Department of Science and Technology
PHILIPPINE TEXTILE RESEARCH INSTITUTE

SusTELAbility

JULIUS L. LEAÑO JR. Ph.D.
Director

2025 National Textile Convention
TelaCon
Weaving Circularity

PHILIPPINE TROPICAL FABRICS MONTH

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A boundary for us to satisfy our current needs without anyway compromising the quality of environment / ecosystem so that it remains equally capable of supporting the future generations, too.

Encyclopedia of Food Security and Sustainability, 2019

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Sustainability

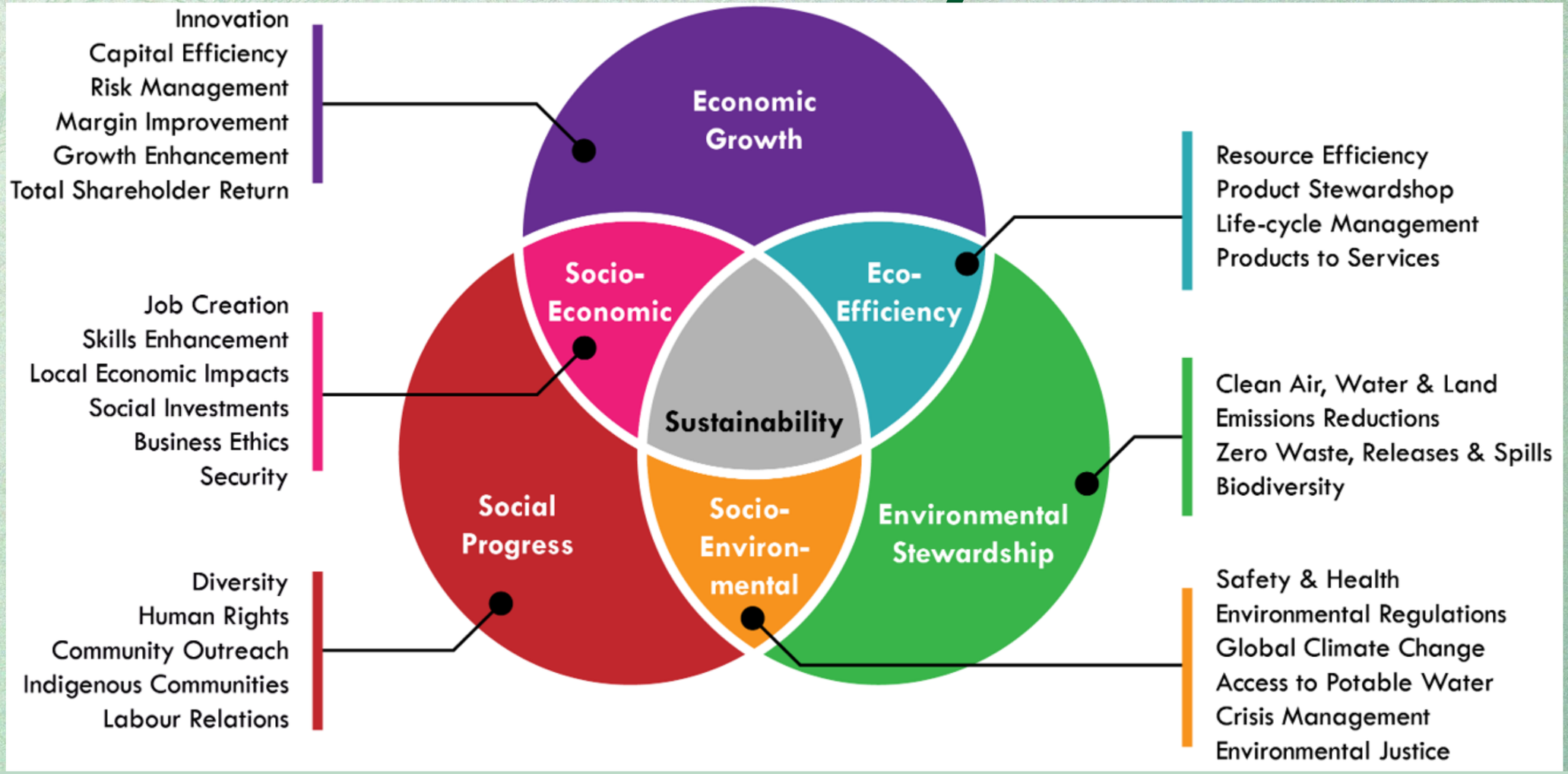
"Meeting the needs of the present without compromising the ability of future generations to meet their own needs"

United Nations Brundtland Commission, 1987

"*To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in **productive harmony** to support present and future generations*."

United States Environment Protection Agency (US EPA)

Pillars of Sustainability



Circular Economy

"The circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended."

United Nations Brundtland Commission, 1987

EU Parliament Tools for circularity:

1. Extending the life cycle of products.
2. Minimizing waste.
3. Creating further value.

Environmental Costs of Textiles

Producing 1 kg of cotton emits more than

7 kgs

of **carbon dioxide** - equivalent to driving for 11.3 kilometers.

Over

2,650 liters

of **water** (enough to fill 22 bathtubs) bathtubs) are used to manufacture ONE cotton T-shirt.

According to the World Bank

17-20%

of **industrial water pollution** is due to textile dyeing and treatment.

160 grams

of **pesticides and herbicides** are used to grow the cotton used in just ONE T-shirt.

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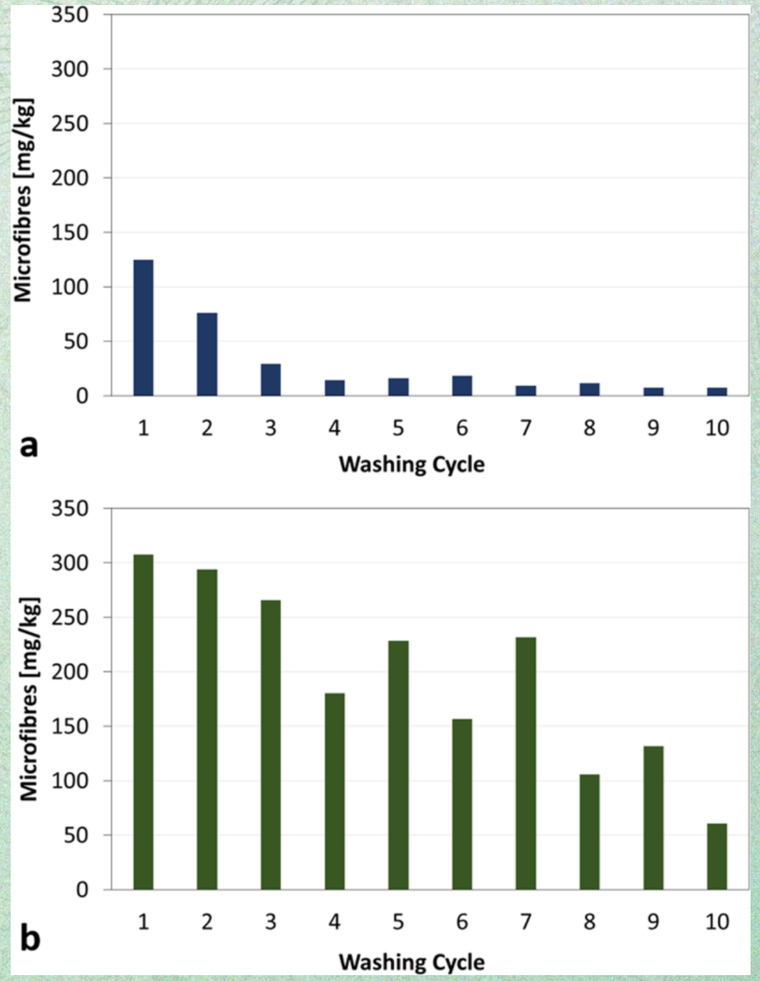
Environmental Costs of Textiles

Total amount of microfibres released during 10 washing cycles from: (a) BT and (b) GT.

BT- 100% Polyester T-shirt

GT- 100% Polyester Blouse with 65% recycled PET



De Falco., et.al., Nature, 2019

International Union for the Conservation of Nature, 2019

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There are enough clothes on the planet right now to dress the next six generations of the human race.

