Material choice for green buildings

A joint report by Arup and WBCSD
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ARUP wbcsd

Introduction

The World Business Council for Sustainable Development (WBCSD) and Arup have conducted a survey to explore material choices in construction and the decision making processes associated with this. The aim was to understand the factors that influence senior construction professionals when considering material options in sustainable buildings. The study is to help guide future WBCSD initiatives working to meet the sustainability challenges in the industry. This report is the final public output of this study programme.

Research goal & scope

In identifying the need for the study, the WBCSD established a series of key research questions. Based on these Arup and the WBCSD examined potential project research routes and explored study options to create a headline goal:

What factors influence construction professionals, and their decision making, when considering material choices for sustainable offices and residential buildings?

The countries of interest were Brazil, China, Germany, UK and USA. These countries were selected because they have green building rating schemes in place and/or provide an emerging markets perspective. The focus was on concrete, but the study was also seeking additional perspectives across other materials and their application in building façade and structure.

The project was interested in how decision making changed between conventional and sustainable construction, and it was also important to develop insights to responsible sourcing as an area of growing industry relevance.

Study method

To establish the evidence base for the project, Arup developed a combined research approach consisting of qualitative personal interviews supported by a quantitative online survey. In this way the survey could be used to validate the findings of the interviews.

Interviews were conducted with senior decision-makers across 36 organisations with a further 165 individuals participating in the online survey. These activities were undertaken across the five areas of geographic interest. This means the project evidence base has been informed by feedback from over 200 individual participants leading to 1000's of separate data items across the issues of interest.

Study participation is now examined followed by key findings under the research questions.

Study participation

The survey was determined to reach the right demographic and participants. This was because responses were received from representatives of relevant professional groups from throughout the construction value chain; and from people who influence material choice decisions and who have experience in green building rating schemes. Knowledge on materials sustainability was found to vary significantly between participants due to different geographies, and variations in the technical nature of people's roles. Perspectives of the survey demographic are presented in the Figures 1, 2 and 3.

Figure 1:
Study participants. The 'Other' category included sustainability consultants, academics and other specialist consultants. The 'Client' category was defined as tenants, landlords and developers.

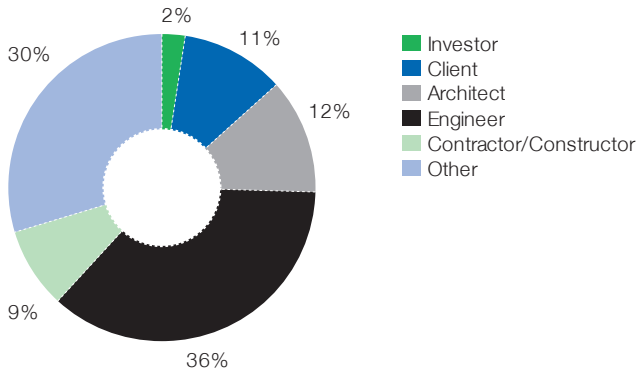


Figure 2:
Participants influence on material choice, shown by the frequency they influence decisions.

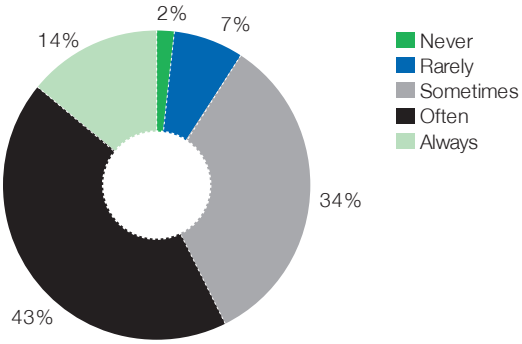
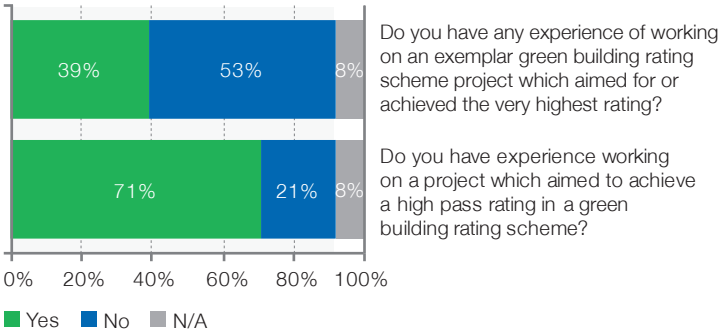


Figure 3:
Summary of responses by experience, demonstrated by their participation in high rating or exemplar green building rating scheme projects.



