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**TOPIC OF RESEARCH-DEVELOPING AN INDEX FOR RATING GREENNESS OF  
THE MANUFACTURED PRODUCTS**

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### **FINDINGS**

The present work focuses on developing a comprehensive framework for measuring and rating the greenness of manufactured products. A detailed literature review is conducted to identify the challenges associated with assessing product greenness, particularly the complexity of evaluating environmental, economic, and social sustainability factors together. Existing assessment methods and indicators are found to be sector-specific, inconsistent, and lacking universality for cross-industry comparison. To address these issues, the study proposes a structured framework based on Key Performance Indicators (KPIs) for assessing the greenness of manufactured products.

The research identifies a total of 52 KPIs grouped under seven dimensions derived from literature surveys, industrial practices, sustainability reports, and identified research gaps. Since it is important to identify the most significant indicators, two approaches of the Pareto Method are employed to shortlist 30 vital KPIs from the original pool. These shortlisted KPIs are considered the foundational parameters for the proposed Product Greenness Index (PGI).

The shortlisted KPIs are further prioritized and ranked using the Full Consistency Method (FUCOM) with inputs collected from experts belonging to industry, academia/research institutions, and customer-oriented management sectors. Sensitivity analysis is also performed to validate the consistency and reliability of the ranking results obtained through FUCOM.

To establish the interdependence among the shortlisted KPIs, an integrated Decision-Making Trial and Evaluation Laboratory (DEMATEL) – Maximum Mean De-Entropy (MMDE) –

Interpretive Structural Modelling (ISM) framework is developed. This integrated methodology provides a systematic and structured approach for identifying the relationship among KPIs and determining their relative significance. Further, MICMAC analysis is carried out to classify the KPIs on the basis of driving power and dependence power, thereby identifying the most critical performance indicators influencing product greenness.

An Index for rating the greenness of manufactured products, namely the Product Greenness Index (PGI), is developed using the Graph Theory Approach (GTA). The proposed PGI framework models the interrelationships among KPIs and provides a numerical representation of product greenness. An analogous matrix is developed to calculate the PGI values for manufactured products.

To validate the effectiveness and applicability of the developed framework, case studies are conducted on two manufacturing firms. The results demonstrate that the proposed PGI framework can effectively evaluate and compare the greenness of manufactured products across industries. The developed methodology is found particularly useful for small and medium-sized enterprises (SMEs) due to its structured, practical, and adaptable approach. The research contributes significantly towards sustainable manufacturing by integrating environmental, economic, and social dimensions into a unified framework for product greenness assessment and rating.