

# Evaluation of Sustainability in Textile Industry

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**Abstract** Sustainability and its assessment are highly critical to industries, governments and even to customers. Every industrial sector, company, individual and even government and different nations have sustainability goals and commitments. It is inevitable to measure the level of sustainability achievement by all these above-mentioned players and for this, a tool to assess sustainability is highly desirable. Assessment of sustainability is an important topic in any field. Choosing a right tool to suit the needs of different players in the field of sustainability is very much crucial. As mentioned in earlier chapter, sustainability focuses on three major elements namely environmental, economic and social aspects and any assessment technique needs to focus on this triple-line thinking. Sustainability can be assessed for a product/process, project and also for a sector and a country. Assessment tools are classified by various ways. Various authors have classified these tools in various ways according to the ruler/scale/method. Not all tools can be used for textiles and clothing supply chain, and some of the tools are highly evident to assess the sustainability of textile products. This chapter deals with various sustainability tools and their implications in textile industry.

**Keywords** Tools • Product assessment • Life cycle assessment • Life cycle costing • Social life cycle assessment • Textile sector

## 1 Classifications of Assessment Tools

According to one of the methods of classification, there are three types of assessment tools existing namely product-related assessment, project-related assessment and sector- and country-related assessment. Additionally, indicators or indices also join this list (Rorarius 2007; Štreimikienė et al. 2009). Other classification method

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classifies the tools again into three types namely monetary, biophysical and indicator-based tools (Gasparatosa and Scolobig 2012). The third type classifies also into three types namely indicators and indices, which are further classified into non-integrated and integrated, product-related assessment tools with the major focus on the material and/or energy flows of a product or service from a life cycle perspective, and finally integrated assessment (Bebbington et al. 2007; Ness et al. 2007).

Back to the basics, any assessment tool for sustainability must focus on three elements namely environmental sustainability, economic sustainability and social sustainability. There are many dedicated tools, and methods were developed for assessing each element of sustainability. One of the major areas which needs to be discussed when it comes to sustainability assessment is life cycle assessment or life cycle thinking. This will be discussed chiefly in this section.

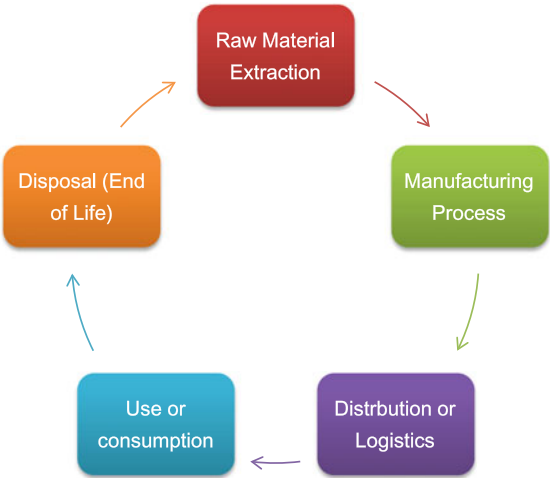
In the above classification of tools, one can understand that the indicators are one of the essential tools captured by all the 3 classification methods mentioned in this book in this section (please note that these three types mentioned here are not exhaustive; there might be many types of classifications in addition to the three types pointed out here). There are many indicators and indices defined by several researchers in the field of sustainability, and one can imagine a list as high as 140 indicators defined by UN Commission on Sustainable Development (CSD) (CSD 2001).

## **2 Life Cycle Assessment (LCA) and Life Cycle Thinking (LCT)**

Life cycle assessment (LCA) is a scientific method or technique to identify, quantify and further to evaluate the environmental impacts (inputs and outputs) of a product, service or activity, from cradle to grave stages (Life Cycle Analysis 2015). It can be used to quantify the environmental impact of processes as well and again it has many variants. As the name implies, it is highly helpful to assess the environmental impacts of a product from the beginning (raw material extraction stage or cradle) to the final (disposal or end of life or it is called as grave stage). Life cycle of a typical product comprises the five stages as depicted in Fig. 1.