Study findings 1:

At what stage of the design-planning-construction process are decisions regarding material choice being made?

Material choice for both structure and façade are considered from very early on in the project process, even from concept design, and are usually finalised in the detailed design phase, see Figure 4.

This is accentuated in 'sustainable projects' where options are generally looked at in more detail, and for longer. Specifics such as responsible sourcing of materials, which are specification driven, can happen right through to the construction phase. Planning requirements were found to be a significant milestone, particularly for the choice of façade material. This is because changes to the visual appearance can be difficult after this point.

'Most decisions are made in the preliminary design and design phase. In the stages after that, material choices don't change, at least not for structure and façade.'
(Architect, Germany)

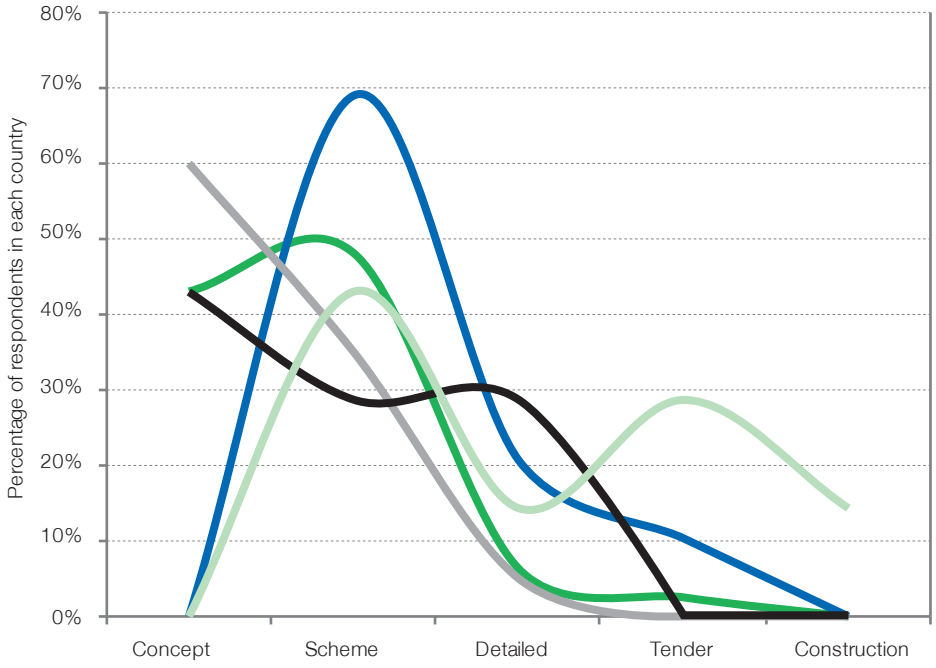


Figure 4:
When is the decision on material choice for structure usually made?

Study findings 2:

What criteria guide building professionals in their material choices for sustainable construction?

The study results showed that a large number of factors influence material choice in construction, with on balance, cost remaining the overarching priority. Function and design influences (of which cost was considered a factor), were found to have the strongest influence on material choice, as illustrated in Figure 5. Within this grouping, key factors such as technical performance and aesthetics were commonly found to be balanced within the constraints set by the project's budget.

Influences from the project team including past experience were found to have an important impact on material choices. By contrast, material sustainability criteria were largely deemed to be less significant, although clearly relevant to many within the material selection process. Indeed, an important observation to make is that material sustainability objectives were recognised and understood, to some degree, in all the markets studied. The significance of this, perhaps with indication to future priorities, was well phrased by one interviewee:

'Sustainability does come into it a lot more now than it did 5-10 years ago, and I would use it as a deciding factor if all else was equal.'
(Engineer, UK)

It was found that clients and investors regularly have significant influence on material choices due to the terms they impose on a project through budget and brief. However, in practical terms material choice decisions generally fell to the design team, led by the architects and engineers, and supported by specialists, see Figure 6.

