TexMat Circular Business Model Blueprint

TEXMAT: Automated Collection and Sorting Solution for Consumer Textiles

Deliverable 2.2 / Dissemination level (Public)

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Author(s)	**Reviewer(s)**		
Erwan Mouazan Nayeem Rahman	Sami Leppänen, Ece Sanli, Critina Naso Rappis		
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Project partners

Short name	Organisation full name	Country
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HUMANA	HUMANA Fundación Pueblo para Pueblo	ES
IRIS	IRIS Technology Solutions S.L.	ES
PRO	Protex Balti AS	EE
ROVI	Rovimatica S.L.	ES
STAM	STAM SRL	IT
TTK	Tallinna Tehnikakõrgkool	EE
UVA	Vaasan yliopisto	FI
YAG	YAGHMA B.V.	NL
REUSE	Pääkaupunkiseudun Kierrätyskeskus Oy	FI
RISE	RISE Research Institutes of Sweden AB	SE
GREEN LIBERTY	Zaļā brīvība Biedriba	LV
UDC	Universidade da Coruña	ES
EMMY	Emmy Clothing Company Oy	FI

Executive summary

Context and purpose

From 2025 onwards, EU Member States are required to ensure the separate collection of used textiles under the revised Waste Framework Directive (WFD), which simultaneously introduces mandatory Extended Producer Responsibility (EPR) schemes for the sector. Yet the system tasked with meeting these obligations remains structurally broken: 87% of discarded textiles are lost to incineration or landfill, textile-to-textile recycling remains below 5% in the EU, and collection infrastructure is too often insufficient, digitally immature, and misaligned with the incentives of the actors it depends on.

This deliverable presents the TexMat Circular Business Model Blueprint — the business logic, financial architecture, governance framework, and technical system requirements underpinning a smart circular textile collection solution developed through a co-design process with the TexMat consortium. Its purpose is to translate regulatory, operational, and behavioural realities into a coherent, scalable model that can be deployed, tested, and validated in the demonstrator phase.

Methodology

The blueprint was developed through two phases. A preparatory phase grounded the work in structural analysis — PESTEL assessment, competitive benchmarking across European circular textile systems, and bilateral interviews with seven partners. A co-design phase translated these foundations into an operational model through three structured workshops, progressing from strategic framing through operational design to financial feasibility. The result is not a proposal but a description of the model the consortium converged on, with its architecture, its value logic, and its economics made explicit.

The TexMat system

TexMat operates as the orchestrating layer in the circular textile ecosystem, connecting consumers, collection infrastructure, sorting facilities, reuse operators, brands, and regulatory bodies through a single integrated architecture. It does not compete with collection operators or resale platforms; it occupies the infrastructure and data position that makes the whole system work.

The system converges three consumer entry points onto one architecture: the same container, the same sorting facility, the same four destinations.

Use Case 1 — App + DPP garment. App deposit with a DPP-tagged garment: the consumer scans NFC/QR tags at home, the system loads garment identity, proposes a routing, and generates a signed drop token. Fibre is known; condition is provisional until the facility.

Use Case 2 — App + no DPP garment. App deposit without a DPP tag: the consumer answers a short guided self-declaration questionnaire. The app uses photo AI at ~70% confidence as a supporting signal, not a binding grade. Provisional routing proposed; confirmed at facility

Use Case 3 — Walk-up, no app. Walk-up, no app: the consumer fills a bag and deposits it directly. No smartphone, no registration required. A contactless card tap links the deposit to a minimal, weight-based reward. Destination assigned at facility.

A critical design clarification frames all three journeys: the Digital Product Passport carries a garment's *identity*, material, brand, care data. It does not carry *condition*. Condition is generated within the TexMat journey: estimated provisionally by the consumer or a prediction model and set definitively by a human sorter at the facility. Separating identity from condition is the design correction on which routing integrity, reward fairness, and EPR auditability depend.

The collection container is deliberately lightweight (weight sensor, passive NFC reader, QR scanner, 4G uplink, no NIR) because the system's intelligence is concentrated at two well-controlled points: the consumer app and the human-staffed sorting facility. The container confirms custody transfer; it does not adjudicate value. This is what makes it affordable at field scale and operationally robust.

Value proposition

TexMat addresses six structural failures in the current system: absence of waste hierarchy enforcement; loss of garment identity and condition at end of use; consumer friction that suppresses participation; insufficient and poorly maintained collection infrastructure; misaligned incentives across actors; and labour-intensive sorting that makes circular operations economically marginal.

For each actor, the system delivers a concrete and distinct gain:

- **Consumers:** a rewarded, transparent, effortless drop-off across three entry points, with agency to override system routing.
- **Reuse operators:** pre-graded, data-enriched inbound streams that cut sorting labour and improve sell-through, in exchange for a share of realised resale value, paid only after sale.
- **Fashion brands:** DPP-linked lifecycle data, verified EPR compliance proof, and ecomodulation upside — without building their own collection infrastructure.
- **PROs / EPR organisations:** verifiable, real-time garment-level diversion data on which to calibrate eco-fees and ecomodulate.
- **Municipalities:** EPR-compliant diversion data and reduced residual waste cost without new capital investment.
- **Recyclers:** Characterised, high-purity feedstock (fibre composition, colour, and flagged non-textile disruptors) at commercially viable volumes.

Business model and financial architecture

Value enters the TexMat system from four structurally distinct pools:

Pool 1 — Regulatory (EPR/PRO fees): per-kg EPR fee — the most stable, scalable revenue base, growing linearly with collected volume.

Pool 2 — Reuse market (operator value-share): a share of realised resale value on pre-graded, data-tagged reuse-grade stock, settled after the item sells rather than charged on receipt. The share is value-tiered: a premium-resale item generates several times the share of a charity-retail item , so the premium fraction carries most of this pool while the charity fraction is protected by a low share and a large in-kind labour saving

Pool 3 — Brand commercial (compliance + data): per-event EPR compliance fee and data licensing subscriptions — the only pool that scales super-linearly, growing with data density rather than collection volume.

Pool 4 — Consumer-borne value: consumer effort, time, and forgone reward (donation mode, coupon over cash) — not visible in financial statements but the upstream condition for every other pool.

The consumer reward structure sets a universal baseline on every qualifying deposit, supplemented by a per-item quality bonus (app-confirmed reuse grade). Two non-cash modalities — operators coupons and a points system — reduce TexMat's cash outflow materially while raising perceived consumer value.

Governance

Five principles frame the governance model: participation is voluntary but designed to be rational; benefit must precede contribution; the system must not disrupt the level playing field; custody changes are explicit and recorded; and win-win is a testable claim, not a slogan.

The governance architecture is polycentric. TexMat sets and enforces system rules, routing-fairness quotas, and platform access policy. The contracted sorting facility holds operational grading authority (End-of-Waste status is a human legal act, not a machine estimate). Destination operators self-select into membership on a voluntary basis with an affordability tier for social enterprises entities. PROs and regulatory frameworks set the external constraints.

Eleven open governance decisions are carried forward to the demonstrator phase, the most consequential being:

Operator contribution mode and level. The mechanism is settled as a per-operator choice between a realised-value share and a sales-decoupled service fee; what remains open is the level and basis of each — the share rate band, and whether the service fee is flat-periodic or capacity-based.

Premium-item citizen incentive. For a high-value garment, a contribution taken from the operator's resale value may leave the consumer with a smaller net reward than selling directly on a peer-to-peer platform such as Vinted or Vestiaire Collective. Whether the system's non-monetary advantages — convenience, speed, and guaranteed, verified reuse — are a sufficient draw for premium items, or whether premium items need a distinct routing or reward treatment, will be carried to the Delphi consultation with key stakeholders.

Operator selection mechanism and eligibility. The design of the transparent, EPR-compliant selection process (public tender or equivalent), and the application of the waste-manager eligibility requirement across Member States with differing EPR implementations, are open for validation. National contexts differ materially — for example, Finland's operators largely run their own collection infrastructure while Spain's collection is charity-led — so the selection model may need country-level adaptation.

System requirements

The blueprint specifies technical requirements across four layers: A Consumer App, Smart Collection container, Sorting Facility, and DPP Infrastructure, using a Must

Have / Could Have / Cherry on Top prioritisation. Key architectural decisions confirmed in the co-design process:

- Batch-first processing is the default collection mode.
- The container is lightweight by design: weight sensor, NFC reader, QR scanner, 4G uplink. No NIR, no touchscreen assessment, no routing decision.
- NIR spectroscopy operates at the sorting facility only, under controlled conditions, where accuracy is reliable.
- The DPP infrastructure is a cross-cutting layer, not a stage in the flow: it manages garment identity, chain-of-custody records, provisional record creation for no-DPP items, facility write-back, and EPR/PRO compliance export.
- The walk-up, no-app entry point (UC3) is a first-class route, not a fallback — a structural commitment to inclusivity and collection volume.

Key uncertainties and next steps

The most consequential open uncertainties, which define the primary validation targets for the demonstrator phase, are: reward calibration (what incentive levels sustain participation without depressing average quality); photo AI precision and its impact on provisional condition accuracy for UC2; NIR throughput performance at the 4-second-per-garment Humana benchmark; DPP read latency and coverage across participating brands; and the EPR fee rate trajectory, which is the single highest-leverage financial variable in the model.

At pilot scale, natural revenue is far below operating cost: the gap is covered by the TexMat Horizon Europe grant. Financial self-sustainability requires reaching regional or national deployment scale, at which the diversified revenue base, in particular brand data licensing and the operator contribution (value-share or service fee), converges with operating cost. The demonstrator's primary function is therefore both to validate the system architecture and to generate the empirical data on which the scale-up financial case is built.

Disclaimer

This deliverable is based on the project Grant Agreement, Consortium Agreement, and relevant guidelines by the European Commission.

Digital tools, including AI-supported language and spelling checks, were used to improve clarity and readability of the text. All content and cited sources were reviewed, selected and validated by the authors, who take full responsibility for the final deliverable.



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Abbreviations

AI	**Artificial Intelligence**
API	**Application Programming Interface**
BMC	**Business Model Canvas**
CBM	**Circular Business Model**
CO_2	**Carbon Dioxide**
CSR	**Corporate Social Responsibility**
CSRD	**Corporate Sustainability Reporting Directive**
DPP	**Digital Product Passport**
EPR	**Extended Producer Responsibility**
ESPR	**Ecodesign for Sustainable Products Regulation**
EU	**European Union**
GDPR	**General Data Protection Regulation**
IP	**Intellectual Property**
NFC	**Near-Field Communication**
NIR	**Near-Infrared Spectroscopy**
PESTEL	**Political, Economic, Social, Technological, Environmental, Legal (analysis)**
PRO	**Producer Responsibility Organisation**
QR	**Quick Response (code)**
ROI	**Return on Investment**
SEE	**Social Enterprise Entity**
SKU	**Stock Keeping Unit**
SLA	**Service-Level Agreement**
UC	**Use Case**
UX	**User Experience**
VSM	**Value Stream Mapping**
WFD	**Waste Framework Directive**
WP	**Work Package**

1 Introduction

1.1 Context

The separate collection of used textiles is becoming a structural requirement across the European Union, driven by regulatory reform, environmental imperatives, and industrial transition objectives. From 2025 onwards, Member States are required to ensure the separate collection of textiles, with the aim of increasing reuse rates, enabling high-quality recycling, and reducing landfilling and incineration. This obligation is reinforced by the revised Waste Framework Directive, which introduces mandatory Extended Producer Responsibility (EPR) schemes for textiles and footwear, clarifies cost allocation for collection and treatment, and establishes that all separately collected textiles are legally considered waste and must undergo appropriate sorting prior to further processing or shipment.

Within this evolving regulatory and market landscape, textile collection systems play a pivotal role as the entry point to the circular textile economy. The design, location, governance, and digital maturity of collection infrastructure directly influence material quality, reuse potential, operational efficiency, and environmental performance. Poorly designed collection systems risk generating contaminated textile streams, increasing handling costs, and undermining the environmental ambitions of EU policy. Conversely, well-designed collection solutions can enable reuse-first strategies, improve material traceability, and provide the data foundation required for emerging textile-to-textile recycling technologies.

At the same time, textile collection systems are under increasing pressure to demonstrate transparency, efficiency, and measurable impact. Municipalities, producers, and operators are expected not only to collect textiles, but to document flows, optimize logistics, reduce emissions, and demonstrate compliance with EPR and waste shipment regulations. This creates a strong need for digitally enabled system-oriented solutions that integrate technical infrastructure with viable business models and stakeholder collaboration.

1.2 Objectives

This deliverable presents the Circular Business Model Blueprint developed within the TexMat project. Its objective is to define and validate the business logic underpinning a smart textile collection solution that facilitates reuse and recycling while aligning with regulatory, economic, and operational realities.

Specifically, the deliverable aims to:

- Develop a shared understanding of the textile collection ecosystem and its key actors;
- Identify value creation, delivery, and capture mechanisms relevant to smart textile collection;
- Translate regulatory, technological, and user requirements into a coherent business model framework;
- Support the design of scalable, economically viable, and environmentally sound collection solutions;
- Provide inputs for system requirements and technical development in subsequent work packages.

The work is grounded in a co-design approach involving project partners and ecosystem stakeholders and focuses on aligning technological innovation with real-world operational constraints and user behaviour.

1.3 Relation to other tasks and work packages

This deliverable builds directly on the outcomes of Task 2.1, which established the contextual circular textile market foundations for the TexMat solution. It further supports and informs:

- WP4 (Hardware and collection system development) by identifying operational needs and design constraints;
- WP5 (System architecture and digital platform development) by defining functional and data-related requirements;
- WP6 (Demonstration and validation) by providing assumptions, scenarios, and performance criteria to be tested in pilots.

The business model developed in this task serves as a reference framework for subsequent technical development, ensuring alignment between system design, stakeholder value creation, and regulatory compliance.

2 Methodology

The methodology adopted for the development of the TexMat Circular Business Model is grounded in a systemic, participatory, and iterative design approach. It combines qualitative research methods, business model innovation tools, and co-design practices to ensure that the resulting solution is both operationally viable and aligned with the regulatory, economic, and social context of textile collection in Europe. The methodological framework was developed to bridge strategic analysis with practical implementation, ensuring that business model choices are informed by real-world constraints, stakeholder needs, and emerging policy requirements.

The overall approach was structured into two main phases: a preparatory analytical phase and a co-design phase. These phases were designed to build progressively from contextual understanding toward the definition of concrete value creation, delivery, and capture mechanisms. Throughout the process, particular emphasis was placed on ecosystem thinking, lifecycle perspectives, and the explicit articulation of assumptions to support later validation activities within the project.

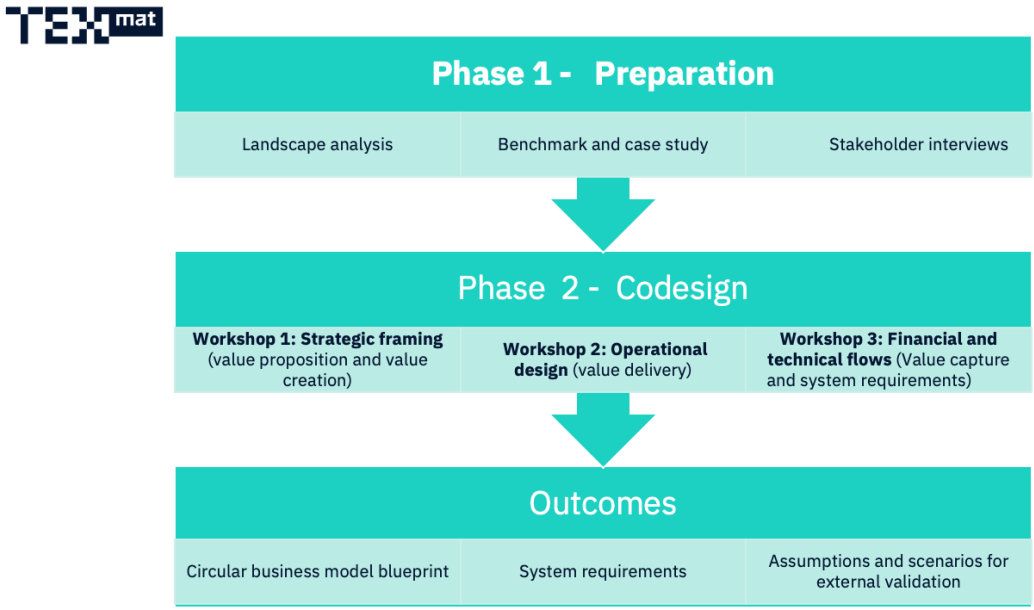


Figure 1: Methodological approach

2.1 Preparatory Phase

The preparatory phase aimed to establish a shared and evidence-based understanding of the environment in which the TexMat solution would operate. Rather than focusing prematurely on technical or business solutions, this phase sought to clarify systemic conditions, stakeholder roles, and boundary conditions that would shape the feasibility and relevance of any proposed model.

A central component of this phase was the analysis of the broader landscape affecting textile collection and recycling. This included a structured assessment of political, economic, social, technological, environmental, and legal factors influencing the sector (PESTEL analysis). Particular attention was paid to evolving European policy frameworks, including the revised Waste Framework Directive, Extended Producer Responsibility schemes, and emerging requirements related to traceability and reporting. This analysis made it possible to identify non-negotiable regulatory constraints, emerging opportunities linked to circular economy policies, and structural challenges such as cost pressures, contamination risks, and market volatility.

In parallel, a benchmark and pattern analysis was conducted to review existing textile collection systems, smart container deployments, and circular business models across Europe and beyond. This step aimed to identify recurring design principles, successful operational practices, and common failure points. The objective was not to replicate existing solutions but to extract transferable insights that could inform the development of a robust and scalable TexMat model. Particular attention was given to initiatives combining digital monitoring, incentive mechanisms, and integration with downstream sorting and recycling processes.

The preparatory phase was further strengthened through stakeholder interviews. These interviews provided qualitative insight into operational realities, incentive structures, and decision-making constraints of the future actors of the ecosystem. The interviews helped to surface critical tensions, such as the trade-off between collection volume and material quality, the challenges of ensuring economic viability under EPR schemes, and differing expectations regarding data sharing and system transparency. The outputs of this phase were synthesized into a consolidated understanding of design constraints, opportunity spaces, and stakeholder priorities. This synthesis served as the analytical foundation for the subsequent co-design activities and ensured that all workshop discussions were grounded in empirical evidence rather than assumptions.

2.2 Co-Design Phase

Building on the preparatory work, the second phase focused on the co-design of the TexMat business model through a structured series of 3 collaborative workshops involving consortium partners. The objective of this phase was to translate contextual insights into an operational and economically viable business logic, while ensuring alignment with user needs, policy requirements, and technical feasibility.

The co-design process followed a progressive narrowing logic, moving from strategic framing to operational definition. Rather than attempting to define a complete solution in a single step, the process was intentionally iterative, allowing insights from each stage to inform subsequent refinements.

The first stage of the co-design process focused on **strategic framing**. During this stage, participants worked collectively to define the role of the TexMat system within the broader circular textile ecosystem. This included identifying key actors, mapping value exchanges between them, and clarifying how value is created, transformed, and captured across the system. Particular emphasis was placed on understanding interdependencies between municipalities, collection operators, sorting facilities, technology providers, and end users, as well as the implications of regulatory requirements for system design. The outcome of this stage was a shared understanding of the system boundaries and a preliminary articulation of the TexMat value proposition.

The second stage translated this strategic framing into **operational terms** by examining how value is delivered and experienced in practice. This involved the development of user journeys, service blueprints, and interaction flows that describe how different stakeholders interact with the collection system over time. Attention was given to user behaviour, incentives, and friction points, particularly in relation to correct textile disposal, participation in reuse schemes, and trust in system outcomes. This stage also explored how digital components, such as sensors and data platforms, could support operational efficiency and transparency without creating unnecessary complexity for users or operators.

The third stage focused on **feasibility and viability**. Here, the proposed business logic was examined from an economic and organizational perspective, assessing cost structures, revenue streams, and value capture mechanisms. Value flow mapping was used to visualise financial and material flows between actors, while assumptions related to volumes, incentives, and operational performance were explicitly

documented. This stage also identified key risks and uncertainties to be tested in later work packages, particularly during pilot implementation and system validation.

2.3 Outcomes

The application of this methodology resulted in a coherent and evidence-based business model blueprint for the TexMat system. Key outputs include a clearly articulated value proposition, an ecosystem-level value flow model, a service blueprint describing operational interactions, and a set of assumptions to be tested through pilot implementation. These outputs provide direct input to the technical development activities in subsequent work packages and establish a shared reference point for evaluating system performance, scalability, and impact.

3 Market landscape

3.1 Introduction

The European market for textile collection infrastructure, including textile containers deployed in public and retail environments, is expanding in response to rising environmental pressures, regulatory change, and the restructuring of value chains around circular economy principles. While discussions often emphasise recycling, the sector is equally shaped by the growing strategic importance of textile reuse, which occupies a higher position in the waste hierarchy and plays a critical role in preserving product value, extending garment lifetimes, and reducing the environmental footprint of clothing consumption (European Environment Agency [EEA], 2022; European Commission, 2022).

Across Europe, policy frameworks increasingly prioritise separate textile collection, preparation for reuse, and high-quality recycling. The EU Strategy for Sustainable and Circular Textiles positions textiles as a key value chain requiring systemic transformation, highlighting the environmental impacts of fast fashion, the low rates of fibre-to-fibre recycling, and the need to scale reuse, repair, and remanufacturing models (European Commission, 2022). In parallel, regulatory developments under EU waste legislation and extended producer responsibility (EPR) schemes are redefining responsibilities and financing mechanisms, shifting textile collection and treatment from predominantly municipal or charity-led systems toward more structured, performance-driven ecosystems involving producers, PROs, collectors, sorters, reuse operators, and recyclers (European Commission, 2023; EEA, 2022).

The proliferation of textile collection points — including street bins, bring-banks, and in-store take-back systems — reflects both regulatory momentum and evolving consumer behaviour. Citizens are increasingly exposed to messaging around donation, resale, and recycling, yet participation rates and material quality remain uneven. Importantly, collection systems now serve dual functions: supplying reusable garments to second-hand and export markets, and generating feedstock for mechanical and emerging fibre-to-fibre recycling processes. The balance between these streams is economically and environmentally decisive. Reuse markets capture significantly higher value when garments are collected in good condition, whereas recycling pathways dominate when textiles are damaged, contaminated, or unsuited for resale (EEA, 2022; WRAP, 2023).

Countries with mature collection and sorting infrastructures demonstrate the structural role of reuse within the textile economy. In several Member States, a substantial share of separately collected textiles is directed toward preparation for reuse, supporting domestic second-hand retail, online resale platforms, social enterprises, and international reuse markets (EEA, 2022). Retail-based collection programmes operated by major fashion brands complement municipal and charity networks, integrating consumer engagement strategies with circularity commitments. However, questions persist regarding transparency, downstream outcomes, and the relative shares of reuse versus recycling achieved in practice (European Commission, 2022; WRAP, 2023).

Despite growth and innovation, the sector continues to face operational and structural challenges. Textile waste streams are highly heterogeneous, comprising multiple fibre compositions, blends, and contamination levels. Sorting technologies, logistics optimisation, and traceability systems are improving, yet the economic viability of collection models remains sensitive to reuse yields, labour costs, and market demand for second-hand goods (EEA, 2022). Furthermore, the expansion of collection networks must be synchronised with downstream preparation-for-reuse capacity and stable end-markets to avoid unintended shifts toward disposal or low-value treatment routes.

Within this evolving landscape, Europe hosts a diverse ecosystem of actors engaged in textile collection, reuse, and recycling. Charitable organisations, commercial collectors, automated sorting facilities, fibre producers, and collaborative industry initiatives collectively shape the infrastructure and governance of textile circularity. At the same time, environmental agencies and policy bodies emphasise that scaling reuse — alongside durability, repairability, and reduced overproduction — remains essential for achieving meaningful reductions in textile-related environmental impacts (EEA, 2022; European Commission, 2022).

3.2 PESTEL Analysis

The European textile waste collection, preparation for reuse, and recycling market operates within a dense and evolving macroenvironment. Reuse is not a peripheral activity; it is central to EU circular economy objectives because it preserves product value and typically delivers higher environmental benefits than material recycling. The following PESTEL analysis highlights how reuse is shaped by political, economic, social, technological, environmental, and legal dynamics.

3.2.1 Political factors

EU textile policy increasingly combines waste regulation, product policy, and Single Market harmonisation. This policy mix strengthens the priority of reuse while tightening conditions for collection and treatment. The revised Waste Framework Directive (WFD) introduces mandatory extended producer responsibility (EPR) for textiles and footwear, shifting financial and organisational responsibility toward producers and producer responsibility organisations (PROs). Politically, this reframes reuse from a largely charity-driven domain into a performance-oriented system expected to demonstrate measurable waste prevention and preparation-for-reuse outcomes. Member State implementation remains politically decisive. Variations in EPR fee modulation, reuse targets, municipal service design, and reporting rules may generate short-term fragmentation. Cross-border actors (brands, collectors, sorters) must navigate heterogeneous governance arrangements, making pilots attractive when they demonstrate scalable allocation of responsibilities (“who pays for what”), credible KPIs (reuse yield, contamination rate), and interoperable reporting. Trade politics and external relations strongly affect reuse. The Waste Shipments Regulation tightens export controls and enforcement, reflecting political pressure to ensure that textiles labelled for reuse are genuinely reusable and not waste exported under ambiguous classifications. This elevates the political importance of documented sorting, quality grading, and traceability to defend reuse claims. At the local level, municipal politics influence bin placement, retail take-back schemes, and Social economy entity partnerships. Reuse-oriented systems gain political support when they visibly reduce overflows, dumping, and nuisance, and when governance clarifies data ownership and vendor neutrality.

3.2.2 Economic factors

Reuse economics hinge on quality, not volume. The value captured through resale or redistribution depends on garment condition, brand mix, and downstream market demand. Collection, logistics, and sorting costs often exceed the average value of

mixed textiles, but modest increases in preparation-for-reuse yield can significantly improve unit economics. Under textile EPR, competition increasingly revolves around cost per kilogram of usable output rather than cost per kilogram collected.

Reuse markets remain volatile. Demand fluctuates with consumer purchasing power, fashion cycles, import regulations, and reputational narratives around second-hand clothing. Tightened shipment rules may increase compliance costs and reduce flexibility for exporting mixed bales, raising the economic value of domestic sorting capacity and stable offtake agreements with reuse operators.

Incentive-based schemes present a trade-off. Rewards can rapidly increase returns but may depress average quality if users treat incentives as disposal subsidies. Financially viable designs typically pair incentives with clear acceptance criteria, user education, and downstream capacity planning.

Labour economics are pivotal: Preparation for reuse is more labour-intensive than disposal and more selective than recycling. Cost structures vary widely across Member States, creating opportunities for models combining local social enterprises with high-quality collection streams, while challenging high-volume, low-margin operations lacking adequate sorting labour or automation.

3.2.3 Social factors

Reuse is deeply shaped by trust, norms, and identity. Citizens decide whether to return textiles separately and whether to return them in reusable condition. Perceived greenwashing or ambiguity about post-drop-off outcomes undermines participation. Transparent communication about the waste hierarchy—reuse first, recycling next—and credible reporting are social prerequisites.

Convenience, dignity, and stigma matter. Donation may evoke solidarity in some contexts and waste disposal in others. Clean, well-maintained containerss and retail take-back points reinforce “donation/reuse” norms; poorly managed sites increase contamination and dumping. Retail channels can encourage cleaner returns but risk excluding users with limited access or reluctance to engage with brand-linked programmes.

Digital features introduce equity considerations. App-based rewards or QR/NFC interaction may privilege digitally connected users and exclude groups with lower digital literacy or accessibility needs unless non-digital alternatives are provided.

Privacy concerns can erode acceptance if smart systems are perceived as monitoring individuals rather than containers.

Shifts in fashion consumption alter reuse streams. Growth in ultra-low-cost garments may increase the share of low-durability items unsuitable for reuse, while social campaigns promoting repair, resale, and wardrobe decluttering can strengthen reuse flows.

3.2.4 Technological factors

Technology influences reuse through optimisation, quality protection, and traceability. Fill-level sensors and connectivity reduce overflows and unnecessary collections, protecting textiles from weather damage that would downgrade reuse potential. Interaction layers (QR/NFC, deposit verification, reward linkage) can guide users toward correct returns and reinforce acceptance rules.

Quality-sensing technologies (e.g., moisture detection, weight analytics, anomaly detection) remain emergent but strategically relevant for reuse because garment condition determines resale value. Their impact depends on integration with downstream sorting and grading processes; isolated deployment yields limited circular benefits.

Traceability infrastructures are increasingly critical. As product information tools such as the digital product passport (DPP) mature under the Ecodesign for Sustainable Products Regulation (ESPR), systems capable of aligning with product-level data may better route items into reuse, repair, or recycling pathways.

Interoperability and vendor lock-in are major risks. Fragmented data standards weaken the ability of PROs and municipalities to benchmark reuse performance, aggregate evidence, and scale pilots. Cybersecurity and resilience are non-trivial because connected containers form part of visible municipal service infrastructure.

3.2.5 Environmental factors

Reuse typically delivers the highest environmental value by extending product life and displacing new production. However, environmental outcomes depend on actual reuse rates and market absorption capacity. Collection expansion without sufficient preparation-for-reuse, resale, or redistribution channels risks shifting textiles toward stockpiling, downcycling, incineration, or landfill.

Quality preservation is environmentally decisive. Overflows, rain exposure, and contamination can render textiles unusable for reuse, converting potential waste prevention into waste generation. Smart routing reduces these risks when combined with weather-protective container design and maintenance.

Transport distances also matter. Local reuse loops can reduce logistics-related emissions, while long export chains face increasing scrutiny regarding environmental soundness and legitimacy.

3.2.6 Legal factors

The legal environment is the most immediate driver of system redesign. The revised WFD provisions introduce mandatory textile EPR and clarify obligations around separate collection and treatment. Legal distinctions between **waste**, **preparation for reuse**, and **products** are central: actors must demonstrate documented sorting, grading, and lawful shipment to substantiate reuse claims.

The Waste Shipments Regulation strengthens rules on exports, enforcement, and traceability, increasing compliance demands for cross-border reuse flows. This elevates the legal value of auditable chain-of-custody processes and credible quality classification.

Data protection law (GDPR) directly affects smart containers and incentive systems. Where programmes collect personal data (apps, rewards, QR scanning), lawful basis, purpose limitation, and data minimisation apply. Privacy-by-design requires clear separation between non-personal container telemetry and personal programme data.

Product policy under ESPR and emerging DPP requirements will progressively influence reuse by shaping durability, repairability, and information availability. Corporate sustainability reporting frameworks (e.g., CSRD) create indirect legal pressure for robust evidence on waste prevention and reuse performance.

Procurement and competition law shape implementation, particularly in municipal or PRO tenders. Transparency, non-discrimination, and measurable KPIs encourage standardisation and formal governance, while liability and health-and-safety regulations constrain rapid network expansion and bin siting.

Table 1: Pestel analysis

Factor	Key Dynamics	Implications for Textile Reuse	Implications for TexMat
POLITICAL	Mandatory textile EPR; policy focus on circularity; tighter waste export controls; national implementation differences	Reuse moves from charity-led to performance-driven systems; higher scrutiny of "genuine reuse"; fragmentation risks across Member States	EPR compliance can position TexMat as a certified reuse-first infrastructure. TexMat can generate auditable reuse data to satisfy PRO reporting requirements. Multi-country deployment requires adaptable data models to accommodate national EPR variations.
ECONOMIC	Collection/sorting costs often exceed material value; reuse markets volatile; compliance costs rising; labour-intensive sorting	Profitability depends on quality and resale yield, not volume; incentives may increase quantity but lower average quality	Automated pre-sorting reduces labour costs and protects the high-value reusable fraction. DPP-based garment characterisation enables quality-tiered routing, maximising resale yield over recycling. App-based incentives should be calibrated to attract quality garments, not just volume.
SOCIAL	Trust, norms, stigma, convenience shape behaviour; perceptions of greenwashing; digital divide concerns	User decisions determine garment condition and contamination; privacy concerns affect acceptance of smart containers	The app must lower participation friction through intuitive UX and tangible rewards. DPP transparency counters

			greenwashing concerns by making reuse outcomes verifiable. Container design should accommodate non-digital drop-off to ensure inclusivity across user segments.
TECHNOLOGICAL	Fill-level sensors mature; quality sensing emergent; traceability growing; interoperability challenges	Technology can protect reuse value (avoid wet/damaged textiles); enables better routing and evidence of preparation for reuse	NIR sensing and computer vision could enable real-time condition and fibre-type assessment to guide reuse vs. recycle routing. DPP integration allows garment-level data to travel with each item from consumer to sorting operator. Interoperability with EPR platforms and downstream sorters is critical for system-wide value.
ENVIRONMENTAL	Reuse offers highest value retention; risk if collection outpaces reuse/recycling capacity; logistics emissions	Environmental benefit realised only if textiles are actually reused; quality preservation critical	Prioritising reuse over recycling maximises environmental value per garment. The DPP enables lifecycle traceability, making reuse claims credible and measurable. App nudges and container sorting logic must jointly prevent high-quality items from entering

			lower-value recycling streams prematurely.
LEGAL	Revised WFD (textile EPR, sorting obligations); Waste Shipments Regulation; GDPR; ESPR/DPP; procurement law	Clear legal distinction between waste vs preparation for reuse; traceability and documentation essential; privacy-by-design required	The system must embed GDPR-compliant data flows from the app through to DPP records. Chain-of-custody logging by the smart container creates the documentation needed to prove preparation for reuse under WFD. DPP data fields should align with ESPR requirements to ensure regulatory readiness across EU markets.

