Barriers to Greater Energy Efficiency within the Building Industry

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ABSTRACT

Barriers exist which are slowing the spread of energy-efficient buildings. The Energy Efficiency in Buildings (EEB) project[1] of the World Business Council for Sustainable Development (WBCSD) has investigated these barriers in workshops and seminars with leading suppliers to the industry and experts in several fields, and by commissioning international research. This paper is based on the project's first findings.

The paper analyses two separate but related barriers. The first concerns the nature of the building sector. The analysis concludes that the complex commercial relationships between the many specialists involved in the sector act as an impediment to energy efficiency being a significant priority in construction projects. This structural barrier is reinforced by practices in the industry which segment the building delivery process, limiting potential for holistic, long-term approaches.

The second barrier concerns the awareness, knowledge, experience and attitudes concerning energy efficiency of participants in the building industry. These factors are clearly important in the ability of individuals to overcome the structural barriers identified in the first part of the paper. The second part of the paper reports the results of research in eight countries to investigate building professionals' awareness and involvement. The research found that awareness is high in most countries covered, but there are significant barriers preventing widespread involvement: There are serious gaps in knowledge about energy efficiency among building professionals, as well as a lack of leadership throughout the industry.

Introduction

It is widely recognized[2] that readily available and financially viable technology could significantly improve the energy efficiency of buildings but the potential is not yet being realized. Understanding the barriers which are limiting implementation should help to identify how to unlock the potential and achieve faster progress towards more energy-efficient buildings. As buildings are responsible for up to 40%[3] of energy use in many countries this would make an important contribution to tackling climate change and energy security.

In this paper the terms "green" and "sustainable" are used interchangeably to refer to building characteristics in tune with sustainability, especially energy efficiency. This usage is supported by the research reported below.

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[1] See www.wbcsd.org

[2] The Swiss building label Minergie can be obtained only if the additional costs are less than 10%. Germany Passivhaus claims that if properly designed, no additional costs are needed and LEED provides figures of additional costs in the range of 0% to 6%.

[3] 40% includes the share of buildings' energy in power generation and commercial/industrial energy use. See WBCSD, Energy and Climate, Pathways to 2050 and IEA 30 years of Energy Use in IEA Countries, ref. fig 9-8, 1998

The Nature of the Building Sector

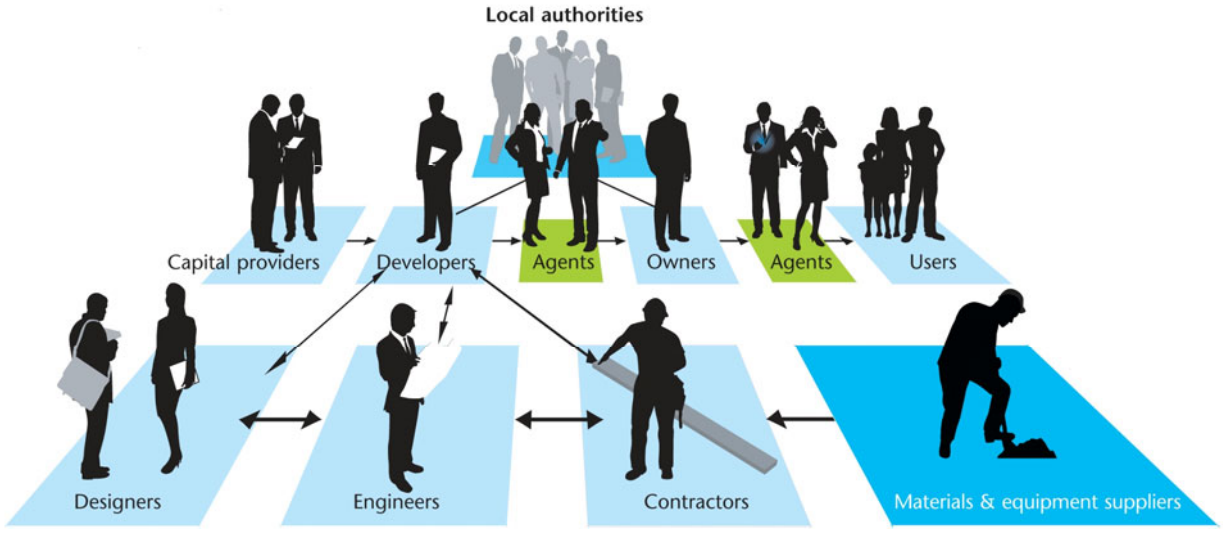
An appreciation of building sector structure, relationships and practices is important in developing an understanding of how to improve energy efficiency in buildings.

