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Ecodesign in the Textile Sector

Unit 09: Ecodesign approaches in textile products

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With this unit, students will be able to:

- To know the different approaches to sustainability in the textile sector
- Have the main information for the adoption of Ecodesign strategies

9.1 Introduction

The connection between the world of production and the world of consumption, with particular attention to the needs and desires of consumers, is the key objective of design.

The evolution of design in Ecodesign is due to the greater emphasis placed on the theme of eco-sustainability, as we saw during the course, the holistic perspective of Ecodesign considers all the factors that could have an effect on the environment and that can occur during the life cycle of the product in order to minimize the effects.

Over the last years, there has been a growing attention and sensitivity to ethical and environmental issues that translate both into greater awareness among individuals and into wide-reaching initiatives by organizations, such as the Greenpeace Detox campaign.

Moreover, expectations on developments in the textile sector identify environmental issues as one of the discriminating factors with regard to the perception of a brand value. In fact, investing in sustainability has important repercussions on the value of the brand in the medium and long term, and also implies a commitment on the part of companies to ensure transparency in their actions.

At the same time, the ecosystem of possible Ecodesign approaches has also seen a rapid expansion, for instance, since 2009 Manzini and V.¹ identified 210 different models. Many of these could have common features, but the fact that there is a wide range of models it requires us to give a scheme of synthesis in order to articulate them and provide a sort of "map", to better address the possible choices.

Two distinct dimensions can be identified on this map:

- the first one is the path of evolution towards the full maturity of sustainability, in which a company adopts certain approaches in relation to its situation, in order to integrate and implement the principles of sustainability;
- the second start from a certain degree of maturity of the previous path, and concerns the different directions of innovation that can be implemented for sustainability.

The path to complete sustainability means that a company has to expand its philosophy and, consequently, its range of products and services.

Sustainable product development is an evolutionary and iterative approach. The perspectives of Ecodesign need to be integrated with product development processes and all decisions and actions need to converge in sustainable approaches and harmonious business visions.

¹ See Manzini and D4D



9.2 Ecodesign and the "maturity of sustainability" path

In a company, the development path towards eco-sustainability begins with brainstorming activities, during which new scenarios and new challenges are analysed. The main aim of this context is to define the new positioning of the company in its reference market. Ideas, related reflections and perspectives can be expressed both in the medium and long term.

Subsequently, it foresees to draw and defines guidelines for product design and the development of products. These can be developed by "ad-hoc" activities made by the company's staff or can be based on external existing practices, and then implemented in internal policies.

The possible approaches can be summarized in seven separate steps related to three macro phases.

The first phase, the so-called "**reactive**" phase, deals with environmental issues, taking into account the compulsory regulations and the voluntary certifications available (as we have seen in Units 03 and 04 of the course). In addition to referring to the state of the art, it is advisable to be constantly updated on their evolution.

The second phase is of a "**proactive**" phase type and it concerns awareness of what is happening during the entire life cycle of the product. In general, it is important to understand the dynamics and opportunities that arise in order to increase operational efficiency. The objective is to reduce costs, environmental impacts and the use of resources (water, energy and materials). It is necessary to evaluate and monitor the own supply chain in order to reduce the environmental impacts, as we have seen in Unit 05, where the STeP certification allows to have a control on the production chain, and in Unit 07 where we saw the certifications that guarantee the sustainability of textiles products.

The last phase, the "**innovative phase**", concerns the development and implementation of innovation policies.

Thanks to the analysis of the "proactive phase" it will be possible to include, in the company's strategic innovation plans, sustainability measures that interact with the business model, and make possible to approach new and different market areas.

