2013) is improving our knowledge of this topic all the time<sup>32b</sup>. What we can conclude from this work is that comfort alone is not enough. We need to continue to develop a more comprehensive view about the effects of the environment on people and widen our scope of design to produce more stimulating places for people to work in and enjoy.

**Derek Clements-Croome, Professor Emeritus in Architectural Engineering, Reading University & the Feeling Good Foundation**

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## Noise & Acoustics



# 66%

Drop in performance when exposed to distracting noise.

### Overview

Distractions from internal or external sources of noise can impact considerably on productivity. In fact, distraction from noise is often one of the lead causes of dissatisfaction with the office environment<sup>33</sup>.

The level of distraction an individual experiences will depend upon the task at hand, the acoustic environment and personal cognitive characteristics<sup>34</sup>. However, there is no question that excessive discernible noise from speech, telephones and so on, particularly likely in an open plan office, is potentially responsible for greater dissatisfaction and productivity loss than any other single environmental factor.

Not only is noise a clear distraction that hinders office workers carrying out their work accurately and efficiently, it can also have a detrimental impact on health and levels of stress<sup>35</sup>. Sound also contributes to how a space 'feels', and there is evidence to suggest that certain soundscapes, such as more natural, rather than urban ones, can be restorative<sup>36</sup>.

However, spaces can also be too quiet, and not all 'sound' is 'noise' (i.e. unwanted). This is highly dependent on the type of activities being carried out in the office and the office culture, and ultimately is entirely subjective.

### Highlights: Key research

A study in 1998 found that there was up to a 66% drop in performance for a 'memory for prose' task when participants were exposed to different types of background noise<sup>37</sup>. A follow-up study by the same authors in 2005 found that 99% of people surveyed reported that their concentration was impaired by office noise such as unanswered phones and background speech<sup>38</sup>.

#### Case study:

### BHP Billiton fit-out, Brookfield Place

Location: Perth, Australia

This is a 6 Star Green Star rated fit-out, where hot-desking means the staff-to-floorspace ratio has decreased dramatically. The real story however, is in productivity improvements. The open plan design provides people with a variety of workspaces, and encourages interaction between employees. Meeting rooms are available for quiet work, phone calls or brainstorming sessions.

Aaron James, Norman Disney & Young sustainability and acoustics consultant on the project says: "Good acoustics are synonymous with quality. It's less about high-technology solutions and more about doing a high-quality job – ensuring rooms are well-sealed and any defects are rectified".

There is also a flexible, mixed-use zone made up of lunch areas, lounges, a business centre and quiet areas. "The challenge was to create a space that is suitable for many activities – but with enough acoustic absorption that many people can be talking and working without affecting productivity. Acoustics can be overlooked, but are often the key to creating a productivity powerhouse," James concludes.

*With thanks to acoustic consultant NDY and GBC Australia*



Ecoedifici, Manlleu, Spain, Lavola

A common problem with offices that rely on opening windows for ventilation is the ingress of noise from traffic which can often drive the decision to air condition or mechanically ventilate the space.

### Design strategies: going for green

Good acoustics are a crucial element of a satisfactory and productive office experience and are considered in some green building rating tools. At first thought, there may not appear to be a close link between acoustics and strategies to reduce energy and resource use, but in fact there are numerous crucial areas of overlap.

Background sound levels need to drown out unwanted distraction, but not be too loud to cause stress. Getting this balance right can be challenging. In open plan offices a lot of extraneous foreground noise can be expected, therefore a background sound level of 45dBA is recommended. In private or cellular offices there is less need for noise to be masked, therefore background sound levels can be reduced to 40dBA<sup>39</sup>. But in both cases, any higher and that background sound itself risks becoming a distraction.

To achieve this balance, the degree of external noise is often the first consideration. A common problem with offices that rely on opening windows for ventilation is the ingress of noise (and pollution) from traffic which can often drive the decision to air condition or mechanically ventilate the space. In future, a shift to electric vehicles may reduce this problem, while green landscaping can also play a significant role in softening noisy external environments.

Ironically, servicing arrangements, such as the use of chilled beams rather than fan-coil units, can reduce background sound to below target levels, at which point it may be desirable to add background sound to help raise it to an acceptable level for masking distracting noises. By creating a more reverberant acoustic, the use of exposed thermal mass for night cooling can also result in aural discomfort (because hard surfaces help propagate distracting sounds), and require the incorporation of sound absorbing materials into fittings and fixtures.

There is also a balance to be struck between providing the need for concentration and privacy on the one hand, and the desire for openness and communication on the other. This will depend on the type of organisation and the different tasks that a person might carry out over a day. There are several design options that can help negotiate this trade-off including personal measures such as the use of headphones, and organisational approaches, such as providing a range of different work spaces and allowing staff flexibility in their use. The latter is an example of so-called activity or task-based working solutions, and is picked up again in the next chapter.

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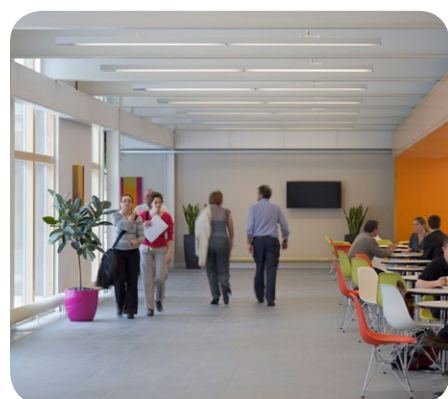
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## Interior Layout & Active Design



Designing for a diversity of working spaces is key to a productive office.



Elizabeth II Court, Winchester, Bennetts Associates

### Overview

There is a complex relationship between the office worker and his or her co-workers, the tasks they carry out and the physical environment in which this takes place. The way the interior of an office is configured has a profound impact on concentration, collaboration, confidentiality and creativity – and can therefore either enable, or limit, productivity. It can also have a very direct impact on health and wellbeing, which in turn also impacts productivity.

Interior layout in this context incorporates workstation density, task based spaces, breakout spaces and social features, and active design. The research assessing the relationships between these varied aspects of design and employee productivity is more qualitative and doesn't exist in the same volumes as some of the issues covered in previous chapters. Important differences in approach to interior layout also exist between business sectors, not to mention different cultures. Nevertheless, having consulted with experts there are some core principles we can highlight with confidence.

### Workplace density and working practice

This is one of the most important, but also complex and at times controversial elements of interior layout. The average density of workplaces is increasing throughout western office culture, both in terms of square metres per workstation and the ratio of desks to occupants<sup>40</sup>. The latter is enabled by more flexible working, although this has not yet been embedded in workplace culture in the Middle East or the Asia-Pacific region.

While higher densities might appear to enable more efficient use of space, that density may be detrimental to wellbeing and productivity if people feel they don't have enough personal space, or if it leads to increased noise distraction. More research is needed in order to quantify the impacts on productivity, in particular if the business case is to be made for lower densities where floor space is at a premium, for example in London, New York or particularly Hong Kong.

If higher densities are to be pursued, the distractions and negative connotations for wellbeing must be mitigated. A common theme in the available research<sup>41</sup> is that installing physical design features and providing etiquette guidance for workers is important to reduce visual distractions and manage noise from conversations. Anything that takes attention away from the task in hand is effectively a distraction and therefore impacts on the performance of the individual<sup>42</sup>.

Flexible working and desk-sharing are typically used to help enable higher densities but could be beneficial in their own right. Research has found that flexible working helps staff feel more in control of their workload, and engender trust and loyalty<sup>43</sup>.

It would appear there are lots more opportunities to offer flexible working to staff. In a 2010 survey of 3,500 white collar workers across 5 countries, only just above a quarter were satisfied with the flexibility offered to them, and only a fifth were encouraged by their employers to work remotely<sup>44</sup>. Significant national variations were noted – with a third of US and a quarter of UK workers encouraged to work remotely, but less than 15% in France, Germany and Japan.



### Case study: Plantronics

Location: Swindon, UK

Plantronics are a global company producing electronic equipment, headquartered in Santa Cruz, California, with offices in 20 countries worldwide. They have embraced a 'smarter working' philosophy to enable its staff to work when and where they prefer, and have reconfigured their offices to support and enable this approach.

In 2011, the UK team underwent an office fit-out when moving from three offices to one, with the new office space designed around the principles of communication, collaboration, concentration and contemplation.

Communication areas were designed for certain teams, such as sales, to be on calls without disturbing others, while quieter spaces – contemplation – provide areas for employees to take a break from their screens.

Formal' collaboration space has been reduced from 18 meeting rooms to five, because they were underutilised. Instead, informal collaboration spaces have been increased, secluded from the rest of the office for employees and designed for one-to-ones or team meetings. Concentration areas are used, particularly by managers, when employees do not wish to be disturbed. The company has worked on sharing workplace etiquette, so all associates know not to approach or disturb a colleague in a concentration area.

Post-occupancy data has shown absenteeism has reduced from 12.7 percent to 3.5 percent and workspace satisfaction has increased from 61 percent to 85 percent<sup>45</sup>.

*With thanks to Plantronics*

Zappos Head Office, Las Vegas, Arup/Bruce Damonte

## Interior Layout & Active Design



A recent pilot study for Bank of America showed the remarkable impact on productivity that occurs in organisations that have strong informal social networks.

### Task-based and social spaces

Recent research<sup>46</sup> suggests that designing for a diversity of working spaces is key to a productive office. This allows people to choose the most appropriate space for the task at hand – whether quiet concentration, or creative interaction.

However, it is not only working spaces, but also social or breakout spaces that have an impact on productivity. Places for staff to congregate socially and relax, and not to disturb or be disturbed directly by the working environment are vitally important. They help to drive a cross-pollination of ideas, employee engagement and foster a sense of community, which can serve to strengthen a company's culture, or its 'organisational ecology'. Sadly, these spaces are sometimes lost in a drive to increase density, which usually generates short term cost savings, but can however be counter-productive to the organisation's overall aims.

### Active Design

Active design describes design features which enable and stimulate a desire for movement around an office building, helping to support healthy metabolic function, combat obesity and get the blood flowing after prolonged bouts of sitting. Not only this, but by moving around and interacting with others, people are more likely to exchange ideas, build relationships and foster innovation and creativity.

### Highlights: Key research

A recent pilot study for Bank of America showed the remarkable impact on productivity that occurs in organisations that have strong informal social networks<sup>47</sup>. Focusing on one of Bank of America's call centres, it suggests that interaction between employees over scheduled breaks in work serves a crucial function of social connectivity, improving cohesion amongst colleagues. Cohesion (the term used to describe how tightly knit a group is) was found to have increased by 18% at the end of the study, which led to a 6% reduction in measured stress and a drastic reduction in employee turnover from 40% to 12%. The performance increases associated with the improved working practice has been estimated to save an enormous US\$15 million per year on call centre costs across Bank of America.

Different business sectors and different national cultures may impact on what is considered 'too close for comfort' in respect of workplace density. These could be described as 'social norms' and are a crucial aspect of environmental psychology. The industry and associated organisational culture impacts on the type of space preferred. Recent research found that respondents from the media and creative sectors showed the greatest preference for bespoke (i.e design-led, non-standard) fit-outs (72%)<sup>48</sup>. The study found that so-called 'Generation Y' employees have different workplace preferences, being more demanding regarding location and fit-out than their older colleagues: 69% of Generation Y respondents who work in an office with a 'funky' fit-out noted a positive impact on productivity.

It is critical for the FM team to be involved right at the start of the planning stage to give input into how the space will function on a daily basis.

### Design strategies: going for green

#### Interior layouts

Applying a 'green lens' to the design of interior layouts highlights the delicate balancing act needed between traditional commercial considerations, resource use implications (primarily energy) and employee wellbeing and productivity. The complexity of these factors means there is unlikely to be a magic formula for project teams or clients to use any time soon. However, this three-way relationship deserves far more discussion in the real estate sector, because workstation density in particular is one of the key financially driven metrics on which clients currently make occupation, relocation and rental cost decisions.

Regardless of the workstation density strategy employed, it is quite common for the intensity of occupation to be entirely disconnected from the facilities management of an office. This can lead to over-use of HVAC and lighting systems, and often stems from poor occupier understanding of building management systems, or a poor workplace strategy to begin with.

It is critical for the FM team to be involved right at the start of the planning stage to give input into how the space will function on a daily basis.

#### Active design

Walking can be encouraged by designing visible, appealing and accessible stairs and walking routes; building functions such as mail and lunch rooms can be located to encourage walking; and in high-rise buildings, stairs can be incorporated for access to adjacent floors, all of which cuts down on elevator and therefore energy use.

A healthy lifestyle can also be encouraged by providing facilities that support exercise, such as showers, locker rooms, secure bicycle storage, and drinking fountains (a theme picked up again in the amenities chapter). Even task based spaces can be designed to encourage some standing and perching, to vary posture and encourage alertness and 'active pauses'.



Lifestyle Working, Melbourne, Lend Lease

## Interior Layout & Active Design



Bournville Place, Birmingham, Cundall

### Viewpoint

Alternative workplace strategies such as Agile Working or Activity Based Working have been around for a long time. However, it is only over the last 5 years that such strategies have become the default for many occupier organisations in Europe. Benefits can include not only enhanced productivity and better work-life balance but also reduced carbon footprint<sup>49</sup>. For example, in their implementation of Workstyle 2000, BT significantly reduced staff travel through home-working and teleconferencing.

Utilisation studies of UK offices typically find that only half of the workstations are occupied at any one time. Nevertheless, those organisations will be servicing the whole of the space, wasting energy. Carl Elefante said “the greenest building is the one already built”<sup>50</sup>. Implementing Agile Working and desk-sharing results in increased space utilisation which ultimately means taking on less office space, yet such strategies are not recognised by sustainability accreditation schemes.

