UPSKILLING FUTURE WORKERS IN THE FASHION SECTOR

AN EDUCATIONAL TOOLKIT FOR SUSTAINABILITY ASSESSMENT

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Abstract

The European Commission within the Strategy for Sustainable and Circular Textiles cited circular business model solutions and ecodesign strategies as paramount for the sustainability of the textile sector. Nevertheless, how can sustainability knowledge be transmitted to the constellation of SMEs? The Eu Act for skills identified a gap between the knowledge currently owned by companies and the skills required for the green transition. The research investigated the possibilities of conducting the upskilling by integrating the Life Cycle Design approach within fashion design education. A toolkit has been developed for the qualitative and quantitative assessment of eco-design strategies in which Life Cycle Assessment analysis has a keyrole. The toolkit validation took place through a set of intensive workshops and a structured course, involving around 400 students at university level. Finally, the brands involved have enthusiastically greeted the effectiveness of students' outcomes.

Keywords: Education toolkit, SME Upskilling, Sustainable Fashion, Life Cycle Design, LCA

Introduction

The production and consumption of textile products continue to grow and so does their impact on climate, on water and energy consumption, and on the environment. Global textiles production almost doubled between 2000 and 2015[1], and the consumption of clothing and footwear is expected to increase by 63% by 2030[2].
In the EU, the consumption of textiles, most of which are imported, now accounts on average for the fourth highest negative impact on the environment and on climate change, and third highest for water and land use from a global life cycle perspective (EEA, 2022).
These negative impacts have their roots in the linear economic model, and Fast fashion is one of the most shocking examples. Fast fashion is the phenomenon of enticing consumers to keep on buying clothing of inferior quality and lower prices, produced rapidly, causing overproduction and overconsumption. To the environmental issue is added the social issue. The main apparel industry, driven by pressures to minimize production costs to meet consumer demand for affordable products, is currently facing worrying child labour and gender equality issues. As women make up the majority of the low-wage and unskilled textile workforce (ILO, 2016), improving the sustainability of the supply chain has also an important cultural dimension.
The European Strategy for fashion (EC,2022) declare that advancing towards sustainability of the textiles ecosystem requires deep changes in the currently prevailing linear way in which textile products are designed, produced, used and discarded, together with reducing its impacts on climate change, unsustainable resource use and environmental pollution, and halting the violation of human rights in the textile value chains. Areas such as eco-design, fibre development, innovative textile production, repair and reuse service are judged as particularly important by the European Commission to maintain competitiveness of European companies in the global market.
The Strategy for a Sustainable and Circular Textile

1 Ellen MacArthur Foundation (EMF) (2017) https://ellenmacarthurfoundation.org/a-new-textiles-economy
2 European Environment Agency (EEA) (2019) Textiles and the environment in a circular economy

(EC 2022) proposes actions for the entire lifecycle of textiles products while supporting the ecosystem in the green and digital transitions. It addresses the way textiles are designed and consumed, including looking at sustainable technological solutions and innovative business models.
However, the textile sector struggles to attract qualified young talents. SMEs in the textiles ecosystem are being held back by a lack of skilled employees who can enable the changes. 40% of European companies reported a green skills gap (Euratex, 2021)[3].
77% of European companies reported difficulties in finding workers with the necessary skills (Eu Year of Skills 2023)[4]. Under the EU Pact for skills the Commission (EC, 2020). supported the establishment of a large-scale skills partnership for the textiles ecosystem to promote upskilling, reskilling and the acquisition and transfer of green and digital skills, including knowledge on life cycle assessment and value chain assessment. Vocational education and training, both initial and continuous, including apprenticeships, are essential for equipping people with the necessary skills.
From the Design Council's Report 2021 Beyond Net Zero: A Systemic Design Approach, most designers are still not fully using their skills and knowledge to support the transition to sustainability. There are still many designers who are not sufficiently aware of sustainability issues and continue to create harmful product-services. At the same time, many designers are working superficially without addressing the underlying issues. From the interviews conducted in the report, it is the designers themselves who report as a limitation the inappropriate knowledge of the tools and approaches needed to design for sustainability.
Andrews (2015) points out that to achieve a radical shift in design thinking in line with sustainable thinking, it must be essential to integrate within Design training academic curricula concepts related to Sustainable Development. The designers have the opportunity to lead the new paradigm through design and communication tools.
This paper presents the intensive workshop What's inside? and the BA course Sustainability in Textile and Fashion Products , as the results of the research that leads to the enlargement of educational offerings in design for sustainability.