The seven steps that can be taken are:

- regulatory compliance
- risk management;
- environmental efficiency
- sustainable supply chain;
- sustainable product portfolio;
- innovation of the business model;
- market transformation.



| Step | | Phase |
|------|-----------------------------------|------------|
| 1 | regulatory compliance | Reactive |
| 2 | risk management | |
| 3 | environmental efficiency | Proactive |
| 4 | sustainable supply chain | |
| 5 | portfolio of sustainable products | Innovative |
| 6 | innovation of the business model | |
| 7 | market transformation | |

Tab. 1: correspondence between the stage and steps of "sustainability maturity"

9.3 Ecodesign approach: Design for Sustainability

Design for Sustainability (DFS), consists of a series of general and qualitative guidelines that put the environment at the centre of the product development process along with the traditional parameters regarding economic, functional, performance and aesthetic aspects. The development of the DFS took place at the University of Delft, which also provides a set of general guidelines for its implementation. It can be focused on the website: <http://www.d4s-sbs.org/>.

Through the DFS, which focuses on environmental and social performance, companies have the opportunity to improve their profit margins, product quality and identify new market opportunities.

The DFS focuses on three phases of the product life cycle: selection of materials, optimisation of production processes and design rethinking.

9.3.1 Selection of materials

Material selection is the first step in the application of the DFS method. This phase involves the use of materials with low environmental impact and a reduction in their use. The guidelines provide a list of priorities for the choices that can be adopted.

The first point, in order of importance, is that the designer must orient himself towards the use of materials from renewable, biodegradable and compostable sources, minimizing where possible the use of chemical agents, such as toxic insecticides or fertilizers in crops, or auxiliaries during production processes. For the evaluation we can refer to environmental standards, as we have seen in previous Units: first of all, evaluating the full satisfaction of the requirements and/or the existence of certifications already allows a certain selection; secondly, the existence of LCA studies (cradle to cradle) allows having more detailed data.



The materials selection must then give priority to materials with the lowest energy consumption and environmental impacts, replacing the most energy-intensive with materials with low overall impacts.

As a second guideline, the DFS process addresses the optimisation of materials in order to reduce their overall consumption volumes and the waste generated during the production process.

In this context, the aim is to eliminate unnecessary parts by optimising product design.

When looking at reducing material consumption, the priority is to reduce waste (for example, see the zero waste pattern cutting, further in this unit).

In this context are also integrated indications on recycling: it can consider using more rates of recycled materials, or maximising the recyclability of the product at the end of its life, referring to the issues explored in Unit 08 and the "DFR" (Design For Recycling, further on in this Unit).

As seen in the previous units, one of the most widely used natural materials in the textile and clothing industry is cotton.

Possible actions of intervention in view of Ecodesign are:

- to prefer the use of certified cotton that meets environmental standards;
- to prefer high quality cotton, which provides superior performance, in order to extend the useful life of the garment;
- to ensure that the supply chain is in line with the best standards;
- to evaluate alternative production technologies to traditional and low-impact ones, such as the use of transfer prints;
- with reference to the recycling techniques seen, and to the indications given in Unit 08, try to optimise the possibility of recycling at the end of the product's life (for example, trying to keep the garment white or dye it with light colours);
- where possible, assess the substitution with lower impacts fibres.

9.3.2 Optimisation of production processes

As seen in Unit 02, the technological development of the textile supply chain has seen a change of route, moving from a system with important impacts to a more sustainable cycle. On the other hand, this change requires considerable efforts from the industry and is constantly under development. New production techniques allow Ecodesigners to introduce new and more sustainable scenarios. Having a constant update on the state of the art is therefore becoming a priority, because it allows to have access to innovations that give concrete results and can make a significant difference.

The Ecodesign principles aimed at optimizing production chains include maximizing energy efficiency, reducing production phases, reducing or eliminating surface



treatments, reducing waste (see the example of "zero waste pattern cutting" within this unit) and adopting guidelines to improve waste recycling.

If the company outsources, the entire supply chain can also be involved and motivated to increase process efficiency. In this case, the use of voluntary certifications (such as the Oeko-Tex standard) is helpful because they provide for the traceability of the entire production chain.

Optimisation of distribution is also important in terms of environmental impact. The priority line starts with the transport of containers by rail, follows by road (trucks and lorries) and lastly by air. Other ways to optimize the distribution system include increasing the use of reusable bulk packaging such as pallets, reducing volumes, reducing the weight of the packaging and avoid unnecessary packaging. In addition, where possible, products can be shipped unassembled in order to reduce the volume of transport.

