The Sustainable Apparel Coalition and the Higg Index

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Abstract The Sustainable Apparel Coalition (SAC) seeks to lead the apparel industry toward a shared vision of sustainability built upon a common approach for evaluating sustainability performance. By developing a common tool—the Sustainable Apparel Index—the SAC enables apparel industry companies to measure the environmental and social impact of apparel production throughout the product lifecycle, from design to end of use or recycling of the product. The potential impact of the Sustainable Apparel Coalition is enormous. SAC member companies (including brands, retailers and manufacturers) are estimated to be responsible for more than one third of the apparel and footwear produced globally. The SAC has built a strong foundation and made significant progress since its launch in 2010. As the coalition looks forward, there are a few key challenges that members must be prepared to overcome in order to reach shared sustainability goals. The Higg Index, announced by the SAC, is primarily an indicator-based assessment tool for apparel and footwear products that was launched in 2012. The Higg Index has a suite of self-assessment tools dealing with facility, brand, and product and asks practice-based, qualitative questions to gauge environmental sustainability performance and drive behavior for improvement. It is a learning tool for both small and large companies to identify challenges and capture ongoing improvement. It targets a spectrum of performance that allows beginners and leaders in environmental sustainability, regardless of company size, to identify opportunities. The SAC has established a strong foundation of organizational culture and progress, faces both opportunities and challenges, opens membership to any interested company in the apparel sector and drives the Index tool through further iterations and industry adoption. As the organization grows and evolves, it must retain its unique culture and speed at the same time that it balances membership growth, which may bring evolving expectations around sustainability aspirations and engagement to the coalition. The SAC must look forward in order to achieve its long-term vision of transforming apparel industry such that it produces no unnecessary environmental harm and has a positive impact on the people and communities associated with its

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activities. The organization is poised to build on its success with strong momentum and member commitment. Translating the coalition's accomplishments and lessons learned across the apparel industry (and to other industries) will be the true measure of SAC's success.

1 Environmental Impact of Products

1.1 Introduction

Every product used by the consumer has an impact on the environment. Many consumers today do not know the extent to which these products impact the environment—low or high. A product is considered to be eco-friendly when it is made, used and disposed of in a manner that would reduce the harm to the environment when compared to a product that was manufactured and used without any environmental concern. However, consumers have become more conscious of these impacts and are spelling out their preferences for eco-friendliness, thereby forcing the manufacturer to adopt clean technologies all along the supply chain to produce environmentally friendly products (Challa 2014).

All products that are manufactured cause environmental degradation, either during manufacture, use, or disposal. This can be evaluated by looking at the different phases of the product's lifecycle and taking action at the phases where it will be most effective to reduce the environmental impact. However, the lifecycle of a product is long and complicated, covering many areas with many people involved in each phase. A remedial measure or policy may not be possible to address this aspect but a variety of voluntary and mandatory tools will help to achieve this objective. These include economic instruments, bans on certain substances, environmental labelling, voluntary agreements and product design guidelines (IPP 2014).

1.2 Principles for the Assessment of the Environmental Impact of Products

To facilitate the assessment of environmental impact, the final consumption of an environment/place has been categorized by the European Commission Communication on Integrated Product Policy into product categories. The classification may divide the total consumption of products into categories based on any of the said methods. The major divisions may be based on the functional areas of consumption, such as transportation, clothing, health care and recreation. The second method may be based on consumption domains, where one category forms a contributing factor to the other category (e.g. transportation being a contributing factor to health care or

recreation). The third method may be on the basis of product groupings that are subclasses of the consumption domains (e.g. transportation may be further divided into subclasses such as rail, road, ship and air). The other classification can be as a homogenous product group or individual product groups, such as medium-range diesel cars (homogenous) and a specific diesel car (individual).

Further two approaches have been identified by the organization to undertake studies on environmental assessment. The bottom-up approach starts with the selection of a product, followed by the completion of a lifecycle assessment (LCA). The top-down approach begins with input and output data compiled by statistical agencies, followed by the production and consumption analysis of an economy. The most important environmental impact categories used in most of the studies were global warming, acidification, photochemical ozone formation and eutrophication. Apart from these categories, ozone layer depletion, human toxicity, eco-toxicity, land use and depletion of nonrenewable resources were taken into account (Tukker et al. 2006).

It is difficult to measure and express a product's overall environmental impact, so the LCA is a useful tool for such use. The first step is to select a functional unit (e.g. a product) and the next process is to set boundaries for the analysis. The classic LCA is carried out on a cradle-to-grave basis, which assesses the environmental impact of extracting and gathering raw materials, assembling the product, transporting it to the user and disposing or recycling at the end of the product's useful life. The next step is to conduct a lifecycle inventory, which involves the tracking of every single part of the product back to its raw material origins. The lifecycle inventory generates large amounts of data, which have to be grouped into different categories (11 or 12 categories) representing the particular impacts on humans, ecosystems or resources. Finally, the LCA report quantifies the total impact of the product on each category. The International Organization for Standardization (ISO) has a set of processes that govern a LCA. According to the ISO, the analysis must be done from cradle to grave and the resources, processes and calculations performed in the analysis must go through a peer-review process conducted by third parties (Palmer 2012).

1.3 Assessment and Promotion of Green Products

To promote a market for greener products and to strengthen the product-focused green policies, many instruments can be used. The policy of differentiated taxation such as reduced value-added tax for eco-labelled products,extends producer responsibility to new areas and the use of governmental laws provides new guidelines forenvironmental protection. These measures could capture the attention of the consumer, who is more likely to use greener products once the price is lowered. When the consumer demand for green products increases, markets are likely to provide them. However, the consumer needs information about the products in order to choose from the wide variety of products available in the market. This requires a

wider labelling policy and relevant, credible information about the product. Environmental impacts cannot be addressed once the product is introduced into the market and attention should be focused on environmentally friendly product design. Improvements in product design can be made by improving the flow of lifecycle information and eco-design guidelines, integrating environmental considerations into the manufacturing processes and involving relevant stakeholders to review the approach. Education on the need for greener and eco-friendly products and the use of case studies and examples would help to strengthen the design and manufacture of green products. LCA is a very useful tool for the evaluation of products in the areas of materials, energy, transportation and end of life.

Another measure adopted by the German government was the formation of a national environment help desk, which serves as a platform for obtaining a good flow of information between the environmental experts and stakeholders. This database will be used for the standardization processes. It has been reported that 80 % of the standardization is European and international standardization. There is a need for a high degree of expertise, which can be found in industry and academia from all parts of the globe, as environmental issues differ from country to country. In Germany, the national environment help desk consists of the secretariat and a steering board. The standardization activities with regard to the environment are communicated regularly to the stakeholders by means of newsletters. Experts from nongovernmental organizations (NGOs) and universities are invited to take part in the standardization process and to report back to the help desk. The European Environmental Citizens Organization for Standardization was founded jointly by the WWF European Policy Office, Friends of the Earth Europe, Birdlife International and French and Danish NGOs. The European Environmental Citizens Organization is working toward a standardization process, with priority for the environment (European Commission 2001a).

The European Commission conducted a series of conferences on environmental policy, with discussions highlighting the importance of LCA and eco-design guidelines. A collaboration between the design centers and the industry needs to be promoted. In this context, a study was conducted to identify and analyze the state-of-the-art activities in the field of eco-design and the methods by which this information can be transferred to small- and medium-sized enterprises by means of workshops and dissemination activities. The lifecycle inventory and LCA were considered as tools to form the database for standardizing and optimizing with due concern for the environment (European Commission 2001b).

One of the economic instruments for evaluating the environmental impact of products is externality valuation. Usually, the measurement of externalities is minimal when compared to the internal costs. In most cases, the impacts are due to consumer use; also, because, the supply comes from global sources, the impacts occur abroad. The problematic areas include the external cost of landfills, the attribution of transport cost, the method of costing resource use and the impact of carbon. Furthermore, only a small part of the overall lifecycle impact is associated with a small company; the majority is distributed along the product supply chain as well as the other phases of the lifecycle of products. The impacts should be

measured in production, consumption and waste management. A high degree of variation exists between different products and the transportation and landfill issues could even vary within the same product. The evaluation criteria for economic instruments should include environmental and economic efficiency, the effects on innovation, their administrability and political acceptability; the incentives provided by the economic instruments should be applied based on the desired behavior and impact. Environmental taxation is based on environmental impacts; therefore, it is essential to measure the environmental impacts and quantify them in terms of monetary value.

Economic instruments have been extensively used in Sweden and more than 50 billion safekeeping receipts were raised in terms of general energy taxes, taxes for issues such as use of solvents and chlorofluorocarbons and others concerning the use of batteries, chemical fertilizers, pesticides, sulfur, CO_2 and differentiated taxation on fuel. Other schemes introduced were the implementation of the EU Landfill Directive, the UK Greenhouse Gas Emissions Trading Scheme, the UK Packaging recovery note, the Norwegian system of weight-based waste taxes and used furniture recycling projects. Producer responsibility should be considered on a more individual basis and incentives for environmental investments should be promoted (European Commission 2001c).