@savetheplanetsociety

TEXTILE PRODUCTION

Global textile fibre production has almost doubled:

from **58** **million tonnes** in 2000

to **109** **million tonnes** in 2020

and is projected to grow to **145** **million tonnes** by 2030

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Textile Market Size by the Numbers

CAGR 5.4%

US$ 1.79 T is the global textile market worth in 2021, accounting for 1.6% of the world's GDP.

- **The Asia–Pacific Region holds one of the top largest market share for textiles at about 392 B US$ in 2024**
- Consumer spending on clothing and footwear in **Asia** surged to **US$ 756.84 B in 2021**, marking an **18%** increase from 2020's US$ 647.26 B

MEDIUM: Asia's Textile Manufacturing Industry: Size, Share, and Growth (2024–2029)

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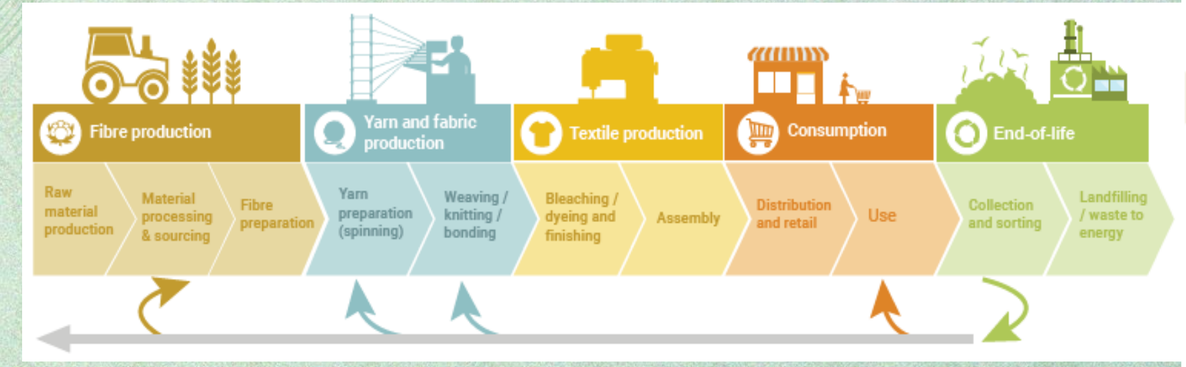
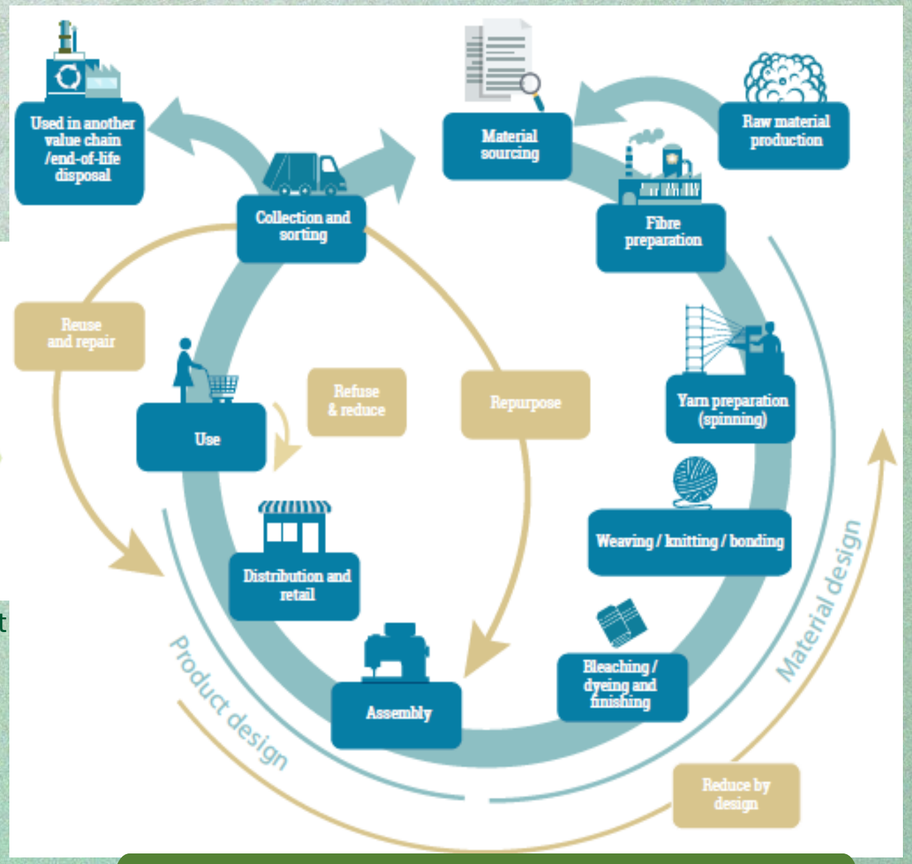
Textile Value Chain: Linear vs. Circular



United Nations Environment Programme, 2020



LINEAR

CIRCULAR

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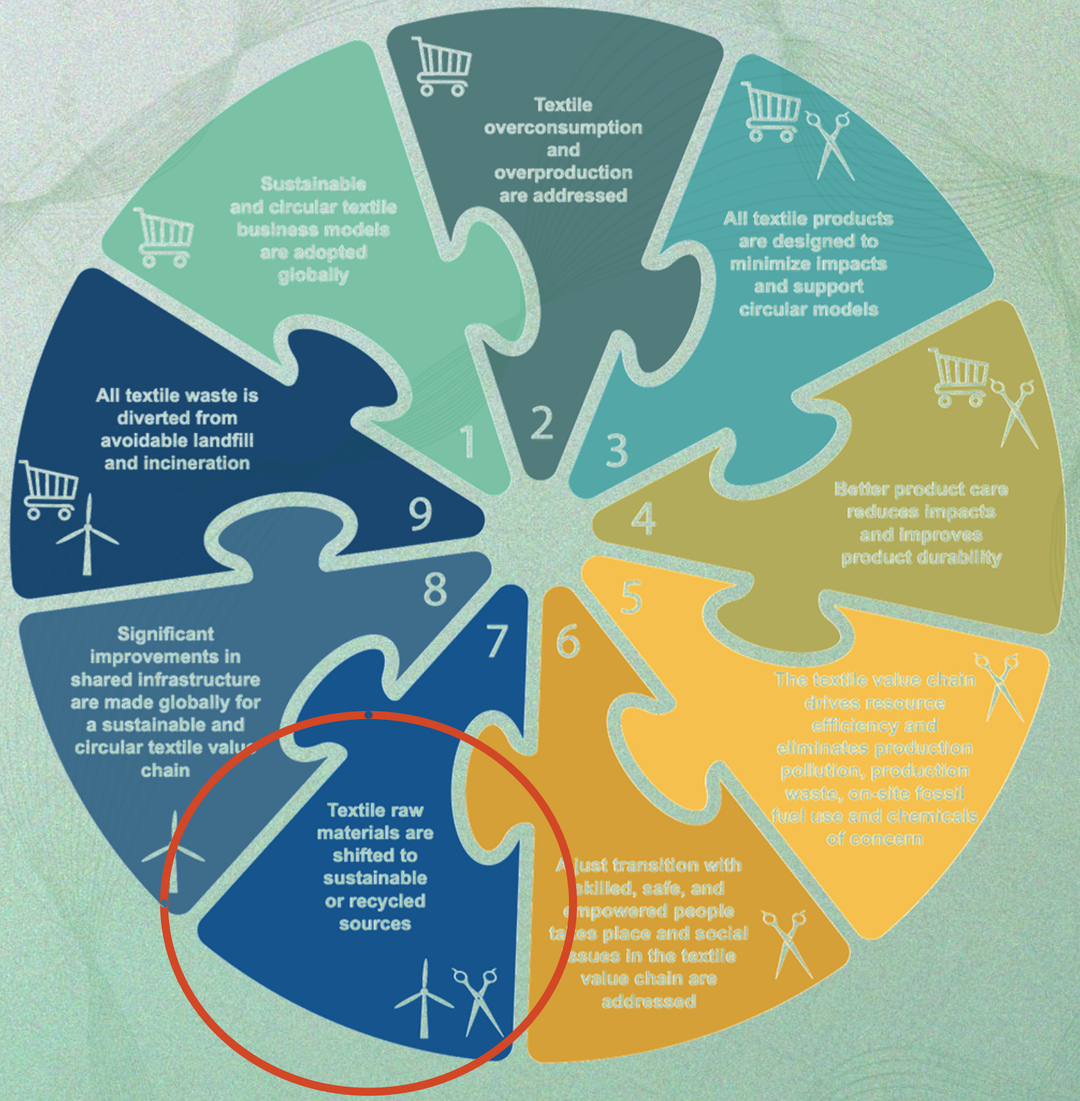
NINE BUILDING BLOCKS TO DELIVER INDUSTRY GOALS