Agile Working can also increase productivity. Those allowed to work from home occasionally, and reduce their commute time, are found to work longer hours, are more able to work free of interruptions, and work until their set tasks are completed<sup>51</sup>. Home-working can also improve wellbeing and, for example, significantly reduce levels of psychosomatic strain among employees, particularly women<sup>52</sup>.

It is important that employees are consulted before implementing Agile Working. The roles of some may not be conducive to desk-sharing and occasional home-working; some of the workforce may not have the facilities to work from home; some will prefer to work amongst their peers and mentors; and a few will even find the idea of desk-sharing stressful leading to lost productivity.

**Claudia Hamm and Nigel Oseland, JLL**



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## Views & Biophilia



New research and insights from neurosciences, endocrinology and other fields are helping to evolve the scientific basis for biophilic design.

### Overview

The stereotype of the coveted 'corner office' may be somewhat outdated, but the rationale for having a view outside the building remains strong, and is arguably getting stronger as new research comes to light.

Longer distance views, away from computer screens or written documents, allow the eyes to adjust and re-focus, which reduces fatigue, headaches and the effects of eye strain in the long term. Views also have a positive impact on wellbeing, in part by providing a psychological connection with other groups of people while in a safe space, satisfying the instinctive human need for 'refuge-prospect'<sup>53</sup>.

The benefits of views outside are closely connected with the provision of daylight, covered in an earlier chapter, which supports health through various mechanisms including regulating sleeping rhythms.

Ideally views should be aesthetically pleasing, and there is good evidence that shows the benefits to occupants are particularly strong if the view features nature. This is an example of 'biophilia', a phrase coined in 1943<sup>54</sup> to describe a relationship between nature and humans, which suggests that because humans are intrinsically "of nature"<sup>55</sup> we need contact with the natural environment to sustain our health and wellbeing.

Biophilia is growing in importance when considering the impact of today's working environment, as urbanisation continues apace and we risk becoming further divorced from nature in our day to day lives. The benefits on physical and mental health are becoming increasingly well understood, with a significant body of evidence supporting this view. New research and insights from neurosciences, endocrinology and other fields are helping to evolve the scientific basis for biophilic design<sup>56</sup>.

### Viewpoint

In the mid-1990s when we wrote *Greening the Building the Bottom Line*, documenting productivity gains in green buildings, our thought was that access to daylight was the most significant factor. Over the years we have seen more and more evidence that views to nature and other biophilic experiences are incredibly important and can be more significant than just the daylight responses.

Biophilia research is now increasingly focusing on physiological responses such as brain activity, heart rate, blood pressure, and stress hormones. New research is documenting fascinating results in a number of areas, like the differential responses to real versus simulated nature (real is better), how experiences of nature versus machinery are processed in different parts of the brain, and that the viewing of naturally occurring fractals (think seashells and snowflakes) strongly stimulates pleasure responses.

While there is still much to learn, there is clear evidence that these experiences of nature can help lower stress, improve cognitive function and enhance creativity. This is why we have clients ranging from tech firms to large financial institutions who are using biophilic design measures in their workplaces as a means to support the health, wellbeing and productivity of their employees. The impacts of this demand are rippling across the building supply chain, with companies like Interface now integrating biophilic principles into their products.

We believe the industry will continue to respond with better design and better products as this emerging research helps us to understand how we can reconnect nature into the built environment and improve the wellbeing of the humans inside our buildings.

**Bill Browning, Terrapin Consulting**



### Highlights: Key research

A seminal study over 20 years ago showed that workers who had window views of nature felt less frustrated and more patient, and reported better health than those who did not have visual access to the outdoors or whose view consisted of built elements only<sup>57</sup>. Various studies since then have suggested similar conclusions, and although from the healthcare sector, a key report in 2012 estimated the economic benefits to the US of providing patients with views of nature to be US\$93 million/year<sup>58</sup>.

A study of workers in a Californian call centre found that having a better view out of a window was consistently associated with better overall performance: workers were found to process calls 7% to 12% faster. Computer programmers with views spent 15% more time on their primary task, while equivalent workers without views spent 15% more time talking on the phone or to one another<sup>59</sup>.

The impact of indoor planting was tested at the Winterswijk Tax Office in the Netherlands in 2001. The study was carried out using a control group (without plants) and a test group (with plants) in comparable areas of the building. The most significant findings of the study included improvements in air quality (both measured and perceived by the employees) and improvements in productivity. Staff processed their work more efficiently and concentration improved, particularly those working at computer terminals, where plants were present<sup>60</sup>.

There is a growing volume of research that demonstrates the importance of greenery and the natural environment to health and wellbeing. A recent study of 2500 residents of Wisconsin showed that across social groups, people who lived in a neighbourhood with less than 10 percent tree canopy were much more likely to report symptoms of depression, stress and anxiety<sup>61</sup>.



### Cross-cutting issues

#### Air quality

Introducing plants and greenery to the office has been shown to filter the air around them and affect the moisture levels. So in offices where air can be quite dry this can support the levels of comfort. This filtering of air will also support the absorption of gases caused by use of certain materials, cleaning products and indeed humans themselves.

The Top 10 Houseplant Air Cleaners<sup>62</sup> based on an assessment of 50 houseplants by four criteria:

- 1) removal of chemical vapors,
- 2) ease of growth and maintenance,
- 3) resistance to insect infestation, and
- 4) transpiration rates.

1. Areca palm (*Chrysalidocarpus lutescens*)
2. Lady palm (*Rhapis excelsa*)
3. Bamboo palm (*Chamaedorea erumpens*)
4. Rubber plant (*Ficus elastica*)
5. Dracaena (*Dracaena decemrensis* 'Janet Craig')
6. English ivy (*Hedera helix*)
7. Dwarf date palm (*Phoenix roebelenii*)
8. Ficus (*Ficus macleilandii* 'Alii')
9. Boston fern (*Nephrolepis exaltata* 'Bostoniensis')
10. Peace lily (*Spathiphyllum wallisii*)



Case study:

### Bioconstrucción y Energía Alternativa head office

Location: Monterrey, Mexico

The renovation of Bioconstrucción y Energía Alternativa's head office was seen by the company as an opportunity for their premises to become a 'living display' of the green building practices and green technology the company promotes.

Aims of the project included the restoration of the natural environment within an urban context and the use of natural features to integrate the building with the surrounding landscape. The exterior features of the building include landscaped surrounds, green walls, green roofs, a roof top garden and herb garden and a courtyard garden. The interior of the office was designed so that the natural exterior could be seen from all working spaces.

With thanks to  
Bioconstrucción y Energía Alternativa

## Views & Biophilia



### Design strategies: going for green

Incorporating views and doing so while minimising energy use, encounters many of the same challenges outlined in the daylight and lighting chapter, particularly in terms of solar gain and glare.

However, it is not just the light, but the view itself that is important. Creating central courtyards, atriums, communal sky gardens, with real trees and plants, could be a solution in congested urban environments. One building's roof garden could be another building's quality view, which would also increase biodiversity and reduce the urban heat island effect – a clear example of the win-win of many biophilic design features. Access to biodiversity and green spaces is vitally important, which is picked up again in the next chapter.

Regional variations matter, too. Where there is a high level of sun, traditional design methods in many Middle Eastern, Mediterranean, South American and African countries are seen as preferable, where the view is provided 'internally' through a large shaded, active and decorated courtyard, which would reduce solar gain and the need for additional cooling.

Encouraging a biophilic workplace is about more than just adding potted plants. Interiors can foster connections between the workplace and nature by mimicking shapes and forms found in nature<sup>63</sup>, while natural soundscapes can even mask noise. Art can provide an alternative solution where real natural features can't be introduced. Studies have found that images of nature have been selected by staff for spaces of their own where they wish to regenerate their concentration levels<sup>64</sup>.

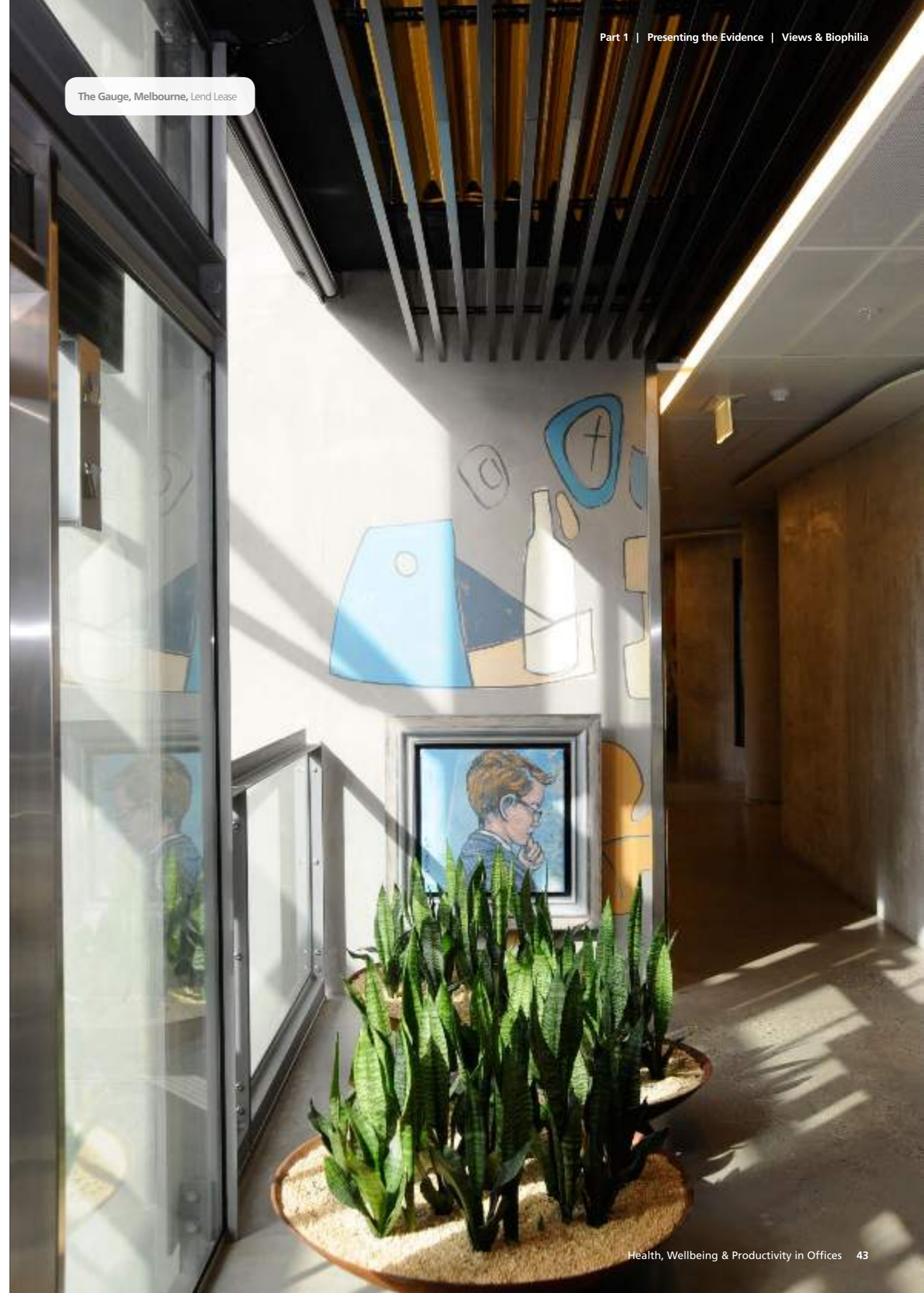


## More information

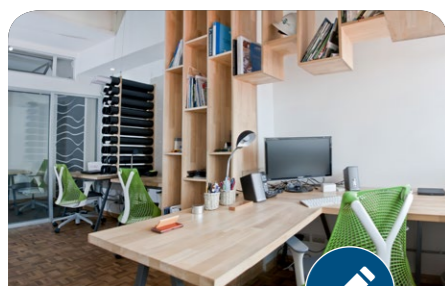
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The Gauge, Melbourne, Lend Lease



## Look & Feel



Case study:

### Centro Colon

Location: San José, Costa Rica

Sphera, a sustainability consultancy, decided to practice what they preach when embarking on their recent office refurbishment. The office is located in one of Costa Rica's first office buildings constructed during the 1970s. The building exterior and hallways can be perceived as dark, heavy and undesirable, but in strong contrast Sphera have created an interior space that feels open, fresh and dynamic.

Colours and textures are used to separate the formal conference space and the main office area. The conference space is carpeted and has a colour palette of grey, black and white, whereas the main office is predominantly white with parquette flooring, wooden office furniture and open book shelves. Green chairs are found throughout.

Ceiling panels were removed from the main office area, exposing textured concrete and increasing the room height to 3.5 metres. This gives occupants a feeling of space, a greater area for natural light to reflect on and improved air circulation.

Artwork from local artists is used to decorate the office space, with the aim of promoting local culture and using art that draws on sustainable principles (with recycled and renewable materials).

*With thanks to Sphera*

### Overview

The look and feel of the office environment is not simply about personal taste. Shapes, textures and colours can all impact our sense of wellbeing; while contours, spatial forms and proportions – such as ceiling heights – can all help or hinder us in carrying out certain tasks.

Much of the theory draws on our innate reaction to our environment. It has been suggested, for example, that the colour green reminds us of the presence of water and life, so we are reassured on a primitive level<sup>65</sup>. Similarly, it is thought that we generally prefer smooth curves and contours around us because we instinctively sense danger from sharp objects. It follows that more angular design and pointed forms can therefore subconsciously aid alertness and concentration in certain task-based spaces.

The office environment can also provide sensory 'triggers'. It has been suggested, for example, that having a variety of textures in the finish of materials can improve cognitive ability to access knowledge, helping the brain to stay alert and engaged<sup>66</sup>.