1.4 Measures for Reducing the Environmental Impact of Products

The Department for Environment, Food and Rural Affairs and the Department of Energy and Climate Change and Environment Agency in the United Kingdom have made sincere efforts to assess the environmental impact of consumer products. Many of the products are imported from all around the world; hence, the environmental impacts are distributed across the world (Encouraging businesses to manage their impact on the environment. https://www.gov.uk/government/policies/. Accessed 30 Apr 2014). The Product Sustainability Forum is a collaborative agency with retailers, suppliers, academics, NGOs and government representatives who joined together to measure, communicate and improve the environmental performance of products, with WRAP as the secretary for the forum (Product Sustainability Forum 2014). PAS 2050:2011 is a freely available specification that provides a methodology for assessing the lifecycle of greenhouse gas emissions for goods and services. This was the world's first structure for calculating the carbon footprint of products, published in 2008. Currently, PAS 2050 has many specifications in individual sectors for the effective assessment of the carbon footprint of products, identification of problems and reduction of carbon emissions in the supply chain (BSI 2014).

Product Environmental Footprint and Organization Environmental Footprint are organizations who are involved in the selection of proposals for tool development to calculate the environmental footprint of products. This selection will be a sample of

the market and is based on the diversity of product groups, availability of lifecycle data and product category rules. The selection of proposals was carried out by a committee of policy officers from different sectors of the General of the European Commission. The Directorate General, Environment and the European Commission Joint Research Centre have worked in tandem for the development of a technical guide for the calculation of the environmental footprint of organizations, which also includes the carbon footprint. The methodology has been developed based on the Lifecycle Data System Handbook, the Global Reporting Initiative, WRI GHG Protocol, CDP Water Footprint, ISO 140064 among others (EC 2014a, b).

Currently, the concern is not only for the manufacture and distribution of the products to the consumer but also the effects of each action involved in the sourcing, manufacturing and supply chain of the product on the environment, society and the welfare of living beings worldwide. Many organizations are working to make people aware of the effects of product development and the responsibility of both the industry and the consumer in actively making wise decisions to adopt eco-friendly attitudes and actions. Since the textile and fashion industries occupy vital positions in the world economy and contribute to a large extent to environmental pollution, concerns for reducing these impacts compelled leaders in the apparel and footwear industries to form an organization called the Sustainable Apparel Coalition, which worked toward eco-friendliness and sustainability to make the future better.

2 Introduction to the Sustainable Apparel Coalition

The world's textile and apparel industry is a 3 trillion industry that includes the manufacturing, marketing and retailing of textiles and garments. This industry has been considered as an approach for industrialization, economic progress and national development. According to the World Trade Organization, China has been leading the world with regard to exports in the field of textiles and apparel, followed by the European Union and India. The Association of Southeast Asian Nations (ASEAN) region is considered to be the biggest competitor to China in terms of being a low-cost manufacturing center and export hub. The ASEAN region, which includes Korea, India, Vietnam and Cambodia, has become one of the fastest growing trade associations. The predictions are that China will remain the leader in textile and apparel sourcing in the Asian region, because no other country can match China in scale, infrastructure, efficiency and stability. Other countries would have to invest significantly to increase productivity and meet the stringent quality demands (Speer 2014; Wikipedia 2014).

Despite the recent recession, strategic moves taken in this sector have saved the industry from various problems. Every industry should concentrate on keeping stock levels low, as well as on being flexible and in tune with the consumer's needs and wants, emphasizing lean management and strong supply chain networks. Ecological friendliness was the main motto and consumers have been very much

aware of its impact, seeking out products that complied with ecological standards. Consumers paid more attention to water conservation, particularly when there was low usage of water for production with zero discharge into the environment.

The governments of various countries have safeguarded their industries by implementing globally focused strategies and policies. Intellectual property rights and free-trade pacts have contributed to the industry's well-being. Profit margins have also increased for industries that have entered into specialized fields of manufacturing and for niche products with an emphasis on stringent quality.

Another development worth mentioning is the formation of the Sustainable Apparel Coalition, which helps industries to rate their products with a numerical sustainability score in order to provide data to customers with regard to the extent the manufacturer has contributed to the conservation of the environment. The Higg Index is one such tool for the assessment of a product's sustainability, which raises a manufacturer's consciousness of the design, choice of raw materials, manufacturing processes, finishing, packaging and distribution through the use and recycling of the product (Martin 2013; Reichard 2013).

Flexibility, sustainability and change are the key words for growth and progress. Industries that simply maintain production in terms of the routine scheduling and orders will soon vanish from the competitive global market. In the near future, the big winners will be manufacturers who are willing to move swiftly and definitively when faced with innovative opportunities. This trend will be centered on the mindset of the consumer and the consumer's awareness, thus leading to solid demand and increasing profits in the coming decades.

2.1 Background

The fashion industry is a popular industry among consumers, but it has a huge effect on many environmental, social and governance concerns. The textile industry prepares the base materials and the fashion and apparel industry converts these materials to suit the desires and needs of consumers; both industries are responsible for high utilization of energy, water, chemicals and resources from cotton to petroleum. The poor onsite conditions of the textile factories and working environment have caused many problems for the workers and operators, forming the basis for social reforms. In addition, the precarious supply chain upon which many manufacturers rely to develop apparels can cause many problems for merchandisers and retailers. The challenges faced by apparel manufacturers and retailers, along with incidents such as the Rana Plaza in Bangladesh and the crisis in Cambodia, led the clothing industry giants and nonprofit organizations to launch an association called the Sustainable Apparel Coalition (SAC), which aims to reduce the environmental and social impacts of the apparel industry around the world (Kayne 2011).

The SAC is a trade organization with brands, retailers, manufacturers, government and nongovernment organizations and academics as members, who together represent more than one third of the global apparel and footwear market. The SAC

Fig. 1 Logo of the sustainable apparel coalition (19)

was founded by a team of sustainability leaders from the global apparel and footwear industries, with the aim of addressing the current social and environmental challenges in the industry (Fig. 1). This organization seeks to highlight sustainability through a multistakeholder arrangement by evaluating and measuring the sustainability of apparel and footwear products, thereby giving rise to technological innovations and actions. This organization has more than doubled its membership and revenue in the 2 years since its inception. (SAC 2012a).

2.2 Mainframe of Sustainable Apparel Coalition

The organizational structure of SAC consists of a board of directors, consisting of eminent industrialists and professionals from various organizations around the globe, headed by a board chair. The members of the board of directors have a rich background in industry and sustainability issues and they form the mainframe of the coalition (SAC 2012b). The board is supported by a team who works toward the goal of SAC. The team members include an executive director, vice president, collaboration projects manager, environmental sustainability manager, implementation lead, product manager, membership development lead and an environmental sustainability analyst. The team members have vast experience in industry, product management, project management, development of assessment tools and sustainability issues (SAC 2012c, d). These members are responsible for the planning, execution and evaluation of the different activities of the coalition and contribute to the sustenance and development of the organization.

2.3 Vision and Mission of the Sustainable Apparel Coalition

The vision of the SAC is to promote an apparel and footwear industry that does not produce unnecessary environmental detriment and supports a positive impact on the people and communities involved with its activities. The coalition was founded by global sustainable leaders in the apparel and footwear arena who recognize the

importance of addressing the current social and environmental challenges facing the industry. The mission of the coalition is to lead the industry towards sustainability based on tools for measuring and evaluating apparel and footwear product sustainability performance, thereby providing opportunities for technological innovation. With the vision and mission established, this organization is working currently towards the development and adoption of the Higg Index, a suite of tools for measuring and assessing the environmental and social performance of apparel and footwear products (SAC 2012e).

The purpose of the SAC is twofold. The member organizations will formulate plans to reduce the impact of the apparel industry with regard to the consumption of water, chemicals and waste generation. This can be achieved by the coordinated efforts of coalition members, industry and supply chain partners by lifecycle transparency for clothing, coupled with an assurance that fair employment practices and safe working environments are provided to the workers in the apparel industry.

Secondly, the SAC will develop an assessment tool for the measurement of environmental and social impacts. Based on the indices developed by Nike and the Outdoor Industry Association, namely Apparel Environment Design Tool and Eco Index, version 1.0 of the Higg Index was developed. This tool assesses energy, water and chemical utilization by the industry and product lifecycle. A firm can then compare their results with those of their peers to create an awareness and improve performance by way of resources and guidelines. These efforts will reduce costs and will eventually develop customized assessment tools for specializations such as footwear (Kayne 2011).

As a collection of assessment tools, the Higg Index was launched on December 11, 2013. Its focus is on the standardization of the measurement of environmental and social impacts of apparel and footwear products across the product lifecycle throughout the value chain.

