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Master Thesis

**Adopting Circular Economy in Vietnam's Textile Industry:
A Practical Analysis and Framework for Local
Implementation**

submitted by

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Vietnamese-German University

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Acknowledgement

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Abstract

Purpose - This thesis investigates how Vietnam's textile industry can transition to a circular economy, addressing the growing pressure from global sustainability standards and regulatory demands while overcoming critical barriers such as limited financing, technological gaps, and fragmented recycling infrastructure that threaten industry competitiveness.

Methodology/Approach - This thesis addresses these challenges by conducting a KPI-based benchmarking analysis of Vietnam's current performance against the EU Circular Economy Monitoring Framework and global best practices. The study evaluates eight indicators across the Return – Make - Use cycle. Then the study systematically identifies barriers and enabling factors unique to Vietnam, particularly for small and medium enterprises, to develop a locally adaptable framework that considers environmental, social and economic impacts.

Findings - The analysis reveals significant challenges in technological readiness, waste management infrastructure, and financial access across Vietnam's textile sector. A contextualized Return–Make–Use framework was developed, providing concrete guidance on waste management, resource efficiency, and product lifecycle extension tailored to local operational realities.

Value - This thesis delivers a stepwise implementation roadmap targeting data collection, policy alignment, skill development, and investment mobilization, enabling Vietnam's textile industry to achieve international compliance while building long-term competitive advantages. The research provides actionable recommendations for policymakers and industry leaders, supporting Vietnam's ambition to lead in sustainable textile production and circular business models.

Key words: Circular economy, textile industry, Vietnam, sustainability, Return–Make–Use, benchmarking, SMEs, waste management, resource efficiency, circularity roadmap

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I. Introduction

1.1. Background of study

a. The scale of Vietnam's textile industry

Vietnam's textile industry represents one of the country's most critical economic sectors, demonstrating remarkable global significance, ranking as the world's third-largest textile exporter with \$42.1 billion in exports in 2023, positioning itself as the second-largest garment exporter globally after surpassing Bangladesh. (Vietnam Plus, 2024). The Vietnamese textile industry comprises approximately 6,000 companies employing over 3 million workers, with 80% of production capacity dedicated to exports and contributing 12-16% of the nation's total export revenue. (VnEconomy, 2025).

This growth is accompanied by an increasing share of the critical export markets. Vietnam continues to widen its garment market share in the US (18.9%), Japan (17.9%) and South Korea (29.2%), often gaining ground against traditional rivals. (Bui, 2025) This aggressive market penetration, however, creates a dependency paradox. The sector's immense export volume and competitive edge are now entirely contingent upon environmental and social compliance. Should industry fail to rapidly adopt regenerative processes and robust closed loops, this competitive strength transforms into a liability, as maintaining market access becomes impossible under stringent new sustainability criteria. The volume of the traditional "Make" process necessitates a fundamental redefinition of production methods to utilize recycled or regenerated inputs derived from systemic "Return" procedures.

The longevity and future competitiveness of the sector are now wholly contingent upon its ability to localize and operationalize the Return-Make-Use model, moving beyond rhetorical commitments to tangible, scalable implementation. This transition is complicated by the collision between aggressive international regulatory mandates and significant local capacity deficits, particularly among the essential network of Small and Medium-sized Enterprises (SMEs).

b. Environmental impact of industry

The traditional production model underpinning this economic success carries a vast and unsustainable environmental toll, driving the imperative for the "Return" phase in Return-Make-Use cycle (waste management and recycling). The textile industry is ranked among the most polluting sectors worldwide, with its annual carbon footprint estimated at 3.3 billion tons of CO₂ emissions, a figure nearly comparable to the total emissions of the entire European Union. (Vinatex, 2024)