Lack of Integration in the Value Chain

Compared to many industries the building sector consists of relatively small players in many discrete segments or specialties. The lack of integration between actors leads to conflicting priorities and motivations and reinforces a tendency for short-term financial criteria to dominate decision-making

There are many stakeholders in the building supply chain. Figure 1 shows a simplified schematic view of the main commercial relationships, illustrating the complexity of interaction between these stakeholders. Below, we describe each of the main players and the key relationships, considering the implications for sustainable building development. The most significant aspect illustrated in the figure is the dominance of developers, and the disconnect between owners and users on the one hand and the designers, engineers and contractors who have the knowledge and skills to create more sustainable buildings on the other.

Figure 1. Relationships in the Building Value Chain



Local authorities influence the value chain through building policies for their area, which are typically layered over national regulations. In setting codes and standards for buildings, the local authorities typically select levels that are a compromise between high levels of energy performance and cost considerations. [4]

Capital providers as lenders or investors they are overwhelmingly concerned with the risk and return equation. This is often over a short time period, although mortgage lending clearly

4 "Who Plays and Who Decides," Innovologie LLC, US DOE, page xiii

involves longer timescales. Their decision-making is dominated by financial criteria, and energy costs are not normally sufficiently significant to influence decisions.

Developers are the primary actors in commercial construction and are frequently speculative, seeking to make capital gains rather than holding the property to reap returns from rental income. This inevitably results in a short-term focus on buildings' value, and value being dominated by estimates of potential rental income. Once a project has the necessary commercial and regulatory backing, there is usually intense pressure to complete construction as quickly as possible, as cheaply as possible, meeting only minimum requirements. These pressures can squeeze out consideration of any aspects considered non-essential.

Developers who hold property to receive income from tenants have a longer-term view. They are likely to be concerned with long-term operating costs, possibly for as long as 50 years. This perspective makes energy-saving investments potentially attractive, even if the payback period is relatively lengthy. But in many countries it may not be possible for developers to reap the benefits of such investments – the energy saving goes to the occupier, even though the developer incurs the investment cost.

Developers are typically conservative. They are naturally reluctant to take technical risks given the scale of commercial risk involved in major projects and the perceived conservatism of potential occupiers. This makes it difficult for architects to incorporate new ideas in many developments.

Developers commission *architects (or designers), engineers and construction companies.* These professionals have the most expertise in technical aspects of construction, including energy efficiency, but usually have only limited influence on key decisions. They respond to and are driven by the requirements and priorities of the developers who commission them. Architects, engineers and contractors often work in relative isolation, even if they all work for the same firm. Financial pressures can mean that proposed enhancements such as energy-efficient features are eliminated in a value-engineering exercise in later design stages, especially because projects are typically carried out as a sequence of separate segments rather than in an integrated fashion.

The role of letting and real estate *agents* can be important. They often stand between developers and tenants, and between owners and occupiers. Their interests are typically short-term and financial, e.g., the agents who act for developers and tenants in a commercial transaction are interested primarily in the lease agreement, focusing mainly on price. Developers complain that this intermediation makes it more difficult to talk to potential tenants about the longer-term, non-financial aspects of buildings, including energy efficiency.

Owners are frequently not the same as end users in residential or commercial buildings. The owner may lease the property to occupiers, sometimes with timescales of only a few months. Agents or property managers may stand between owners and end users, without knowing or communicating the benefits of energy efficiency to either side.

Owners' perspectives may be short-term or long-term, depending on their objectives. Some owners buy to sell on (and make a capital return), while others buy to lease (as an investment), and a declining proportion buy to occupy. Owner-occupiers are in the best position to consider investments which may have lengthy pay-backs. Owners of investment properties are in a similar position to long-term developers. They may be able to consider investments with

lengthy payback periods, but may be inhibited by split incentives, which mean that they cannot reap the benefit of the investments.