2.4 Outcomes of the Sustainable Apparel Coalition

Outcomes envisaged by the SAC include five important areas of apparel or product manufacturing, as shown in Fig. 2. The first aspect, water use and quality, targets the improved efficiency of water usage and reuse in the cultivation or production of raw materials and manufacturing of products. Its main feature is to minimize the effluent load and quantity of water discharges associated with apparel manufacturing and eliminate the impact on the neighboring environment and local communities. The development of alternatives to conventional washing practices are also considered to reduce the need for water use in garment care.

The second outcome, energy and emissions, aims to minimize the use of direct and embedded energy and carbon in apparel products, with the intention of reducing the use of resources and greenhouse gases. It also aims to promote design and technology in the creation of apparel products that lessens carbon impacts, such as reducing the need to use heating and air conditioning systems.

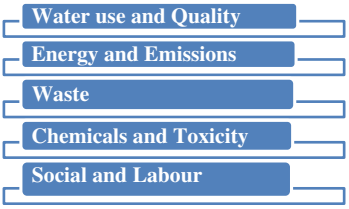

Fig. 2 Outcomes of sustainable apparel coalition

Minimizing waste in all operations, the supply chain and the end stage of apparel products, as well as the effective use of textile waste as raw materials or recycling of waste for further use, is the third outcome. Generally, the use of chemicals in the apparel supply chain—namely in the cultivation and production of raw materials and manufacturing of apparel products—results in environmental and health hazards if these materials are not handled efficiently.

The fourth outcome is the reduction and effective management of chemicals and toxicity to safeguard the environment. The final outcome deals with the human concern for fair, safe and nondiscriminatory workplaces, as well as to network with industry and supply chain partners to attain lifecycle transparency about the social and ethical performance of all companies and products (SAC 2012f).

2.5 Membership Benefits

The benefits of joining the SAC are many, as the apparel brands and products are evaluated by consumers using quality and benchmarking systems. These benefits fall under three heads—business value, leverage and leadership. When manufacturers and business partners become aware of the measurement of sustainability performance, they will look out for ways to promote operational efficiencies in energy, material and water use, thus resulting in benefits in these areas of production and management of resources. The process of benchmarking performance with industry peers or against a set of standards will bring about a positive change in practices and technology. Rating performance using indexes will help to evaluate the supplier management practices and the risk areas for improvement and capacity building. The process of duplication and assessment fatigue can be avoided by collaborating on a single index and the resources spent in measuring and reporting can be reduced. Networking and sharing of best practices with other industry leaders and promotion of industry-wide projects will hasten innovation in technology and practices. This collaboration will serve to reduce costs for individual companies involved in developing the index and related tools. On the whole, networking and collaboration can unite many apparel and footwear industries under a common forum to work for sustainable and developmental activities.

The SAC is an organization with the power and ability to influence people, events and decisions because it has a wide network of industries and multistakeholders under its wing. It is equipped with a databank of resources and information, which can serve the industry as a whole. This leverage can help to unite the highly fragmented textile and apparel industry for improvements that will promote change. It could also address systemic issues that cannot be addressed by any individual industry, ensure credibility and broad acceptance of the framework and help the industry to come to the forefront using measurement methods and regulations for reporting on product impacts.

The SAC will help in capacity building by taking part in the development and use of sustainability measurement tools, strengthening brand value and consumer recognition. The methodology of sustainability assessment will bring the industry to the forefront as a role model for other sectors. The quality of leadership and recognition will build a foundation for the overall development of the industry in a sustainable manner (SAC 2012g).

The global textile and apparel industry has moved from the agrarian age to the technological era, passing through many phases of change as new ideas and technologies emerged. These ideologies have been incorporated in the industrial system to serve the fundamental needs of the society and customer demand. Challenges that have arisen during these eras have transformed the industry into a competitive one, equipping itself to surpass these tests and emerge as one of the global leaders among industries. The greatest challenge facing the industry is the green transformation of the global economy, which calls for transparency in the supply chain of products and their life cycles. All the stalwarts of industry have started scrutinizing their production processes and side effects and are looking out for new solutions to help to save the environment from pollution. These green concerns have led to the development of many organizations that have devoted their energies toward sustainability. The Sustainable Apparel Coalition is one such organization, calling for the networking of many stakeholders and providing ways and means of assessing the results of industrial actions to reduce carbon footprints and save the natural resources and environment for future generations.

3 Higg Index

3.1 Overview

The Higg Index is a set of assessment tools that are used to evaluate the environmental impact of apparel and footwear products. The index was initially released on June 26, 2012 as the Higg Index 1.0, and it has been used by many organizations —both SAC members and nonmembers. The Higg Index 1.0 used a Microsoft Excel interface and worked on qualitative indicators for assessment. The sustainability topics were related to the environment, and the product category was apparel. The Higg Index tools used were the environment-based brand module,

facility module, and product module. Approximately 44 materials were included in the Material Assessment Data and the Material Sustainability Index used basic indicator questions on the environment. The weightages for the environment modules were equal, but an option was given to choose from custom settings or SAC-recommended weightages.

The Higg Index 2.0 was released on December 11, 2013. It is based on tools such as the Eco Index, Nike's Apparel Environmental Design Tool, Global Social Compliance Program reference tools and social/labor practice tools, such as the SAI Social Fingerprint and FLA Sustainable Compliance Initiative. After a pilot testing period and use of the second version by many organizations for over 14 months, the Higg Index 2.0 was introduced. This tool helps to standardize the methodology for measurement and evaluation of the environmental performance of the apparel products all along the supply chain in three levels—namely the brand, product and facility levels. The scope of the Higg Index 2.0 is to assess the environmental and social/labor performance of apparel and footwear products. It is based on lifecycle analysis spanning the entire lifecycle of apparel products, encompassing raw materials, manufacturing, packaging, transportation, use and end of life. Retailing has not been included in this phase but is being considered for future use (SAC 2012h).

The Higg Index 2.0 is a tool that educates small and large companies to recognize challenges and sustain improvement. The self-assessment tool helps scientific learning by means of identifying the vital aspects of environmental sustainability and opportunities that will provide improvement. This index is the basis for future operations and efforts to ensure sustainability and is the starting point for the commitment, learning, and collaboration among stakeholders. Regardless of the company size, it allows beginners and leaders in environmental sustainability to detect opportunities by means of a spectrum of performance tools. The organizations who use this index can start from any module that is most comfortable to them, after which they can branch out whenever suitable to other Higg Index tools. There is no hard-and-fast rule to use all the modules (SAC 2012h).

3.2 Suite of Tools: The Higg Index 2.0

The Higg Index 2.0 tools fall under three heads: facility tools, brand tools and product tools, as shown in Fig. 3. The facility tools include Facility Module: Environment—Apparel/Footwear and Facility Module for Social/Labor—Apparel/Footwear beta. The facility module for the environment helps to assess the performance of materials, packaging and manufacturing facilities, whereas the second module is used for the social and labor performance of materials, packaging and manufacturing facilities.

There are three brand tools. Environment: Apparel is used to assess apparel products with special reference to the specific environmental practices at the brand level. The brand module Environment: Footwear functions the same as the previous module but the product is footwear. The brand module Social/Labor: Apparel/

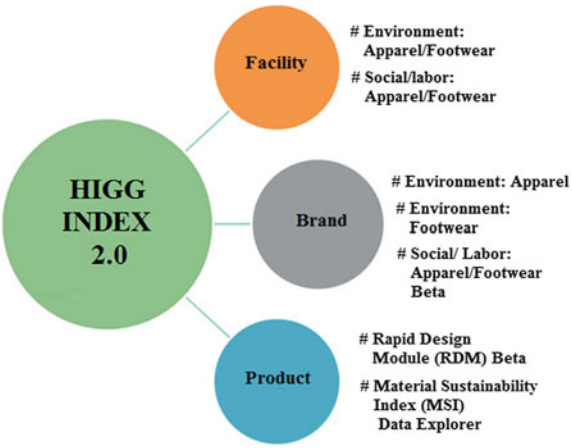

Fig. 3 Higg Index 2.0—suite of tools (SAC 2012h)

Footwear Beta is used to assess the specific social and labor practices for both apparel and footwear at the brand level.

The Rapid Design Module (RDM)–Beta and the Material Sustainability Index (MSI) Data Explorer are the two assessment tools for measuring the impact of products. The most important feature required is a product design that leads to sustainability. The RDM helps to guide designers toward sustainable product design by providing vital data and the support framework to enable them to make the right decision. The MSI Data Explorer is an online interface that helps the users to understand the method and strategy behind the MSI Base Material Scores used in the RDM–Beta. It also serves as a platform for the submission of data to improve the quality of the material scores or help in the addition of new materials (SAC 2012h).