3.3 Insights from the competitive landscape

Appendix 1 provides an in-depth overview of key solutions currently operated in Europe and beyond that support textile reuse. The analysis of the cases included in this report reveals that innovation in circular textile systems does not emerge from a single technological breakthrough. Instead, it develops through the interaction of multiple innovation layers that together reshape how materials, information, and value flow across the ecosystem. The cases examined — spanning consumer applications, smart collection containers, digital platforms, and automated sorting technologies — illustrate complementary rather than competing forms of innovation.

At the **consumer interface**, applications such as reGAIN, TooUsed, Droppie, and Cyclothe demonstrate that a significant share of circular system performance depends on behavioural activation. These solutions focus on reducing friction, embedding incentives, and reframing textile disposal as a rewarding and meaningful activity. Their innovation lies primarily in influencing participation dynamics. By simplifying return processes, offering financial or symbolic rewards, and providing feedback, these applications help mobilize dormant textile stocks stored in households. However, the cases also show that consumer-facing innovation alone does not ensure system efficiency or material quality. Increased inflows without corresponding logistics and sorting capacity may amplify operational strain.

At the **collection infrastructure level**, the cases involving Ekocharita + Sensoneo, Moda re- + Nordsense, highlight the transformation of textile containers from passive containers into smart, data-generating assets. IoT sensors and fill-level monitoring introduce real-time visibility into collection networks. This innovation directly addresses logistical inefficiencies that traditionally burden textile collection systems, particularly in low-value waste streams where transport and labour costs dominate. Demand-driven collection models reduce unnecessary trips, prevent overflow, and help stabilize material flows. Importantly, these cases show that technological improvements at the container level contribute not only to cost reduction but also to the preservation of textile quality by avoiding contamination and prolonged storage.

At the **data and coordination layer**, platforms such as RE4Circular and Trosort illustrate how digitalization restructures the informational backbone of circular textile systems. These platforms convert heterogeneous garments into standardized digital entities through AI-enabled classification, metadata extraction, and traceability mechanisms. The innovation resides in creating visibility, comparability, and routability of textile flows. Platforms enable new forms of value capture by linking collectors, recyclers, resale actors, and brands through marketplaces and

analytics tools. They also reduce decision uncertainty by supporting routing choices between reuse, repair, resale, and recycling. Nevertheless, platform performance remains contingent upon the reliability of upstream data and downstream processing capabilities.

At the **material transformation stage**, sorting technologies such as Fibersort and TOMRA AUTOSORT address the critical technical bottleneck of textile circularity. These innovations directly influence whether collected textiles can enter high-value recycling loops. Automated fibre identification, colour separation, and contaminant detection enable industrial-scale precision and throughput that manual sorting cannot match. The cases confirm that sorting innovation is fundamental to unlocking textile-to-textile recycling and improving recovery yields. Yet they also demonstrate that even the most advanced sorting systems depend on the quality, composition, and predictability of collected inputs.

Across all cases, a consistent pattern emerges. Each innovation layer solves specific constraints but leaves others intact. Consumer applications increase participation but do not optimise logistics. Smart containers improve logistics but do not perform fibre classification. Platforms enable coordination but rely on accurate data and processing capacity. Sorting technologies unlock recycling value but depend on upstream collection quality. The cases therefore collectively challenge the notion that circular economy performance can be achieved through isolated interventions.

For TEXMAT, the synthesis suggests that the **most significant opportunity for innovation lies in system integration**. The competitive and societal value of TEXMAT will not derive solely from introducing recognition technology, deploying smart containers, or developing digital interfaces in isolation. Instead, innovation potential resides in designing an architecture where behavioural activation, smart collection infrastructure, digital data layers, and automated sorting operate as a coherent system.

An integrated model enables reinforcing feedback loops. Consumer-facing tools stimulate returns. Smart containers stabilize flows and reduce costs. Platforms structure data and coordinate decisions. Sorting technologies preserve and recover material value. Together, these layers transform textile waste management from a fragmented chain into a coordinated circular system.

The cases further indicate that integration is not purely technological. It is organisational, economic, and institutional. Incentive structures must align with logistics capabilities. Data standards must align with sorting requirements. Financial

flows must sustain both infrastructure and operations. Governance mechanisms must coordinate actors with differing objectives. In this perspective, the real innovation challenge for TEXMAT is less about inventing a new component and more about orchestrating existing innovations into a scalable, resilient, and value-generating ecosystem.

Circular textile innovation is inherently **multi-layered and systemic**. Apps activate behaviour. Containers optimise logistics. Platforms structure information. Sorting technologies unlock material value. Sustainable transformation occurs when these elements are strategically combined. TexMat's innovation trajectory should therefore prioritize integration strategies that connect consumer engagement, collection efficiency, data intelligence, and material classification into a unified circular value logic.

3.6 Partner Perspectives: Challenges and Opportunities

Alongside the desk-based benchmarking, the TexMat business model has been informed by a first round of bilateral interviews with seven partner organisations: Reuse Centre/Kierrätyskeskus, Humana Spain, Protex, Emmy.fi, IRIS, STAM, and ROVIMATICA. Each was asked to articulate the contribution they could make to the TexMat system, the value or risk the system would create for their own operations, and any structural constraints that should shape its design.

The interviews produced a consistent message: partners see TexMat as a credible response to real operational pain points, but each highlights distinct conditions under which the system would create value rather than displace it. Five cross-cutting themes emerge from the synthesis.

3.6.1 Theme 1 — Quality routing equity: the central design tension

Two partners articulated opposite ends of the same concern. Reuse Centre/Kierrätyskeskus identified its structural ability to handle low-value items as its contribution to the system — they can process and sell textiles that other actors reject. The corresponding risk is direct: if TexMat filters higher-quality items toward premium channels, the donation-basis economics of charity reuse operators are undermined. Emmy.fi, by contrast, framed TexMat positively as a demand-driven "order system" — a database from which resale platforms can select specific item types matched to market demand. The same routing capability is therefore an opportunity for one partner and a structural risk for another. This tension is the central design challenge for the system's routing algorithm and bilateral offtake agreements (addressed in Section 6.2, Q2).

3.6.2. Theme 2 — Service-based adoption is the preferred engagement model

Humana Spain explicitly stated a preference for contracting TexMat as a service rather than owning infrastructure, in order to reduce capital risk and maintenance burden. ROVIMATICA's observation that outdoor containers must be low-cost and vandalism-resistant — limiting how much technology can be deployed at the container — reinforces the same logic from the hardware side. STAM's framing of its participation as an entry point into the textile sector with commercialisation potential implies a service-and-licensing posture rather than an asset-ownership one. Across these partners, the consensus is that TexMat should be operated as orchestrated infrastructure with clear service contracts — not as an asset that any single partner would acquire and run. This directly supports the container ownership model proposed in Section 6.2 (Q1).

3.6.3 Theme 3 — Liability and EPR boundaries must be respected, not redrawn

Protex raised the most explicit institutional concern: under emerging EPR regulation, garment lifecycle ownership and compliance liability remain unclear, and there is concern that financial liabilities could shift unfairly onto manufacturers. The corresponding requirement is that TexMat must not bypass existing customer–producer relationships; responsibility for garments (defects, early disposal, warranty obligations) should remain consistent with current contractual and regulatory logic. The implication for system design is significant: TexMat's role is to enable EPR compliance reporting and ecomodulation, not to absorb or redistribute liability. The DPP governance question raised by VTT in Workshop 2 (Section 6.2, Q5) intersects directly with this concern.

3.6.4 Theme 4 — User experience simplicity is a hard constraint, not a preference

Three partners independently flagged consumer interaction simplicity as a non-negotiable design requirement. IRIS stated that consumers should not be required to perform complex actions such as scanning items individually, as this would hinder adoption. STAM went further, framing the design insight that "innovation is expected to lie primarily in user interface and interaction design rather than in container mechanics" — the system's competitive advantage comes from how easy it is for a consumer to use, not from hardware sophistication. Humana Spain added the operational corollary: item-level tracking is not feasible at the scale Humana operates at, so TexMat must accommodate bulk-level processing. Taken together, these constraints validate the batch-default processing principle (Section 3.5, Decision 1) and the lightweight container specification (Section 3.5, Decision 2). They also reinforce the UC3 walk-up entry point as a non-optional system feature.

3.6.5 Theme 5 — Reward logic is the open uncertainty across the consortium

ROVIMATICA flagged consumer reward logic as the critical design uncertainty: when should consumers be rewarded (instant vs. delayed), and on what basis (quality vs. quantity, weight vs. item)? This uncertainty is shared across partners and is the most consequential open variable in the financial model. The reward structure (per-kg baseline plus per-item quality bonus, with three modalities) is the consortium's current best answer, but it remains the assumption most in need of empirical calibration in the demonstrator phase.

3.6.6 Additional partner-specific insights

Beyond the cross-cutting themes, two partner observations are worth retaining as design inputs in their own right:

Reuse Centre/Kierrätyskeskus on consumer behaviour in the Finnish context: consumer participation depends heavily on the physical proximity of collection points, not monetary incentives. This has direct implications for the demonstrator network density and for the calibration of reward levels — a 30-container pilot covering 0.5 million people may not achieve sufficient container proximity to test reward sensitivity in isolation from accessibility effects.

Emmy.fi on the data feedback loop: TexMat could generate data on product condition and failure points that creates new information flows valuable to brands. This supports the brand data licensing revenue stream documented in Section 5.2 and confirms that the value proposition for brands is not only EPR compliance reporting but also product design intelligence.

IRIS on value capture: brands could pay for access to sorted items and associated condition-based insights. This further reinforces the brand-side monetisation logic and suggests that the brand data licensing stream may have multiple sub-components (lifecycle analytics, condition-graded inventory access, design feedback).

3.6.7 Implications for the business model blueprint

The seven partner interviews validate the architectural and financial choices documented in this deliverable, while sharpening five concerns that must be resolved before demonstrator deployment:

- Routing equity rules must be negotiated bilaterally with reuse operators before the algorithm is finalised
- Service-based container governance is the consensus operating model and should be confirmed at consortium level
- EPR liability boundaries must be explicitly mapped — TexMat enables compliance, it does not absorb liability
- UX simplicity is structurally non-negotiable — the system must work for batch-mode deposit and zero-app walk-up users
- Reward logic remains the most empirically uncertain element of the model and is the primary calibration target for the demonstrator (Section 6.1, Assumptions block)

These five points form the bridge between the consortium-validated context described in this section and the co-design outputs presented in Section 4.

4 Business model codesign results

This section presents the TexMat business model as it emerged from the codesign process — the workshops, scenario testing, and partner validation through which an abstract circular-textile ambition was turned into a concrete, costed system. It is the synthesis of that work: not a proposal of what TexMat might be, but a description of the model the consortium converged on, with its architecture, its value logic, and its economics made explicit.

The model rests on a single organising idea. TexMat is not a buyer-and-seller transaction but a coordinated set of financial and data flows linking consumers, collection operators, sorting facilities, reuse channels, brands, and regulators — with TexMat positioned as the orchestrating layer that makes those flows visible, verifiable, and compliant. Value is therefore created, delivered, and captured across the system rather than at any single point, and the structure of this section follows that distinction.

Section 4.1 sets out the business model architecture — the three interdependent dimensions through which the model works: value created in the layers, delivered through orchestration, and captured from the platform position. Section 4.2 expresses the model in Business Model Canvas form, and Section 4.3 states the value proposition for each actor in the system. Together these establish what the model is and for whom it creates value.

The remaining subsections move from structure to mechanism. Value creation and delivery (the ecosystem architecture, the consumer user journeys, and the service blueprint) describe how the system functions in practice — how a garment moves from a consumer's wardrobe through collection, sorting, and routing to its highest-value destination. Value capture then explains the economics: the four value pools the model draws on, how value circulates between actors, where each stakeholder nets out, and the revenue and cost mechanics that determine whether the orchestrator role is financially sustainable at each scale of deployment.

A consistent thread runs through all of it: TexMat captures value not by competing with collection operators or resale platforms, but by occupying the infrastructure and data position that makes the whole system work — integrating collection into garment product passports and EPR compliance, and turning verified end-of-use data into a resource no other actor in the textile chain currently holds.

4.1 Texmat Business model Architecture

The business model operates across three interdependent dimensions. Value creation happens in the layers. Value delivery happens through orchestration. Value capture flows from the platform position.

01 Value Creation *How the system generates value*	02 Value Delivery *How value reaches each actor*	03 Value Capture *How TexMat sustains itself*
— Consumer activation increases return rate and input quality — Identity–condition separation keeps consumer data provisional until human grading — Facility-based human grading, with selective NIR support, protects the high-value reuse fraction — DPP chain-of-custody makes reuse claims auditable from drop-off to destination — Ecomodulation incentivises brands to improve product durability	— Consumers: effortless drop-off via three entry points, with a quality-calibrated reward and destination transparency — Reuse operators: pre-graded, data-enriched inbound streams that cut sorting labour — Brands: DPP-linked lifecycle data and verified EPR compliance proof — PROs / municipalities: real-time, garment-level diversion and reporting data — Recyclers: high-purity, NIR-characterised feedstock	— Regulatory (Pool 1): EPR / PRO fees per kg collected — the primary, scalable revenue base — Reuse market (Pool 2): Resale value share of reuse operators — Brand-commercial (Pool 3): compliance fees and lifecycle-data licensing, decoupled from volume — Premium services: consumer subscription, brand intelligence tiers, platform data feeds — Residual recycling: thin-margin feedstock payments that monetise an otherwise-disposal cost

4.2 Texmat Business model Canvas

The Business Model Canvas below (figure 2) consolidates the codesigned model into a single view, using Osterwalder's nine-block framework. It maps how TexMat creates, delivers, and captures value across the system: the partners and resources the model depends on, the activities TexMat performs as the orchestrating layer, the distinct value propositions for each actor, and the cost and revenue structure that underpins viability. The canvas serves as the reference frame for the detailed treatment of value creation, delivery, and capture in the subsections that follow.

01 KEY PARTNERS
Who makes the system work

Reuse operators (premium-grade routing: receive demand-matched premium-grade stock; contribute via value-share or service fee. Premium is a stock tier, not an operator type: any operator, including a SEE with a vintage line (e.g. Humana Vintage), may receive it; in some countries a distinct platform (e.g. Emmy in Finland) is one such recipient.

PRO / EPR organisations : fee payers, compliance counterparties

Brands & fashion companies: partners in take-back routing; buyers of compliance and data services

Municipalities : diversion mandates, site access

Collection & logistics operators — third-party fleets, or reuse operators running their own collection

Property owners / site hosts: container placement

06 KEY ACTIVITIES
What TexMat does

Orchestrate the circular collection ecosystem

Deploy & maintain the lightweight smart-container network

Operate DPP infrastructure: read/write, chain-of-custody, EPR export

Manage consumer reward logic & route flows to four destinations

Generate & license brand and operator analytics

Manage EPR compliance reporting

07 KEY RESOURCES
What it owns or controls

TexMat platform : orchestration, DPP connector, data infrastructure

Smart-container hardware & IoT network

02 VALUE PROPOSITIONS
Value created, per actor

Effortless, rewarded, transparent deposit of any garment, and the verified data layer that makes the whole system compliant.

Consumers : effortless, rewarded, transparent deposit; any garment, any condition

Social Enterprises Entities: pre-graded, + condition verified stock, removed sorting labour; vouchers drive store footfall

Premium-grade stock: demand-matched routing of premium items to eligible operators; triage of unsellable intake removed upstream. Any operator may receive it, including SEE with vintage lines.

Brands: DPP lifecycle traceability, EPR compliance proof, SKU return analytics

Municipalities & PROs: auditable diversion data, ecomodulation-ready reporting

04 CUSTOMER RELATIONSHIPS
How TexMat engages each

Consumers : self-service app + container; automated reward & impact alerts; optional community

Reuse operators: bilateral contribution agreement (value-share or service fee); inventory API; performance reporting; routing of premium-grade stock to eligible operators.

Social Enterprise Entities: bilateral voucher agreement; ; quality feedback loop

Brands:data-licensing subscription; bilateral EPR compliance service

Municipalities / PROs: service contracts; EPR dashboards

05 CHANNELS
How value is delivered

Consumer: smart-container network (high-footfall sites); app (iOS + Android); paper receipt with QR tracking

03 CUSTOMER SEGMENTS
Who the model serves

Primary : consumers

Reuse, Social Enterprises Entities — offtake partners; contribute via value-share or a sales-decoupled service fee; also issue vouchers.

Reuse — premium-grade routing — operators receiving premium-grade stock; contribute via value-share or service fee. A value tier, not a separate operator type — Social Enteprises Entitiess with vintage lines and dedicated platforms (e.g. Emmy) alike.

Brands: EPR compliance clients & data subscribers

Regulatory: PRO / EPR organisations as fee payers

Enabling :municipalities & property owners as infrastructure hosts

	NIR spectroscopy units at sorting facilities Consumer app (iOS + Android) Sorting-facility partnerships		**Operator / brand:** platform portal; API integration **Public / regulatory:** EPR compliance export; PRO reporting dashboard	

09 COST STRUCTURE

Where the orchestrator spends

FIXED

Container capex €4,800–5,500/unit annualised

NIR capex at facility: €45–50K/node (Regional+)

Programme overhead

VARIABLE

Collection logistics : €0.10–0.18/kg

Sorting labour : €140–320/tonne

Consumer reward : €0.40/kg baseline; Quality bonus funded per route (premium share / charity share or voucher / brand fee)

App & DPP development: project-funded at demonstrator

08 REVENUE STREAMS

How TexMat earns

01 EPR / PRO fee
€0.22/kg → 0.28–0.32
Producer-funded; load-bearing base

02 Resale value-share post-sale
Premium ≈12% (≈€2.40/€20 item); charity lower rate (≈€0.20–0.48/€4 item). Both routes contribute.

03 Brand EPR compliance fee
€0.10–0.40/item

04 Brand data licensing
€0 → €200K/yr

05 TexMat Pro subscriptions
€0 → €120K/yr

06 Fibre recycler payments
€0.06–0.14/kg

07 Public grants (bridge)
€80K/yr · Pilot

Figure 2: Business model canvas

4.3 Texmat value proposition

Reuse first. Every garment, every time.

TexMat is a digitally-enabled circular textile infrastructure that makes reuse the effortless default — for consumers, operators, brands, and the system as a whole. It is not a collection operator competing for volume, but the orchestrating layer that coordinates financial, material, and data flows across the actors who already make up the textile value chain, and makes those flows visible, auditable, and aligned with the waste hierarchy.

87%	<5%	WFD Art. 9
of discarded textiles lost to incineration	textile-to-textile recycling rate in the EU	mandatory separate textile collection and emerging EPR across EU Member States

4.3.1 The Problem: today's system loses value at every step

Across Europe, post-consumer textiles follow a predictably broken path: convenience is absent, condition data is missing, and high-value garments are routinely downgraded to incineration. The result is a system that wastes resources, frustrates stakeholders, and cannot evidence compliance with the regulatory moment.

01 — No enforcement of the waste hierarchy	**02 — Identity and condition are lost**	**03 — Consumer friction kills participation**
There is no mechanism to verify whether a garment was reused or simply disposed of. Reuse is declared, not tracked — making EPR compliance unauditable.	A garment's identity (material, brand, care data) is rarely available at end-of-use, and its *condition* is assessed nowhere reliable. Sorting operators receive uncharacterised mixed streams; quality assessment is manual, slow, and expensive.	People store unused clothes rather than donate them. Cognitive overload, unclear drop-off options, and zero feedback create a system people opt out of.
04 — Infrastructure is insufficient and broken	**05 — Incentives are misaligned across actors**	**06 — Sorting capacity is the bottleneck**
Not enough containers, containers too small, containers broken or overflowing. The physical layer fails before any digital value can be created.	Brands, operators, municipalities, and consumers each respond to different signals. No joint incentive model coordinates them around reuse-first behaviour.	Labour-intensive sorting makes circular operations economically marginal.

4.3.2 The TexMat Solution

TexMat makes reuse the effortless default. It gives consumers a rewarded, transparent drop-off — through three entry points that meet them wherever they are, from a fully app-guided deposit to a no-app walk-up. It gives ecosystem actors verified, DPP-linked data so they can act on quality instead of volume. And it turns garment flows into auditable, policy-grade proof that the waste hierarchy is working — without asking any single actor to carry the system alone.

A clarification underpins the whole model: the Digital Product Passport, where it exists, carries a garment's **identity** — material, brand, care data, recorded at market placement. It does not carry the garment's current **condition**. Condition is generated fresh within the TexMat journey: estimated provisionally by the consumer or a prediction model, and set definitively by a human sorter under controlled conditions at the facility. Separating identity from condition is the design correction on which everything downstream depends.

4.3.3 Four Value Dimensions — why this system deserves to exist

User Value — the consumer experience, redesigned

Consumers today face cognitive overload: unclear options, no feedback, no reason to repeat. TexMat makes participation effortless and tangibly rewarding through **three entry points onto one journey**: an app deposit for DPP-tagged garments, an app deposit with photo-assisted assessment for the far larger pool of untagged ones, and a no-app walk-up for those who prefer it. These are not segments to choose between; the same person may use different doors on different days, and the non-digital path is a first-class route, not a fallback. Drop-off sits near daily routines. The system proposes a sensible destination for every item automatically — but never removes the consumer's agency to override it. A digital or printed confirmation shows where each garment went. Rewards are calibrated to garment quality, not just weight, and can be taken as cash, as a partner coupon, or as points — or donated to charity. For a genuinely high-value garment the consumer may net less through TexMat than through a direct private sale on a peer-to-peer platform, because part of the realised value funds the system; the system's draw for those items is therefore convenience, speed, and the guarantee of verified reuse rather than maximal payout, and the per-item override lets a consumer instead route a premium piece to a consignment channel where they retain the majority of the proceeds.

Stakeholder Value: every actor gains what they couldn't access alone

If stakeholders don't benefit, no policy or technology will make the system work. TexMat creates concrete gains for each actor. **Brands** receive DPP-linked lifecycle data — design feedback, durability insight, and verified diversion proof for EPR reporting — plus the option to license deeper SKU-level return analytics. **Reuse operators** receive pre-graded, data-enriched inbound stock that cuts sorting labour and improves sell-through, in exchange for their elected contribution — a post-sale value-share or a sales-decoupled service fee. **Municipalities** get EPR-compliant diversion data without new infrastructure. **PROs** can ecomodulate fees on real garment-level data. Social Enterprises Entities access quality items and consumer-donated rewards. **Logistics providers** benefit from fill-level-triggered route optimisation. Each of these is a distinct flow and the structure of who pays, who collects, and who breaks even is set out in the value-capture analysis.

System Value: a shared infrastructure that coordinates the ecosystem

The core innovation is not any single component; it is the coordination layer that connects them. TexMat closes the enforcement gap on the waste hierarchy by making reuse-first routing trackable and auditable for every garment. It maintains a chain-of-custody record that travels with each item, from deposit, through facility grading, to destination, layered onto the brand DPP where one exists. It enables ecomodulation: brands whose garments prove durable and traceable earn lower future EPR fees, creating a structural incentive for better design. Critically, value enters the system from **four structurally distinct pools**: regulatory (EPR), reuse-market, brand-commercial, and consumer-borne effort, so the model does not depend on any single source. TexMat occupies the one position from which these pools can be coordinated, and is the only actor that absorbs the early-stage funding gap no individual stakeholder will carry.

Environmental value is the result of system performance and user behaviour working together — not a marketing claim. TexMat's direct measurable outcomes: a higher textile reuse rate; reduced premature incineration of still-reusable garments; and extended average clothing lifespan across multiple users, especially for higher-value items. At EU level: improved material resilience, lower virgin-resource consumption, and a quality signal within the EPR system that structurally disincentivises fast-fashion overproduction over time. Two risks require active management — logistics CO_2 from denser collection must be managed by fill-level route optimisation, and the system must not become a "guilt offset" that licenses continued overconsumption.

4.3.4 Key Stakeholders — benefits across the ecosystem

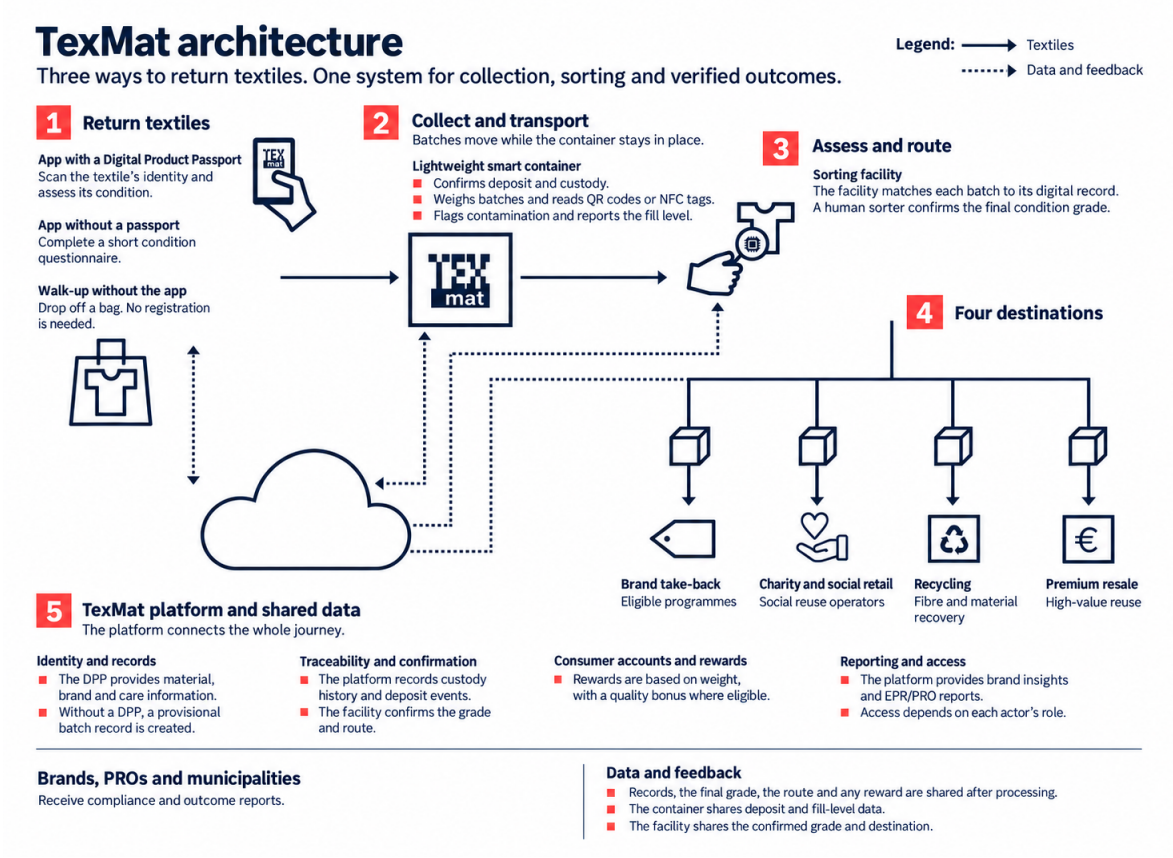
TexMat only works if every actor has a reason to participate. What each gains that they don't have today:

Consumers	Fashion Brands	Reuse Operators
An effortless, rewarding, transparent way to ensure clothes are reused, not wasted. One system, any brand, three entry points, real impact feedback. Reward as cash, coupon, points, or donation. *(App + container, or no-app walk-up)*	DPP-linked lifecycle data for sustainability reporting, durability design feedback, and EPR compliance proof — plus take-back integration without building infrastructure. *(Compliance proof + data licensing)*	Pre-graded, quality-assured inbound streams that cut labour cost and lift sell-through; garment-use-cycle data that improves pricing and procurement. *(Pre-graded inbound streams)*
Municipalities	**Producer Responsibility Orgs**	**Social Enterprises Entities**
EPR-compliant diversion data without new infrastructure investment; ability to ecomodulate collection levies on real garment-level data. *(Compliance + data)*	Verified, real-time garment data to calibrate eco-fees on actual durability and reuse outcomes; auditable basis for ecomodulation governance. *(Fee ecomodulation)*	Access to quality, pre-graded items previously lost in mixed streams; consumers can donate TexMat rewards directly; assisted digitalisation of charity flows. *(Quality items + donations)*

4.3.5 How It Works — three entry points, one system

Circular performance cannot be achieved through isolated interventions. TexMat converges three consumer entry points onto a single architecture: the same container, the same sorting facility, the same four destinations.

1 — Consumer deposits	2 — Lightweight container receives	3 — Data follows the garment	4 — Facility grades and routes
Through one of three entry points: app deposit of a DPP-tagged garment ; app deposit with photo-assisted condition estimate for untagged garments; or no-app walk-up . The app eliminates sorting decisions and proposes a destination per item, which the consumer can accept or override**.**	A **lightweight container** — weight sensor, contamination camera, passive NFC reader, receipt printer. It records the deposit and reads the DPP where present. It does **not** perform NIR or pre-sorting; that is done later, under controlled conditions. Collection is batch-based and triggered by fill level.	Each deposit creates a chain-of-custody record, layered onto the brand DPP where one exists. Consumer-side condition is carried as *provisional* — identity and condition kept distinct — until the facility sets the binding grade. This makes reuse claims verifiable, EPR compliance auditable, and brand reporting credible.	The sorting facility applies human grading under controlled conditions, with NIR used selectively for recycling-stream characterisation and contested composition cases. Items route to one of four destinations — high-end resale, Social Enterprises Entities, brand take-back, or recycling honouring any consumer override. Reusable garments reach reuse markets; the rest become clean recycling feedstock, not incineration.