Qualitative and Quantitative Assessment of Ecodesign Strategies

Life Cycle Design (LCD) is a design approach that considers what the impacts might be at all stages of the life cycle of the product-service (Vezzoli & Sciama, 2006). The phases of a product-service system life cycle have been identified by the ISO 14000 standard itself as: extraction, processing and production, transportation, use, and decommissioning. The phase of decommissioning, End-of-Life (EoL), should be understood as the phase in which a new cycle could be born for the system under analysis. Sustainable innovation possibilities can be implemented in each phase with different strategies; moreover, several strategies can be combined simultaneously to achieve more effective solutions. To eco-design it is important to compare the strategies proposed in relation with the context. Strategies should be assessed and then quantified in environmental and social impacts. The Life Cycle Design approach uses both qualitative and quantitative tools to evaluate the opportunities from the design strategies. Life Cycle Assessment analysis is therefore used in conjunction with the LCD approach to verify the improvements achieved with the strategies (Bretz et al., 2001).
The Strategy-Wheel is a visual representation to frame strengths and weaknesses regarding a given issue; the axes represent design requirements that are given a score. The EcoDesign Strategy Wheel (Brezet & Van Hemel, 1997) is a qualitative tool and is a variation of this diagram that arranges on the axes as evaluation parameters the phases of the life cycle of a product-service system, and associates with each phase the possible strategies for sustainable implementation in that specific phase. A total of eight strategies are identified: development of new concepts, selection of low-impact materials, reduction of material use, optimization of production techniques, optimization of the distribution system, reduction of impact during use, optimization of initial life span, and optimization of the end-of-life system.
Life Cycle Assessment (LCA) is a well-defined method to calculate the environmental burden of a product or service. However, LCA has been made so complex that it seems to be a job for specialists

3 https://euratex.eu/news/which-skills-companies-need-from-their-workforce/
4 https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-year-skills-2023_en

only. The specialists jargon ('functional unit', 'fate analysis', 'midpoints', 'endpoints', 'attributional modelling', etc.) makes it even more impossible for non-specialists to find out what they need to know to make an LCA (Vogtländer, 2012). Designers should be able to develop these analyses in autonomy during the design process, however LCA seems more a complication that is left at the end of production processes. Professor Joost Vogtländer has identified two main criticisms in using LCA methodology during the design process: lack of time to dedicate at the assessment of each strategy investigated, and lack of money to invest in software, people and time - to make an LCA requires a lot of time (at least 2-3 month). For these reasons, he has written the guide "LCA. A practical guide for students, designers and business manager" and he has developed Idemat, a fast-track app for LCA.

The aim is to assist users that are not so much interested in all the ins and outs of LCA but that just want to have quantitative guidance in the decisions they have to take. Users are identified as: students, designers, business managers, consultants in the field of business strategy, product innovation, or in the field of government advice. Users do not want to spend much time on LCA, since their primary task is the introduction of innovative products and services. Users often have no dedicated computer software, no licenses on LCI databases, and no budget available for specialized LCA consultant firms. They want to do it themselves, but the time they can spend on the issue is limited. They are not interested in formalities and deliberations on accuracy: they just are interested in results (Vogtländer,2012).

The LCA. A practical guide for students, designers and business manager (Vogtländer,2012) is in compliance with the ISO 14040 and 14044, as well as the formal LCA manual of the ILCD of the EU. The Idemat app, on IOS and Android, is a tool that allows designers to compare materials and derived processes based on environmental impact. The IDEMAT dataset (made available by the Delft University of Technology at www.ecocostvalue.com) is a set of Life Cycle Inventories (LCI) of more than

LCA PHASE	EDUCATIONAL OBJECTIVE	TOOL
1° Goal and scope definition	Learn to identify the supply chain system, through info graphing that makes it easier to read the processes involved. Define the boundaries of the analyzed system.	Circular Design Guide: - Product journey Mapping
2° Life Cycle Inventory	Know how to search for detailed information related to materials and processes within the system boundary.	Circular Design Guide: - Smart material Choices
3° Life cycle Inventory Assessment	Know how to manage data collection from the database, including as a result of the absence of certain entries and their replacement or removal from the analyzed system.	IDEMAT app o excel sheet
4° Interpretation	Know how to read indicator values. Know how to identify items with environmental criticality and set up the search for an alternative solution.	Eco-strategy Wheel

Table 01

1200 materials, services, production processes and end-of-life scenarios. The accessible nature of the app makes it highly useful in the early stages of the design process. The impact data included in this app is licensed under CC BY-4.0 (see creativecommons.org) and is therefore free to use in all projects (even commercial) as longs as both the creator and Delft University of Technology are attributed Idemat data are available for Simapro as well as Open LCA.