The MSI is based on the data derived from the lifecycle assessment, which deals with cradle-to-gate information on apparel and footwear products. This module was originally developed by Nike and then incorporated into the SAC Higg Index, thereby measuring the environmental and social performance of apparel and footwear products. The lifecycle assessment takes into account the raw material origin and processing involved, premanufacturing, actual material/product manufacturing and the postmanufacturing processes. The assessment is usually taken in two stages —namely from raw material to the intermediate stage as phase I and the intermediate stage to the final product as phase II (SAC 2012i). A 50-point scale with 13 individual indicators is used to score the impact of base materials.

The key improvements between the Higg Index 1.0 and Higg Index 2.0 are summarized in Table 1.

The environment impact areas under consideration for the evaluation of product sustainability across the entire lifecycle of a material are chemistry, energy, greenhouse gas intensity, water and land use intensity and physical waste. The land use intensity concentrates on the origin of the raw material in phase I and is not considered elsewhere in the material lifecycle. Table 2 gives the contribution and scores for each factor under an evaluation of base materials (SAC 2012j).

Table 1 Comparison of Higg Index 1.0 and Higg Index 2.0 (SAC 2012h)

	Higg Index 1.0	Higg Index 2.0
User interface	Microsoft excel	Web tool and microsoft excel
Assessment type	Qualitative Indicators	Qualitative indicators + facility quantitative data (data values are not scored)
Sustainability topics		
Environment	Yes	Yes
Social/labor	No	Yes
Product categories		
Apparel	Yes	Yes
Footwear	No	Yes
Value chain area		
Higg Index tools	Brand module (environmental) Facility module (environmental) Product module	Brand module (environmental + social/labor) Facility module (environmental + social/labor) Rapid design module—beta
Validation	None	Pilot of validation protocol for environmental facility module
Material assessment (MSI)	44 materials	46 materials, with 2 new and 2 updated from public data submission
Chemistry	Basic indicator questions (environment); MSI	Incorporate content from chemicals management module and refer users to full assessment: social/labor
Benchmarking	None	Enabled through web tool
Section weights (environmental modules)	Equal weighting is default, with option to choose custom or SAC-recommended weightings	SAC-recommended weightings are default, based on survey of SAC members

The SAC and stakeholders can review and compare material data and scores because the MSI dataset is open source. This will help to bring about collaboration and transparency in data across the apparel and footwear industries (SAC 2013a, b).

The RDM–Beta is an original product to test the efficiency of a tool that aims to provide education and guidelines to apparel and footwear designers to study the impact of their design creations on the environment. This is a modified version of the Higg Index 1.0. It allows the designers to get involved in the process and methods of lifecycle assessment and the methods by which the materials are assessed for sustainability through the MSI. The RDM–Beta is a product-focused tool, which helps to gather information that will be useful for the modification of the tool. The feedback from members has resulted in the formation of a post-2.0 module task force, which aims to develop a broader strategy for the product module in the Higg Index (SAC 2012j).

Table 2 Material sustainability index scores (SAC 2013b)

Impact area	Indicator	Maximum points
Chemistry	Carcinogenicity	2.5
	Acute toxicity	2.5
	Chronic toxicity	2.5
	Reproductive toxicity and endocrine disruption	1.4
	Subtotal	9
Energy and greenhouse gas (GHG) intensity	Energy intensity	4.4
	GHG intensity	6.6
	Subtotal	11
Water and land use intensity	Water intensity	9.4
	Land use intensity	3.6
	Subtotal	13
Physical waste	Hazardous	6.8
	Municipal solid waste	4.3
	Industrial	3.4
	Recyclable/compostable	1.7
	Mineral	0.9
	Subtotal	17
Grand total		*50*

3.3 Areas for Improvement in the Higg Index

Although the Higg Index 2.0 was introduced after analysis, pilot testing, and feedback, there is always room for improvement. The index format will tend to change according to the situation, challenges and real-time situations. Some of the areas of improvement are discussed below. The needs of the users in the industry are varied and require tools that would help them to make sustainable choices. Product assessment tools can be improved by the RDM–Beta, which continues to test various theories on how to get the necessary sustainability information for making critical decisions. The index should provide facility for the inclusion of quantitative data and metrics. Qualitative questions should be substantiated with numerical data, thereby providing accurate information on environmental performance, such as energy use data (SAC 2013c).

The scoring system can be improved by a thorough and systemic review of scoring principles and their application to the index and support data on point allocations. The scoring of packaging can be improved by the Material Sustainability Index. The section weighting could be improved by using a panel approach involving a larger group of stakeholders and a multicriteria-based approach to allocate weights. Consistent benchmarking could be assured by aligning one set of weights to enable a product comparison for business decisions and communication

with customers. Many brands, facilities and suppliers usually invest in key certifications and standards; the index should prescribe equivalents and fit a set of questions that would address these certifications. The Material Sustainability Index needs to be continuously refined as the database expands and more data, information and methodologies become available when there is an increase in industrial and stakeholder engagement. The SAC should develop an assurance process to help organizations build confidence in response to third-party assessments (SAC 2012h).

4 Assessment Tools for Apparel and Footwear Products

The textile and apparel sector is an important and emerging industry that relies heavily on manufacturers and the labor force, thus making the supply chain very fragmented and risky and thereby leading to a major sustainability challenge. Sustainability issues are very stringent and call for transparency throughout the supply chain. In California, the Supply Chain Act requires all companies with an annual gross turnover exceeding $100 million to publicly disclose the nature and scope of the corporate compliance efforts to prevent human trafficking, slavery and child labor in their global supply chains. Furthermore, the sustainability issues inside the region or industry face regulations that safeguard the workers' rights and preferences, such as the Bangladesh Accord and the Bangladesh Worker Safety Alliance. The zero discharge of hazardous chemicals initiative (2011) compels the footwear and apparel industries to work with their suppliers and contract factories to eliminate all releases of toxic substances and hazardous chemicals into global water sources. Legislation and reform in the area of sustainability have changed the outlooks, manufacturing and industry environments and evaluation methods and tools for assessment are used to quantify the sustainability parameters (Ceres 2011).

4.1 Tools for the Assessment of Environmental Impacts

The SAC quantifies product lifecycle impacts in a standardized way with the help of the product category rule guidance document. The product category rule guidance document consists of 80–90 methodological questions, which are common across all categories of products. A review process was carried out to ensure that the document is in line with the current best practices and is devoid of duplication and potential errors. The SAC has created three PCRs based on the review and reports: one for t-shirts, one for coats and jackets, and one for slacks and shorts (SAC 2013d).

The Outdoor Industry Association Sustainability Working Group is currently collaborating with SAC to develop sustainability indexes for apparel, footwear, and equipment. There are three categories of facility tools that are to be used by facilities, vendors and manufacturers to assess specific facility sites. The facility modules are for Environment/Social-Labor: Apparel/Footwear/Equipment. The brand modules

are used to assess apparel or footwear product-specific environmental practices at the brand level. The brand modules are for Environment: Apparel/Footwear and Social-Labor: Apparel/Footwear–Beta. The product tools are used to understand the impact of products, which include the MSI and RDM–Beta. All these tools are grouped under the Higg Index (Outdoor Industry Association 2014).

The Outdoor Industry Association's Chemicals Management Working Group has developed the Chemical Management Framework, which is a comprehensive assessment tool to guide companies along the entire apparel and footwear product chain towards better management of chemicals for regulatory compliance to sustainable chemistry innovation. The goal of this framework is to eliminate hazardous chemicals in consumer products and their emissions in the workplace and environment. The Eco Index is one such self-assessment tool, which works towards the same goal jointly developed by the European Outdoor Group and the US Outdoor Industry Association (ISPO 2014).

Nike Inc's Environmental Apparel Design tool is designed to reduce the environmental footprint of apparel and footwear products. This tool uses a numeric scoring system based on the data filed by the manufacturer for each specific category. The category points are added together and then ranked within a range: good, better, best or needs improvement. About 60 % of the environment impact of the garment is related to materials. The evaluation is in terms of issues including energy, chemistry, carbon dioxide, water, land use and waste. The Material Assessment Tool gives scores for materials based on 21 metrics in specific impact areas. The scores for materials range from 0 to 100, with assessment values such as an additional 5 points for garments that use a single-fiber raw material because they are totally recyclable; conversely, 5 points may be deducted for coating and laminating fabrics with a dissimilar material (Eco Textile 2014).

The Sustainability Reporting Framework helps in measurement, disclosure, and accountability to internal and external stakeholders for the organizational performance towards sustainable development. Like many other sustainability tools, it works on economic, environmental and social impacts and can be used for benchmarking, demonstrating and comparing the performance of the industry. The Sustainability Reporting Framework (Fig. 4) consists of principles for defining report content and ensuring the quality of reported information. This includes standard disclosures made up of performance indicators and other disclosure items, as well as guidance on specific technical reports. Indicator protocols exist for each of the performance indicators present in the guidelines and provide definitions, compilation guidance and information to assist with report writing. The sector supplements provide information on how to apply the guidelines in the given sector. The technical protocols provide guidelines on issue of reporting, setting the report boundaries and working in unison with all other parts of the framework. This sustainability tool works for issues such as economic, environmental, social, human rights, society and product responsibility (RG 2011).