The key principle is design that eliminates weak points in the product that can cause rapid obsolescence or frequent maintenance, extending its useful life and allowing it to be repaired.

9.3.3 Design rethinking

The rethinking of the design must meet the needs of the consumer, but also it requires to evaluate new methods, techniques or expedients in order to improve sustainability compared to the current situation.

In other words, if the selection of materials and the optimization of production processes have a reactive and proactive development approach, the rethinking of design requires an innovative and holistic effort, starting from the interaction between users and production in order to explore new conceptual ways.

Therefore, openness to new approaches potentially leads to new guidelines for the development of the design phase.

A common principle is to increase the functionality of the product. Theoretically, a multifunctional garment is versatile, therefore, suitable for several uses, and so it minimize the need of complementary garments. The main strategies concern the transformability, intended as the ability to adapt to different settings thanks to a modular construction of the product. For example, thinking of technical mountain wear, a jacket that can guarantee good performance in a wider range of temperatures and in different climatic conditions avoid the need to have more jackets or additional covers, each one for few specific conditions.

Another general principle of design rethinking is the optimisation of the end of life of the product. As seen in Unit 08, reduce, reuse and recycle are the three ways to optimize and extend product life. The initial design phase may take into account useful measures to maximize end of life, through the selection of materials, or the Design for



Disassembly (DFD), which will be discussed in the next paragraph and it may facilitate the disassembly and reuse of the product and minimize premature obsolescence.

The ISO 14062:2002 standard also contains Ecodesign guidelines aimed at improving the benefits obtainable for consumers and companies.

The guidelines are explained in the following five criteria:

1. cost reduction, which derives from actions aimed at optimising the use of materials, energy, processes and waste disposal;
2. the development of new products with a focus on innovative and creative aesthetic aspects;
3. the development of new products through the use of recycled materials;
4. taking into account consumer trends and new social behaviours, the emergence of new expectations creates new opportunities;
5. compliance with environmental sustainability can also lead to an improvement of the brand image.

9.4 Ecodesign approach: Design For Recycling and Disassembly

Design for Recycling (DFR) and Design for Disassembly (DFD) are two interrelated approaches that are largely applied in the product and industrial design definition phases, with the explicit objective of facilitating the recycling of products, their components and end-of-life materials.

The DFR and DFD initiatives have led to the production of guidelines and design check-lists aimed to promotion of reuse by developing products that are easy to separate, avoiding permanent fasteners and/or the use of recycled materials, and using pure raw materials (or minimizing the blends of fibres) to maintain a high resale value.

A technical factor that hinders the success of textile recovery operations is the heterogeneity of the various types of materials used and the extensive use of fibre blends. This hampers sorting operations and imposes a condition of recycling into indistinct blends, forcing to downcycling which, in turn, lowers the commercial value of the recycled material. As seen in previous Unit, the market niches available for recycled fabrics are influenced by colour, fibre, quality and thus by the purity of the fibres blends.

According to the DFR principles, the priority of preferences for maximizing recycling potential is to:

- **white fabrics** which allow easy dyeing;
- **natural fibres** that are easier to extract and are more versatile;
- **good quality fibres** (length and fineness), which can be processed on faster machines
- **pure, unblended fibres** that require less processing than fibre mixtures, guaranteeing reliable results and efficiency in the recycling process.



However, for current industrial practices this list is more a challenge than a guide. Very often, therefore, compromises have to be found, and the designer has to decide if give more importance to some components and leaving others behind. For example, limiting the number of fibres used may lead to the development of more profitable markets for recycled fibres, but at the same time it may generate some inappropriate uses of raw materials, reaching unconsidered consequences, such as increasing the rate of monoculture crops (such as for cotton growth), with a significant environmental impact, related to consideration made during Unit 01

9.5 Ecodesign approach: Zero waste pattern cutting

During the traditional production process of the making of the final garments or goods, there is a loss of first quality material, in particular the cutting phase of the patterns generates waste and scrap material.

