

ABSTRACT

Technology assessment (TA) is one of the tools developed in early 1970s to provide indications of the impacts of technologies. TA continued in its institutional form until the US Office of Technology Assessment (OTA) was closed down in 1995, twenty three years after its establishment by the US Congress. One of the reasons for OTA's closure was related to methodological deficiencies both at the conceptual and tactical level.

Solving the methodology problem of TA requires a multifaceted effort. At the conceptual level, the three dimensions of sustainability (ecological, economic and social) could be used as a framework for TA. In addressing the problem at the tactical level, combining different systems analysis tools and concepts is important. This thesis is particularly about using a tool that combines Material/Substance Flow Analysis (MFA/SFA), Life Cycle Assessment (LCA), and Life Cycle Costing (LCC) in TA applications.

The combination of MFA/SFA, LCA, and LCC addresses the ecological and economic dimensions of TA. A specific tool that has such combination of MFA/SFA, LCA, and LCC is the Swedish ORWARE model.

The pros and cons of the combinations of these tools generally, and particularly within the ORWARE platform are discussed using illustration from research applications.

The quantitative nature of the component tools enhances both measuring and understanding issues addressed. MFA/SFA-based TA simplifies recognition of potential accumulation of toxic substances or depletion of resources. The advantage that LCA is established among decision makers, and has international standard and established platform for methodological development and harmonisation places a TA having LCA as a component in a good position. Use of LCC in a TA tool reinforces the economic assessment capability of the latter with considerations of both internal and external costs.

ORWARE has the merit of providing quantitative, even-handed, and holistic analysis with a well structured result presentation. Its basic limitation is related to the difficulty of describing technologies that do not exist at commercial scale in terms of material and energy flows. Using the analogy of a three-legged stool, the limitations of MFA/SFA, LCA, and LCC have an effect on the performance of ORWARE as a TA tool.

Keywords: technology assessment (TA), material flow analysis (MFA), substance flow analysis (SFA), life cycle assessment (LCA), life cycle costing (LCC), technology, systems analysis, sustainable