1. Sustainable and circular textile business models are adopted globally
2. Textile overconsumption and overproduction are addressed
3. All textile products are designed to minimize impacts and support circular models
4. Better product care reduces impacts and improves product durability
5. The textile value chain drives resource efficiency and eliminates production pollution, production waste, on-site fossil fuel use and chemicals of concern
6. A just transition with skilled, safe, and empowered people takes place and social issues in the textile value chain are addressed
7. Textile raw materials are shifted to sustainable or recycled sources
8. Significant improvements in shared infrastructure are made globally for a sustainable and circular textile value chain
9. All textile waste is diverted from avoidable landfill and incineration



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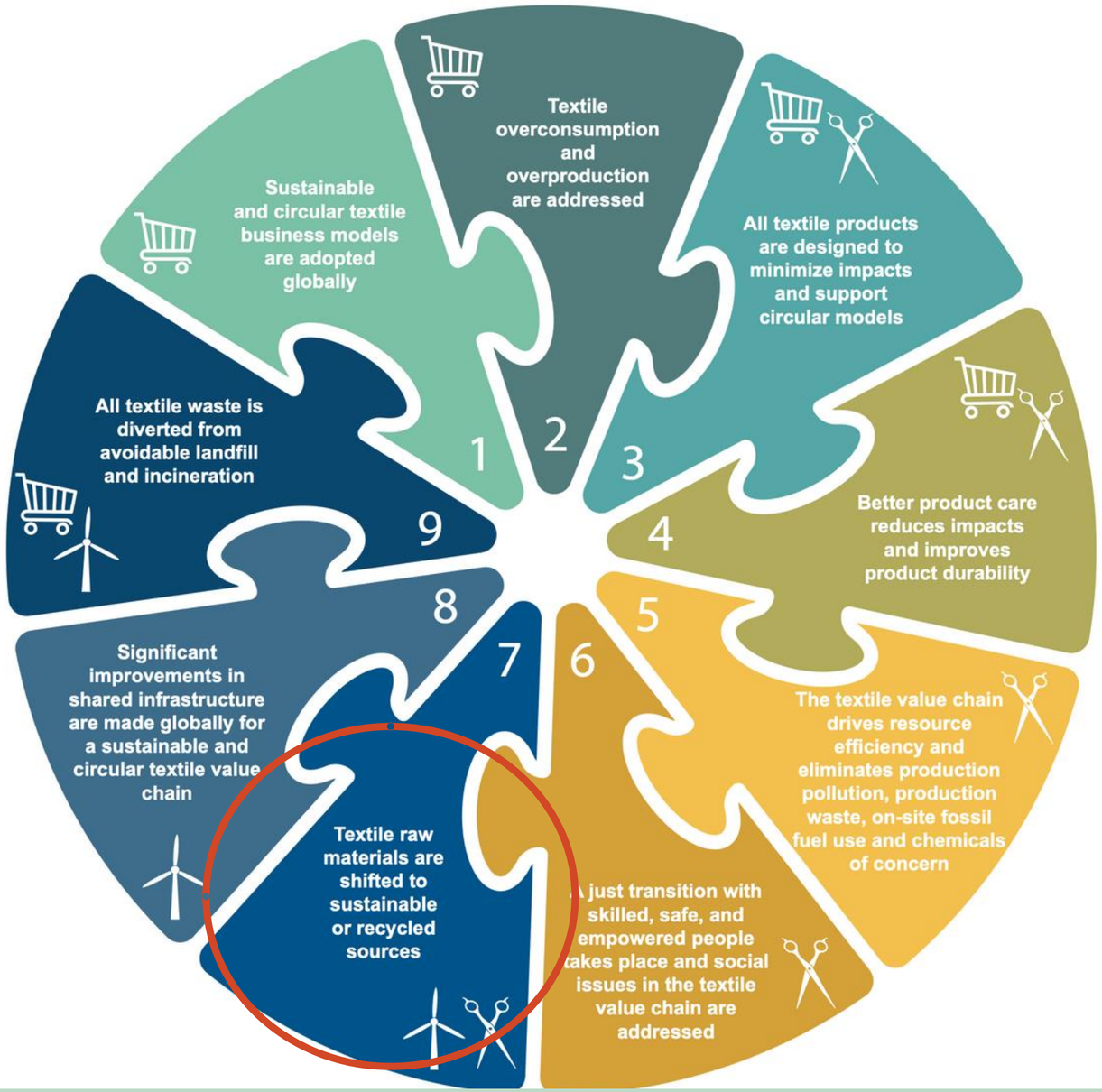
UNEP Sustainability and Circularity in the Textile Value Chain: A Global Roadmap

INDUSTRY GOALS:

Shifting Consumer Patterns

Improved Practices

Infrastructure Investment



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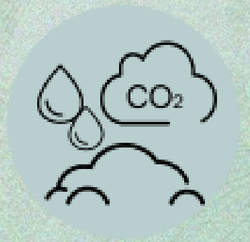
Global Textile Regulation and Policies Related to Circular Economy

European Union (EU) Textile Clothing Consumption

Each person in the EU contributes to the staggering **11.3 kg** of textile waste annually, culminating in a total of 5.8 million tonnes discarded each year.

Less than **1 %** of the material used around the world for clothing is recycled into new clothing



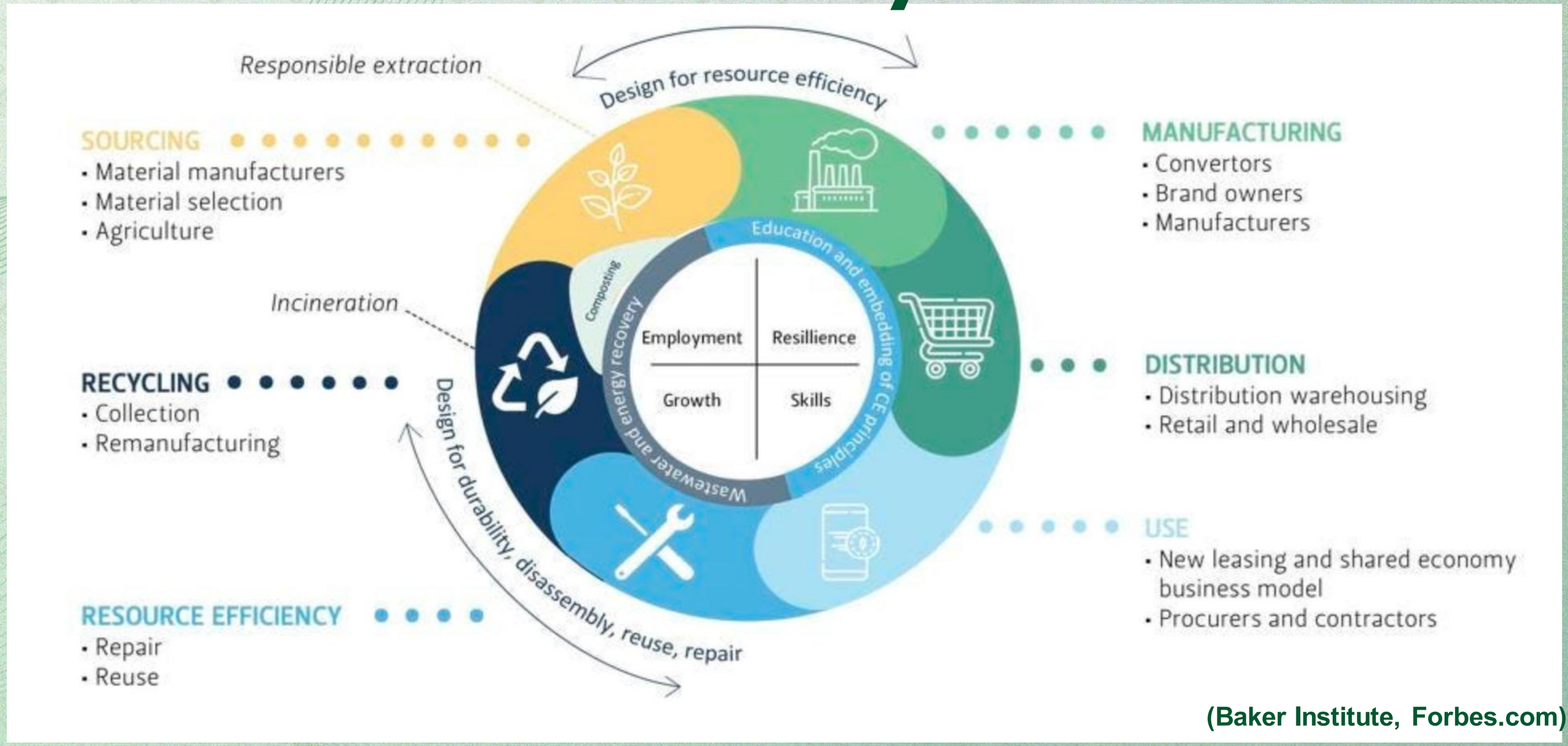
Every garment in the fashion industry adds to CO2 emissions and water use, fueling climate change and soil erosion.