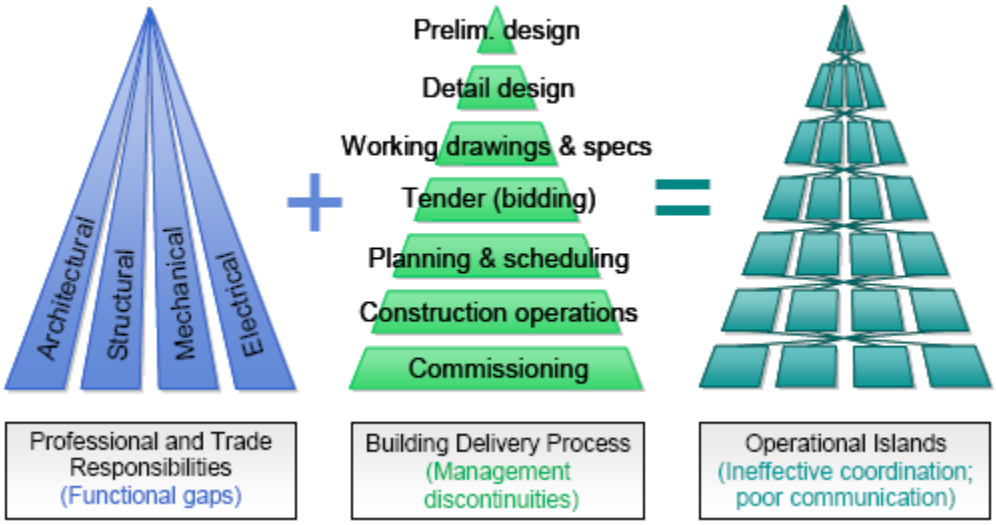
Tenants are likely to be in the best position to benefit from energy savings, but if they are tenants they rely on landlords to make the necessary investments. This is the reverse of the position for owners and developers, who are in a position to make the investments but will not be able to reap the rewards of lower energy consumption if energy bills are paid by the tenants. More significantly, energy costs are likely to be a small proportion of their total occupancy costs, and may therefore not receive enough attention to drive energy-saving activity. For example, in a study of office buildings in Germany, heating and electricity make up less than 6% of the total running cost of the building.[5]

The Design Process

One way to visualize the complexity of interaction in the building design process is shown in Figure 2. The first pyramid describes the various technical disciplines involved in the building sector, which have traditionally tended to work in isolation from each other. The second pyramid describes the building delivery process, identifying the main discrete stages from preliminary design to commissioning. Combined, the third pyramid depicts the ineffective coordination that exists due to the functional gaps and management discontinuities. For example, there are often lengthy delays between the design stages, due to difficulties with building permits, project financing or signing up anchor tenants for commercial property. The risk to completing the project is highest in the early stages, which means there is financial pressure to limit the amount of money at risk early in the process.

5 Sources: Jones Lang LaSalle GmbH, CREIS .based on 397 buildings with 6 million m2 in 2006. Office Service Charge Report **2006, Dusseldorf**

Figure 2. Players and Practices in the Building Market [6]



More prevalent vertical integration in the supply chain could improve energy efficiency in buildings. While there are a number of major companies which integrate these design and delivery functions (e.g., Skanska, Hochtief, Peter Kiewit) they rarely carry out such fully integrated design/build projects, which are perceived to be more costly to implement[7]. Property developers may prefer not to integrate because they believe competition within each specialty generates value (i.e., results in lower bids in a tendering process).

A more directly integrated relationship exists in the public sector, where the state may finance, develop and own property such as schools, hospitals and other public buildings, including public housing.

The functional separation and ineffective coordination between participants in the value chain have two important consequences:

- incentives to reduce energy use are usually split between different players and not matched to those who can invest in energy-saving measures
- there is normally very little opportunity for users to provide feedback through the market to developers or designers.

This aspect is exacerbated by the nature of property transactions, which are not part of a continuing commercial relationship that allows users to provide feedback that can influence product design. The market consists of a relatively small number of large transactions. In most business sub-sectors, buyers seldom have the opportunity to return to the same seller. Retail and warehousing are the main exceptions, where customers acquire a series of outlets based on a standard model over several years.

6 Mattar, S.G. "Buildability and Building Envelope Design". Proceedings, Second Canadian Conference on Building Science and Technology, Waterloo, Nov. 1983.