Waste generation poses an equally severe crisis. Globally, the textile sector accounts for 5% of all waste. (Vinatex, 2024) Critically, despite the inherent recyclability of textile fibers, an alarming 75% of textile waste is still directed to landfills. (Ghiffari, Sondakh, & Nurwantara, 2025) For a major manufacturing economy like Vietnam, this linear waste trajectory threatens water resources, energy security and ecosystem health Recognizing this existential threat, the Government of Vietnam has integrated CE promotion into its National Action Plan on Sustainable Production and Consumption, setting a specific target to achieve a 7-10% percent decrease in resource and material use by major sectors, including textiles, by 2030. (Menzel-Hausherr, König, Volz, & Julia Körner, 2022) This national commitment institutionalizes the necessity for systematic material and circular material. (Hora, 2023)

c. Evolving policy and market landscape

Vietnamese textile suppliers are being subjected to mandatory changes driven by two primary external forces: interlocking European Union regulations and stringent global brand mandates.

Firstly, EU Regulatory Coercion The EU, as Vietnam's second-largest export market, is utilizing legislative measures to push sustainability objectives deep into global supply chains. These directives directly impact the massive volume of apparel consumed in the EU but produced in emerging markets like Vietnam.

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- EU Strategy for Sustainable and Circular Textiles (EUSSCT): This foundational strategy mandates that textiles sold in the EU must be durable, repairable, recyclable and free of hazardous substances. This initiative directly challenges the linear, fast-fashion model, ensuring that the Make phase must prioritize design for longevity and recyclability, thereby preparing products for subsequent Return. (Directorate-General for Environment - European Commission, 2022)
- Corporate Sustainability Due Diligence Directive (CSDDD): Adopted in May 2024, this directive requires EU companies to identify and mitigate environmental and social risks throughout their entire global value chain. This critically extends due diligence obligations to Vietnamese business partners, holding them indirectly and often directly, accountable for the integrity of their Make processes and associated labor/environmental standards. (THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,, 2024)
- Corporate Sustainability Reporting Directive (CSRD): Mandatory comprehensive disclosure on sustainability performance, including Scope 3 emissions, forces Vietnamese suppliers to enhance transparency and tracking across their value

chains. (THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION, 2022)

- Extended Producer Responsibility (EPR): Anticipated EU amendments to the Waste Framework Directive focusing on textiles will increase monitoring of exported recyclables and could reduce demand for virgin-material products from Vietnam, demanding domestic capacity for managing product Return. Vietnam is also actively developing its own legal framework to promote recycling and prevent the country from becoming a textile waste dumping ground. (Barnes, 2023)

Besides global regulations, Major international brands sourcing from Vietnam impose specific circularity thresholds that necessitate immediate structural investment in sustainable production and recycling capacity. Brands such as H&M and Nike require suppliers to meet high recycled content thresholds and sustainable raw material targets (e.g., H&M's goal for 100% recycled raw materials). (Hằng, 2020) Furthermore, major fashion consortia, including Nike, H&M and New Balance, explicitly advocate for Vietnam to implement Direct Power Purchase Agreements (DPPA) to allow suppliers to achieve 100% renewable energy targets. (Hằng, 2020) This showcases the integration of decarbonization and circularity as non-negotiable prerequisites for maintaining long-term sourcing relationships.

1.2. Problem statement

External-wise, Vietnamese textile companies face a wave of international sustainability regulations that are fundamentally reshaping market access requirements. Those requirements mainly come from large and sustainability-oriented markets, such as EU regulations mentioned in point 1.1. Most of the above initiatives expand on a similar 5–10 year timeline, meaning that by the early-to-mid 2030s, textile products sold in or exported to the EU must comply with a comprehensive set of sustainability and circularity criteria. This will require the industry to undergo fundamental changes in all aspects: product design, material sourcing, production processes, supply chain governance and waste management systems. Companies that start as soon as possible these initiatives will be better positioned to maintain market access, avoid regulatory penalties and gain competitive advantage in these demanding markets. Considering the status quo, this timeline poses a challenge for the emerging textile industry in Vietnam.

Thus, despite the high allocation of exports to EU, it is estimated that only 5% of Vietnam's garment factories fully meet EU sustainability requirements, including clean energy usage and environmental compliance. (Le, 2021) This represents a significant market access risk as regulations become more mandatory to the exporters.