The textile and clothing sector employs around **1.5 million** people in Europe, fostering local employment and business growth.

The EU formally adopted the first three (3) proposals that now await implementation:

1. **Ecodesign for Sustainable Products Regulation (ESPR)**
2. **Corporate Sustainability Due Diligence Directive (CSDD)**
3. **Packaging and Packaging Waste Directive (PPWD)**

Circular Economy Framework



(Baker Institute, Forbes.com)

836

Enterprises

PSA-ASPBI

P38.5 B

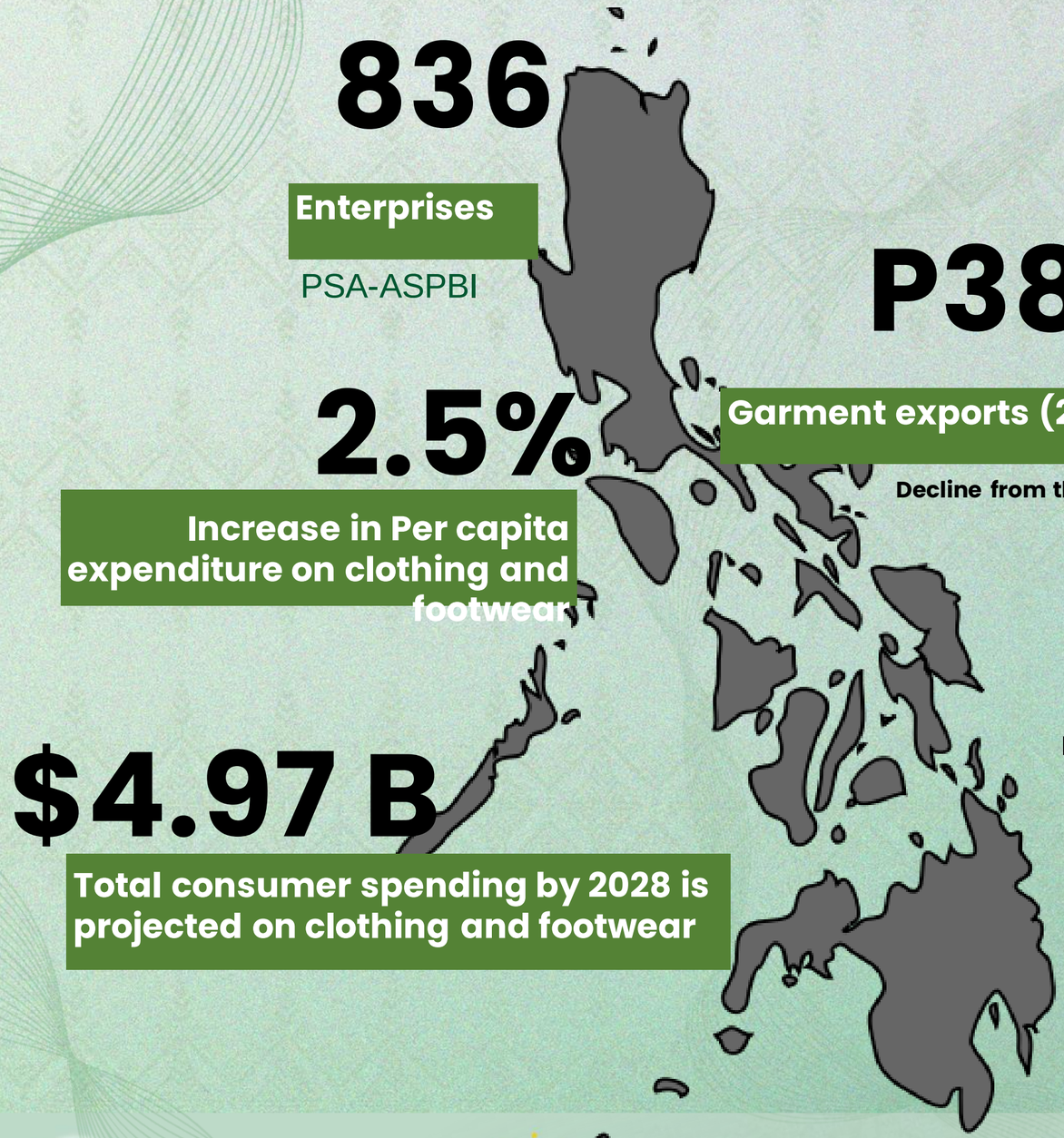
Garment exports (2023)

14%

Decline from the P 44.69 Billion worth on 2022

2.5%

Increase in Per capita expenditure on clothing and footwear



$4.97 B

Total consumer spending by 2028 is projected on clothing and footwear

1.1 Million

Jobs as of 2019

https://www.statista.com/statistics/758359/textile-manufacturing-value-added-philippines/

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NINETEENTH CONGRESS OF THE)
REPUBLIC OF THE PHILIPPINES)
Second Regular Session)

Senate
Office of the Secretary

23 AUG -9 P1 :35

RECEIVED BY:

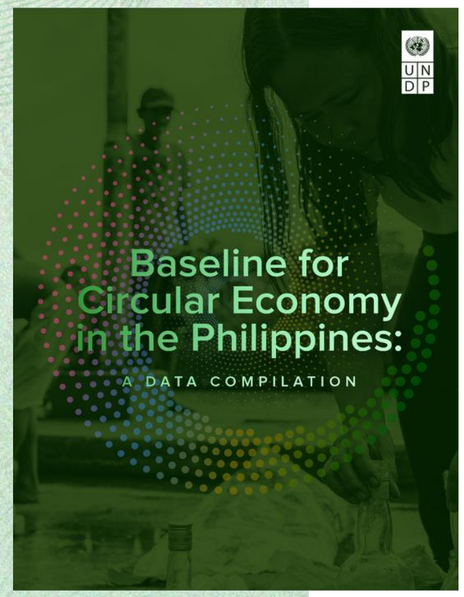
SENATE
P.S. Res. No. 731

Introduced by Senator Maria Lourdes Nancy S. Binay

RESOLUTION
DIRECTING THE APPROPRIATE SENATE COMMITTEES TO CONDUCT A FULL ASSESSMENT, IN AID OF LEGISLATION, OF THE CURRENT SITUATION OF PHILIPPINE TEXTILE AND GARMENTS INDUSTRY

