SUSTAINABILITY OF SOCIAL HOUSING IN THE URBAN TROPICS

A Holistic Development Process for Bamboo-Based Construction

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The seminar will be held in English
Opponent: Professor Mark Hughes, Aalto University

The thesis is available at the
Chair of Sustainable Building
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This thesis is motivated by a tremendous need for more inclusive, sustainable and disaster 
resistant social housing in rapidly developing countries such as the Philippines. The 2030 
Agenda for Sustainable Development and the New Urban Agenda name the use of local raw 
materials as one area for action. In the Philippines bamboo is an available, culturally rooted 
material, which is frequently used by rural and urban low-income groups. However, its current 
use in buildings does not meet the regulatory, technical and social requirements of urban spaces. 
The general objective of this thesis is to guide the development, implementation, and 
continuous assessment of a bamboo-based building technology for social housing in the 
Philippines, according to the multi-dimensional requirements of sustainability. The conceptual 
framework of the thesis is aligned to the standards EN 15643 and ISO 15392 on the 
sustainability assessment of buildings. A localization of the standards has been achieved 
through a multi-stakeholder participatory process. Beyond stakeholders from within the 
Philippines, this process builds on a learning exchange with Latin America, where significant 
knowledge on bamboo-based building exists, as well as Europe, where timber frame 
construction is established.

Issue-focused research captured the performances in technical, environmental, social, economic 
and governance dimensions. It was shown that the most common bamboo species in the 
Philippines is of a structural grade that is suitable for low-rise house construction. With quality 
selected, treated bamboo culms and climate-adjusted house designs, the construction of reliable 
and durable buildings was possible, designed to withstand the impacts of their surrounding 
environment. The walls received a fire resistance rating of 60 minutes and full-scale test houses 
withstood the storm impacts of four typhoons with 120–213 km/h wind speeds. A thorough life 
cycle assessment predicted that the building method results in a 74%-reduction in carbon 
emissions. Furthermore, surveys and physical measurements attested that a higher indoor 
thermal comfort is achieved. Active participation was applied throughout the research and 
implementation activities, and acceptance barriers were overcome among involved 
stakeholders. Beyond savings from a life cycle cost perspective of the buildings, the use of the 
renewable local material strengthened local economies and created rural-urban linkages.

Sustainability theory was used as a tool for decision-making for the planning, implementation, 
and continuous improvement of 500 social houses across the Philippines. These were erected 
by the Base Foundation, an initiative supported by the Hilti Foundation, and its partners. In a 
continuous improvement process, the achievements and learning obtained in the research and 
implementation were exchanged in feedback loops over a period of 4 years. Sustainability is 
shown to be a continuous, balancing process that can be used to transparently discuss and evolve 
a holistic value proposition. Because adequate housing is only one of many components 
required for sustainable cities and resilient communities, this thesis aims to contribute to holistic 
integrated projects and policy advocacy.