Environmental Impact — direct outcomes, directional targets

↑ Reuse rate	↓ Premature incineration	×2–3 lifespan	High fibre purity
Textile reuse-rate increase per collection hub	Reduction in incineration of still-reusable garments	Extended clothing lifespan through multi-user reuse chains	Fibre-stream purity at sorting facilities — enabling recycling feedstock contracts

4.4. Texmat value creation and delivery mechanisms

4.4.1 Texmat Ecosystem Architecture

The following table describes the overall TexMat ecosystem architecture

Table 2: Texmat Ecosystem Architecture

layers	Actors and infrastructure	System outcome
Orchestrator TexMat — System Integrator *Connects all layers · governs data standards · manages financial flows · monitors performance · ensures reuse-first routing*	· TexMat Platform · Ecosystem Governance · Data Standards · Financial Flow Management · Performance Monitoring	Single coherent infrastructure where reuse is structurally the default, not the exception
Layer 1 Behaviour Activation *Increase garment return rate and input quality through convenience, trust, and rewards*	· Consumers · Retailers · Consumer App · Incentive / Rewards System · Social Enterprise Entities	Higher return rates · better garment condition · broader social participation
Layer 2 Physical Infrastructure *Collect, pre-sort and route textiles across the physical system — protecting reuse value*	· Smart Containers · Collection & logistics operators — third-party fleets, or reuse operators running their own collection · Reuse Operators · Sorting Facilities · Recycling Companies · Technology Partners (STAM)	Reduced contamination · maximised reuse yield · clean recycling feedstock
Layer 3 Data & Governance *Enable traceability, EPR compliance, ecomodulation and ecosystem coordination via DPP*	· DPP Infrastructure · Brands / Fashion Companies · PRO / EPR Organisations · Municipalities · Digital Platform	**SYSTEM OUTCOME** Auditable reuse claims · ecomodulated fees · credible brand reporting · policy compliance

Table 3: TexMat Stakeholder Table

Actor	Resources & Assets	Key Activities	Value Created for Ecosystem	Value Captured by Actor
Orchestrator				
TexMat *System Integrator*	Platform architecture, DPP connector, smart container ecosystem, data infrastructure, governance framework	Orchestrates all actors and layers; manages data standards and financial flows; ensures reuse-first routing; monitors circular performance	Single coherent circular textile infrastructure; closed loop between consumer input and verified reuse outcome; auditable waste hierarchy enforcement	Platform service fees; EPR infrastructure contracts; data licensing to brands and regulators; potential revenue share on reuse value unlocked
Layer 1 — Behaviour Activation				
Consumers *Activation*	Garments, behavioural participation, usage data, time and effort	Drop off garments via app or container; pre-sort where motivated; engage with rewards; spread word-of-mouth adoption	Quality input stream into the system; higher return rates; real behavioural data on textile lifecycle	Financial rewards calibrated to garment quality; transparency on destination; option to donate rewards to charity
Retailers *Activation*	Physical store locations, customer interface, loyalty programmes, digital platforms	Host collection points or containers in stores; co-finance consumer incentives; promote take-back at point of sale	Accessible drop-off infrastructure integrated into consumer daily routine; mass-market activation channel	Increased footfall; enhanced sustainability positioning; consumer loyalty; reduced EPR liability through verified collection

Social Enterprise Entities *Activation*	Collection networks, community trust, social retail stores, volunteer capacity	Operate collection points; receive consumer-donated reward credits; provide accessible channels for non-digital users. Can host containers in their shops.	Social inclusion in the circular system; community-level behaviour change	Higher quality pre-sorted incoming stock; donated consumer rewards; assisted digitalisation of flows
Layer 2 — Physical Infrastructure				
Commercial reuse operators & resale *platforms infrastructure*	Sorting expertise, second-hand retail networks, pricing knowledge, reuse markets	Receive pre-sorted garments; quality-grade and price items; sell through stores or platforms; feed demand signal back	Maximised garment lifetime; higher reuse rate per item; market signal on quality	Reduced labour cost through pre-sorting; higher margin inventory; access to DPP garment data for pricing
Logistics Providers *Infrastructure*	Transport fleets, routing systems, collection infrastructure	Collect from containers when full (triggered by smart container data); route flows to correct facility; optimise routes based on real-time fill levels	Efficient, low-contamination circulation of textile flows; reduced empty runs	Service contract revenues; optimised routing reduces operational cost; access to new circular logistics market
Sorting Facilities & Recycling Companies *Infrastructure*	Automated sorting lines, recycling technologies, fibre processing capacity	Classify textiles by fibre type, condition, colour; route to reuse or recycling; process non-reusable textiles into raw materials	High-purity fibre streams enabling textile-to-textile recycling; dramatically increased sorting throughput	Revenue from recovered materials; access to pre-characterised input improving yield; bankable feedstock contracts

Technology Partners *Infrastructure*	Hardware capability, software development, embedded sensing (NIR, computer vision), cybersecurity	Design and manufacture smart containers; develop consumer app and platform; embed DPP reader and NIR sensors; maintain system	Physical-digital integration enabling automated pre-sorting at scale; interoperable hardware ecosystem	Equipment sales and leasing; software licensing; service and maintenance contracts; IP development
Layer 3 — Data & Governance				
Brands / Fashion Companies *Data & Gov.*	Product data, DPP data fields, garment design information, take-back scheme budgets	Integrate DPP at product level; analyse end-of-life feedback; co-finance take-back via EPR; use durability insights to improve design	Garment-level lifecycle traceability; design feedback loop; credible recycled content sourcing	EPR compliance; brand reputation; circular material sourcing; lower EPR fees for durable products (ecomodulation)
PRO / EPR Organisations *Data & Gov.*	Financial mechanisms, regulatory frameworks, producer responsibility data, fee management systems	Manage and redistribute EPR fees; fund collection/sorting infrastructure; set targets for collection, reuse and recycling, set and monitor compliance; potentially own or operate container network	Financial sustainability of the overall circular textile system; ecomodulated incentives for durable product design	Validated real-time reporting data; new data-service position; ability to calibrate fees on actual reuse outcomes
Municipalities & Public Authorities *Data & Gov.*	Public infrastructure space, regulatory authority, urban collection networks,	Host collection infrastructure; provide regulatory support for pilots; enable EPR alignment;	Local textile waste reduction; verifiable circular economy performance	Reduced waste management costs; achievement of EU targets; ability to ecomodulate

	EU/national funding access	co-finance through EU/public funds	data; policy-grade evidence on waste hierarchy compliance	local taxes based on garment data

4.4.2 Texmat User journey

The user journey that follows is told through two personas developed in the co-design process. Together they span the full range of consumer engagement the system is designed to serve, from the digitally fluent app user to the deliberately app-free walk-up depositor. The same architecture serves both; only the entry point differs.

Alex Moreno
34 · Barcelona, Spain **ENTRY POINTS UC1 & UC2**

"If I'm clearing out my wardrobe, I want it to count — and I want to know where things actually go."

Alex is a digitally fluent, reward-motivated city dweller who already engages with second-hand and resale platforms. Some of Alex's newer garments carry a Digital Product Passport; many older ones do not. Alex represents the mainstream app user and is the persona through whom both digital entry points are designed — UC1 for tagged garments and UC2 for the far larger pool of unlabelled ones.

Motivation A tangible reward, plus transparency on where each garment ends up. Convenience matters as much as the payout — the process must fit into an ordinary errand.

Behaviour Prepares a batch at home in the app: scans DPP tags where present (UC1), answers a short guided self-check where absent (UC2), reviews the suggested routing, and overrides individual items when motivated to. Generates a QR drop token and visits the container when convenient.

Needs from the system An honest reward estimate up front; the ability to accept a sensible default without per-item effort, yet retain agency to redirect a special item; clear notification once the facility confirms the grade.

Friction / risk Loses trust if a reward feels arbitrary or if a routing promise is silently broken. UC2 self-declaration is provisional — the system must set expectations honestly so a later downgrade reads as fair, not as a bait-and-switch.

Marta Leinonen
58 · Tampere, Finland **ENTRY POINT UC3**

"I just want to drop my bag and know it's going somewhere useful — without downloading anything."

Marta is eco-motivated and conscientious but does not want to use a smartphone app for everyday tasks. She represents a meaningful share of the population — older residents, people without smartphones, and the many people fatigued by app-for-everything friction. Her entry point is retained as a deliberate commitment to inclusivity, not as a marginal accommodation, and it directly serves the system's collection-volume goal.

Motivation Doing the right thing with unworn clothes, with minimal effort and no digital barrier. A small acknowledgement that the contribution mattered is welcome but not the primary driver.

Behaviour Fills a bag with mixed garments — no pre-sorting, no label check, no account. Walks to the nearest container; her entire pre-container journey is zero digital steps. Identification, where she wants a reward, is a simple contactless tap (payment, transit, or library card).

Needs from the system A walk-up path that works with no phone and no registration; a minimal, weight-based reward and a printed confirmation; reassurance that her donation is genuinely reused, not landfilled.

Friction / risk Excluded entirely by any app-only design. The container must therefore support no-phone identification and a minimal reward — a path that also doubles as a gentle on-ramp to full participation should she later choose to register.

The User journey was designed around a single integrated architecture with three consumer entry points, all converging on the same collection container, flowing through the same sorting facility, and routing to the same four destinations.

These three entry points are not market segments to be chosen between; they are a single journey that begins at three different doors. A consumer may use one entry point this month and another the next — the same person, Alex, appears in two of them below — and the system treats all three as first-class citizens rather than treating the non-digital path as a fallback. The journeys diverge for the first few steps (the consumer's "pre-container" experience) and then become identical from the moment of deposit onward. The full visual storyboard of all three journeys, panel by panel, is provided as Annex [Integrated User Journey]; this section carries the narrative and the design rationale and refers to the annex for the step-level illustration.

A clarification frames all three journeys: the brand DPP, where it exists, carries a garment's *identity* — material composition, brand, care data, as recorded when the

product was placed on the market. It does not carry the garment's current *condition*. Condition is generated fresh within the TexMat journey — estimated provisionally by the consumer or by a prediction model, and set definitively by a human sorter at the facility. This distinction was the single most clarifying correction of the workshop and is the reason the journeys treat consumer-side condition data as provisional throughout.

Use Case 1 — App user with a DPP-tagged garment

The first entry point represents the system operating with the richest available information. It is illustrated by Alex, a reward-motivated user in Barcelona whose wardrobe already contains some DPP-tagged garments.

Alex opens the TexMat app in batch mode and holds the phone to each tagged garment in turn. The passport loads instantly: material, brand, care data. What the passport does not contain is whether the garment is worn, stained, or pristine — so the app supplements the identity data with a lightweight condition step. Where the TexMat prediction model can infer likely wear from the DPP record it does so; where it cannot, Alex answers a short set of plain questions. The result is a provisional condition estimate, never a binding grade — the binding grade comes later, at the facility, from a human sorter.

The app then presents a batch summary: each item with its identity, its provisional condition, and a system-suggested destination. This is where the journey makes its central design move. Alex is not required to make a decision per item; the system proposes a sensible routing automatically — high-grade items to premium resale, mid-grade to charity retail — and Alex can simply accept it. But Alex can also override any item: send a high-value jacket to a charity as a gift rather than to resale, choose a specific brand take-back programme, or confirm recycling for something worn out. This honours a principle confirmed in Workshop 3 — automate the default, but never remove the consumer's agency. The estimated reward is shown as a range, not a promise, precisely because the final grade is not yet set.

Once Alex confirms, the app generates a QR batch token with the destination preferences embedded, valid for seven days. There is no time pressure beyond that window, and the token can be reactivated if it lapses. Alex travels to the nearest container at her convenience. Crucially, the manifest — the digital record of the batch — is created here, at home, in the app.

The emotional arc of UC1 is one of purposeful control: the consumer clears the wardrobe, sees transparently where each item will go and what it is worth, and leaves with a sense of a completed, accountable transaction.

Use Case 2 — App user with no DPP

The second entry point is, in practice, the most important, because it represents the overwhelming majority of garments in circulation today: items with no Digital Product Passport. The same user, Alex, now finds an old coat whose label has worn away — no QR, no NFC, no passport to read.

The app detects the absence of a DPP and opens a short questionnaire instead of a camera: three or four plain questions covering garment type, wear level (presented with reference images so the consumer can match "good condition" to a visual standard), the presence of defects, and confirmation that the item is clean and dry. The consumer self-declares condition; the app does not pronounce a verdict from a photo. A photograph can still be attached as optional supporting evidence for a doubtful item, but it does not set the grade. Where a worn-off label is later retro-fitted with a DPP — a research direction the consortium is pursuing for legacy garments — the prediction model can then contribute an estimate; but in the demonstrator, for the no-DPP majority, condition is the consumer's provisional self-declaration, later confirmed by the human sorter.

From this point UC2 mirrors UC1: a batch summary with system-suggested routing, per-item override, a reward shown explicitly as a provisional range, and a batch token and manifest generated at home. The one substantive difference is honesty about provisionality. Because the consumer's self-declaration is an estimate, the app states up front that if the facility sorter grades an item lower, it may be rerouted and the reward adjusted. Telling the consumer this in advance is itself a design decision: a later correction that was anticipated feels fair, whereas an unannounced downgrade feels like a broken promise. The emotional arc of UC2 is therefore the journey from "will this even count?" to a reassured confidence — restored not by a machine's verdict but by simple questions and an honest estimate.

Use Case 3: Walk-up, no app

The third entry point removes the smartphone entirely. It is illustrated by Marta, 58, in Tampere, who has no app and no wish to download one, and simply wants to drop off a bag of used garments.

This journey is retained as a deliberate commitment to inclusivity, not as a marginal accommodation. Two reasons for this logic: first, a meaningful share of the population — older people, those without smartphones, and the many people fatigued by being required to install an app for every transaction — would be excluded by an app-only system. Second, the system's overriding goal is to increase collection volume, and a frictionless walk-up path serves that goal directly. Marta fills a bag,

walks to the container, and deposits it. Her entire pre-container journey is zero digital steps.

The design question UC3 raises is how a consumer with no app can be identified and rewarded at all. Texmat working answer is a minimal, weight-based reward issued at the container: a contactless tap — a payment card, or equally a transit or library card carrying an identifier — opens the container and links the deposit to a reward, and a printed ticket confirms it. The reward is deliberately small, set below the recycling value of the batch and calculated on weight rather than item count, because no item-level assessment is possible without the app. This keeps UC3 economically coherent: the walk-up user is genuinely included and rewarded, but the richer reward remains tied to the richer participation of UC1 and UC2. The minimal entry point also functions as an onboarding funnel — a walk-up user who discovers that a small reward is available may be drawn to register and become a full app participant on a later visit. The cost of adding contactless identification to the container is a question for the technical partners, but the principle that the system does not exclude the unconnected is fixed.

The emotional arc of UC3 is effortlessness: no preparation, no decisions, no friction, and a small tangible acknowledgement that the contribution mattered.

Convergence: one shared journey from the container onward

From the moment of deposit, the three journeys become a single shared experience, and this convergence is the structural heart of the integrated design. Whether Alex scanned a token or Marta tapped a card, the container performs the same minimal functions: it weighs the batch, performs a coarse contamination check (flagging only the obvious — visible dirt, moisture, or non-textile items, not fine analysis), reads any DPP tags passively present, and validates the entry. It makes no value judgement and no routing decision. The container empties in place; only its contents travel onward. This deliberate minimalism is what makes the container affordable to deploy at field scale and what keeps the system's highest-stakes decisions at a single supervisable point rather than distributed across hundreds of unattended devices.

The deposit is also the moment of custody transfer: the garment passes from the consumer's ownership into the TexMat system, and from here the system is accountable for its chain of custody, routing, and destination. The reward is not paid instantly. It is finalised only after the batch reaches the facility and is processed — a sequencing decision that reflects both the gaming-resistance logic of the reward structure and the fact that the binding condition grade does not yet exist at the container. The consumer is told this, and the brief wait is framed as the system doing its work properly rather than as a delay.

At the facility, a professional human sorter sets the definitive condition grade: human judgement is primary, not a fallback to a machine. There are two reasons. The practical one is that experienced sorters perceive the fine condition detail that automated systems miss. The regulatory one is that the human grade is the legal act that establishes End-of-Waste status for separately collected textiles — a function that cannot be delegated to an unsupervised estimate. Near-infrared spectroscopy (NIR) remains part of the facility but in a reduced and selective role: it is used for recycling-stream characterisation and contested cases, not run on every reuse item, because reuse routing rarely depends on precise fibre composition.

The facility reconciles the confirmed grade against the consumer's destination preference, applies the fair-allocation rule (honouring preference within quotas so that charity and social-economy entity destinations are not left only the lowest-grade stock — see Section 6.4), and finalises the routing. The consumer is then notified: the final grade, each item's destination, any reroute and the reason for it, the reward credited, and the avoided-CO_2 impact. The four destinations — premium resale, charity retail, brand take-back, and recycling — are offered as a market-configurable set, with only the streams available in the consumer's country shown. The loop is visibly closed, and the consumer can see, concretely, that the contribution resulted in reuse rather than disposal. This closing transparency is what converts a single deposit into repeat participation: the emotional arc ends in a sense of reward and pride grounded in evidence rather than assertion.



Figure 3: Integrated User Journey. Full panel-by-panel storyboard provided in Anne

4.4.3 Texmat Service blueprint

Where the customer journey (Section 4.4.2) describes what the consumer experiences, the service blueprint describes what the system must do behind that experience to make it real — and, critically, what each layer is not asked to do. The blueprint is the bridge between the consumer-facing promise and the technical requirements that follow: every must-have capability in the systems requirements section traces back to a step in this blueprint. The full visual blueprint, with the emotional arc, line of visibility, backstage operations, data layer, and support processes laid out across the divergent and shared phases, is provided as Annex [Integrated Service Blueprint]. This section carries the operational logic in narrative form.

The central principle of the blueprint is that **intelligence is concentrated, not distributed**. The system deliberately places its demanding work in two well-controlled places — the consumer's app at home, and the human-staffed sorting facility — and asks the layer in between, the physical container in the field, to do as little as possible. This is the opposite of the intuition that a "smart container" should be smart. The design insight, articulated by partners in early phases and validated since, is that the system's competitive advantage lies in interface and coordination, not in container mechanics; the container is a confirmation node, not an assessment node. The four layers below follow from this principle.

Layer 1 — Consumer app (app-optional by design)

The app is the primary intelligence layer for the two digital entry points, and is bypassed entirely by the walk-up path. Its essential functions are reading a DPP tag where one exists; running the guided self-characterisation questionnaire where one does not; assembling a batch of garments under a single batch identifier; letting the consumer set or override a destination per item; generating the digital manifest and QR drop token at home; and displaying the reward — as a provisional range before processing, and as a confirmed value after. The app does not claim to grade condition from a photograph. It collects a structured self-declaration and, where a DPP is present, an estimate from the prediction model; it presents these as provisional; and it sets the consumer's expectation that the facility will confirm them. Secondary functions — offline token caching for low-connectivity areas, multilingual support, a deposit history, and impact display — enhance the experience but are not load-bearing.

Layer 2 — Smart collection container (lightweight, single tier)

The container's role is to confirm that a custody transfer happened and to capture the few facts that genuinely require the physical object to be present. It weighs the batch; it validates the QR token (or, for a walk-up, reads a contactless identifier); it reads any DPP tags passively; it performs a coarse contamination check that flags only the obvious — visible dirt, moisture, or non-textile content — rather than attempting fine analysis; and it reports its fill level so collection can be triggered on demand. It does not perform NIR spectroscopy, it has no assessment touchscreen, and it makes no routing decision. Two clarifications refine this layer. First, because the manifest is now generated in the app, the container's former receipt-printing role is reduced to an optional fallback, used mainly for the walk-up path. Second, the container empties in place: only its contents are transported, not the unit itself. Keeping the container minimal is what makes it affordable, vandal-resistant, and viable to deploy at the density the collection-volume goal requires.

Layer 3 — Sorting facility (where value is determined)

The facility is the system's value-determination node. The definitive condition grade is set by a professional human sorter. This is primary, not a fallback: experienced graders perceive the fine detail that automated vision misses, and — decisively — the human grade is the legal act that confers End-of-Waste status on separately collected textiles, which a machine estimate cannot do. NIR spectroscopy remains available but in a selective (and optional) role, used for recycling-stream characterisation and contested cases rather than run on every reuse item, since reuse routing rarely turns on precise fibre composition. The facility matches the physical batch against its digital manifest, applies the confirmed grade, reconciles it against the consumer's stated destination preference, applies the fair-allocation rule that protects charity and social-enterprise destinations from being left only low-grade stock (Section 6.4), and writes the outcome back to the platform — an act that simultaneously finalises the consumer's reward, seals the chain-of-custody record, and generates the EPR compliance data. A practical consequence worth noting is that the facility is also the point at which waste is removed before allocation, so that what reaches any reuse destination is sellable rather than a disposal burden passed downstream.

Layer 4 — DPP and data infrastructure (the cross-cutting backbone)

The fourth layer is not a stage in the flow but the connective tissue running through all of it, and it is broader than the DPP alone. The platform maintains, in effect, several linked stores: a consumer store (account, reward balance, points), a garment or

batch store (DPP records where they exist, plus TexMat-generated condition, routing, and lifecycle status), and a real-time container store (weight, fill, deposit events). Access is governed by role: the consumer app, the facility worker interface, and the brand/PRO reporting interface each see only their appropriate slice. Four capabilities make the journey work: a DPP read returning a garment record fast enough for a fluid scan experience; provisional record creation for the no-DPP majority, flagged as pending confirmation; an append-only chain-of-custody log per garment or, where no individual identifier exists, per batch (token issued → deposited → in transit → graded → routed → reused or recycled); and a facility write-back that supersedes provisional consumer data with the authoritative grade and produces the auditable EPR/PRO export. The honest limit of this layer, acknowledged in Workshop 3, is that for no-DPP items identity is held only at batch level, and the batch-to-item link can degrade when bags are opened and mixed at the facility; item-level history across multiple reuse cycles is therefore not assumed in the demonstrator.

Reading the blueprint: divergence, convergence, and the line of visibility

The blueprint's structure mirrors the journey. In the pre-container phase the three entry points run as separate columns, because the frontstage actions and the data events genuinely differ — a DPP read, a questionnaire, or nothing at all. At the container, the columns merge into a single shared sequence that runs unchanged through collection, sorting, routing, reward finalisation, and loop closure. The line of visibility sits just below the container: everything above it is experienced by the consumer (the app, the deposit, the notification), and everything below it — the contamination flag, the manifest uplink, the human grade, the write-back, the EPR export — is invisible to them and is the system's responsibility to get right. The support-processes row beneath the backstage records what each step depends on contractually and institutionally: the app and DPP infrastructure, the container-operation SLA, the logistics contract, the tendered facility arrangement and its EPR-funded processing fee, and the bilateral offtake and affordability arrangements with destination operators. Those support processes are where the service blueprint hands over to the governance model (Section 6) and the financial mechanisms which specify how each is owned and funded.

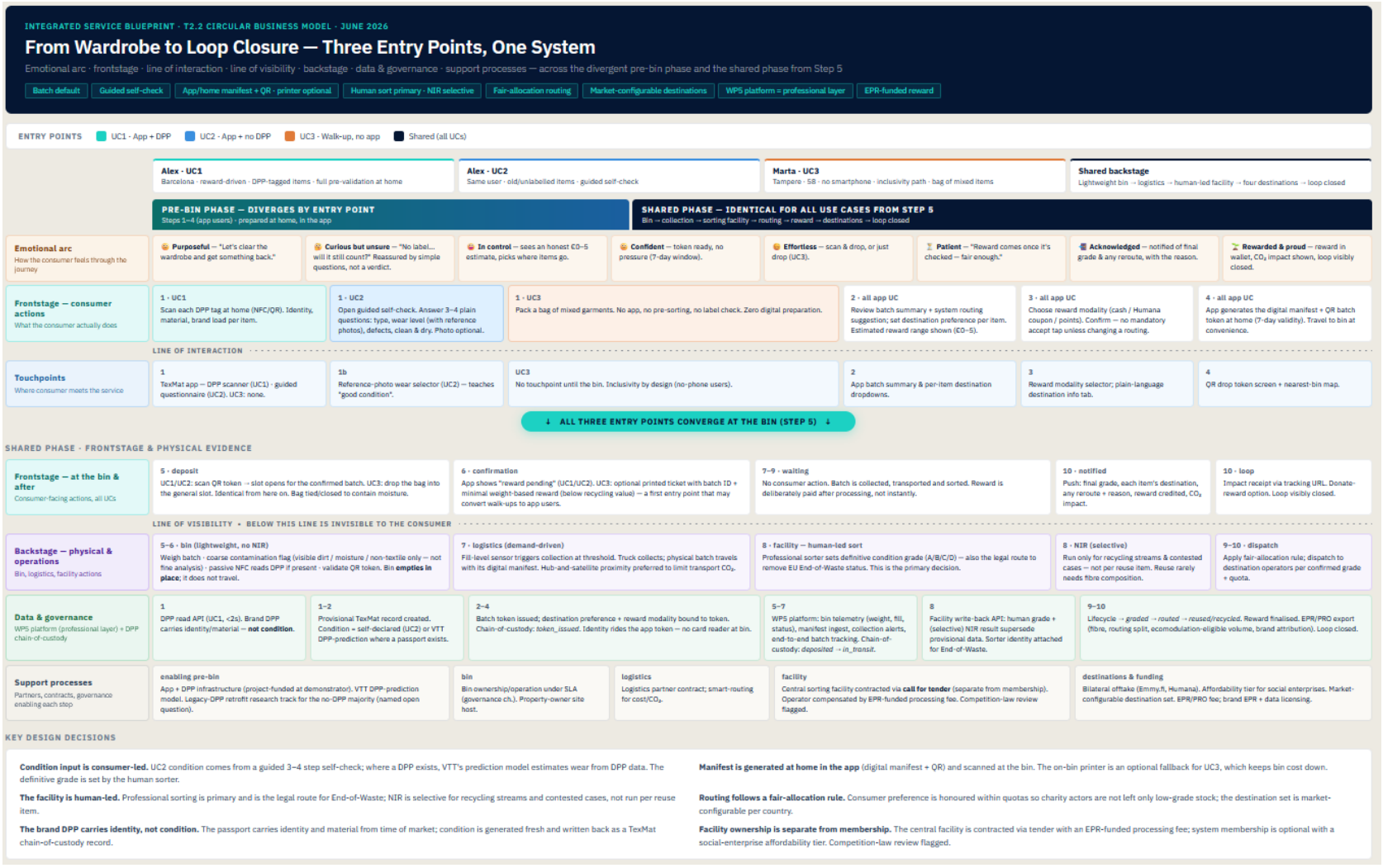


Figure 4: Integrated Service Blueprint: Step-level operational tables are provided in annex

4.4.4 Batch Identity and Chain of Custody for Garments Without a Digital Product Passport

Digital Product Passports are mandatory for new garments under ESPR but absent from the existing wardrobe stock that will dominate collection volumes for the foreseeable future. The system must therefore establish and maintain a chain of custody for items that carry no machine-readable identity of their own. This subsection specifies how that chain is constructed, where it is vulnerable, and what the system does when it breaks.

For UC2 and UC3 deposits, no item-level identity exists before the sorting facility. The unit of custody from the consumer's home to the facility receiving dock is the batch: a closed bag of garments bound to a single identifier. Item-level TexMat records are created at the facility, at the point of human grading, and are parented to the batch identifier that brought them there.

The chain of custody proceeds in five links (Table 4).

Table 4: Chain of custody

Link	Carrier	Data event
Consumer to batch	Signed QR batch token generated in the app at home (7-day validity), bound to the user account	Batch record created; destination preferences and reward modality bound to token
Batch to garment information	Provisional item records from guided self-characterisation.	Consumer declarations written to batch record; no measured attributes
Batch to bin	Token scanned at the deposit slot; weight, passive NFC sweep, contamination check	Chain-of-custody entry 1: deposit confirmed. Declared item count validated against measured weight
Bin to facility	Pre-printed coded label drawn from a dispenser at the bin, applied to the bag and bound to the manifest by app scan before deposit	Chain-of-custody entry 2: label bound, batch in transit, then received
Facility to item and back to consumer	Facility write-back API; item-level TexMat IDs minted and parented to the batch	Human grade and selective NIR result supersede provisional declarations. Reward finalised against the bound account; EPR diversion records generated

Identity therefore rides the app token rather than any hardware at the container. No card reader, payment terminal, or interactive screen is required at the point of deposit.

The practical consequences are three. First, mixed-destination bags are permitted, and consumers need not be asked to separate garments by intended destination before deposit. Second, consumer destination preferences are recorded as preferences rather than instructions, and are honoured where the grade permits. Third, the provisional self-declaration functions as an expectation-setting device and a reward estimate, not as an input to the routing decision, which remains anchored to the accountable human grade that establishes End-of-Waste status.

Because the container empties in place and batches are commingled during collection, the digital manifest arrives at the facility independently of the physical bag it describes. Reconciliation depends on a machine-readable identifier travelling on the bag itself. The identifier is issued at the point of deposit rather than prepared at home, which removes any requirement for the consumer to own a printer or to hold a stock of pre-coded bags, and removes the corresponding barrier to first-time and occasional use.

The deposit sequence is as follows. The consumer arrives with a closed bag and the batch token generated at home. A passive dispenser mounted on the container issues a pre-printed adhesive label carrying a unique code. The consumer applies the label to the bag and scans it with the app, which binds the label code to the batch manifest and releases the deposit slot. The bag is then deposited. Binding occurs on the consumer's device rather than in the container, which is consistent with the principle that intelligence does not reside in the physical collection layer.

Table 5: Requirements

Requirement	Specification
Packaging standard	Closed and tied bag. Containment is required for moisture and contamination control as well as for identifier retention
Identifier form	Pre-printed adhesive labels carrying unique codes, supplied in a passive dispenser mounted on or beside the container. No printing hardware, power draw, or paper path is added to the bin
Identifier application	Applied by the consumer to the bag at the container, before deposit, and bound to the manifest by app scan. Application after deposit is not possible

Multi-bag deposits	Each bag receives its own label, and each label is scanned individually. Binding cannot be inferred where more than one bag is deposited in a single session
Single-garment deposits	Adhesion to textile surfaces is unreliable. Single items are bagged, or default to unattributed treatment
Dispenser replenishment	Labels are a consumable restocked on the same service visit as emptying, or by the site host under the hosting agreement. Dispenser stock level is reported alongside fill level
Failure mode	Where the label is absent, unbound, or unreadable at the facility, the batch is processed as an unattributed deposit. Items are graded and routed normally, and EPR records are generated, but only the per-kilogram baseline reward can be settled

Container siting in indoor, hosted locations such as shopping centres, libraries, and supermarket concourses materially improves the reliability of this arrangement. Labels and dispenser are protected from weather, adhesion is not compromised by moisture or low temperature, and restocking falls naturally within an existing site-host relationship. Deposit also takes place in a sheltered setting where the additional interaction of applying and scanning a label is a minor imposition rather than a deterrent.

The quality-differentiated component of the UC2 reward is conditional on correct label application and binding. This dependency is stated explicitly rather than assumed away. The relevant risk is no longer whether an identifier survives transport, which a labelled closed bag largely resolves, but whether consumers apply and scan the label correctly under the mild time pressure of a public deposit. This is directly observable during pilot operation in Barcelona and Tampere, and the resulting unattributed-batch rate is proposed as a demonstrator performance indicator.

The walk-up entry point carries no consumer link by design. UC3 deposits generate a batch record with bin identifier, timestamp, weight, and item count, and nothing further. A flat weight-based reward is issued at the point of deposit, set below the recycling value of the batch. A walk-up consumer may nonetheless take a label from the dispenser and retain the duplicate stub, which carries a tracking reference allowing the batch outcome to be viewed without holding an account. Chain of custody begins at the container rather than at the home, and the resulting provenance gap is accepted as the cost of an inclusive entry point rather than treated as a defect. Where a contactless identifier is offered as an optional walk-up affordance, as discussed in Section 5.6, it creates the same consumer-to-batch link described above without requiring an application.

4.5 Value capture mechanisms

4.5.1 Why value capture is a systems question

The TexMat business model is not a single transaction between a buyer and a seller. It is a coordinated set of financial flows linking citizens, operators, sorting facilities, reuse channels, brands, and regulators, with TexMat positioned as the orchestrating layer that makes those flows visible, auditable, and aligned with the waste hierarchy. The question "where is the money?" therefore has no single answer. Money enters the system from several distinct sources, circulates through multiple actors before reaching its destination, and exits the system either as reward to consumers, as recovered material value, or as administrative cost.

Understanding how this circulation works at the system level is a prerequisite to designing the operational mechanisms (reward logic, cost structures, fee schedules) that determine whether the system is financially sustainable for each individual actor. This section presents the value circulation logic in three layers: the sources of value entering the system, the circulation paths from entry to exit, and the resulting net position for each stakeholder. The operational mechanisms that implement this circulation are detailed in the sub-sections that follow.

4.5.2 The four value pools

Money entering the TexMat system originates from four structurally distinct pools, each with its own logic, time horizon, and political dynamics. These pools are not interchangeable: a financial model that relies too heavily on any one of them is structurally fragile.

Pool 1 — Regulatory revenue (EPR fees and policy-driven funding). Under the revised Waste Framework Directive and emerging national EPR schemes for textiles, producers pay fees per weight of the products placed on the market. These fees are administered by Producer Responsibility Organisations (PROs) and redistributed to actors that perform collection, sorting, and treatment functions. For TexMat, this represents the most stable and scalable revenue source: it is not subject to market volatility and grows linearly with the volume of textiles processed. Indicative scale: €0.22/kg collected under current EU benchmarks, with potential uplift to €0.28–0.32/kg under the French model.

Pool 2 — Reuse market value. Value captured by reuse operators is transferred to TexMat through one of two operator-elected contribution modes: (A) a share of realised resale value, settled after sale — indicatively ~12% (≈€2.40 on a €20 premium-grade item, ≈€0.48 on a €4 charity-grade item); or (B) a service / subscription fee for the collection and pre-sorting infrastructure, NOT linked to goods sold or volume acquired. Mode B exists so that non-profit operators with waste-

operator status can contribute without jeopardising that status. Both modes are calibrated to the same underlying value — the pre-sorting and handling benefit TexMat delivers — and an operator elects its mode at onboarding.

Pool 3 — Brand-side commercial revenue (compliance services and data). Brands purchase services from TexMat in two distinct categories: EPR compliance services (take-back routing, verified diversion reporting) and data licensing (lifecycle analytics, SKU-level return behaviour). This pool is the most strategically valuable because it grows with TexMat's data density rather than with collected volume — meaning the system can expand revenue without scaling physical infrastructure proportionally. Indicative scale: €0.10–0.40/item compliance fee plus €40,000–€200,000/year in licensing depending on deployment scale.

Pool 4 — Consumer-borne value (effort, time, and forgone reward). Consumers contribute value to the system in the form of unpaid labour (sorting at home, transporting garments to containers, scanning DPPs) and in some cases forgone monetary reward (when they choose donation mode or coupon over cash). This pool is not visible in conventional financial statements but is critical: consumer participation is the upstream condition for every other pool to deliver value, and the perceived fairness of the reward structure determines whether participation is sustained.

