



RECYCLING IN TEXTILES

Promoting Sustainability in the Textile and Garment Industry in Asia (GIZ-FABRIC)

Day 2:

RECYCLING IN TEXTILES



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on behalf of Ho Chi Minh City University of Technology

Contents



Introduction



Recycling in textile materials



Ho Chi Minh City University of Technology –
Current status and future perspective

1. Introduction

By 2050, the textile sector is expected to represent a quarter of the world carbon budget—26%

FOR FASHION INDUSTRY

Fresh water depletion



Pollution



Deforestation



FOR OTHERS

Global pandemic



Immense demand for disposable mask



Environmental crisis



1. Introduction - Concept

Sustainability?

- *Not new !*

(1962 - Rachel Carson's Silent Spring.)

A well-known and very frequently read definition:

'development which meets the needs of the present without compromising the ability of future generations to meet their own needs'.

-World Commission on Environment and Development 1987-

*"able to be maintained at a certain rate or level" or
"conserving an ecological balance by avoiding depletion of
natural resources"* -Oxford dictionary-



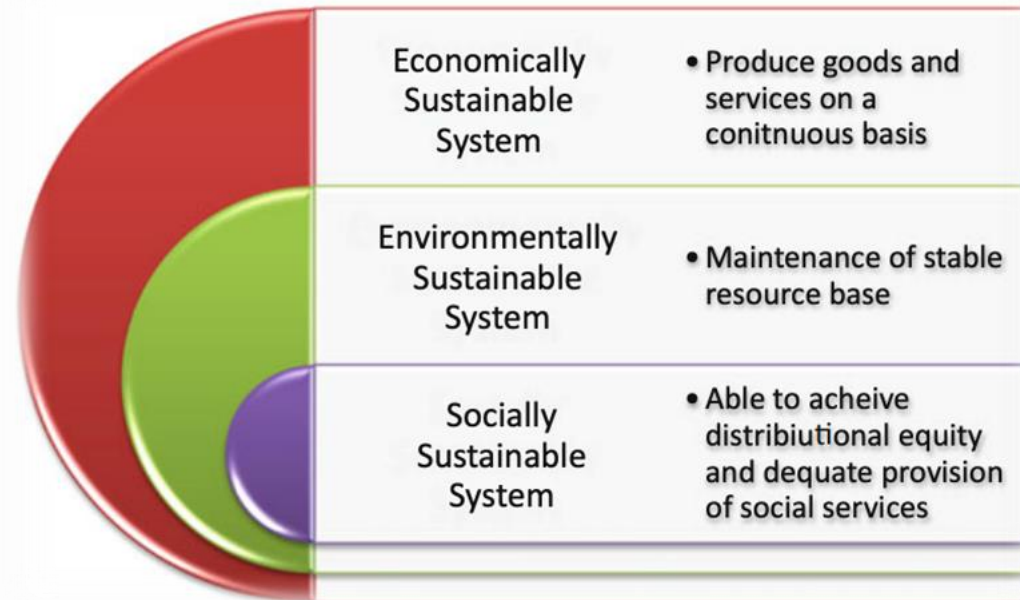
A million-dollar question

What does sustainability really mean?

1. Introduction - Concept

Sustainability?

Sustainable system (Harris,2000; Muthu, 2017)



Three dimensions—economic, social and environmental, and all the three have to be fulfilled (Rankin 2014)

1. Introduction - Concept

Sustainability in Textile Supply Chain

Life cycle of textile products

- Fibre cultivation or manufacturing;
- Textile and clothing production;
- Retailing;
- Consumer use;
- End of life.