This is "significant" waste, because these materials, in addition to being of first quality and having a higher economic value than those of previous phases, have already passed all previous phases of manufacturing and are therefore of great environmental value, because they correspond to a certain amount of waste generated during previous phases of supply chain.

In the production of clothing the cutting phase is the one in which the losses of good quality material are greater.

In fact, in the traditional method, the fabric is rolled out and the shapes (or patterns) are cut out while the space around the shapes remains unused and discarded because it cannot be reused. Typically, waste varies between 10% and 20% of the fabric depending on the efficiency of the final layout.

Some designers and stylists have tackled the issue of waste reduction, called "Zero Waste Pattern" (ZWP), this is a design approach aimed at eliminating the resulting waste. The designer adapts the shape of each component of the model in order to "fit it like a puzzle", until it uses 100% of the useful surface. Currently, some software facilitates positioning, development and also allows simulating the finished garment aesthetic.

One of ZWP's most interesting experiments is certainly the one carried out by Issey Miyake in 1976, in which he presented the concept "A Piece Of Cloth" (A-POC), or rather a design concept focused on extracting from a single piece of fabric a single garment that can dress the body without failing to "normal" needs, rather, restoring the canons of aesthetics.

This concept was then further developed by the same studio, and it was adopted as the main concept of the further collections presented in 1999.



Subsequently, in 2010, it was evolved by combining it with another innovative approach to garment design, maintaining the focus on the absence of waste and drawing inspiration from the art of origami (Japanese decorative folding techniques).

Using these concepts, the designers have created geometric shapes that, starting from a flat surface apparently without cut-outs, open and form a 3D shape that forms the garment itself.



Fig 01 - 02 A piece of Cloth – Issey Miyake

With a different approach, designers Timo Rissanen and Holly McQuillan worked on and investigated alternative formats of configuration, positioning and construction of patterns of shapes. They intervene on the layout and shape of the single pieces, modifying them as if they were an Escher framework to reduce to zero any waste of material during the cutting process. The result of their research is based on pieces with repositioned seams, exaggerated lines and an aesthetic change.

On their website it is also possible to download the set of instructions to implement this process.



