Modular Course B: Creative Design in shoe Industry

Unit B – CREATIVE DESIGN

Lecture LB3.2 – Circular Design in F&L Goods: approaches and best practices

Co-funded by the Erasmus+ Programme of the European Union

DISHOLEA | Improving the digital skills of workforce in Shoe and Leather goods Industry in Jordan and Palestine | GA 101129194

T2.2 – Development of modular courses and training material.

D2.2 – Modular Course in Creative Design

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Introduction to Circular Design

- Circular design integrates sustainability into the earliest stages of product development.
- Goal: keep materials and products in use for as long as possible.
- Moves away from the linear “take-make-dispose” model.
- Applications in footwear & leather goods:
  - use of sustainable and innovative materials,
  - design for repair and disassembly,
  - circular business models (leasing, take-back, subscription).

Linear vs Circular Economy in Footwear & Leather Goods

Adapted from European Parliament Research Service

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  - design for repair and disassembly,
  - circular business models (leasing, take-back, subscription).
- Delivers environmental, social, and economic benefits.

Principles of Circular Design

Design out waste & pollution

Prevent negative impacts from the start

Keep products & materials in use

Use the R-Strategies

Regenerate natural systems

Support biodiversity, use renewable materials

Design for longevity

Focus on durable, repairable, and high-quality products with extended lifespans

Design for disassembly

Products easy to take apart, recycle, or refurbish

Transparency & communication

Inform users about sustainability impacts

Common R-Strategies in Circular Economy

R	Name / Strategy	Meaning / Role
Refuse	Don’t accept harmful or unnecessary materials or products	Avoid production or use of items that don’t align with sustainability goals
Rethink	Reconsider how things are made or used	Innovate alternative designs, models, or systems from the ground up
Reduce	Minimize resource and material use	Design lighter, efficient, use fewer inputs
Reuse	Use a product again for the same purpose	Extend life by multiple uses / second-hand / sharing
Repair / Maintain	Fix what is broken or worn	Allow products to stay in use rather than discarding
Refurbish / Remanufacture	Restore / rebuild / upgrade to nearly new condition	Bring used items back to high-functionality

Circular Design in F&L Goo

Application of circular principles to footwear & leather goods:

- **Design for durability** – higher quality stitching, stronger outsoles, long-lasting leather alternatives.
- **Design for repair** – replaceable soles, modular components, easy stitching.
- **Design for disassembly** – snap-fit fastenings, reduced adhesives, standardized components.
- **Use of sustainable materials** – recycled PET, organic cotton, Piñatex®, mycelium leather, algae foams.

- Goal: extend product lifespan, reduce virgin material demand, minimize waste.
- Outcome: more resilient, transparent, and eco-conscious F&L sector.

Design for Durability & Repairability

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Durability:

- Use of high-quality materials (e.g. robust outsoles, strong stitching, leather).
- Construction methods that extend lifespan (Goodyear welt, reinforced seams).
- Long-lasting alternatives to conventional leather.

Repairability:

- Modular designs with replaceable soles, insoles, and laces.
- Accessible fastening methods (snaps, screws) instead of permanent glues.
- Repair services & guidance (in-store repairs, repair kits, tutorials).

Benefits: reduce waste, lower costs

Design for Disassembly & Recycling

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Design for Disassembly (DfD):

- Shoes designed with fewer materials and simplified layering.
- Use of reversible fastening (snaps, screws) instead of permanent adhesives.
- Modular components (soles, uppers, insoles) for easy replacement.
- Clear markings for material identification (traceability).

Design for Recycling:

- Materials chosen for recyclability or biodegradability.
- Closed-loop recycling (old shoes ground into new components).
- Examples:
  - *Adidas Futurecraft Loop* – 100% recyclable TPU.
  - *Nike Grind* – old shoes processed into materials for sports surfaces & new shoes.

Design for the Environment (DfE)

Definition: A systematic design approach integrating environmental considerations into every stage of product development.