Moreover, internal pressures are also substantial to the transition into CE models for the companies. Raw material sources of textile depend 80-90% on imported goods, including textiles and fabrics, creating vulnerabilities in meeting rules of origin requirements and extending supply chain carbon footprints. Domestic weaving and dyeing capacity remains severely limited, representing a fundamental structural weakness. (Linh, 2025) (NGUYEN, 2016)

One more internal factor which is still loosely controllable is technology gap. Only 18% of Vietnamese textile manufacturers have adopted comprehensive digital transformation strategies, compared to 38% in Thailand and 45% in China. (Linh, 2025) This technological readiness gap limits adoption of advanced manufacturing systems, automation and circular production technologies essential for sustainability compliance. Going along with technology is cost. Green technology adoption involves significant cost increases of 8-12% for comprehensive sustainability standards, particularly challenging for the 70% of companies that are small and medium enterprises. (Linh, 2025) Limited access to affordable financing for sustainability investments creates additional barriers, especially for smaller manufacturers with fewer resources. Waste infrastructure, besides mentioned soft technology, is also a pain point. Vietnam generates approximately 250,000 tons of pre-consumer textile waste annually, with only 60% currently recycled through mostly downcycling processes. The remaining 40% goes to waste-to-energy facilities or disposal, indicating significant room for improvement in circular waste management. The recycling ecosystem remains highly fragmented with over 200 waste facilities lacking transparency and traceability systems. (Phan, et al., 2025)

Finally, regarding skill gap, the industry faces knowledge gap in green production, administrative technology and industrial fashion design capabilities. Many companies lack strong expertise in sustainable material sourcing, environmental management systems and compliance with international certification requirements. (Anh, et al., 2024) (Hà, 2024).

In summary, there are some critical gaps in the effectiveness of CE transitions in Vietnam textile industry.

While these gaps have long been addressed and closely investigated by international entrepreneurs, Vietnam business leaders and government, the international solutions still cannot be transferred directly into Vietnam's context. The reason is the difference in industry structure, economic context and regulatory mismatches.

Regarding the industry itself, Vietnam's textile sector is characterized by a heavy concentration in cut-make-trim operations (70% of enterprises) with limited vertical integration, unlike more developed textile economies with integrated value chains that can

more easily implement circular models. (NGUYEN, 2016). While most raw materials are from overseas, it is difficult for circular model to work efficiently.

Also, as Vietnam transitions to middle-income status, rising labor costs (average \$300/month) create pressure to move up the value chain while simultaneously investing in sustainability infrastructure, creating competing resource demands that differ from established economies. (Textile Insights, 2024).

Problem statement:

In summary, Vietnam's textile industry faces a critical imperative to transition to the regenerative Return-Make-Use circular model, driven by aggressive domestic targets and mandatory global compliance frameworks, including the EUSSCT, CSDDD and the specific demands of major buyers. This ambitious policy landscape, however, is fundamentally undermined by a systemic implementation ability gap across the local manufacturing base. This gap is defined by a lack of accessible dedicated financing for SMEs, acute knowledge and technical deficits and insufficient infrastructure for scaled waste Return and regeneration. Without a localized, actionable, multi-aspect strategy that systematically mobilizes financial instruments, addresses capacity building and ensures regulatory coherence, most Vietnamese manufacturers risk losing access to crucial export markets, thereby undermining national sustainability goals and creating significant economic instability.

1.3. Significance of the study

a. Research significance

This research provides evidence on the challenges and opportunities inherent in applying the Return-Make-Use circular model within a developing-world manufacturing hub as Vietnam. By focusing on practical, localized mechanisms to achieve resource efficiency and closed-loop material flow, the study directly contributes to refining theoretical CE frameworks for emerging industrial contexts.

b. Policy and industry significance

The findings offer actionable recommendations for Vietnamese policymakers grappling with the complexity of reconciling ambitious national CE objectives and mandatory international compliance (CSDDD/CSRD) with local economic capacity. The framework specifically identifies levers for improving regulatory coherence and financial mobilization, such as leveraging the National Technology Innovation Fund (NATIF) to support circular concepts and integrating performance-based models, like chemical leasing, into existing or planned

Extended Producer Responsibility (EPR) frameworks. By offering this structure, the study helps mitigate the imminent risk of market exclusion facing unprepared domestic firms.