Toolkit to Integrate Sustainability Assessment in Fashion Design Education

The aim of this research has been to upskill education in textile and fashion design with eco-design knowledge. The method used has been to give the students a toolkit for both qualitative and quantitative assessment, and enable them to interact with specialists of the supply chain. The research then led to the development of two educational formats: an intensive workshop and course both at university level, with the topic the application of LCD and LCA approach and tool for the redesign.
For both the cases, the aim is to let students practice on one hand with the individuation, the assessment and the communication of supply chain hotspots, and on the other hand with the proposition of more sustainable strategies.

Fig. 01

The intensive workshop has been built on the structure of LCA analysis required by the ISO 14040. Specifically, each phase was assigned a training objective (see table on previous page). The LCA methodology according to the ISO standard is introduced and applied to real cases brought by the students, mainly everyday objects or clothing, through the use of the Idemat database. The supply-chain mapping of the individual product case-studies is carried out by the students following the two worksheets developed by the Ellen MacArthur Foundation in collaboration with the design firm IDEO, within the Circular Design Guide. With the starting point that through proper visual representation of the system's inventory to analyse, it will be easy to define the boundaries of the analysis system, and manage the inventory of necessary data, collected data, and missing data. In particular the tool Smart material Choices - Understand the breakdown of materials that go into your product and Product journey Mapping - Ensure your product is in a useful state for as long as possible were used to cover the first and second phases of ISO 14040 - Scope & goal Definition, and Life Cycle Inventory LCI.

The third phase, the Life Cycle Inventory Assessment (LCIA) is conducted through Idemat. Students are asked to download the database from https://www.ecocostsvalue.com/data/ or use the smartphone application and search for the items included in their system's inventory.

The fourth phase, data interpretation, is proposed in the workshop as the redesign of the product analyzed using the Eco-strategy Wheel. Students are asked to identify the critical values that emerged from the analysis, and to look for alternative solutions which could be already on the market or not. New design strategies can be investigated, which will be verified again through LCA analysis, and then a comparison between the two analyses will be conducted.

The task of the course is to introduce supply chain complexity and prepare for the LCA analysis. The assignments aim to highlight the importance of the mapping phase of the system to analyze and the interpretation and redesign phase.

Proper graphical representation of the supply chain, with all its processes, and clear mapping of input and output flows significantly facilitate the conduction of the environmental and social assessment. A correct mapping facilitates the collection and management of data, but also helps in the definition of the boundaries of the LCA

