UDC 687.3

Angela SCRIPCENCO, Alexandru SCRIPCENCO
Technical University of Moldova, Republic of Moldova

CIRCULAR BUSINESS MODELS FOR TEXTILE WASTE MANAGEMENT AND VALUE RETENTION

Purpose. *To develop a differentiated framework of circular business models and enabling capabilities for textile-waste prevention, value retention and circularity in the Moldovan textile and apparel sector, with particular attention to local brands and export-oriented CMT/FOB manufacturers.*

Keywords: *circular business models, circular fashion, textile waste management, Digital Product Passport, Extended Producer Responsibility, CMT, Republic of Moldova.*

Objectives. The objectives are: (1) to distinguish core circular business models from enabling infrastructures; (2) to identify mechanisms for retaining material and economic value throughout the garment life cycle; (3) to differentiate strategies for local brands and export-oriented manufacturers; and (4) to assess the relevance of traceability, take-back, repair, rental, secondary-material exchange and integrated management in the current European and Moldovan regulatory context.

Methodology. The study combines a conceptual review of circular business-model literature with comparative analysis of the Moldovan textile and apparel sector and a regulatory review of current European and Moldovan developments. The proposed framework segments enterprises by control over product design, ownership of materials and access to the final customer. Each model is assessed according to its value-retention mechanism, reverse-logistics requirements, data needs, organisational intensity and regulatory relevance. The study is conceptual and sector-oriented; it does not claim empirical validation of profitability or environmental impact.

Research results. Circular transformation is increasingly understood not only as a technological problem of recycling, but as a problem of value architecture [4, 5, 13]. A firm may use recycled fibres, improve cutting efficiency or reduce energy consumption and still remain structurally linear if revenue depends mainly on increasing the volume of newly manufactured products. Circular business models therefore seek to slow resource loops through durability, repair and extended use, close loops through reuse and recycling, and, where appropriate, shift part of value creation from ownership to services [1, 4]. Take-back schemes

illustrate that such models require coordinated reverse logistics, customer participation and clear criteria for recovered value [5]. In Moldova, this challenge is amplified by the coexistence of local brands that control design and customer relationships and export-oriented CMT/FOB manufacturers whose decisions are constrained by international buyers and contractual ownership of materials [1, 3].

1. RECONFIGURING VALUE IN THE CIRCULAR TEXTILE ECONOMY

A useful distinction is required between circular business models and circularity enablers. A business model defines how a company creates, delivers and captures value, whereas instruments such as traceability systems, social audits and integrated management systems provide the information and organisational capability needed to operate such models. In the textile sector, the core value-retention mechanisms include longer product use, repair and refurbishment, resale, take-back linked to reuse or recycling, rental or access-based services, and the redistribution of usable surplus materials. Digital traceability and management systems should therefore be treated as enabling infrastructure rather than as business models in their own right [4, 5].

From this perspective, economic value is no longer associated exclusively with the first sale of a newly manufactured garment. Repair can generate value by extending use; resale can retain part of the product's residual value; rental can increase utilisation of products that would otherwise remain underused; take-back can create reverse flows for reuse or material recovery; and business-to-business exchange can redirect deadstock and production surplus before they become waste [1, 2, 4, 5]. The environmental benefit of each model remains conditional on actual utilisation, logistics, cleaning, product durability and the treatment route applied at the end of use.

The policy environment has also moved from strategic intention towards implementation. Regulation (EU) 2024/1781 on ecodesign for sustainable products establishes the framework for product-specific ecodesign requirements and Digital Product Passports (DPPs) [9]. As of October 2026, textile apparel is a priority product group, but textile-specific DPP requirements are still under development, with adoption of the relevant delegated act indicated for late 2027 [9]. Directive (EU) 2025/1892 requires EU Member States to establish extended producer responsibility (EPR) schemes for textile, textile-related and footwear products by 17 April 2028 [10]. In Moldova, a draft regulation on textile products and textile waste, based on EPR principles, underwent repeated public consultation in July 2026 and should therefore be treated as an emerging, rather than already fully implemented, national framework [12].

2. STRATEGIC MODELS FOR LOCAL ENTERPRISES WITH THEIR OWN BRANDS

Local enterprises that own their brands and sell directly to consumers have the greatest freedom to redesign the relationship between product, customer and revenue. Their advantage lies in control over design, retail communication, after-sales interaction and, in many cases, product ownership before sale. For Moldovan small and medium-sized brands, circularity is therefore most credible when services and reverse flows are connected to a clear value proposition and can be introduced through measurable pilot projects rather than isolated sustainability claims [1, 3].

2.1. Traceability as enabling infrastructure: DPP-ready product data

Digital traceability is an important enabling capability, but it should not be confused with a business model. The future textile DPP under the ESPR framework is intended to connect a physical product with structured information on material composition, origin, sustainability characteristics, care, repair and end-of-life options [7, 9]. Current research indicates that DPP-enabled transparency can reduce information asymmetry and strengthen consumer confidence, while also supporting lifecycle management by producers and downstream actors [7, 8].

