STRUCTURAL EQUATION MODELING (SEM) APPROACH FOR CAUSAL INVESTIGATION OF CAUSES AND CHALLENGES FOR DEMOLITION WASTE SUSTAINABLE MANAGEMENT

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Abstract – Demolition waste from road networks remains a significant global issue with profound environmental and economic implications. The situation becomes more of a concern when the quantum of such infrastructure facilities is also taken into account. However, a great number of impacts can be managed if the relationship between the causes and their challenges can be established at the planning stage, an early life cycle phase. The current work proposes a comprehensive framework for sustainable Demolition Waste Management (DWM). By identifying critical causes and impacts, a Delphi-based data tool explored the interrelationships among variables influencing DWM in such construction endeavours. Additionally, Life Cycle Assessment (LCA) methods assess the environmental impact of demolition waste management. Using Partial Least Squares Structural Equation Modeling (PLS-SEM), the study analysed connections between causes, challenges, and solutions in DWM for road projects. It reveals significant relationships, showing that demolition waste causes strongly influence both challenges (path coefficient = 0.727) and solutions (path coefficient = 0.175), underscoring their dual impact. Moreover, challenges exhibit a robust link with solutions (path coefficient = 0.760), emphasizing their role in shaping effective strategies. Addressing root causes and challenges is crucial for efficiently and sustainably mitigating demolition waste impacts sustainably. The developed framework offers systematic approaches for tackling demolition waste, providing pathways for capacity building, implementation, and evaluation. It empowers industry stakeholders with actionable insights to enhance DWM practices and offers guidance for policymakers in managing road construction waste sustainably. This research underscores the importance of addressing underlying causes and challenges to manage the complexities of demolition waste effectively while promoting environmental stewardship and economic efficiency.

Keywords – Demolition Waste Management; environmental management framework; multicriteria decision modeling; statistical modeling