[7] "Who Plays and Who Decides," Innovologie LLC, US DOE

Attitudinal Research

The barriers created by the structural and process factors described above can be overcome – but only with well-informed and highly-motivated actors in the value chain. The EEB research set out to discover the extent of knowledge about and activity in sustainable building practices among building professionals in eight countries representing a range of development and climate: Brazil, China, France, Germany, India, Japan, Spain and the USA. They constitute more than half of the world's population (approximately 3.5 billion people in 2004) and two-thirds of world energy demand.

The research consisted of two strands to provide a rich picture of attitudes in and around the building industry. The results presented below are based on the findings of both qualitative and quantitative research.

Qualitative: In-depth interviews with opinion leaders and others who influence attitudes and action on sustainable building provided qualitative inputs. This qualitative research was with three groups:

- Opinion leaders – architects, journalists, NGOs, academics
- Regulators – policymakers, politicians, regulators
- The finance community – analysts, financiers, property investment companies

Researchers carried out in-depth interviews between October 2006 and January 2007, either face-to-face or by phone, with 45 people, the majority in the Opinion Leader group. The interviews covered attitudes towards sustainable buildings and barriers to progress

Quantitative: The quantitative research questioned three broad sub-groups of building professionals:

- Specifiers and developers – including architects, engineers, builders and contractors
- Agents and professional landlords – including corporate building owners
- Corporate tenants

Researchers interviewed 1,423 people using a telephone questionnaire between November 2006 and February 2007.

The research did not include input from private landlords and homeowners. Results from Japan were anomalous but are included here, for completeness.

Terminology and Objectives

The qualitative research investigated perceptions of sustainability in relation to buildings, including the use of the terms "green" and "sustainable". The word *sustainable* tends to be more prominent in Europe, while *green* is more suited to Asia, especially Japan.

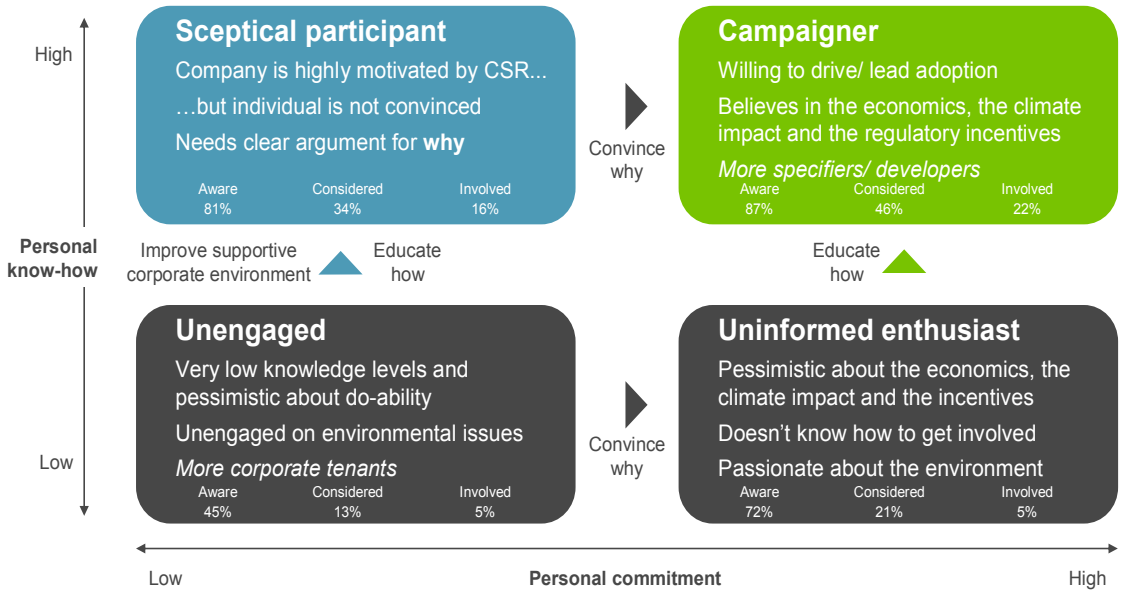
Regardless of the term used, energy costs and energy use were the highest priorities for building professionals when they were asked to rank nine possible objectives. Their other prominent objectives were occupant well-being and productivity, conservation of water, and reducing the risks from rising energy costs. Potential future resale value and reputational

benefits for companies were ranked lowest of the main factors, significantly below the others. The differences between the three categories of professionals were minor in most cases, with the exception of high future resale value, which was more important for agents and landlords than for the other two groups.