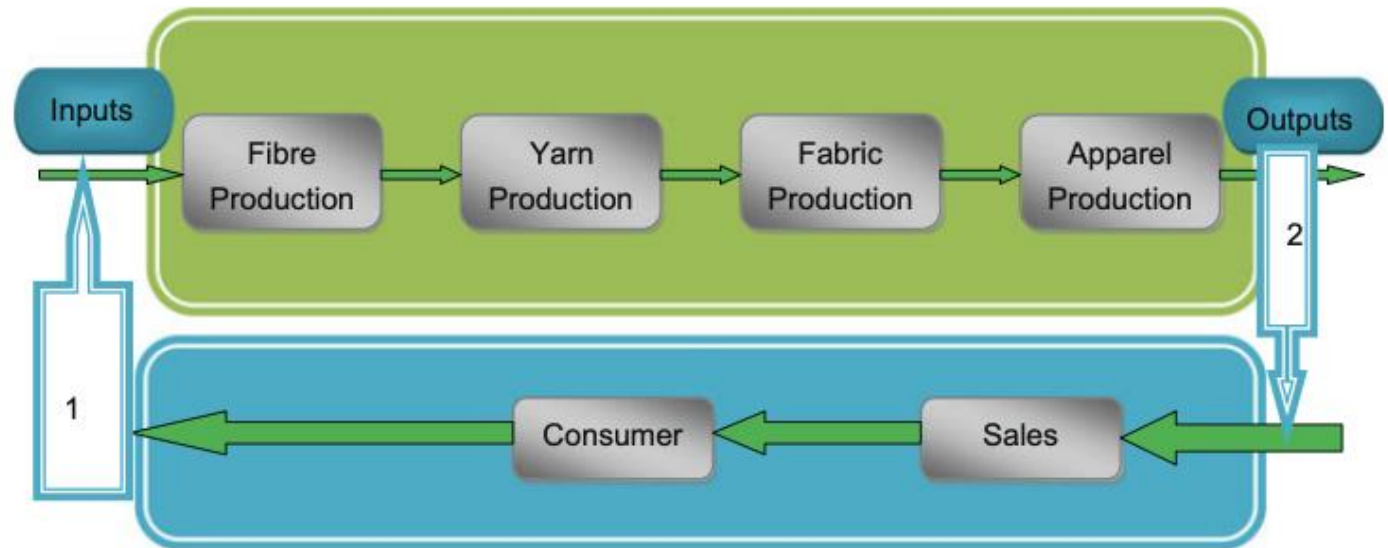
Sustainability of textiles >> look

into the **entire supply chain** >>

assess and further to improve upon

the **social, environmental and**

economic impacts at each stage



Textiles and clothing supply chain (Muthu, 2017)

1. Introduction - Concept

Fast fashion

Definition

Fast fashion is a term used to describe *cheap and affordable clothes* which are the result of catwalk designs moving into stores in the fastest possible way in order *to respond to the latest trends*.

→ Fast fashion retailing is leading consumers towards an increased rate of purchasing and the trend to keep clothing for an ever shorter time with the **resulting rise in clothing disposal**.



Image source: Halfpoint (zerowastememoirs.com)

1. Introduction - Concept

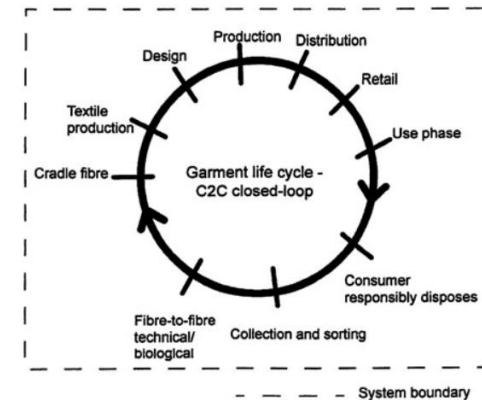
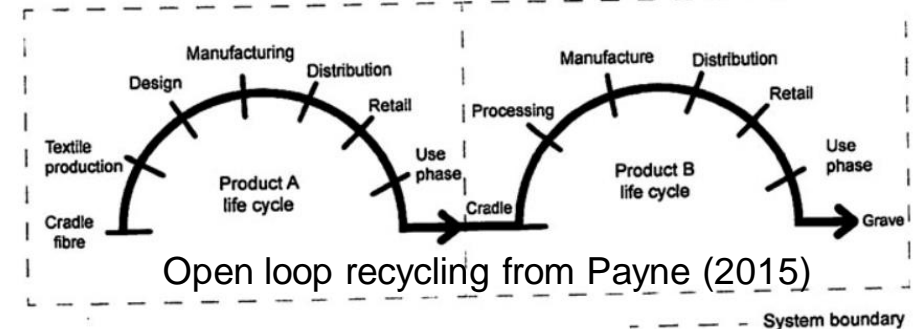
Recycling and Reuse

Reuse

- *to use* something again.

Recycle

- *to treat* things that have already been used so that they can be used again
- Upcycling and downcycling can be considered as examples of recycling.



