A Framework for Integrated Assessment of Sustainable Supply Chain Management

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Abstract - This paper presents a framework for calculating an integrated index to assess the sustainability of the supply chain of a given product. Analytical Hierarchy Process (AHP) has been used to obtain relative weights of the different indicators and dimensions of sustainable development context. This framework considers all entities involved in the supply chain and provides an integrated index to evaluate supply chain movement towards a more sustainable environment. Plastic carrier bags supplied by a large supermarket chain, Shahrvand, is chosen as a case study. An integrated index of sustainability is presented for plastic carrier bags supply chain in two periods of time. Interpretation and sensitivity analysis of results is given and effectiveness of integrated index is pointed out.

Keywords - Supply chain management, sustainable development, analytical hierarchy process (AHP), plastic carrier bags

I. INTRODUCTION

The concept of sustainable production emerged at the United Nations Conference on Environment and Development in 1992 and is closely related to the concept of sustainable development. The conference concluded that the major cause for the continued deterioration of the global environment is the unsustainable pattern of consumption and production, especially in industrialized countries [1]. Moving toward sustainable development needs to meet the objectives in three mentioned areas in such a way that:

- Maintain a high and stable level of economical growth and employment
- Effective protection of the environment
- Provide social progress which recognizes the needs of every one

The achievement of such ambitious sustainability objectives requires a radical re-think of many of practices in industry and different approaches are needed to evaluate efforts to move towards sustainable development[2]. The companies are already involved in various activities aimed at addressing sustainable development, which has been defined as the creation of goods and services using processes and systems that are non-polluting, conserving energy and natural resources, economically viable, safe and healthful for employees, communities and consumers, socially and creatively rewarding for all working people [3].

Moving towards more sustainable production needs some changes through the supply chain. These changes can be classified in two categories: process changes and structural changes. Process changes relate to every improvement that can be applied in the single process of supply chain of a product such as production, transportation, packaging etc. Structural changes relate to changing configuration of given supply chain network [4]. After conducting the required changes to the supply chain, there is a need to assess the degree of success of policies for moving toward more sustainable environment. Achieving this goal requires a systems approach that enables balancing of economic, environmental and social concerns through:

i. Identification of stakeholders and key sustainability issues;
ii. Programs and actions needed to address these issues;
iii. Development of sustainability indicators to enable performance measuring and monitoring;
iv. Progress evaluation to ensure continuous improvements of the triple bottom line; and
v. Information sharing and communication with stakeholders

Warhurst [6] considers measuring of sustainable development as a two-step approach. Firstly, the progress made in a number of selected individual fields is measured by sustainable development indicators and secondly, the overall progress made towards sustainable development is assessed by a combination of these individual fields with regard to their interlinking. This paper presents the design of an integrated sustainable supply chain index (Isc) that would assess performance of a given supply chain. The paper organizes sustainability assessment of a supply chain in terms of economic, environmental, and social performance. This structure has been chosen because it reflects the most widely accepted approach to introducing sustainability [7]. In doing so, at first different entities and stakeholders involved in a given supply chain is identified. Next, sustainability assessment indicators in three dimensions of sustainable development are determined for each entity. This can be achieved through a brainstorming group sessions incorporating relevant stakeholders. All indicators are integrated in a single composite indicator using Analytical Hierarchy process (AHP) methodology [8] to assess sustainability of the supply chain. AHP adopts the normalized social, environmental, and economic indicators to incorporate them into a unique measure of