

Sustainable Life Cycle Management: Indicators to assess the sustainability of engineering projects and technologies

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Corporations are increasingly pressurised to incorporate economic, environmental and social performances into policies and decision-making processes. Furthermore, companies that compete globally are progressively more required to commit to and report on the overall sustainability performances of operational initiatives, i.e. undertaken projects or technological innovations. A prerequisite for aligning these operational initiatives with the principles of sustainable development is a clear understanding of the various life cycles that are involved and the interactions between these life cycles. Such a holistic Life Cycle Management (LCM) approach therefore requires an effective integration of different life cycles that are fundamental to the manufacturing sector, i.e. projects that drive internal change, assets (or technologies) that are required to manufacture products or supply services, and products (or services) from which income is derived. Tools are also necessary to evaluate the sustainability of these integrated life cycles. A detailed examination has shown that the current indicator frameworks that are available to measure overall business sustainability do not effectively address all aspects of sustainability at project and technology management level. Social criteria, especially, do not receive due considerations. A new framework to evaluate the sustainability of projects and technologies in the manufacturing sector is subsequently introduced. The framework focuses on the operational aspects of industry, i.e. where implemented projects and technologies impact society. The economic criteria of the framework are centred on the internal financial feasibility of a project or technology, whereas environmental criteria are concerned with the external impacts of the asset and product life cycles. The social criteria include both internal and external aspects that are influenced by operational initiatives in terms of Internal Human Resources, External Population, Stakeholder Participation, and Macro-Social Performance. The acceptance of the framework and associated criteria by decision-makers in petrochemical companies in South Africa is assessed. Case studies in a petrochemical company are also used to determine whether all relevant sustainability aspects are captured in the framework. These case studies consider the construction, operation and decommissioning of assets in the process industry. Two approaches are thereafter discussed through which measurable indicators may be established for the different criteria. A Sustainable Cost Accounting (SCA) methodology is introduced to translate the framework criteria (where possible) into monetary indicators. A case study in South Africa (to manufacture Gas-To-Liquid diesel) is used as basis to demonstrate this approach. The second approach applies the Multi Criteria Decision Analysis methodologies to evaluate and compare different kinds of (quantitative and qualitative) indicators. Such indicators that are relevant for the criteria of the sustainability assessment framework are subsequently proposed in the context of the South African process industry. Furthermore, case studies are described whereby these indicators are currently being tested. The way forward to achieve truly sustainable LCM in the manufacturing industry is therefore outlined.

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