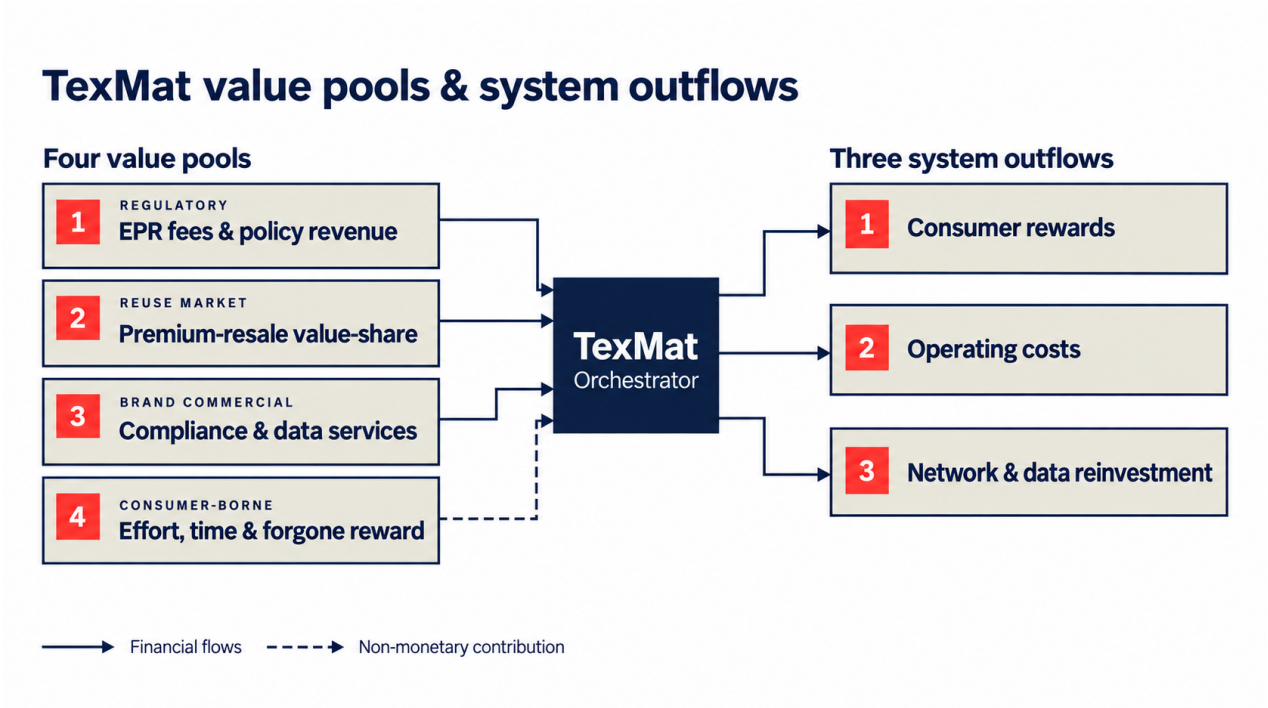


Figure 5: The four value pools entering the system

4.5.3 How value circulates: end-to-end

The simplest way to understand the system is to follow a single euro of EPR fee from its origin to its final destination — and to map the parallel circulation of material value, consumer reward, and data along the way.

Step 1: Origination. A brand places a garment on the market and pays an EPR fee to its PRO (€0.10–0.40 per item, depending on ecomodulation tier). The garment enters consumer use.

Step 2: Aggregation at the PRO. The PRO collects EPR fees across all participating brands, deducts administrative cost, and redistributes the balance to certified collection and treatment operators. TexMat receives a per-kilogram payment for verified collected and processed textiles (€0.22/kg).

Step 3: Allocation across the operating system. Of every euro of EPR revenue TexMat receives, a substantial share is committed to operating costs: collection logistics, sorting facility services, platform maintenance, container maintenance, and programme overhead. A second share funds the consumer reward layer — the €0.40/kg baseline paid at the container to every depositor.

Step 4: Material flow and reuse value capture. The same garment, having reached end of first use, is deposited at a TexMat container. At the sorting facility, NIR spectroscopy and condition grading determine its destination. If routed to reuse, the receiving operator contributes to TexMat under its elected mode: either a share of the garment's realised resale value once it sells (funded from resale margin), or a periodic service fee for the pre-sorting infrastructure that is independent of any individual sale. Either way this is a market transaction for a service received, not a regulatory transfer.

Step 5: Consumer reward finalisation. Consumers who used the app receive a quality bonus on top of the baseline. The bonus is financed per route by the value that item actually generated downstream, not by a flat fee: on a premium-resale item the operator's realised-value share (around €2.40) covers the bonus many times over; on a charity item the bonus is issued as an in-store voucher funded by the operator from its own labour saving, at no cash cost to TexMat; on a branded item the brand-side compliance fee covers it; and on all other routes a partner-funded points credit covers it, net of breakage. An item therefore never creates a reward obligation that its own downstream value has not already covered.

Step 6: Brand-side returns. Brands receive two outputs from TexMat: verified EPR compliance data (volume diverted, condition confirmed, fibre composition) and aggregated lifecycle data (return rate per SKU, condition degradation, geographic patterns). Brands may purchase the second of these as a data licensing subscription, generating revenue for TexMat that is decoupled from physical material flow.

Step 7: Residual recycling value. Items graded as non-reusable enter the recycling pathway. Fibre recyclers pay TexMat €0.06–0.14/kg for NIR-characterised feedstock — a thin-margin flow that is nonetheless meaningful at scale because it monetises what would otherwise be a cost (disposal of unsalvageable textiles).

Step 8: Closing the loop. All flows are recorded against the DPP / TexMat chain-of-custody record, which feeds back into the PRO's reporting and, where applicable, into the brand's ecomodulation tier calculation for future garments. The closed loop creates a forward incentive: brands that design for durability and traceability pay lower future EPR fees, lowering their cost of participation in the system.

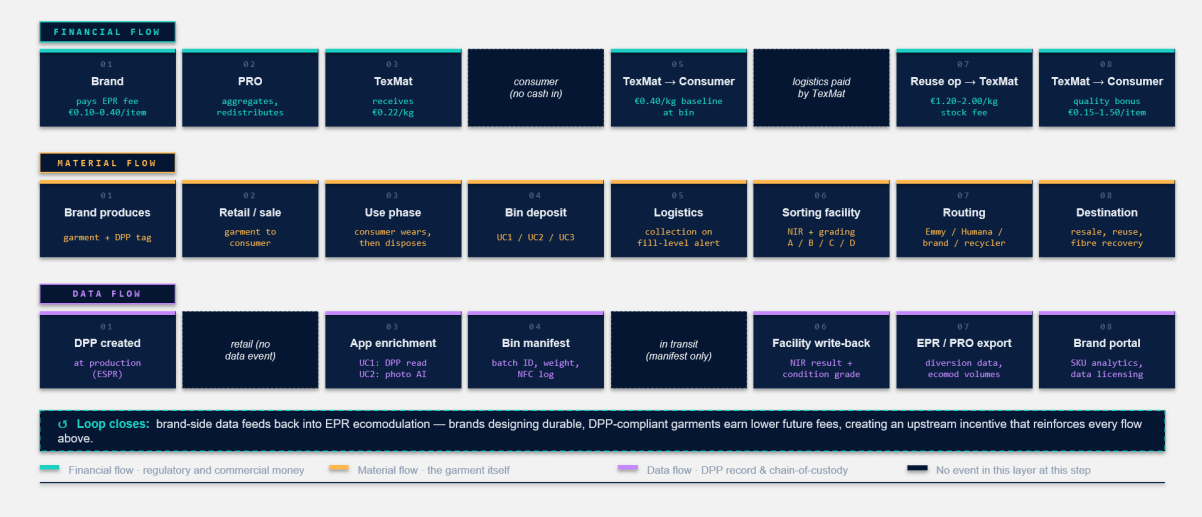


Figure 6: End-to-end value circulation map

4.5.4 Per-stakeholder net position: who pays, who collects, who breaks even

The value circulation described above produces a different net position for each actor. The table below summarises pay-in and take-out flows at the National deployment scale (Year 3 steady state — the scale at which the model approaches financial sustainability).

Table 6: Net financial position per stakeholder (indicative, National scale, Year 3)

Stakeholder	Principal pay-in	Principal take-out	Net position	Notes on dependency
Consumers	Effort and time (non-monetary)	€0.40/kg baseline + quality bonus (UC1/UC2) or impact receipt (UC3)	Net positive in monetary terms for active users	Reward structure must remain perceived as fair; otherwise participation collapses
Brands	EPR fees (€0.10–0.40/item) + data licensing (€200K/yr at scale)	EPR compliance proof + lifecycle data + reputation value + ecomodulation upside	Net negative in cash, positive in compliance and brand value	Voluntary participation depends on TexMat's ability to demonstrate measurable ROI
PROs / EPR organisations	Administrative cost; redistribution to TexMat and others	EPR fee margin retained; ecomodulation governance role	Net positive (regulatory mandate)	Performance evaluated by Member State governments — reliable diversion data essential
Reuse operators	Pay-in = EITHER realised-value share (post-sale) OR a sales-decoupled service fee — operator's choice.	higher sell-through + demand-matched sourcing	Strongly positive under either mode (labour saving exceeds contribution).	Share rate calibrated per route; no fee on unsold items
Sorting facilities	NIR equipment capex; labour	Per-tonne service fee from TexMat + recycler revenue share on graded fibre	Net positive at scale	Capex amortisation requires sustained throughput volumes

Logistics providers	Vehicle, fuel, labour	Service contract fees from TexMat	Net positive (standard service contract)	Margin depends on route optimisation efficiency
Municipalities	Permits and site provision (low cost); optional co-financing	Diversion data + reduced residual waste cost + EPR compliance evidence	Net positive when residual waste reduction exceeds permit cost	Political value secondary to financial — visible CO_2 outcomes critical
Property owners	Container space (opportunity cost)	CSR recognition + monthly volume reports	Net neutral in cash, positive in CSR	Reputational risk if containers poorly maintained
Technology partners (ROVIM, IRIS, VTT)	Development cost (project-funded in demonstrator)	Hardware sales + software licensing + maintenance contracts	Net positive at deployment scale	Demonstrator funded by Horizon Europe grant — long-term contracts begin Y4
TexMat (orchestrator)	Programme overhead + reward cash outflow + platform opex	EPR fees + operator contribution (value-share or service fee) + brand fees + data licensing + recycler payments	Net negative at Pilot scale; converges to break-even at National scale with EPR uplift	The orchestrator absorbs short-term funding gaps that no other actor will carry

The single most important reading of this table is that TexMat is the only actor that carries net negative cash flow at sub-national scale. Every other stakeholder is either net positive in cash or positive in non-cash value (compliance, CSR, data). The orchestrator role exists precisely because someone must absorb the temporal mismatch between short-term system costs and long-term revenue ramp-up — and because the orchestrator captures returns that are not available to any individual actor (data licensing, EPR contract aggregation, multi-brand service revenue).

This has a direct strategic implication: the financial sustainability of TexMat depends on reaching the scale at which its diversified revenue streams (Pools 1, 2, and 3) collectively exceed the operating cost of orchestrating the system. The viability conditions documented in the next section — EPR rate uplift, brand licensing ramp,

national network threshold — are the three operational levers that determine when this convergence occurs.

4.5.5 Structural features that make the model work

Three structural features of the value circulation pattern are worth making explicit, because they distinguish the TexMat model from a generic "platform that takes a cut from every transaction" approach.

Two-tier funding of universal acceptance. The €0.40/kg consumer baseline reward is paid universally and is funded from the EPR revenue stream, consistent with the producer-pays principle: producers finance the collection and treatment of all separately collected textiles, including the low-value fraction. On top of this regulatory base, the premium-resale fraction does the discretionary work. A premium item realising around €20 yields a TexMat value-share of roughly €2.40, against roughly €0.48 for a €4 charity item and €0.02–0.04 for a recycling-grade item; the discretionary layer is funded by the operator contribution on higher-value stock, taken either as a value-share or as a service fee.

Asymmetric scaling of revenue streams. The four value pools scale at different rates relative to physical infrastructure deployment. Pool 1 (regulatory) scales linearly with collected volume — twice the containers, twice the EPR revenue. Pool 2 (reuse market) scales with reuse yield, which improves with sorting quality and operational maturity rather than container count alone. Pool 3 (brand commercial) scales super-linearly — the value of lifecycle data grows with the *density* of the data, not just the volume. Pool 4 (consumer-borne) scales sub-linearly — the marginal additional effort per consumer decreases as the system becomes familiar. This asymmetry is why financial viability improves disproportionately at scale: the most valuable revenue streams are precisely those that grow fastest as deployment expands.

Decoupling of cash and data value capture. A unique feature of the model is that TexMat captures value in two parallel currencies: cash and data. Cash flows are bounded by the physical volume of textiles processed; data flows compound as the network captures more lifecycle records per garment, per brand, per geography. At Pilot scale, data revenue is zero. At National scale, data revenue (€200,000/yr in brand licensing) becomes a material contribution to financial sustainability. The same physical infrastructure that generates €1.5M/yr in cash revenue at National scale also generates a data asset whose long-term value is independent of any single year's collection volume.

4.5.6 Revenue streams

TexMat's revenue derives from four distinct payers, corresponding to the four value pools defined in §4.4.2: the regulatory system (Pool 1), the reuse market (Pool 2), brand commercial demand (Pool 3), and the consumer (Pool 4, which is a cost rather than a revenue source and is treated in Part B). Each stream below is described by its payment basis and unit economics.

EPR / PRO fee revenue (Pool 1)

The EPR fee is the per-kilogram payment TexMat receives for collecting textiles that fall under Extended Producer Responsibility obligations. Under the revised Waste Framework Directive, producers placing textiles on the EU market must finance their collection and treatment; those fees are pooled by a Producer Responsibility Organisation (PRO) and disbursed to accredited collection operators on a per-kilogram basis.

Payment basis: euro per kilogram collected. The model uses a benchmark rate of €0.22/kg, the rate observed in early-stage national schemes. This revenue scales linearly with collected volume — each additional kilogram through the system earns the prevailing rate at no additional operational cost, because the collection infrastructure is already deployed.

Reference points for the rate basis:

3. France (Refashion) operates an established textile EPR scheme at €0.26–€0.32/kg, providing a mature-market reference for where rates settle.
4. Finland and Spain are implementing WFD Article 9 for textiles and sit at the earlier, lower end of the rate range.
5. Rate sensitivity: at the benchmark €0.22/kg the fee covers roughly half of the €0.40/kg consumer baseline; movement in the rate flows directly to the net position with no cost offset.

Operator contribution revenue (Pool 2)

The operator contribution to TexMat is paid by reuse operators on stock received that is pre-graded, condition-verified, and data-tagged. It is the mechanism by which TexMat captures part of the value it creates for the receiving organisation through pre-sorting and demand-matched routing. Because reuse operators differ in legal form, market position, and the constraints attached to their status, the contribution is offered in two modes, and each operator elects the one that fits its situation at onboarding.

Mode A — realised-value share. The operator pays a percentage of each item's realised resale value, settled only once the item sells. The model uses an indicative 10–18% share (12% central case). Because it is value-based, the same rate yields very different absolute amounts by stock tier: roughly €2.40 on a €20 premium-grade item and roughly €0.48 on a €4 charity-grade item at the central rate. No charge arises on stock the operator has not sold, so the mode sits inside the operator's existing pay-on-sale risk profile rather than imposing inventory cost.

Mode B — service / subscription fee. The operator pays a periodic fee for the collection and pre-sorting infrastructure it draws on, calculated independently of goods sold or volume acquired. This mode exists so that non-profit operators holding waste-operator status can contribute without tying any payment to sales or material acquisition, which could otherwise place that status at risk. The fee is anchored to the same pre-sorting benefit that justifies Mode A — the sorting labour avoided, the reduced waste-disposal cost, and the demand-matched sourcing — so the two modes price the same service by different means rather than offering two different deals. The basis of the fee (flat-periodic versus capacity-based, and its level) is carried to the demonstrator phase as an open calibration, since partners declined to fix a figure at this stage.

Value basis (both modes). TexMat's pre-grading and demand-matched routing create value for the receiving operator by removing triage labour (rejected items never reach the operator), reducing waste-disposal cost, matching supply to demand, and improving sell-through through accurate condition grading. For premium-grade stock this benefit is amplified, because the operator's largest hidden cost — inspecting unsorted intake that is ultimately rejected — is eliminated upstream. The contribution is anchored to this demonstrable operator-side benefit, so the operator pays in proportion to value actually received, whichever mode applies.

Table 7: Operator Contribution Economics

Element	Mode A — value-share	Mode B — service fee
Payment basis	% of realised resale value, per item, settled after sale	Periodic fee for collection + pre-sorting, independent of sales
Indicative level	10–18% (12% central)	Open — flat-periodic or capacity-based (Delphi/demonstrator)
Premium-grade item (≈€20)	≈€2.40 to TexMat	Not item-linked

Charity-grade item (≈€4)	≈€0.48 to TexMat	Not item-linked
Anchored to	Operator-side benefit + realised price	Operator-side benefit (pre-sorting service)
Fits operators who	Can tie contribution to sales	Must decouple contribution from sales (e.g. non-profit/waste-operator status)

Brand EPR compliance fee revenue (Pool 3 — compliance)

Distinct from the PRO-channelled EPR fee (A.1), this is a per-event fee paid directly by a brand for a verified return-and-treatment record of its own products. Under the revised WFD and ESPR, producers must increasingly demonstrate to PROs and regulators that their products were collected and correctly processed; a verified third-party return event satisfies that evidentiary need.

Payment basis: euro per verified return event, in the range €0.05–€0.18 per item. The fee depends on brand attribution — the share of collected items that can be matched to a paying brand via DPP tag or photo/AI attribution. The model assumes 50% attribution at Pilot, rising as app and DPP adoption increase; higher attribution raises the proportion of collected volume that earns this fee.

Routing note: this fee can be collected either through the PRO or, where TexMat holds the necessary accreditation and a bilateral brand agreement, directly from the brand (the direct-brand EPR service). The compliance fee is the floor of the brand relationship; the data licensing described in A.4 sits above it.

Brand data licensing revenue (Pool 3 — commercial)

Brand data licensing monetises the lifecycle dataset TexMat accumulates as the verified intermediary at the end of the use phase. TexMat is positioned to hold systematic, item-level data on garment condition, composition, and consumer return behaviour — data that no brand, retailer, or resale platform currently captures. This stream prices that data as product intelligence, separate from the compliance reporting in A.3.

The data TexMat is positioned to hold:

6. **Product lifetime** — elapsed time between sale and return, a proxy for construction quality and fibre durability.
7. **Condition at return** — degradation profile by product type, fibre, and price point.
8. **Return trigger** — the consumer behaviour preceding deposit (replacement purchase, seasonal shift, relocation).

9. **Geographic return flows** — where products are returned relative to point of sale.
10. **Reuse-vs-recycle rate by product** — which design features predict reuse viability.
11. **Condition vs. price point** — whether a brand's quality premium is borne out by durability data.

Table 8: Data products and pricing

Data product	Price model	Est. annual value (Regional)	Buyer
ESPR compliance report (audit-grade)	€800–€2,000 / submission	€5–€15K (5–10 brands)	Brands with EU sales obligation
Product lifetime intelligence — annual	€8,000–€20,000 / brand / yr	€25–€60K (3–5 partners)	Sustainability & design leads
Real-time return event API	€15,000–€40,000 / yr	€15–€40K (1–2 enterprise)	Brands with own DPP teams
Circular design score by SKU	€3,000–€8,000 / category	€10–€25K (targeted)	Product development teams
Category benchmarking (anonymised)	€5,000–€12,000 / yr	€10–€24K	PROs, industry bodies
Brand take-back white-label feed	€20,000–€60,000 / yr	€20–€60K (1–3 programmes)	Brands running own take-back

Governance conditions on this stream

- **Aggregation minimum**: no individual consumer or item-level data is sold; a minimum aggregation of 100 items per data point applies, GDPR-compliant by design.
- **Data ownership**: TexMat owns the collected data as the verified intermediary; consumer data is anonymised before any brand reporting.
- **Brand-specific opt-in**: a brand receives identifiable data only on its own products; cross-brand benchmarks are anonymised.

Premium service revenue (volume-independent)

Premium services generate revenue that does not depend on collection volume, reducing the model's sensitivity to collection-rate assumptions. Three customer segments carry distinct offerings: consumers, brands, and reuse platforms.

Premium consumer subscription — "texmat pro"

A consumer subscription at €3.99/month adds reward-timing, routing control, a fuller impact dashboard, home-collection scheduling, and a points multiplier. Revenue basis: subscriber count × monthly fee. At Regional scale, 0.5% penetration among active users (≈750 subscribers) yields approximately €36,000/yr. Home-collection scheduling can be priced separately at €1.50–€2.50 per collection.

Table 9: free vs premium

Feature	Free tier	TexMat Pro (€3.99/mo)
Reward timing	After facility (48h)	Same-day estimate + instant baseline
Routing control	System suggestion	Full per-item control, Emmy.fi lock-in
Impact dashboard	Basic (kg, CO_2)	Full lifecycle: resale price, destination
Collection	Self-directed to container	Home collection scheduling
Points multiplier	1× standard	2× on every deposit

Premium brand services "texmat brand intelligence"

A tiered annual subscription packaging compliance certification with data products from A.4. Revenue basis: number of brands × tier fee. At Regional scale, 3–5 Standard-tier brands (€10–€20K each) plus one Premium brand (€40K) generates €70–€140K/yr, independent of collection volume.

Table 10: expected brand services revenues

Tier	Annual fee	Target customer
EPR Compliance Basic	€1,500–€3,000	Any EU brand needing EPR reporting
Brand Intelligence Standard	€10,000–€20,000	Mid-size sustainable brands

Brand Intelligence Premium	€30,000–€60,000	Large brands with circularity teams
Take-back White-Label	€25,000–€80,000	Brands with own sustainability commitments

Premium platform services — "texmat data connect"

Services sold to reuse platforms: a pre-sorted condition-verified inventory feed, a demand-forecasting API, and a condition-certification mark. Revenue basis is per-item for the inventory feed (€0.25–€0.60/item delivered with data) and subscription for the forecasting API (€8–€15K/yr).

Table 11: Premium platform services revenues

Service	Pricing model	Revenue est. (Regional)
Pre-sorted inventory feed	€0.25–€0.60 / item	€15–€40K/yr
Demand forecasting API	€8,000–€15,000 / yr	€8–€30K/yr
Condition certification mark	€0.10–€0.20 / certified item	€10–€25K/yr
Returns intelligence sharing	Revenue-share / data exchange	Non-cash; raises routing accuracy

Revenue streams at a glance

The full set of revenue streams, with payer, payment basis, and scaling behaviour:

Table 12: Revenue streams overview

Stream	Payer	Payment basis	Scaling
EPR / PRO fee (A.1)	PRO / regulatory	€0.22/kg collected	Linear with volume
Operator Value Share (A.2)	Reuse operators	10–18% of realised resale value (≈€2.40/item premium; ≈€0.48/item charity)	With reuse yield and resale price
Brand EPR compliance fee (A.3)	Brands	€0.05–€0.18 / return event	With attribution rate
Brand data licensing (A.4)	Brands	Per report / API subscription	Super-linear (data density)

Premium consumer (A.5.1)	Consumers	€3.99 / month	With subscriber count
Premium brand (A.5.2)	Brands	€1.5K–€80K / yr tiered	Volume-independent
Premium platform (A.5.3)	Reuse platforms	Per-item + subscription	With reuse-grade volume

4.5.7 Cost structure

TexMat's costs fall into two groups: the consumer reward outflow (the implementation of Pool 4, the consumer-borne value pool) and the orchestrator's operating cost (infrastructure, logistics, sorting, and platform). This part describes the mechanics of each, including the two non-cash reward modalities — coupons and points — that change the form, and therefore the cost, of the consumer reward.

Consumer reward outflow

The consumer reward has two layers. The universal baseline of €0.40/kg is paid in cash on every qualifying deposit (minimum 0.5 kg) and rewards the physical act of contributing volume. The quality bonus is a per-item amount paid only on app-confirmed reuse-grade items (UC1/UC2); at Pilot it is €0.20 per item. The baseline is fixed cash; the quality bonus is the layer whose form can vary across three modalities.

The cost of the quality-bonus layer depends on which modality the consumer takes — cash, coupon, or points. The baseline is unaffected by modality and is always cash.

Coupon modality (Humana-routed items)

On items routed to Humana, the cash quality bonus can be replaced by a Humana in-store voucher. TexMat continues to pay the cash baseline; the quality-bonus cost transfers to Humana, who issues a voucher from its own stock. The voucher's face value (€0.40–€0.50) exceeds the cash bonus it replaces (€0.20), so perceived consumer value rises while TexMat's cash outflow on that layer falls to zero.

Why the transfer is sustainable for Humana: at a 50–60% gross margin, a €0.40 voucher costs Humana roughly €0.16–€0.20 in goods — and Humana saves approximately €2.40 per item in sorting labour by receiving pre-sorted stock, so the voucher is a small fraction of its own saving. Coupon breakage (30–35% never redeemed) lowers Humana's effective cost further, to roughly €0.11 per issued coupon.

Table 13: cash model vs coupon model

Action	Cash model	Coupon model	Net change for TexMat
Baseline paid by TexMat	€0.40/kg cash	€0.40/kg cash	Unchanged
Quality bonus paid by	TexMat (€0.20/item)	Humana (€0.40 voucher)	TexMat saves €0.20/item
Cost to Humana per voucher	—	~€0.17 in goods	Humana cost < TexMat saving

Consumer receives	€0.20 cash	€0.40 voucher	Higher perceived value
Breakage (unredeemed)	0%	~30–35%	Real Humana cost ~€0.11/issued

Scope and conditions: the coupon applies only to Humana-routed reuse-grade items confirmed via app (UC1/UC2). Emmy.fi-routed items retain the cash bonus, which is comfortably covered by the realised-value share Emmy generates on premium stock (around €2.40 per item against a €0.20 bonus). The modality requires a bilateral agreement under which Humana issues coupons as its contribution. Precedent for voucher-over-cash schemes includes retailer garment-collection programmes that report higher consumer satisfaction with vouchers than with equivalent cash, partly from the higher face value and partly from the in-store touchpoint created.

Points modality (all routes)

A points layer runs parallel to cash across all segments. The consumer may choose a lower cash reward or a higher-value points reward redeemable across the partner network. Points reduce the effective reward cost through three mechanisms: breakage (20–35% of points are never redeemed), partner funding (70–80% of redemptions are funded by partners as marketing spend rather than by TexMat cash), and repeat-engagement effects that raise lifetime volume per user.

Table 14: Point earning structure

Action	Points earned	Cash equivalent
Deposit ≥ 0.5 kg (any UC)	100 pts / kg	€0.40/kg baseline (earns both)
Quality-confirmed reuse item	50 pts / item	Cash bonus OR double points (consumer choice)
DPP garment deposited (UC1)	+20 pts bonus	Incentivises app + DPP adoption
3rd deposit within 6 months	+200 pts streak	~€0.80 equivalent
10 kg lifetime milestone	+500 pts	~€2 equivalent
Refer a new depositor	+300 pts	~€1.20 equivalent

Table 15: Redemption options and who funds them

Redemption option	Points	Cost to TexMat	Funded by
Humana voucher (€2 face)	400 pts	~€0.80 in goods	Humana (marketing)

Emmy.fi discount (10%)	300 pts	~€0.60 avg value	Emmy.fi (acquisition)
Brand partner voucher	500 pts	~€2 face value	Brand (EPR / marketing)
Municipality perk	600 pts	Municipality-funded	Municipal partner
Cash out (lower rate)	500 pts = €1.00	€1.00 cash outflow	TexMat (discouraged)
CO_2 offset / plant a tree	200 pts	~€0.15	Partner offset programme

How points reduce reward cost relative to cash:

Table 16: Points systems vs Cash systems

Factor	Points system	Cash system
Breakage	20–35% never redeemed	0% — all cash spent
Partner funding	70–80% partner-funded	100% TexMat-funded
Repeat behaviour	Streak / milestone raise frequency	One-off incentive only
Cash-out	Penalised (lower rate)	Always cash

Design principle governing both non-cash modalities: cash is always available, with the non-cash option presented as the default. Points and coupons are framed as an upgrade rather than a restriction; the choice architecture, not coercion, drives adoption.

Orchestrator operating costs

Beyond the consumer reward, the orchestrator's operating cost covers logistics (collection routing and transport), sorting (facility operation and NIR spectroscopy under controlled conditions), and platform operation (app, DPP infrastructure, data systems). These costs concentrate in logistics and sorting, and they exhibit economies of scale: fixed platform and facility costs are amortised over rising volume, so cost per kilogram falls as deployment expands. This is the cost-side counterpart to the asymmetric revenue scaling described in §4.4.5 and is why cost-coverage improves disproportionately at Regional and National scale.

Several operating costs can be reduced in form rather than in service level: sorting can draw on existing charity sorting infrastructure rather than standalone facilities; logistics cost falls with fill-sensor-driven routing; and NIR infrastructure can be shared with textile recyclers who require the same equipment. These are structural choices about how the cost is incurred, not reductions in the activity performed.

Why scale governs the net position

The relationship between revenue and cost is scale-dependent in a way that is intrinsic to the model rather than a matter of execution. At Pilot scale, natural revenue (≈€31K) is far below cost (≈€247K), and the gap is covered by the TexMat grant. The volume-independent streams (brand data licensing, premium services) are near zero at Pilot because they require an established data position and partner base. As volume rises, the linear streams (EPR fee) grow proportionally, the super-linear stream (data) grows faster than volume, and fixed costs amortise — so the cost-coverage ratio rises with scale. Single-city deployment is structurally insufficient for self-sustaining operation; Regional and National scale are the thresholds at which the diversified revenue base reaches financial coherence.

5 Governance and System Coordination

The preceding section describe *what* TexMat does — the integrated architecture and the financial mechanisms that fund it. This section addresses *who decides, who owns, who pays, and who is accountable* once the system operates across multiple independent actors.

This section is structured around six governance domains, followed by a consolidated governance model and a register of decisions that remain open. Throughout, a distinction is maintained: the separation between the **demonstrator** (what the project will build and prove with its partners and budget) and the **target system** (how a fully realised national service would need to be governed). Several governance questions are necessary for the target system but explicitly out of scope for the demonstrator; these are marked as such rather than left ambiguous.

5.1 Governance Principles

Five principles emerged from the co-design process and frame every decision in this section.

Participation is voluntary, but the system is designed to make participation rational. TexMat does not replace existing collection infrastructure; it operates alongside it. A consumer who does not want to use the system can continue to use conventional containers, and an operator who does not join can continue to operate independently. The system's leverage comes not from compulsion but from the value it concentrates — higher collection volumes, pre-characterised quality, and reward-driven consumer participation — such that joining becomes the economically sensible choice.

Benefit must precede contribution. Any fee an actor pays into the system must be justified by a demonstrable benefit they receive from it. A reuse operator pays for access to better-quality, pre-sorted inbound stock; they do not pay merely to exist within the system. A fee that is not clearly tied to value received is not defensible and would not survive contact with the thin margins of the second-hand sector.

The system must not disrupt the level playing field. TexMat must not advantage large, well-resourced operators at the expense of smaller actors, social enterprises entities whose mission depends on access to reusable textiles. A model that concentrates high-grade stock with a few commercial players and leaves charity actors with residual quality would be both ethically and politically untenable.

Ownership changes are explicit and recorded. The moment a garment enters the system is a transfer of custody, and from that point the system is accountable for its chain of custody, its routing, and its eventual destination. Governance follows the garment.

Win-win is a testable claim, not a slogan. Texmat ambition is that every participating stakeholder is better off inside the system than outside it. This is treated as a falsifiable proposition: each actor's net position with and without TexMat is to be modelled, and if any core partner is net-negative, the governance or financial model is not yet complete.

5.2 Infrastructure Governance — Container Ownership and the Collection Layer

The collection container is the system's physical entry point and the locus of the custody transfer described above. Three governance questions attach to it: who owns the asset, who operates and maintains it, and who hosts the site.

The demonstrator assumes a model in which **TexMat (or its operating entity) owns the container hardware and the platform**, contracts **maintenance and first-mile collection** to a logistics partner under a service-level agreement, and secures **site access** from property owners (malls, universities, transit hubs, housing estates) in exchange for CSR recognition, volume reporting, and footfall association rather than rent. This separation matters because the three roles have different incentives and failure modes: an unmaintained or overflowing container damages the property owner's reputation and the consumer's trust simultaneously, so maintenance responsiveness must be contractually guaranteed, not best-effort.

The lightweight container specification adopted has a direct governance benefit: because the container performs no value assessment — only weight, a coarse contamination flag, passive DPP reading, and token validation — disputes about value do not arise at the container. The container records that a custody transfer occurred; it does not adjudicate what was transferred. Value determination is deferred to the facility, where it can be performed under controlled conditions and by an accountable human grader. This keeps the highest-stakes governance decisions at a single, supervisable point rather than distributed across hundreds of unattended field devices.

A consequence is that the **container empties in place** — it is not transported to the facility and returned. Only its contents move. This simplifies asset governance (the

container is a fixed installation with a known site host) and isolates the logistics contract to the movement of batches, not of infrastructure.

5.3 System Membership and the Sorting Facility

Two questions were repeatedly conflated in business model codesign discussions and must be separated, because they have different answers.

Question one: who operates the central sorting facility? The project does not intend to build a sorting facility from scratch. The realistic model is that an existing operator with sorting capability acts as the contracted TexMat facility for a given territory — for example, the official TexMat sorting facility in Finland — receiving batches and dispatching them onward to the appropriate destination operators. Because designating a single facility confers a material advantage, this designation should be made through an **open call for tender** against published TexMat requirements, with the best-qualified bid winning. This converts a potentially preferential arrangement into a contestable, transparent procurement, which both improves legitimacy and partially mitigates the competition-law exposure discussed in 6.4.

Question two: who may participate in the system as a destination operator, and on what terms? The logic the project advances is that a reuse operator who joins gains access to a larger volume of pre-characterised, reuse-grade stock than they could collect independently, and that this benefit justifies a transaction flowing from the operator to TexMat. The concern raised — legitimately — is that the second-hand mid-segment operates on margins so thin (an average sale price cited at approximately €4 per garment) that a poorly calibrated membership fee would erase the operator's margin entirely and make participation worse than non-participation, violating the benefit-precedes-contribution principle.