The combined effect of colours, shapes and use of space – the whole look and feel – can help companies to reinforce (whether knowingly or not) values and behaviour that support their brand and ethos. It is therefore an important element of corporate brand identity; employee retention and recruitment; and also the relationship with clients.

Although these ideas have been around for some time, this is still an emerging discipline, and there simply isn't the volume of quantitative research that exists on many of the other topics covered in this report. However, we present this chapter following discussions with professionals working in this area and firmly believe it is an issue that occupiers, designers and the real estate sector must engage with more purposefully, to help maximise satisfaction, wellbeing and productivity.

### Highlights: Key research

The Wright Theory has been hugely influential since being first published in 1984<sup>67</sup>, and explains the mechanics behind our basic reactions to colours and harmony within four groups of colour combinations. A major study in 2003-2004, subjected this theory to scientific assessment, using over 100 participants of various ages and nationalities. The results showed strong agreement between participants in terms of reactions to colour, with an 'agreement ratio' of over 90% in parts and strong correlation with the theory overall, showing the universality of reactions to colour combinations<sup>68</sup>.

A comprehensive US study in the late 1990s suggested a link between the physical office environment and retention and recruitment of staff<sup>69</sup>. One of the most significant results was the importance workers placed on the 'visual appeal' of the workplace compared to many other factors.

### Viewpoint

The creation of good spaces to work in requires 'design' to take place. Design is a process. A process of thought and actionable steps that requires the acknowledgement and marriage of fundamental elements that encourage a state of wellbeing:

- occupant behaviour found in psychology
- the reasons behind the use of art, and
- the application of effective science.

Until these become acceptable topics on the agenda of design team meetings, projects will fall short of achieving a good investment in property and ultimately, our wellbeing.

We have exhausted and prevaricated around the safety of meter readings long enough to know the answer to wellbeing, and a better world to live in, is not found just there.

Comments by occupants of Huckletree, our recently completed interior design project for the shared office workspace, have validated the approach to intentionally design spaces for occupant wellbeing. The project also achieved a Silver SKA Rating, proving that good practice in environmentally friendly design can go hand in hand with wellbeing and economics. Occupants say it 'feels good', which is the result of creating the right 'look and feel' for wellbeing and productivity.

**Elina Grigoriou, Grigoriou Interiors/Feeling Good Foundation**

1 Silo, Cape Town, Arup/Michael  
Groenewald & Allan Gray



## Look & Feel

### Viewpoint

#### Dealing with cultural and religious diversity

With a population comprised of nearly 80% expatriates, the United Arab Emirates (U.A.E.) is probably the best example of a country dealing with multicultural office management. Continuously addressing the professional melting pot remains crucial, as dealing with diversity is not free of challenges.

Accommodating open space and flexibility often advocated as modern ways to make an office more productive, can be twofold: one needs to accept differences and remain open-minded and professional at all times; on the other hand there are limitations to what can be done without going against other cultural/religious customs. What is noisy, smelly or unattractive to one group might be relevant, if not the norm, to another. Open space is not necessarily the best option for all cases.

Consider how your office captures religious diversity: does your office/building have a worshipping place and ablution options? Are your staff allowed to pray during working hours? In case of Islam, are the worshipping places available for both men and women?

The Islamic holy month of Ramadan is, for instance, a crucial time of the year during which office management needs to adapt to religious practices: the workspace needs to accommodate both fasting and non-fasting people, for instance by dedicating a clearly separated room for drinking and eating. During this month productivity is also affected by the change in rhythm for fasting people but also by the shortening of office hours for many.

Cultural and religious differences emphasize the need to adapt your workspace and accommodate both genders and their respective needs. For example, office bathrooms might need to be strictly separated, while in some Western offices they are often shared by both male and female staff.

Open-mindedness and respect are necessary to address cultural and religious differences. It is also encouraged to develop and apply a code of conduct which clearly integrates these differences within daily operations to prevent any conflict or discrimination. Diversity is an asset to most offices, especially when the above is taken into consideration.

**Marie-Helene Westholm-Knebel, Emirates Green Building Council**



### Cross-cutting issues

#### The impact of gender, age, religion and culture on office experience

Experience of the office, particularly the look and feel and the interior layout (covered in the earlier chapter) is highly dependent on the users' profile – age, gender, religion and culture can all play a part.

See the viewpoint from the Emirates GBC, for a perspective on religion and gender in the Middle East.



### Design Strategies: Going for Green

There are links between 'look and feel' and more traditional 'green' design strategies, which may not be immediately obvious.

Lighting, for example, is an important influence on how users experience a space, and designing for look and feel needs to be combined with a low energy lighting strategy, which is perfectly feasible. The choice of certain materials, in particular their colour, will also affect how light is experienced, and manufacturers are beginning to take this into account with light optimising finishes that are less absorptive, and could result in lighting energy savings<sup>70</sup>.

The sourcing of materials themselves is a crucial element of the green office, which is absolutely compatible with a design's look and feel approach. Materials should be low in VOCs, and also easy to clean, given that cleaning products themselves can be a major source of pollutants.

Fundamentally, the look and feel of an office should be designed with the long term in mind. If a space is not right for its occupants, it will be changed more frequently, with all the associated embodied impacts and potential waste.

Getting the look and feel right requires designers to take into account social norms or trends, and personal psychological reactions. It will also be heavily dependent on the type of activity being conducted in a given office. For example, creative tasks are thought to be aided by high ceilings emulating a 'cathedral effect', whereas a task that is based on accuracy and focus benefits by lower ceilings and smaller spaces. These design decisions clearly would have an impact on HVAC strategies.



### More information

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Feeling Good Foundation: a new hub for research and best practise on wellbeing in the built environment <http://feelinggoodfoundation.org>

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Isagen Head Office, Medellin, AIA

## Location & Access to Amenities



### Case study: Isagen Head Office

Location: Medellín, Colombia

The utility company Isagen's head office is located in the central business district of Medellín, Colombia. The seven storey office block includes 770 work stations and 45 meeting rooms, common areas and service areas.

Onsite facilities include a rooftop terrace with mountain views, a vegetable garden, sauna, gym, café and restaurant. These facilities can be used by every level of worker from cleaning staff to the CEO, as well as their families. The public are given access to the roof top restaurant and garden. The central location benefits from local restaurants, banks, retail outlets and medical centres.

The office is easily accessible by foot, bus, metro and car. Most people walk or use public transport due to the office's central location. For those who cycle there is parking for 53 bicycles, showers and dressing rooms. Driving is limited in Medellín through a 'Pico y Placa' scheme, which restricts driving at certain times of the week depending on the car registration number. While Isagen does have 281 car parking spaces, preference is given to those who car share.

Isagen says the concept and design allows colleagues to build relationships and ensures all workers feel valued.

*With thanks to GBC Colombia*

### Overview

It is not just the office building itself that has an impact on the health, wellbeing and productivity of its occupants. The surroundings and community context of an office building can affect individual employees' perceptions and behaviour and the overall performance of the organisation.

Many of the areas covered are recognised as aspects of a high quality, mixed use community, as supported by various green rating systems (e.g. LEED Neighbourhood Development, BREEAM, BEAM Plus Neighbourhood and Green Star Communities tools). To date the majority of research has focussed on community-wide benefits rather than specific productivity improvements for office workers. Although we can extrapolate from this research, and the associated benefits of health and wellbeing on individuals' working lives are intuitively clear, there is very limited evidence on the direct links between amenity access and productivity at present. This is an area where further research is needed.

Location and amenities-related design strategies can be included in developers' considerations for new communities and precincts, or the regeneration of existing urban fabric. These strategies could equally form part of local authority guidance to developers and owners of existing buildings. Occupiers can use them as a guide for location and building selection criteria and to generate initiatives to counteract a lack of amenity at their existing location.

The amenities and services available to office workers – such as shops, restaurants, healthcare, gyms and entertainment – now rank fourth on the list of location decision-making priorities for office occupants<sup>71</sup>. Whether these amenities are onsite or just nearby, the benefits are fairly consistent.

Transport options have a major impact on whether the daily commute is easy or stressful with ongoing impacts on worker wellbeing and productivity. Walking and cycling are great for improving health and require solutions at both a community and building level. Reducing the length and complexity of daily car and public transport journeys is also beneficial.

The quality of the local public realm plays a part in how an office worker experiences their workplace and surroundings. Aesthetics, standards of maintenance and perceptions of personal security all make a difference to the individual's experience. Access to nature within the public realm can reap benefits in terms of providing space for active recreation and also enhances the biophilia effect (see earlier chapter), improving physical and psychological wellbeing. Lastly, the creation of public spaces conducive to interaction with colleagues (and people from adjacent enterprises) has anecdotally improved collaboration, innovation and engagement, with positive productivity implications.

These issues are grouped together because of the similarities in how the benefits are felt. Many of these features involve the availability of choice for office workers rather than a set of conditions. The resulting experience may result in stress reduction; improved physical and/or mental health; and time-based convenience leading to increased productivity.

One of the key benefits of a high quality location and provision of appropriate amenities is the ability to attract and retain the best employees, which has a clear financial benefit to an employer. Conversely, research has shown that employees may expect additional financial remuneration to move to poorly located and serviced workplaces<sup>72</sup>.

# €27m

Savings associated with absenteeism if more people were encouraged to cycle to work according to a Dutch study.



New Street Square, London  
Bennetts Architects/Tim Crocker

### Highlights: Key research

Access to all kinds of amenities and services provides benefit to office workers, but perhaps most important is access to childcare facilities, which can have a significant impact on workplace productivity. One study of a major employer found that 68% of parents would have missed work if they had not used the onsite childcare centre, leading to productivity savings of nearly US\$400,000<sup>73</sup>.

Childcare featured alongside green space, bike racks and gyms as key ways for employers to attract and retain staff in the 2012 Colliers International Office Tenant Survey. The survey also found 95% of tenants wanted to occupy a green building, up from 75% just two years previously<sup>74</sup>. Another survey suggested that 95% of respondents (from a large sample of commercial tenants) not only believe access to good open space adds value to commercial property, but are prepared to pay at least 3% more to be in close proximity to it<sup>75</sup>.

A Dutch study found that employees who cycle regularly to work are less frequently ill, with on average more than one day per annum less absenteeism than colleagues who do not cycle to work. The study extrapolated that the Netherlands could save approximately 27 million euros per year associated with absenteeism if more people were encouraged to cycle to work<sup>76</sup>.

There is significant evidence to suggest that the quality of architecture and the public realm has an impact on wellbeing with a Knight Foundation/Gallup survey finding that an area's physical aesthetics is one of the three most important features identified by respondents in terms of creating a sense of attachment to community (and resultant wellbeing)<sup>76b</sup>.

### Design strategies: going for green

There are many examples of win-win strategies for both people and planet, when considering location and access to amenities, few of which require lengthy explanation.

Good public transport links and features that enable cycling and walking are some of the most obvious ways to both boost health, wellbeing and productivity and reduce greenhouse gas emissions. Locations close to good public transport networks can allow employees to avoid commuting by car, which has been shown to increase stress and in many cases increases fossil fuel consumption and emissions.

By addressing the 'walkability' of a site, employers can enhance options for fitness and leisure and on-foot amenity access and commuting to work. This will in turn impact wellbeing and productivity, and reduce transport related emissions. The "walkability" of a location can be assessed through an index such as that available at [walkscore.com](http://walkscore.com).

Similarly, as the chapter on biophilia showed, access to green space and biodiversity is hugely beneficial for both office worker and the local environment.

Perhaps less obvious, but just as important, is the role that employers can play in helping workers make healthy and sustainable food choices through the management of on-site "canteen" facilities and location close to a variety of food vendors.

## Location & Access to Amenities



Darling Quarter, Sydney, Lend Lease

## Viewpoint

In the competitive hiring environment of Silicon Valley, the human resources manager of a prospective tenant has become a key property decision maker. The top engineering talent is besieged with offers from other tech companies such as Google, Apple and Facebook – all of which have extensive on-site amenities, free transit options, and employee benefits supporting health and wellbeing. As a result, employers now view building location, amenities and services as essential recruiting tools.

Champion Station is an 810,000 square foot office/R&D campus located in the heart of Silicon Valley. Formerly the headquarters of technology giant Cisco Systems, the campus is being renovated by TMG to become a model for a healthy workplace environment – one that encourages employee health and productivity while providing direct and significant fiscal benefits to the employer.

TMG is maximizing the project's attractive location with complementary amenities. Adjacent to both the Ulistac Natural Area and the Guadalupe River Trail boasting 11.4 miles of pedestrian and bicycling paths, the project will have an internal path network as well as provide secure bicycle parking, lockers and showers for cyclists.

The extensive landscaped grounds will have exercise stations, edible landscape areas and community gardens. Tenants will have access to numerous outdoor meeting and gathering areas and open amphitheatres – all with access to power outlets and WiFi to expand usable business areas and enable a creative and open work environment. Further enhancing the connection to the outdoors are sheltered patios for each building and operable window-walls in public spaces.

The on-site light rail station and regional bus service will be supplemented with shuttles to nearby regional transit hubs. The project is close to both neighborhood mixed-use retail and regional shopping centers and food service will be offered on-site.

In today's market, it's no longer enough to offer a good price or an efficient building, the design of the space and the location as a whole must enhance employee wellbeing; we don't see this as a trend but as an essential long-term strategy for successful commercial developments.

**David P Cropper, Managing Director  
TMG Partners**



## More information

### Useful links

ULI – Building Healthy Places Initiative <http://www.uli.org/research/centers/initiatives/building-healthy-places-initiative/>

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Part 2:

# Measuring Impact:

## A Framework for Assessing Health, Wellbeing and Productivity

## Background



### What really matters to most executives is this: How does *my* building impact *my* people?



Turkish Contractor's Association, Ankara  
Atelier Ter/Avci Architects

There is an important difference between showing how things are related and showing how things are relevant. No amount of the former will stimulate large-scale change without a high degree of the latter. While evidence is interesting, evidence plus relevance is instigating.