RDC Environment specializes in the quantification of the environmental impact of products through lifecycle assessment, carbon footprinting, inventory for greenhouse gases, energy audits and waste and water management projects. This

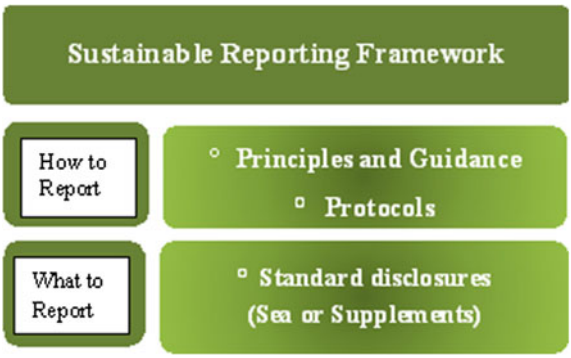

Fig. 4 Sustainability reporting framework (RG 2011)

tool is based on transparency, ethics and objectivity and provides advisory services and consultancy services for environmental studies. This software uses preintegrated LCA methodologies and is standard-compliant with ISO 14040-44: 2006 and with the product category rule. This tool identifies the hotspots for assessment and provides comparisons with other organizations or within the same organization before and after implementation of steps to promote sustainability (RDC Environment, LCA Tools. http://www.rdcenvironment.be/. Accessed 2 May 2014).

4.2 Lifecycle Assessment

LCA is a global analysis of the direct or indirect impact of a material, process or service from raw material extraction to the end of life of a product. This tool has a four-step approach:

(1) Definition of methodology and needs
(2) Data collection and LCA modelling
(3) Data classification
(4) Tool interface customization and development

The first step is to define and fix the criteria for the allocation of system boundaries and the scope of the study, the fixation of LCA methodologies and specifications to be used in the tool, such as the provision for ecodesign action, environmental footprint for labelling or work with suppliers. The second step is to collect the two types of data necessary to build the LCA model—namely, the activity data (e.g. quantity of tons produced, yields of production) and the emission factors (quantity of CO_2 generated per process). To achieve the required precision with minimum effort, the data collection and selection of external sources were performed in an iterative manner, as recommended by the International Reference Life Cycle Data System Handbook. The first iteration deals with rough data collection, with minimum and maximum values; association of the assumptions based

Table 3 Data classification (Ooms et al. 2012)

	Data accessibility (cost of data research)	
	Easy →	Hard
Influence on the results + ↓ −	Specific	Half-specific
	Half-specific	Generic

on the textile producer; the use of general or average data for the background and the presentation of preliminary results to identify the key processes and parameters. The second iteration would include additional data collection and fine-tuning of the parameters that have a significant impact. The last iteration will eventually give reliable conclusions. The activity data included bibliographic reviews of national, international or European data while the emission factor dealt with a review of main LCA databases at European or international levels and inventory data, as well as data based on the experiments and visits performed previously (Ooms et al. 2012; Wolf et al. 2012; EC-JRC-Institute for Environment and Sustainability 2010; Wolf et al. 2011; EC-JRC 2008).

The third step is data classification (Table 3) which includes specific data (the data entered into the tool by users), half-specific data (default values entered due to lack of knowledge or cost factor) and generic data (the entered default values not accessible in the interface).

The last step is to develop tool interfaces in response to step 1 and step 3 and to define data and export results. The results are used to assess ecodesign action, calculate the environmental footprint, work with suppliers to improve their processes and improve specific and half-specific data reliability. A standard version and an expert version are available for use. The standard version deals with the initiation of LCA and eco-design, whereas the expert version develops LCA and eco-design skills through the industrial supply chain (Ooms et al. 2012; Paragahawewa et al. 2009).

4.3 Social Lifecycle Assessment

Today's consumers are conscious of their choice of products and their impact on the environment and local economies. The evaluation will include choosing products that will result in less pollution or greater sustainability. The product choices will have social and socioeconomic effects on workers and entire communities where the production takes place. These social and socioeconomic effects are the major focus of a social or socioeconomic lifecycle assessment (S-LCA). This assessment also facilitates the social responsibility of the companies by providing information about the potential social impacts on people caused by the activities in the life cycle of the products offered to the consumers. The S-LCA, when combined with the environmental lifecycle assessment (E-LCA), will result in a holistic approach and will move toward sustainable production and consumption.

The S-LCA methodology has four major steps: goal definition, scope definition, inventory analysis, and impact assessment (UNEP 2009; LCI 2013). The nature of social impacts may be either negative or positive when compared with a specific human value or standard prescribed by the society or law. The primary concern of the E-LCA is the protection of environmental qualities in line with the values of society with regard to environment. The areas of protection by the E-LCA are human health, natural environment, natural resources and manmade environment. The S-LCA has another dimension, human dignity and well-being, added on to the areas of protection to supplement the human health factor. The ultimate goal of the S-LCA is to improve the social conditions throughout the lifecycle of the product with the central concept of human well-being.

The goal of S-LCA studies is to compare the extent of negative social impacts and the greatest social benefits of two similar products manufactured by different methods, thereby providing information to consumers to help them to make ethical choices. The second goal is to identify the hotspots in the production process or manufacturing centers that have negative social impacts, the short-term results and the long-term impacts, the victims of the impacts and how these can be addressed. The main stakeholders include workers/employees, the local community, society (national and global), consumers and value chain actors. Further categories that are under consideration for inclusion are NGOs, the state and future generations.

The system boundaries are set using the ISO 12044 framework and the social indicators are assessed at the organizational level rather than the individual level. The S-LCA indicators are categorized as quantitative, qualitative and semi-qualitative. In E-LCA, the impact of indicators is based on the numerical values of endpoint indicators, whereas the S-LCA uses midpoint and endpoint indicators. Some endpoint indicators in S-LCA are mortality, morbidity, autonomy, safety, security, tranquility, equal opportunities, participation and influence. The inventory analysis collects data on the social impacts to be considered in relation to behavior of the company towards the stakeholders. The impact of the assessment is based on the grouping of data based on the social setup to provide substantial conclusions. This is a difficult task and requires a great deal of correlation of data and classifying the data to get results. The general steps to achieve the objective of the S-LCA are the identification of significant social issues, such as infringement to human rights or labor laws, evaluation of the study in terms of completeness, consistency, appropriateness of methodology with respect to goal and scope, conclusions and recommendations based on the goal and scope of the study and finally reporting the involvement and participation of stakeholders in the particular case under study.

There are many limitations of S-LCA because it is a new process and not many studies have been undertaken. There is much debate on the appropriateness of the methodology, inclusion of stakeholders and interpretation of data. Practitioners should be skilled in LCA as well as in social science, corporate social responsibility and social impact assessment. In S-LCA, the use phase has not been included because it is very difficult to assess; hence, this stage of assessment requires further development. The field is still in the early stage and requires a lot of input from many social researchers and experienced socialists (Subic et al. 2013).

4.4 The Capability Assessment Tool for Sustainable Manufacturing

In general, performance apparel and footwear have a heavy carbon footprint due to pollution, extensive use of nonrenewable resources and waste during manufacturing. An example for the extent of the environmental impact of sports apparel at the different stages of the lifecycle of the product is shown in Table 4. The art of reducing or alleviating these impacts is highly dependent on the skill of the faculty and management to identify and implement these improvements within the particular environment.

Green manufacturing is a relatively new concept. The industry needs to develop knowledge, skills and values to incorporate such concepts into the manufacturing system. This is possible only when sustainability targets are set and monitored by efficient and capable personnel. Traditionally, environment management systems and sustainability frameworks encourage environmental awareness and focus on strategy and decision making. However, an assessment framework is essential to identify capability gaps in order to achieve the environmental sustainability targets and to encourage suppliers to take part in environmental initiatives. Due to the many gaps in the existing systems, it was essential to develop a new framework to assess the particular capabilities across the supply chain of the manufacturing industries, which could be applied to a broad range of industries. The new framework had to be objective-based with a focus on the environmental footprints and associated capabilities at the manufacturer's level, thereby enabling provisions for real value additions to different types of manufacturers.