The materials sustainability aspects that were found to be most prominent were embodied energy and carbon, recycled content and local sourcing. These are all featured in green building rating schemes. In addition, the health implications of materials (particularly from an in-use perspective) emerged as a theme that many participants were concerned about. Issues such as end of life are less comprehensively dealt with in the green building rating schemes and came up less frequently as a priority.

Figure 5:
Rate the extent of influence that each factor has on decisions around material choice.

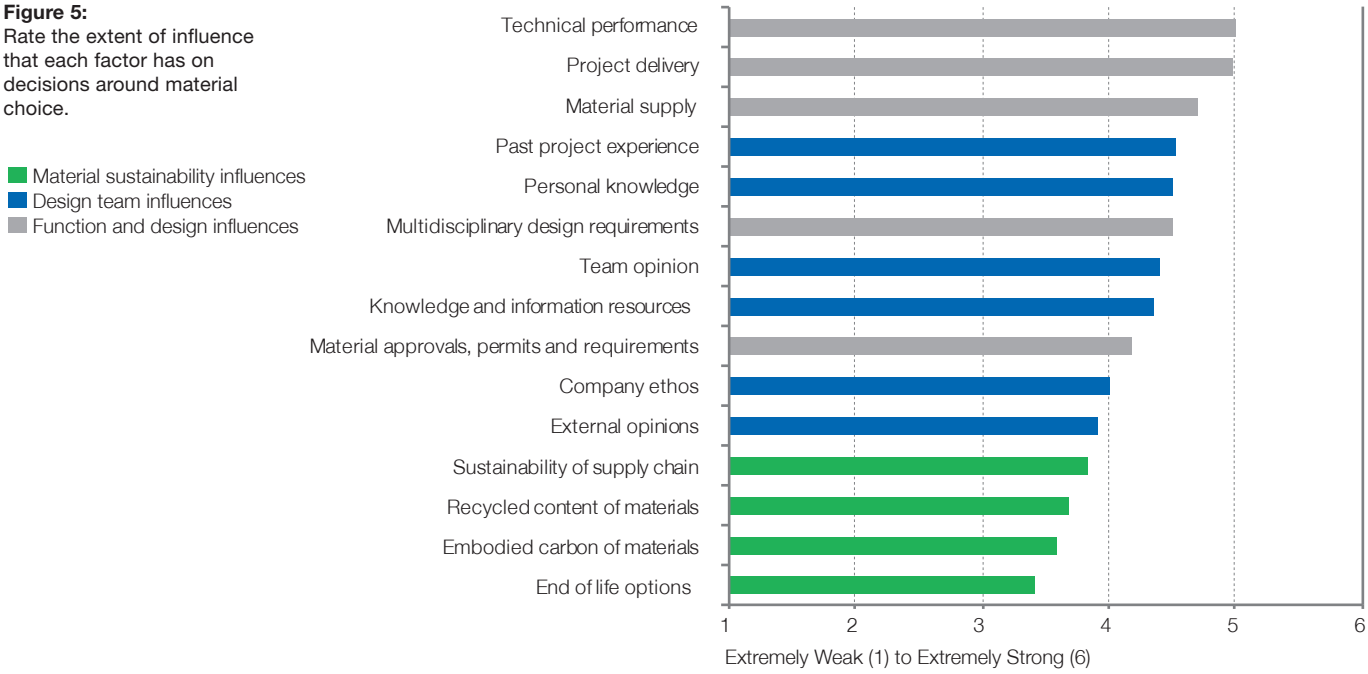
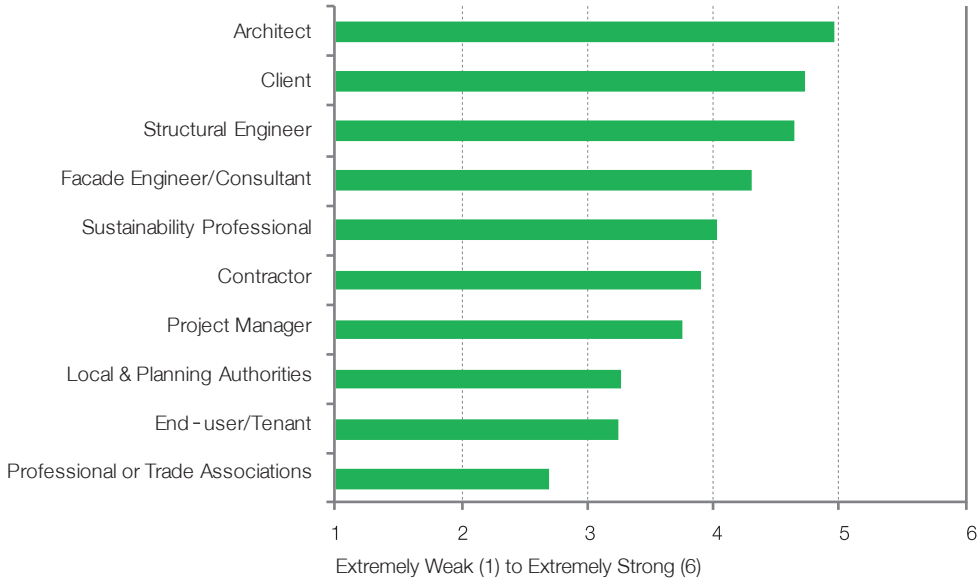