The research provides a necessary, structured roadmap for the textile sector. By articulating the necessary financial and technical pathways, the proposed framework allows Vietnamese textile enterprises to shift their perception of CE compliance from a punitive regulatory cost to a key competitive necessity. Successfully adopting these practices is essential for maintaining unrestricted access to major export markets like the EU and the US. Most importantly, the study provides resource-constrained SMEs with practical access solutions needed to address high-level buyer demands regarding recycled content targets and renewable energy sourcing, ensuring that the benefits of the circular transition are widely distributed across the domestic supply chain.

1.4. Research question

The objective of this study is first, to perform a qualitative benchmark analysis of CE current performance of Vietnam textile industry and second, to generate an evidence-based, practical framework to provide localized mechanisms for implementing the Return-Make-Use circular model in Vietnam's textile sector.

The primary question guiding this study is: What practical framework can help Vietnam's textile industry adopt circular economy (CE) practices that align with global sustainability demands and local economic realities?

This framework bears a mission of bringing textile industry towards reducing raw materials extraction, minimizing environmental impact. Alongside the cycle, these research questions will support the analysis and findings:

- a) How is CE defined in Vietnam? What are CE activities? Are current Vietnam textile company performing well compared to global requirements, why or why not?
- b) What are the specific barriers and enablers to CE implementation in Vietnam's textile industry compared to developed economy? To determine and prioritize the most critical internal barriers and external impediments that obstruct the scaling of CE adoption. Concurrently, the objective is to identify and assess potential policy, financial and technical levers (enablers) available to the Vietnamese government or utilizing performance-based models like chemical leasing, to accelerate the transition
- c) Is there a local strategy framework that is practical and applicable for Vietnam and other similar industries?

To synthesize the performance assessment and barrier analysis into a practical, multi-aspect strategy designed explicitly to enable local manufacturers, especially

SMEs, to systematically implement the Return-Make-Use circular model and achieve critical international compliance levels.



II. Literature Review

2.1. Current status quo of textile manufacturing & sustainability in Vietnam

Vietnam's textile industry represents a cornerstone of the country's economic development, achieving remarkable growth in recent years. As of 2024, textile and garment exports reached nearly \$44 billion, marking an 11.26% increase from 2023 and accounting for 12-16% of the nation's total export revenue (ASEM Connect Vietnam, 2025; Vietnam News Agency, 2025a). This performance positions Vietnam as the world's third-largest textile exporter and second-largest garment exporter globally, trailing only China (Vietnam News Agency, 2025a). The sector employs over 3 million workers across approximately 7,000 companies, dedicating 80% of production capacity to exports and 20% to domestic consumption (Vietnam News Agency, 2025a).

The industry's momentum continues in 2025, with Vietnam targeting \$48 billion in export revenue. First-quarter performance showed promising results with export turnover of \$8.69 billion, up 11.1% compared to the same period in 2024 (Vietnam Sourcing Expo, 2025). By May 2025, textile and apparel exports reached \$3.29 billion, reflecting a 7.1% month-on-month increase and a strong 19.0% year-on-year growth (CCF Group, 2015). The United States remains Vietnam's largest market, accounting for 48.2% of total exports, followed by Japan (9.9%) and the Netherlands (4.6%) (CCF Group, 2015).

Vietnamese textile manufacturers have begun implementing various sustainability practices, though these remain limited in scope and scale. Leading companies are adopting eco-friendly manufacturing practices including water-saving dyeing techniques, renewable energy adoption through solar and wind power and wastewater recycling systems (Valo Vietnam, 2025). Companies like Faslink have pioneered sustainable fiber production from recycled materials including coffee grounds, lotus fibers and oyster shells, representing innovative approaches to circular material sourcing (VietNamPlus, 2024a).

