

## BARRIERS TO SUSTAINABLE PRACTICE AND MATERIALS IN THE JAPANESE CONCRETE INDUSTRY

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### 1. Introduction

Increased awareness of sustainability in recent years has led the concrete industry to consider its practice, looking particularly at the environmental impact. A wide variety of approaches to reducing the industry's impact have been proposed, including increased durability of concrete structures, utilization of waste and recycled materials, reduction in cement content by application of admixtures, and more. However, in order to implement these proposed approaches a wide variety of barriers must be overcome. These barriers differ depending not only on the approach but also on the involved parties and the socio-economic environment in which the concrete construction is performed. Therefore, this research was performed to identify the barriers to implementing sustainable practices and materials considering the Japanese concrete industry, looking at the difference in perspectives between different stakeholder groups.

### 2. Survey investigation

#### 2.1 Methodology and barrier classification

A social study was conducted by surveying the relevant stakeholder groups in the Japanese concrete industry. The survey asked the respondents to identify whether a set of 21 barriers to sustainable practice and materials, identified in a previous investigation, applied to their organization, the concrete industry excluding their organization, both, or neither. These barriers can be classified into six categories, as shown in Table 1; the complete list of barriers is given in the results (Figure 2).

#### 2.2 Sample distribution

The distribution of survey respondents is shown in Figure 1. 229 survey responses were received, with 47.2% in the owner group (public and private infrastructure owners), 28.8% in the contractor group, 13.1% in the academic group, and 10.9% in the materials group (misc. manufacturers, cement and admixture companies).

#### 2.3 Survey response to barriers

The survey response results are shown in Figure 2. Many of the barriers are perceived as a general barrier

(both to the concrete industry and the respondent's organization), among which the most agreement is on "no definition of sustainable materials" (52.7%), "lack of standardized code" (54.3%), "balance between different criteria" (57.9%), "lack of information on environmental impact" (58.7%), "lack of knowledge on sustainability" (60.7%), "lack of consideration of full life cycle" (63.7%), and the barrier with the highest agreement, "difficult to evaluate durability" (68.9%).

"Perception of concrete as not sustainable" is the only barrier to which a majority of responses indicate that this is not a barrier (51.8%). Another barrier which has a high "none" percentage is "doubts about CO<sub>2</sub> and climate change," although opinion is roughly split between "none" and "both." Opinion is also roughly split between "none" and "both" for "low level of technology." Finally, the percentage of "concrete industry" responses is highest for the "lack of vertical integration" barrier (39.1%).

Table 1 Barrier categories and examples

Category	Example
Institutional	Lack of standardized code
Social	Perception of concrete as non-sustainable
Organizational	Lack of vertical integration
Economic	Difficult to balance company benefits vs. society
Technological	Difficult to evaluate durability
Knowledge	Lack of knowledge on sustainability