Cradle-to-cradle closed-loop recycling from Payne (2015)

1. Introduction - Concept

Upcycling

“creates something new and better from the old or used or disposed items”



Requirement

- Environmental awareness
- Creativity
- Innovation
- Hard work

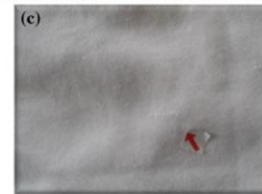
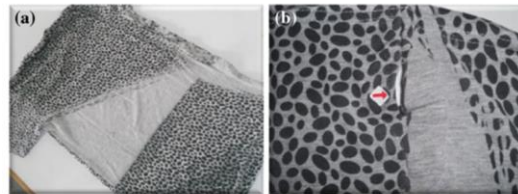
Aim of products

- truly sustainable,
- affordable,
- innovative
- creative

1. Introduction - Concept

Fashion Renovation via Upcycling

T. Vadicherla et al.



DON'T WAIT FOR A BIG CHANCE TO DO LARGE THINGS

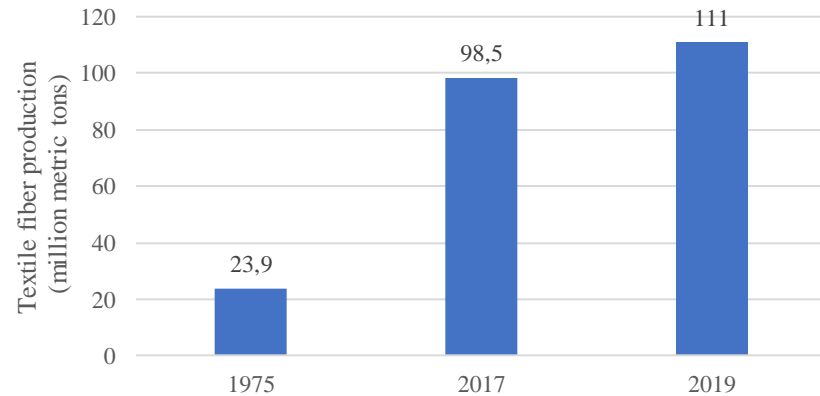
DO SMALL THINGS FIRST

1. Introduction - Concept

Recycling in textile and clothing industry

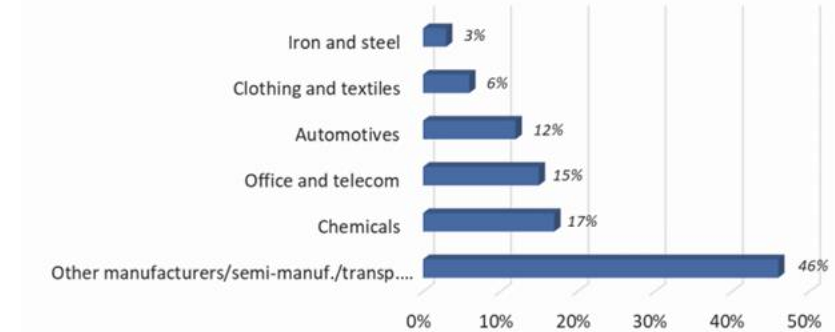
Overview

The worldwide volume production of textile fibers (million metric tons)



Global fiber production share in 2019

in 2002, polyester demand surpassed cotton fiber and has continued to grow at a faster rate than cotton fiber.



Percentage share of world exports of manufactured goods in 2017

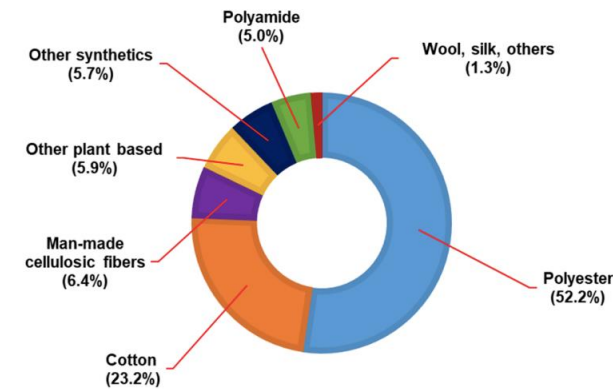


Image source: BBC, London recycles

1. Introduction - Concept

Recycling in textile and clothing industry



Jeanger et al (2022)