For Moldovan brands, a practical near-term approach is to create a DPP-ready digital product profile accessible through a QR code or NFC identifier. Until textile-specific EU requirements are legally adopted, such systems should be described as voluntary digital traceability profiles rather than as fully compliant EU textile DPPs. Their business value lies in preserving product information for repair, resale and recycling, supporting customer communication after the initial sale, and preparing data structures for future regulatory interoperability [8, 9, 11].

2.2. Closing consumer loops: take-back, resale and reuse

Take-back can become a circular business mechanism when returned products are linked to defined value-retention routes. The retailer may direct garments towards repair, resale, donation, remanufacture or fibre recovery according to product condition and material composition [1, 5]. International experience shows that collection alone is insufficient: performance depends on consumer participation, reverse-logistics costs, sorting capacity and the proportion of returned products retained at higher-value stages of the waste hierarchy [7]. In the European context, the new textile EPR framework reinforces the importance of organised collection, sorting, preparation for reuse and recycling [10].

For local brands, the incentive level for returns should not be fixed a priori. A modest voucher, loyalty credit or service discount may be tested experimentally, but its value should be calibrated against return rates, product residual value,

logistics costs and the risk of stimulating additional consumption. Evaluation should therefore combine material indicators – quantities collected, shares reused, repaired or recycled – with commercial indicators such as repeat interaction, service uptake and net recovery value.

2.3. Extending product life: repair, customisation and selective rental

Repair, alteration, customisation and refurbishment directly support the slowing of resource loops by maintaining products in active use [4]. For small brands, these services can also create a post-purchase revenue stream and provide feedback on recurrent design or quality failures. The business logic is strongest where products have sufficient material and construction quality to justify intervention and where repair can be integrated into retail or partner-service networks.

Rental is potentially appropriate for high-cost, low-frequency-use products such as occasion wear, ceremonial garments and selected specialised clothing. Product-service systems can increase utilisation, but environmental benefits should not be assumed automatically because transport, cleaning, packaging, product losses and shortened service life can offset gains [5]. A pilot should therefore focus on categories with predictable repeated use and evaluate utilisation rate, turnaround costs, maintenance intensity and product lifetime. The same principle applies to resale: circular value is created only if a second use phase genuinely extends total product service life.

3. CIRCULAR REQUIREMENTS FOR B2B ENTERPRISES: EXPORT AND CMT SERVICES

For medium-sized and large factories operating under CMT and FOB arrangements, circularity has a different economic logic. These firms often have limited control over product design, branding and post-consumer services, while their competitiveness depends on delivery performance, quality, cost and increasingly on verified environmental and social data. Their circular strategy should therefore focus on resource efficiency, auditable material flows, responsible handling of production waste, data interoperability with buyers and, where contracts permit, higher-value redistribution of surplus materials [3].

3.1. Traceability, waste data and emerging DPP/EPR requirements

The expansion of European product-policy requirements makes reliable material data strategically important for Moldovan suppliers. However, legal responsibility must be distinguished from supply-chain support. Under the ESPR, DPP obligations attach to economic operators placing regulated products on the EU market once product-specific rules apply [9]. Under Directive (EU) 2025/1892,

EPR obligations concern producers placing covered textile, textile-related and footwear products on Member-State markets [10]. A Moldovan CMT subcontractor is therefore not automatically the EPR-obligated producer, but it may be required contractually to provide accurate input, composition, waste and treatment data to the buyer that carries market-placement obligations.

A practical B2B response is to establish auditable protocols for recording fabric input, cutting losses, waste categories, storage, transfer and final treatment. Where contractual ownership allows, usable roll ends, deadstock and homogeneous production surplus can also be redirected through B2B exchange or industrial-symbiosis channels instead of being classified immediately as waste. In this model, verified traceability becomes part of the manufacturer's service proposition: the factory supplies not only production capacity but also reliable environmental data and controlled material flows, reducing compliance and due-diligence risks for international clients [3].

3.2. Social due diligence as a complementary sustainability capability

Social auditing should be treated as complementary to circular business modelling rather than as evidence of circularity itself. Circularity concerns the preservation of product and material value, whereas social sustainability concerns the conditions under which that value is created. For export-oriented enterprises, systems such as SMETA or amfori BSCI may support transparency in labour practices, occupational conditions and supply-chain governance, but they do not substitute for material circularity metrics.

The strategic relevance of social due diligence is nevertheless significant because international buyers increasingly evaluate suppliers through multidimensional sustainability criteria. For Moldovan manufacturers, a coherent governance system should therefore connect environmental data, labour conditions, quality management and traceability without conflating these dimensions. This reduces duplicated reporting and helps distinguish verified performance from marketing claims.

3.3. Integrated Management Systems as organisational infrastructure

An Integrated Management System (IMS) can provide the organisational infrastructure for consistent implementation by combining quality, occupational health and safety, and environmental management. A configuration integrating ISO 9001, ISO 45001 and ISO 14001 can align documentation, internal auditing, corrective action and continuous improvement. Its relevance to circularity lies not in certification itself, but in embedding waste, resource and traceability indicators within routine decision-making.