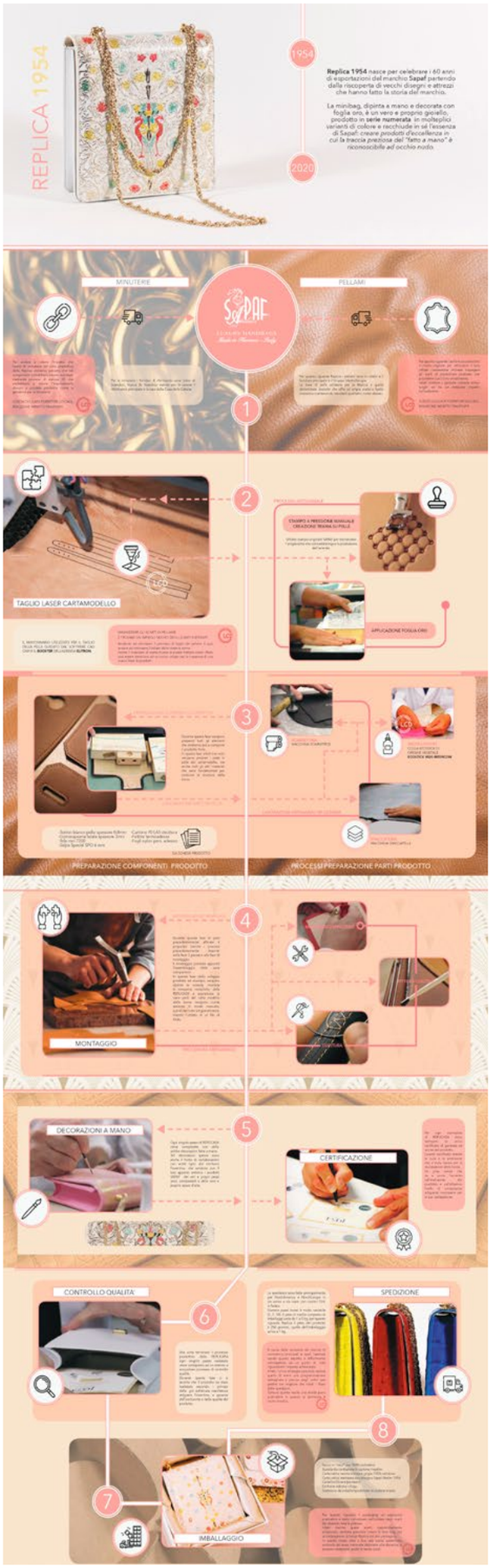

Fig. 02

analysis required by the ISO 14040 standard. Appropriate visualization helps the communication of analysis results within the company, facilitating discussion of strategies to apply or not. Data mapping is thus framed as a strategic tool for the designer and the commissioning company, both to facilitate understanding of systems and redesign strategies and to communicate value through traceability and transparency.
Usually, however, the graphic representation of the supply chain is relegated to the interface of calculation software such as Gabi or Simapro, with the sole purpose of setting up the calculation problem, without enhancing its communicative opportunities.

Toolkit Validation through the Two Educational Formats

The first format was the intensive workshop, named What's Inside?, with the intended to recall the exploratory action that is put in place during an LCA analysis. The workshop was offered between the years 2020-2022, involving about 100 students in different training contexts: the School of Architecture University of Florence (UNIFI), the Ecole Euro-Mediterranean d'Architecture, Design et Urbanisme (EMADU) of the UEMF Fes- Morocco, the Amsterdam Fashion Institute (AMFI) HvA, and an IFTS technical-scientific training course of the Tuscany Region.

Regarding the assignments related to systems mapping, the student outcomes varied widely in relation to the educational background of each class. however in each case the assignment was achieved and then understanding of supply chain complexity, as well as the issues of processes and materials. Students showed a high enthusiasm in the possibility of actually quantifying sustainability and they were gratified by the simplification achieved with the use of the Idemat phone app [Fig. 01]. A wider range of outcomes has been noticed for the strategies originalities proposed for redesign the products.
The brands, when involved, have remarked a great interest in the graphical representation of production processes, for the communication of the value chain involved in the product [Fig. 02] .
Finally two main reactions from the students were noted. On the one hand there was considerable enthusiasm in being able to achieve the 'truth' about sustainability. nevertheless, on the other hand there was also the perception of a certain complexity of the systems to be analyzed and the variables present, which sometimes led to a feeling of frustration.
The second format for the validation has been the course "Sustainability in Textile and fashion Products" that took place during the academic year 2022-2023 involving about 300 students from the first year of the BA Degree in Textile and Fashion Design (UNIFI). Students were asked to choose a