Textile solid waste

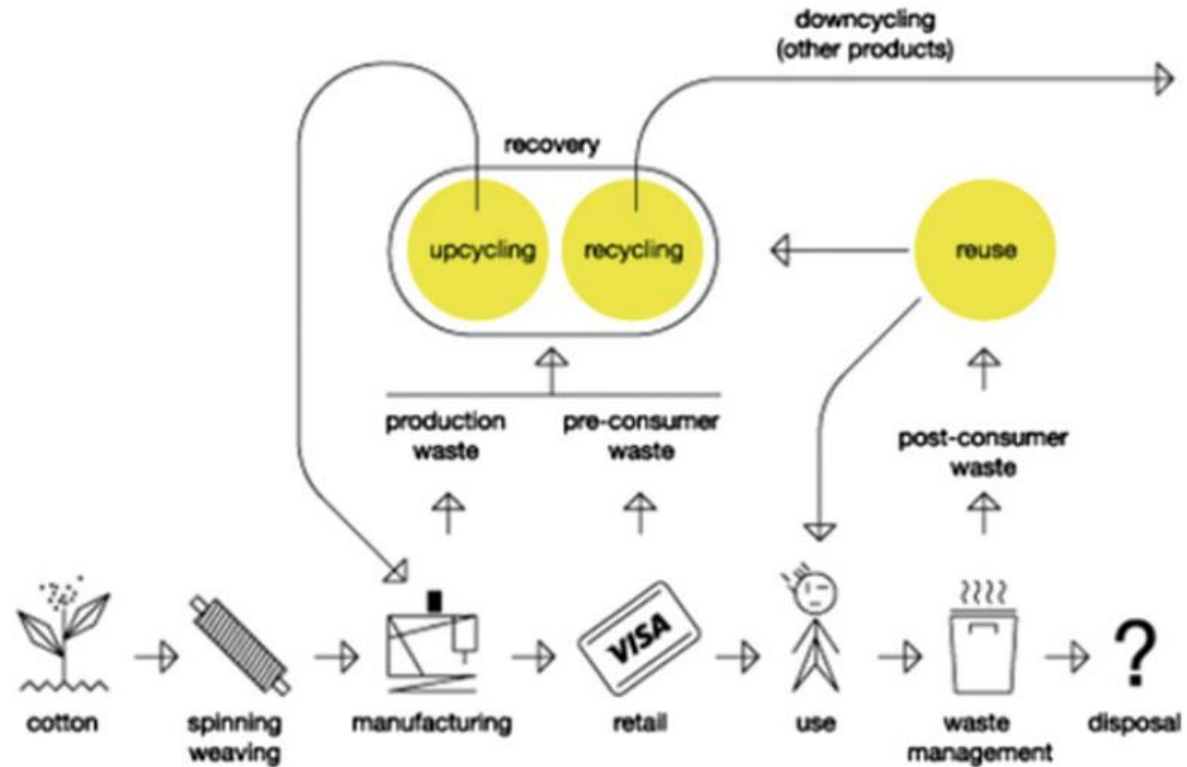


Image source: BBC, London recycles

1. Introduction - Concept

Recycling in textile and clothing industry

Textile solid waste



Types of textile waste (Muthu, 2017)

2. Recycling in textile materials

Textile waste classification

Pre-consumer textile wastes (PrCTW)

are those wastes which never make it to the consumers and which come directly from the original manufacturers

Post-industrial textile wastes (PITW)

are generated during the manufacturing process of upstream products

Post-consumer textile wastes (PtCTW)

are the wastes that come from the consumer, and these are generally the clothes that are ready for disposal or landfill

Brainstorming

Examples for textile waste classification !!!