Attitudinal Segments

The quantitative research identified four broad attitudinal segments among building professionals (see Figure 3). The segmentation is based on personal know-how and the extent of personal conviction or commitment to sustainable buildings, as revealed by their responses to the research questions. Each box in the Figure shows the characteristics of the segment, including the level of awareness of and involvement in sustainable buildings. (The figures relate to the "purchase funnel" in Figure 6.) Figure 3 also indicates the key requirements to move groups towards the "Campaigner" quadrant.

Figure 3: Segments among Building Professionals



Encouragingly, the "Unengaged" segment was the smallest, just under a fifth (19%) of those interviewed, but roughly a quarter were in each of the "Skeptical participant" (26%) and "Uninformed" segments. Less than a third (31%) were classified as "Campaigners", believing in the economics of sustainable buildings and willing to lead.

Professionals' Sustainable Building Knowledge

Respondents recognize that sustainable buildings are important for the environment, but underestimate buildings' contribution to greenhouse gas levels – which is about 40%[8] in most of these markets (see Figures 4 and 5). They also generally overestimate the likely cost premium, which is likely to be under 10% in developed countries (although the estimates from China, Brazil and India may be more appropriate to those countries). For example, a study of 40 US offices and schools found cost premiums lower than 10% even for the highest standard of LEED certification.[9]

Figure 4: Estimates of Buildings' Emissions as a Percentage of Total

What percentage of CO2 emissions do you think buildings give rise to – directly and indirectly?

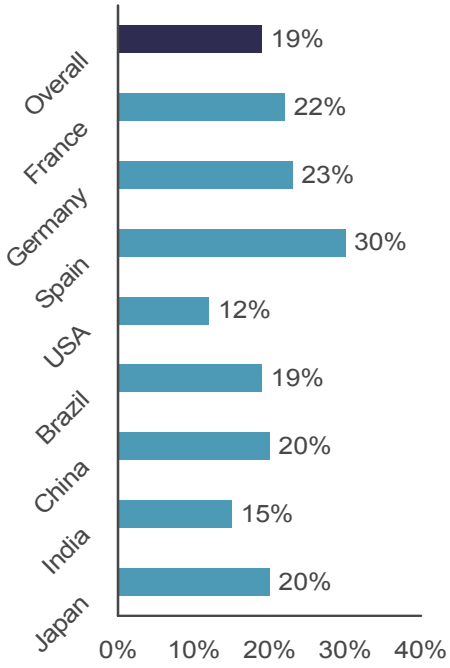
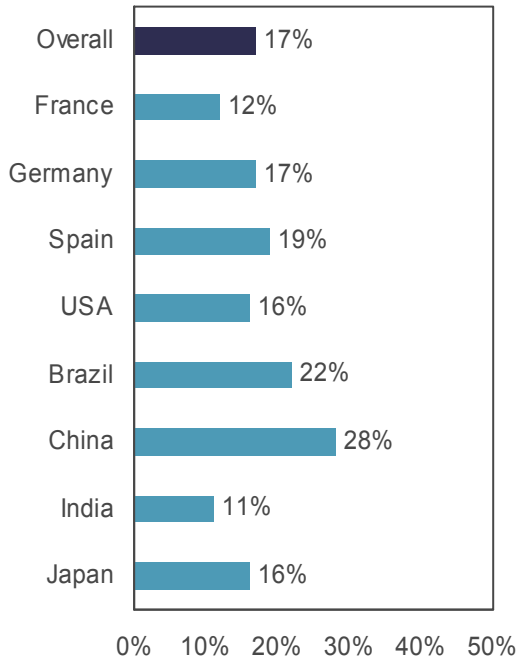


Figure 5: Estimates of Cost Premium for "A Certified Sustainable Building"

How much more do you think a certified sustainable building would cost to build relative to a normal building?



Awareness and Involvement

Awareness of environmental building issues is relatively high in all markets and across the three broad professional sub-groups. But in most markets the numbers drop fairly sharply on

[8] 40% includes the share of buildings' energy in power generation and commercial/industrial energy use. See WBCSD, Energy and Climate, Pathways to 2050 and IEA 30 years of Energy Use in IEA Countries, ref. fig 9-8, 1998

[9] Source: Greg Katz, CapitalE, Economic Costs and Benefits of Green Buildings

questions about involvement in green building activity (see Figure 6 below). Typically only a third of those who said they were aware of green building had considered involvement, and only a third of those had actually been involved (11% of the total).