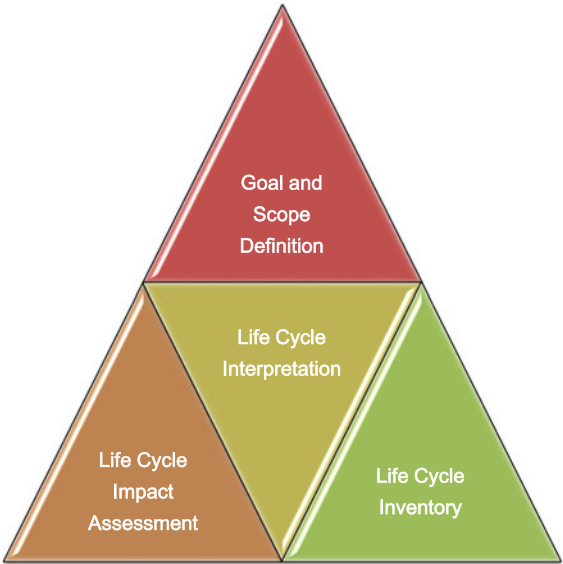
Not always a LCA study has to include all the stages from cradle to grave. At times, the depth of the study can be shortened and confined from cradle to gate or gate to gate stages. Likewise, there are many such variants of LCA such as well to wheel. A very detailed explanation of LCA and how a LCA study needs to be conducted and what are the challenges and limitations pertaining to LCA studies in textiles are already explained in depth by the author in his other books (Life Cycle Analysis 2015; Muthu 2014; Muthu 2015a). Instead of repeating the same here, very important points are only mentioned in this section. Readers are strongly encouraged to read those books to get detailed information on LCA studies on textiles and clothing sector.

**Fig. 1** Life cycle stages of a typical product



Life cycle assessment is a multi-step process to calculate the environmental impacts (potential) created by a product in its lifetime. ISO standards have a dedicated series for LCA methodology, and the important widely used and accepted standards for LCA are ISO 14040 and 14044. There are many other variants of LCA such as product carbon footprint assessment (assessed by ISO/TS 14067), which is again based on LCA technique and relying on ISO 14040/44. According to ISO series of LCA standards, a LCA study necessarily has four steps (Fig. 2).

**Fig. 2** Four-step process of LCA



This concept of LCA can be used to measure different types of sustainability, and there are many tools developed in line with life cycle thinking to measure different dimensions (economic, social and environmental) sustainability. Life cycle thinking (LCT) is the concept of including the whole product life cycle system from the “cradle to the grave” under the consideration (raw material extraction stage to the end of life stages) with the objective of preventing individual life cycle stages are considered for assessment which will subsequently shift the environmental burdens to another life cycle stage (Finkbeiner et al. 2010).

### 3 Life Cycle Approach—Sustainability Assessment

As discussed in the previous section, to measure the three elements or faces of sustainability namely environmental, economic and social, life cycle approach is widely used. There are different types of tools developed to measure these three sustainability elements, and based on the element of sustainability to be assessed, an appropriate tool has to be chosen.

To assess the environmental impacts of a product, LCA is widely used. LCA typically refers to environmental LCA. As discussed above, LCA follows cradle to grave concept with cross-media environmental assessment approach, i.e. all relevant environmental impacts such as both on the input side (consumption of resources) and on the output side (emissions to air, water and soil, including waste) (Finkbeiner et al. 2010). If the life cycle stages of a product are assessed with an environmental lens, then it is referred to as environmental LCA. LCA is defined by ISO 14040 as “compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle” (ISO 14040 2006).

