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Review of Life-Cycle Analysis Applications on Sustainable Building and Construction Sector as Decision Support Tools

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Abstract : Considering the environmental issues generated by the building sector for its energy consumption, solid waste generation, water use, land use, and global greenhouse gas (GHG) emissions, this review pointed out to LCA as a decision-support tool to substantially improve the sustainability in the building and construction industry. The comprehensiveness and simplicity of LCA make it one of the most promising decision support tools for the sustainable design and construction of future buildings. This paper contains a comprehensive review of existing studies related to LCAs with a focus on their advantages and limitations when applied in the building sector. The aim of this paper is to enhance the understanding of a building life-cycle analysis, thus promoting its application for effective, sustainable building design and construction in the future. Comparisons and discussions are carried out between four categories of LCA methods: building material and component combinations (BMCC) vs. the whole process of construction (WPC) LCA□attributional vs. consequential LCA, process-based LCA vs. input-output (I-O) LCA, traditional vs. hybrid LCA. Classical case studies are presented, which illustrate the effectiveness of LCA as a tool to support the decisions of practitioners in the design and construction of sustainable buildings. (i) BMCC and WPC categories of LCA researches tend to overlap with each other, as majority WPC LCAs are actually developed based on a bottom-up approach BMCC LCAs use. (ii) When considering the influence of social and economic factors outside the proposed system by research, a consequential LCA could provide a more reliable result than an attributional LCA. (iii) I-O LCA is complementary to process-based LCA in order to address the social and economic problems generated by building projects. (iv) Hybrid LCA provides a more superior dynamic perspective than a traditional LCA that is criticized for its static view of the changing processes within the building's life cycle. LCAs are still being developed to overcome their limitations and data shortage (especially data on the developing world), and the unification of LCA methods and data can make the results of building LCA more comparable and consistent across different studies or even countries.

Keywords : decision support tool, life-cycle analysis, LCA tools and data, sustainable building design
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