The Capability Assessment Tool for Sustainable Manufacturing is used to identify the gaps in capabilities and associated training and development requirements all along the supply chain for sustainable manufacturing. The first step for assessing a supplier's capability with regard to sustainable manufacturing was to

Table 4 Environmental impacts across the lifecycle of sports apparel

Lifecycle stage	Environmental impact
Raw materials (growth, acquisition, and processing)	Resource consumption, greenhouse gas emissions, air/water pollution and toxicity, soil degradation/contamination, biodiversity/land use, solid and hazardous waste
Fiber production (natural and synthetic)	Greenhouse gas emissions, air/water pollution and toxicity, soil degradation/contamination, biodiversity/land use
Clothing production and garment assembly	Greenhouse gas emissions, air/water pollution and toxicity, soil degradation/contamination, biodiversity/land use
Packaging	Solid and hazardous waste
Distribution	Greenhouse gas emissions
Retail	Solid and hazardous waste
Use	Resource consumption, solid and hazardous waste
End-of-life management	Greenhouse gas emissions, solid and hazardous waste

Table 5 Sustainable manufacturing framework

	Cluster	Applied outcome
Resource management	Energy efficiency	Reduce energy use Maximize alternative energy resources
	Water efficiency	Reduce water use Increase alternative water supply
	Material efficiency	Optimize material flow and usage Manage inventory and usage
Emission management	Control and reduce Environmental Flow	Implement and apply waste management hierarchy Handle, store, treat and dispose appropriately Prevent groundwater and land contamination
	Carbon emissions	Account for carbon emissions Reduce carbon emissions
Improved environmental management practices	Effective environmental management system	Enhance auditing and environmental monitoring performance Comply with environmental systems
	Environmental decision making	Implement industrial clustering and resource pooling Undertake risk assessment (environmental and business) Identify, develop and implement business cases for sustainability improvement
	Continued environmental improvement	Lead environmental management initiatives Innovate for environmental improvement (including process optimization)

develop a Sustainable Manufacturing Framework (SMF), shown in Table 5, in consultation with the manufacturer and participating suppliers along with a review of the sustainability targets and documents of the manufacturer and similar global manufacturers.

Assessment of 170 capabilities can be done for areas of concern, such as managing of energy, water, resources, carbon emissions and waste as well as environment management practices for sustainability. Environmental indicators and initiatives set by the manufacturer are grouped under eight clusters of the framework and environmental capabilities and the associated indicators are classified under three management categories: resources (energy, water and material), emissions (greenhouse gases and waste) and the environment (ISO 14001 etc.). The Sustainable Manufacturing Framework formed the basis for the development of Comprehensive Capability Metrics Assessment Tool, which used a five-point Likert scale for assessment. Four assessment methods were selected: a walk-through assessment based on observation of capability in work activities, a questionnaire based on simulated workplace activities, interviews through responses to verbal

questions and work samples or projects indicating prior demonstration of capability. The number of methods used for assessment depended on the need and requirement. Each assessment method had a set of questions to be answered by a focus group and the overall score of the cluster was generated using the following formula:

$$C = \frac{1}{2NA}\sum_{n-1}^{N}\left(\sum_{n-1}^{Mn}\frac{\left(\left(\sum_{a-1}^{A} C_a\right)_{method1} + \left(\sum_{a-1}^{A} C_a\right)_{method2}\right)}{M_n}\right)_n$$

where C is the overall average score of the cluster (a number between 1 and 5) calculated by an assessment group i; A is the number of assessors; N is the number of applied outcomes under the cluster being assessed (1, 2, or 3 as per formula); M_n is the number of capabilities under the applied outcome of n (n varies from 1 to N), which is a number between 5 and 16 depending on how many capabilities are listed under the applied outcome; and C_a is the score given to a capability by an assessor based on any method used for assessing that capability.

The results of the assessment are compared with the minimum expectations of the manufacturer in terms of applied outcomes and clusters, and the gaps in the capabilities are identified followed by the formulation of a capacity-building training program for the suppliers to enable them to attain knowledge and skill for meeting the environmental targets set by the manufacturers. The sensitivity analysis will show the cluster-based overall results determined by the different assessors, which are reviewed as the assessment is conducted by two or more independent representative assessors. The difference in the scores was used to calculate the maximum effect of such a difference in the overall score of the cluster. The results also reveal the degree of agreement between the different assessors and also helped to identify the lacunas among the suppliers, showing the need for training and improvement, which will lead to the achievement of the environmental targets (NAEM 2014).

5 Future Directions

The Sustainable Apparel Coalition has been leading the apparel industry toward a vision of sustainability built on a common approach for the evaluation of the performance of the stakeholders with regard to sustainability. This coalition has a commitment to leadership to steer the apparel and footwear industries in the right direction of ethical, social and environmental practices. The members of the SAC are from varying perspectives, interests, and locations; the coalition has nurtured an open culture of equality, respect, and transparency, thereby promoting unity and faith in the members to move towards sustainability. This organization has formulated many tools and indexes for assessment with great speed and efficiency and is making progress with great planning and dedication. However, many important

factors have contributed to the success of the organization, starting with committed organizations and members, planning of meetings to collaborate and deliver results, involving members in index development and highlighting leadership and work towards opportunities, innovation and action. The future holds promise for sustainable development due to the forecasts and opportunities that are focused, discussed and developed. Some of the trends and initiatives are discussed here to demonstrate the future role of sustainability.

5.1 Macro Trends for the Future

The National Association for Environmental Management has been tracking corporate environmental management programs and has documented the emergence of corporate sustainability. They have identified the trends for the global future in terms of global sustainability and environmental management. The top leadership companies have turned their attention toward these trends. They envisage that environment management has many factors woven together, contributing to complex business problems and the sustainability curve.

- Resource Management: The current major resource issues are energy and water management. Energy programs for the conservation of energy, alternatives to fossil fuels and energy efficiency are being formulated; the primary focus of water is being highlighted by programs focusing on water risk assessments, water conservation visions and the development of site-specific strategies.
- Product Sustainability and Compliance: Regulations such as REACH and RoHS have ensured that many industries are pursuing a number of programs to bring sustainability to their products. These include product labelling, carbon footprint assessment, green chemistry and reduction of upstream impacts.
- Supply Chain Transparency: Companies are focused on seeking data from their suppliers to fulfill the compliance standards of creating data sheets for potential risks in the supply chain, manufacturing methodology and end-of-life recycling.
- External Reporting Requirements: Reporting has become an essential part of sustainability and materiality has become a rubric for external environment, social and governance reporting.
- Employee Engagement: This factor has become a top priority in 2014 and cultural changes at all levels are facilitated by adopting new ways to bring about the change.
- Climate Change Adaptation: Most companies have started the process of conducting a comprehensive climate risk assessment of their operations and are involved in developing the results into climate adaptation plans.
- Next-Generation Sustainability Goals: The strategic planning of sustainability goals has begun and goals have been set by many companies to mature in the coming years. People have become conscious and this process will continue for the future.

The concepts that will enable us to fulfil the goals of the future are *integration of sustainability* at all levels of the organization, *engagement* in valuing future prospectives in the environmental and social context. *Transparency* has become a business initiative for product stewardship and for suppliers with business-to-business orientation. *Collaborative efforts* will lead to shared benefits, problem solving and realizing the capacity of companies and *resilience* to enable an industry to become responsive, interdependent and ultimately flexible and adaptive (Yoemans 2014).

A common idea until recently was that many manufacturers were unable to reach a majority of the consumers to convey their ideas for sustainability. Hence, sustainability issues were discussed only with stakeholders, NGOs, investors and specific media. The Social Media Sustainability Index 2013 has helped industries to convey the concepts of sustainability to far-reaching consumers, who are responsible for spreading the message of sustainability at the product, brand and facility levels (DEFRA 2010).

5.2 Future Action Plans

The action plans with regard to sustainability and environmental protection activities are many. The participation of industries and manufacturers in sustainability actions will surely increase over time. Projects such as increasing the public understanding of sustainable clothing, unlocking consumer behavior for sustainability benefits, using sustainable fibers and fabrics that move forward, reducing energy and chemical intensity in clothes cleaning and maximizing end-of-life clothing reuse and recycling would prove to be useful to industries and provide data for sustainable solutions. Development of regulations, policies and voluntary groups would serve to bring awareness to and streamline sustainability issues. Members of the group and stakeholders can participate by giving suggestions and consumers could give their views and feedback for a more strategic approach.

Action plans in areas such as improving environmental performance across the supply chain, consumer trends and behavior, awareness, media, education and networks, market drivers for sustainable clothing and instruments for improving traceability along the supply chain would bring about changes in the minds of both the business community and the consumer to improve the sustainability of clothing. The prime areas of change for the consumer would be to ease the impacts of buying, maintaining and disposing of clothes. For the business community, this would require developing and offering ranges of clothing that have enhanced social and environment sustainability qualities; informing and helping consumers about areas where they can impact a change; bringing about better environmental, labor, trade and animal welfare practices; establishing traceability all along the apparel supply chain; and working with the government and other stakeholders to identify and implement best practices. The Department for Environment, Food and Rural Affairs, UK, suggests that many case studies and policies should be carried out on a global level, such as the Green Public Procurement and the International SCP

Policy aimed at improving the supply chain among manufacturers who export to the UK. This organization also suggests influencing consumers through a direct government environmental website, where web pages could be developed to advise consumers on how they can reduce the environmental footprint for their clothing consumption (TFIA 2014).