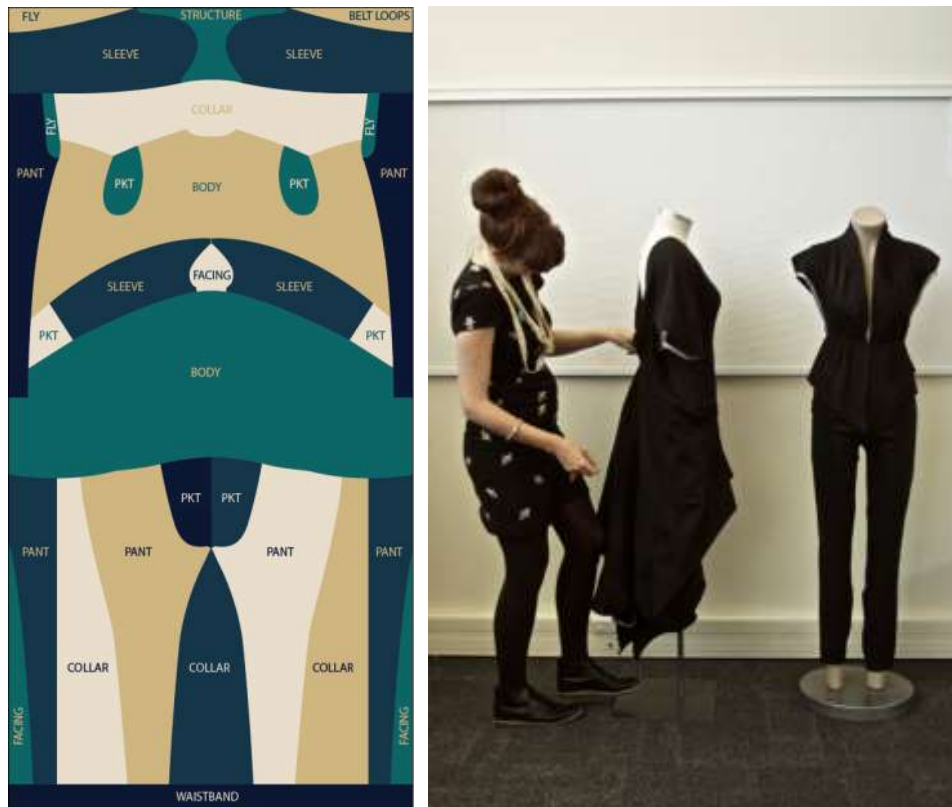


Figure 03 - 04 Zero Waste pattern Cutting – Holly McQuillan

9.6 Ecodesign approach: Design for Longevity

One of the strategies to improve the environmental aspects of a textile product is connected to the extension of the useful life of the product. This theme is very relevant in the clothing sector in which, in recent years, on conversely, there has been a "fashion bulimia" in consumer behaviour, deriving from the Fast Fashion trend, which has led to an increase in the quantity of garments produced and marketed, and with them also in the environmental impact of the sector

As we saw during Unit 04 and 06, it is necessary to evaluate the amount of impacts derived from the maintenance phase of products, and, certainly, to communicate the right practices of care allows to minimize both impacts and early degradation.

The British association WRAP is helping in this regard, since it deals with sustainability in various sectors, including textiles and clothing.

They have written several studies, downloadable from their website <http://www.wrap.org.uk/sustainable-textiles>, which help Ecodesigners and companies to develop guidelines for sustainable design.



The publications cover a wide range of topics, from market analysis on the situation of the sector in England, and guidelines for design activities.

One of these documents is the report of a study made to develop guidelines for the implementation of Design For Longevity, DFL, which is how to extend the useful life of fashion garments.

The principles of Design For Longevity are aimed at intervening in the initial design phase in order to maximise the useful life of a product, and in the fashion sector the first and main obstacle is the obsolescence of the products themselves.

The study was conducted through several workshops in which different stakeholders, including researchers, stylists, technicians, students and entrepreneurs participated.

The participants in these workshops identified and explored a number of possible actions of DFL and tried to identify their priorities. The various options identified have been assessed with reference to:

- cost implications, in particular for materials and production;
- the expected impact on the longevity achieved;
- the overall environmental impact, for example by also considering where the action taken has a potential to have a positive effect, such as the possibility to recycle the product.

The guide then identifies four areas of action in clothing design:

- Sizes, dimensions and shapes that allow easy adaptation of the garment to varying body sizes. The most effective system would be the construction of the tailored suit, because on the one hand it structures the shape of the body, and on the other hand, thanks to a careful design in this direction, it can ensure a certain "adaptability" to changes in the customer's body; in second place, in order of effectiveness, there are the "kimono" layout, or the oversize sweaters, because they are both comfortable and versatile;
- quality of the fabrics used, the highest quality available, in addition to give a better appearance to the garment, it also allows to better withstand the stress to which the garment is subjected, lengthening its useful life;
- colours and styles, it should be preferred the use of classic colours that do not give an obsolescence caused by the rapid change of styles, but at the same time they are appreciated by the consumer, just because they are perceived as "timeless" colours and styles;
- care: perhaps it can be seen as a simple matter, but in reality it is one of the main issues, in order of importance, to be analysed in order to lengthen the useful life of a garment. It is linked to the area of communication towards the customer on how to handle the garment (see: Care and maintenance rules, Unit 03), and how to recover it in case of tears or abnormal wear. For example, we mentioned a similar practice at the end of the video for Unit 03, in which



the return of the modular design allows to lengthen the life of the garments, as well as being a distinctive sign.

The report also provides a priority list of specifications to be considered for the design process:

1. fabric resistances to washing;
2. colour fastness under normal conditions of use;
3. resistance to abrasion and wear, resistance to the formation of pilling, resistance to tearing, and slippage of seams, and others;
4. ease of handling and following care instructions.

The study also analyzed 8 different categories of clothing, investigating which are the optimal solutions for that category, it shows that if the main principles are common and similar, when it comes to the details, small differences can lead to solutions with different priorities.