The preceding chapters in Part 1 of the report have demonstrated how office buildings impact people and, by extension, organisational success. The evidence presented leaves little question that buildings and human performance are related. But the question that really matters to most executives is this: How does *my* building impact *my* people?

Part 2 of the report therefore is focussed on action. We introduce different ways of measuring health, wellbeing and productivity 'outcomes', which we refer to throughout as 'outcome metrics' and then discuss how you might begin to measure them in your own organisation.

The barriers to participating must be low and the potential payoff high. Our proposed way forward reflects this approach and is designed to encourage the collection of much-needed common data.

We seek to provide the tools for building owners and occupiers to engage directly with this agenda. This can be done not just by measuring the outcomes themselves, but by relating them back to physical features of the buildings and the perceptions such features engender in the workforce. We suggest a set of simple procedures from the research and propose a basic framework for measuring outcomes that ordinary organisations can and (hopefully) will want to use.

No amount of argument can ever take the place of first-hand experience. Our framework gives organisations the guidance and concepts they need to begin to make the only business case that truly matters – their own.

We were helped by a task group comprised of leading academics and industry practitioners from all around the world, who met (remotely) numerous times over a period of months to agree the process, offer advice and make decisions. However, any study of this kind is by definition a work in progress. We look forward to continuing to engage with other organisations in this space over the years to come.



Council Offices, Derby  
Corstorphine+Wright/Daniel Shearing

# The Challenge of Measuring Outcomes



Microsoft, Beijing, B+H Architects

## Introduction

Health, wellbeing and productivity are interrelated, but it is important to understand that the relationships are not always overlapping and/or symbiotic.

It is difficult to be productive if you are ill, but it is possible to be productive – at least for short bursts – without necessarily being in the best of health (think of the sort of gruelling training programmes in investment banking). It is also possible to be healthy without having a sense of wellbeing. Offices are full of people who are ostensibly healthy but have low levels of wellbeing (and, probably therefore, productivity).

That is why it is important to think about health, wellbeing and productivity as related but different concepts and to use a range of approaches ('outcome metrics') to assess them. Objective outcome metrics include such quantitative measurements as absentee rates and staff retention. Such metrics are considered reliable by some because they appear transparent and replicable. Anyone measuring the impact would arrive at the same number.

But some important factors – especially worker attitudes – are, by definition, not objective and yet are vital to understanding individual and organisational performance. Relying on measuring apparent physical conditions and objectively-measured outcomes ignores an important intervening variable – human perception.

## The state of the research

The subject area of health, wellbeing and productivity in buildings is not new. Research extends back decades, both in the laboratory and in office settings.

The outcome metrics used have changed over time to fit the modern workplace and its practices. For example, measurements of typing speed and file processing, once potentially valuable measures of productivity, have much less relevance today. Today, new concepts like "presenteeism" (i.e. being present in the office but not productive, which is extremely important but extremely difficult to measure objectively) are the focus of much research.

Ironically, when it was possible to define productivity in offices in relatively simple numerical terms (number of pages typed or cases handled, for example) it was easier to demonstrate relationships between office environments and worker performance. So at issue is not just this relationship, but this relationship in the modern workplace.

Similarly, the concept of wellbeing has expanded in recent years, much beyond the work in early studies. This is because of a greater awareness that attitudes and perceptions are every bit as important to work outcomes as physical conditions.

Of the three areas – health, wellbeing and productivity – health is the one that has perhaps remained the most constant over time, at least until recently. The measures that have defined these outcomes (absentee rates, medical complaints/costs) are more stable. But the new possibilities of measuring previously unrecorded health conditions through more prevalent use of wearable technology remains an area to watch. It may be that going forward our concept of measuring health will be the one to undergo the most change.

One of the most exciting developments in this area is portable and wearable technology.

## Different kinds of studies

Generally speaking, there are two broad streams of research on measuring health, wellbeing and productivity outcomes – laboratory experiments and real-life office-based studies.

### Lab-based studies

In terms of identifying direct causal relationships between building features and human performance, lab-based studies are perhaps the most successful. They can control for other factors and focus on the impact of one particular condition. An example is Satish's 2012 research into the effect of CO<sub>2</sub> on decision-making tasks, which was outlined in the chapter on indoor air quality<sup>77</sup>.

### Office-based studies

Studies of actual office environments are closer to reality, such as the Heschong Mahone study of office workers in California, referred to in the biophilia and views chapter. However, the isolation of causal factors can be difficult.

Of all the real-world settings, studies of pre and post fit out arrangements are perhaps the most useful, for example the Plantronics case study included in the interior layout chapter. If they are done by an organisation that retains the same people, there is an element of the "controlled" setting sought in lab studies, in a real life scenario. However, only by tracking metrics over a period of time, can it be demonstrated that improvements in productivity are not simply a result of a 'newness' factor that might fade.

### Lab meets the office

One of the most exciting developments in this area is portable and wearable technology. These have the power to measure physical conditions and human impacts in real time. At the time of this study they are just beginning to go mainstream. It looks likely that these devices will substantially expand our understanding of health, wellbeing and productivity in the workplace.

Portable sensors, which can measure and map physical conditions at a more granular level, will add immeasurably to our understanding of the physical environment. Wearable technologies will make prevalent much data (such as heart rate and brain activity) that was once only available in the lab.

Some examples are highlighted in the More Information box on page 77.

Microsoft, Beijing, B+H Architects



## The Challenge of Measuring Outcomes



### Cross-cutting issues

#### Studies relating rated buildings to health and productivity

There have been several studies in the last few years that have conducted analysis across multiple buildings, analysing the correlation between green building certification and performance in terms of certain health, wellbeing and productivity metrics.

The results tend to show the positive impact of green accreditation. For example, a National Research Centre Canada study<sup>78</sup> demonstrated superior performance of LEED-rated buildings compared to conventional buildings in terms of physical indoor environmental quality metrics and perceptions of satisfaction, as well as improvements in sleep quality, mood, physical symptoms and airborne particles. A similar correlation was found in a recent study of green rated buildings in Taiwan<sup>79</sup>.

An interesting nuance, suggested by Leaman and Bordass<sup>80</sup> when analysing data from the Building Use Studies in the UK, is that occupants are inclined to be more 'tolerant' or 'forgiving' when they understand the intention behind green design. However, other analysis challenges how clear the relationship is

between green buildings and occupant satisfaction, notably some recent work by Altomonte and Schiavon<sup>81</sup>.

Green Building Councils (GBCs) are strong advocates for green building rating tools, believing they have driven change in markets all around the world, increasing demand for low energy, resource-efficient building products and services. However, no GBC would say that rating tools are a panacea, and they champion the importance of post-occupancy evaluation, and continuous innovation and development of the various rating tools in the market.

On the whole, the results of these meta-studies are positive for proponents of green building, but to the individual owner or occupier they are less useful, since by their nature they cannot account for site or organisation-specific variables. Nor do they typically assess the impact on quantifiable financial metrics. As we noted at the outset, what matters for most real estate decision-makers is how will my building impact my people, and what is the business case? The development of our framework that follows is based on confronting this challenge.

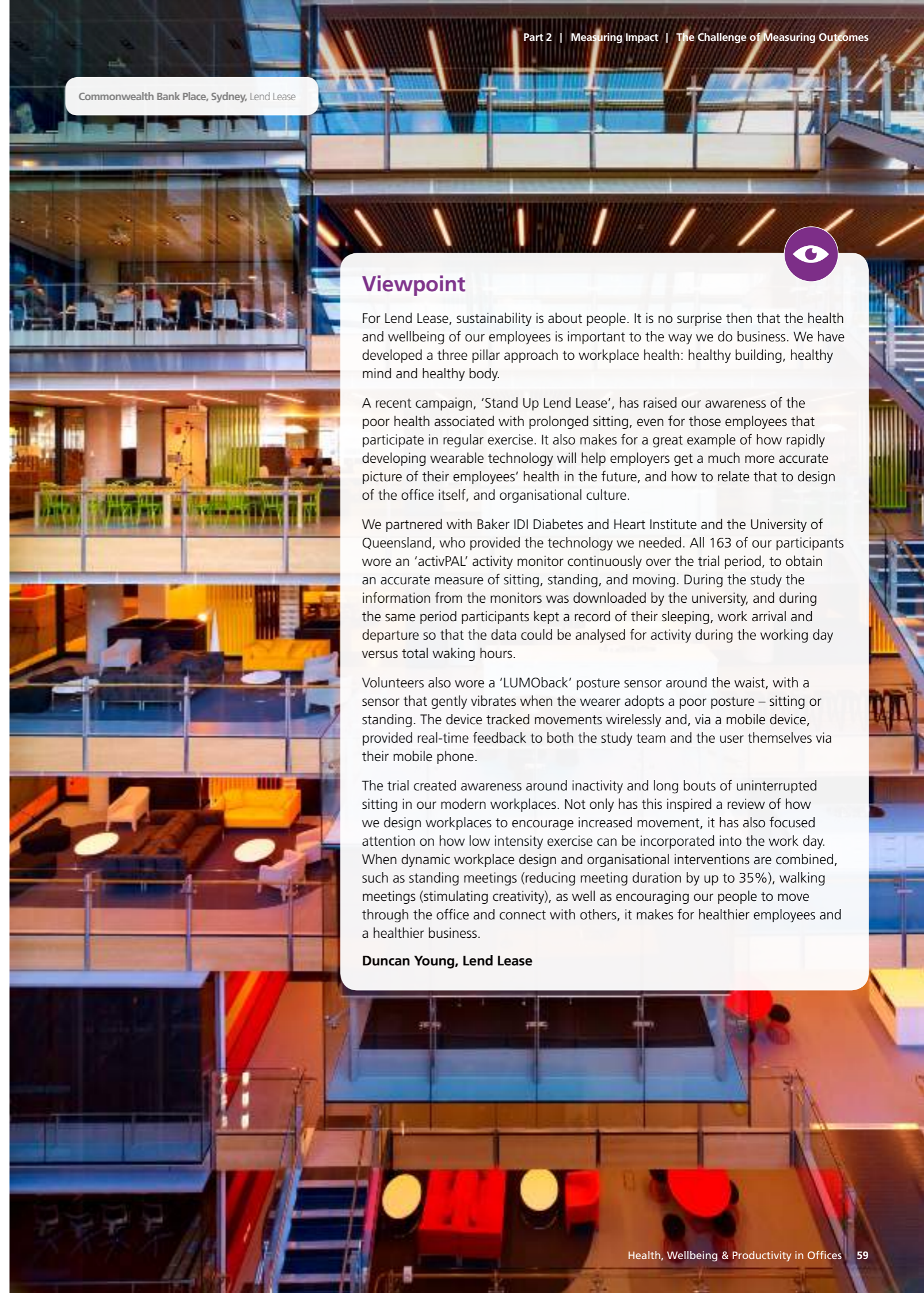


### More information

#### Footnotes

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Commonwealth Bank Place, Sydney, Lend Lease



### Viewpoint

For Lend Lease, sustainability is about people. It is no surprise then that the health and wellbeing of our employees is important to the way we do business. We have developed a three pillar approach to workplace health: healthy building, healthy mind and healthy body.

A recent campaign, 'Stand Up Lend Lease', has raised our awareness of the poor health associated with prolonged sitting, even for those employees that participate in regular exercise. It also makes for a great example of how rapidly developing wearable technology will help employers get a much more accurate picture of their employees' health in the future, and how to relate that to design of the office itself, and organisational culture.

We partnered with Baker IDI Diabetes and Heart Institute and the University of Queensland, who provided the technology we needed. All 163 of our participants wore an 'activPAL' activity monitor continuously over the trial period, to obtain an accurate measure of sitting, standing, and moving. During the study the information from the monitors was downloaded by the university, and during the same period participants kept a record of their sleeping, work arrival and departure so that the data could be analysed for activity during the working day versus total waking hours.

Volunteers also wore a 'LUMObac' posture sensor around the waist, with a sensor that gently vibrates when the wearer adopts a poor posture – sitting or standing. The device tracked movements wirelessly and, via a mobile device, provided real-time feedback to both the study team and the user themselves via their mobile phone.

The trial created awareness around inactivity and long bouts of uninterrupted sitting in our modern workplaces. Not only has this inspired a review of how we design workplaces to encourage increased movement, it has also focused attention on how low intensity exercise can be incorporated into the work day. When dynamic workplace design and organisational interventions are combined, such as standing meetings (reducing meeting duration by up to 35%), walking meetings (stimulating creativity), as well as encouraging our people to move through the office and connect with others, it makes for healthier employees and a healthier business.

**Duncan Young, Lend Lease**

## Our Process for Developing a Framework



We had to consider the hard realities of the business environment, most notably the perceived costs and benefits of collecting and evaluating data.

### Narrowing down potential metrics

Our initial research and discussions produced a list of almost 40 possible health, wellbeing and productivity outcome metrics. This was far more than we expected most businesses could or would want to use. It was also evident that not all of the metrics we collated were equally feasible to collect or applicable to all types of businesses.

Some of the outcome metrics were potentially powerful but difficult and/or expensive to assess. Others seemed easy to collect but were less relevant to today's business practices. We had to filter the outcome metrics through some hard realities of the business environment, most notably the perceived costs and benefits of collecting and evaluating data.

Therefore we screened the metrics through a number of categories, including:

- Applicability across business types
- Ease of measurement
- Ease of relation to building features
- Cost to measure
- Financial impact of metric to business
- Manifestation time (how long it takes for the metric to appear: for example, immediate illness vs. long-term health impact).