Life cycle costing refers to the assessment technique if different life cycle phases of a product from its cradle to grave stages are examined with the aid of an economic lens. Life cycle costing is defined as summing up total costs of a product, process or activity discounted over its lifetime (Spitzer and Elwood 1995; Henn 1993; Spitzer et al. 1993; EPA 1993). For economic sustainability assessment, two factors are mainly considered—cost and performance—and there are variety of approaches and tools developed for the same. Manufacturing costs (from a business perspective) and life cycle costs (from the customer’s perspective) are mainly considered for economic evaluation (Finkbeiner et al. 2010; Publications of the European Platform of LCA 2010).

Life cycle costing (LCC) is a methodology that enables you to incorporate costs and benefits that occur over the entire life cycle of a product into your procurement decisions, rather than considering the initial capital cost of a product only (Mungcharoen 2013). The process of life cycle costing (LCC) fundamentally involves investigating the costs arising from an asset over its entire life cycle and also investigating and suggesting the alternatives that have an impact on this cost of ownership (Life Cycle Costing 2011). Australian Standard AS/NZS 4536:1999

defines life cycle cost as the sum of acquisition cost and ownership cost of an asset over its life cycle from design stage, manufacturing, usage, maintenance and disposal (Australian Standard AS/NZS 1999).

Life cycle costing helps to ascertain the costs of any product in different life cycle stages, and it offers great help in green public procurement (GPP). It is a misconception that green or sustainable products will cost more and if we have a deeper dive into this, this does not necessarily be true. Even though in many cases (of course not all the time), the sustainable alternatives or green choices may have higher initial or purchase price. However, when we interrogate into the total cost throughout the entire life cycle of the product, these sustainable/green choices may prove to be cheaper than the nongreen alternatives. Green alternatives may compensate the higher initial cost in the further life cycle stages such as usage/waste/disposal stages when compared to their rivals (Life Cycle Costing 2008). This kind of knowledge or information can be disseminated through LCC, and it can be a wonderful tool in textile industry, where there a lot of sustainable/green alternatives are coming in every day. However, the applicability of LCC in textiles and clothing industry is still at infancy state.

The third face of sustainability, which is social face, can also be assessed with the aid of life cycle approach. Such approach/methodology is called as social life cycle assessment (S-LCA). Contemplation of integrating social aspects into the traditional life cycle assessment of products started in the beginning of 1990s itself. Social life cycle assessment (S-LCA) assesses the potential positive and negative social impacts along a product's life cycle, while avoiding shifting negative impacts from one part of the supply chain to another.

S-LCA method can be used to evaluate the social and sociological aspects of products, their actual and potential positive as well as negative impacts along the life cycle. This assessment encompasses various life cycle stages of a product beginning from the raw material extraction and processing and progresses through the subsequent phases namely manufacturing process, transportation and distribution, consumer use and end of life (reuse, recycling and disposal). S-LCA utilises generic and site-specific data, which can be quantitative, semiquantitative or qualitative. S-LCA complements the environmental LCA and LCC, and it can either be applied alone or in combination with the other techniques (S-LCA; UNEP).

S-LCA method is becoming popular recently, and the methodological part pertaining to every industry is also getting familiarised and many researchers are now working into this field. Readers are suggested to refer to the author's recent book on Social Life Cycle Assessment for further details (Muthu 2015b).

Textile industry is facing a huge challenge in terms of social impacts especially working conditions, child labour and so on. Though there are a very few (one or two only to the knowledge of the author even after the vast literature search) studies on textiles to measure the social impacts of clothing products, an earmarked tool or methodological choice for measuring the social impacts of textiles and clothing products is yet to be developed.

Integrating all the three tools for assessing the three faces of sustainability is attempted and coined under the umbrella of life cycle sustainability assessment (LCSA).

LCSA = (environmental) LCA + LCC + S-LCA (Klöpffer 2008; Finkbeiner et al. 2010)

Combining (environmental) LCA, S-LCA and LCC contributes to an assessment of products, providing more relevant results in the context of sustainability (UNEP/SETAC Life Cycle Initiative 2011). However, such tool is yet to be attempted for measuring the overall sustainability of textile products.

## Recommendations for Further Study

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