Operator eligibility and selection. Two conditions govern which operators may receive routed stock, and they apply regardless of the contribution mode an operator elects. First, a reuse operator must hold waste-manager status: under EU law, separately collected used textiles are classified as waste until a professional assessment confers End-of-Waste status, so only an operator authorised to handle waste may receive stock ahead of that determination. Second, the allocation of TexMat routing and offtake must follow a transparent, EPR-compliant selection process — a public tender or equivalent — so that access to the system is auditable and non-discriminatory, consistent with the producer-pays governance the EPR framework requires. These eligibility and selection rules operate alongside the fair-

allocation routing quota (§6.4): eligibility determines who may receive stock at all, selection determines on what terms, and the fair-allocation rule then governs how graded stock is distributed among eligible operators so that social economy entity destinations are not left only the lowest-grade fraction.

The governance response has three parts. First, the **fee basis must be derived backwards from realistic unit economics** rather than set as a flat membership charge: the financial model (Section 5) must demonstrate, for a representative low-value garment, that every actor retains a positive margin after the fee. If it does not, the operator-paid membership mechanism fails and must be replaced — the most credible alternative being an **EPR-funded processing fee**, in which the cost of running the system is mainly borne by the EPR/PRO revenue stream rather than extracted from the operator's resale margin.

Second, **membership must remain genuinely optional, and non-membership must remain viable.** A consumer can still drop garments at a TexMat container without any operator being a member; an operator who declines membership is not locked out of the wider market. The system must not become a gatekeeper that punishes non-participation by foreclosing access.

Third, an **affordability tier is required for** social economy entities **and small actors.** Mission-driven organisations — those creating employment for disadvantaged communities, particularly significant in Spain — may lack the resources to participate on commercial terms and could be effectively excluded, or might actively boycott a system perceived as disrupting the level playing field. A reduced or volume-indexed fee, or a fee-waived donation-only participation mode, is therefore a governance requirement.

A further structural observation is that participation in TexMat may **reshape operators' own business models** rather than simply supplement them. An operator that today performs its own collection, sorting, and resale might, within TexMat, become a resale channel only, with handling consolidated at the contracted facility. This is not inherently negative — it can reduce duplicated logistics and lower sector-wide emissions, which are significant in a geographically dispersed market such as Finland — but it means the governance model must be designed with operators, mapping each actor's current and future role per territory, rather than imposed on them.

Table 17: Separation of facility operation and system membership

Dimension	Central sorting facility	System membership (destination operators)

Governance question	Who runs the contracted hub?	Who may receive routed stock, and on what terms?
Mechanism	Open call for tender against TexMat requirements	Voluntary membership with tiered fee basis
Number of parties	One per territory	Many
Obligatory?	A territory has one designated facility	No — optional; non-members use conventional channels
Basis of payment	Service contract for sorting/dispatch	Fee justified by access to pre-sorted reuse-grade volume
Fairness safeguard	Transparent, contestable procurement	Affordability tier for social enterprises and small actors
Funding fallback	EPR-funded processing fee if operator-paid fee is unviable	Same — EPR-funded model relieves margin pressure

5.4 Routing Fairness and Competition

Two related risks sit at the routing layer: that the system unfairly allocates value between destination operators, and that the system's structure attracts competition-law scrutiny.

Routing fairness. If routing were driven by quality alone, the highest-grade garments would flow to the highest-margin commercial resale channels, leaving social economy entity destinations with progressively lower-grade stock. Two facts need to be stated: incoming garment quality is structurally declining and will continue to decline, and the system's ability to divert genuinely unsellable items before they reach charity partners is a benefit worth preserving. The governance response is a **fair-allocation rule**: consumer destination preference and quality-based routing are honoured *within quotas* that guarantee classical reuse Social Economy Entities and foundations a defined share of reuse-grade stock, rather than only the residual. The reward and points system is the nudging mechanism — consumers can be incentivised to direct good garments toward traditional reuse operators, not only toward premium resale. The precise quota mechanism is a design task for the next phase, but the principle — that routing is governed by a fairness rule, not by margin maximisation — is settled.

A specific safeguard already in the architecture supports this: the facility sets aside quality that is not good enough *before* allocation, so that whatever a charity destination receives is genuinely sellable rather than a disposal burden passed downstream. The fairness rule allocates *among viable stock*, not raw mixed input.

Competition law. Designating a single contracted facility per territory, with privileged access to consumer-routed stock, may raise competition concerns The tender mechanism (6.3) is a partial mitigation because it makes the designation contestable and transparent, but it does not eliminate the risk. A **competition-law review is required before the facility contract model is finalised**, and is listed as an open governance action. This review should also consider whether, if forthcoming EPR regulation makes sorter participation effectively compulsory, the resulting obligations fall equally on all comparable actors — which would change the fairness calculus from "advantage to members" to "shared regulatory baseline."

5.5 Data Governance

Data is the connective tissue of TexMat: the DPP read at the container, the self-declared condition entered in the app, the human grade written at the facility, the routing decision, and the EPR compliance export all flow through a shared platform. Three governance questions arise, and we need a clear position on the boundary between what the project will solve and what it will not.

The platform is broader than the DPP. Not all system data is DPP data. The platform maintains, in effect, several linked stores: a **consumer store** (account, reward balance, points, ranking — held with privacy protection and anonymisation where required), a **garment/textile store** (DPP records where they exist, plus TexMat-generated condition, traceability, and lifecycle status), and a **container/real-time store** (container fill level, capacity, deposit events). Access is governed by role-based filters: the consumer app, the facility worker interface, and the brand/PRO reporting interface each see a restricted, purpose-appropriate slice. The platform is therefore a professional coordination layer in its own right, not merely a DPP reader.

Chain of custody is the governance backbone. Each garment (or, where no individual identifier exists, each batch) carries an append-only record: token issued → container deposit → in transit → graded → routed → reused or recycled. This record is what makes the custody transfers of 6.2 accountable, what triggers reward finalisation, and what produces the auditable diversion volumes on which EPR contract revenue depends. Where a garment has no DPP — the substantial majority of current stock — identification is held at batch level, with the acknowledged risk that unloading and mixing at the facility can break the batch-to-item link. Managing this degradation gracefully is a design constraint, not a solved problem; the honest position for the demonstrator is that no-DPP items are tracked at batch granularity and that item-level history across multiple reuse cycles cannot be assumed. A reuse operator confirmed in Workshop 3 that their current operations handle stock by

weight with no per-item identifiers, so cross-round item history is not available from existing practice.

Multi-party data ownership is out of scope for the demonstrator. When independent operators connect to TexMat, each owns its own commercial data, and a fully realised system would require a negotiated data-space governance regime — rules on who owns, who may see, and who may monetise shared data, with its own institutional arrangements. Solving this data-space problem is a separate undertaking and is **out of scope for TexMat**, while remaining necessary for any real-world rollout. The deliverable's position is therefore to acknowledge the data-space problem, define the demonstrator's narrower data model clearly, and exclude the multi-party governance regime from project scope rather than under-specify it. A concrete example that illustrates the boundary: whether a garment's prior-sale history (e.g. that it was previously sold by a named operator) can be surfaced to a later handler is a data-rights question the project will frame but not adjudicate, because it implicates the commercial confidentiality of independent actors.

5.6 Accessibility and Regulatory Governance

Inclusivity as a governance commitment. The walk-up entry point (Use Case 3) — a consumer with no smartphone and no app who simply deposits a bag — is retained as a deliberate governance choice, not a fringe accommodation. A meaningful share of the population is unable or unwilling to use an app for every interaction, and that an inclusive system must serve them. The governance implication is that the system must support identification and a minimal reward without requiring a smartphone: candidate mechanisms discussed include a contactless card tap (payment card, or equally a transit or library card carrying an identifier) and a printed ticket conferring a minimal, weight-based reward set below the recycling value of the batch. The cost of adding contactless identification to the container is a budget question for the technical partners, but the principle — that the system does not exclude the unconnected — is fixed. This minimal entry point doubles as an onboarding funnel: a walk-up user who receives a small reward may be drawn to register and become a full app participant.

Regulatory governance — End-of-Waste and DPP. Two regulatory mechanisms shape the system's governance obligations. First, separately collected textiles are legally classified as waste and must undergo documented sorting before onward processing; the human-led grade at the facility is therefore not only a quality decision but the **legal act that establishes End-of-Waste status**, which is one reason condition determination is anchored to an accountable human grader rather than an automated estimate. Second, the ESPR/DPP framework means that as product-level

passports become mandatory for new garments, the system's ability to read and write DPP records becomes a structural compliance advantage — and the facility write-back that records condition, composition, and destination is what makes the EPR/PRO export auditable. Governance of the DPP write-back (who is authorised to write, and how provisional consumer-declared data is superseded by the authoritative facility record) is specified in the DPP infrastructure layer of the technical requirements and is a must-have for the demonstrator.

5.7 Consolidated Governance Model

The table below consolidates the governance role of each principal actor: what they decide, what they are accountable for, and the primary governance tension attached to them.

Table 18: TexMat Governance Responsibilities

Actor	Decision rights	Accountable for	Primary governance tension
TexMat operating entity	System rules, fee basis, routing-fairness quotas, facility tender criteria, platform access policy	Win-win integrity; auditable diversion data; consumer trust; non-discrimination	Balancing scale (broad membership) against fairness (not advantaging large players)
Contracted sorting facility	Operational grading and dispatch within TexMat rules	Definitive condition grade (End-of-Waste); accurate facility write-back	Single-facility designation vs. competition law; input-quality volatility
Destination operators (reuse, charity, brand take-back, recycling)	Whether to join; reward co-funding terms (where applicable)	Honouring offtake commitments; quality feedback	Thin margins vs. membership fee; fair access to reuse-grade stock
Logistics partner	Routing and collection scheduling within SLA	Container maintenance responsiveness; batch custody in transit	Unpredictable fill rates; cost/emissions of dispersed collection
Property owners (site hosts)	Granting and withdrawing site access	Site suitability; local promotion	Reputational exposure to poorly maintained containers

Consumers	Destination preference (within fairness rule); reward modality; donation	Honest self-declaration of condition	Effort vs. reward calibration; trust that the system is not greenwashing
Brands	Take-back terms; data licensing participation	Substantiated circularity claims; EPR fee payment	Greenwashing perception; bilateral accreditation requirement
PRO / EPR bodies	EPR fee rates; compliance acceptance criteria	Validating diversion volumes; ecomodulation	Political pressure to minimise scheme cost vs. funding system viability
Municipalities	Co-financing; permits	Public legitimacy; reporting to national bodies	Budget constraints; political exposure

The model is deliberately polycentric: no single actor governs the whole system. TexMat sets and enforces the rules of participation and fairness; the facility holds operational authority within those rules; Destination operators self-select into membership on a voluntary basis and elect their contribution mode at onboarding: a realised-value share, or a service fee decoupled from sales. The earlier provision for an affordability tier on a single fee is superseded by this choice. For non-profit operators and those holding waste-operator status, the service-fee mode is the route that preserves that status, since it ties no payment to sales volume or material acquisition; for operators able to share resale value, the value-share mode applies. The level and basis of each mode — in particular whether the service fee is flat-periodic or capacity-based — are not fixed in this blueprint. Destination operators self-select into membership; and the PRO and regulatory framework set the external constraints (EPR rates, End-of-Waste, DPP). The coherence of the system depends on the benefit-precedes-contribution and level-playing-field principles holding across all of these actors simultaneously — which is why the financial validation in Section 5 is, at root, a governance test.

5.8 Open Governance Decisions

The following decisions are unresolved and are carried forward as named actions. They are distinguished by whether they must be resolved within the demonstrator or belong to the target system.

Table 19: Open Governance Register

#	Open decision	Scope	Dependency	Owner
G1	Fee basis: operator-paid membership vs. EPR-funded processing fee	Demonstrator-critical	Backward unit-economics model from a ~€4 garment (Section 5)	TexMat + reuse operators
G2	Affordability tier design for social enterprises / small actors	Demonstrator-critical	G1	TexMat + Humana + reuse operators
G3	Fair-allocation quota mechanism (how charity share is guaranteed)	Demonstrator-critical	Reward/points nudge design	TexMat
G4	Facility designation via tender — criteria and territory definition	Target system; demonstrator uses single partner facility	G5	TexMat + consortium
G5	Competition-law review of single-contracted-facility model	Demonstrator-critical (before contract)	Legal counsel	TexMat + consortium
G6	Container ownership/operation/maintenance SLA structure	Demonstrator-critical	Logistics partner contract	TexMat + logistics partner
G7	No-DPP batch-to-item traceability degradation handling	Demonstrator-critical	Facility process design	TexMat + facility + VTT
G8	Legacy-DPP retrofit governance (who tags, where, at what cost)	Target system; research track in demonstrator	Tagging technology	VTT + technology partners
G9	Multi-party data-space governance regime	Out of scope — acknowledged, not solved	Separate work package	Future / consortium
G10	Contactless (card-tap) identification for UC3 — cost vs. inclusion	Demonstrator (could-have)	Container hardware budget	ROVIM + technology partners

G11	Per-country operator role mapping (current vs. future roles)	Demonstrator input to Workshop 4	Operator engagement	All operators

6 Systems requirements

The requirements below are organised into three tiers. **Must Have** features define the minimum viable system to be built and validated at demonstrator level; these are committed scope for the pilot. **Could Have** features are strong candidates for inclusion but should be subjected to financial assessment first — they are added if, and only if, the project's financial mechanisms generate the margin to support them. **Later Development** features are deferred by design: they are to be considered once the core system is operational and flowing reliably, and are documented here to preserve the design intent rather than to commit resources in this phase.

6.1 Consumer App

MUST HAVE

Feature	Description
QR + NFC DPP tag scanner	Reads DPP tags at item level. Triggers garment data load (fibre, brand, care). NFC passive read with QR fallback. Foundation of the UC1 flow.
Photo upload	Captures a photograph of each garment at characterisation. The image is not used for AI grading; it forms part of the consumer's self-declaration record and creates an auditable liability trace — a visual baseline of declared condition that the facility can reconcile against on receipt. Supports decision-making and protects both parties in any subsequent dispute.
Guiding tutorial / set of tips	A short onboarding sequence shown on first use and accessible thereafter, explaining how to characterise a garment, what condition categories mean, and how routing and rewards work. Reduces declaration error and sets realistic expectations that the facility confirms final grade and reward.
Characterisation questionnaire	A guided four-to-five step self-characterisation flow that replaces AI photo grading as the authority on condition. The consumer answers structured prompts on garment type, material, wear, and defects; the app records this as a provisional declaration pending facility confirmation. Core to the UC2 (no-DPP) path.

Batch drop-off flow	Groups multiple garments into one deposit session. Assigns a batch ID. Displays item count and system routing summary for consumer review or override.
Destination preference (per item or batch)	Consumer selects or overrides the routing suggestion: Emmy.fi / Humana / brand take-back / recycling. Preference is locked into the drop token before arriving at the container.
Drop token generation (7-day validity)	Signed, time-limited token embedding batch ID, item manifest, destination preferences, and DPP data. QR output for container scan. No time pressure at the container.
Push notifications — reward & routing	Notifies the consumer at deposit received, -confirmed at facility, and reward finalised. Handles the provisional-to-confirmed status transitions.
Reward wallet	Displays accrued reward value (voucher, donation, or cash equivalent). Reward sourced from EPR ecomodulation via the PRO. Basic ledger plus redemption flow.
Multi-language support (ES / FI / EN)	Prerequisite for meaningful consumer testing in both geographies (Spain and Finland)
Real-time container map & fill level	Nearest containers, fill status, and estimated next collection. Reduces wasted trips. Requires the IoT fill sensor in the container layer.

COULD HAVE

Feature	Description
Garment history & deposit log	Timeline of past deposits, confirmed destinations, and rewards earned. Builds consumer trust and feeds impact calculations.
CO_2 & water impact display	Per-deposit environmental metric (kg CO_2 avoided, litres water saved). Requires a verified methodology to avoid greenwashing risk.

Brand take-back channel selector	Consumer explicitly routes eligible items to a brand take-back programme. Brand logo and incentive displayed. Activates the EPR ecomodulation channel.
AI photo pre-assessment	Computer vision identifies garment type and estimates condition (~70% confidence). Supports — but does not grade — the UC2 declaration; final authority remains the consumer questionnaire and facility confirmation. Cloud inference acceptable at MVP.
Consumer trust system	A transparency layer that shows the consumer how their declaration was treated downstream: declared versus confirmed grade, actual destination reached, and reward rationale. Closes the loop between promise and outcome, reinforcing honest declaration and reducing the perception of a black box.
Defect capture	A structured prompt within characterisation for flagging specific defects (stains, tears, missing parts, wear). Feeds the provisional condition declaration and gives the facility a targeted checklist on receipt, improving grading accuracy and dispute resolution.
Gamification & community impact board	Neighbourhood- or city-level collective impact metrics, streaks, and milestones. Opt-in to avoid trivialisation.
Chatbot support	A guided assistant that helps the consumer choose the right route for an item (reuse versus recycling versus brand take-back) and answers questions about characterisation, drop-off, and rewards. Reduces declaration error and support load without requiring human staff.

LATER DEVELOPMENT

Feature	Description
Wardrobe inventory & pre-sort suggestions	Digital wardrobe built via DPP scans over time. App suggests items ready to circulate based on wear count or age.

Consumer DPP contribution (care data write-back)	Consumer adds wear history, washing notes, and repair records to the DPP. Enriches condition data. Requires a DPP governance framework first.

6.2 Smart Collection Container

MUST HAVE

Feature	Description
QR scanner — drop token validation	Reads the consumer drop token at deposit. Authenticates the batch, unlocks the deposit slot, retrieves the embedded manifest. Embedded scanner — no touchscreen required.
NFC reader for credit card	A contactless reader enabling card-based identification or micro-transaction at the container — primarily to give UC3 walk-up users a frictionless way to associate a deposit with a reward account without the app. May also support any future deposit-fee or pay-out mechanism. Passive, embedded, no touchscreen.
4G / WiFi and Bluetooth module	Persistent uplink for manifest transmission, token validation, and remote monitoring. 4G SIM preferred for field deployment independence. Bluetooth supports local device pairing and maintenance.
Manifest generation & platform uplink	Firmware compiles the deposit event: batch ID, weight, NFC tags, DPP data, consumer preferences, timestamp. Transmits to the platform on deposit confirmation. (To be confirmed whether this feature is container- or app-deployed.)
Controlled deposit slot & tamper deterrence	Slot opens on valid token scan (UC1/UC2). UC3 walk-up: always-open bag-drop mode. Vandal-resistant housing. No retrieval once deposited.
Weatherproof vandal-resistant enclosure	IP54 minimum, IK08 impact rating. Standard textile container form factor for public space. TexMat livery.
Smart lock system	Electronically controlled locking mechanism governing the deposit slot, released only on a validated token (UC1/UC2) or

	set to open-access mode (UC3). Prevents unauthorised retrieval, protects deposited stock, and provides the physical enforcement layer behind chain-of-custody.
Solar panel + battery (autonomous power)	Off-grid operation eliminates the mains power requirement. Significantly expands deployment site options.
Printed receipt / bag label output	On-demand printed confirmation slip at deposit. Useful for UC3 walk-up users as a physical trace. Label carries batch ID and provisional destination.

COULD HAVE

Feature	Description
Passive NFC reader — DPP tag detection	Reads NFC-embedded DPP tags on garments passing through the drop slot. Captures tag data without active consumer interaction.
Fill level sensor (ultrasonic)	Measures container fill % in real time. Triggers a logistics alert at threshold (~80%). Prevents overfill and associated contamination risk.
LED status indicator array	RGB LED feedback: green = deposit accepted, amber = token pending, red = error. Low-cost consumer feedback at the container without a screen.
Environmental sensors (humidity + temperature)	Internal container climate monitoring. Prevents mould and degradation risk.
Precision weight sensor	Batch weight measurement (±50g accuracy). Validates the deposit against declared item count. Key manifest data point — compared against facility receipt.

LATER DEVELOPMENT

Feature	Description

Minimal touchscreen (5″) with basic UX	Destination choice confirmation or walk-up token entry. Requires screen heating for cold climate. Significantly increases unit complexity.
Limited NIR module — fibre type only	Broad fibre classification at container level. Not condition grading — that requires a facility-controlled environment. Challenges the lightweight-container architecture principle.
Deposit video recording	Short video clip of the deposit event per batch. Dispute resolution and contamination audit trail. GDPR privacy design required.

6.3 Sorting Facility Tech

MUST HAVE

Feature	Description
Industrial NIR spectroscopy unit	Full fibre composition identification (natural, synthetic, blends, contamination flags). Controlled environment essential. Target: 3-sec/garment throughput (Humana ref.).
TexMat manifest reception & batch matching	Facility software receives manifest from container. Matches physical batch (weight check) against manifest data. Flags discrepancies. Links NIR results and condition grades to item records.
Condition grading protocol + operator UI	Standardised grading (A/B/C/D) with structured operator data entry. Comcontaineres NIR fibre result with visual/tactile condition assessment. Critical for Emmy.fi vs. Humana routing distinction.
Routing decision engine (4 destinations)	Rules-based routing:premium resale, grade A, SEE retail, grade B-C, brand take-back (EPR compliance), recycling/fibre recovery (grade D). Consumer preference honoured where possible.
Item-level data record & closed-loop write	Facility writes final outcome (NIR result, condition grade, destination, timestamp) back to TexMat platform. Triggers consumer reward finalisation. Seals the data loop.
EPR / PRO compliance data export	Automated EPR-compliant tonnage and routing reports for PRO submission. Tracks fibre composition, destination split, and ecomodulation-eligible volumes.

COULD HAVE

Feature	Description
Computer vision — condition pre-screening	Camera-based visual triage before manual grading. Flags obvious grade D items. Reduces manual handling time and protects throughput target. Does not replace NIR or final human grade.
Facility operator real-time dashboard	Live throughput metrics, routing split, NIR result distribution, and batch queue. Key for pilot evaluation and shift management.

Automated destination label printing	Per-item or per-batch label at routing decision point. Carries destination code, batch ID, and DPP reference. Eliminates manual labelling error.
Emmy.fi + Humana inventory API integration	Outbound API push to partner inventory systems on routing confirmation. Requires partner API readiness — validate with both sorters.
DPP write-back — condition & destination	Facility writes NIR result + condition grade + destination back to the item's Digital Product Passport. Supports second-cycle traceability.

LATER DEVELOPMENT

Feature	Description
Fully automated NIR + CV sorting line	Conveyor-integrated NIR and computer vision with automated physical diverters. 5-10x throughput uplift. Requires purpose-built facility layout and full business case.
ML-based routing optimisation model	Predictive model trained on NIR + condition + market demand signals. Requires 12-18 months of pilot data before sufficient signal exists.
Brand real-time take-back dashboard	Brand-facing portal showing volume, condition, and routing of their own garments. Enables brands to track EPR compliance contributions.
Cross-facility data federation	TexMat platform aggregates NIR and routing data across multiple sorter facilities (Humana ES + Emmy.fi + others). Enables system-level analytics at PRO scale.

6.4 DPP Infrastructure

MUST HAVE

Feature	Description
DPP read API (garment identity retrieval)	Authenticated endpoint returning garment record: fibre composition, brand, manufacture date, care instructions. Called by app at UC1 NFC/QR scan. Response target under 2 seconds. Handles batch reads for multi-item sessions.
Provisional record creation (UC2 + UC3)	Create and store garment records for items entering without DPP tags. UC2: seeded with photo AI metadata and confidence scores. UC3: anonymous shell record. Both flagged confirmation_pending .
Chain-of-custody record management	Append-only log per garment recording each lifecycle event: consumer scan to token issued to container deposit to in transit to NIR confirmed to destination assigned to loop closed. Tamper-evident and immutable once written.
Garment lifecycle status model	Defined status states: active, token_issued, deposited, in_transit, graded, routed, reused, recycled. Transitions triggered by platform events. Drives reward calculation logic and consumer notification triggers across all three UCs.
Facility write-back API (NIR + condition + destination)	Authenticated write endpoint for sorting facility to record confirmed fibre composition, condition grade (A/B/C/D), and final destination per item. Supersedes provisional data for UC2/UC3. Triggers reward finalisation.
EPR / PRO compliance export	Structured export of item-level data for PRO reporting: fibre composition, destination routing split, ecomodulation-eligible volumes, brand attribution, and weight. Required for EPR reward funding mechanism to function.

COULD HAVE

Feature	Description
Consumer read access (garment history + status)	Consumer-facing API enabling read access to deposited garments' lifecycle status and custody history. Powers the in-app deposit log, impact dashboard, and garment tracking. Requires GDPR-compliant anonymisation layer.

Cross-platform DPP interoperability (ESPR-aligned)	Ability to consume DPP records from multiple brand DPP platforms. Schema normalisation layer to reconcile format differences. Prerequisite for scaling beyond pilot brands. Alignment with ESPR DPP standards reduces future rework.
Brand anonymised data API	Aggregated and anonymised lifecycle data returned to brands per garment model or collection: reuse rate, routing split, condition distribution, return geography. Activates the brand EPR data value proposition.
Real-time status webhooks (push to app)	Webhook-based push notifications to consumer app when garment status changes. More efficient than polling. Enables real-time reward confirmation UX. Requires secure webhook registration and retry logic.
Destination partner inventory push	Outbound data push to Emmy.fi and Humana Spain inventory systems when routing confirmed. Enables downstream partners to anticipate incoming volume and grade mix. Requires partner API readiness.

LATER DEVELOPMENT

Feature	Description
Multi-cycle DPP continuity (second-life tracking)	DPP record persists beyond first reuse cycle. New owner can scan and access full lifecycle history. Enables TexMat to track secondary sales as a second data layer. Requires post-pilot governance design.
Consumer DPP contribution (care data write-back)	Authenticated write access for consumers to add wear history, washing frequency, repairs, and notes to the DPP. Enriches condition data reaching the facility. Requires governance framework for data quality standards.
Distributed DPP registry	DPP records stored on distributed infrastructure rather than TexMat-controlled platform. Reduces single point of failure, increases brand trust, aligns with EU digital infrastructure ambitions. Significant architectural commitment — defer to post-demonstrator.
Brand real-time take-back dashboard	Live brand portal showing volume, condition, and routing of their own garments in the take-back stream. EPR compliance tracking per collection or SKU. Viable once throughput volume justifies the data density.

7 Uncertainties

The business model and system architecture set out in the preceding sections rest on a number of assumptions that the codesign process could specify but not yet resolve. This section makes those open questions explicit. Rather than presenting the blueprint as settled, it catalogues the uncertainties that remain across the four layers of the system — the consumer app, the collection containers, the DPP and data infrastructure, and the sorting facilities — and pairs each with the validation method best suited to resolving it, whether desktop research, stakeholder focus groups, consumer experiments, or demonstrator scenarios. The uncertainties are then prioritised on an impact-versus-uncertainty matrix that sorts them into four levels: key strategic uncertainties that are both high-impact and highly unresolved, system-design questions where the stakes are high but the answer is closer to hand, behavioural questions that warrant testing but carry lower systemic risk, and operational details to be optimised once the core design is fixed. This prioritisation is what turns an open list into a work plan: it identifies which questions must be answered before pilot deployment, and which can be refined in the course of it.

7.1 Consumer app

Table 20: Consumer app uncertainties

Category	Key Uncertainties	Suggested Validation Method
Adoption & behavioural motivation	Will consumers download and use the app? What motivates participation (rewards, environmental impact, resale)? How does motivation vary across generations? Does the app reduce or increase friction?	**Consumer experiments** (online behavioural experiments, UX testing)
Digital inclusion	How to address the digital divide? What happens to users without smartphones? Should the system function without the app?	**Consumer experiments + stakeholder workshops** (municipalities, reuse operators)
Role of the app in the system	Is the app mandatory or optional? Is its role guidance, tracking impact, resale integration, or rewards? Could TexMat	**Stakeholder focus groups** (brands, retailers, reuse operators)

	functionality be integrated into existing apps?	
Competition with existing platforms	How does TexMat interact with resale platforms like Vinted? Could the app link to resale markets?	**Desktop research + stakeholder workshops**
Rewards & incentives	What incentive mechanisms work best? Discounts, deposits, resale revenue share, points? Who finances the rewards (EPR, brands, retailers) ? How can the rewards be used?	**Consumer experiments + demonstrator scenarios**
Trust, privacy & security	Will consumers trust data collection? What level of transparency is needed?	**Consumer experiments + desktop research (GDPR)**
User experience design	How simple must the interface be? How much effort can be required from users?	**Consumer experiments (UX testing)**

7.2. Collection containers

Table 21: Collection containers uncertainties

Category	Key Uncertainties	Suggested Validation Method
Location & accessibility	Where should containers be placed (retail stores, supermarkets, public spaces)? Indoor vs outdoor? What locations maximize usage?	**Consumer experiments + stakeholder workshops (municipalities, retailers)**
Ownership & governance	Who owns and operates the containers (PRO, municipality, TexMat consortium)?	**Stakeholder focus groups**
Cost & financial viability	How expensive should containers be? What is the trade-off between advanced technology and scalability?	**Desktop research + demonstrator scenarios**

Garment identification method	Should garments be tracked individually (QR/NFC) or in batches?	**Demonstrator testing**
Security & vandalism risks	How to prevent vandalism, theft, or contamination?	**Desktop research + demonstrator pilots**
Operational logistics	Who empties containers? How often? What are optimal logistics routes?	**Demonstrator scenarios**
Integration with existing infrastructure	Should TexMat replace or integrate with current textile collection containers?	**Stakeholder workshops (reuse operators, municipalities)**

7.3. DPP / data infrastructure

Table 22: dpp infrastructure uncertainties

Category	Key Uncertainties	Suggested Validation Method
Data governance & ownership	Who owns the data generated (brands, TexMat platform, PRO)? Who can access it?	**Stakeholder focus groups + legal desktop research**
Interoperability with DPP standards	How does TexMat integrate with ESPR Digital Product Passport frameworks?	**Desktop research**
Data value for stakeholders	What data is actually valuable for brands, recyclers, reuse operators and PROs?	**Stakeholder focus groups**
Data architecture	Where is the data stored? Centralised platform vs distributed systems?	**Desktop research + stakeholder workshops**
Data integrity & validation	How to prevent falsification or modification of garment data?	**Desktop research (technology solutions)**
Garments without DPP	How should garments without digital identifiers be handled?	**Demonstrator scenarios**

Data carrier technology	QR codes, NFC chips, removable tags?	**Desktop research + demonstrator pilots**
Environmental and behavioural implications	Could traceability unintentionally sustain overconsumption?	**Desktop research + stakeholder workshops**

7.4 Sorting facilities

Table 23: Sorting facilities uncertainties

Category	Key Uncertainties	Suggested Validation Method
Automation vs human expertise	Can sorting be automated with NIR/computer vision? What role remains for human expertise?	**Demonstrator pilots**
Operational efficiency	Can sorting speed be improved relative to current manual sorting rates?	**Demonstrator pilots**
Reuse vs recycling routing	What classification criteria determine reuse vs recycling?	**Stakeholder workshops + demonstrator testing**
Integration with existing reuse operators	Will TexMat strengthen or disrupt existing reuse organisations?	**Stakeholder focus groups**
Sorting infrastructure model	Should sorting be decentralised or centralised? Should operators share sorting infrastructure?	**Stakeholder workshops + demonstrator scenarios**
Logistics flows	Who transports garments to sorting facilities? Can flows be optimised across regions or countries?	**Demonstrator pilots**
Waste stream classification	How many sorting categories are necessary (reuse, resale, repair, recycling etc.)?	**Desktop research + demonstrator pilots**
Direct recycling flows	Should certain materials be routed directly to recyclers?	**Demonstrator pilots**

7.5 Validation strategy

Table 24: Validation approach

Validation Approach	What it Should Address
Desktop research	Regulation (EPR/DPP), technological feasibility, data standards, economic benchmarks
Stakeholder focus groups	Governance models, ecosystem roles, data ownership, operational collaboration
Consumer online experiments	App adoption, incentives, behavioural drivers, usability
Demonstrator scenarios	Container design, sorting technology, logistics flows, DPP integration

7.5.1 Prioritizing uncertainties

The matrix (Figure 7) is used to prioritize uncertainties based on 4 priority levels: key strategic uncertainties, system design experimentation, behavioural validation and operational optimisation.