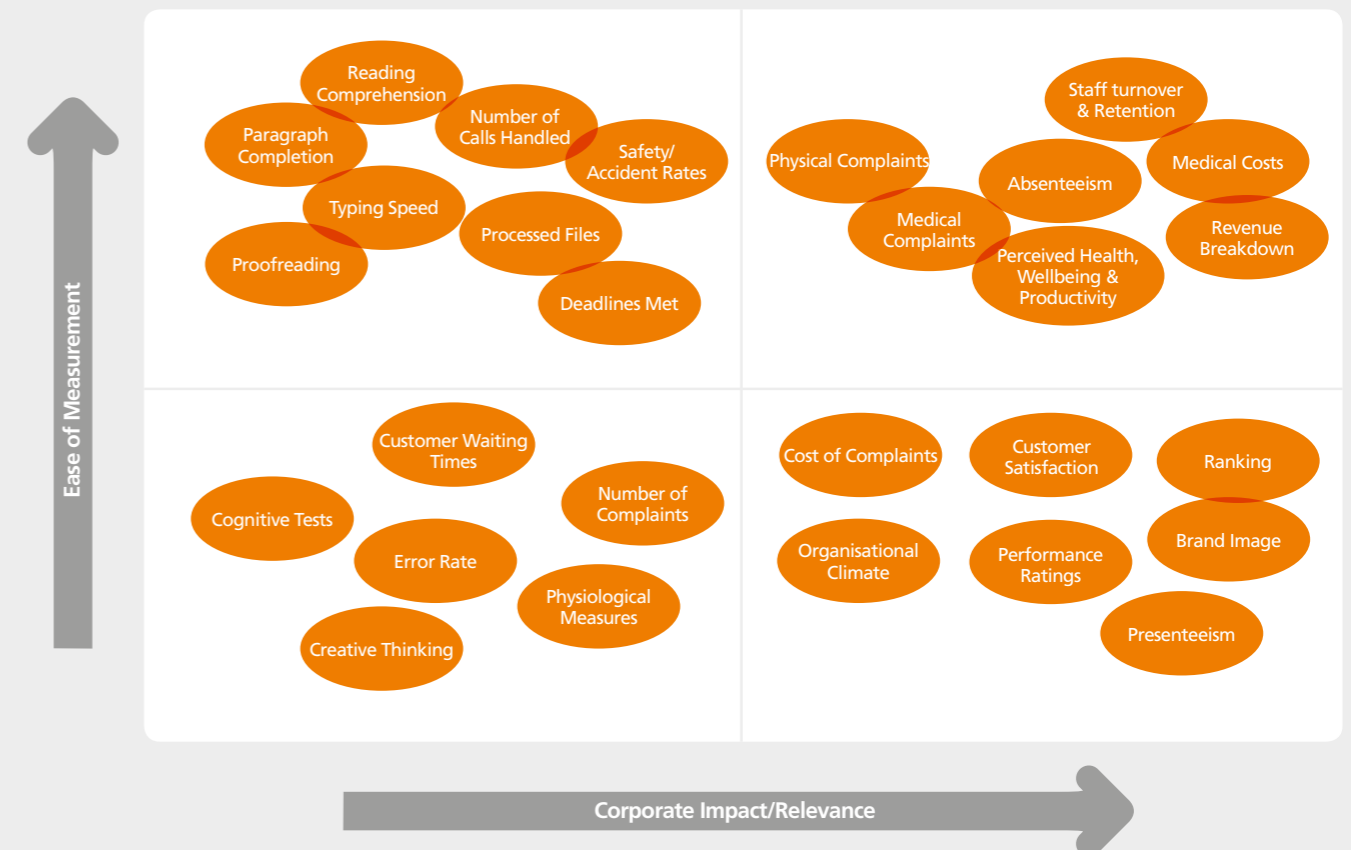
Zappos Head Office, Las Vegas, Arup/Bruce Damonte

Angel Building, London, AHM

Based on these criteria, the group narrowed the list of outcome metrics down and compiled a 4-quadrant schematic (see below) to separate out the outcomes by ease of measurement and impact on business.

This process informed a final list of seven metrics:

1. Absenteeism.
2. Staff Turnover/Retention.
3. Revenue breakdown.
4. Medical costs.
5. Medical complaints.
6. Physical complaints.
7. Self-perceptions as determined by a survey.



The precise placement of metrics on this schematic will vary across business types.



## Our Process for Developing a Framework

AZV Erdinger Moos, Munich, Architektur  
Werkstatt Vallentin/Tomas Riehle



Elizabeth II Court, Winchester, Bennetts Associates

### Thinking differently about this data

The idea that businesses should be thinking about this organisational data in relation to its buildings is a key proposition at the heart of this report. It is one of the easiest and potentially most effective things most organisations could do to understand how the business case for health, wellbeing and productivity in buildings applies to them.

Organisations that are interested in measuring changes in health, wellbeing and productivity think that they might have to wait until the next move or refurbishment. But it is clear from this report that the major opportunity for most organisations is not the next transaction, but right now.

Many organisations are sitting on a treasure trove of information that, with a little sifting, could yield important immediate improvement strategies for their two biggest expenses – people and places. The costs of collecting and organising this data is low and the payoff potentially very high. Our aim in the next section is to demonstrate how you can begin to do this.

We start from the premise that the physical design and operation of your buildings will affect the health, wellbeing and productivity of office workers. We then set out the proposed outcome metrics in more detail, and suggest capturing them on a building-by-building basis. Of course, differences in these metrics across (or within a building) may not be related to the design or operation of the building – but they may well be, and that is crucial information worth understanding. This is a starting point for more investigation and industry learning.

By thinking differently and narrowing down the data, you will hopefully begin to ask more questions about the relationship of your premises to your organisational performance. This will help you make the business case for health, wellbeing and productivity in your buildings, or the buildings of those you are working for or advising. It will make the literature on the subject real to you, and, in the process, make the research findings more accessible to the industry.

**Many organisations are sitting on a treasure trove of information that, with a little sifting, could yield important immediate improvement strategies for their two biggest expenses – people and places.**

### Insights from HR professionals

We tested this final list of seven metrics with HR professionals and from this, drew the following conclusions:

1. Organisations surveyed already collect some data that we think would be useful in assessing health, wellbeing and productivity in office environments. This means that with a little bit of effort and the right framework to draw from, organisations could greatly improve their understanding of the impact of their office on staff.
2. Of the organisations that were not collecting data already, they were generally inclined to start doing so, with most expressing the sentiment that the proposed metrics would help them understand the health, wellbeing and productivity agenda and its place in their organisations.
3. Some data – absenteeism, staff turnover, revenue and medical costs – were collected with rigor, centrally. However, other data, such as medical and physical complaints was collected on a more ad-hoc basis. Much of the information is not shared widely within organisations and almost certainly not evaluated against the kinds of spaces workers occupy.
4. The outcome metrics proposed appeared to have the right balance of ease and importance, suggesting that we had got the concepts right for wider participation.
5. Overall, the interest in applying these metrics appeared high amongst those we surveyed, suggesting that there is an appetite to begin to assess these metrics within their own specific workplaces.

## Applying an Integrated Framework: Financial, Perceptual, Physical



The framework presented here is one way that organisations can begin to take an integrated approach.

### Introduction

This chapter sets out how you can begin to look at corporate data on human performance through a different screen – the buildings in which your colleagues spend the majority of their time.

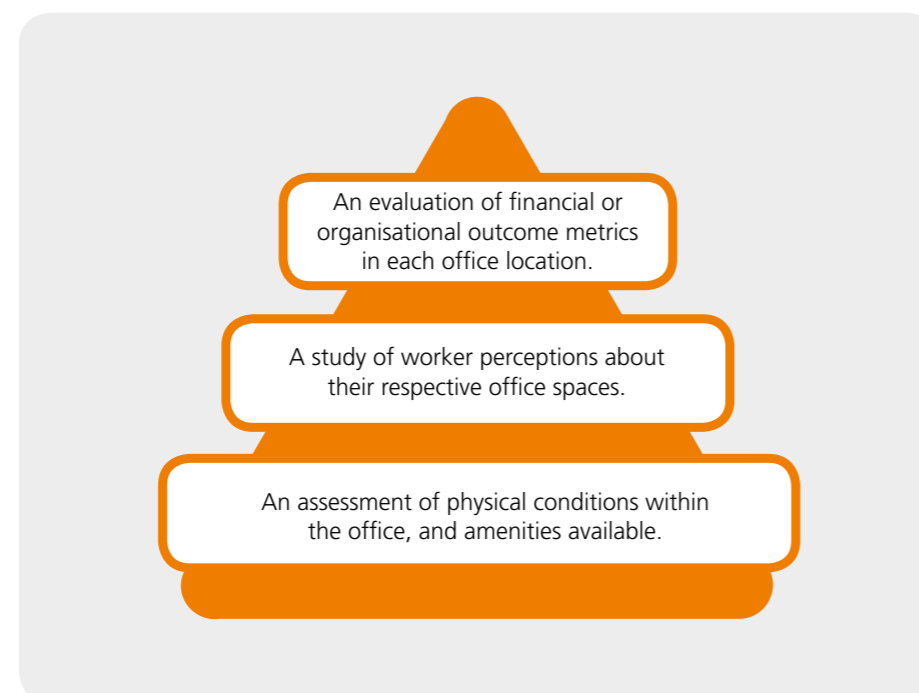
Performance metrics of different kinds are not unfamiliar terrain for organisations. Most companies that seek to improve their businesses routinely undertake a review of outcomes (such as revenue) and relate them to smaller units (business divisions, teams, and even individual managers) to understand the specific factors driving performance.

The thinking for this framework is much the same – taking overall company metrics and assessing them in terms of place. Do people tend to have more absences in one office rather than another? How do medical and physical complaints vary across offices within a portfolio? Are teams performing the same tasks in different kinds of offices producing the same or different results? Do employee self-perceptions about health, wellbeing and productivity vary across offices, and are they related to objective measures of outcomes?

Of course, buildings are complex and can require a high level of commitment to understand, while drawing the links between physical spaces and human and organisational performance can appear difficult for the average organisation. In this report, we have tried to distil the information and make it actionable.

The framework presented here is one way that organisations can begin to take an integrated approach, with an emphasis on making headline assessments of buildings using an adequate but not overwhelming number of data points. This method could be used, in part or in whole, by all kinds of actors in the industry who want to understand the issue better and get the best from their buildings. We are grateful to Richard Francis of The Monomoy Company for assistance in developing this<sup>82</sup>.

The framework has three major components, which are taken in turn below.



Absence through sickness comes at a major financial cost to companies.

### Financial (or organisational) metrics

**Absenteeism:** Number of days (or hours) of absence due to illness annually

As demonstrated in Part 1, one of the most fundamental and established relationships in the literature on healthy buildings is that of poor indoor environmental quality and higher rates of sickness, manifested by increased rates of absenteeism. Absence through sickness comes at a major financial cost to companies.

Most organisations have some system for measuring absenteeism, but often it ends there. Even if organisations track absenteeism levels they may not know why that absence has occurred because they do not record a specific cause. Seldom is this measure considered more widely in the context of the physical environment.

One way to begin to understand whether your spaces are negatively impacting the health of your workers is to do the following:

1. Track and record the number of absences reported by all of your employees.
2. Identify a specific reason for the absence (e.g. whether it is health-related or for some other reason).
3. Break down your overall absenteeism by location (across and, where feasible, within buildings).
4. Compare health-related absenteeism rates in different locations.
5. If rates are noticeably higher in one building or location, consider possible physical causes.

For organisations that have a number of offices, or for those that can examine pre and post move or refurbishment data, there are many comparisons that can be made.

For organisations that have only one (or a small number of offices), there are a couple of options. Firstly, they can do comparisons within buildings since the quality of space even within the same building can differ dramatically. Secondly, they can benchmark their offices against national statistics on average absenteeism rates where available. If the numbers are significantly higher than expected, organisations may wish to consider a physical cause<sup>83</sup>.

Of course, employees may report falsely a reason for an absence if they do not want to reveal the true cause. They may report being physically ill, for example, when the true reason for the absence is psychological in nature. Even in these instances it is still valid to track the numbers on absenteeism by location, since it may be something about the physical place itself that causes employees to want to remain at home.

Rawstorne Place, London, Bennetts Associates Architects



## Applying an Integrated Framework: Financial, Perceptual, Physical

A generally accepted figure is that replacing an existing employee costs, in total, about 1.5 to 2 times that lost employees' annual salary.

**Staff Turnover:** Percentage of regular, full time employees leaving employment (voluntarily or involuntarily) in a given year.

Most organisations track staff turnover in the normal course of business and most track reasons for leaving. Clearly, many reasons for leaving are not related to dissatisfaction with the office environment.

Nevertheless, because employee turnover is so costly for organisations it is worth exploring further in relation to the office building itself. A generally accepted figure is that replacing an existing employee costs, in total, about 1.5 to 2 times that lost employees' annual salary<sup>84</sup>.

To begin tracking the relationship between buildings and staff turnover, it is helpful to consider only that category of staff turnover in which the employee voluntarily leaves the organisation. It is also important to consider recruitment, as a slightly separate but closely related issue.

We propose that organisations:

1. Track and record staff turnover for all employees on an annual basis. Turnover is defined as the percentage of employees who leave employment in a given year.
2. Within turnover, identify the percentage of staff that left voluntarily.
3. Break down this category by location (across and, where feasible, within buildings).
4. Compare voluntary leaving rates in different locations.
5. If rates are noticeably higher in one building or location, consider possible physical causes.
6. Where an employee is leaving for a competitor, ask what the motivation is through an exit interview or survey.
7. Conduct an 'entry' interview for new recruits, including questions on whether the office building was a factor in their application.