The 8 categories investigated are:

- Childrenswear;
- Occasionwear, referred to clothes for special events and occasions, such as bridal wear, dinner jackets, evening wear, party dresses and high quality suits.;
- knitted outerwear, including jumpers, cardigans, and dresses
- Tailoring, such as suits, jackets, skirts for regular use
- denim;
- Sportswear, in mean garments used for physical activity
- Casualwear, such as t-shirts, sweatshirts and leggings
- Underwear

On the website, indicated above, it is possible to download the complete document where the results of the project are described.

9.7 Other sources of inspiration

As indicated at the beginning of this Unit, if on the one hand the technical/scientific component of the actions that help Ecodesign is well defined and explained in the previous Units, the part that instead concerns creative development does not always have linear paths, but usually it has more inspirations that can be transposed from one concept to another.

In fact there is not only a single way of approaching Ecodesign, but there are several approaches that can be taken into consideration.

We have seen in Unit 05 of the basic module the 8 main strategies, we will see in Unit 10 how they can be translated to establish business models based on sustainability.



It is necessary, for the preliminary development phase of a concept, to have an open vision, and it is necessary to have a constant update to have, in addition to notions that can be directly useful (such as the availability of a new technology that improves environmental impacts), but can also be a source of inspiration.

Very often the themes are recurring and similar, but it is possible to understand the different aspects of the same theme, sometimes can be more towards on the theoretical side, sometimes instead it can be more oriented on the practical/empirical experience.

In this regard, in this last chapter we include some of the most significant portals and websites that periodically publish research, articles or case histories that can be a creative stimulus for the development of new concepts.

Textile Environment Design, <http://www.tedresearch.net/teds-ten/>, born from the "Chelsea University of the arts" in London, provides a guide to 10 (ten) Ecodesign strategies, which can be consulted with in-depth information on the site, and a blog where the latest news is published.

The 10 strategies are:

1. Design to minimise waste
2. Design for cyclability
3. Design to reduce chemical impacts
4. Design to reduce energy and water use
5. Design that explore clean/better technologies
6. Design that takes models from nature & history
7. Design for ethical production
8. Design to reduce the need to consume
9. Design to dematerialize and develop system & services
10. Design activism

Textile Exchange, <http://textileexchange.org/>, is a global non-profit organization that aims to transform the textile industry and integrate sustainable standards. The website contains guides and reports on sustainability issues, such as: "Quick Guide to Biosynthetics" <http://textileexchange.org/downloads/quick-guide-to-biosynthetics/>

Design for longevity <https://designforlongevity.com/> is a project of the Danish Fashion Institute, and collects a series of information and posts focused on the issue of sustainability in the textile and fashion, reporting in fact interesting case histories, examples and publications of successful examples.



The site is structured in thematic areas: system; mind-set, aesthetics, cycles, business models, materials, making, lifespan, and technology.

The website is therefore an interesting source of updates and creative stimulus, and it is possible to investigate some issues, such as an article about a brand that has worked on the production of [completely compostable garments](#), or a series of articles about design for disassembly: a guide to the [implementation of the DFD in clothes](#), and an article of [DFD examples in footwear](#).



If you are willing to investigate the themes dealt with in this unit:

Sustainability in the Textile Industry (2017), Subramanian Senthilkannan Muthu

<http://www.textileworld.com/textile-world/features/2016/02/design-for-sustainability/>

Design For Sustainability, <http://www.d4s-sbs.org/>

Sustainable Fashion and textiles, Kate Fletcher, Chapter 4

<http://www.aquafil.com/it/>

WRAP: *Design for longevity* <http://www.wrap.org.uk/sustainable-textiles>

<http://mistrafuturefashion.com/>

<https://hollymcquillan.com/>

<https://www.seamwork.com/issues/2016/05/zero-waste-design>

https://issuu.com/claudiademcak/docs/zero_waste_presentation

<http://www.tedresearch.net/teds-ten/>

<http://textileexchange.org/>

<https://designforlongevity.com/>

