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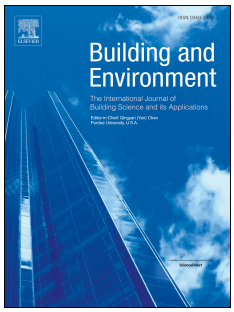


Sustainability and resiliency metrics for buildings – Critical review

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# Sustainability and resiliency metrics for buildings – Critical review

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## Abstract

The driving forces for change in the construction and building industry are several, not least of which are health and environmental awareness combined with the innate urge to improve living conditions and standards under economic constraints. Based on in-depth observation of the current practices, improved practices, market conditions, and driving forces, it is postulated that the next logical advancement in building construction technology is manufactured-modular-prefabricated-off-site construction, referred to as off-site construction (OSC). Accordingly, current metrics for sustainability and resiliency for buildings are reviewed for determining their state of development and application. The review revealed that a variety of metrics exist to prove any sustainability claims, or portion thereof. Of all the metrics, life cycle assessment (LCA) is currently the state-of-the-art in quantifying parts of sustainability, namely the environmental impacts, however it faces significant challenges. Certification systems, such as LEED, BREEAM and DGNB are found to be useful and successful at meeting their purpose, however they fail to address all of sustainability's requirements. Moreover, these certification systems have yet to produce metrics that are repeatable, reproducible and true reflection of the building performance. Sustainability metrics for industrial processes and other industries were reviewed and found to be more developed in comparison to those used for buildings including methods such as the Canberra and Mahalanobis distance been employed to aggregate the various sustainability factors. The review also revealed that there are no metrics for assessing the resiliency for buildings, particularly in-tandem with sustainability. Of relevance to OSC systems is the certification systems' inability to adequately account for innovative and new construction techniques and material. Although OSC systems have shown potential for being a sustainable construction system for residential, commercial and industrial buildings, the review revealed that the potential is missed in the absence of a true sustainability and resiliency metrics for building systems.

**Keywords**: buildings; metrics; off-site construction; resiliency; sustainability