WHEREAS, the Philippine Textile-Garment Industry Roadmap was launched in December 2019. The roadmap envisions a sustainable, competitive and integrated Philippine textile-garment industry that generates inclusive growth;

The Philippine Circular Economy Baseline Framework



ASEAN FRAMEWORK FOR CE

RA 9003

NDC

PAP4SCP

NPOA-PRMML

RA 9729

RA 9275

PDP 2023-2028

Governance and Infrastructure

- Capacity Building
- Public Awareness and Education

Envrionment

- Greening Daily Processes
- Resource Efficiency & Waste Management

Business and Technology

- Sustainable Consumption and Production
- Material Flow and Behavior Change: Closing the Loop

MONITORING AND EVALUATION

Immediate — Medium — Long Term

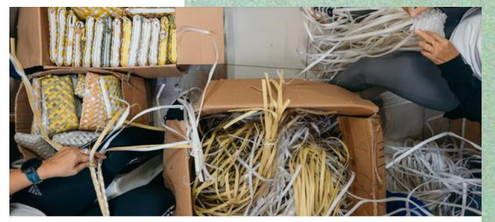


Photo: Jiwan Tiu/UNDP Philippines

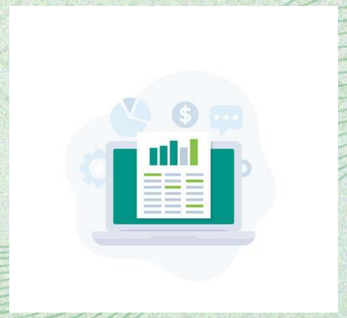
Table 1. List of National Government Agencies Consulted

National Government Agencies	Date Coordinated
Department of Environment Natural Resources-Environment Management Bureau (DENR-EMB) – Pollution Adjudication Board	23 January 2023
Department of Environment Natural Resources – Climate Change Service (DENR-CCS)	23 January 2023
Department of Environment Natural Resources – Knowledge and Information System Service (DENR-KISS)	23 January 2023
DENR-EMB – Solid Waste Management Division	23 January 2023
Department of Trade and Industry (DTI)	7 February 2023
Commission on Higher Education (CHED)	16 February 2023
Philippine Statistics Authority (PSA)	22 February 2023
National Economic and Development Authority (NEDA)	3 March 2023
Department of Science and Technology (DOST) – Industrial Technology Development Institute	23 May 2023

- **Further deduplication.** For example, indicators on CO2 emissions and CO2 emissions reduction were removed as information on these indicators can already be covered by baseline data on greenhouse gas emissions and greenhouse gas reduction.
- **Inclusion of indicators beyond the scope of NPOA ML.** Indicators beyond the NPOA ML, such as ecolabel holders, use of packaging waste articulated to extended producer responsibility, and percentage of urban wastewater treated/total wastewater generated were added.

(UNDP Philippines, 2024)

The Philippine Textile Circular Economy Framework



Data Gathering and Analytics

Policy Review and Benchmarking

International CE Frameworks and Roadmaps

Governance

Policy
Infrastructure
Financial Investment

Education and Technology

Awareness
Research and Development
Innovation

Industry and Business Development

System transition/improvement
Compliance policies
Marketing and Promotions

Planning - Implementation - Monitoring - Evaluation - Improvement

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Science, Technology, Innovation Intervention

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Philippine Tropical (Textile) Fiber

A DOST-PTRI Patented Technology

Fiber source

Leaf
Psuedostem
Stem

Raw Fiber

Handstripped
Decorticated
Retted

Treated Fiber

(Spinnable Fiber)
PTRI Technology

Yarns

Blended with cotton fibers

Fabric

Woven
Knitted

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Bakong

Hanguana malayana

Raw Bakong fiber

Fiber Treatment

Mechanical

Blending

Drawing

Roving

Yarn

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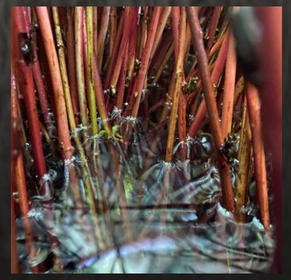
Saluyot

Corchorus olitorius



Raw Bakong fiber

Fiber Treatment

Blending

Drawing

Roving

Yarn

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Water Hyacinth

Eichhornia crassipes (Mart) Solms

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SED PILIPIN

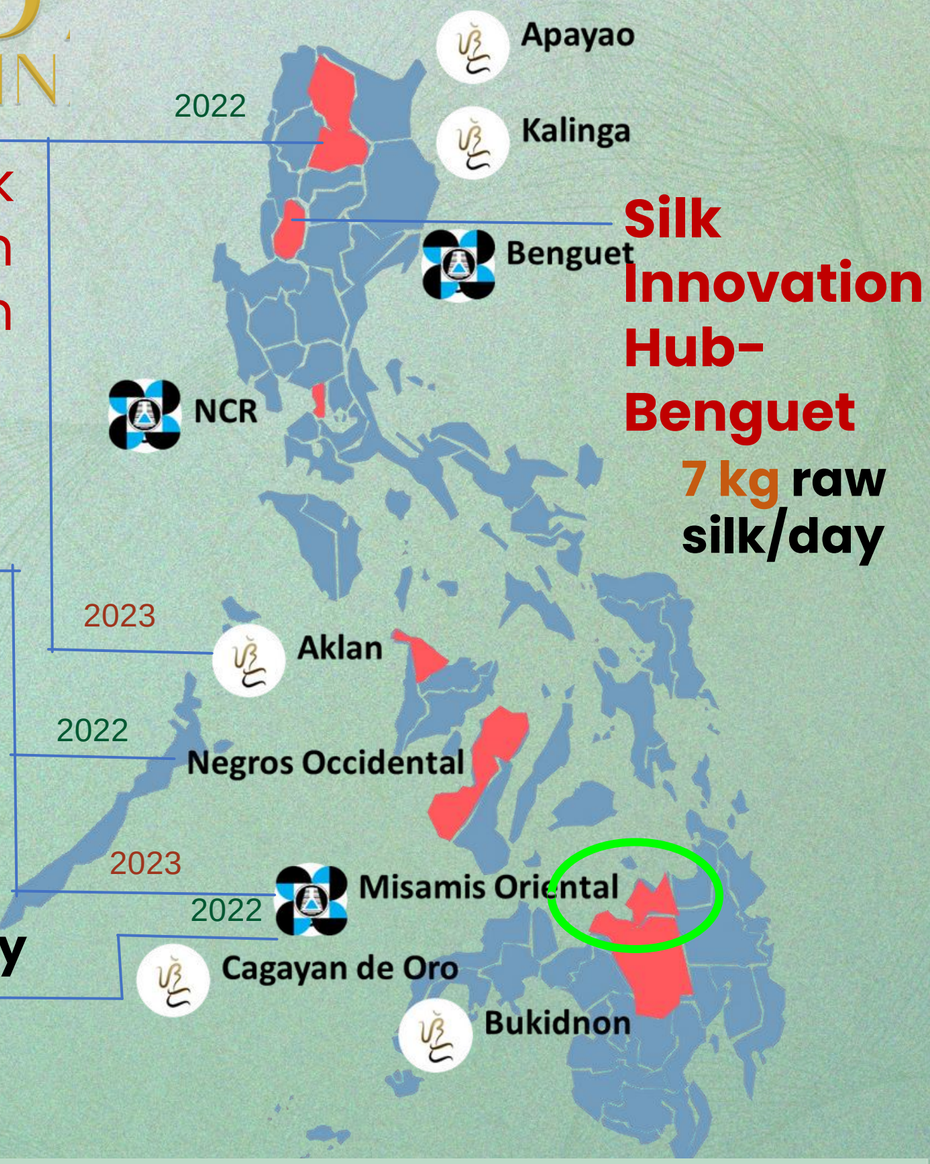
Silk Innovation Hub-Kalinga
30 kg dried cocoons/day
7 kg raw silk/day

Silk Innovation Hub -Negros
20 kg thrown silk/day

Silk Research & Innovation Center – Misamis Oriental
30 kg dried cocoons/day

Silk Innovation Hub-Aklan
7 kg raw silk/day

7 kg raw silk/day



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Philippine NatDyes Hubs™

FRONTIER: Fostering the Revitalization of Nascent Textile Innovation Ecosystems in the Regions Program

