

**Appendix 1** Methodology articles for literature reviews.

<b>ID</b>	<b>Title</b>	<b>Authors</b>	<b>Year</b>	<b>Journal</b>	<b>Main methods for combining Life Cycle analysis</b>	<b>Life Cycle criteria</b>
1	Building A Comprehensive Conceptual Framework for Material Selection in Terms of Sustainability in The Construction Preliminary Design Phase	Dinh and Dinh	2021	International Journal of Sustainable Construction Engineering and Technology	A conceptual framework	Total LCC cost; Cost efficiency; Budget management; Site efficiency; Water efficiency; Energy efficiency; Material efficiency; Toxic emission; Impacts of stakeholders; Health and well-being
2	Towards precise sustainable road assessments and agreeable decisions	Inti, Sundeeep and Tandon, Vivek	2021	Journal of Cleaner Production	A hybrid analytic hierarchical multi-criteria group decision-making model	Agency Costs; User Costs; CO <sub>2</sub> emission; Eutrophication; Smog; Acidification; Air Pollutants; Energy Consumption; Social Emissions
3	Systematic review of Life Cycle Assessment and Life Cycle Cost analysis for pavement and a case study	Alaloul, Wesam Salah, et al.	2021	Sustainability (Switzerland)	Assess the economic, environmental and social impact cost	Total LCC cost; fuel costs; CO <sub>2</sub> costs; and social costs
4	Life-cycle sustainability assessment of pavement maintenance alternatives: Methodology and case study	Zheng, X., et al.	2019	Journal of Cleaner Production	MCDM method and LCSA method	Agency cost and user cost; Global climate change; Eutrophication; Acidification; Human health criteria pollutants; Smog; Working hours; Health and safety; Professional growth; Access to material resources; Safe/healthy living conditions; Public commitments to sustainability issues

5	An extended decision-making framework for sustainable pavement management	Xiaoyan, Z., et al.	2017	Canadian Society for Civil Engineering Annual Conference and General Meeting 2017	MCDM method	Agency cost, user cost, energy consumption, conventional air pollutants (e.g., SO <sub>x</sub> , NO <sub>x</sub> , and CO), and CO <sub>2</sub> emissions; social problems in the Worker, Consumers, Local Community, Society, and other actors of the value chain.
6	Multi-criteria decision-making applied to the sustainability of building structures based on Modern Methods of Construction.	Antonio J. Sánchez-Garrido, et al.	2022	Journal of Cleaner Production	MCDM method	Total LCC cost; Endpoint impacts; Local community: Consumer; Worker; Society
7	Sustainable material choice for construction projects: A Life Cycle Sustainability Assessment framework based on BIM and Fuzzy-AHP	Karoline Figueiredo, et al.	2021	Building and Environment	Multi-criteria decision-making and the LCSA method	Global Warming; Acidification; Eutrophication; total LCC cost; Fair Wage;
8	How to conduct consistent environmental, economic, and social assessment during the building design process. A BIM-based Life Cycle Sustainability Assessment method	B. Soust-Verdaguer, et al.	2022	Journal of Building Engineering	LCSA and BIM	CO <sub>2</sub> emissions; total LCC cost; working hours
9	Implementing Life Cycle Sustainability Assessment during design stages in Building Information Modeling: From systematic	Carmen Llatas, et al.	2020	Building and Environment	LCSA and BIM	Climate change; Acidification; Eutrofization; Working hours; Labor cost; material cost

literature review to a  
methodological approach

10	A cumulative risk and sustainability index for pavements	Sheldon A. Blaauw, et al.	2022	Transportation Research Part D: Transport and Environment	<a href="#">Markov chain</a> <a href="#">Monte Carlo</a>	energy use; pollution; water use; stable flow; drought stress; health and safety; value for money; social-economic impact
11	A holistic Life Cycle Sustainability evaluation of a building project	Olubukola O Tokede, et al.	2021	Sustainable Cities and Society	Life Cycle Sustainability evaluation (LCSE) based on Integral Theory (IT)	Contemplative Interconnection, Cultural System Interconnection, Ecological Systems Interconnection, Ecologically Dynamic Interconnection, Individual Considerations, Community Considerations, Value Considerations, Eco-system Considerations, Human-action Impacts, Geo-spatial Impacts, Environmental Impacts, Product-level Impacts, Users' Indirect Cost, Cultures' Indirect Cost, Society Direct Cost, Building Direct Cost
12	Life Cycle Sustainability assessment of window renovations in schools against noise pollution in tropical climates	Ali Tighnavard Balasbaneh, et al.	2020	Journal of Building Engineering	MCDM method	Noise Pollution; CO <sub>2</sub> Emission; Present value of cost; worker; local community; society; occupant; value chain actor
13	Life Cycle Sustainability assessment of fly ash concrete structures	JingJing Wang, et al.	2017	Renewable and Sustainable Energy Reviews	LCSA and Sustainable value	Climate change; Respiratory effects; Terrestrial acid/nutr; Mineral extraction; Cost of raw material; Cost of fuel