Many important initiatives are being undertaken around the globe to promote sustainability and ethical supply. Clean Energy Future is an official website of the Australian Government that outlines the plan for a sustainable and prosperous country. This forum links with all the programs administered by various government departments under the Clean Energy Legislation and also has a section on assistance for the industry. The Ethical Clothing Australia website has a section for manufacturers and brands explaining the accreditation process and an ethical shopping guide for consumers, which shows a list of accredited brands that demonstrated legal obligations and standards were met throughout the supply chain. The Banksia Environmental Foundation is a nonprofit organization that promotes environmental excellence and sustainability through its award programs and other associated events. Some of the most prestigious awards include the Prime Minister's Environmentalist of the Year Award, the Environment Minister's Young Environmentalist of the Year Award, the Mercedes-Benz Research Award, and the Brian Robinson Fellowship. All these activities and initiatives show that the future looks promising for sustainability plans and accomplishments at all levels—the individual consumer, the community, society and governments across the globe (TARGET 2012).

Many organizations are involved in sustainability commitments with the help of sustainability focus teams. The first effort should be directed to sustainable living where consumers and members of the group will be empowered by the right information, tools and incentives to lead more sustainable lifestyles. Consumers should increase their selection of sustainable products to effectively balance price, performance and convenience. Smart use of resources, such as the effective use of space in retail outlets and improving connectivity between the organization and local communities, is necessary for future development. The responsible use of resources, eliminating waste and minimizing carbon footprint are some of the measures for sustainability commitments (Ulibarri 2011).

5.3 Challenges Facing SAC

The SAC planned to create a database to track the environmental impact and fair labor practices for the apparel and footwear industries. In this regard, the SAC would create a universal index to set standards for apparel manufacturing in terms of energy usage, fair labor practices, waste reduction and water quality. Eventually, the data collected will serve as a base to create a consumer label that would inform the consumer about the sustainability rating of the product (Kester and Ledyard 2012).

The key challenge facing the organization is to make the Sustainable Apparel Index workable and usable to ensure adoption of the tool by all industries and manufacturers in the related field. The standards that support sustainability and the real-time practices must be coordinated and negotiated to make it workable. This requires coordination across the globe and untiring effort to make the index part and parcel of the system. Apart from adoption of the tool, questions remain as to whether the data obtained is meaningful for benchmarking, how the data could be shared, and whether it will be useful to encourage the members to innovate and improve. The organization was environment focused when it launched the index in 2012, but the social and labor indicators have been added into the index and the progress in that direction is very slow. It has been difficult for the organization to come to a consensus regarding standards and metrics for the social and labor aspects and include them into the index.

The credibility of the index will depend on the verification of the data compiled by the members of the organization. Much time and effort are required for third-party verification, for which funds have to be allocated. The authentication of the reported data, the responsibility of additional monitoring to ensure the incorporation of the results and the associated costs have to be addressed. Some members of the coalition are keen on conveying their sustainability scores to the consumer to capture the market, while others are assessing the feasibility of the idea and feel that this communication would serve to confuse the consumer because many eco-friendly ideologies already exist in the apparel market. The SAC has to decide on its overall approach to communication and branding and must send a clear message at the product, brand and facility levels (Nike Inc 2012a).

The organization should aim for representation from around the globe by way of membership and members in the organizational setup. Apart from the board of directors and the working team, there should be an intermediary board/system that has representatives from all parts of the world. This will enable better understanding of the data collected, problems interlinked with product development, supply chain activities and consumer attitudes. The manufacturing environments, government policies, duties and taxes, infrastructure, equipment and process methodologies vary from place to place and require immense planning and analysis for implementation of schemes and systems. This process of sustainability, which is now under the purview of the industries and organizations, should move to a larger scale on a governmental and global level, so that essential requirements for tool implementation and coordination would be enhanced. Data, which is received from all around the world, must be catalogued and stored for future reference and use. Provisions should be allocated for sharing of knowledge, research and development, and efficient personnel employed for the analysis and interpretation of data to foresee and forecast the action plan for the futuristic years. Research conventions, conferences and symposiums should be held to serve as a platform for interactions between the members and the outside world. Results of the research platforms and organizations with regard to all features of sustainability should reach the manufacturers and consumers. This can succeed only when the research efforts are converted to industry-viable solutions through organizations devoted to this cause.

Promotional activities should be undertaken to create awareness among consumers and they should effectively create a long-lasting image that would encourage consumers to think in terms of sustainability and green economy. Funding for all of these activities should be raised from members, organizations, industries and other international sources. On the whole, the focus should be on sustainability, from the grassroot level to the highest authority.

The SAC has grown to great levels since its inception in 2010. The feedback received has highlighted that the Higg Index is being used as a common measurement tool by apparel and footwear industries and members in the supply chain to undertake sustainable practices to bring about change and improvement. This organization is unique and the development of a strong unified culture is a foundation for future increases in membership and the evolving expectations around sustainability. The transference of the lessons learnt across the apparel industry and its supply chain and communication of the accomplishments of the SAC to consumers, would help in moving the organization forward on the path of success.

6 Nike, Inc.: A Case Study

Nike, Inc. is the world's largest athletic footwear and apparel company, with a mission to inspire every athlete in the world to reach his or her fullest potential. The cofounder Bill Bowerman was a visionary who perceived human achievement through sport. Innovation is at the heart of the organization to serve athletes, which will form the basis of growth of the organization and in turn provides inspiration to achieve. Nike serves sports personnel with five distinct brands that have a powerful rapport with their customers. Sport-inspired lifestyle products including footwear, apparel, equipment and accessories are designed, developed and sold under the high-quality athletic performance gear category. Casual sneakers, apparel and accessories are designed, licensed and marketed by Converse, Inc. Hurley International LLC designs, markets and distributes surf and youth lifestyle footwear, apparel and accessories. The dynamic legacy, vision and direct involvement of Michael Jordan serves as an inspiration for the Jordan brand of premium footwear. Golf equipment, apparel, balls, footwear, bags and accessories are designed and marketed by Nike Golf.

Nike, Inc. has its headquarters near Beaverton, Oregon, USA. Contract factories in more than 40 countries manufacture products that are sold in nearly every country around the world. In 2013, Nike's global workforce was approximately 48,000 employees located worldwide. The company has more than 750 retail stores, 90 administrative offices and more than 110 sales offices and showrooms. Over the past 10 years, the revenue has more than doubled. It has been estimated that revenue will be $30 billion by the end of fiscal year (FY) 2015 and $36 billion by FY17. Strong growth has been estimated in the field of sports gear for running, basketball, football, men's and women's training sportswear and direct-to-consumer sales. Sustainability is one of the key drivers for innovation and continued

growth. The integration of sustainability into every aspect of the business is the aim of Nike and the greatest challenge is to explore ways that would enhance performance of the wearer in terms of design, materials and manufacturing (www.cmu.edu/teaching/designteach/teach/instructionalstrategies/casestudies.html. Accessed 1 May 2014).

A case study examines realistic, complex and content-rich events or situations that center on a problem or conflict. Usually, the facts surrounding the problem are highlighted as it becomes a source for discussion and debate. The case study is a link between theory and practice and between academy and industry. Case studies shed light on the parameters of the problem, the evaluation of courses of action, and the possible solutions to or the reasons and remedies for the problem (Nike Inc 2012b).

Sustainability, which was a domain for experts and ideologists, has become one of the key drivers of success for any industry or manufacturing company. In the future, we will likely find environments where competition for scarce natural resources will affect the cost and availability of raw materials for manufacturing. The traditional methods of manufacturing are slowly giving way to new sustainable models because there is immense pressure due to rising energy costs and greenhouse gas emissions. Regulations related to raw materials, labor practices and other issues are shaping the business environment to face these challenging demands.

Sustainable innovation is a current trend. At Nike, an executive-level committee for sustainable innovation was formed in 2011 to monitor and capitalize on opportunities by the adoption of new strategies on a commercial scale.