The industry benefits from government policy support through the Strategy for Development of Vietnam's Textile, Clothing, Leather and Footwear Industry to 2030, which emphasizes greening production processes and encourages enterprises to obtain environmental protection certifications (Nguyen, 2025). International collaboration through initiatives like the German government's Green Tech Landing Pad has supported pilot projects including energy management solutions and sustainable fabric innovations such as pineapple-based fibers (Nguyen, 2025).

Major international investment demonstrates confidence in Vietnam's CE potential. Syre's planned \$1 billion textile recycling facility in Binh Dinh province is designed to process up to 250,000 metric tons of textile waste annually, representing a significant step toward

establishing Vietnam as a global hub for circular textiles (Vietnam News Agency, 2025a). Similarly, Recover has opened a manufacturing facility in Dong Nai province with initial production capacity of 10,000 tonnes annually, focusing on recycled cotton fiber production (Vietnam News Agency, 2025).

Despite progress, Vietnam's textile industry faces significant environmental and operational challenges. The sector contributes approximately 5 million tons of CO₂ emissions annually, representing a substantial environmental burden (WTO Center, 2024a). Water pollution remains a critical concern, with the textile industry identified as carrying some of the highest water risks due to wet processing of fabrics (Fair Water Footprints, 2022; WWF, 2018). Research in Hue revealed that dyeing factory pollution has affected local communities since 2008, causing health symptoms including headaches, dizziness and respiratory issues (Fair Water Footprints, 2022).

The industry faces severe raw material dependency, with Vietnam lacking sufficient domestic textile materials and relying heavily on imports (VnEconomy, 2024a; VnEconomy English, 2024). This creates vulnerability to supply chain disruptions and price volatility. Additionally, Vietnamese enterprises currently lack three key resources: administrative technology, industrial fashion design capabilities and marketing workforce capable of sourcing suitable suppliers (VnEconomy, 2024a; VnEconomy English, 2024).

Current market pressures include customers preferring small, rapid orders with quick turnaround times, creating operational challenges for manufacturers accustomed to larger production runs (VietNamPlus, 2024b). The industry also faces significant labor shortages, needing approximately 500,000 workers across manual labor, managerial and design roles (VietNamPlus, 2024b). Compliance with increasingly strict international environmental and labor standards poses additional operational pressures, requiring ongoing investment in sustainable infrastructure (THT Textile, 2025).

Vietnam's strategic advantages create substantial opportunities for sustainable transformation. The country's extensive network of free trade agreements, including CPTPP, EVFTA and RCEP, provides preferential market access and reduced tariffs, enhancing competitiveness across key markets (TLD Apparel, 2025). Vietnam's position as a preferred alternative for international buyers seeking to diversify supply chains away from traditional manufacturers creates significant growth opportunities (TLD Apparel, 2025).

The textile industry benefits from substantial pre-consumer waste generation of approximately 250,000 tonnes annually, representing opportunities for CE development through advanced recycling infrastructure (Enerteam, n.d.). The country has established

over 230 waste collectors and pre-processors, along with 40 established recyclers, providing foundational infrastructure for expansion (Enerteam, n.d.).

Government commitment to achieving net-zero emissions by 2050 creates policy support for green transformation initiatives (International Journal of Economics and Finance Management, n.d.). The National Action Plan for CE until 2035 specifically targets the textile sector as a priority area for implementation (Nguyen, 2025). Financial support mechanisms include preferential tax policies and green credit initiatives providing financing at favorable interest rates for environmental projects (Nguyen, 2025).

Growing global consumer demand for sustainably produced textiles offers vast market potential, with 84% of Vietnamese consumers indicating consideration of environmental impacts in purchasing decisions (Nguyen, 2025). The rise of sustainable fashion brands and second-hand markets demonstrates changing consumer preferences that support CE business models.