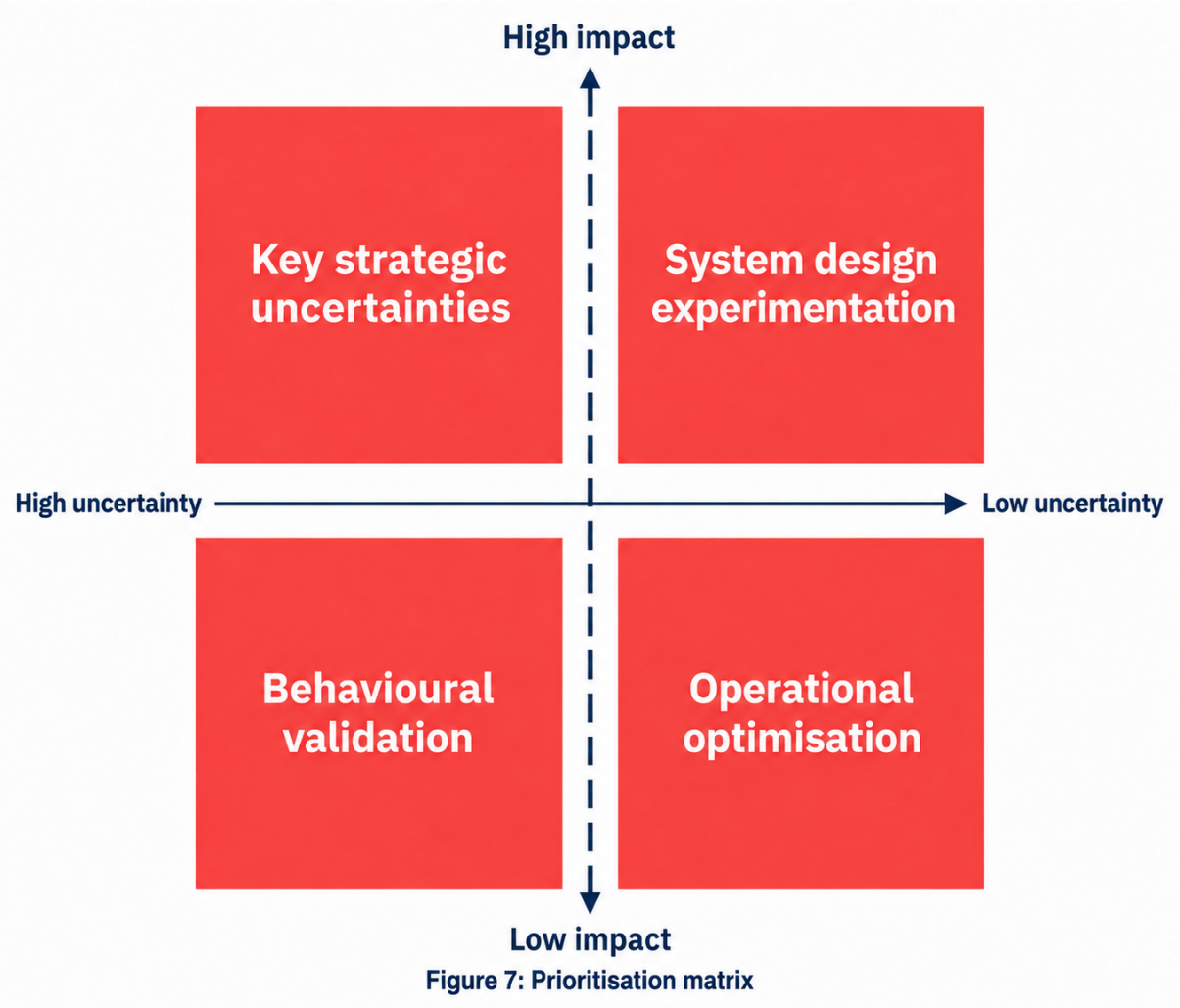


Figure 7: Priorisation matrix

Table 25: Key Strategic Uncertainties (High impact – High uncertainty)

Stream	Strategic Uncertainty	Suggested Validation
App	Will consumers actually adopt and use the app?	Consumer behavioural experiments
App	What incentives motivate textile return behaviour?	Consumer experiments + demonstrator pilots
Containers	Where should containers be located to maximise usage?	Demonstrator pilots + location experiments
DPP infrastructure	Who owns and governs the data generated by TexMat?	Stakeholder governance workshops
DPP infrastructure	What data actually creates value for ecosystem actors?	Stakeholder focus groups
Sorting	Can automated sorting meaningfully improve reuse/recycling outcomes?	Demonstrator pilot
Sorting	Will TexMat disrupt or strengthen existing reuse organisations?	Stakeholder workshops

Table 26: System Design Experimentation (High impact – Lower uncertainty)

Stream	Uncertainty	Suggested Validation
App	Should the TexMat system require the app or remain optional?	Pilot comparison
Containers	Ownership and governance of collection infrastructure	Stakeholder workshops
Containers	Integration with existing textile collection systems	Demonstrator testing
DPP infrastructure	Integration with EU Digital Product Passport standards	Desktop research
Sorting	Number of textile categories (reuse, resale, recycling etc.)	Demonstrator testing

Sorting	Centralised vs decentralised sorting infrastructure	Stakeholder workshops

Table 27: Behavioural Validation (Lower impact – High uncertainty)

Stream	Uncertainty	Suggested Validation
App	Digital divide (elderly users, non-smartphone users)	Consumer experiments
App	App usability and time required from users	UX testing
App	Trust in data privacy and data sharing	Consumer experiments
Containers	Indoor vs outdoor container placement preferences	Consumer experiments
Containers	User preference for batch drop vs item-by-item scanning	Consumer testing

Table 28: Operational Optimisation (Lower impact – Lower uncertainty)

Stream	Uncertainty	Suggested Validation
Containers	Frequency of container emptying	Demonstrator pilots
Containers	Logistics optimisation	Demonstrator pilots
Sorting	Role of human expertise in final sorting stage	Demonstrator pilots
Sorting	Transport flows between sorting facilities	Demonstrator pilots
DPP infrastructure	Data storage architecture	Desktop research

7.6 Transition Pathway

TexMatTask 6.2 will implement two demonstrations, in Spain and in Finland, across one rural and one urban region, each running for at least one month. Selected end users will be supplied with tagged second-hand garments and pseudonymised research profiles, and will use the smart container together with the mobile application. The demonstration will exercise the container hardware, the application, the DPP carrier integration, the routing of material to reusable and recyclable flows, and the digital platform end to end.

This is a validation of the DPP-bearing pathway under controlled conditions. It establishes that the technical chain works when identity is present, when users are recruited and briefed, and when garment supply is curated. It does not, and is not designed to, validate the system under its actual future operating condition: an unbriefed public depositing an uncontrolled mix of garments, the overwhelming majority of which carry no passport, at volumes sufficient to test the economics.

The no-DPP majority is however the operating condition for a decade. The regulatory sequence and the physics of wardrobe turnover compound. The Commission adopted the first ESPR Working Plan (COM(2025) 187) on 16 April 2025, identifying textiles among the priority product groups with an indicative delegated act adoption date of 2027. Compliance deadlines are expected to follow roughly eighteen months later, around 2028 to 2029, and the pattern of slippage already observed in earlier delegated acts suggests these dates may move later rather than earlier. The obligation attaches at the point a product is placed on the market, so the first DPP-bearing garments enter European wardrobes towards the end of this decade at the earliest.

They then have to leave those wardrobes. Garments are typically worn for several years and stored for several more before being discarded or donated, so the lag between a garment acquiring a passport at retail and arriving at a collection container is not months but the better part of a decade. DPP-bearing items therefore begin appearing in collected volumes in meaningful quantity in the middle of the 2030s and become a majority of collected volume later still. Over the whole planning horizon relevant to this business model, the system will be handling legacy stock.

Table 29: Four horizons

Horizon	Period	Dominant stream	What the system must do	Revenue basis	What is being proven
H0 Demonstrator	M24 to M31	Tagged garments, recruited users	Prove the DPP chain end to end; prove container, app, platform, and facility write-back	Project-funded	Technical feasibility of the mechanism

H1 No-DPP operation	Post-project, first years of operation	Legacy garments, effectively all without passports	Run entirely on batch-level custody, guided self-declaration, and the human facility grade. No automated condition method is claimed	EPR or PRO fees and brand commercial services, both independent of DPP penetration	Economic viability at volume, and the unattributed-batch rate
H2 Mixed stream	Approximately mid-2030s	Legacy majority, growing DPP minority	Handle both pathways in parallel without operating two systems. DPP items yield richer records and brand attribution; the batch path remains the default	As H1, with DPP-enabled data services and ecomodulation accuracy improving margin	That the DPP pathway adds value without becoming a dependency
H3 DPP-bearing majority	Beyond the 2030s	Passport-bearing garments predominate	Item-level custody becomes the norm; batch-level custody persists for the residual legacy tail	Full four-pool model as specified in Sections 4 and 5	The system as originally conceived

Three design rules follow from this sequencing.

First, no revenue stream that the model relies on in H1 may be conditional on DPP penetration. The load-bearing streams identified in Section 5, EPR or PRO contract revenue and brand commercial services, are calculated on diverted volume, fibre composition, and routing splits. All three are produced by the facility grade and the NIR result, not by the passport. This is what makes the model viable before the regulation matures.

Second, batch-level custody is the system's default architecture and item-level custody is the enrichment, not the reverse. The specification in Section 4.5.4 is therefore not a workaround for a temporary gap. It is the operating design for the first decade, and it deserves the investment in reliability that status implies: the label dispenser, the packaging standard, the unattributed-batch failure mode, and the pilot measurement of application rates.

Third, the legacy retrofit track is the only available accelerator, and it is a research track rather than a capability. Retro-fitting an identifier onto a legacy garment at or before drop-off would convert a UC2 item into a UC1-style item and pull H2 forward by years. The consortium is pursuing this, and its unresolved business logic, who applies the tag, at what point in the chain, at whose cost, and under what standard for placement, is registered as open governance decision G8.

Transition conditions. Movement between horizons is not automatic and can be stated as testable conditions. H0 to H1 requires the unattributed-batch rate to fall within an acceptable band under unbriefed public use, and requires the fee basis question, G1, to be settled. H1 to H2 requires DPP read integration with at least one major brand platform in production rather than in demonstrator conditions, and requires the ecomodulation mechanism to be recognised by at least one national PRO.

8 Conclusions

What this deliverable set out to do

This deliverable presented the TexMat Circular Business Model Blueprint: a business logic for smart textile collection that makes reuse the default while remaining coherent with regulatory, economic, and operational reality. It set out to build a shared understanding of the textile collection ecosystem and its actors, to identify the mechanisms through which value is created, delivered, and captured, to translate regulatory, technological, and user requirements into a single business-model framework, and to provide the assumptions and requirements that subsequent work packages will build on. The preceding sections deliver against each of those aims.

What the work established

Read as a whole, the deliverable moves from context to a concrete, testable system. The market landscape — the PESTEL and competitive analysis, and the partner perspectives — located TexMat in a regulatory moment defined by the revised Waste Framework Directive and emerging EPR for textiles, and in a competitive field where TexMat's distinctive position is not as a collection operator competing for volume but as the orchestrating infrastructure and data layer that the rest of the ecosystem lacks. The codesign methodology then turned that positioning into a designed system through iterative workshops and initial stakeholder validation.

The business model itself converged on three settled foundations. An **integrated architecture with three consumer entry points** — app with DPP, app with photo-assisted assessment, and no-app walk-up — flowing through one container, one sorting facility, and four destinations with consumer override. A set of **design principles** that resolve the hardest practical questions: batch collection as the default, a lightweight container that records and reads rather than grades, NIR spectroscopy reserved for the controlled conditions of the sorting facility, and a disciplined separation of garment identity (carried by the DPP) from garment condition (set by a human sorter). And a **value-capture logic** built on four structurally distinct pools — regulatory, reuse-market, brand-commercial, and consumer-borne — coordinated by TexMat as the only actor positioned to absorb the early-stage funding gap, with financial coherence reached not in single-city operation but at regional and national scale.

Around this core, the deliverable specified the **system requirements** across the consumer app, collection containers, DPP/data infrastructure, and sorting station, and set out honestly the **uncertainties** that remain — strategic, design, behavioural, and operational — together with the **governance and coordination** model through

which the ecosystem holds together. The result is not a finished commercial proposition but a validated reference framework: internally coherent, costed at indicative figures, and explicit about what it still needs to prove.

What remains to be validated

The blueprint's coherence rests on assumptions of two kinds, and they call for two different validation methods. On the **institutional and B2B side**, the EPR fee rate TexMat can realistically command, the fee reuse operators will accept, brand willingness to pay for compliance proof and lifecycle data, and the scale threshold at which the orchestrator breaks even are all estimates that depend on the considered judgement of the actors involved. On the **consumer side**, the reward structure, the cash–coupon–points modality, routing-override behaviour, and the relative draw of the three entry points are design hypotheses that require behavioural evidence before they are fixed.

Next steps

Two validation tracks follow directly from this deliverable and target these two categories of question.

A **Delphi study with B2B stakeholders** will test the institutional and economic assumptions with the business-side actors in the ecosystem — reuse operators, PROs, brands, sorting and technology partners, and municipal authorities. These parameters cannot be settled experimentally; they depend on the iterated, expert judgement of actors who understand their own constraints. Conducted over successive anonymous rounds with controlled feedback, the study is intended to converge expert opinion on the contested variables — fee rates, stock-fee acceptability, data-licensing willingness-to-pay, ecomodulation logic, and the conditions each stakeholder attaches to participation — and to feed its findings back into the financial model and the per-stakeholder analysis.

A **consumer experiment** will, in parallel, gather behavioural evidence to fine-tune the specific aspects of the user journey that the codesign could specify but not yet validate. It will refine targeted elements rather than re-open the architecture: the calibration of the reward, the acceptability of automated routing with override, the friction points across the three entry points, and the framing that sustains repeat participation without becoming a guilt-offset. Its findings will refine the user-journey design and reward logic ahead of pilot deployment.

Contribution to the project

Together, these tracks close the gap between a codesigned model and a deployable one — the Delphi study hardening the institutional and financial assumptions, the consumer experiment hardening the behavioural ones. Their combined output will inform the next iteration of the business model and feed the work packages this

deliverable was written to support: the system architecture and platform development of WP3, the hardware and collection-system development of WP4, and the demonstration and validation of WP5. In that sense the blueprint is both a conclusion and a handover: it closes the business-model design task, and it sets the validated foundation on which TexMat's technical development and pilot deployment can proceed.

References

Abrishami, S., et al. (2024). Textile recycling and recovery: An eco-friendly approach. *Sustainability*.

Archiva Market Research. (2024). *Textile recycling service 2025–2033 trends*. https://www.archivemarketresearch.com/reports/textile-recycling-service-53801

Ardoq. (2024). *Value stream mapping overview: What is VSM and how to*. https://www.ardoq.com/knowledge-hub/value-stream-mapping

City of Lahti. (2023a). *Lahti pilots a deposit system to encourage recycling of textile waste*.

City of Lahti. (2023b). *Swap in your old towels for pool passes: Recycling rate goes up 500% as Lahti pilots an incentive system for used textiles*.

Dziubaniuk, O., et al. (2022). Circular economy models implementation in textile industry: Empirical insights from Finland. *Journal of Cleaner Production*.

EURATEX. (2023). *ReHubs Europe initiative: Scaling textile waste collection, reuse and recycling capacities*. https://euratex.eu/rehubs

European Commission. (2019). *Communication on the European Green Deal*. https://eur-lex.europa.eu

European Commission. (2020). *A new circular economy action plan*. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0098

European Commission. (2022). *EU strategy for sustainable and circular textiles*. https://environment.ec.europa.eu/publications/textiles-strategy_en

European Commission. (2023). *Textiles strategy*. https://environment.ec.europa.eu/strategy/textiles-strategy_en

European Commission. (2024a). *Ecodesign for Sustainable Products Regulation (ESPR)*. https://single-market-economy.ec.europa.eu

European Commission. (2024b, May 20). *New Regulation on waste shipments enters into force*. https://environment.ec.europa.eu

European Commission. (2024c). *Stricter EU rules on waste exports to support circular economy*. https://ec.europa.eu/commission/presscorner

European Commission. (2024d). *Waste shipments*. https://environment.ec.europa.eu

European Commission. (2025a, October 16). *Revised Waste Framework Directive enters into force*. https://environment.ec.europa.eu

European Commission. (2025b). *Revision of EU waste rules for textiles and food waste*. https://ec.europa.eu/commission/presscorner

European Commission. (2025c). *Waste Framework Directive*. https://environment.ec.europa.eu

European Environment Agency. (2022). *Textiles and the environment: The role of design, consumption and circular economy* (EEA Report No. 10/2022). https://www.eea.europa.eu/publications/textiles-and-the-environment-the-role-of-design-consumption-and-circular-economy

European Union. (2016). *Regulation (EU) 2016/679 (General Data Protection Regulation)*. EUR-Lex. https://eur-lex.europa.eu

European Union. (2024). *Regulation (EU) 2024/1781 establishing a framework for the setting of ecodesign requirements for sustainable products (ESPR)*. EUR-Lex. https://eur-lex.europa.eu

Expert Market Research. (2025). *Top 10 textile recycling companies worldwide*. https://www.expertmarketresearch.com/blogs/top-textile-recycling-companies

Fontell, P., et al. (2025). *Model of circular business ecosystem for textiles*. VTT Technical Research Centre of Finland.

Heikkilä, P., Fontell, P., Kamppuri, T., & Saarimäki, E. (2024). Scaling textile reuse and recycling systems in Europe: Policy, market, and technology challenges. *Sustainability, 16*(4), 2103. https://doi.org/10.3390/su16042103

Heikkilä, P., et al. (2024). *Technologies and model for sustainable textile recycling*. VTT Technical Research Centre of Finland.

IVL Swedish Environmental Research Institute. (2025). *Study highlights positive environmental impacts of increasing textile-to-textile recycling rates in the EU*. European Environment Agency.

Köhler, A. R., Watson, D., Trzepacz, S., Löw, C., Liu, R., Danneck, J., Konstantas, A., & Donatello, S. (2021). Circular economy perspectives in the EU textile sector. *Journal of Cleaner Production, 281*, 125–137. https://doi.org/10.1016/j.jclepro.2020.125137

Market Data Forecast. (2025). *Europe textile recycling market size & share 2033*. https://www.marketdataforecast.com/market-reports/europe-textile-recycling-market

McKinsey & Company. (2022). *The state of fashion 2022: An unprecedented recovery*.

Persistence Market Research. (2025). *Europe textile recycling market size & growth trends 2032*. https://www.persistencemarketresearch.com/market-research/europe-textile-recycling-market.asp

Spieth, P., & Schneider, S. (2015). Value capture innovation: Changing revenue models and cost structures in business models. *Journal of Business Models, 3*(3), 35–54.

Watson, D., Gylling, A. C., Tojo, N., Ekvall, T., & Milios, L. (2018). *Business models for increased reuse and recycling of textiles*. Nordic Council of Ministers. https://doi.org/10.6027/TN2017-535

WRAP. (2023). *Textiles market situation report*. Waste and Resources Action Programme. https://wrap.org.uk/resources/report/textiles-market-situation-report

Wyszkowski, P., et al. (2022). Implementation of selective collection of textile waste in Poland — SWOT analysis. *Environmental and Regional Studies Journal*.

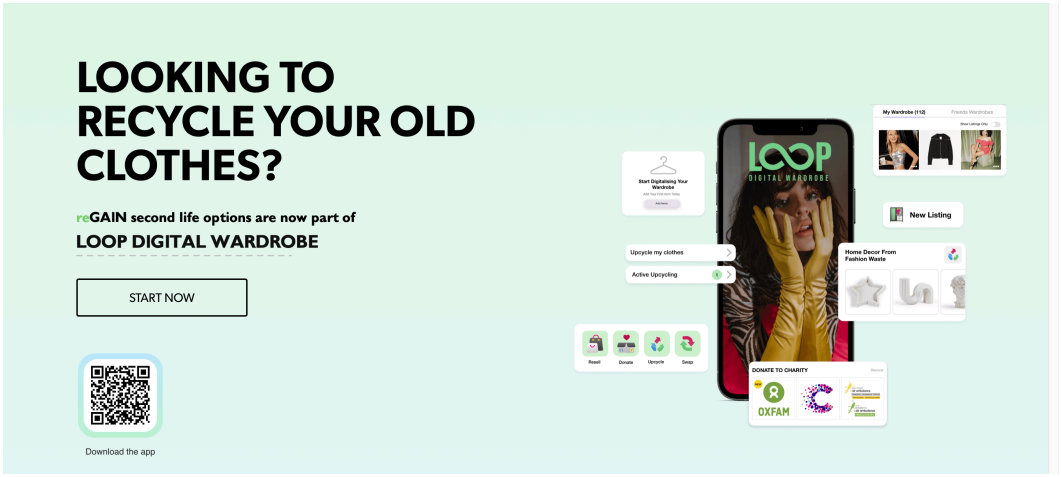
Annexes

APPENDIX 1: Competitive landscape

1. CONSUMER-DRIVEN APPLICATIONS

Innovation in consumer-driven applications primarily lies at the behavioural interface between citizens and circular textile systems. These solutions do not change recycling technologies themselves but reshape how consumers engage with disposal, return, and value recovery. Apps such as reGAIN, TooUsed, and Cyclothe transform textile discarding into an incentivised, guided, and sometimes rewarded activity. The novelty resides in reducing friction, embedding incentives, and digitising the user journey. Innovation here is therefore centred on activation of return behaviour, perceived value creation, and integration of circularity into everyday consumer routines.

1.1 reGAIN App



Value Proposition The **reGAIN app** positions itself as a digital take-back solution that reframes textile recycling as a rewarding choice. Consumers who no longer want their clothes, shoes, or accessories can use the app to locate drop-off points or arrange shipment to the reGAIN network. In return, participants receive discount vouchers for partner brands and retailers, creating an immediate and tangible incentive to recycle items rather than discarding them. The platform's proposition blends environmental impact with consumer benefit: contributing to circular fashion while gaining savings on future purchases.

Value Creation and Delivery

reGAIN creates value by lowering the friction traditionally associated with textile recycling. Users first download the app and prepare a bag or box of unwanted garments. They then either visit a reGAIN drop-off location — of which there are thousands across the UK — or arrange for home pickup. Once the garments are received, reGAIN redirects the textiles into one of several pathways: items in good condition may be resold or reused, others may be recycled or upcycled, and residual materials are repurposed where possible. Meanwhile, consumers receive digital vouchers for partner brands, reinforcing positive behaviour. The platform thus interlinks consumer action, logistics, and downstream textile reuse and recycling operations.

Value Capture

reGAIN's financial model captures value across multiple streams. The app's partners — including fashion and lifestyle retail brands — provide discount vouchers that drive consumer engagement and repeat spending, effectively subsidizing part of the circular return incentive. The value of donated clothes can be captured through resale or reuse channels, generating revenue or supporting charity work. In some cases, the resale value or recycling monetization helps offset operational costs. Although the app itself may not charge consumers, its ecosystem of retailers, charities, and recyclers creates a hybrid value network where consumer participation triggers voucher redemption, brand engagement, and material recovery. The model aligns environmental goals with commercial incentives, creating a value loop that sustains the platform.

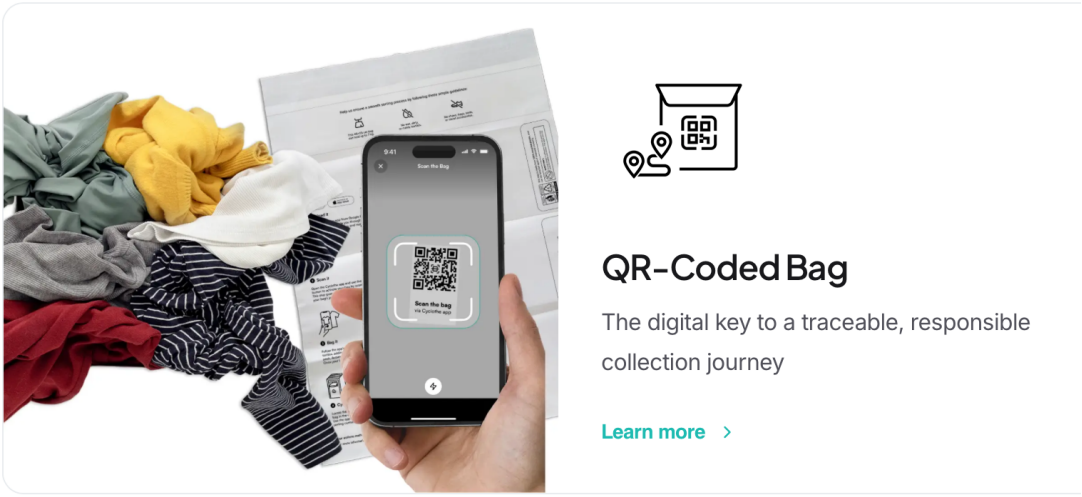
Implications for the TEXMAT Business Model

The reGAIN case offers several insights for TEXMAT, particularly in how consumers might send used textiles into a collection and reuse ecosystem:

- **Incentivizing consumer participation.** reGAIN demonstrates that consumers are more motivated to take circular actions when they receive immediate, tangible rewards. For TEXMAT, establishing similar incentives — such as credits, discounts, or social recognition — could increase return behaviour.
- **Ease of consumer action.** The app's emphasis on using existing drop-off points or simple shipment underscores the importance of reducing friction. TEXMAT should design return channels that fit smoothly into consumers' routines, whether through local partners, pick-up services, or integrated logistics.
- **Brand partnerships enhance engagement.** reGAIN's network of partner brands plays a dual role in offering rewards and legitimizing the recycling action. TEXMAT could similarly partner with brands that share circular goals, which can help amplify participation and potentially underwrite incentive programmes.

- **Hybrid value flows.** The reGAIN model blends material recovery, resale, and consumer benefits into a hybrid ecosystem. TEXMAT might adopt a similar logic by integrating multiple revenue and value streams — such as resale markets, data services, or reward platforms — rather than relying solely on material recycling revenues.
- **Traceability and communication.** While reGAIN focuses on consumer action, TEXMAT should also consider how to communicate the journey and destination of returned textiles. Transparency builds trust and reinforces behaviour over time.

1.2 Cyclothe



Value Proposition

Cyclothe proposes a digitally enabled textile collection and sorting system designed to increase material recovery, improve sorting precision, and create transparency across the value chain. For consumers, the solution simplifies textile disposal while offering traceability and feedback. For municipalities and waste operators, Cyclothe aims to improve collection efficiency and diversion from residual waste. For recyclers and reuse actors, the system promises higher-quality input streams supported by better identification and classification. The value proposition centres on converting textile waste into a measurable and optimizable resource flow.

Value Creation and Delivery

Cyclothe creates value by integrating physical infrastructure, digital tools, and data analytics. The model typically involves consumer-facing elements such as certified collection bags or digitally connected drop-off points. Consumers interact with the system through a digital interface that enables registration, tracking, or guidance. Once collected, textiles enter sorting processes supported by recognition

technologies and classification protocols. Data generated along the chain improves visibility into volumes, material composition, and routing decisions. This integration of digital and physical layers allows Cyclothe to enhance operational efficiency, reduce uncertainty, and support decision-making across stakeholders. Value is delivered through improved recovery rates, better material quality, and enhanced system transparency.

Value Capture

Cyclothe's value capture logic depends on multiple revenue streams linked to service provision and ecosystem coordination. These may include contracts with municipalities, partnerships with waste management operators, technology licensing, or revenues associated with sorting and material valorisation. The financial sustainability of the model relies on demonstrating cost savings, efficiency gains, or improved recovery outcomes compared with conventional collection systems. Data services and reporting capabilities may also represent emerging value capture opportunities, particularly as regulatory requirements for traceability and circularity metrics expand.

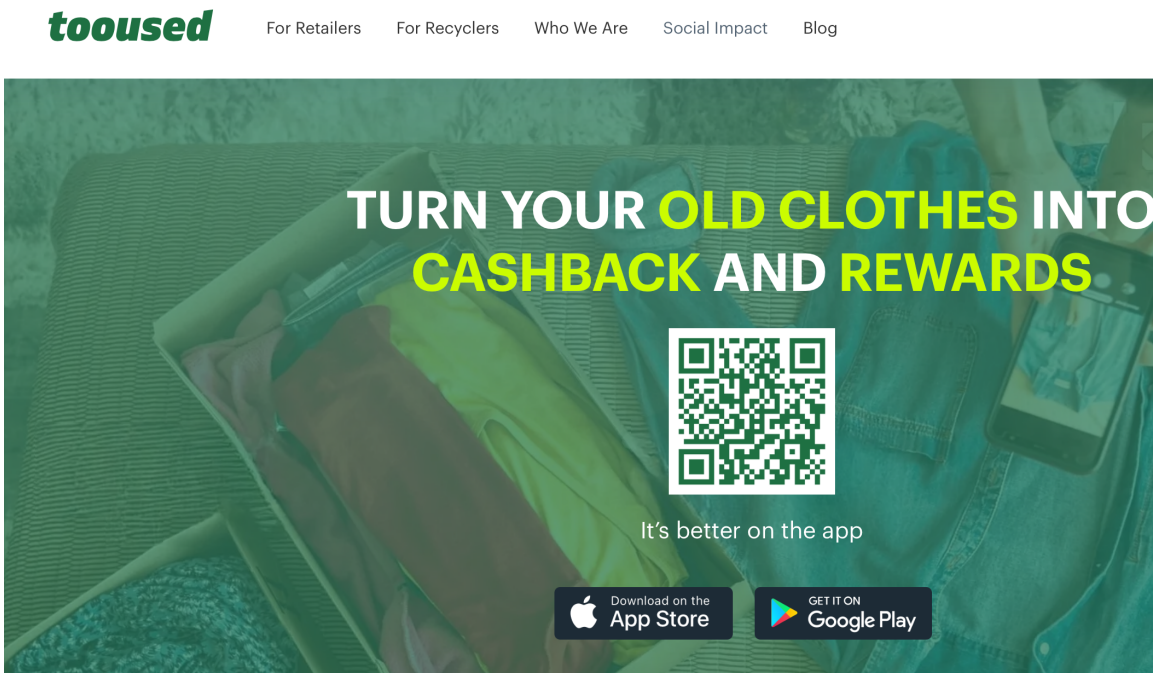
Implications for the TEXMAT Business Model

Cyclothe's approach offers particularly relevant insights for TEXMAT, especially regarding consumer engagement and system architecture.

- **Digital layer as system integrator**
  Cyclothe illustrates how digital interfaces can connect consumers, collection infrastructure, and sorting operations. TEXMAT can similarly leverage digital tools to guide disposal behaviour, provide feedback, and capture data at the point of return.
- **Traceability and data generation**
  By embedding tracking mechanisms into collection processes, Cyclothe enhances visibility across the value chain. TEXMAT could integrate identification technologies or Digital Product Passports to improve sorting decisions and reporting accuracy.
- **Consumer experience and participation**
  Cyclothe emphasizes structured consumer interaction rather than passive disposal. TEXMAT may benefit from designing return experiences that feel purposeful, transparent, and rewarding.
- **Sorting optimization**
  Cyclothe's focus on classification and routing aligns with TEXMAT's objectives. Recognition technologies such as NIR/VIS scanners, combined with standardized evaluation protocols, are essential for preserving textile value.
- **Service-oriented value capture**
  Cyclothe demonstrates that circular textile models often depend on service revenues rather than pure material margins. TEXMAT's financial logic may similarly require contracts, partnerships, and data-driven services.

- **Ecosystem orchestration**
  Cyclothe operates as a coordinating actor linking municipalities, recyclers, and consumers. TEXMAT may require comparable orchestration mechanisms to stabilize stakeholder roles and incentives.

1.3 TooUsed



Value Proposition

TooUsed offers a digital platform and mobile app that enables people to recycle or sell old clothes, accessories, and household textiles in a convenient, responsible, and rewarding way. Users can upload details of their unwanted items, schedule doorstep pickup, or drop garments at designated points. Once received by TooUsed, items are evaluated through a quality check and routed into appropriate reuse, resale, or recycling channels. In return, users receive **TooUsed Credits**— digital rewards that can be redeemed for cash or vouchers at a wide range of retail partners. This creates an immediate economic benefit tied directly to sustainable action, turning wardrobe decluttering into a valuable transaction.

Value Creation and Delivery

TooUsed creates value by reducing friction in the garment disposal process and linking it to visible environmental and economic outcomes. The user journey begins with a simple app interaction in which the consumer indicates the volume and type of textiles they want to offload. TooUsed facilitates home pickup or drop-off, freeing consumers from the effort and uncertainty of traditional donation channels. Clothing items are then processed through inspection and sorting, with wearable pieces channelled to resale or distribution networks and lower-quality textiles directed to

recycling. TooUsed uses technology, logistics coordination, and partnerships with recyclers and retailers to balance ease for users with efficient downstream material flows. Rewards are disbursed promptly as credits that can be converted into real-world economic benefits, reinforcing positive behaviour and encouraging repeat participation.

Value Capture

TooUsed's financial model captures value from multiple sources tied to incentives, network effects, and operational flows. The platform monetizes user engagement by partnering with brands and retailers that accept TooUsed Credits for purchases, effectively subsidizing part of the reward ecosystem while driving customer loyalty and spend. So-called Give Back Bags filled by users provide the raw material for TooUsed's resale, reuse, and recycling streams, enabling revenue through resale margins or sale of pre-sorted textile batches to secondary markets and recyclers. B2B services such as bulk textile sourcing for corporate gifting or recycled-product production further diversify revenue. Over time, social impact, increased collection volumes, and technology-enabled sorting help TooUsed improve operational efficiency and expand its ecosystem value capture across the circular textile chain.

