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# ECO DESIGN IN TEXTILE AND CLOTHING

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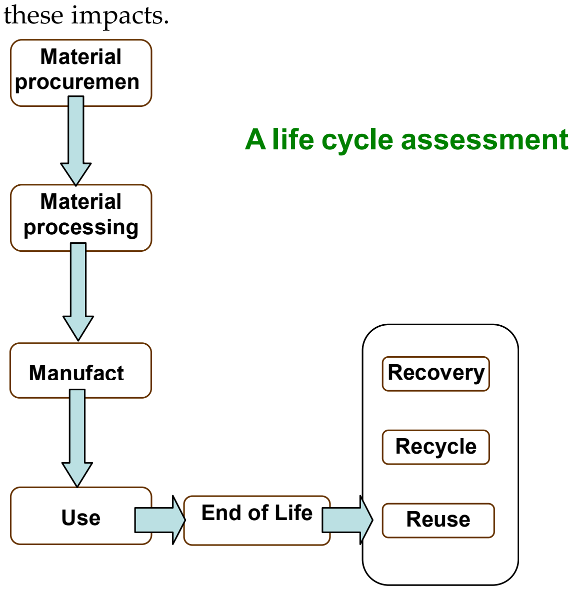
## ABSTRACT

Design for the Environment (DfE) probably had its origins in 1974 it works to prevent pollution, and the risk pollution presents to humans and the environment. The DfE program provides information regarding safer electronics, safer flame retardants, safer chemical formulations, as well as best environmental practices. DfE employs a variety of design approaches that attempt to reduce the overall human health and environmental impact of a product, process or service, where impacts are considered across its life cycle.

**KEY WORDS:** life cycle assessment; sustainable product packaging; waste management.

## INTRODUCTION

Design for Environment (DfE) aims to minimize environmental impacts and use resources efficiently. The aim of DfE is to promote sustainable Products. Simply stated, sustainable Product development consists of meeting the needs of the current population or Market without compromising the ability of future generations to meet their needs. DfE considers the environmental impact of a product throughout its entire life cycle, including raw material acquisition; processing; manufacturing and assembly; product use, service, and repair; retirement; and treatment and disposal. A life-cycle assessment is conducted to gain an understanding of these impacts.




*A life-cycle assessment includes three phases of analysis: (1) inventory, (2) impact, and (3) improvement.*

During the inventory analysis, all energy and raw material requirements, emissions to air and water, solid wastes, and other releases are quantified for the product throughout its entire life cycle. During the impact analysis, the effects of the resource requirements and wastes generated are qualitatively and/or quantitatively assessed. The improvement analysis evaluates the opportunities to reduce the environmental impact on the production, use, and retirement of the product. This assessment naturally leads into product design and DfE. Therefore, environmental considerations should be included as design criteria, as are legal, cultural, performance, and cost criteria. Design objectives that minimize environmental impact include the following:

- Use recycled or renewable sources of raw material.
- Design a product to be more energy efficient.
- Make a product with a longer useful life.
- Increase reliability, Simplify maintenance
- Increase durability
- Design for adaptability
- Plan for product remanufacture or reuse
- Make a product that is easier to recycle or that, when disposed of, has less environmental impact.

These types of objectives take different forms for different products. For example, in the electronics industry—in which technology changes rapidly—extending the useful life of a product might involve

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making a computer more easily upgradable or adaptable. However, for the textile industry, an example of extending the useful life of a product would be to make carpeting or a piece of apparel more durable.

Traditional Textile design looks at fibre blends, fabric weights, colour, pattern and finishing types. Textile Designers explore techniques to create new patterns, new hand and finishing processes for a product. Environmental issues make designing much more complex because it requires a more thorough knowledge of production processes than ever before. Some of the major problems are due to the complexities of the textile processing chain. Understanding the impacts of raw materials, use of chemical substances, processing and production methods requires a high degree of technical knowledge.

## THE TEXTILE INDUSTRY

From the early days of the industrial revolution, the textile industry has been seen as a major polluter of rivers .Textile effluents were generally all directed to watercourses, often with no prior treatment to remove contaminants. The textile industry is energy-, water-, and chemical-intensive. Within the industry, the majority of energy, water, and chemicals consumed is for wet processing. Most wet processing involves treatment with chemical baths, which often require washing, rinsing, and drying steps between key treatment steps. Consequently, wastewater is generated, having a very diverse range of contaminants that must be treated prior to disposal, About 200 litres of water are required to produce 1 kg of textile, on the average. Textile manufacturing is also a chemically intensive industry and, therefore, the wastewater from textile processing operations contains processing residues from preparation, dyeing, slashing, and various other operations.Many processes in textile mills produce atmospheric emissions. Air emissions from chemical finishes, dyeing process residues, and assembly/fabrication residues can include formaldehyde and amine. Other air emission sources may include ,solvent-based cleaning activities (facility cleanup, maintenance, parts cleaning, and print screen cleaning). Wastewater treatment systems for mixed liquor and spent processing baths with dye carriers and solvent scours, Warehouses (formaldehyde emissions from stored fabric), and) spills. Pollutants may include mineral oil, knitting oils, fibre finishes, softeners, hydrocarbons, urea, and volatile disperse dye carrier components that are desorbed from the fabric during subsequent heat setting, drying, and curing.