2.2. Research gaps

Empirical and Methodological Limitations

Current research on CE implementation in Vietnam's textile industry reveals significant methodological and empirical gaps. Most existing studies focus on descriptive analyses of current practices rather than systematic evaluation of outcomes, impacts and sustainability over time. The absence of comprehensive impact assessment studies represents a fundamental barrier to understanding which CE models demonstrate sustained effectiveness and which face implementation challenges requiring modification.

Research indicates that macro-level results of CE implementation "are still limited and not fully statistically reported" when comparing Vietnam with international practices. This data scarcity significantly constrains researchers' ability to conduct robust quantitative analyses and develop evidence-based recommendations for policy and practice. The lack of systematic data on pre-consumer and post-consumer textile waste generation, processing capacities and material flows represents a fundamental barrier to understanding the potential scale and impact of circular economic initiatives.

Theoretical Framework Gaps

Significant limitations exist in the theoretical foundations underlying CE studies in Vietnam's textile sector. Current studies lack comprehensive theoretical frameworks that integrate global CE principles with Vietnam's specific institutional capabilities, developmental priorities and cultural context. The fragmented nature of existing theoretical approaches has resulted

in incomplete understanding of how CE models can be effectively adapted and scaled within Vietnam's textile industry ecosystem.

The absence of sector-specific measurement indicators represents another crucial theoretical gap. While various CE measurement tools exist globally, research reveals that Vietnam currently lacks "a set of criteria to identify, evaluate, summarize and give an accurate classification of CE development." This gap constrains the development of effective monitoring and evaluation systems for CE implementation.

Stakeholder Analysis and Implementation of Strategy Gaps

Research reveals significant gaps in understanding the complex multi-stakeholder dynamics that influence CE implementation in Vietnam's textile industry. While studies have identified that Vietnamese textile enterprises face challenges including "limited sharing and exchange of information between businesses, lack of constant supplier relationships and absence of shared vision for collaboration," comprehensive analysis of stakeholder interactions and collaboration mechanisms remains underdeveloped.

The absence of detailed research on how different types of enterprises (small, medium and large) can effectively implement CE practices represent another significant gap.

Understanding implementation requirements, support needs and success factors across different enterprise categories is essential for developing targeted support strategies and policy interventions.

2.3. Key concepts in circular economy

Linear vs. Circular Economy Models

The traditional linear economy operates on a "take-make-dispose" model, where resources are extracted from the environment, transformed into products, used by consumers and eventually discarded as waste (Digital Link, 2024; Reconomy, 2025a). This model assumes infinite resources and unlimited disposal capacity, leading to resource depletion, waste accumulation and environmental degradation (Reconomy, 2025a). In the textile industry, the linear model manifests as fast fashion, where clothes are produced quickly and cheaply to meet trends, worn briefly and often discarded after minimal use (Smart Fashion News, 2025).

In contrast, CE represents a fundamental shift toward a regenerative system based on three core principles: eliminating waste and pollution, circulate products and materials at their highest value and regenerate natural systems (Ellen MacArthur Foundation, 2024). Unlike the linear model's straight-line flow, the CE creates closed-loop systems where materials are continuously reused, refurbished, remanufactured, or recycled (Digital Link, 2024; Greener

Insights, 2025). The CE aims to decouple economic growth from finite resource consumption by designing waste out of the system from the outset (Sustainable Living, 2025).

CE Principles and Strategies

The CE is built on three fundamental principles driven by design (Ellen MacArthur Foundation, 2024). The first principle, "eliminate waste and pollution," requires products and systems to be designed from the outset to minimize waste and avoid pollution, involving rethinking product design, material selection and production processes (Digital Link, 2024; Greener Insights, 2025). The second principle, "circulate products and materials," emphasizes maintaining the value of products, materials and resources in the economy for as long as possible through strategies such as reuse, repair, remanufacturing and recycling (Greener Insights, 2025; Sustainable Living, 2025).

The third principle, "regenerate natural systems," goes beyond reducing negative impacts to actively improve the environment by adopting practices that restore soil health, increase biodiversity and ensure industrial systems support rather than deplete natural systems (Digital Link, 2024; Greener Insights, 2025). This regenerative approach distinguishes the CE from traditional sustainability models focused primarily on harm reduction.