Turnover rates can be tricky when looking across organisations (and geographies) simply because some industries (and locations) have rates that vary substantially. It is important, therefore, that organisations compare turnover rates in an appropriate fashion, controlling for business type and location where possible, and being otherwise mindful of any trends that might skew the result.

Staff turnover is slightly different from absenteeism in that it is likely less related to health issues and more to wellbeing, motivation or perception of the workplace environment. It is therefore useful to consider turnover rates in relation to self-perception surveys.



Eversheds, London, Woods Bagot

**Revenue:** Revenue per division/department/team, per building/building zone, and/or per employee.

If absenteeism largely relates to health, and staff turnover to wellbeing then the third metric – revenue – most certainly falls under productivity. This is the one measure that all companies collect but also one that companies are least likely to consider from a building point of view.

This is not to say that companies think buildings and the locations are unimportant – quite the contrary. Setting the right corporate tone and having the right address are paramount concerns to many companies. Businesses clearly recognise that internal environments are important for productivity, as demonstrated by the number of workplace studies and consequent refurbishment strategies they engender.

However, despite these efforts, organisations seldom systematically consider financial metrics in relation to particular properties. It is common to see revenue broken down by country or region or division, but it is almost never considered on a building-by-building basis.

Studies of pre and post refurbishment activities would be useful in this regard, as they would hold constant activities and people and change only the buildings.

Our framework proposes that organisations:

1. Record revenue on an office by office basis.
2. Group offices where individuals are performing similar functions.
3. Compare unit revenue per individual or per square meter.
4. Compare results and where results are substantially different consider possible physical causes.

Revenue can be a difficult measure, since it depends so much on factors external to the building (the state of the market, how it is measured and reported, how much is related to staff efforts, etc.). It is also hard to compare across different business types, although companies could begin to consider what figures are typical for their industries. Despite these challenges, if buildings improve the health and wellbeing of employees we would expect a concomitant rise in productivity, which in most organisations is reflected in revenue or net profit.

Zappos Head Office, Las Vegas, Arup/Bruce Damonte

## Applying an Integrated Framework: Financial, Perceptual, Physical



### Most organisations do not record or interrogate the numbers on a building-by-building basis.

**Medical Complaints & Private Medical Costs:** Incidents of reported/documented medical complaints resulting from the physical work environment or work activity; and expenses associated with providing medical insurance or medical care to employees annually.

These are separate metrics but grouped here because of the close linkages.

If the health of employees (both physical and mental) is related to buildings, we would expect medical complaints and medical costs for employees to be higher in buildings without features that promote health and wellbeing. Yet, as with the other metrics we put forward, most organisations do not record or interrogate the numbers on a building-by-building basis.

Medical costs, defined as the expenses associated with providing insurance or medical care to employees annually, are almost always tracked for the organisation as a whole. Companies that do provide medical insurance cover for their staff can get actual costs broken down by staff member and therefore by location. Medical complaints (like physical complaints in the section below) may also be tracked formally or informally, but again are seldom aggregated and evaluated at the building level.

For medical complaints and private medical costs, we propose that organisations:

1. Track medical complaints on a building-by-building basis.
2. Request insurance costs by employee (and therefore location) where possible.
3. Benchmark medical complaints and costs across the portfolio and determine those properties that have levels significantly above the average number of complaints.
4. Where results are substantially different or unexplained consider possible physical causes.

Medical costs (which we recognise will be more or less relevant in different organisations in different countries) are not always paid in the same way, and are usually aggregated across companies. This presents more of a difficulty of separating costs on a building-by-building basis.

However, organisational medical costs raise another tantalising opportunity that cannot be ignored – the possibility of arguing for lower insurance rates based on lower rates of health problems. Some employers are already arming employees with fitness trackers in the hopes of lowering insurance premiums. If data on physical health could be overlaid against data on healthy buildings and shown to have a relationship, then there is the longer term possibility that occupiers of healthy buildings may be able to argue for lower insurance rates.

For many companies, medical/insurance costs represent large numbers and are currently untapped by those who make the business case for healthy buildings. Comparing figures in your buildings against average statistics may present a new opportunity for you to leverage healthy environments into financial savings from third parties. This already happens with many companies now having ‘wellness’ plans (gym membership etc) and buildings represent a prime opportunity for this kind of thinking.

### Some employers are already arming employees with fitness trackers in the hopes of lowering insurance premiums.

**Physical Complaints:** number and type of complaints reported to the company of physical discomfort associated with the work environment or work activity.

Physical complaints, like medical complaints, are usually collected by organisations, but often on an ad hoc basis, or in a centralised database that is seldom considered by anyone beyond the facilities managers. Yet we know that complaints about thermal comfort, air quality and light quality do have a major impact on staff productivity.

Monitoring physical complaints and grouping them by building (or by parts of a building) is a relatively easy exercise for companies to undertake. While this requires a bit more effort than most companies currently expend, the financial reasons for beginning this effort is clear – worker productivity has been shown to be strongly and adversely affected by poor physical environments.

We recommend that organisations:

1. Track and record physical complaints reported by all of your employees, making an effort to include even minor complaints that normally go underreported.
2. If not too burdensome, track speed of response, and whether a complaint was resolved in a satisfactory fashion.
3. Evaluate the type and number of physical complaints by location (across and, where feasible, within buildings).
3. Where rates are noticeably higher in one building or location, consider possible physical causes.



Sika Training Centre, Stuttgart, Sika

GPT Head Office, Sydney, Woods Bagot

## Applying an Integrated Framework: Financial, Perceptual, Physical



### Perceptions may provide the missing link between the physical office environment and health, wellbeing and productivity outcomes.

#### Perceptual

The financial or organisational metrics above are concerned with measuring objective indicators of health, wellbeing and productivity. What they can miss are important underlying attitudes about the workplace that can be harder to quantify but can have significant impacts on human performance. To tap into attitudes requires a different kind of measure: the self-perception survey.

In many ways, perceptions may provide the missing link between the physical office environment (discussed below) and health, wellbeing and productivity outcomes. How workers feel about the office is vital yet underutilised information by many employers. This is true even though the costs of administering a survey are low and the value potential, (in terms of knowledge, engagement, etc.) very high.

Even if organisations do undertake surveys, they very often do not ask questions on wellbeing and instead focus on whether workers are physically comfortable and able to get work done. So the results may reveal that an office is physically comfortable and functional, but that does not mean it is optimal.

In the same way that workers can be physically present in an office but not 'well', an office can be physically adequate without promoting wellbeing, or inspiration. And yet as suggested in Part 1, studies increasingly infer that it is this later component that is a driving force behind increased productivity.

Effective perception studies test a range of self-reported attitudes to gain insight into health, wellbeing and productivity in the workplace. The answers that workers provide can contain a wealth of information for improving office performance. Asking employees about their preferences and opinions – and responding to them – will also go a long way toward establishing trust and a sense of engagement. As the market becomes more occupier-focused, establishing worker preferences and incorporating them into office design and operation will become an increasingly important business strategy.

There is a brief introduction to some of the existing employee perception tools in the marketplace in Appendix I, but most have a particular specialist focus. We recommend that any survey should ask questions about health, wellbeing and productivity (i.e. all three) and probe their relationship with features of the office itself, and the amenities available. This should also be a crucial element of any Post-Occupancy Evaluation.

Guidance on the practicalities of carrying out a perception survey, and a pool of questions that could be used to put one together, can be found in Appendix II.

Orona Ideo, San Sebastian, Xabier Barrutieta, Eneko Goikotexea, Javi de la Fuente, Santi Perez



Zappos Head Office, Las Vegas, Arup/Bruce Damonte

## Applying an Integrated Framework: Financial, Perceptual, Physical



### Measurement of the physical conditions in the office is complicated by the range of components.

#### Physical

The physical conditions in the building which could be measured or evaluated were discussed throughout Part 1 of the report. This could include but is not necessarily limited to:

Direct measures of:

- Pollutants
- CO<sub>2</sub>
- Ventilation rate
- Air velocity
- Indoor air temperature
- Mean radiant temperature
- Relative humidity
- Illuminance levels (Lux)
- Daylight
- Background noise.

Evaluations or assessments of:

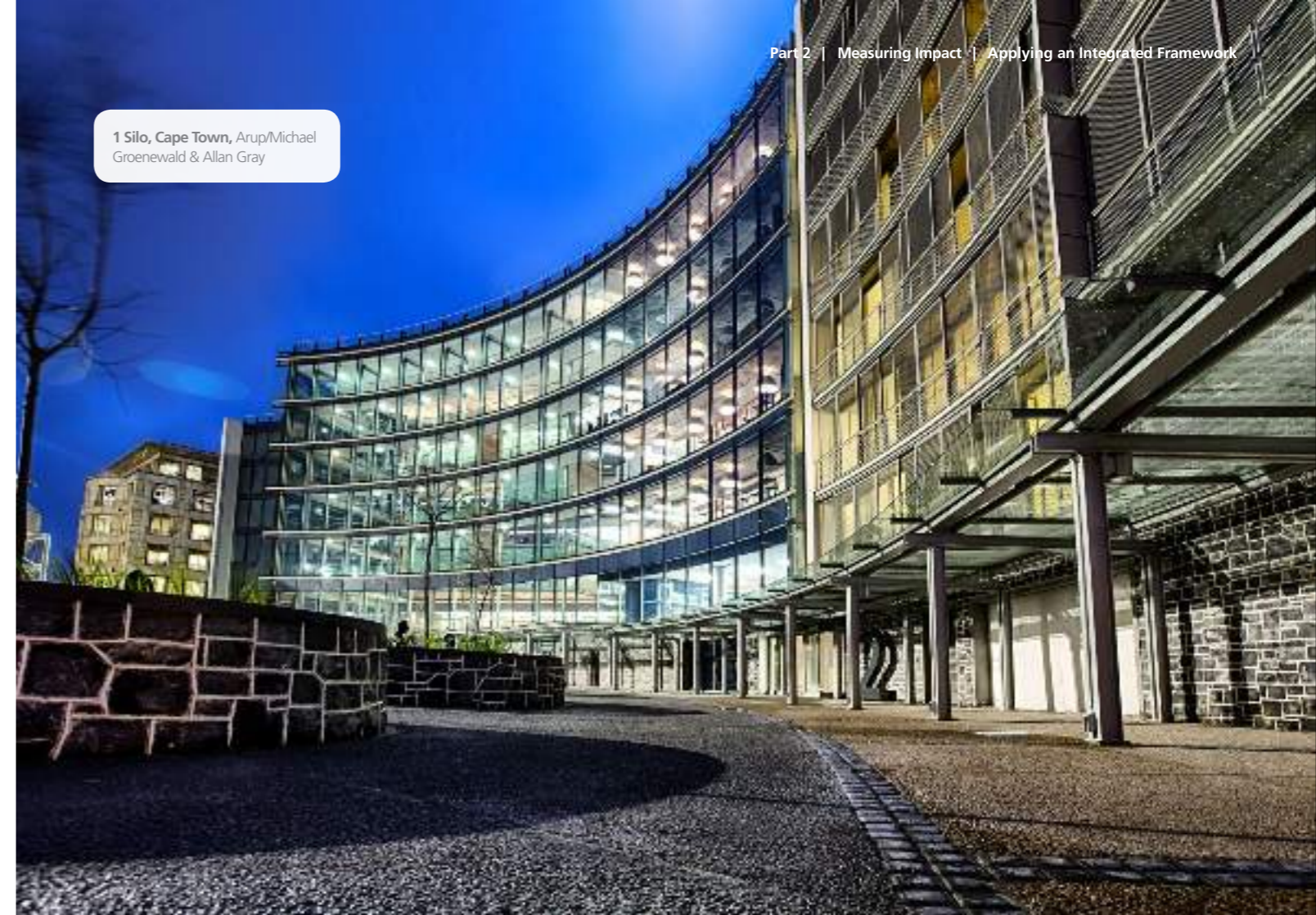
- Visual comfort
- Privacy & interference
- Policies to encourage adaptive clothing in the office
- Level of personal control of indoor environment
- Workstation density
- Task based spaces & ergonomics
- Breakout spaces & social features
- Active design
- Connections to nature
- Views outside
- Design character & brand ethos, including colour, shape, texture & art
- Cultural, gender & age sensitive design
- Access to amenities & transport
- Quality of public realm.

Measurement of the physical conditions in the office is complicated by the range of components. It is easy to measure temperature by using a thermometer, but how do you measure outdoor air supply rate, or air pollutant levels? Will it require a team of experts to conduct detailed and intrusive technical analysis of your office?

A number of best practice guides are available through organisations such as ASHRAE, BSRIA and the EPA which provide minimum acceptable levels, or best practice performance targets on elements of IEQ. Similarly, green building rating tools such as LEED, BREEAM, BEAM Plus, NABERS and SKA all assign credits relating to the indoor environmental quality.

However, being aware of best practice, or having gone through a rating process during construction or fit-out does not necessarily help you to measure the key elements of IEQ on a day to day basis, or to benchmark against performance in other buildings.

1 Silo, Cape Town, Arup/Michael Groenewald &amp; Allan Gray



### Measurement needs to be placed in the hands of the occupants where possible.

One of the key issues here is identifying which measures of the physical environment can be carried out by building occupants (or indeed owners/managers), and which require experts with specialist equipment. For example there are a number of organisations who are able to provide professional guidance and services on this, and modern BEMS (Building and Energy Management System) innovations are even linking building systems to IAQ sensors mounted in ventilation ducts which in turn drive those systems. Similar advances are being made in light sensors.

However in order to deliver non-intrusive, ongoing measurement of the indoor environment, and create the demand for organisations to act on this knowledge, measurement needs to be placed in the hands of the occupants where possible. We have already seen the growing impact of wearable technologies on measuring occupant health. We need to see a similar revolution in user-friendly monitoring systems for indoor environmental quality.