2. Recycling in textile materials

Recycling technology

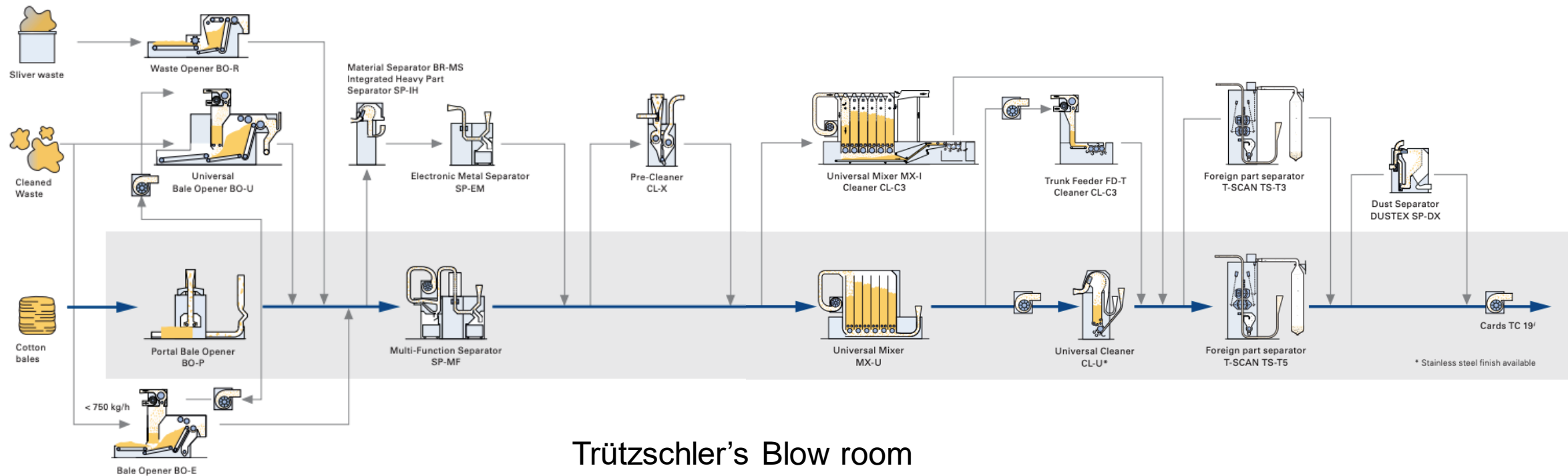
Approaches	Raw material for recycling
Primary approach	Industrial scraps
Secondary approach	Mechanical/melting processing of post-consumer products
Tertiary approach	Pyrolysis/hydrolysis of polymeric wastes to get monomers or fuels
Quaternary approach	Burning the fibrous solid wastes and utilizing the heat generated

Recycling approaches (Muthu, 2017)

2. Recycling in textile materials

Recycling technology

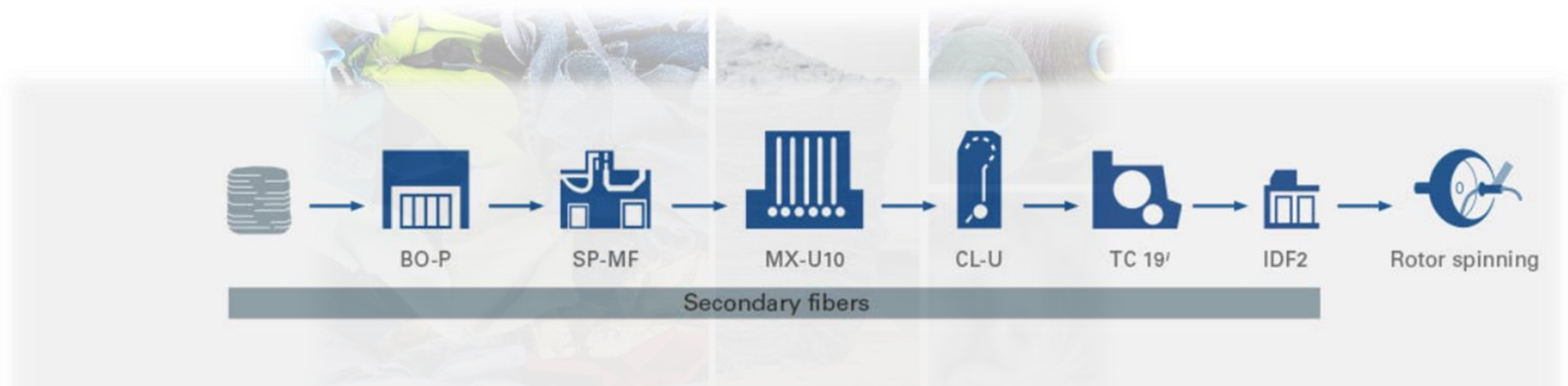
Primary approach case study: Recycling fibers from cleaning & combing in staple yarn production