Implementation of CE principles involves ten R-strategies that guide how circular design and manufacturing can keep resources in use: R0 Refuse, R1 Rethink, R2 Reduce, R3 Reuse, R4 Repair, R5 Refurbish, R6 Remanufacture, R7 Repurpose, R8 Recycle and R9 Recover (Circularise, 2025). These strategies are hierarchically organized, with strategies higher on the list (lower R-numbers) generally preferred as they maintain higher material value and require less energy input (Circularise, 2025).

Extended Producer Responsibility (EPR)

Extended Producer Responsibility represents a mandatory, fee-based environmental policy approach where producers' responsibility for products extends to the post-consumer stage of the product lifecycle (CE Europa, 2024; Fashion Sustainability Directory, 2025). Under EPR legislation, businesses that place products on the market become responsible for managing their products when discarded by consumers, with responsibility potentially being financial, organizational, or both (CE Europa, 2024).

In the textile context, EPR makes brands, retailers and online marketplaces that place clothing, footwear and household textiles on the market responsible for end-of-life management (CE Europa, 2024; Fashion Sustainability Directory, 2025). This includes collection, sorting, reuse, recycling and disposal of textile waste, representing a fundamental

shift from traditional models where waste management burden falls primarily on consumers and municipalities (Fashion Sustainability Directory, 2025).

EPR schemes typically operate through Producer Responsibility Organizations (PROs) that collectively manage EPR obligations on behalf of multiple producers (Fashion Sustainability Directory, 2025). These organizations handle fee collection, setup and management of collection and sorting infrastructure and reporting to regulatory bodies. A key feature of textile EPR is eco-modulation, which adjusts fees producers pay based on environmental performance of their products (Fashion Sustainability Directory, 2025; Carbonfact, 2025). Textiles designed for durability, ease of recycling, or containing recycled content may incur lower fees, while those difficult to recycle face higher costs, creating financial incentives for sustainable design (Fashion Sustainability Directory, 2025).

Circular Business Models in Textiles

Circular business models in textiles encompass various approaches to implementing CE principles. The Product Lifetime Extension Model focuses on rebuilding, renewing, redesigning and repairing textile products to extend their useful life (World Economic Forum, 2022). Companies like Patagonia's Worn Wear program exemplify this approach by repairing used clothing or reselling it to keep garments in circulation (RTS, 2025).

The Resource Recovery Model emphasizes recycling textile residues to generate raw materials, with companies demonstrating successful implementation by recycling materials through closed-loop processes (World Economic Forum, 2022). The Sharing Economy Model maximizes idle asset utilization across communities while providing affordable access to products and services (World Economic Forum, 2022). Product-as-a-Service models shift focus from volume to performance, with customers purchasing services for limited time while providers maintain product ownership and responsibility for maintenance, durability and end-of-life treatment (World Economic Forum, 2022).

The Circular Inputs Model uses renewable, recycled, or highly recyclable inputs in production processes, enabling partial or total elimination of waste and pollution (World Economic Forum, 2022). Examples include Adidas' Futurecraft Loop shoes made entirely from one recyclable material and designed to be returned, ground down and remade into new shoes (RTS, 2025).

III. Methodology

3.1. Methodology design

3.1.1. Research methods

The research adopts the European Commission's revised Circular Economy Monitoring Framework (CEMF), published in May 2023, as the foundational reference for indicator selection and performance benchmarking. This framework represents the most comprehensive and policy-relevant set of circular economy metrics currently available at the international level.

The European Commission first adopted the EU Circular Economy Monitoring Framework (CEMF) in January 2018 as a systematic tool to track progress toward circular economy transition across EU member states. In response to the 2020 Circular Economy Action Plan for a cleaner and more competitive Europe and reflecting the priorities of the European Green Deal, the European Commission revised the monitoring framework. The revised framework was officially published on May 15, 2023, representing a significant evolution in how Europe measures and monitors circular economy progress.