Key Goals:

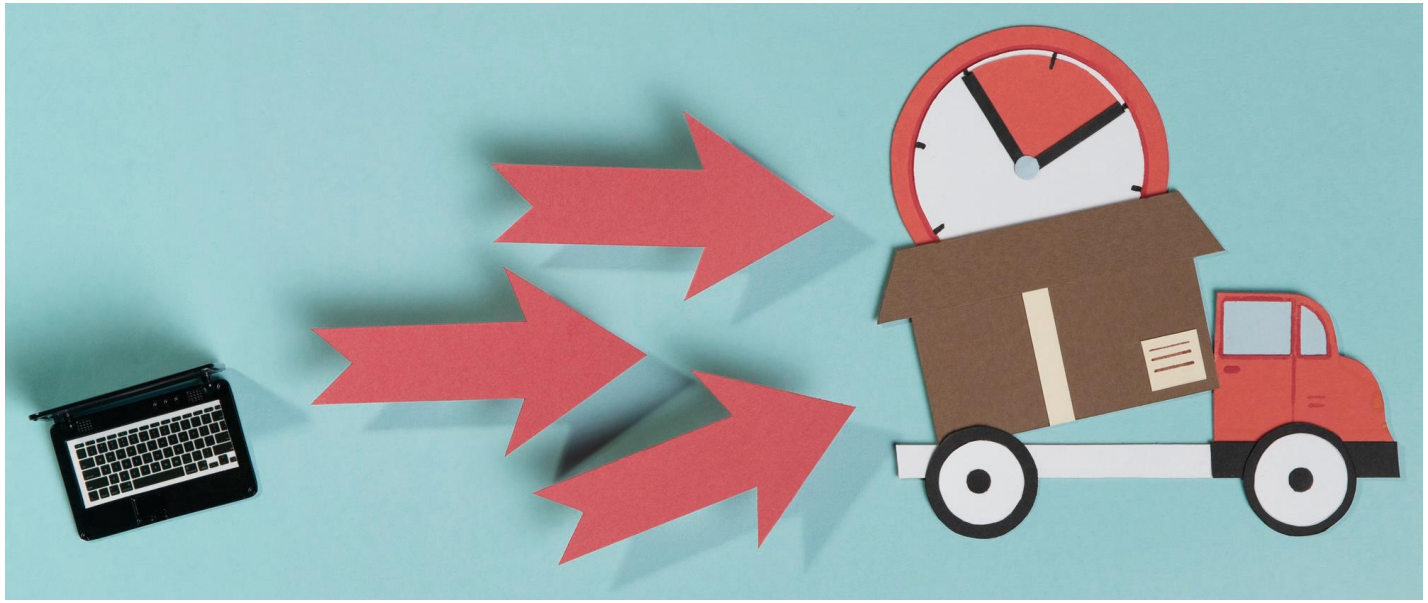
- Minimize resource use & waste generation.
- Eliminate or reduce hazardous substances.
- Ensure recyclability, reusability, or safe disposal.

DfE Strategies in Footwear & Leather Goods:

- Material substitution (eco-leather, bio-based foams).
- Cleaner production processes (less water, energy, chemicals).
- Product design for disassembly & modularity.
- Integration of LCA results into design decisions.

Outcome: Aligns product performance, consumer needs, and environmental responsibility.

Circular Business Models



Take-back schemes
Customers return used shoes/bags for recycling or refurbishing.

Leasing & Subscription models
Access over ownership (e.g. seasonal, children’s shoes).

Resale platforms
Second-hand markets extend product life.

Repair & refurbishment services
Offered by brands or local workshops.

Rental services
Short-term use for events or sports activities.

Best Practices in F&L Industry

Recycling worn-out shoes into new materials (rubber, foam, textiles)

Sneakers made from ocean plastics

100% recyclable TPU running shoe

Take-back and refurbishment program

Organic cotton, Amazon wild rubber, Transparency in supply chains

Pioneer in luxury vegan leather (mushroom & plant-based).

Consumer Engagement in Circular Design

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- **Growing demand** → for sustainable footwear & leather goods.
- **Transparency & traceability** → consumers expect info on sourcing & production.
- **Labels & certifications** → Organic, Vegan, Fair Trade influence buying decisions.
- **Durability & longevity valued** → customers willing to pay more for lasting products.
- **Participation in circular business plans** → return worn shoes, repair programs.
- **Shift towards local & artisanal products** → lower footprint + support local economy.
- **Education & awareness campaigns** → NGOs, activists, brands drive behavioral change.