2. Recycling in textile materials

Recycling technology

Secondary approach case study: Recycling used clothes in staple yarn production



Key: Portal Bale Opener BO-P | Multi Functional Separator SP-MF | Universal Mixer MX-U *optionally with Universal Cleaner CL-U, stainless steel version | Card TC 19i for recycling | Integrated Draw Frame IDF 2

Trützschler's Recycling line – From Waste to Value

2. Recycling in textile materials

Recycling technology

Recycling PET bottles into filament in melt spinning process



Sadeghi et al., 2021

2. Recycling in textile materials

Recycling technology

Recycling textile waste into bio-based textile products by biotechnology

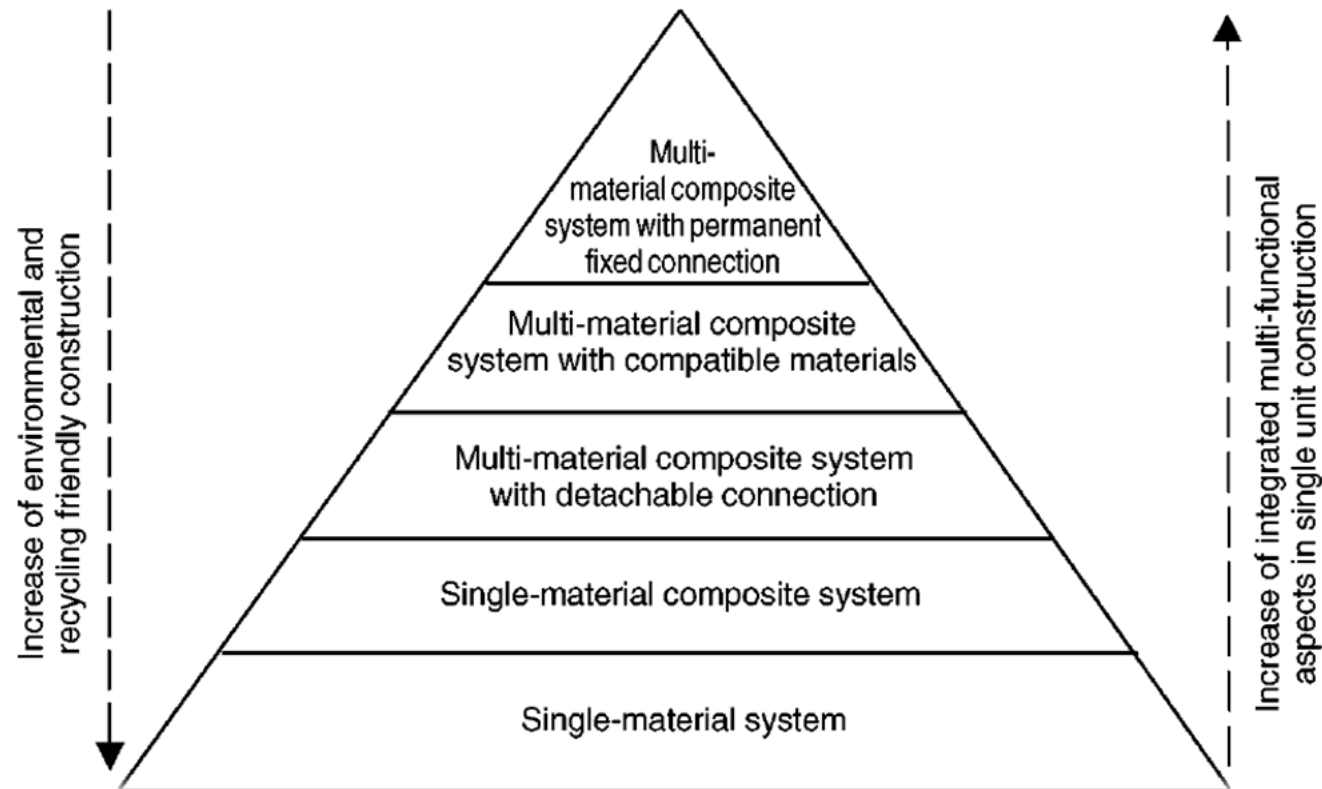


Video: [Click here](#)