## ENVIRONMENTAL IMPACT OF TEXTILES FIBRES

*Fibre Growth*

- displaces land for crops
- leaches nutrients from soil
- contaminates soil and water through use of chemicals such as pesticides, biocides and herbicides
- weakens crop strain
- uses energy and water, which are finite resources

*Harvesting*

- chemicals such as defoliants, are borne by the air. They are a human health hazard on contact and/or by breathing
- significant use of chemical defoliants and fuel powered machinery

*Production Cleaning*

- use of strong chemicals
- waste to landfill
- water pollution by detergents, soaps, bleaches
- by-product: lanolin from wool scouring
- chemicals and fuel emissions
- noise and dust

*Textiles and energy*

- Energy consumption is evident throughout the total life cycle of textiles, from use of farm machinery, to transport to processing plants), to manufacture (including finishing and dyeing), distribution, sales and disposal.

*Spinning*

- dust and noise
- loose fibres can be breathed in
- noxious fumes
- solid waste: cones and pallets

*Fabric Production*

- uses finite resources
- dust and noise
- releases fumes from chemicals
- uses energy and water, which are finite resources

*Finishes*

- toxic by-products and fumes from POP chemicals such as PCBs, Dioxins, heavy metals, dyes, resins etc

- VOCs emanate from fabric and garment
- handling health hazards
- storage of waste – used dye
- uses energy and water, which are finite resources

*Garment Production*

- waste from off-cuts
- dust
- health hazard through handling of fabric and other processed products
- chemical residues from the application of finishes
- dry cleaning uses chemicals
- solid waste: packaging, inks, plastics, hangers

*Distribution*

- air pollution
- use of fuel, which is a finite resource, for distribution

*Consumer Use and Disposal*

- solid waste: packaging
- excess consumption because of frequently changing fashions
- emissions from waste incineration and/or dumps
- care of products, by washing, ironing, dry cleaning: water pollution, energy and chemical use

## DESIGN FOR ENVIRONMENT IN TEXTILE

Design for Environment (DfE) in Textiles attempts to reduce the impact of product (Textile) design upon the environment. It takes into account the whole life cycle - going beyond just the use of recycled materials or proper packaging or disposal.

It is an umbrella term describing techniques used to incorporate an environmental component into textiles and clothing before they enter the production phase. DFE seeks to discover product innovations in textiles that will meet cost and performance objectives while reducing pollution and waste throughout the life-cycle of a textile. A wide variety of techniques are available, and they fall into two broad categories:

1. Techniques that are used to identify the environmental impact of a Textile product throughout its life cycle such as life-cycle assessment;

2. Techniques that help Textile designers improve the environmental performance of their products.

Analysis tools can be used to identify broad environmental issues, but improvement techniques are needed in order to solve any problems identified.

The most common DFE practices used include:

- design for recycling;
- design for energy efficiency;
- design for disposability;
- Hazardous material minimization.

Design plays a crucial role in the innovation of environmentally responsible textile products. That function can take the form of either DFE strategies or concept demonstrators.

DFE strategies are sufficiently broad to be used at the product planning and problem definition stage of the design process. Concept demonstrators, on the other hand, are a tangible vision of the possible product of the future

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| **Raw materials**<br>- Design for resource conservation<br>- Design for low impact materials | **Manufacturing**<br>- Design for cleaner production of textiles |
| | **Distribution**<br>- Design for efficient distribution |
| **Use**<br>- Design for energy efficiency<br>- Design for water conservation<br>- Design for minimal consumption<br>- Design for low-impact use<br>- Design for low impact chemicals<br>- Design for durability | **End of life**<br>- Design for re-use of textiles<br>- Design for recycling<br>- Design for safe disposal. |

## GUIDELINES FOR ECODESIGN

1. Strictly comply with the law
2. Conserve energy : Energy consumption: often underestimated
3. Conserve resources : Use a minimum of material
4. Facilitate disassembly and collection : Do not design products, but life cycles
5. Facilitate reuse and recycling
6. Minimize final waste to be land filled
7. Develop products with long life time
8. Develop products that last in the marketplace ; Natural materials are not always better

## CONCLUSION

Traditionally, the environmental impacts associated with the textile industry are spread throughout the life cycle of fabrics and there are different issues at every stage of production, use and disposal. Therefore, it can not be said that a single fibre is more environmentally benign than another. Designers should try to specify a textile which is manufactured from renewable or recycled resources , produces little or no waste throughout its life cycle, is not reliant on polluting or toxic chemicals throughout its lifetime, is long-lasting and durable, requiring little or no care, uses minimal energy and resources from growth to manufacture, uses minimal water consumption during its life cycle, is reusable, recyclable or biodegradable.

It's therefore important to carefully understand the functional aspects of conventional textile products and explore the potential for designing new, sustainable services as opposed to simply redesigning existing products. The future in textile design and production can be greener and more sustainable and this might create totally new design and market opportunities.

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