Figure 6:
Rate the level of influence that each of these practitioners has over material choice.



Study findings 3:

To what level do responsible sourcing schemes influence material choices?

Feedback demonstrated that responsible sourcing of materials has influence on the procurement and specification of materials, but not on the decision of which material to use.

A key driver to encourage a project to look at responsible sourcing of materials was found to be the green building rating schemes, which reward using certified responsibly sourced and/or local materials.

'If the contractor can find the right materials locally, he would prefer to do that - maintains industry, reduces transportation costs, creates projects that are more local in nature (community engagement & local socio-economic development).'
(Developer, US)

'Choose the material first and as a priority think about it as a material and what it does. Sustainability and responsible sourcing of materials is less important - it's perhaps thought about in tandem, and becoming more equal.'
(Investor, UK)

'Responsible sourcing of material schemes are (very influential) when the project is driven by BREEAM, when not it is more of a 'nice to have.'
(Engineer, UK)

Study findings 4:

How important are product certification schemes such as responsible sourcing in the decision making process?

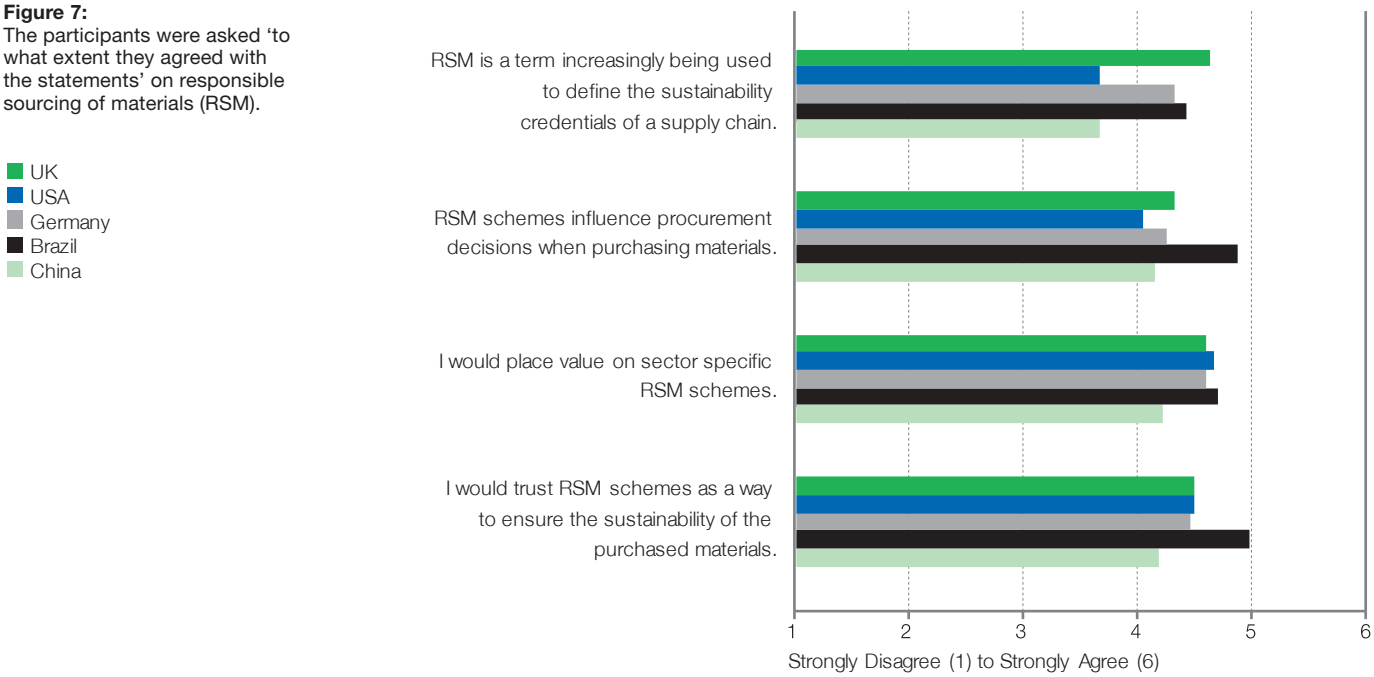
The overall impression from feedback was one of uncertainty towards responsible sourcing schemes. Apart from the timber sector where schemes have been estabilshed for some time, this perspective was considered to arise because it is only relatively recently that other sectors have started to develop their own schemes. These viewpoints can be seen from Figure 7.