Four (4) partnership (Academe, ROs, private enterprise)

88 personnel trained
(Capacity-building)

200m of NatDyed fabric produced

25 Local Weavers
(Indirect employment)

Nine (9) Public Engagements
(Local and Abroad)

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NNS Nonwovens

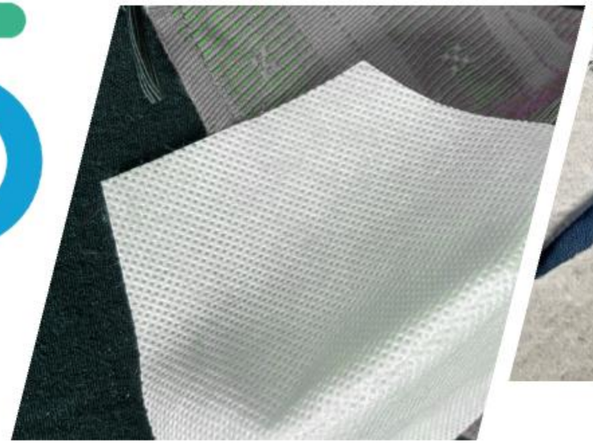
Diversification of Philippine Textiles Through Nonwoven Innovations

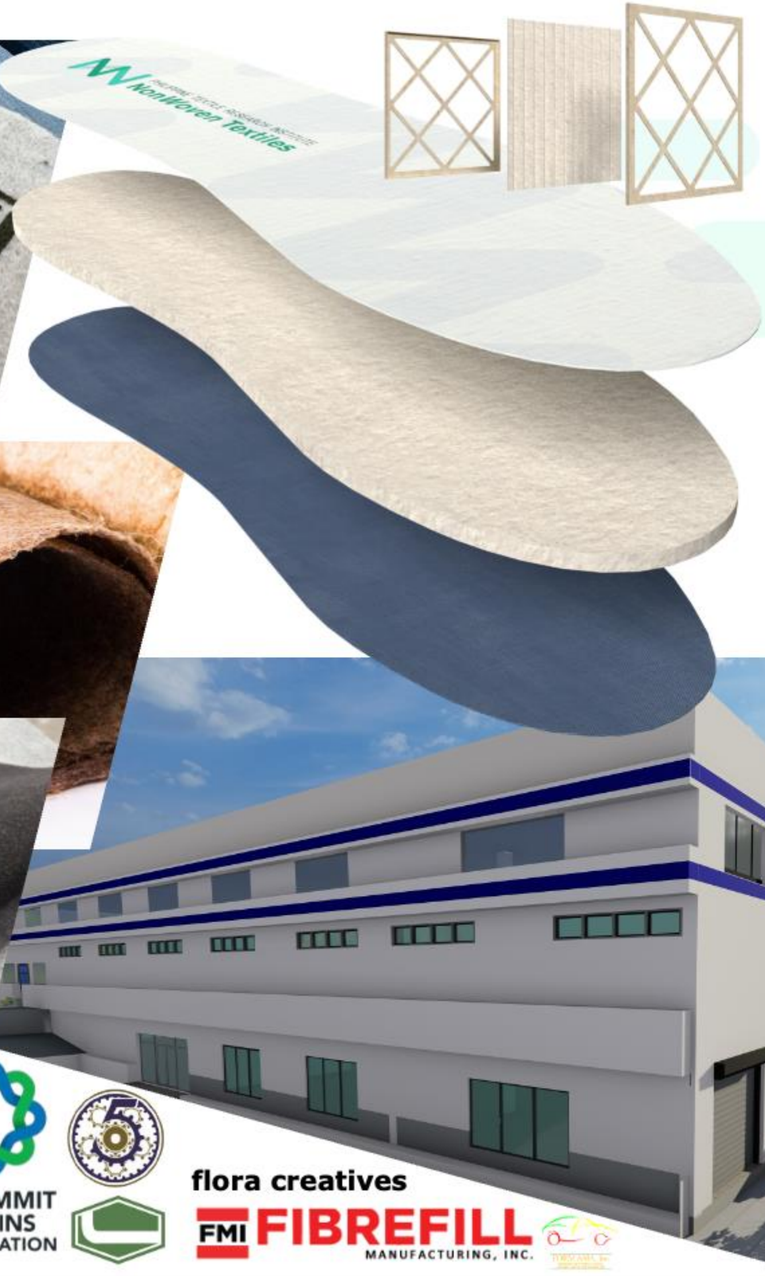
500 **Meters of Nonwoven** (Pineapple, Abaca, Bamboo, and Banana)

1K+ **Pairs of footwear sold**

1st **Heat Flow Analyzer and Acoustic Absorption Analyzer in the country**

25 **Alternative leather accessories**





JG SUMMIT OLEFINS CORPORATION

flora creatives

FMI FIBREFILL MANUFACTURING, INC.

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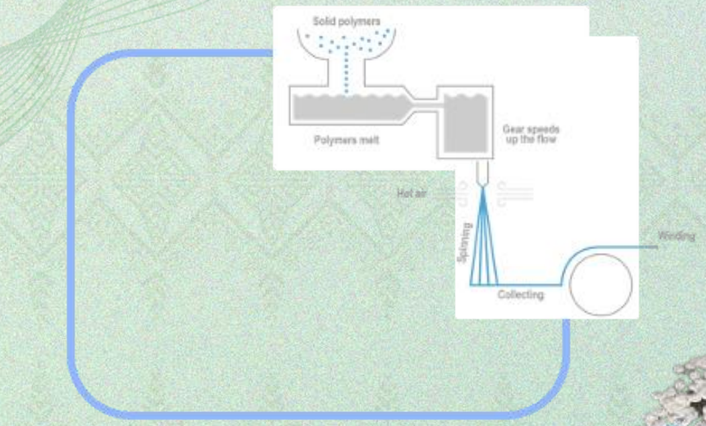
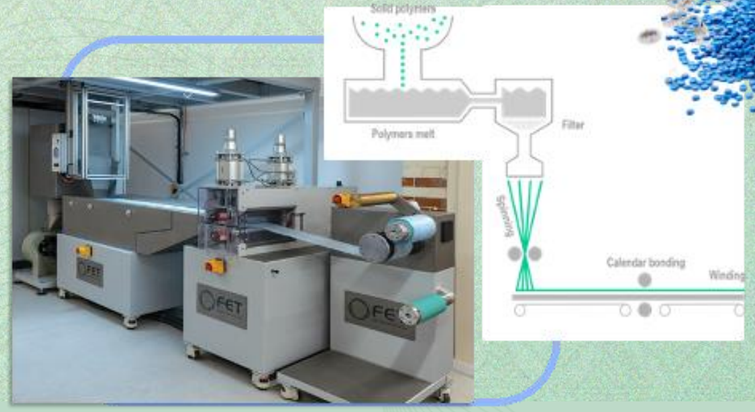
Program Framework

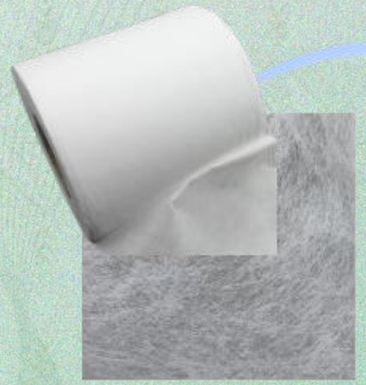
SUSTAINABLE MELTBLOWN AND SPUNBONDED NONWOVEN TEXTILES

1 MELTBLOWN & SPUNBOND NONWOVEN TEXTILE ASSEMBLY





2 MELTBLOWN & SPUNBOND NONWOVEN TEXTILES



3 MELTBLOWN PRODUCT DEVELOPMENT & TESTING

SPUNBOND AGRO- & GEOTEXTILE DEVELOPMENT & TESTING

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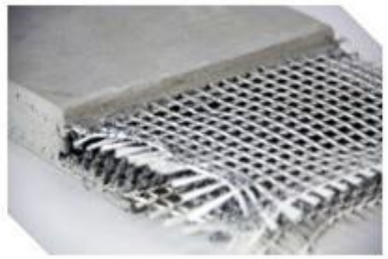
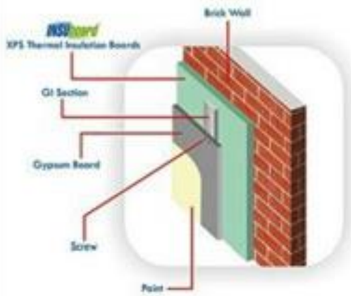
Natural Textiles in Structural and Civil Works

