

System Dynamic Modelling within Sustainability Constraints

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The complexities of the ecological and social systems and their interrelationships have been a source of confusion and frustration for industrial sustainability practitioners. In response, a vast range of sustainability related ideas, tools, concepts and approaches have been developed and to keep the analysis effort at manageable levels sustainability practitioners have learnt to apply strict system boundaries in terms of the topic of study, the geographic area, the time frame, the impact categories, etc. A drawback of this approach is that some ideas, issues and impacts may be excluded from the study, not because they are judged irrelevant but since no one is looking in their direction. ‘Backcasting from Sustainability Principles’ is a planning methodology that offers a theoretical solution to this dilemma, namely, to include everything in the study – disregarding geographic, temporal or other boundaries - that may stop us from achieving success as defined by ‘Basic Sustainability Principles’ or sustainability constraints [1,2]. Previous studies have shown that ‘Backcasting from Sustainability Principles’ can be applied for systematic planning towards sustainability in both public and business organisations, for different societal problem areas and for the selection and design of tools and concepts relevant for sustainable development [3,4,5]. We are currently entering a whole new research field, in which we, from the same overriding sustainability perspective, analyse and design various tools and concepts like product development [6,7], lifecycle thinking [2] and industrial ecology [8].

In this study we are asking ourselves whether ‘Systems Dynamic Modelling’ can be combined with ‘Backcasting from Sustainability Principles’ to support strategic planning towards sustainability. From the perspective of a ‘Backcasting Practitioner’, ‘Systems Dynamic Modelling’ is a set of tools that help in gaining insight into the detailed functioning of a given system, but lacks the ability to support strategic planning towards sustainability – unless complemented with a satisfactory goal definition. ‘Backcasting from Sustainability Principles’, in the eyes of a ‘Systems Modeller’, is the planning step of a learning loop that also includes action implementation and follow-up. Since no dynamic modelling takes place this methodology typically produces laundry lists of isolated problems and solutions, thereby missing potentially important feedback loops, delays, hidden problems and suitable intervention points in the system.

We suggest a new integrated approach that starts with an initial analysis of the problem at hand, utilizing ‘Backcasting from Sustainability Principles’. This creates laundry lists of critical present-day flows and practices, and of solutions and visions, i.e. a frame for continued analysis. After that, system dynamic tools are applied to study the interrelationships between the listed items, which create more robust analyses both of the problems at hand, and the possible solutions. Furthermore, it is helpful to make choices as regards the best road (out of several) forward towards sustainability, within the overall frame.

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