However, the survey results indicate that the existence of responsible sourcing schemes would be welcomed as a way to ensure the sustainability of purchased materials. They were also deemed to offer benefit as a means to respond to future trends, specifically the desire for greater access to information, demonstration of corporate responsibilities, and to ensure future alignment with green building rating scheme objectives.

'It is difficult for (consumers) to know what responsible sourcing of materials means. A certification scheme for other materials would be valuable, however it would need to be clear, transparent, have a reasonable process, and provide information about the system (showing what it covers etc.)'

(Architect, UK)

Figure 7:
The participants were asked 'to what extent they agreed with the statements' on responsible sourcing of materials (RSM).



Study findings 5:

How the decision making process differs in a sustainable building scheme compared to more conventional construction projects

The key differences found between conventional and sustainable construction were that the material choice is generally considered earlier in the design process, and for longer. In addition, the decisions are more of a joint effort between the whole design team because they would be looked at in more detail.

'In more sustainable construction the decision is debated for longer and may happen later in the process as more thought goes in as options are fully explored.'
(Engineer, UK)

Summary

This study has shown that decision making on material choice is complex. Material sustainability criteria are increasingly becoming part of the decision process, but are typically further down the priority list compared to functional performance and design team influences.

Decision making on choice of material is made by design teams, with clients in the background having a strong influence through budget and brief. There was little evidence to suggest that clients are seeking specific material outcomes based on material sustainability criteria at this time.

Materials sustainability is of definite interest to the practitioner involved in sustainable construction projects. It can be expected that the topic will grow in prominence with time. However, functional requirements will always remain important, and a sustainable building will ultimately also have to be a functionally successful building.

In the round, construction professionals see materials for the benefits they can offer and have a good general appreciation of the strengths and weaknesses of different material design and selection strategies. Materials sustainability is a developing agenda, and practitioners acknowledge they need more information and knowledge to understand it better.

About WBCSD

The World Business Council for Sustainable Development is a CEO-led organization of forward-thinking companies that galvanizes the global business community to create a sustainable future for business, society and the environment. Together with its members, the council applies its respected thought leadership and effective advocacy to generate constructive solutions and take shared action. Leveraging its strong relationships with stakeholders as the leading advocate for business, the council helps drive debate and policy change in favor of sustainable development solutions.

The WBCSD provides a forum for its 200 member companies - who represent all business sectors, all continents and a combined revenue of more than $7 trillion - to share best practices on sustainable development issues and to develop innovative tools that change the status quo. The Council also benefits from a network of 60 national and regional business councils and partner organizations, a majority of which are based in developing countries.

www.wbcsd.org

About Arup

Arup is the creative force at the heart of many of the world's most prominent projects in the built environment and across industry. We offer a broad range of professional services that combine to make a real difference to our clients and the communities in which we work.

We are truly global. From 90 offices in 35 countries our 10,000 planners, designers, engineers and consultants deliver innovative projects across the world with creativity and passion.

Founded in 1946 with an enduring set of values, our unique trust ownership fosters a distinctive culture and an intellectual independence that encourages collaborative working. This is reflected in everything we do, allowing us to develop meaningful ideas, help shape agendas and deliver results that frequently surpass the expectations of our clients.

The people at Arup are driven to find a better way and to deliver better solutions for our clients. We shape a better world.

www.arup.com

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