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Using Sustainability Metrics and Indicators to Design Sustainable Supply Chains

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ABSTRACT

Sustainability is widely associated with the statement from the World Commission on Environment and Development, 1987: "… development that meets the needs of the present without compromising the ability of future generations to meet their own needs…" Hence, sustainability is about the world supporting human society for the indefinite future. Because a major feature of human society is the production and use of goods and services using a supply chain, it is important for sustainability that these supply chains spanning the entire life-cycle be as sustainable as possible. To do this in any practical way, however, one needs at least semi-quantitative means of measuring progress towards or away from sustainability. There is, therefore, a need for scientifically sound indicators and metrics to at least provide quantitative measures of progress. Note, though, that there is a distinct difference between pollution prevention and sustainability. Pollution prevention is when the environmental impact is reduced along the supply chain for the activities of raw material acquisition and transportation, goods and services production, goods and services distribution, and goods disposal. Pollution prevention is done based on indicators which may include indexes of environmental impact, energy efficiency, raw material to product ratios, etc., and these can greatly reduce environmental impacts when used judiciously. Sustainability, however, goes beyond reducing environmental impacts to consider whether the underlying processes in the ecosystem, energy flow and cycling system, the economy, and society are functioning well and are being preserved. This requires a wider look not so much at the components of the supply chain but the supply chain in its entirety. This requires the use of sustainability metrics which may be based on footprint analysis (e.g. ecological foot print), energy systems analysis (e.g. emergy), thermodynamic analysis (e.g. exergy), economics (e.g. green accounting), and information theory (e.g. Fisher information), and it also requires criteria that relate these metrics to sustainability. The goal of this seminar is then to discuss the use of sustainability indicators and metrics in the design and retrofit for sustainability of supply chains spanning the product or service life-cycle its entirety.