

## **A Diagnostic Expert System For Green Productivity Assessment of Manufacturing Processes**

**Ruby Pineda-Henson**

Dept. of Industrial Engineering  
Holy Angel University-Angeles City, Philippines

[hensonrp@datelnet.net](mailto:hensonrp@datelnet.net)

**Alvin B. Culaba**

Dept. of Mechanical Engineering  
De La Salle University-Manila, Philippines

[coeabc@mail.dlsu.edu.ph](mailto:coeabc@mail.dlsu.edu.ph)

Green Productivity (GP) is a new paradigm in sustainable manufacturing where resource conservation and waste minimization constitute the strategy in simultaneously enhancing environmental performance and productivity. This productivity approach to the sustainability of industries requires the adoption of clean technology techniques and the development of appropriate indicators and instruments to measure eco-efficiency.

The methodology for GP assessment integrates the use of life cycle assessment (LCA) as the technical framework and the analytic hierarchy process (AHP) as the multicriteria decision analysis (MCDA) support. LCA provides a systematic and holistic perspective to GP analysis that spans inventory, impact and improvement assessment. AHP addresses the need for a valuation tool in impact and improvement assessment. An input-output analysis approach using appropriate material and energy balances provides the basis of GP performance measurement.

Expert system technology is explored in developing a diagnostic prototype that emulates how human experts diagnose green productivity of manufacturing processes. Using CLIPS (C Language Integrated Production System), rule-based knowledge processing is made on the parameters derived from the application of the LCA-based model to generate the diagnostic interpretation and advice on the priority weights obtained from the AHP procedure and the resulting GP performance ratios and indices. Initial application of the diagnostic model on a semiconductor assembly/packaging case study demonstrated the suitability of a diagnostic expert system in implementing GP assessment in an 'intelligent' fashion so that it is easily accessible as a decision support for industries.