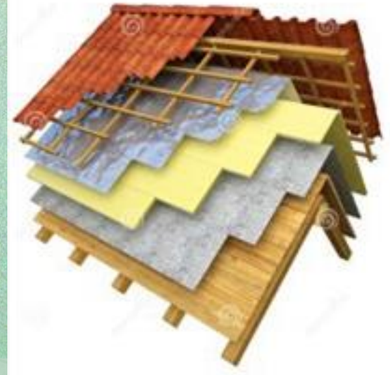
CoBUILDTex

Constructions and **B**uildings **U**sing **I**ndigenous **L**ocally-**D**evelopmed **Natural Textiles:** *Natural Textile Fiber-based Innovations for Green and Smart Structural Applications*





FREEFORM STRUCTURES
- Free-Form
- Lightweight
- Prefabricated



SMART INTERIOR INSTALLATIONS
- Acoustic absorption
- Thermal insulation
- Lighting diffusion
- Electromagnetic shielding

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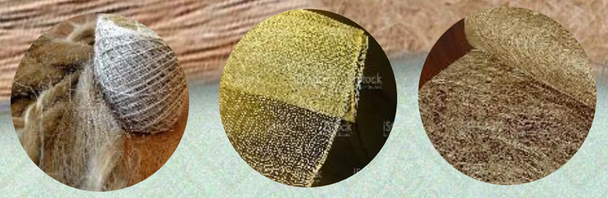
Natural Textile Fibers

Agricultural By-products

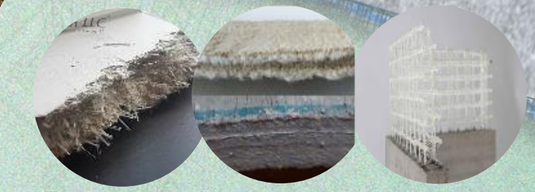
Bamboo, Banana, Abaca, etc
Good mechanical properties at lower cost!

Reinforcement Forms



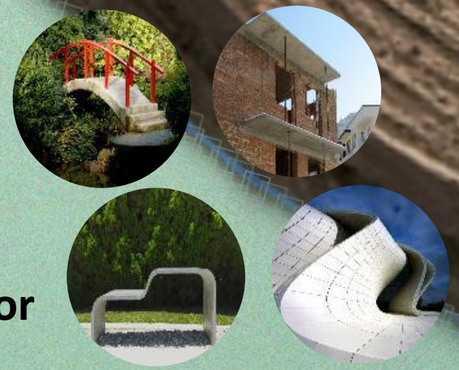
Grids, Nonwovens, Treated Fibers as Reinforcements

Cementitious Composites



Optimize Cementitious material; prevent fiber degradation through pozzolanic materials

Freeform and Flat-Panel Prefabs



Bridges, Balconies, Freeform Roofing, Outdoor Furniture

CoBUILDTex

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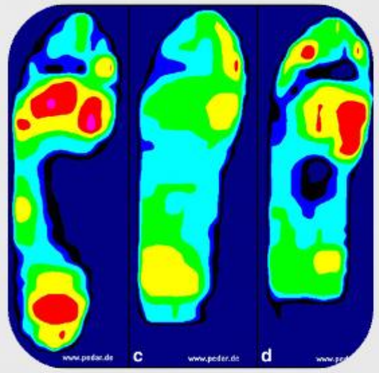
SAFATOs



10 Industry and Academe Partners

50 Pairs of footwear using Banana, Bamboo, Abaca, Pineapple

1st In-shoe pressure dynamic tester in the country

10 Manufacturers scoped from Marikina, Laguna, Cebu, and Davao

Philippine Footwear Federation, Inc.

REDEYES FOOTWEAR Solutions

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BAGONG PILIPINAS

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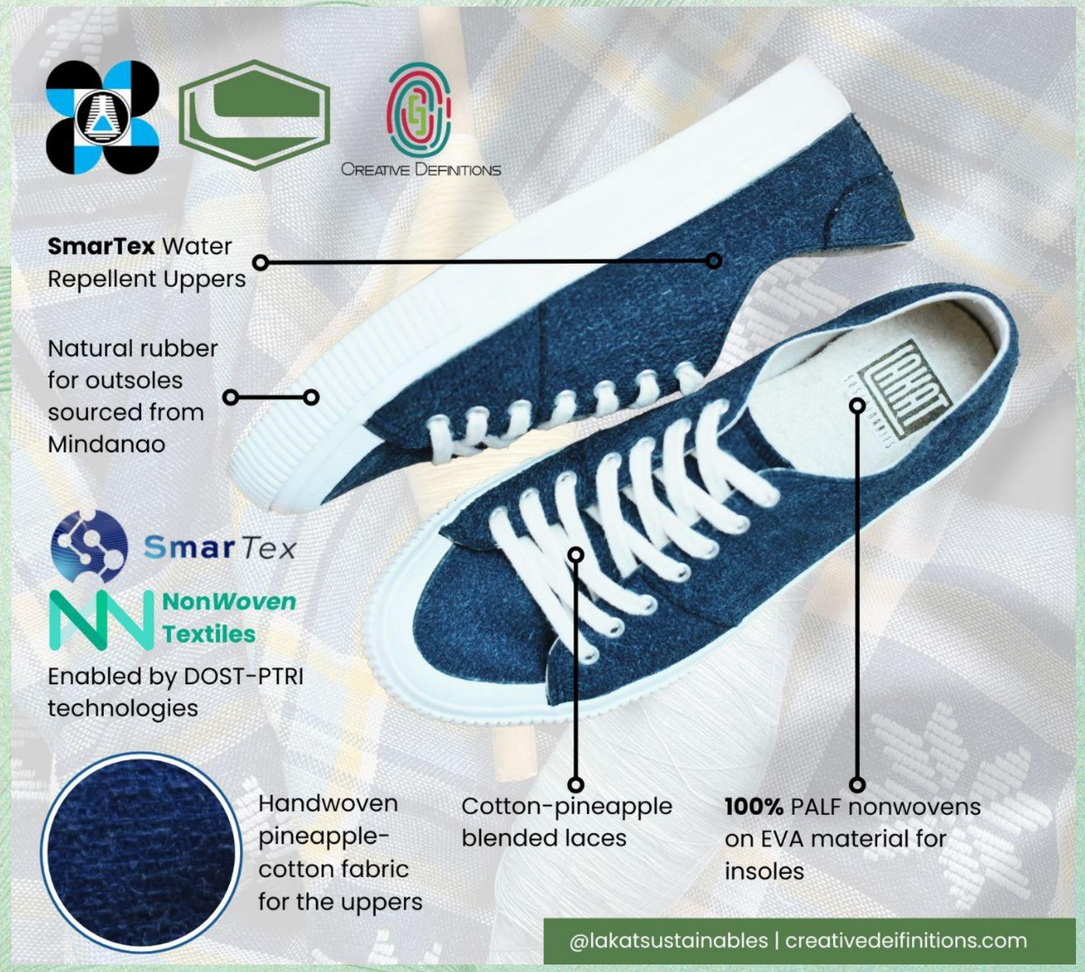

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Life Cycle Assessment

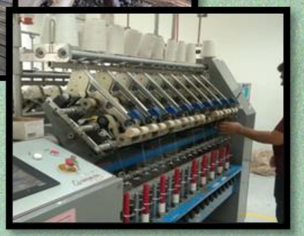
Life Cycle Assessment (LCA)