Implications for the TEXMAT Business Model

TooUsed's approach reveals several insights relevant to TEXMAT, especially in relation to how consumers can be motivated to send used textiles into circular systems:

- **Incentive-linked participation.** TooUsed demonstrates that consumers respond strongly to immediate, tangible rewards — such as credits that can be redeemed for cash or retail value — when deciding to send in used clothing. TEXMAT should consider similar incentive mechanisms to increase voluntary returns and reduce garment leakage.
- **Convenience and user experience.** Scheduling home pickup or using a simple mobile interface lowers participation barriers. TEXMAT could adopt multiple convenient return channels, including pick-up services or integrated drop-off points, to make textile returns seamless.
- **Clear routing and accountability.** TooUsed assures users that their items will be responsibly reused or recycled, which builds trust. TEXMAT should embed transparent tracking and communication to reinforce trust and encourage repeat contributions.
- **Partnerships and hybrid revenue.** TooUsed leverages retail partners to subsidize rewards and partners with recyclers and resale networks to create value from collections. TEXMAT could similarly integrate brand, recycler, and marketplace partnerships to diversify revenue and strengthen system sustainability.
- **Digital engagement and behavioural feedback.** The app experience with credits and impact reporting reinforces positive behaviour. TEXMAT could integrate digital dashboards that track environmental impact, provide personalised feedback, and reinforce habitual circular actions.

1.4 Sellpy



Sellpy is a Swedish recommerce company that has developed a centralized platform model for second-hand fashion and consumer goods. Founded in Stockholm in 2014 and later majority-owned by H&M Group, Sellpy aims to reduce the friction traditionally associated with second-hand selling by managing the entire resale process on behalf of consumers. Rather than operating as a peer-to-peer marketplace, Sellpy functions as an intermediary orchestrating logistics, sorting, pricing, digital listing, storage, sales, and distribution through centralized infrastructure.

Value proposition

The business model is built around a simple consumer proposition: individuals order a Sellpy bag, fill it with unwanted clothes or household items, and send it to Sellpy's facilities. Once received, Sellpy evaluates the items, photographs them, creates digital listings, sets prices, stores inventory, and handles transactions and shipping to buyers. Sellers receive a share of the revenues from sold products after service and commission fees are deducted.

From a business model perspective, Sellpy addresses one of the major barriers to circular consumption systems: the effort required to participate in second-hand markets. Traditional resale platforms such as Vinted or eBay require consumers to individually photograph items, write descriptions, communicate with buyers, manage pricing decisions, package products, and organize shipments. Sellpy shifts these activities from consumers to a centralized operational system. The company therefore transforms reuse participation from an active "seller task" into a low-effort disposal and recovery service.

The value proposition operates on two interconnected sides. For sellers, the platform offers convenience, time savings, and simplified wardrobe decluttering. For buyers, Sellpy provides access to large volumes of affordable second-hand products through a professionally managed digital platform with standardized listings and logistics. At the ecosystem level, the

company creates infrastructure enabling large-scale circulation of used textiles and fashion products across multiple European markets.

Value creation and delivery

Operationally, Sellpy relies heavily on centralized processing capabilities. The company has developed warehouse-based systems for sorting, quality control, photography, pricing, and fulfilment. Economies of scale are critical to the viability of the model because profitability depends on processing large volumes of relatively low-value products efficiently. Digitalization also plays a central role through automated listing systems, pricing algorithms, inventory management, and platform coordination.

Value capture

Revenue generation combines several mechanisms. Sellpy charges sellers handling and service fees while also retaining commissions from successful sales transactions. Additional value is created through high inventory turnover, cross-border resale operations, and partnerships with brands and retailers seeking solutions for returns, overstock, or unsold inventory. The model therefore combines elements of C2B2C (consumer-to-business-to-consumer) and increasingly B2B2C recommerce systems.

Implication for Texmat business model

- From a circular economy perspective, Sellpy represents an important example of infrastructure-enabled reuse. Rather than focusing solely on consumer awareness or sustainability messaging, the company redesigns the operational and logistical conditions required for reuse participation. In this sense, Sellpy functions as a reuse infrastructure orchestrator that lowers transaction costs, increases accessibility to second-hand markets, and extends product lifetimes at scale.
- The model also illustrates several tensions associated with industrialized resale systems. The convenience offered to consumers is partially offset by lower financial returns for sellers compared to direct peer-to-peer resale. Centralized processing creates efficiency gains but may also generate concerns regarding transparency, item valuation, or rejection decisions. Moreover, the economic viability of the model depends on maintaining sufficient processing speed and inventory turnover across very large product volumes.
- Sellpy demonstrates how circular business models can scale by combining digital platforms, centralized reverse logistics, and managed service models to normalize participation in reuse systems. The company therefore provides a useful example of how recommerce infrastructures can support broader circular economy transitions in the fashion and textile sectors.

A1.4 Droppie (Netherlands) — multi-stream, app-rewarded urban return hubs

Overview

Droppie is a Dutch for-profit start-up founded by Natascha Hermsen and Stef Traa, operating a network of staffed urban return hubs combined with a consumer mobile application. The first hub opened in Amsterdam in mid-2024, and the network has since extended to Utrecht, Rotterdam and The Hague. Unlike single-stream textile collection schemes, Droppie accepts a broad set of household return streams at one location: textiles, small electrical and electronic equipment, deposit-bearing bottles and cans, plastic packaging and beverage

cartons, cooking oil, batteries, and a small number of site-specific streams such as mattresses. Textiles are deposited in a closed bag into a dedicated in-store unit branded the "Dropbot". An experimental "Recycle Wall" is used to trial take-back of additional materials before they are added to the standard offer.

The case is included here because it combines, in a single operating model, three features that the TexMat architecture also relies on: app-based consumer identification, a per-kilogram or per-item monetary reward, and a routing relationship with downstream reuse and recycling operators. It differs from TexMat in that it is staffed, multi-stream, and carries no item-level data layer.

Value proposition

For consumers, the proposition is convenience combined with a direct monetary return. The user registers in the app using a phone number, presents a personal QR code at the hub, and receives a credit per item or per kilogram depending on the stream. Credit is paid out to a bank account through a third-party payment service, or can be donated to one of a set of listed charities. A single visit can discharge several household return obligations at once, and the hubs additionally act as parcel drop-off and collection points for several carriers, which raises visit frequency for reasons unrelated to recycling.

For municipalities, the proposition is framed explicitly against post-separation of mixed municipal waste. Droppie argues that separation at the household, verified at the point of return, produces cleaner fractions than mechanical separation downstream.

For brands, a distinct offer ("Droppie for Brands") positions take-back as a customer loyalty instrument. Returned packaging or products trigger rewards in the brand's own loyalty currency, and the brand receives real-time data on what is returned, how often and in which streams, presented as usable for producer responsibility and sustainability reporting.

Value creation and delivery

Value is created primarily through fraction purity rather than volume. The controlled, staffed return environment allows each stream to be checked at the point of deposit, so the material handed to downstream partners requires less pre-sorting and carries a lower reject rate than kerbside or unattended bank collection. For textiles specifically, the accepted and rejected item lists are narrow and explicit, and the deposit must be made in a closed and preferably transparent bag. Wet or mouldy garments, carpets, duvets, pillows and textiles contaminated with oil or paint are excluded.

Sorting and destination decisions are not made by Droppie. Collected textiles are transferred to a collection and sorting partner, which reports that approximately 85 per cent of the clothing received is directed to second-hand retail, with the balance recycled into applications such as vehicle seat padding and insulation. Droppie presents this figure as substantially higher than the reuse share obtained from conventional textile banks, which it attributes to the deposit conditions and the staffed environment rather than to any technology in the return unit itself.

Delivery to the consumer is mediated entirely by the application. Identification, reward calculation, transaction history, payout and location information sit in the app; the physical

unit performs no identification function of its own. Company-reported figures at the time of writing indicate twelve drop-off points, more than 60,000 registered households, more than 220,000 drop-off events and more than four million deposit containers handled.

Value capture

Droppie does not monetise the consumer. Revenue is captured downstream and upstream of the deposit event, through four routes. First, and principally, producer responsibility organisations and deposit system operators pay for clean, well-characterised material streams; Droppie names the Dutch packaging, WEEE and beverage deposit schemes among its partners. Second, brand-facing take-back programmes are sold as a combined loyalty and reporting service. Third, the hubs generate service income from parcel handling and from a small retail assortment of sustainable products. Fourth, municipal partnership provides both siting support and a public-policy rationale for the network.

The textile stream is the weakest of these in value capture terms. Because sorting and resale are performed by the partner, Droppie captures a collection margin rather than a share of realised reuse value, and the reward paid to the consumer is funded from that margin. The wider model is therefore cross-subsidised: streams with a strong statutory funding base, notably deposit containers and WEEE, carry the fixed cost of a staffed retail location that the textile stream alone could not support.

Implication for Texmat business model

- Droppie is direct evidence that a per-kilogram or per-item cash reward, settled after the deposit event through an app account rather than at the container, is operationally workable at consumer scale. It also suggests that using an existing consumer payment rail is preferable to building a proprietary wallet, and that a charity donation option should be offered alongside cash payout.

2. INNOVATION AROUND TEXTILE BINS

Innovation around textile bins focuses on upgrading traditionally passive infrastructure into **smart, connected collection nodes**. Solutions deployed by Ekocharita + Sensoneo, Moda re- + Nordsense, introduce IoT sensors, fill-level monitoring, and real-time analytics. These technologies do not directly recycle textiles but dramatically improve **collection efficiency**, **route optimisation**, and **material quality preservation**. The innovation stands at the intersection of physical infrastructure and digital monitoring, where bins evolve from static containers into **data-generating assets** within circular logistics systems.

2.1 Ekocharita + Sensoneo (Slovakia)



In Slovakia, textile waste collection has historically been inefficient and costly. A private firm, **Ekocharita**, operated a large network of collection containers for used clothing, shoes, and home textiles, distributed mainly in urban areas. These bins filled at unpredictable rates because consumers delivered unwanted textiles irregularly, making it difficult to plan and optimize collections. Drivers often visited many half-empty containers, leading to high labour costs, wasted vehicle mileage, and inconsistent material flows into warehouses. Because textile waste has relatively low market value, operational efficiency was crucial to making collection economically viable rather than seeing textiles end up in landfill or incineration.

Ekocharita's main challenges therefore lay in uncertain collection logistics, unpredictable bin fill cycles, and high financial and time demands on operations.

Value Proposition

Ekocharita provides a structured, organised network of textile collection points across western Slovakia, encouraging citizens to sort and deposit unwanted garments and textiles responsibly rather than discarding them with general waste. The company's value for communities and partners lies in diverting textiles from landfill or incineration and supplying consistent material volumes for reuse, donation, and recycling streams. By equipping its operations with **Sensoneo's smart sensor technology**, Ekocharita enhances this value proposition. Real-time fill-level data transforms the collection network from a reactive system based on estimations into a data-driven infrastructure that improves timing, reduces unnecessary trips, and optimises logistics planning.

Value Creation and Delivery

The partnership between Ekocharita and **Sensoneo** creates value through the integration of digital monitoring and operational analytics into traditional textile waste collection. Sensoneo's ultrasonic sensors and IoT connectivity monitor bin fill levels continuously, transmitting data to a central platform. Collection managers and drivers then use this live information to decide which containers truly need servicing on a given day, eliminating guesswork and wasted effort. Drivers open a mobile app each morning to view only the bins requiring collection, reducing unnecessary routes and enabling better planning of warehouse workflows. This real-time coordination supports more predictable material flows into Ekocharita's processing and sorting facilities, improves worker satisfaction, and enables the company to scale its network with confidence that the infrastructure will be used efficiently.

Value Capture

Ekocharita's financial sustainability depends on capturing value through operational efficiency rather than direct revenue from low-value textile materials. By partnering with Sensoneo, the company reduces the primary cost drivers in its model: collection labour, vehicle mileage, and time spent by drivers on inefficient routes. Real-time monitoring led to measurable reductions in the time required to collect one tonne of textile waste (around a 30 % improvement) and a significant drop in waste collection costs (around 20 %) within the first six months of implementation. These efficiency gains translate directly into lower operating expenses per unit collected, smoothing

the earnings profile despite the low market prices for textile waste. The improved predictability of material supply also reduces warehousing bottlenecks, enabling better downstream sorting, resale, donation, and recycling allocation — all of which help stabilise material throughput without proportionally increasing costs.

Implications for the TEXMAT Business Model

The Ekocharita + Sensoneo case offers several strategic insights for TEXMAT:

- **Data-driven logistics reduce uncertainty.** Real-time fill-level monitoring turns unpredictable return patterns into actionable data, enabling dynamic route planning, better allocation of drivers, and more stable input streams — critical for any system relying on voluntary consumer returns.
- **Operational efficiency can drive financial viability.** In low-value material streams such as textiles, reducing costs (collection time, fuel, labour) can be as important as increasing volume. TEXMAT should integrate digital monitoring and optimisation to lower unit costs.
- **Technology enhances trust and service quality.** Predictable and visible collection systems attract partners (e.g., retail or public spaces) to host infrastructure because they reduce the risk of overflow and community nuisance. TEXMAT can leverage similar technology to secure key locations for roll-out.
- **Scaling requires predictable material flows.** With better data on when and where bins fill, programs can expand more confidently because planners avoid over-servicing and under-servicing, keeping logistics lean.
- **Digital feedback loops support worker engagement.** Drivers and staff who can see concrete benefits from digital tools adopt them more readily, smoothing transitions and improving operational morale. TEXMAT should consider human-centred design around digital tools.

2.2 Moda re- and nord sense (Spain)



Value Proposition

Moda re-positions unwanted clothing and textiles as recoverable assets and channels them into structured circular pathways that balance social impact and environmental value. The organisation operates Spain's largest network of second-hand clothing shops and thousands of collection points for used garments. For consumers, donating textiles to Moda re- offers a clear and socially meaningful disposal option. For partners — including municipalities, brands, and waste management actors — Moda re- provides a framework for diverting textiles from general waste streams into reuse and recycling. Across its operations, Moda re- combines social employment creation with circular economy principles, emphasising both environmental impact and social inclusion.

Value Creation and Delivery

Moda re- creates value by integrating collection infrastructure, processing capacity, and digital technologies to make textile recovery more efficient. A key technological innovation documented in practice is the **installation of smart sensors on textiles donation containers**. Through a partnership with digital solutions providers such as Nordsense, Moda re- equips its clothing banks with **volumetric and fill-level sensors** that monitor garment accumulation in real time. This information flows into a central analytics platform that enables dynamic optimisation of collection routes,

ensuring trucks and personnel service bins only when they approach capacity. This reduces unnecessary vehicle trips, prevents overflow and contamination, and stabilises inbound material quality. Over 7,500 containers have been outfitted with this smart sensing infrastructure, and the data insights generated have allowed Moda re- to prioritise peak collection points, maintain cleaner collection sites, and gather more textiles without excessive operational waste.

In addition to sensor technology, Moda re- has introduced digitalisation projects including mobile and backend systems for logistics planning, container management, and traceability. These innovations are supported in part by EU recovery funding to improve operational efficiency and environmental performance across its collection and processing network.

Value Capture

Moda re- operates on a hybrid social enterprise model where financial and social returns are intertwined. The organisation captures economic value through:

- **Reuse and resale revenues** from second-hand stores distributed across Spain. These sales fund part of the operational cycle.
- **Donated textile flows** that, when sorted and recycled, can be monetised through resale of reusable garments or sale of recyclable fibres, offsetting operational costs.
- **Operational cost savings enabled by sensor technology**, which reduces unnecessary collection mileage, labour time and fuel costs, thus lowering per-unit collection expense.
- **Partnership contracts and service agreements** with municipalities and EU programmes, which cover costs associated with digital platforms, logistics optimisation, and data analytics.
- **EU and national funding** mechanisms (e.g., NextGenerationEU), which subsidise investments in digital infrastructure, sensor deployment, and digital ecosystem components.

This hybrid model balances sales revenues, operational savings from digital optimisation, and external funding to sustain the organisation’s environmental and social missions without relying on traditional profit extraction alone.

Implications for the TEXMAT Business Model

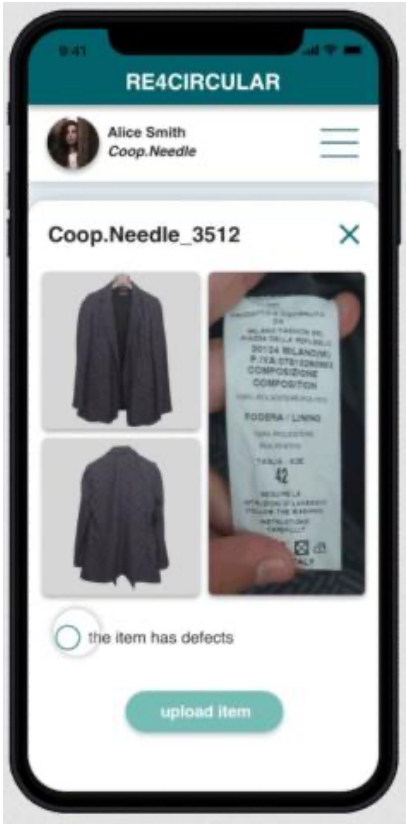
The Moda re- case highlights several strategic lessons for TEXMAT:

- **Real-time data improves operational efficiency.** Sensor-based monitoring of fill levels converts unpredictable donation patterns into predictable operational inputs, enabling dynamic route planning and cost reduction.
- **Digitalisation strengthens material quality and flow.** Data insights support planning and help prevent contamination and overflow, which preserves the usability of donated textiles.

3.INNOVATION IN TEXTILE WASTE PLATFORMS

Innovation in textile waste platforms lies in data structuring, classification, and ecosystem coordination. Platforms such as RE4Circular digitise garments, extract metadata, and enable routing decisions across reuse, resale, repair, and recycling streams. These systems transform heterogeneous textile waste into searchable, tradable, and traceable resources. Innovation here resides less in hardware and more in AI-enabled classification, marketplace creation, and value chain transparency. Platforms serve as coordination layers connecting collectors, sorters, brands, recyclers, and resale actors

3.1 RE4Circular by Atelier Riforma (Italy)



Value Proposition

RE4Circular is an **AI-powered technology and digital platform** designed to catalog, classify, and digitise used textiles at scale. It helps organisations managing both pre- and post-consumer textile waste to identify essential garment attributes — such as material composition, type, size, condition, and other features — faster and more accurately than manual processes. By turning textile waste into structured digital

data, RE4Circular enables **transparent routing to reuse, recycling, or upcycling pathways**, connecting collectors with circular fashion professionals through a B2B marketplace and analytics platform. This increases material value, reduces waste, and improves supply–demand matching within the circular textile ecosystem.

Value Creation and Delivery

Atelier Riforma's journey began as a social upcycling initiative that repaired and resold used clothing, building a network of tailors and artisans across Italy. However, manual processing proved difficult to scale, leading to development of RE4Circular, a patented AI-based system that automates textile assessment and classification. The technology uses **AI and computational methods** to extract garment features from images and metadata, categorising items in a way that reflects their most appropriate circular pathway. Unlike manual sorting, RE4Circular digitises garment attributes at scale, making textile waste visible, searchable, and actionable. The resulting structured data feeds into a **digital marketplace** where collectors can list textiles and circular fashion professionals (thrift shops, upcyclers, recyclers, refashioners) can source materials aligned with their business needs.

In practical pilots such as the **RiVestiTo project in Turin**, RE4Circular has been tested to catalog and analyse textiles collected by municipal partners, making the entire flow transparent and enabling the city to monitor quantities, characteristics, and potential reuse outcomes. Through this integration, the city and partner organisations gain real-time insights into textile streams, while the platform provides a more efficient bridge between supply and reuse/recycling demand.

Value Capture

Atelier Riforma's business model captures value at multiple layers:

- **Technology licensing and platform fees.** Organisations that collect textiles — from charities to municipal schemes and PROs — can integrate RE4Circular's AI classification and digital tools into their operations, paying licensing or access fees.
- **Marketplace transaction fees.** The integrated B2B marketplace enables wholesale sourcing and trading of categorised textiles, generating fees on listings and transactions that connect collectors with circular fashion businesses.

- **Data and analytics services.** Corporates and public entities may subscribe to analytic dashboards and monitoring tools that support transparency, reporting, and operational optimisation.
- **Consulting and integration support.** Atelier Riforma offers services around regulatory compliance, eco-design, and circular value chain design for organisations transitioning to sustainable models.
- **External funding and public programmes.** RE4Circular has been supported through EU funding programmes (e.g., Horizon Europe and SocialTech4EU) that accelerate technology development and adoption.

This model blends **technology monetisation**, **marketplaces**, and **services** in a circular context, aligning incentives across stakeholders while preserving flexibility in low-margin textile streams.

Implications for theTEXMAT Business Model

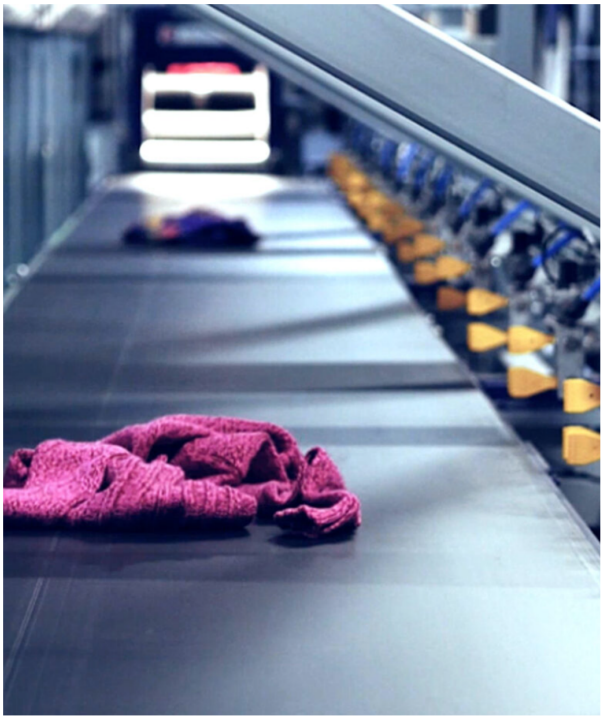
The RE4Circular case offers strategic insights for TEXMAT:

- **Automated classification enhances value preservation.** AI-enabled categorisation allows assignment of garments to the highest-value circular pathways — a principle essential for TEXMAT's sorting logic.
- **Data infrastructure enables transparency and optimisation.** Structured data on textiles facilitates traceability, reporting, and demand–supply matching, providing the backbone for efficient value flows.
- **Digital marketplaces can bridge circular supply–demand gaps.** Connecting collectors with reuse and recycling professionals through digital platforms reduces friction and improves utilisation of material resources.
- **Hybrid revenue streams strengthen financial resilience.** Combining platform access, marketplace transactions, consulting, and analytics creates diversified value capture that mitigates low unit material values.
- **Regulatory alignment boosts adoption.** Tools like RE4Circular support compliance with upcoming EU textile waste policies (e.g., mandatory separate collection), positioning technology as an infrastructure layer within wider ecosystem transformations.

12. INNOVATIONS IN SORTING TECHNOLOGIES

Innovation in sorting technologies directly targets the core technical bottleneck of textile circularity**.** Technologies such as Fibersort and TOMRA AUTOSORT apply NIR spectroscopy, optical sensors, and machine learning to automate fibre identification, colour separation, and contaminant detection. These innovations enable industrial-scale precision, higher throughput, and improved feedstock purity. Unlike apps or bins, sorting technologies intervene at the material transformation stage, determining whether textiles can realistically enter high-value recycling loops.

4.1 Fibersort



Value Proposition

Fibersort offers a technological solution that addresses the critical bottleneck in the textile recycling chain: sorting. The company's technology automates the separation of mixed post-consumer textiles based on **fibre composition and colour**, using a combination of Near Infrared Spectroscopy (NIRS) and camera systems. This enables the creation of consistent, homogeneous material streams that are suitable for high-value recycling processes. For recyclers and processors, Fibersort delivers better input quality and higher throughput than manual systems. For collection

organisations and waste operators, it enables the capture of greater value from textiles that would otherwise remain low-value waste. For the industry as a whole, Fibersort moves textiles farther along the circularity curve by transforming unsorted waste into verified feedstock for new products.

Value Creation and Delivery

Fibersort's core value is created through advanced optical and spectral sorting technology. The system scans and classifies individual garments based on the chemical signatures of fibres and visible colour properties. Machine learning models interpret the spectral data to predict fibre composition — including cotton, polyester, viscose, wool, nylon and other fibres — and assign items to predetermined categories. The technology can operate automatically at industrial scales, processing hundreds of kilograms of textiles per hour and delivering sorted fractions that meet recycler specifications. Delivery of value occurs through partnerships with sorting facilities, recyclers, and brands that integrate Fibersort into broader recovery operations. Increased sorting precision enhances downstream recycling yields while reducing contamination, lowering processing costs and creating new pathways for textile-to-textile recycling.

Value Capture

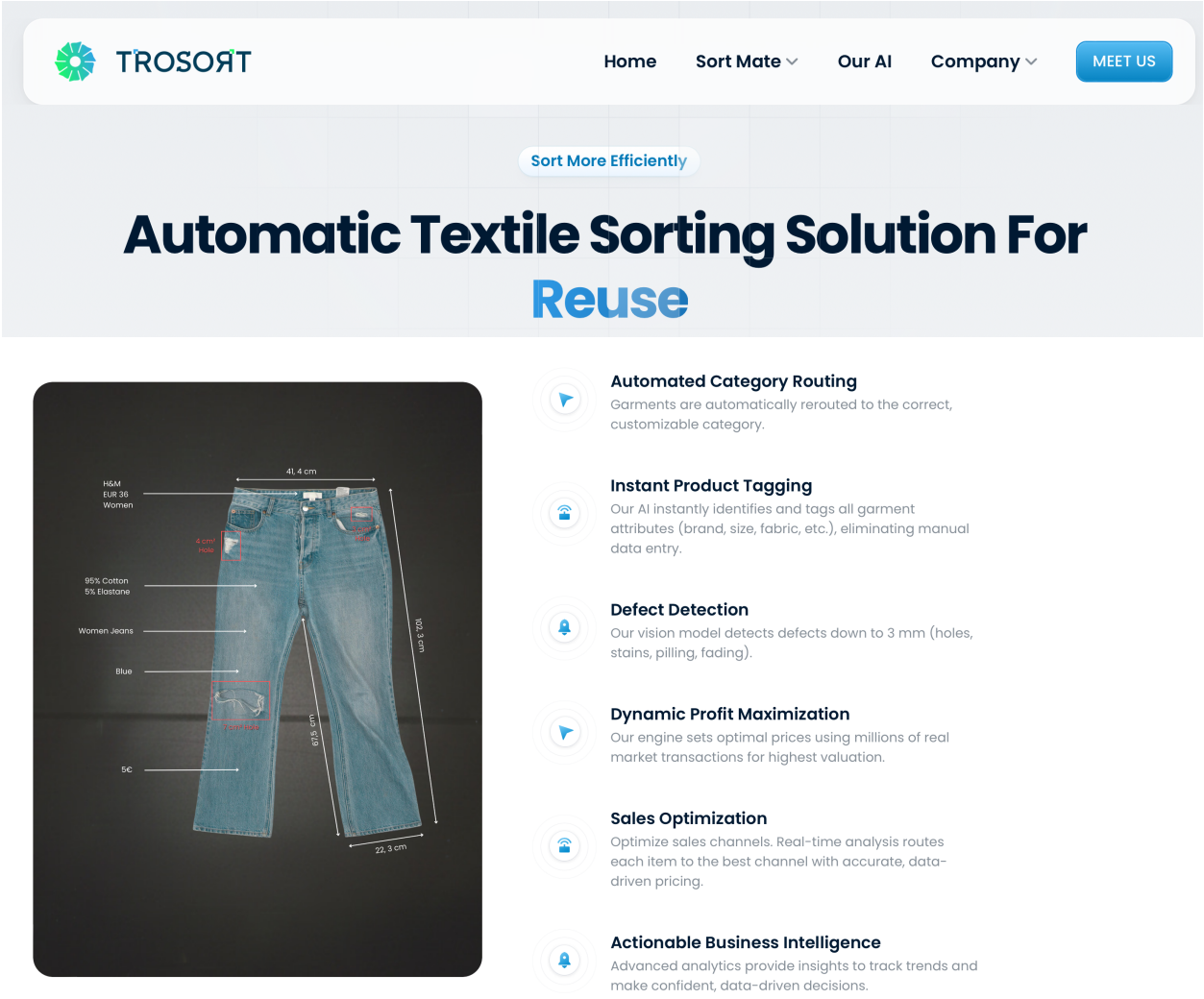
Fibersort captures value by selling, leasing, or integrating its sorting systems into textile recovery operations. Revenue streams may include equipment sales, robotic integration, maintenance contracts, and software support. Value is also captured indirectly through operational cost savings for customers: automation reduces labour costs, improves sorting throughput, and increases the economic value of sorted feedstock by aligning it with recycler requirements. By enabling higher quality inputs for recycling, fibresorted materials can command better pricing than unsorted waste, opening revenue opportunities within circular supply chains. As textile recycling technologies mature, Fibersort's value capture can expand through performance-based contracts, licensing of data analytics tools, and value-added services that support traceability and reporting. The business model thus integrates product-based revenues with service and system-level value creation.

Implications for the TEXMAT Business Model

Fibersort offers several insights relevant to the development of TEXMAT:

- **Precise sorting as core value driver.** The technology highlights that accurate classification of textiles by fibre and colour dramatically increases material value. TEXMAT should prioritise sorting technologies that can reliably differentiate material types, because this directly influences recycling quality and revenue potential.
- **Automation and scalability.** Fibersort shows that high-volume processing is critical for economic viability. TEXMAT's model will need to consider automation not as an optional enhancement but as a core enabler of throughput, cost efficiency, and competitive feedstock quality.
- **Data integration and traceability.** Automated sorting generates rich data about material flows. TEXMAT can adopt similar data infrastructure to support traceability, improve decision-making, and generate reporting that builds trust with brands and regulators.
- **Partnership and ecosystem alignment.** Fibersort's impact depends on collaboration with waste collectors, sorters, recyclers, and brands. TEXMAT likewise must design partnerships that align collection incentives, technology deployment, and market demand for recycled fibres.
- **Market pull and end-use development.** Fibersort alone cannot create demand for recycled textiles. TEXMAT should integrate strategies that align material quality with clear downstream applications, potentially co-developing markets with brands and manufacturers.
- **Economic pathways beyond material streams.** The value capture logic — combining hardware sales, service contracts, and feedstock enhancement — suggests that TEXMAT may benefit from similar diversified revenue opportunities, including data services or performance-linked revenue sharing with recyclers.

4.2 Trosort



Value Proposition

Trosort offers an **AI-driven sorting and inventory automation platform** designed specifically for the textile reuse and second-hand ecosystem. The company's core technology combines advanced image recognition, artificial intelligence, and automation to categorise garments based on attributes such as brand, material, condition, and resale potential. This data-rich output supports accurate tagging, dynamic pricing, and efficient routing of items to the most appropriate destination — whether that be resale, repair, or recycling. For sorting centres and post-consumer textile operators, Trosort reduces operational friction, boosts throughput, and enhances material traceability. For resale businesses and digital marketplaces, the

platform simplifies product listing, inventory management, and sales optimisation. Trosort's technology is designed to transform second-hand sorting from a manual, intuition-based process into a scalable, data-powered operation.

Value Creation and Delivery

Trosort creates value by digitising the entire textile sorting and preparation process. Its **SortMate** technology uses sensors, cameras, and AI models to analyse each garment in real time, extracting metadata and directing it into customised categories. The system can automatically identify fabric types, brands, defect features, size, and even estimated market value. This enriched tagging enables quicker decisions about resale value, the most suitable sales channel, or the optimal recycling route. Trosort's digital platform also supports automated product sheet generation, dynamic pricing tools, and integration with e-commerce systems to streamline online listings. By replacing manual data entry and subjective judgement with automated classification and analytics, the company significantly improves inventory velocity and accuracy. The same technology fuelled by AI also produces analytics and insights that help partners refine sorting strategies, predict demand, and better match supply to market opportunities.

Value Capture

Trosort captures value through a **technology and service-oriented business model** focused on helping textile operators scale their sorting and resale capabilities. According to investment documentation, the company operates on a **pay-per-use SaaS model**, charging clients based on the volume of clothing processed through its system, which allows organisations of varying sizes to adopt the solution with minimal upfront cost. Longer-term revenue streams may also arise from enterprise contracts, custom system integrations, and maintenance or support services. As the platform supports both physical sorting centres and online resale operations, Trosort is positioned to capture value across multiple segments of the circular textile ecosystem — from sort-and-route automation to e-commerce enablement. The technology also generates valuable data that can be monetised or used to support analytics offerings. The recent seed funding round (€1.15M) validates investor confidence in the model's scalability and underscores potential for commercial expansion. €1.15M has been raised to scale textile circularity technology and equip sorting centres with automated systems backed by AI.

Implications for the TEXMAT Business Model

Trosort's case offers meaningful insights for TEXMAT, especially in how consumers and operators can send used items into a circular system:

- **Digital engagement and ease of participation.** Trosort shows the importance of lowering friction for participants entering the system. TEXMAT can develop digital interfaces where consumers easily register, tag, and prepare textiles for drop-off or shipment, reducing cognitive and logistical barriers.
- **AI-enabled classification enhances routing decisions.** Just as Trosort automates identification and valuation for resale, TEXMAT can leverage AI and imaging technologies to assess garments at collection points, improving routing into reuse zones or recycling streams.
- **Data and metadata unlock value.** Rich item metadata enables better decision-making about pricing, material routing, and market alignment. TEXMAT can adopt similar data capture points to inform stakeholders and improve value capture over time.
- **Scalable business model design.** Trosort's pay-per-use SaaS model illustrates how technology can deliver recurring revenues tied to throughput. TEXMAT might similarly build service-based revenue layers — for example, charging partners for sorting processing, data dashboards, or traceability reports.
- **Traceability builds trust and compliance.** Automated tagging not only improves operations but also enhances transparency. TEXMAT could integrate traceability layers to show consumers where their textiles go next, strengthening trust and engagement.
- **Incorporating resale logic.** Though not always the focus, Trosort's linkage with resale marketplaces highlights how circular systems can blend reuse with recycling. TEXMAT could expand its model to consider third-party resale or peer-to-peer platforms as part of the textile lifecycle.