Methods & Tools for Circular Design

- **Design for the Environment (DfE)** – integrates environmental aspects into product development; balance of performance, cost & eco-impact.
- **Life Cycle Assessment (LCA)** – identifies environmental “hotspots” across product stages.
- **Eco-indicators** – metrics for comparing environmental impact of design options.
- **Material Flow Analysis (MFA)** – tracks material use and waste.
- **Eco-material selection tools** – software & databases for sustainable material choice.
- **Collaborative design platforms** – enable teamwork & sustainability tracking.
- **Environmental Product Declarations (EPD)** – transparent sustainability info for products.
- **Design for Disassembly (DfD)** – planning products for easy recycling/upcycling.

The R-Strategies of Circular Design in Footwear

- **Refuse** ⊘ – avoid harmful/toxic materials. Ex: refuse chromium-VI tanned leather, PVC soles.
- **Rethink** 💡 – innovate new ways to meet needs.
  Ex: 3D-printed sneakers on demand, rental services.
- **Reduce** ▼ – minimize resource & energy use.
  Ex: lightweight eco-designs with fewer material layers.
- **Reuse** 🔄 – extend product life. Ex: resale markets, donation of gently used shoes.
- **Repair** 🔧 – fix instead of discard.
  Ex: resoling, re-stitching, replacing

- **Repurpose** 🔁 – new use for materials. Ex: turning old soles into flooring, leather scraps into keychains.
- **Recycle** ♻ – process into raw inputs. Ex: Nike Grind rubber, Adidas closed-loop TPU.
- **Recover** 🔥 – energy recovery when reuse/recycling not possible. Ex: incineration with energy capture of unusable scraps.
- **Rot** 🌱 – biodegradation of natural materials. Ex: compostable soles from natural rubber, hemp uppers breaking down safely in soil.
- **Regenerate** 🌍 – restore and enhance natural systems. Ex: sourcing leather

Waste Management Strategies in F&L Sector

Benefits:

- reduces pollution,
- conserves resources,
- creates economic opportunities.

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- Minimize production waste: optimize cutting patterns, digital design (CNC/3D).
- Product waste: extend life through reuse, repair, refurbishment.
- Post-consumer waste: take-back systems, recycling hubs, second-hand markets.
- Organic waste: compostable materials (hemp, cork, natural rubber).
- Closed-loop recycling: grind worn shoes into raw materials (rubber, foam, textiles).
- Open-loop recycling & repurposing: shoe leather → accessories, rubber → playground flooring.
- Energy recovery (last resort): incineration with energy capture.

Challenges & Trade-offs

Challenge / Trade-off	Description	Footwear & Leather Example
Cost 💰 vs Sustainability 🌱	Eco-materials often more expensive	Piñatex® sneakers cost more than synthetic leather ones
Durability 🛡️ vs Recyclability♻️	Durable composites are hard to recycle	Strong glued soles last longer but can’t be disassembled
Design Complexity 👟 vs Scalability ⚙️	Modular design complicates production	Shoes with detachable soles take more time & cost to produce
Consumer Preference 🛒 vs Eco-impact 🌍	Consumers may prefer unsustainable aesthetics	Glossy synthetics look appealing but shed microplastics
Infrastructure Gap 🚚♻️	Limited recycling systems available	Few local facilities accept old shoes for recycling

Trade-off: choosing one benefit at the expense of another (e.g., more durable ≠ easily recyclable). Circular design requires balancing cost, function, aesthetics, and sustainability.

Interactive Activity – Think-Pair-Share

Think – Individually reflect:

How could a local footwear or leather goods company apply at least two circular strategies (e.g. Reuse, Repair, Recycle, Rot)?

Pair – Discuss your ideas with a partner.

Share – Present your joint solution to the class.

Takeaways

- Circular design moves the sector beyond “take–make–dispose”.
- It integrates sustainability at the earliest design stages.
- Strategies include durability, repairability, disassembly, sustainable materials, and circular business models.
- The extended R-Strategies (Refuse → Regenerate) guide decision-making.
- Tools such as DfE, LCA, eco-indicators, and EPDs support evidence-based choices.
- Challenges exist (cost, infrastructure, consumer acceptance), but opportunities are growing.
- Circular design = innovation + responsibility, essential for the green transformation of footwear & leather goods.

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