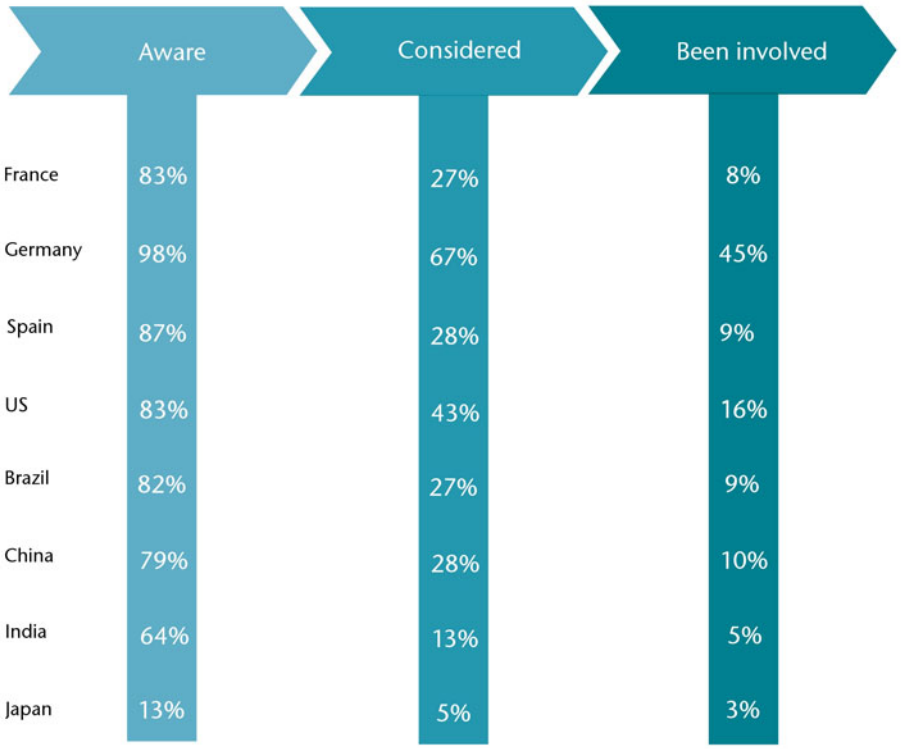
The highest awareness was among specifiers and developers and in Western Europe. The lowest awareness was among corporate tenants in Japan and India.

Results in Japan are particularly interesting: the 13% level of awareness of green/sustainable buildings contrasts to an average 84% overall awareness in the other surveyed countries. Japan's unusually low awareness response is odd given building energy use, per capita and per floor area, is the lowest of the developed countries.

Overall, only 13% of those questioned have been involved in green or sustainable building, although this figure ranges from 45% in Germany to just 5% in India, and from 20% among specifiers and developers to just 9% among owners and tenants. On each of the three dimensions, specifiers and developers were ahead of the other two groups with roughly twice the level of consideration and involvement as the agents, landlords and tenants.

Figure 6: Awareness and Involvement of Building Professionals

"What is your level of awareness/consideration/involvement of green/sustainable buildings?"



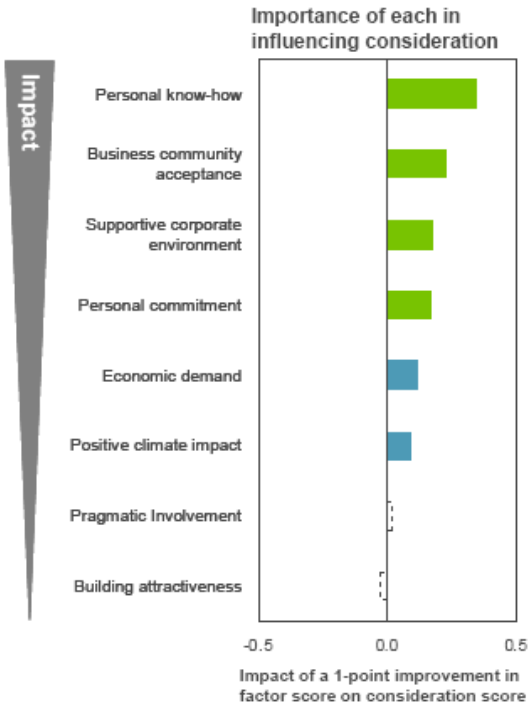
Barriers to Progress

Qualitative research found that interviewees believe financiers and developers are the main barriers to more sustainable approaches in the building value chain. The quantitative research identified eight factors that influence decision-makers about sustainable buildings (see

Figure 7). Four of these are the main barriers to greater consideration and adoption by building professionals and are the most significant in influencing respondents' consideration of "sustainable building". They are described below.

