

Selecting Criteria for Assessing “Environmentally-Friendly” Material Options in Construction: Part I

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1 Introduction

One of the aspects of construction sustainability is reducing the project's and the resulting built facility's negative impact on the environment. This impact is typically assessed in the course of some form of Life Cycle Analysis (LCA) (Ortiz *et al.*, 2009). They typically share the element of assessing the consequences of using particular construction materials in the building's fabric, so the materials' contribution to the overall environmental impact. However, the scope, criteria, and measures used in the analyses are not identical (Doan *et al.*, 2017; Park *et al.*, 2017). On the one hand, there exist standards on reporting the environmental impact of products, (ecolabelling). On the other hand, the standards and methodologies evolve (Allacker *et al.*, 2017). Due to the proliferation of LCA methodologies, the comparability of information on a product's environmental qualities becomes an issue (European Commission, 2013; Passer *et al.*, 2015). Many researchers and practitioners use their own criteria and measures.

The paper is the first part of a review of the most recent literature on the comparison or assessment of construction products and components to select the “environmentally friendly” ones. The authors provide a classification of research problems covered by the sample, discuss papers devoted to designing “green” materials and selecting sustainability criteria for construction materials, products, or components. Finally, they investigate into the number and type of criteria in use, thus into how the authors understand the environmental impact of construction products or built facilities.

2 Materials and Methods

The sources' approach to the life cycle phases was juxtaposed to the life cycle phases used in LCA and adopted for Environmental Product Declarations (EPDs). The “environmentally friendly” aspects were considered only those covered by the scope of environmental impacts, aspects of resource use, and generation of waste as defined in EPDs prepared according to EN 15804:2012 (ITB, 2013). The query was limited to one database (Web of Science), publications from the years 2016-2020, and a particular structure of search terms. The selection was manually refined. The final sample comprised 43 publications. The sample was analyzed in terms of aspects of sustainability covered by the analysis, life cycle stages considered, sources of input, and mathematical methods used for selecting the best option (if applicable).

3 Results and Conclusions

The papers of the sample were classified into four groups according to their research problem (some paper dealt with more than one):

- designing environmentally-friendly materials (9 papers),
- selecting a set of sustainability criteria for comparing construction products or components of built structures (7 papers),
- assessing the sustainability of alternative solutions (materials, material supply chains, component design) (33 papers),
- optimizing construction components (2 papers).

Judging by the sample, there exists no agreed set of environmental criteria for comparing sustainability of construction products, components and methods. The number of the environmental criteria varied from one to 12; one paper aiming at providing a list of potential criteria, prompted as many as 33. Even with similar problems, the numbers and types of criteria differed strongly. Most authors identified the criteria in the course of literature review and interviews with experts to suit a particular decision problem. Only 14 admitted drawing directly from particular LCA methodologies.

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