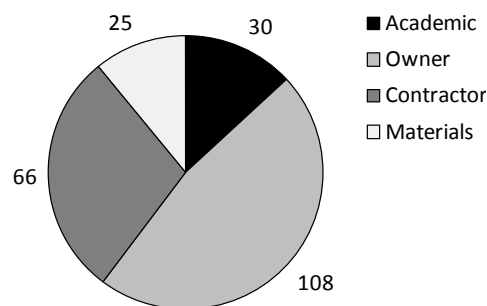


Figure 1 Distribution of survey samples

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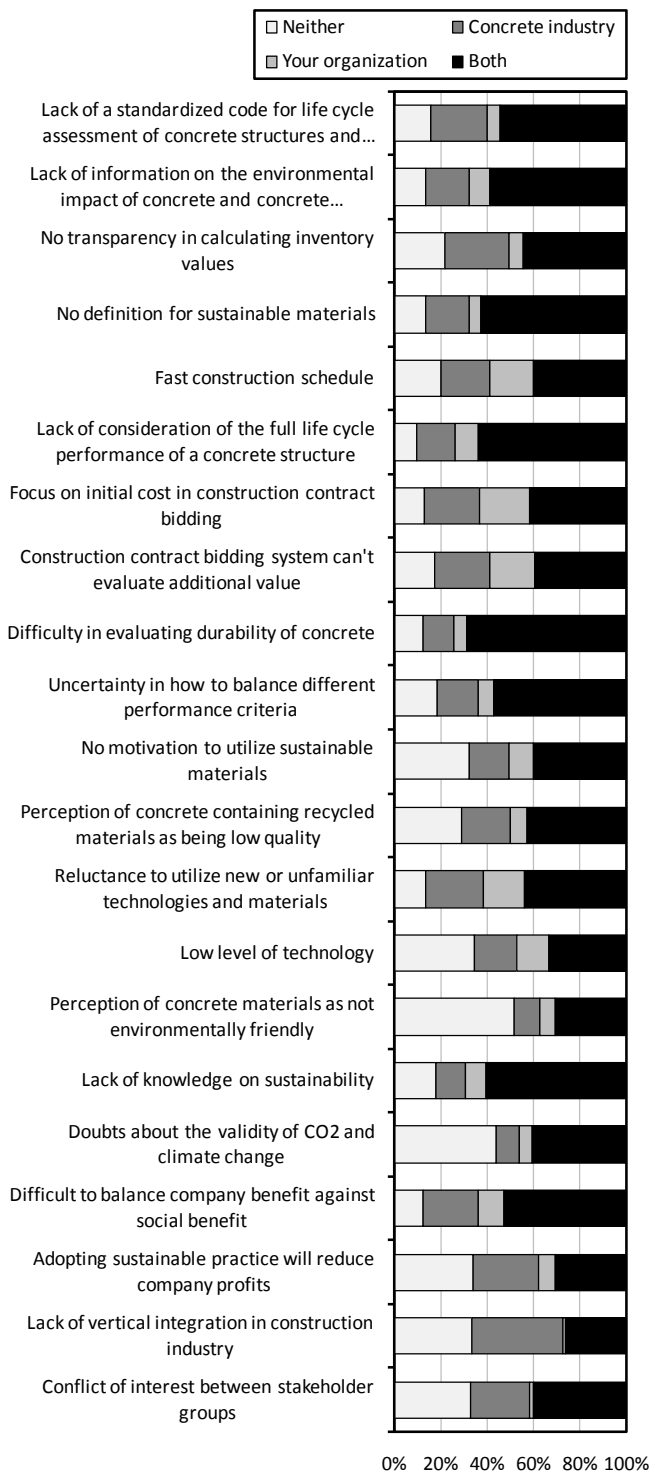


Figure 2 Barriers to sustainable practice and materials

## 2.4 Differences between social groups

There were some similarities but also clear differences between the stakeholder groups' perspectives when comparing the highest-rated barriers. For the academic, contractor, and materials groups, the highest-rated barrier was "difficult to evaluate durability," which was also third-highest for the owner group. "Lack of standardized code" was highest for the owner group and second-highest for the academic and materials groups. However, excluding these two barriers, there was little

similarity between the other highly-rated barriers. The academic group didn't greatly identify with any other barriers, whereas the owner and materials groups focused on knowledge-related barriers. For the contractor and materials groups, business performance is of high importance, so it's necessary to find means whereby these groups can realize their benefits along with society. Finally, the contractor is dependent on the construction bidding system, so if the system is not adapted to consider sustainability it's difficult for the contractor to implement it. The difference in perspectives of the stakeholder groups is thus summarized in Figure 3.

## 3. Social specificity of barriers

Although these barriers were identified in a study focusing on just the case of Japan, some of them may be applicable globally as well as domestically. Institutional, social, and organizational barriers are most likely specific to Japan, as these three vary the most between different countries. Of the important barriers identified in Figure 3, the bidding system and standards fall within this category. Economic, technological, and knowledge barriers are more global; durability, cost, and knowledge fall within this category. Therefore, to overcome these barriers, institutional change will have to come from within Japan, whereas the other barriers may be overcome both domestically and through international cooperation.

## 4. Conclusion

In this paper, the importance of barriers to sustainable practice and materials was investigated considering stakeholders in the Japanese concrete industry. It was found that difficulty in evaluating durability is a key barrier and has high relevance for all the stakeholder groups. Institutional and knowledge barriers were also highly ranked overall, but their importance differed depending on the stakeholder group.

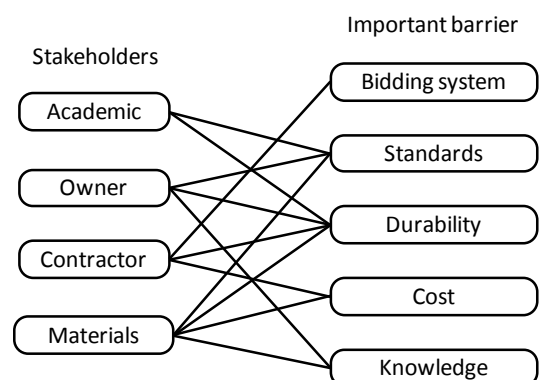


Figure 3 Important barriers for each stakeholder group