For CMT and FOB enterprises, an IMS can improve the reliability of information supplied to buyers and reduce dependence on ad hoc project reporting. Waste records, resource-efficiency indicators, non-conformity management and occupational controls can be incorporated into normal operating procedures. The resulting capability can support future DPP data exchange, buyer due diligence and emerging EPR-related information flows even where the factory is not itself the legally obligated producer [9, 10].

Conclusion. The analysis supports a differentiated framework for circular transformation in the Moldovan textile and apparel sector. The central distinction is between companies that own brands and maintain direct relationships with consumers and export-oriented CMT/FOB manufacturers whose role is embedded in international supply chains. It also shows that circular business models should be distinguished from enabling infrastructures: repair, resale, take-back, rental and secondary-material exchange alter value creation, whereas DPP-ready traceability, social auditing and integrated management primarily enable, verify or govern these models.

For local brands, the most relevant pathways are those that extend the economic relationship with products beyond the first sale. Take-back linked to reuse or resale, repair and customisation services, selective rental and digital product information can support higher utilisation and customer retention. DPP-ready systems are strategically useful, but as of October 2026 textile-specific EU DPP obligations have not yet entered into force; preparatory data structures should therefore be presented as readiness measures rather than current compliance [9].

For export-oriented manufacturers, priority should be given to auditable material and waste data, separation and documented recovery of production scraps, B2B redistribution of usable surplus where ownership permits, and integration of environmental data with buyer systems. EPR and DPP obligations must be interpreted according to the actor that places products on the relevant market; CMT status alone does not automatically determine legal producer responsibility [9, 10].

The proposed framework is conceptual and requires empirical validation. Future research should test selected models in Moldovan enterprises and compare unit economics, reverse-logistics costs, utilisation or return rates, quantities retained at higher-value circular stages, and organisational requirements. Such evidence is necessary to determine which combinations of business model and enabling infrastructure can deliver both measurable resource savings and commercially viable value retention under Moldova's evolving regulatory environment [12].

References

1. Scripcenco, A. Circular business models as a modernisation strategy for the fashion industry in the Republic of Moldova. Annals of the University of Oradea. Fascicle of Textiles, Leatherwork. 2026. Vol. 27, no. 1. P. 133. https://textile.webhost.uoradea.ro/Annals/Volumes.html
2. Scripcenco, A.; Scripcenco, A. Collaborative fashion consumption: digital resale platforms as enablers of circular fashion. Annals of the University of Oradea. Fascicle of Textiles, Leatherwork. 2026. Vol. 27, no. 2. P. 135. https://textile.webhost.uoradea.ro/Annals/Volumes.html
3. APIUS; Future Technologies Activity. The Future of Fashion: Mapping Moldova's Sustainable Journey. Employers' Association of the Light Industry of Moldova; supported by USAID, Sweden and UK Aid. Brussels; Chisinau, 2024.
4. Bocken, N. M. P.; de Pauw, I.; Bakker, C.; van der Grinten, B. Product design and business model strategies for a circular economy. Journal of Industrial and Production Engineering. 2016. Vol. 33, no. 5. P. 308-320. DOI: 10.1080/21681015.2016.1172124.
5. Scripcenco A., Ghelbet A. Aligning Circular Fashion Business Models with the EU Textiles Strategy: Opportunities for Sustainable Business Development in Moldova. 2026. DOI: 10.53486/ser2026.34.
6. Scripcenco, A.; Pashkevich, K. From linear to circular fashion: is it new trend or necessity? Actual Problems of Modern Design. 2020. Vol. 2. P. 265-268. https://er.knutd.edu.ua/handle/123456789/16160
7. Carvalho, C.; Silva, C. J.; Abreu, M. J. Circular Economy: Literature Review on the Implementation of the Digital Product Passport (DPP) in the Textile Industry. Sustainability. 2025. Vol. 17, no. 5. Article 1802. DOI: 10.3390/su17051802.
8. Becchi, B.; Cascavilla, A.; D'Adamo, I.; Grosso, C. Digital product passports for cleaner production: economic evidence from producers and consumers in the fashion industry. Journal of Cleaner Production. 2026. Vol. 545. Article 147792. DOI: 10.1016/j.jclepro.2026.147792.
9. European Union. Regulation (EU) 2024/1781 of the European Parliament and of the Council of 13 June 2024 establishing a framework for the setting of ecodesign requirements for sustainable products. Official Journal of the European Union. 2024.
10. European Union. Directive (EU) 2025/1892 of the European Parliament and of the Council of 10 September 2025 amending Directive 2008/98/EC on waste. Official Journal of the European Union. 2025.
11. Scripcenco, A. Circular fashion: development competencies among university students. В: Актуальні проблеми сучасного дизайну: 2025.,Vol 3, p. 247-250. ISBN 978-617-7763-53-5. https://repository.utm.md/handle/5014/33384 .
12. Ministry of Environment of the Republic of Moldova. Draft Regulation on the Management of Textile Products and Textile Waste: repeated public consultation, 8-21 July 2026 [online]. Available at: https://particip.gov.md/ro/document/stages/proiect/14406