<https://youtu.be/PfLQdC4VqWg>

2. Recycling in textile materials

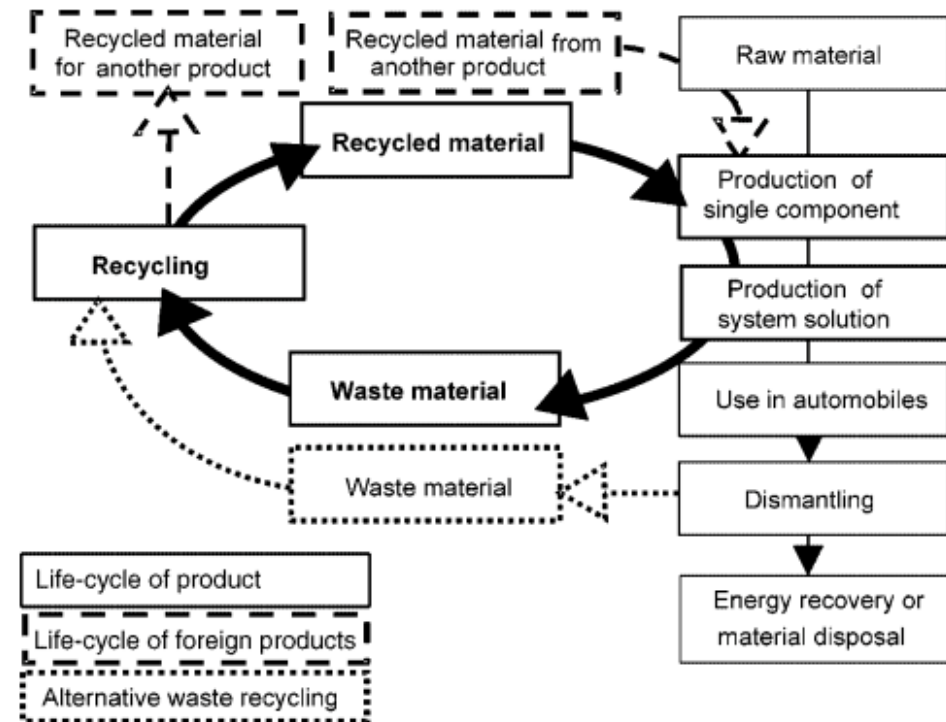
Principle of material system: recycling-friendly construction and functionality



2. Recycling in textile materials

Factors affected Recycle capacity of textile materials

- Polymer components: single
- Easy-to-separate component
- Development of material cycle



Designing textile products that are easy to recycle

3. HCMUT current status and future perspective

3.1. Current status of Ho Chi Minh City University of Technology – Dept. of Textile and Garment Engineering

a. Training

Bachelor/Engineer: 10% credits of curriculum relating to recycling in textiles (6 objects, 15-19 credits)

- Recycling in textile materials
- Eco textile products
- Environment and Sustainability Development in Textile and Clothing Industry
- Biodegradable polymer
- Textile materials recycling
- Thesis

Post-graduate:

- Eco textiles
- Thesis
- Safety and sustainable development in textiles



3. HCMUT current status and future perspective

3.1. Current status of Ho Chi Minh City University of Technology – Dept. of Textile and Garment Engineering

b. Research

- Developing new applications for agricultural wastes and by-products: natural dyeing from avocado peels, avocado seeds, coffee grounds, tea grounds, and pineapple peels.
- Recycle materials according to biological principles
- Recycle materials according to the principle of polymer processing
- Biodegradable polymers
- Improve technological processes to save raw materials and reduce waste
- Improve production management process to save raw materials and reduce waste

3. HCMUT current status and future perspective

3.1. Current status of Ho Chi Minh City University of Technology – Dept. of Textile and Garment Engineering

b. Research

Publication in textile recycling

Dat Van Truong, Song Thanh Quynh Le, Huong Mai Bui *, Development of an oil-absorbent web by the dry-laid method from polypropylene and chemically treated kapok, Research Journal of Textile and Apparel, published online 5 May, 2022, 15606074, 25158090, Scopus: Journal 2.4

Bui Mai Huong, Trinh thi Kim Hue, A study of sustainable coloration of lyocell fabrics using extracts of tropical onion skins, Vietnam Journal of Science and Technology, Vol.57 No.3A, 69-76, 2019.

Bui Mai Huong, Trinh thi Kim Hue, ANTIBACTERIAL FINISHING ON COTTON 100% AND CVC FABRICS WITH TANNIN FROM PIPER BETLE EXTRACT, Vietnam JOURNAL OF SCIENCE AND TECHNOLOGY, 57 (6), 693-702, 2019.

