

## **A Comprehensive Approach to Sustainable Building Design: Bridging Design for Adaptability and Circular Economy with LCA**

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**Abstract :** Incorporating the principles of Design for Adaptability (DfAd) and Circular Economy (CE) into the service life planning of buildings and construction engineering projects can significantly enhance sustainable development. By employing DfAd, both the service life and design process can be optimized, gradually postponing the building's End of Life (EoL) and extending the service life of buildings, thereby closing material cycles and making them more circular. This paper presents a comprehensive framework that addresses adaptability strategies and considerations to objectively assess the role of DfAd in circularity. The framework aims to provide a streamlined approach for accessing DfAd strategies and identifying the most effective ones for enhancing a project's adaptability. Key strategies include anticipating changes in requirements, enabling adaptations and transformations of the building for better use and reuse, preparing for future lives of the building and its components, and contributing to the circular material life cycle. Furthermore, the framework seeks to enhance the awareness of stakeholders about the subject of Design for Adaptability through the lens of the Circular Economy. Additionally, this paper integrates Life Cycle Assessment (LCA) methodologies to evaluate the environmental impacts of implementing DfAd strategies within the context of the Circular Economy. By utilizing LCA, the framework provides a quantitative basis for assessing the sustainability benefits of adaptable building designs, offering insights into how these strategies can minimize resource consumption, reduce emissions, and enhance overall environmental performance. This holistic approach underscores the critical role of LCA in bridging DfAd and CE, ultimately fostering more resilient and sustainable construction practices.

**Keywords :** circular economy (CE), design for adaptability (DfAd), life cycle assessment (LCA), sustainable development

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