12.3 TOMRA AUTOSORT (Textile Sorting Technology)



AUTOSORT™

The most powerful multifunctional sorting system worldwide

Multifunctional sensor configuration

Optimized costs & performance

Highly efficient FLYING BEAM™

Future-proof system design

Minimal maintenance

Value Proposition

AUTOSORT delivers a high-performance, multifunctional sorting system that transforms how textiles are separated and prepared for recycling. Using a combination of advanced sensors — such as NIR (near-infrared), VIS (visible spectrum), and electromagnetic detection — the technology automatically identifies material types, colours, and contaminants like zippers or buttons before directing them into defined fractions. By significantly improving sorting accuracy and throughput compared with manual methods, AUTOSORT enables recyclers to produce consistent, high-purity textile fractions suitable for downstream recycling technologies such as mechanical recycling or chemical depolymerisation. This reduces waste, increases recyclable output quality, and supports a more circular textiles value chain.

Value Creation and Delivery

TOMRA creates value by integrating cutting-edge sensor technology with scalable industrial automation. AUTOSORT units are deployed in textile recovery facilities and sorting plants, where bales of post-consumer and post-industrial textiles are unwound, dosed, and passed under sensor arrays. The system detects fibre composition and other attributes in real time, directing each piece into the appropriate sorting stream. Optional digital services like TOMRA Insight add a layer of data analytics that helps operators optimise performance and material purity over time. TOMRA also collaborates in ecosystem projects — for example, industrial-scale automated sorting facilities developed with partners like STADLER and Circle-8 — demonstrating how technology can be embedded into broader textile recovery infrastructure. By enabling faster, more precise sorting at industrial volumes, TOMRA facilitates the creation of feedstock that matching the quality requirements of modern recycling processes.

Value Capture

TOMRA’s business model for AUTOSORT revolves around technology licensing and systems sales, supported by after-sales services and digital offerings. Revenue is generated primarily through selling or leasing AUTOSORT machines and integrated sensor systems to recycling plants, waste processors, and textile recovery facilities. Additional value is captured through optional add-ons such as cloud-based monitoring (TOMRA Insight), calibration technology, maintenance, and performance support services. This combination of hardware and recurring service revenue ensures long-term customer relationships. TOMRA benefits from economies of scale

due to its global footprint and cross-sector demand for sensor-based sorting solutions. Moreover, as textile recycling becomes more economically viable and regulated, investment into advanced sorting technology is increasingly supported by green financing, incentives, and partnership projects, expanding markets for AUTOSORT installations.

Implications for the TEXMAT Business Model

TOMRA's AUTOSORT case offers several strategic lessons that are highly relevant for TEXMAT's textile collection and sorting model:

Automated sorting is a core value driver. TOMRA demonstrates that material classification accuracy and throughput are essential to unlock high-value recycling. For TEXMAT, investing in (or partnering with) similar technology is necessary for generating recyclable feedstock that meets industrial recycling specifications.

Technology needs ecosystem integration. AUTOSORT works best when integrated with pre- and post-processing infrastructure, suggesting that TEXMAT should consider full workflow orchestration — from collection and bale preparation to sorting and routing — rather than isolated technology deployments.

Data adds operational value. Digital monitoring services enable continuous optimisation and performance tracking. TEXMAT can embed similar data analytics to improve sorting decisions, transparency, and reporting for stakeholders.

Partnerships amplify impact. TOMRA's collaborations with projects like SIPTex and Circle-8 show that technology alone does not solve systemic barriers. TEXMAT may also need to work with regulators, brands, and recycling facilities to build demand and infrastructure around sorted textiles.

Financial sustainability through hybrid revenue. Revenue from technology sales, services, and digital add-ons illustrates how diversified income streams can enhance financial robustness. TEXMAT could similarly combine service fees, data platforms, and partnerships to distribute financial risk and value capture across the ecosystem.

5. RETURN SCHEMES IN OTHER SECTORS

5.1 PALPA Deposit-Return System – FINLAND



Value Proposition

PALPA's deposit-return system redefines beverage containers as assets rather than waste. For consumers, the system offers a straightforward financial incentive combined with a highly convenient return experience. Empty containers can be returned at widely accessible retail locations, and refunds are issued immediately through automated reverse vending machines. For producers and importers, the system ensures compliance with Extended Producer Responsibility obligations while providing access to high-quality recycled materials. Retailers benefit from increased customer visits and standardized return infrastructure. At the societal level, the system contributes to reduced littering, improved recycling rates, and more efficient resource utilization. The core value proposition lies in creating a reliable loop where economic motivation, operational efficiency, and environmental performance reinforce each other.

Value Creation and Delivery

The effectiveness of the PALPA system emerges from its integrated ecosystem design. Deposits embedded in product pricing create a direct behavioural trigger for consumers. Reverse vending machines simplify participation by enabling rapid container identification, acceptance, and refund processing. Barcode-based recognition systems ensure that only eligible containers are accepted, reducing fraud and maintaining system integrity. Behind the consumer interface, centralized

logistics and sorting operations optimize material flows, enabling compaction, transportation, and processing at scale. Governance is structured around a neutral, not-for-profit operator that coordinates producers, retailers, and recyclers. Financial stability is achieved through a combination of producer fees, deposit flows, revenues from recycled materials, and unredeemed deposits. Data infrastructure supports monitoring, reporting, and continuous optimization. Together, these elements ensure that value creation is distributed across actors while maintaining system-wide efficiency.

Value Capture

The PALPA system captures value through a carefully balanced financial structure. Deposits function as temporary monetary flows rather than revenues, circulating between consumers and the system. Producer and importer fees finance collection, logistics, sorting, and administration. Revenues generated from the sale of high-quality recycled materials contribute to operational stability. Unredeemed deposits provide an additional buffer that helps offset system costs. This hybrid funding logic distributes financial responsibility while maintaining economic resilience. Producers internalize the cost of packaging recovery under EPR principles. Consumers are rewarded for participation. The operator remains financially viable without relying on profit maximization. Value capture is therefore systemic, combining regulatory compliance, material value preservation, and behavioural economics.

Implications for the TEXMAT Business Model

The PALPA case provides several insights that are highly relevant for the development of TEXMAT's textile collection and sorting model:

- **Incentive structures shape participation.** Deposit-return systems demonstrate that financial motivation can significantly increase return rates and reduce material leakage.
- **Convenience drives behaviour.** Ubiquitous and frictionless return options encourage routine consumer engagement.
- **System design affects material quality.** Clear eligibility rules and controlled return channels reduce contamination and help preserve material value.
- **Centralized orchestration stabilizes complexity.** A neutral system operator can coordinate standards, responsibilities, and data flows across stakeholders.

- **Diversified revenue mechanisms enable financial sustainability.** Combining producer contributions, material value capture, and operational efficiencies strengthens economic resilience.
- **Data infrastructure is critical.** Traceability and monitoring systems build trust, enable optimization, and support regulatory compliance.

5.2 Swappie



Value Proposition

Swappie positions itself as a trusted intermediary in the refurbished smartphone market. For buyers, the company offers high-quality pre-owned iPhones with warranties, transparent grading, and prices significantly below new devices. For sellers, Swappie provides a simple and predictable way to monetize unused phones. The process emphasizes convenience, speed, and clarity of valuation. The broader promise is to make circular consumption attractive, reliable, and mainstream by reducing perceived risks traditionally associated with second-hand electronics.

Value Creation and Delivery

Swappie creates value by integrating digital interfaces, logistics, refurbishment capabilities, and quality assurance processes. The consumer journey begins online, where sellers receive an instant price estimate based on device model and condition. Swappie provides shipping instructions and, in many cases, prepaid packaging. Devices are sent to centralized facilities where they undergo diagnostic testing, data wiping, repair, and cosmetic grading. Refurbished phones are then resold through Swappie's e-commerce platform. This vertically integrated model allows Swappie to control product quality, standardize processes, and deliver a consistent customer experience. Trust is reinforced through warranties, clear return policies, and professional refurbishment standards.

Value Capture

Swappie captures value by arbitraging between acquisition costs and resale value. Devices are purchased from consumers at prices reflecting expected refurbishment costs and market demand. Value is added through repair, component replacement, grading, and certification. Revenue is generated through resale margins on refurbished devices and complementary services such as extended warranties. Operational efficiency, accurate pricing algorithms, and refurbishment productivity are critical for profitability. The model transforms underutilized consumer assets into revenue-generating products while preserving residual material and functional value.

Implications for the TEXMAT Business Model

The Swappie case offers particularly relevant lessons for TEXMAT's textile return and collection logic.

- **Consumer motivation and value recovery**
  Swappie succeeds because consumers perceive a clear economic benefit when sending their used phones. Devices are framed as assets with residual value rather than obsolete waste. For TEXMAT, this suggests that textiles should similarly be positioned as value-bearing items. Financial incentives, store credits, or reward mechanisms could strengthen return behaviour
- **Convenience and friction reduction**
  Swappie minimizes effort by providing prepaid shipping solutions and clear instructions. The process is designed to feel easy, predictable, and safe. TEXMAT can adopt similar principles by simplifying textile return channels. Examples include prepaid return bags, home pick-up options, or seamless drop-off systems integrated into existing routines.
- **Trust and risk mitigation**
  Consumers send phones to Swappie because they trust pricing fairness, data security, and transaction reliability. In textiles, trust barriers may relate to privacy concerns, uncertainty about garment fate, or scepticism about environmental claims. Transparent communication, tracking mechanisms, and visible sorting outcomes can help build confidence.

- **Digital interface as behavioural enabler**
  Swappie's digital platform guides users through valuation, shipping, and transaction steps. For TEXMAT, digital tools could similarly support textile returns. Applications may include scanning garments, estimating reuse/recycling potential, tracking environmental impact, or rewarding participation.
- **Standardized evaluation and grading**
  Swappie's pricing logic depends on standardized diagnostics and grading. TEXMAT faces analogous challenges in assessing textile quality and routing decisions. Recognition technologies (e.g., NIR/VIS scanners) combined with classification protocols can enable consistent valuation and sorting.
- **Logistics integration**
  Swappie embeds reverse logistics into its core model rather than treating it as an afterthought. TEXMAT must similarly treat collection, transport, and sorting as central value creation activities. Efficiency and predictability are essential for financial viability.

References

Atelier Riforma. (n.d.-a). *Re4Circular—Technologies for circular fashion*. https://atelier-riforma.it/en/re4circular-en/

Atelier Riforma. (n.d.-b). *Services—Re4Circular AI platform and solutions*. https://atelier-riforma.it/en/services/

Brussels startup Trosort selected for EU funding. (2025). *BrusselsNetwork*. https://ncp.brussels/brussels-startup-trosort-eu-funding/

Circle Economy. (n.d.). *Fibersort project insights*. https://knowledge-hub.circle-economy.com/article/4263

Comprehensive plan to boost the social economy: ModaRE. (n.d.). *European Commission Project Overview*. https://commission.europa.eu/projects/comprehensive-plan-boost-social-economy-modare_en

Deposit system for beverage containers in Finland. (2024). *Palpa*. https://www.palpa.fi

Droppie. (2026). *Droppie makes recycling easy, fun, and rewarding*. https://www.godroppie.com/en

European Investment Fund. (2024, June 17). *Moda re-: Eco-social impact*. https://www.eif.org/case-study/all/moda-re-eco-social-impact

Fashion for Good. (n.d.). *reGAIN app—Circular fashion innovation*. https://www.fashionforgood.com/innovator/regain-2/

Fibersort. (2026). *Home—Fibersort®*. https://www.fibersort.com/

Fibersort. (n.d.). *Technology—Fibersort® technology for textile sorting*. https://www.fibersort.com/en/technology

Fibersort automated sorting for recycling textiles. (n.d.). *Textile sorting solutions—Valvan*. https://www.valvan.com/en/solutions/textile-sorting-recycling

Fibersort goes to the market: Making recycled textile the new norm. (n.d.). *SmartFibersorting*. https://smartfibersorting.com/fibersort-goes-to-the-market-making-recycled-textile-the-new-norm/

Fibersort machine and load volumes. (2025). *Textile sorting capacity and market context*. Texintel. https://www.texintel.com/eco-news/the-fibersort-machine-with-infra-red-technology-is-capable-of-sorting-900-kg-per-hour-of-post-consumer-textiles

Global Recycling. (2021). *Monitoring sensors reduce collection time and costs: Ekocharita case*. https://global-recycling.info/archives/5935

Moda re- participates in 2025 catalogue of good practices with digitalised textile collection. (2025, September 16). *Moda re- Case*. https://modare.org/magazine/circular/catalogo-2025-buenas-practicas-observatorio-textil-y-moda-contenedores-modare-en-ruta/

Moda re- and Nordsense partner up for clothing bank optimisation. (2022, November 24). *Nordsense Case*. https://nordsense.com/moda-re-and-nordsense-partner-up/

Numata, D. (2022). Deposit-refund systems for packaging waste: A global review. *Waste Management, 138*, 171–184. https://doi.org/10.1016/j.wasman.2021.11.038

Organisation for Economic Co-operation and Development. (2022). *Extended producer responsibility: Updated guidance for efficient waste management*. OECD Publishing.

Partnerships. (n.d.). *Re4Circular by Atelier Riforma is the first AI-based system to catalogue, sort, and digitise textile waste*. Texmater. https://www.texmater.com/partnerships/

Ranta, V., Aarikka-Stenroos, L., & Väisänen, J. (2021). Digital technologies catalyzing business model innovation for circular economy. *Business Strategy and the Environment, 30*(8), 4045–4062. https://doi.org/10.1002/bse.2836

RE4Circular project. (n.d.). *SoTecIn Factory—Atelier Riforma*. https://sotecinfactory.eu/social_innovators/atelier-riforma/

reGAIN app. (2024). *reGAIN app—Recycling rewarded*. https://regain-app.com/

Sensoneo. (n.d.-a). *Monitoring textile waste bins with smart sensors: Ekocharita case study*. https://www.sensoneo.com/success-stories/textile-waste-monitoring-bins-sensor/

Sensoneo. (n.d.-b). *Sensoneo: Smart waste management and digitalised circular economy solutions*. https://www.sensoneo.com/

Swappie. (2024). *About Swappie*. https://www.swappie.com

TOMRA. (n.d.-a). *AUTOSORT™—Automated sorting systems for recycling*. https://www.tomra.com/waste-metal-recycling/products/machines/autosort

TOMRA. (n.d.-b). *Textiles—Material sorting—Waste recycling*. https://www.tomra.com/waste-metal-recycling/applications/waste-recycling/textiles

TOMRA. (2026). *Why the textile recycling revolution needs more than just tech*. https://www.tomra.com/en-gb/waste-metal-recycling/media-center/news/2026/why-the-textile-recycling-revolution-needs-more-than-just-tech

TOMRA & CARBIOS Partnership. (2024). *Scaling circularity of polyester textiles*. RecyclingInside.com. https://recyclinginside.com/textile-recycling/carbios-and-tomra-textiles-join-forces-to-scale-circularity-of-polyester-textiles/

TOMRA Textiles & Circle-8. (2024). *Collaboration to explore solutions for automated textile sorting*. Circle-8. https://www.circle8ecosystems.co.uk/post/tomra-textiles-and-circle-8-to-explore-solutions-for-a-uk-circular-textile-ecosystem

TooUsed. (2024). *Sell old clothes, recycle and earn rewards*. https://tooused.com/

TooUsed. (2025). *Tooused: Recycle your wardrobe—Google Play listing*. Google Play. https://play.google.com/store/apps/details?id=com.tooused.app

TooUsed for Recyclers. (n.d.). *TooUsed textile sourcing for recyclers and resale partners*. https://tooused.com/for-recyclers/

TooUsed LinkedIn. (n.d.). *Company overview*. LinkedIn. https://in.linkedin.com/company/tooused

Trosort. (2024). *Trosort—AI-powered textile sorting & inventory platform*. https://www.trosort.com/

Trosort AI Features. (n.d.). *Automated product identification and analytics*. https://www.trosort.com/ai-for-second-hand-fashion

Trosort LinkedIn. (n.d.). *Company profile and overview*. LinkedIn. https://be.linkedin.com/company/trosort

Turin's circular initiatives. (2025, June 25). *Turin: Making citizens the main actors of the circular economy*. Climaborough. https://climaborough.eu/portfolio/blog-14-turin-making-citizens-the-main-actors-of-the-circular-economy/

With Tooused, you can recycle old clothes and earn credits. (2025, June 18). *YourStory*. https://yourstory.com/2025/06/new-delhi-startup-tooused-recycle-old-clothes-earn-credits-fast-fashion

STORYBOARD · T2.2 CIRCULAR BUSINESS MODEL · JUNE 2026

Single Architecture · Three Consumer Entry Points

Batch-first · App/home manifest · Lightweight container · Human-led facility sort + selective NIR · Fair routing · EPR-funded reward

Batch default | App optional | DPP optional | Guided self-check | App/home manifest + QR | Lightweight container · empties in place | Human sort + selective NIR at facility | Fair allocation rule | Emmy.fi · Humana · Brand take-back · Recycling

App user
34 · Barcelona · UC1 & UC2
UC1: App + DPP
UC2: App + no DPP

Walk-up user
58 · Tampere · UC3
UC3: Walk-up · no app

CONSUMER LAYER
Three entry points. UC1: full DPP pre-scan + destination choice at home. UC2: guided self-characterisation (3–4 questions); condition predicted from DPP data where a passport exists, otherwise self-declared. UC3: bag drop with no digital interaction. Batch is the default; manifest generated in-app at home.

CONTAINER LAYER
Weight · contamination flag (coarse: dirt/moisture/non-textile) · passive DPP reader · network uplink. No NIR. No touchscreen assessment. No routing decision. Manifest arrives via app QR — on-container printer is optional fallback. Container empties in place. Cost-viable at field scale.

FACILITY LAYER
Professional human sort sets definitive condition (also required for EU End-of-Waste status). Selective NIR for recycling streams and contested cases — not per-item reuse grading. TexMat ID assignment · routing decision. Receives manifest from container; closes data loop.

DESTINATIONS
Emmy.fi (premium resale) · Humana (charity retail) · Brand take-back (EPR compliance) · Recycling (fibre recovery). Only streams available in the consumer's country are shown. Routing follows a fair-allocation rule, not quality alone, so charity actors are not left only low-grade stock.

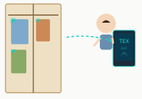
PRE-CONTAINER · DIVERGES BY ENTRY POINT

4 steps for app users (UC1/UC2), 2 steps for walk-up (UC3) · Consumer sets destination preference before arriving at container

UC1 · APP + DPP GARMENT

App user · reward-driven · DPP tag present · full pre-validation + destination choice at home

1a CONSUMER + APP



Sort wardrobe → scan DPP tags
The consumer opens TexMat app batch mode. Holds phone to each DPP-tagged garment. Identity, material and brand load instantly per item. Condition is not in the brand DPP — it is predicted from DPP data (VTT model) and confirmed by the human sorter at the facility.
DPP read · data event

2a CONSUMER APP



Batch summary + system routing suggestion
App displays 3 DPP-confirmed items with system routing suggestion (Emmy.fi × 2, Humana × 1). Consumer can accept directly or tap "Review routing" to adjust per item.
Decision point · review or accept

3a CONSUMER APP · PREFERENCE



Consumer sets destination preference per item
Consumer reviews system suggestion and can override any item: route a high-grade item to Humana as a gift, select a brand take-back program, or confirm recycling for worn items. Preference is locked into the batch token and travels with the manifest.
Destination preference locked

4a CONSUMER APP

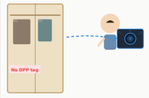


Drop token generated — 7 days valid
App generates QR batch token with destination preferences embedded. The consumer heads to the nearest container at their convenience. No time pressure beyond the 7-day validity window.
Token created · destinations locked

UC2 · APP + NO DPP GARMENT

App user · curious · old/unlabelled items · guided self-characterisation · destination choice at home · condition confirmed by human sort at facility

1b CONSUMER + APP



Sort wardrobe → start guided self-check
The consumer finds an old coat — label worn off. No QR, no NFC. App detects 'no DPP' and opens a short guided questionnaire. A photo can be added as optional supporting evidence, but it does not set the grade.
No DPP → guided self-check

2b CONSUMER APP · GUIDED SELF-CHECK



Guided self-characterisation
App asks 3–4 plain questions (type, wear level with reference images, defects, clean & dry). The consumer self-declares condition, which stays provisional until the facility confirms it. Where a DPP exists, VTT's prediction model estimates wear from DPP data. Definitive condition is set by the human sorter at the facility.
Self-declared · confirmed by human sort

3b CONSUMER APP · PREFERENCE



Consumer sets provisional destination preference
Same destination options as UC1, shown as an estimated reward range (e.g. €0–5, provisional). Emmy.fi routing is provisional: if the human sorter at the facility grades the item lower, it may be rerouted to Humana and the reward adjusted. The consumer is told this up front, so a later correction does not feel like a broken promise.
Provisional preference · est. range shown

4b CONSUMER APP



Provisional token + digital manifest generated
App generates the batch manifest and QR token at home, with self-declared condition and destination preferences embedded. The consumer heads to the container. Condition is confirmed by the human sorter at the facility — Emmy.fi routing finalised there.
App/home manifest · prefs locked

UC3 · WALK-UP · NO APP · NO LABEL

Walk-up user · eco-motivated · no smartphone · maximum accessibility · bag of mixed items · destination assigned at facility

1c CONSUMER



Fill a bag — no preparation needed
The consumer fills a bag with mixed garments. No app, no pre-sorting, no label check. Maximum accessibility. Destination assigned at sorting facility based on item quality.
Zero digital friction

2c CONSUMER



Walk to container — zero preparation
The consumer walks to the nearest TexMat container. No token, no account, no phone. Entire consumer journey before the container: zero steps. Destination will be assigned by the facility based on assessed quality.
No digital action required

No app steps for UC3 → converges at container

Destination assigned at sorting facility

↓ ALL THREE USE CASES CONVERGE AT THE CONTAINER ↓

SHARED · CONTAINER → FACILITY → DESTINATION

From step 5 onward all use cases are identical — the TexMat manifest carries everything known from UC1 / UC2 / UC3

5 CONSUMER + CONTAINER



Container drop-off — all use cases
UC1/UC2: the app user scans the QR token → assigned slot opens for the confirmed batch. UC3: the walk-up user drops the bag into the general slot. All flows identical from this point.
Deposit received

6 CONTAINER · PLATFORM



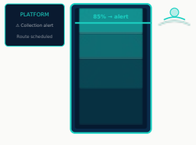
Container processes deposit
Container weighs the batch. A coarse check flags only obvious contamination — visible dirt, moisture, or non-textile items (not fine analysis). Passive NFC reads DPP tags if present. No NIR — condition and fibre are handled at the facility.
Weight · contamination flag · NFC logged

7 CONTAINER · PLATFORM



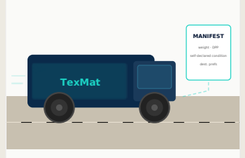
Manifest already in app · printer optional
For UC1/UC2 the digital manifest was generated at home in the app (batch ID, weight, item count, DPP data, self-declared condition, destination preferences) and scanned in at the container. The on-container printer is an optional fallback for UC3 walk-ups (bag sticker). Reward pending until the facility confirms.
App/home manifest · printer optional

8 CONTAINER · IOT · LOGISTICS



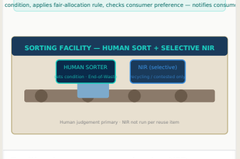
Fill level triggers collection route
IoT fill sensor alerts TexMat platform at threshold (85%). Platform schedules collection truck on demand — no fixed schedule needed.
Collection alert · route optimised

9 LOGISTICS · PLATFORM



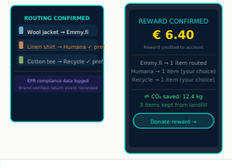
Batch transported with digital manifest
Truck collects container. Digital manifest travels with the physical batch: weight, DPP records, self-declared condition, and destination preferences. Sorting facility pre-notified.
Manifest in transit

10 SORTING FACILITY · HUMAN-LED



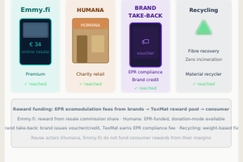
Facility: human sort + selective NIR
A professional sorter sets definitive condition — also the legal route to remove EU End-of-Waste status. NIR is used selectively for recycling streams and contested cases, not run on every reuse item (reuse rarely needs fibre composition). The facility applies the fair-allocation rule and reconciles against consumer preference; the consumer is notified of any reroute.
Human sort · selective NIR · fair allocation

11 PLATFORM · CONSUMER



Routing confirmed + reward finalised
Platform confirms per-item routing under the fair-allocation rule (preference honoured within quotas, so charity actors are not left only low-grade stock). Reward credited per the confirmed grade. Consumer notified: each item's destination and CO_2 impact shown. EPR compliance data logged for brands. Donate-reward option available.
Reward finalised | EPR logged

12 DESTINATIONS



Four destinations — loop closed
Emmy.fi: premium resale. Humana: charity retail (donation mode available). Brand take-back: brand issues voucher (assumption pending validation), TexMat earns EPR compliance fee. Recycling: fibre recovery. Only streams available in the consumer's country are offered; preference is honoured within the fair-allocation rule.
All destinations reached | EPR data to brands

INTEGRATED SERVICE BLUEPRINT · T2.2 CIRCULAR BUSINESS MODEL · JUNE 2026

From Wardrobe to Loop Closure — Three Entry Points, One System

Emotional arc · frontstage · line of interaction · line of visibility · backstage · data & governance · support processes — across the divergent pre-container phase and the shared phase from Step 5

Batch default | Guided self-check | App/home manifest + QR · printer optional | Human sort primary · NIR selective | Fair-allocation routing | Market-configurable destinations | WP5 platform = professional layer | EPR-funded reward

ENTRY POINTS UC1 · App + DPP UC2 · App + no DPP UC3 · Walk-up, no app Shared (all UCs)

	Alex · UC1	**Alex · UC2**	**Marta · UC3**	**Shared backstage**
	Barcelona · reward-driven · DPP-tagged items · full pre-validation at home	Same user · old/unlabelled items · guided self-check	Tampere · 58 · no smartphone · inclusivity path · bag of mixed items	Lightweight container → logistics → human-led facility → four destinations → loop closed

	PRE-CONTAINER PHASE — DIVERGES BY ENTRY POINT Steps 1–4 (app users) · prepared at home, in the app			**SHARED PHASE — IDENTICAL FOR ALL USE CASES FROM STEP 5** Container → collection → sorting facility → routing → reward → destinations → loop closed			
Emotional arc How the consumer feels through the journey	🙂 **Purposeful** — "Let's clear the wardrobe and get something back."	🤔 **Curious but unsure** — "No label… will it still count?" Reassured by simple questions, not a verdict.	😌 **In control** — sees an honest €0–5 estimate, picks where items go.	😊 **Confident** — token ready, no pressure (7-day window).	😎 **Effortless** — scan & drop, or just drop (UC3).	⏳ **Patient** — "Reward comes once it's checked — fair enough."	📲 **Acknowledged** — notified of final grade & any reroute, with the reason.	🌱 **Rewarded & proud** — reward in wallet, CO_2 impact shown, loop visibly closed.
Frontstage — consumer actions What the consumer actually does	**1 · UC1** Scan each DPP tag at home (NFC/QR). Identity, material, brand load per item.	**1 · UC2** Open guided self-check. Answer 3–4 plain questions: type, wear level (with reference photos), defects, clean & dry. Photo optional.	**1 · UC3** Pack a bag of mixed garments. No app, no pre-sorting, no label check. Zero digital preparation.	**2 · all app UC** Review batch summary + system routing suggestion; set destination preference per item. Estimated reward range shown (€0–5).	**3 · all app UC** Choose reward modality (cash / Humana coupon / points). Confirm — no mandatory accept tap unless changing a routing.	**4 · all app UC** App generates the digital manifest + QR batch token at home (7-day validity). Travel to container at convenience.		
LINE OF INTERACTION								
Touchpoints Where consumer meets the service	**1** TexMat app — DPP scanner (UC1) · guided questionnaire (UC2). UC3: none.	**1b** Reference-photo wear selector (UC2) — teaches "good condition".	**UC3** No touchpoint until the container. Inclusivity by design (no-phone users).	**2** App batch summary & per-item destination dropdowns.	**3** Reward modality selector; plain-language destination info tab.	**4** QR drop token screen + nearest-container map.		

↓ ALL THREE ENTRY POINTS CONVERGE AT THE CONTAINER (STEP 5) ↓

SHARED PHASE · FRONTSTAGE & PHYSICAL EVIDENCE

Frontstage — at the container & after Consumer-facing actions, all UCs	**5 · deposit** UC1/UC2: scan QR token → slot opens for the confirmed batch. UC3: drop the bag into the general slot. Identical from here on. Bag tied/closed to contain moisture.	**6 · confirmation** App shows "reward pending" (UC1/UC2). UC3: optional printed ticket with batch ID + minimal weight-based reward (below recycling value) — a first entry point that may convert walk-ups to app users.	**7–9 · waiting** No consumer action. Batch is collected, transported and sorted. Reward is deliberately paid after processing, not instantly.	**10 · notified** Push: final grade, each item's destination, any reroute + reason, reward credited, CO_2 impact.	**10 · loop** Impact receipt via tracking URL. Donate-reward option. Loop visibly closed.	
LINE OF VISIBILITY • BELOW THIS LINE IS INVISIBLE TO THE CONSUMER						
Backstage — physical & operations Container, logistics, facility actions	**5–6 · container (lightweight, no NIR)** Weigh batch · coarse contamination flag (visible dirt / moisture / non-textile only — not fine analysis) · passive NFC reads DPP if present · validate QR token. Container **empties in place**; it does not travel.	**7 · logistics (demand-driven)** Fill-level sensor triggers collection at threshold. Truck collects; physical batch travels with its digital manifest. Hub-and-satellite proximity preferred to limit transport CO_2.	**8 · facility — human-led sort** Professional sorter sets definitive condition grade (A/B/C/D) — also the legal route to remove EU End-of-Waste status. This is the primary decision.	**8 · NIR (selective)** Run only for recycling streams & contested cases — not per reuse item. Reuse rarely needs fibre composition.	**9–10 · dispatch** Apply fair-allocation rule; dispatch to destination operators per confirmed grade + quota.	
Data & governance WP5 platform (professional layer) + DPP chain-of-custody	**1** DPP read API (UC1, <2s). Brand DPP carries identity/material — **not condition**.	**1–2** Provisional TexMat record created. Condition = self-declared (UC2) or VTT DPP-prediction where a passport exists.	**2–4** Batch token issued; destination preference + reward modality bound to token. Chain-of-custody: *token_issued*. Identity rides the app token — no card reader at container.	**5–7** WP5 platform: container telemetry (weight, fill, status), manifest ingest, collection alerts, end-to-end batch tracking. Chain-of-custody: *deposited* → *in_transit*.	**8** Facility write-back API: human grade + (selective) NIR result supersede provisional data. Sorter identity attached for End-of-Waste.	**9–10** Lifecycle → *graded* → *routed* → *reused/recycled*. Reward finalised. EPR/PRO export (fibre, routing split, ecomodulation-eligible volume, brand attribution). Loop closed.
Support processes Partners, contracts, governance enabling each step	**enabling pre-container** App + DPP infrastructure (project-funded at demonstrator). VTT DPP-prediction model. Legacy-DPP retrofit research track for the no-DPP majority (named open question).	**container** Container ownership/operation under SLA (governance ch.). Property-owner site host.	**logistics** Logistics partner contract; smart-routing for cost/CO_2.	**facility** Central sorting facility contracted via **call for tender** (separate from membership). Operator compensated by EPR-funded processing fee. Competition-law review flagged.	**destinations & funding** Bilateral offtake (Emmy.fi, Humana). Affordability tier for social enterprises. Market-configurable destination set. EPR/PRO fee; brand EPR + data licensing.	

KEY DESIGN DECISIONS

Condition input is consumer-led. UC2 condition comes from a guided 3–4 step self-check; where a DPP exists, VTT's prediction model estimates wear from DPP data. The definitive grade is set by the human sorter.

The facility is human-led. Professional sorting is primary and is the legal route for End-of-Waste; NIR is selective for recycling streams and contested cases, not run per reuse item.

The brand DPP carries identity, not condition. The passport carries identity and material from time of market; condition is generated fresh and written back as a TexMat chain-of-custody record.

Manifest is generated at home in the app (digital manifest + QR) and scanned at the container. The on-container printer is an optional fallback for UC3, which keeps container cost down.

Routing follows a fair-allocation rule. Consumer preference is honoured within quotas so charity actors are not left only low-grade stock; the destination set is market-configurable per country.

Facility ownership is separate from membership. The central facility is contracted via tender with an EPR-funded processing fee; system membership is optional with a social-enterprise affordability tier. Competition-law review flagged.