						consumed in transportation; Cost of energy consumed in concrete preparation; Living conditions; Medical treatment and health; Education and culture
14	Incorporating uncertainty into the Life Cycle Sustainability assessment of pavement alternatives	Xiaoyan Zheng, et al.	2020	Journal of Cleaner Production	Uncertainty-based LCSA framework	Agency cost, user cost, net present value (NPV), energy consumption (EC), global climate change (GCC), eutrophication (EU), acidification (A), human health criteria pollutants (HHCP), and smog (S), Working hours, Health and safety, Professional growth, Access to material resource, Safe/healthy living conditions, public commitments to sustainability issues, Health and safety
15	Evaluating the sustainability of soil improvement techniques in foundation substructures	Antonio J. Sánchez-Garrido, et al.	2022	Journal of Cleaner Production	MCDM method	Total LCC cost, ecosystem quality, human health, resources, Local employment, Access to material resources, User safety, User's health, Occupational health and safety, Fair wage
16	Sustainability Identification of Steel and Concrete Construction Frames with Respect to Triple Bottom Line	Amir Oladazimi, et al.	2021	Buildings	Sensitivity analysis and the triangle graph	Total LCC cost; Health and Safety; Fair salary; Local employment; Local community acceptance; Extraction of material resources; CO <sub>2</sub> emission
17	Integration of Sustainability Criteria and Life Cycle Sustainability Assessment Method into Construction Material Selection in	Dinh, et al.	2020	International Journal of Sustainable Development and Planning	LCSA and MCDM	Total LCC cost; Energy consumption; Water consumption; CO <sub>2</sub> emission; Waste production management; Toxic emission; Natural resources depletion; Acidification of land and water; Potential in recycling

	Developing Countries: The Case of Vietnam					and reuse materials; Safety in construction and operation; The health of laborers and residents; Labor availability; Aesthetics; Traffic congestion
18	Demonstrating circular Life Cycle Sustainability assessment – a case study of recycled carbon concrete	Luthin, et al.	2023	Journal of Cleaner Production	LCSA and material circularity indicator (MCI)	Total LCC cost, global warming potential, human toxicity potential, social risks, and social acceptance
19	Eco-effective sustainability assessment in buildings: Status and future directions for Life Cycle studies	Kumar and Mani	2023	Journal of Physics	LCSA	Total LCC cost; Cost efficiency; Budget management; Site efficiency; Water efficiency; Energy efficiency; Material efficiency; Toxic emission; Impacts of stakeholders; Health and well-being
20	Analyzing the Environmental, Economic, and Social Sustainability of Prefabricated Components: Modeling and Case Study	Chen, et al.	2024	Sustainability	LCSA and MCDM	Total LCC cost, the consumption of materials, machinery, and manpower, Local community: Consumer; Worker; Society
21	A General Framework for Sustainability Assessment of Buildings: A Life-Cycle Thinking Approach	Tran, et al.	2023	Sustainability	LCSA and Likert scale	Total life-cycle cost, CO <sub>2</sub> emission, Energy consumption, Dust pollution, Water pollution, Noise pollution, Resource Consumption, Usage of recycled materials, and the use of environmentally friendly materials, Local community: Consumer; Worker; Society
22	Life Cycle Sustainability Assessment of Building Construction: A Case Study in China	Dong, et al.	2023	Sustainability	LCSA and AHP method	Total life-cycle cost, Climate change, Ozone depletion, Human toxicity, Photochemical oxidant formation, Particulate matter formation, Ionizing

radiation, Terrestrial acidification,  
Freshwater eutrophication, Marine  
eutrophication, Terrestrial ecotoxicity,  
Freshwater ecotoxicity, Marine  
ecotoxicity, Agricultural land occupation,  
Water depletion, Metal depletion, Fossil  
depletion, Local community, Worker,  
Society

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