Raw materials

Manufacturing

Disposal

Packaging



Water Footprint

CO² FOOTPRINT

ECOTOXIC

TOXIC INJURY

Use

Distribution

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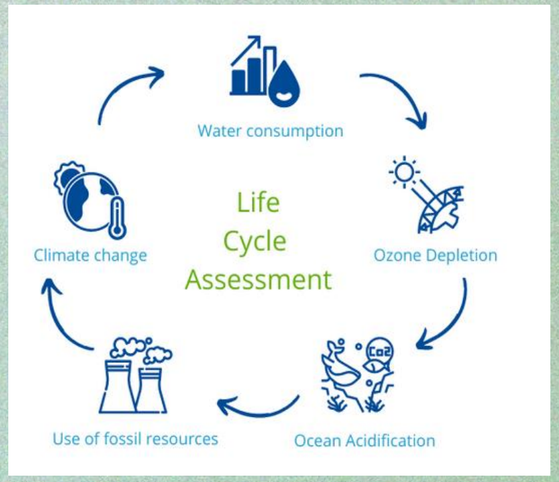
Textile LCA

ISO 14040:2006



Energy

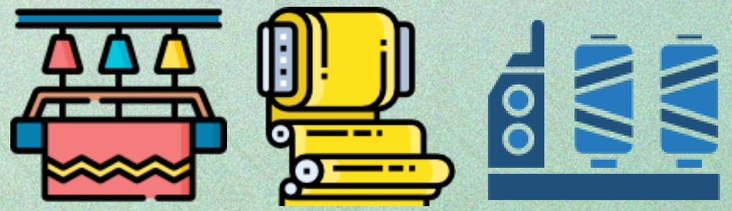
Water

Chemicals

Materials

Raw Materials

Yarn Production



Textile Production

Textile Products

Products

Emission/Waste

By-products

Characterization

Consumption Behavior

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CRADLE: SUSTAINABLE MATERIAL SOLUTION FROM POST-INDUSTRIAL TEXTILE WASTES

TEXREV
Empowering creativity thru sustainability

Textile Upcycling

To develop a mechanical textile technology that will upcycle post-industrial textiles into innovative textile materials.

MATERIALS

Post-Industrial Textile Wastes

BAYO Manila Foundation Inc.
Taytay, Rizal

Sorting by type and color, cutting into strips

TEXTILE DISINTEGRATION

Reclaimed Fibers

TESTINGS AND EVALUATION
- Morphology (SEM)
- Fiber length
- Total Neps Count
- Total Neps Mean size
- Upper quartile length
- Short fiber content
- Fineness

YARN SPINNING

Opening, Blending, Carding, Drawing Roving, Spinning

FINISHING

- Singeing, Mercerization, Singeing-Mercerization
- Smart Finishing

PERFORMANCE TESTING

- Physical Properties Testing
- Functional Textile Testing

PRODUCT DEVELOPMENT

- Product/Process Assessment
- Cost Analysis

PHYSICAL PROPERTIES TESTING
- Breaking Strength and Elongation
- Tensile Strength
- Abrasion Resistance
- Pilling Resistance
- Yarn Counts
- Twists in Yarns
- Yarn Evenness
- Yarn Faults

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TEXREV

Empowering creativity thru sustainability

CRADLE-TexRev Project with BAYO
on Upcycling of Post-Industrial Textile Waste

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TEXREV

Empowering creativity thru sustainability

PAMAHALAANG BAYAN NG TAYTAY
REPUBLIKA NG PILIPINAS
LALAWIGAN NG RIZAL

Memorandum of Understanding
on Textile Upcycling and Other Garments/ Textile Interventions

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Inclusive Textile Upcycling Program

24M learners (2024-2025)

36M PET bottles recycled

1kg of PET bottles = 0.6kg yarn = 1 set school uniform

Potential Market for (non-recycled PET) school uniforms: **PhP 36B**

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FIBRECYCL: Facilitating Innovative Bottle Recycling for Eco-friendly Conversion into Yarn for Closed-Loop Production

1. Materials Recovery

Collection

Sorting

Baling

2. Technology Verification
(bottle-to-yarn)

PET Flakes

Melting & spinning

Testing & evaluation

3. Textile Transformation

Weaving

Finishing

Cut & Sew

4. Product Distribution

LGU | DOST-PTRI | Industry & community partners

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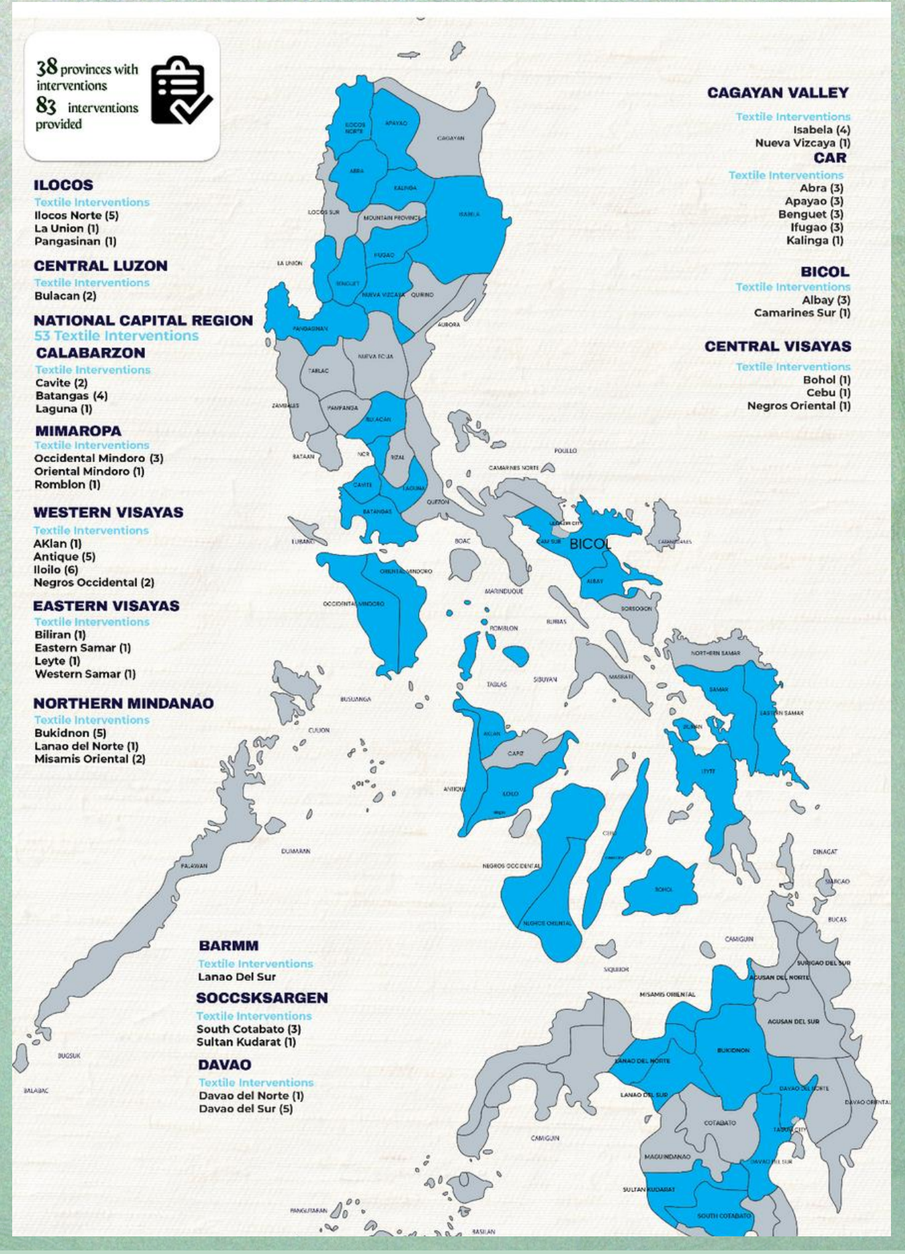
FRONTIER

Fostering the Revitalization of Nascent Textile Innovation Ecosystems in the Regions Program

94%
16 of the 17 Regions

54%
46 of the 85 Provinces*

with Textile Engagement



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Department of Science and Technology
PHILIPPINE TEXTILE RESEARCH INSTITUTE

SusTELAbility

JULIUS L. LEAÑO JR. Ph.D.
Director

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