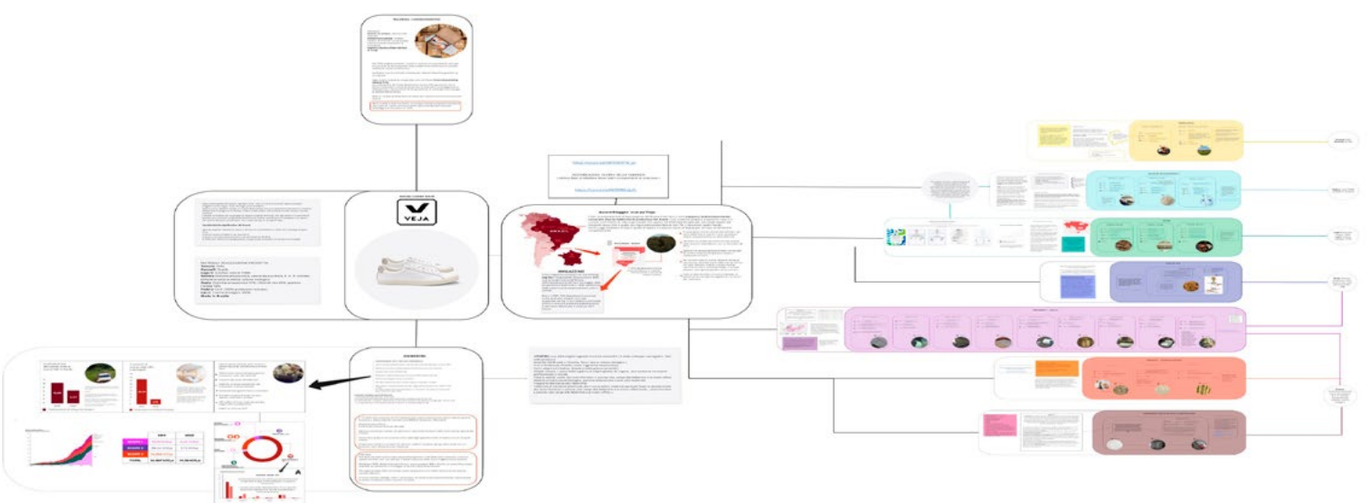

Fig. 03

Fig. 04

product and in a first phase to perform a supply chain analysis [Fig. 03] , and subsequently to use the Eco-strategy Wheel to redesign the product [Fig. 04]. Using Miroboard as support, students reconstructed the product supply chain from cradle-to-sale, seeking information from company websites and literature about materials and production processes. The results are visual mappings that unravel complexities of each component's production processes, and highlight the environmental and social hotspot referred to as input and output of all the processes. In the second phase, students were asked to assess the present product following the strategies displayed by the Eco-strategy Wheel and then redesign the product improving the social and environmental aspects.

The product's supply chain was reconstructed by all the students but with a wide range of depth. Most students carried out an accurate investigation of data, by literature and by getting in touch with companies.

However students have shown some difficulties in managing the lack of data and in the differentiation of greenwashing from real data. At the same time, students have shown interest in investigating criticism linked to process, materials and logistics. The efficacy of graphic representation proves successful comprehension and handling of information.

When the students have involved the brands of the product analyzed to show the supply-chain representation and make propositions, the brand has shown enthusiasm in developing a dialogue based on a graphic support. The output made by the students results as a facilitator for the dialogue between the actors in the supply chains, resulting in a broadening of the discourse.

Conclusion

It turns out to be increasingly necessary to increase corporate competitiveness in the area of sustainability and to prepare designers working in SMEs to manage sustainability within companies so that they can liaise with other experts and various

suppliers. Together Life Cycle Design approach and Life Cycle Assessment are the base to root sustainable decisions in the design process.
The research addresses the need identified by the European Commission for upskilling the future workers in order to achieve the green transition. Within the case of the textile and fashion industry, this need translates into the dissemination of eco-design practice and knowledge at different professions of the sectors.
The research aims to help train a professional figure in the fashion sector who must reconcile both knowledge related to design and production processes and knowledge about quantifying environmental impacts, so as to facilitate redesign and collaboration with experts such as chemists and environmental engineers.
The toolkit proposed within the workshops and the university course, provides participants with a toolkit for assessment of product sustainability. Although complex methodologies as LCA have been introduced, students demonstrated an understanding of the possibilities of using them in the ecodesign context. The dialogue that took place with the brand involved, confirmed the achievement of the goal to upskill the students and make them more competitive in the job market, thanks to making them conscious of their design actions. The overall goal is to broaden the educational offerings, increasing students' skills by providing them with the skills to apply the Life Cycle Assessment methodology to their projects, and to be able to collaborate in obtaining certifications from companies both in terms of traceability and transparency.
The shift toward a more sustainable fashion, wished by Europe and its citizens, can be achieved only with a spread of sustainability assessment knowledge at different levels with different complexity. In this work we tried to tradeoff between analysis complexity and analysis ease, in order to bridge the gap with skills needed by companies. The road ahead seems to still be long, but we hope that more effort is drawn in the direction of sustainable change both from the educational institutions side and the SMEs side.

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Figure Captions

Table. 01: Intensive workshop framework based on LCA analysis structure, with educational objectives description and tools used.
Fig. 01: Students' coursework. What's Inside? Workshop. Example of LCA analysis of a fashion product carried out on the Idemat app. Source: author
Fig. 02: Students' coursework. What's Inside? Workshop. Examples of web communication of the production process and value chain of the Replica bag. Source: author
Fig. 03: Student's coursework. Course in Sustainability in textile and fashion product. Example of Supply Chain Mapping of Vaia pair of shoes, inventory of materials and process involved. Source: author
Fig. 04: Student's coursework. Course in Sustainability in textile and fashion product. Example of Eco-Strategy Wheel application to redesign a fashion product. Source: author