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b. Research

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Bùi Mai Hương, Trịnh thị Kim Huệ, Applying bi-functional dyeing and UV protection on protein textile materials with waste from used teabags and mangosteen hulls, Journal of Science and Technology, Volume 55, Number 1B, 91-98, 2017

3. HCMUT current status and future perspective

3.1. Current status of Ho Chi Minh City University of Technology – Dept. of Textile and Garment Engineering

c. Social activities to raise awareness and action on recycling, energy saving and waste reduction

- Participate in contests to raise awareness about material recycling and energy saving organized by associations and companies (Woolmark, Puma, Adidas)



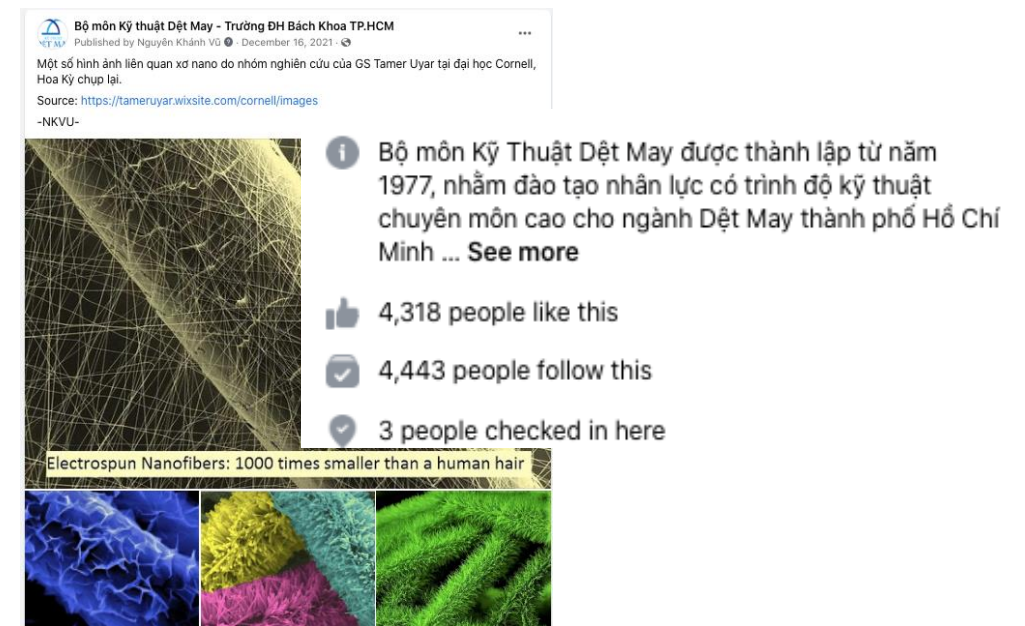
: Adidas Future Creator – Topic: Recycling in Textile materials: 2 winner teams from Dept. of Textile and Garment Engineering - HCMUT

3. HCMUT current status and future perspective

3.1. Current status of Ho Chi Minh City University of Technology – Dept. of Textile and Garment Engineering

c. Social activities to raise awareness and action on recycling, energy saving and waste reduction

- Guide students to participate in start-up activities, organizations related to energy saving, recycling materials
- Actively organize contests for students on saving and recycling materials, reducing environmental waste
- Develop a Department page on social media to express information relating to sustainable development.



3. HCMUT current status and future perspective

3.2. Future perspective

- Promote research into recycling textile materials used for medical, technical and environmentally friendly purposes in the direction of microbiology.
- Promote recycling practices associated with businesses
- Disseminate recycling through the Department's information channels to the public

Reference

- [1] Youjiang Wang, *Recycling in textile*, the Textile Institute, Woodhead publishing limited, Cambridge England, 2006.
- [2] Marion I. Tobler-Rohr, *Handbook of sustainable textile production*, Woodhead publishing limited, Cambridge England, 2011.
- [3] Richard Horrocks, *Recycling Textile and Plastic Waste*, Woodhead publishing limited, Cambridge England, 1996.
- [4] Subramanian Senthilkannan Muthu, *Textiles and Clothing Sustainability : Recycled and Upcycled Textiles and Fashion*, Springer Science+Business Media Singapore 2017.

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