Sustainable innovations have been implemented based on a four-way approach using interconnected insights and disruptive innovations (Fig. 5). The first pillar for sustainability is the choice of materials for the products, which affects the entire value chain and the creation of a portfolio of sustainable materials (Nike Inc 2012c). Extensive work has been done on ways to improve the environmental attributes of materials for over a decade. The material rating tool—the upgraded version of Nike

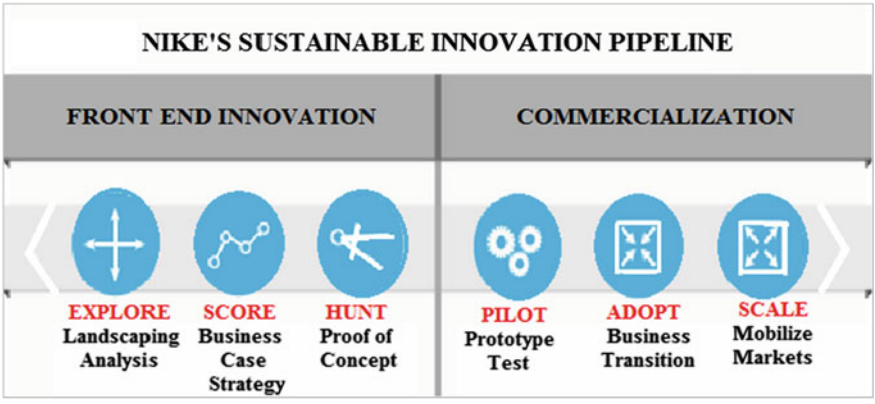

Fig. 5 Nike's sustainable innovation pipeline (Nike Inc 2012c)

Material Sustainability Index—is being used by designers and developers to identify affordable materials that meet environmental standards because materials form a substantial part of the product cost. It has been estimated that 60 % of the lifecycle environmental impacts of a product are due to raw materials and 25 % are accounted for by the manufacturing process. The remaining 15 % is allocated for transportation, retail, office facilities, packaging, use and disposal. The assessment focuses on the choice of materials used (recycled or recyclable), processing methods (showing reduced usage of energy, water, chemicals and waste), better choices (index creation, restricted substance list, policies, operating methods, and sharing of information with vendors and suppliers) and bringing choices to scale (increasing the scale and availability of new materials, enabling recycling of materials and sharing of intellectual properties).

The difficulty of making a choice among materials is overcome by the evaluation system for the environmental impacts of materials evolved at Nike, in which 80,000 materials have been assessed for their environmental impacts. The product design teams work in synergy with these results when choosing raw materials. Sourcing of the materials from independent vendors is based on the quality and the environmental impacts. In 2006, Nike introduced a design system (Considered Design) coupled with evaluation systems (Considered Indexes), which enables the product design teams to quickly select the proper material based on sustainability during the design phase. Training is given to the design teams and scoring targets are given for each season of products they design. The Considered Indexes make up 35 and 60 % of the score for footwear and apparel, respectively. Nike and affiliated brands have begun using these tools for the evaluation of their product designs and the tool is being modified and updated for the current environment.

The Material Sustainability Index (Fig. 6) is also applicable for material vendors and about 500 material vendors have been trained to use the Index. Material vendors are also given scores based on the criteria/standard that they have followed, such as complying with the restricted substance list, Nike water requirement program, global recycle standard and ISO 14001 certification. This will encourage the

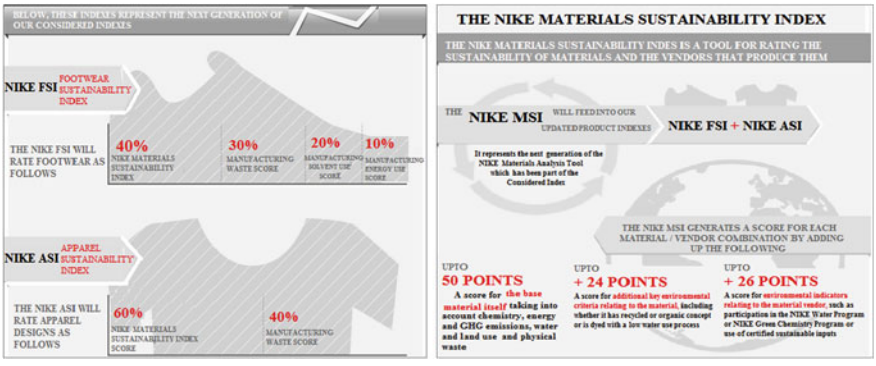

Fig. 6 Material sustainability index (Nike Inc 2012b, d)

vendors to develop more eco-friendly materials, which will fetch them higher MSI scores. The evaluation of the footwear and apparel products of the Nike Brand revealed that in FY 2011, approximately 97 % of the footwear and 40 % of apparel products met the baseline requirements. Efforts are being directed toward a 100 % achievement for both footwear and apparel by FY 2015 (Nike Inc 2012d).

The second pillar for sustainable innovation is prototyping and scaling sustainable sourcing and manufacturing models, which will affect the activities vital to the value chain. The vision of the organization is to create a sustainable supply chain that is lean, green, equitable and empowered across all the brands produced. The Manufacturing Index, launched in 2012, gives same weightage to the performance of a factory and sustainable manufacturing practices as it does to traditional measures of quality, delivery, cost and sourcing evaluation. The index measures the progress of the worker's health and safety, labor compliance, human resource management, lean implementation, energy and carbon management and other sustainability issues. The value chain of Nike is global, with more than 900 contract factories and 500,000 different products, each with its own environmental and social impacts. The supply chain is fragmented and complex and beyond the purview and power of this organization, making the building of a positive approach through contracts a challenge (Nike Inc 2012d).

Thee two indexes developed for sourcing decisions, the Manufacturing Index (MI) and the Manufacturing Sustainability Index, embed the Risk Index and performance indicators using the MI metrics. The Risk Index will be able to identify low factory performance based on the MI metrics. Features such as political risk, social/compliance risk, economic risk, infrastructure and climate risk are given an equal weightage of 25 % of the total score. These tools will help to identify low-risk, high-quality factories to manufacture sustainable products. A business system that works for continuous improvements and high-quality products while eliminating waste (time and material) is known as lean manufacturing. Changes in production processes, increasing leadership capabilities and the development of an empowered workforce will enable the production of a quality product in record time. The factories that manufacture Nike products are expected to meet the code of conduct and code of leadership standards, as prescribed by Nike. The environmental impacts of the contract factories, such as greenhouse gas emissions, waste generation, and the use of energy, water, and materials, are measured, monitored and reported to maintain sustainability.

Achieving an equitable supply chain is an important aspect of sustainability. In many contract factories, wage concerns, compensations, pay and benefits and skill development are some of the important features for a highly valued workforce to be able to produce quality products. Sustainability also encourages incentives and rewards for high-quality production, which will result in confidence, productivity and good management practices. Another drive in the contract factories is to bestow empowerment to the workforce by means of human resource management (HRM), training and support. A sustainable manufacturing training package for workers addresses issues such as lean manufacturing, HRM, health and safety, environmental compliance, energy management, environmental sustainability and freedom

for association. Thus, the manufacturing module works for the development of the factory as well as the workforce for sustainable production (Nike Inc 2012d).

Systemic analysis and carbon footprinting have revealed six areas of greatest impact on the environment: energy, labor, chemistry, water, waste and communities. All of these areas are interconnected and they need to be addressed in a progressive manner with commitment to reduce them to the lowest possible levels. The Nike Energy and Carbon program has found that 41 % of the contract factories have met the minimum requirements leading to improvement. The use of renewable energy for the retail stores in North America was through the purchase of Green-e-Certified American wind renewable energy certificates. Nike also has two global distribution centers for renewable energy in Laakdhal, Belgium and Iaichang, China. Furthermore, 33 LEED-certified stores were in operation in FY 2013; on average, these LEED-certified stores use 30 % less energy per square foot than standard designs. This lower consumption of energy showed a 2.8 % decrease in greenhouse gas emissions.

It has been assessed that 56 % of the carbon dioxide emissions are found to be in the raw material stage in the footwear chain. Reduction of process heat loss, improved energy management systems and proper synchronization of the energy field team and contract factories have brought about reductions in energy requirements. Equitable manufacturing and lean manufacturing are tools for reducing energy requirements. With regard to chemicals, many companies have joined the Zero Discharge of Hazardous Chemicals Coalition; this can be achieved by positive chemistry (use of environmentally preferred chemistries), rejection of toxins, chemical management and awareness training, material traceability and disclosure advancements. Commitments have been made for the phase-out of perfluorinated chemicals and the use of alternatives for these finishes. The assessment of the geographic impact of water and the use of waterless technologies have helped to save many industries. Waste reduction at manufacturing, recycling of shoebox waste, reduction in the weight of packaging materials and the recycling, reuse and repurposing of waste are some of the methods for addressing the problem of waste. Physical inactivity has led to many problems in health and the forum 'Designed to Move' will take care of this problem (Nike Inc 2012e).

Finally, the organization works with the underlying principle of building sustainability into the core of the business model, the operations and culture where innovation is conceived, shared and commercially applicable. The commitment requires an eye for sustainability in every field, with constant attention to the measurement and evaluation of the sustainable measures in order to find the right direction for growth and progress. This will bring about all-around development, market transformation and consumerism. Nike has done immense work to enrich our living space by working on sustainability. The company has partnered with many projects and legislations in this field and has worked in union with many other leaders in the industry. The formulation and execution of the tools for Higg Index has been used by this organization and the basis of all such work has been taken from Nike Inc. Many of the products manufactured by Nike have proven to be sustainable and there are many industries who will follow this leader in favor of sustainability.

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