There is a limited selection of products entering the market which monitor a range of indicators at minimal cost, and provide real time readings to occupants<sup>85</sup>. A few examples are provided in the 'more information' section below, but we believe this is just the start.

Zappos Head Office, Las Vegas, Arup/Bruce Damonte

## Applying an Integrated Framework: Financial, Perceptual, Physical



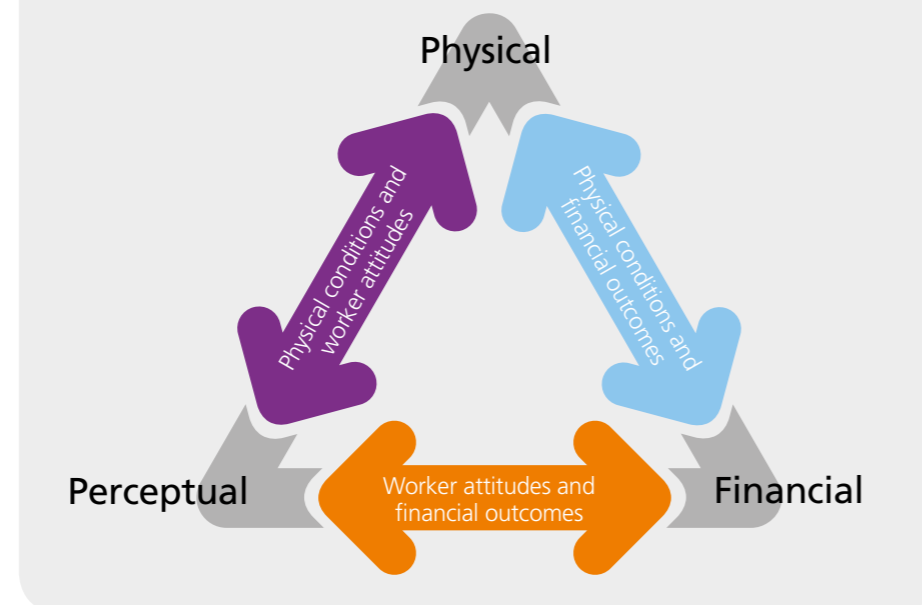
There is clearly an opportunity for organisations to begin to think differently and use their physical premises for competitive gain.

### Practical applications

Using the three components set out above, an organisation could examine data and analyse relationships between:

1. Physical conditions and worker attitudes.
2. Physical conditions and financial/organisational outcomes.
3. Worker attitudes and financial/organisational outcomes.

### Summary of metrics framework and key relationships



Having captured these three separate but related data streams, organisations will begin to better understand the relationships between their own buildings, employees, and outputs. By comparing the financial metrics against physical conditions (including location & amenities) and worker perceptions, organisations can begin to understand how physical factors influence the business case for better quality buildings.

This analysis should take place within and across buildings, and comparisons are likely to yield rich data. Typical comparisons of buildings could include open plan vs. conventional cellular offices; narrow footprints vs. deep-plan layouts; and buildings with high/low levels of natural light.

The list of practical applications for understanding these relationships is a long one, including due diligence on new space, rent review on existing space, fit-out guidance on refurbished space, and so on. If you can understand how buildings impact your people and take steps to improve your space, it may be one of the most important business decisions you can make.

## In the next few years will we start to see the rise of the Chief Wellbeing Officer?

Organisations looking to buy or rent space could assess buildings along the criteria set out above (See Appendix III Guidance for Tenants), to make an assessment about the health and performance-enhancing features of the building. This information in turn could inform the development of benchmarks on what constitutes 'healthy' levels in each case. Benchmarking is commonly done at the due diligence stage for other kinds of sustainability performance, most notably around energy efficiency, and could easily be adapted to this area. Given the potential impact on asset value that health, wellbeing and productivity factors may have, it is inconceivable that these kinds of issues will not make their way into due diligence activities.

For organisations that already have space, they could begin to measure and compare the physical components of their spaces to better understand how their environments may relate to performance. Benchmarking buildings against best practice guidelines is the first step in understanding how buildings are performing and whether the physical space itself is impacting people.

There is clearly an opportunity for organisations to begin to think differently and use their physical premises for competitive gain. This is true from investors right through to occupiers, whether you are trying to command a higher price for a high-performing building or looking to take the kind of space you think will help drive business success.

### Making it happen

This is less difficult than it seems. It requires a different way of thinking and working rather than a great deal of extra, expensive data capture. Facilities managers, for example, are likely to have a wealth of data about the building itself, its physical features and even some outcome metrics – such as physical complaints. Likewise, HR departments are already in possession, in many cases, of data about worker attitudes as well as performance data – absenteeism, medical costs, retention, etc. And, of course, the CFO or Finance Director will be well aware of revenue and related financial metrics.

The sweet spot in this agenda is where the circles on buildings (FM), people (HR) and finance (CFO) overlap and yet so few businesses take advantage of this rich space, which is a huge missed opportunity.

Finally, what role for the sustainability executive? They should perhaps have the keenest interest of all. The forward-thinking sustainability professional could be viewed as having a role in helping to get all three sets of actors above to start thinking and working together. There is an argument for suggesting health, wellbeing and productivity should be synonymous with sustainability. In the next few years will we start to see the rise of the Chief Wellbeing Officer?



Orona Ideo, San Sebastian, Xabier Barrutieta, Eneko Goikotexea, Javi de la Fuente, Santi Perez

AZV Erdinger Moos, Munich, Architektur Werkstatt Vallentin/Tomas Riehle

## Applying an Integrated Framework: Financial, Perceptual, Physical



### Viewpoint

#### Developing Measurable Criteria for Creating Healthy, User-Focused Workplaces

Why does a company like Google find it so important to build the healthiest workspaces imaginable around the world? We apply the same focus to designing our offices that we use for any of our products: put the user first. We're constantly exploring and testing out ways our work environments can positively impact the short and long-term health and well-being of our employees so they can perform at their best every day.

To that end, we've set ambitious environmental performance goals across our global facilities portfolio, establishing key Indoor Environmental Quality (IEQ) criteria – including indoor air quality, acoustics, biophilia, lighting quality and thermal comfort – that best support employee health, happiness and productivity.

In doing so, we've identified a few best practices in developing IEQ approaches designed to support a company's unique culture and specific business needs:

- Establish clear and measurable goals at the outset. While it may seem obvious, clearly defining your IEQ goals and metrics with stakeholders upfront is critical to aligning a project's performance requirements with your desired outcomes. In Google's case, we aim to collect building data and measure the environmental performance of our office space, using these findings to iterate and make data-driven design decisions for our offices. For example, we are evaluating the extent to which staff have access to nature – indoor plantings, views, etc. – to determine the effectiveness of our biophilia strategy.
- Seek both qualitative and quantitative feedback from your users. Valuable findings come in many forms, so leveraging both quantitative data as well as user insights and comments from employees can help provide a more complete picture about what's working (or not) in your workspaces. In addition to feedback that Google's employees regularly share in our workspace surveys, we also use input from focus groups, user interviews and various pilot projects to learn from and inform our future workspace decisions around the globe.
- Identify links between your healthy, high-quality work environment and your organisation's productivity. One example is the impact on employee recruitment and retention efforts. By designing user-focused workplaces that inspire collaboration, creativity and community, companies can further differentiate themselves in attracting the best and brightest talent.

In addition to feedback that Google's employees regularly share in our workspace surveys, we also use input from focus groups, user interviews and various pilot projects to learn from and inform our future workspace decisions around the globe.

We're entering uncharted territory in defining the healthy workplaces of the future. Whether you're a startup or a Fortune 500 company, organizations of all sizes can play an important role in advancing industry-leading IEQ research and broadening understanding of the built environment's impact on employee health and productivity.

**Andreas Gyr, [e]Team Design and Construction Integrator, Google**



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### More information

#### Footnotes

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Alima <http://getalima.com/>  
Netatmo [www.netatmo.com](http://www.netatmo.com)



## Concluding Remarks



### This is not an opportunity that requires a large commitment, or a prime portfolio.

We set out in the key findings chapter the argument for investment in healthy, productive office environments. However, we are acutely aware that the best business cases make themselves and they only do so when they are personal and not hypothetical.

By taking you through what we see as a low cost route to potential better building and organisational performance our aim is not to argue a general business case. Instead we want to make you aware of a prime, currently missed opportunity in real estate and give you specific steps to understand what that means to you, your customers or those you advise.

This is not an opportunity that requires a large commitment, or a prime portfolio. It is not a high risk strategy or an opportunity for someone else. It is, or should be, a core business strategy.

We set out the number at the start of the report that typically accompany a business case argument for health, wellbeing and productivity: people are 90% of an organisation's expense and well exceed building costs and energy costs, therefore a small improvement in employee productivity can yield significant value.

This is a compelling argument and has certainly helped to move the agenda forward, but by and large this has so far failed to engender a lot of action. Surely, part of this is because people see the numbers but do not know what to do. This report, presented the way we have, is an attempt to remedy this situation.

Studies of human nature tell us that people are risk averse, and while unwilling to gamble for a gain are highly reactive to loss. This kind of thinking has pervaded the industry regarding energy, where companies have been reluctant to act based on a 'premium' but are highly sensitive to depreciation for perceived poor performance. So talking about gains, however big, is often not as effective as talking about small losses.

We think that these principles may begin to play out in the health, wellbeing and productivity agenda as the topic goes more mainstream and as our ability to measure performance in these areas increases. The business case for healthy buildings has always been based on what occupants can gain, but increasingly (as with energy) the most important question is what do owners stand to lose?

Various industry actors are already investigating how they may leverage IEQ performance in transactions. Observers of the market expect the following to occur in the relatively short term:

- Increased awareness of these issues leading to investor/tenant education and changing expectations
- Buyers/occupants using health, wellbeing, and productivity metrics at due diligence or rent review
- Health, wellbeing and productivity metrics becoming influential in obsolescence/worth.

This is a different kind of business case, but one to watch. It is the value equation – not cost savings – that has driven the business case for energy improvements and/or green building certification in many markets and there is every reason to think that may begin to happen with health, wellbeing and productivity as well.

There is an important difference between energy and health that cannot be overlooked and certainly affects the business case. The health, wellbeing and productivity agenda is powerful because it impacts everyone, not just those with an interest in sustainability. It appeals to workers and management alike by promising more (health, wellbeing, profit) and not mandating less (energy, resource use, etc.). From a business perspective, engaging with this issue can be a very potent and attractive strategy.

Health, wellbeing and productivity are on the cusp of being better understood and applied in the industry, and advances in technology will bring that even closer. Is it too far-fetched to think that in the not-too-distant future, cheap wearable and portable technology may allow occupier-driven 'big data' to compare office environments at scale? Engaging with this agenda early and carefully promises significant benefits for companies who choose to stay ahead of the curve.

Lastly, the role of WorldGBC and the national Green Building Councils around the world is very much an open question. We know this is an issue that has captured the imagination of many people across our global network. The role that we play in the future is up to you.



CAFOD, London, Black Architecture

## Appendix I: Workplace Surveys Already In The Market

A handful of organisations and researchers are already using surveys to quantify a range of concepts which had previously been extremely difficult to measure. Here we provide a brief summary of some of the more prominent workplace surveys that we have come across to date.

### The Gallup Workplace Audit

In the 1930s Dr. George Gallup's pioneering scientific sampling process to measure popular opinion<sup>86</sup> and research into human well-being, led to decades of research into a range of topics including happiness, health, and attitudes towards work.

More recently the Gallup Organisation has developed research into the relationship between wellbeing and business outcomes, including quantitative and qualitative research of employee perceptions of management practices across a variety of industries<sup>87</sup>.

The resulting 12 question/statement employee perception survey, with graded responses from 1-6 based on level of agreement, The Gallup Workplace Audit, surveys hundreds of organisations (198,514 individuals to date)<sup>88</sup> globally and can provide Business Unit measures of performance that are comparable from one business to another. These include: employee turnover; customer satisfaction; loyalty; productivity; and profitability.

### The Leesman Index

Leesman Office is a measure of workplace effectiveness which comprises an 11 minute perception survey where employees rate their working environment. The survey categorises questions into four main areas:

- Work Activities
- Impact of Design
- Workplace Features
- Workplace Facilities.

While the core survey is fixed elements can be tailored to the specific organisation.

The survey assigns a score to each employee based on their responses, and their physical surroundings, this is aggregated for all respondents within an organisation to provide a benchmark score; the Leesman 'Lmi' Benchmark, and facilitate comparability of workplaces.

The far right box shows the ability of the LMI to be 'personalised' for a particular organisation/ building.

With over 25,000 responses in the UK, and a further 15,000 across Europe the Leesman Index represents one of the largest such datasets.

### Building Use Studies (BUS) Methodology

The BUS methodology was initially developed in the 1990s as part of the widely referenced PROBE building performance evaluation studies in the UK.

The commercial Post Occupancy survey, available in paper or electronic form and in several languages, contains up to 45 questions relating to:

- Thermal comfort and ventilation
- Lighting and noise
- Personal control
- Space, design and image
- Perceived productivity
- Transport to work.

Results are reported in graphical and statistical form and each building is rated according to overall building performance. The BUS database now contains responses from 650 buildings across 17 countries and sets annually updated benchmarks.

### CBE Berkeley

The Centre for Built Environment and the Lawrence Berkeley Laboratory have conducted research into various building features and their effects on building users. This includes a survey on the Indoor Environmental Quality of a building from a building user's perspective, and questions within those surveys relating to how that feature affects the respondent's ability to perform their job.

The standard IEQ survey includes questions on:

- Acoustic quality
- Air quality
- Cleanliness and maintenance
- General comments
- Lighting
- Office furnishings
- Office layout
- Thermal comfort.