Figure 7: Factors Influencing Adoption of Sustainable Building Practices

Personal barriers[10]



- **Personal know-how** - whether people understand how to improve a building's environmental performance and where to go for good advice. This is based on reactions to these five statements:
  - *I know where to go for advice on sustainable buildings*
  - *I know which components will deliver the greatest environmental benefit*
  - *I try to persuade colleagues/clients to consider sustainable options*
  - *Sustainable building rating is well-known and easy to understand*
  - *Architects and designers are knowledgeable about sustainability*

- **Business community acceptance** – whether people think the business community in their market sees sustainable buildings as a priority. This is based on reactions to these statements:
  - *Sustainable building is practical and important for my country*
  - *Environmental issues are one of my top priorities in building*

[10] Technical note: The statements connected with each barrier are grouped together based on statistical analysis of responses. These four deficiencies were identified as the most significant contributors to barriers out of the eight dimensions because of their importance in influencing respondents' consideration of "sustainable building.

- **A supportive corporate environment** – whether people think their company's leaders will support them in decisions to build sustainably. This is based on reactions to these statements:
  - *My company donates a lot of money to charity*
  - *My company is generally first to bring new innovations to market*
  - *My company has a strong corporate social responsibility culture*

- **Personal commitment –** whether action on the environment is important personally
  - *It is critical that we make sacrifices now to protect the future*
  - *I always stand up for what I believe in*
  - *I make a big effort to live an environmentally friendly lifestyle*

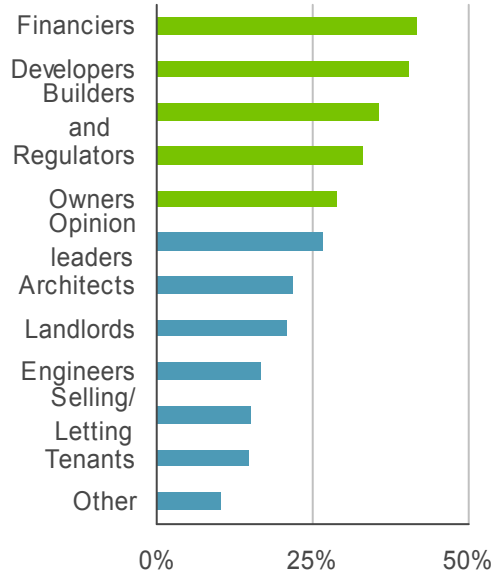
It is interesting to note that building attractiveness, the actual climate impact of action, and economic demand were considered much less significant influencing factors.

The ranking of these barriers is broadly consistent across the groups of professionals, with two exceptions. Know-how and business community acceptance were more significant barriers for the specifier/developer group than the other two groups, while a supportive corporate environment was more important for corporate tenants. This suggests there is potential for demand and competent supply if these shortcomings can be overcome.

Fig 8: Perceptions of Barriers by Business Group

Who are the biggest barriers to more sustainable buildings?

Respondents identified financiers and developers as the main barriers in the building value chain. It is interesting that landlords and tenants were low in this ranking, while builders and contractors are seen as more significant than owners.



When asked about their responsibility in driving change, very few of the decision-makers saw their task as leading the move to sustainable building (see Figure 9). The answers suggest some willingness to adopt new practices, but also hint at the conservatism for which the industry is renowned.

Figure 9: Roles in Sustainable Building

Conclusions

The research suggests that progress towards more energy-efficient buildings is being held back by the limited knowledge and commitment of building professionals, and by a lack of leadership throughout the industry. These factors are made more important by the structure of and practices in the industry, which create institutional barriers that are only likely to be overcome with significant personal commitment from professionals in the industry. The EEB project is now working to identify policies and other factors which will help to overcome the institutional and personal barriers and accelerate progress towards greater energy efficiency in buildings.