There are also a number of optional question categories available for use in addition to the standard survey:

- Accessibility
- Building and grounds
- Commute
- Conference and training rooms
- Court work
- Daylighting
- Laboratories
- Maintenance service
- Office support equipment
- Operable windows
- Raised floor and floor diffusers
- Restrooms
- Wayfinding.

### WELL Building Standard

This is not a workplace survey, but we thought it was worth including here. This is a building standard, which at the time of writing is at pilot stage. The standard can be applied to commercial, institutional, and residential developments including new construction, core and shell, and tenant improvements. It is a system for measuring, certifying, and monitoring the performance of building features that impact health and wellbeing.

The WELL Building Standard has the following categories:

- Mind
- Comfort
- Fitness
- Light
- Nourishment
- Water
- Air.



### More information

#### Useful Websites

The Leesman Index <http://leesmanindex.com/leesman-office>

BUS Methodology <http://www.busmethodology.org.uk/>

CBE Berkeley – Occupant Indoor Environmental Quality (IEQ) Survey and Building Benchmarking <http://www.cbe.berkeley.edu/research/briefs-survey.htm>

CBE Occupant Satisfaction Demo Selection <http://www.cbesurvey.org/survey/demos2010/>

The WELL Building Standard <http://wellbuildinginstitute.com/>

#### Footnotes

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88. Harter JK. Schmidt FL. And Keyes CLM. (2003) Well-being in the Workplace and its Relationship to Business Outcomes – A Review of the Gallup Studies available from: <http://media.gallup.com/documents/whitePaper--Well-BeingInTheWorkplace.pdf> Last accessed 1 September 2014



## Appendix II: Designing Your Own Perception Survey

### Introduction

Perception surveys enable organisations to assess direct responses relating to specific themes (such as productivity, stress, workplace environment, comfort and satisfaction) and while their outputs must not be over-relied upon in isolation, correlation analysis against financial and physical metrics provides a powerful tool for better understanding the impact of the office on its occupants.

Key drivers, objectives, organisational structure and outputs will vary across different organisations, and surveys will need to account for these differences if at all possible. However, as a general rule, surveys should attempt to address health, wellbeing and productivity as part of the same exercise.

### Practical Considerations

Increasingly organisations see a benefit in sharing results with employees, and this has now become expected, irrespective of the results. You should consider how you will communicate the findings of your survey once completed. We suggest that responses should be anonymised, so people feel able to be truthful.

The majority of questions proposed below are designed so that rated or graded responses are possible as this provides the opportunity to convert subjective responses into quantitative data, observe trends through data analysis, and identify links to the other metrics (i.e. financial and physical).

On the scale of responses, unless otherwise stated, 1 represents a very negative response (strongly disagree/definitely not/very unsatisfactory etc), 3 represents a neutral or no opinion response, and 5 is very positive (strongly agree/definitely/very satisfactory etc).

Additionally we recommend you include an open ended question at the end of the survey (or at the end of each section) to allow respondents the freedom to provide more detailed responses, and/or to raise any particular issue which is not covered by the questions in the survey.

Please note that proposed questions/categories are for guidance only, and organisations should frame their questions to suit their own objectives.

A survey is only representative of a population if the response rate is adequate, but you will need to judge whether you can rely on a survey being completed electronically, or whether hard copies are necessary.

The survey should be short; there are a large number of potential questions below but you should be looking to take a selection of these that best suit your organisation in order to compile a survey that will take absolutely no longer than 15 minutes to fill out. After all you do not want to scare off potential respondents with too much detail.

It is worth making all responses mandatory as it can be extremely frustrating to go through a whole survey process to then find that a large proportion of respondents have chosen not to comment on key responses – this will diminish the representativeness of your dataset. Consider including a ‘no response’ option for the key questions in the survey but then ask why they have not responded in an open ended question – it may be that some respondents have only just started working in a given building and so are only able to make general comments about the building and cannot comment on improvements brought about through a refurbishment for example.

### Possible Survey Questions

This is a deliberately long list of possible survey questions. We do not propose organisations use every single one, but decide what is most appropriate for them, bearing in mind the need to maximise responses and minimise administrative burden.

#### General Information:

- Male/Female
- Age (range <20; 21-30; 31-40 etc)
- Time at company (< 1 year; 2-4 years; 5-7 years etc)
- Department/team/building zone/location
- Time spent in office (part/full- time, 1 day a week etc)
- Workstation type (Open plan, cubicle, private/shared office, own desk/hot-desk etc)
- Time worked at company
- Time worked in that specific office building.

#### Building/Company General:

- Rate how happy you are in your job
- My employer invests in my health and wellbeing
- My company cares about sustainability
- I am proud to work for \_\_\_\_\_
- I work in a nice building
- My workplace (building, not organisation) supports me in carrying out my work
- My workplace provides a suitable and comfortable working environment
- I do not like the building that I work in
- There is nothing I would like to change about the building I work in
- My workplace is often very uncomfortable.

#### The Role of Sustainability:

- I am not interested in sustainability
- I often moderate my behaviour to reduce my environmental impact
- I do not care if my employer has a good sustainability record
- My company has taken targeted action on becoming more sustainable
- My employers demonstrate a proactive approach to sustainability
- I approve of my employers proactive approach to sustainability

- Investing in sustainable buildings demonstrates my employers commitment to me
- My company promotes flexible working (e.g. working from home/flexi-time)
- I would not work for a company which doesn't prioritise sustainability
- I am more likely to remain with my employer because they invest in sustainability.

#### Building Fabric and Systems:

- Rate your working environment (1-5)
- The building is generally very attractive
- The building is generally a comfortable place to work
- The building does not support a comfortable working environment
- The physical indoor environment of the office is poor
- I am often too cold in winter
- I am often too hot in summer
- Rate the artificial lighting levels in your office
- Rate your level of control over lighting in your office
- I believe the heating, ventilation and lighting in our office should be automated to save energy
- I find the lighting levels to be inadequate
- I suffer from glare from the windows
- I can see a window from my desk
- There are good levels of natural daylight in the office
- Fresh air levels in the office are excellent
- The office regularly becomes hot and stuffy
- The ventilation system is very noisy
- The ventilation system works well
- The Indoor Air Quality is poor
- The office always smells
- The air conditioning gives me a sore throat
- I never get too hot in the office
- I never get too cold in the office
- I dislike the lack of control of heat and light in my immediate proximity
- I am able to control the temperature at my workstation
- I am able to turn on and turn off lights as I please
- The office can get very draughty in autumn and winter
- Our office lights are controlled by absence/presence detectors
- I find automated lighting controls irritating
- The lack of control over lighting often affects my work.

## Appendix II: Designing Your Own Perception Survey

### Office Design/Layout:

- I sit within close proximity to those who I need to communicate with at work
- I have many friends at work
- I often get up and move around the office during my daily tasks
- I do not know many of my colleagues
- I have plenty of privacy at my workstation
- I am constantly distracted by office noise
- If we open the windows there is a lot of noise from the street
- There are lots of plants in our office
- There is somewhere for me to go and make quiet phone calls
- Where I work within my office depends on the task I am carrying out
- I always work at the same desk
- The person next to me always speaks loudly on the phone and distracts me
- There are too many people in our office
- Our office is normally half empty
- We have a great view from our office
- Our office feels spacious and pleasant.

### Location and Amenities:

- The office is close to a train station (5 point scale: 1=>10 miles, 2=7-10 miles, 3=4-6 miles, 4=1-3 miles, 5=<1 mile)
- The office offers easy access to bus links
- I am able to walk to work
- My employer encourages me to walk to work
- My employer provides a complementary travel service (e.g. mini-bus)
- I have to drive to work as there is no other option
- Our office has adequate parking
- I am able to run to work
- My office is an easy commute from my home
- How long is your commute (1=>1.5 hours; 2=>1 hour; 3=31-59 minutes; 4=15-30 minutes; <15 minutes)
- I am very stressed from my commute by the time I get to work (1= Everyday, 2=Often, 3=Sometimes, 4= Rarely, 5=Never)
- We have plenty of secure bicycle storage racks in our office
- We have plenty of showers in our office for all runners/ cyclists to shower at work
- We have safe storage facilities for personal belongings
- We have cupboards/clothes rails available for hanging up work clothes
- I would like to cycle/walk/run to work but we don't have shower/changing facilities
- I would like to cycle/ walk run to work but it is too far
- We have shower facilities but they are always dirty/messy
- We have a work canteen
- There is only unhealthy food available in our canteen
- Our canteen offers a great selection of healthy foods and snacks
- There are a number of shops/restaurants within an easy walk of my office
- I have to walk for 15 minutes just to get a coffee.

### The Workplace and Me:

- I find the office an excellent environment to work in
- I have trouble concentrating at work
- Our office gets really hot in the afternoons and I struggle to concentrate
- I am more productive when I work from home than at the office
- I am very productive when I am at the office
- I often get headaches after a long day in the office
- Our office does not support good health.

### Employer:Employee Engagement:

- I am made aware of sustainability initiatives and activities that take place in my workplace
- A large number of employees buy into our sustainability agenda
- I am very aware of why my employer takes actions relating to our building
- I had no idea this was a sustainable building
- Our employer is only investing in energy efficiency to save money
- I have begun to adopt the environmentally beneficial behaviours that are encouraged by my employer (switching off, closing doors, using less water etc)
- I have begun to adopt more efficient behaviours at home as a result of work initiatives
- Our employer encourages us to get up and walk around at certain intervals throughout the day
- Our employer encourages lunch-time activities (stretch and flex, going for a walk etc).

### Post Refurbishment/ Post-move section:

- The general appearance of the office is much better than before
  - I feel more comfortable at work since the move/refurbishment
  - I do not like the new office
  - I have noticed that my concentration levels have improved since the move/ refurbishment
  - A low carbon refurbishment of our office was the right thing for our employer to do
  - I am very proud to work in a sustainable building
  - I feel fresher and more energetic since working in the new building
  - The building looks great but some of the systems don't work very well
  - The ventilation system is inadequate
  - Our employer did a good job of communicating changes to us
  - I was always aware of the works taking place and the reasons for carrying them out
  - There has been a number of minor building issues since the move
- Since the move/ refurbishment...*
- ...I feel less stressed at work
  - ...I feel less healthy at work
  - ...I am able to get more work done (please give details)
  - ...I spend more time doing productive work
  - ...I feel more comfortable at work
  - ...I am not able to control the temperature at my work station
  - ...I have found the indoor office environment unpleasant.

## Appendix III: Guidance for Tenants

This is a proposed guidance sheet for tenants (and potential owner-occupiers) seeking new space, in the form of a list of questions to raise with the landlord's letting or sales agent.

It deliberately poses questions that it may not be possible to answer easily at the moment, but serves to provide a steer for the direction we believe discussions are likely to go in, in the future. It therefore should prove instructive to landlords as well who may want to stay ahead of the curve on this issue and be better prepared to handle questions from prospective investors/occupants.

### Indoor Air Quality

Tenant to ask if it is possible for the landlord to provide the following information (or to allow their own technical assessment):

- What level of particulates is present in the indoor air in the tenants' demise?
- What systems do the buildings have in place to filter outdoor/indoor air?
- What CO<sub>2</sub> levels are present in the indoor air in the tenants' demise?
- What VOCs levels are present in the indoor air in the tenants' demise?
- What CO levels are present in the indoor air in the tenants' demise?
- What NO<sub>x</sub> levels are present in the indoor air in the tenants' demise?
- How easy is it to fit monitors to existing systems to allow for monitoring?

### Thermal comfort

- What is the source of ventilation for the building?
- What is the ventilation rate for the building?
- What are the temperature set-points for the HVAC system?
- What is the level of relative humidity in the tenants' demise?
- What is the level of personal control in the tenants' demise?
- Is there a record of physical complaints and can this be viewed?

### Lighting

- Does daylighting meet industry standard lux levels for specific tasks, to allow artificial lighting to be switched off around desk areas for the majority of the working day?  
Where the landlord has installed the lighting:
- What type of lamps have been installed and what is their predicted annual energy consumption?
- What is the lamp colour temperature?
- Please provide lux levels for the demised space.

### Biophilia

- What is the provision of green space adjacent to the building?
- What is the nature of the provision of planting in common areas?
- What are the external views of, and are there views of trees and green space from the building?

### Design including active design

- Please provide photographs to illustrate the design character & brand ethos – incl. colour, shape, texture & art
- What is the provision of cycling facilities in the building (bicycle racks, showers, drying rooms, lockers)
- Does the design of the building encourage the tenants to use the stairs rather than the lift?

### Amenities & location

- Describe public transport provision within ten minutes walk of the building
- Describe the services available local to the building (e.g. shops; restaurants; post office; leisure facilities; healthcare facilities; childcare)
- Describe any services within the buildings, e.g. canteen, onsite childcare facilities, gym, laundry/dry-cleaning service, etc.
- Describe the local public realm in terms of standards of maintenance and perceptions of personal security, and please provide photographs to illustrate aesthetics
- Are there any communal spaces conducive to interaction with colleagues (and people from adjacent enterprises)?

### Post-Occupancy Evaluation

- Has the building/space undertaken POE studies?
- Are these able to be reviewed?
- Beyond energy, does the building/space publicly report other areas of environmental performance, including IEQ indicators?

## Acknowledgements

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#### Editor's note

Towards the end of this project we heard the very sad news of the sudden death of Paul Hinkin, MD of Black Architecture, whose 'viewpoint' piece is included in the report. Paul was a passionate advocate for sustainable design and the wellbeing agenda, and will be missed tremendously by those who knew him. This report is dedicated to him.

Partner GBCs



The World Green Building Council connects a global coalition of more than 100 national Green Building Councils and their 27,000 member companies with a single mission: to transform the building industry and ensure our buildings and cities are healthy, efficient, productive and sustainable.

[www.worldgbc.org](http://www.worldgbc.org)