The 2023 CEMF consists of 11 statistical indicators organized across 5 thematic areas. The addition of a fifth dimension on global sustainability and resilience reflects growing recognition of the circular economy's contribution to climate neutrality and resource security. The areas are:

- Production and Consumption (3 indicators)
- Waste Management (2 indicators)
- Secondary Raw Materials (2 indicators)
- Competitiveness and Innovation (2 indicators)
- Global Sustainability and Resilience (2 indicators)

Table 1: EU Monitoring Framework indicators 2023

Thematic areas	Indicator	Sub-Indicators
1. Production and Consumption	Material consumption	Material footprint; Resource productivity
	Green public procurement	
	Waste generation	Municipal waste; Food waste; Plastic packaging waste; E-waste
2. Waste Management	Overall recycling rates	
	Recycling rates for specific waste streams	Packaging waste; Plastic packaging; Electrical and electronic waste

3. Secondary Raw Materials	Contribution of recycled materials to raw materials demand	Circular material use rate; End-of-life recycling input rates
	Trade in recyclable raw materials	Between EU countries and the rest of the world
4. Competitiveness and Innovation	Private investments, jobs and gross value added in circular economy sectors	
	Innovation	Patents related to recycling and secondary raw materials
5. Global Sustainability & Resilience	Global sustainability from circular economy	Consumption footprint vs planetary boundaries; GHG emissions from production activities
	Resilience from circular economy	Material dependency; Self-sufficiency for selected raw materials

The CEMF was selected as the reference for this study because it offers strong policy relevance and practical applicability. It not only guides EU policy development but also influences global sustainability standards, which are increasingly important for Vietnam's textile exports to European markets. It provides a comprehensive approach, covering material flows, waste management, economic competitiveness and environmental impacts, rather than focusing on isolated indicators. Its indicators are based on standardized methodologies and internationally recognized accounting principles, such as the SEEA, ensuring scientific rigor and comparability. Moreover, the framework has been developed through extensive stakeholder consultation, which enhances its legitimacy and usability. Finally, its alignment with Vietnam's development priorities particularly sustainability, value chain upgrading and circular economy principles, which makes it highly relevant for assessing progress and guiding implementation in the textile sector.

3.1.2. KPI selection for benchmarking

From the comprehensive CEMF, this research strategically selects 8 key performance indicators (KPIs) for detailed analysis, while explicitly excluding 6 indicators with documented rationale. The selection process is guided by four primary criteria:

1. **Applicability:** Indicators must be directly relevant to textile manufacturing and supply chain operations, rather than economy-wide or cross-sectoral metrics.
2. **Data feasibility:** Selected indicators must be measurable with data available or obtainable from Vietnamese government sources, industry reports and company disclosures within the research timeframe.

3. Actionability: Indicators should inform specific interventions and policy recommendations that Vietnamese textile firms and policymakers can implement.
4. Strategic alignment: Selected indicators must align with Vietnam's Textile Industry Development Strategy to 2030 and the National Green Growth Strategy.

Based on the criteria mentioned, the selected KPIs are presented in the table below, with its detailed description and how it is directly relevant to the research.

Table 2: Selected KPIs for benchmarking analysis

Stage	KPI	Description	Relevance to textile industry
Return	Material consumption	the total quantity of materials (virgin and recycled) used as input in the textile production process over a specified period. This encompasses all raw materials entering the system, with the goal in a circular economy to minimize the use of virgin inputs and maximize resource efficiency.	Lower material consumption per unit output indicates improved resource productivity (decoupling growth from resource use), supporting circularity by reducing demand for virgin resources.
Return	Collection efficiency	the effectiveness with which textile waste is collected for subsequent recycling, reuse, or proper disposal, out of the total generated waste.	High collection efficiency ensures that the maximum possible volume of textiles is diverted from landfill and can re-enter circular material flows
Make	Generation of waste per production volume	the volume (or mass) of waste generated by production relative to the output produced (e.g., kg of waste per ton of textile products manufactured). It provides a clear measure of process inefficiency and material losses.	Reducing this ratio is a central objective in circular production models, indicating improvements in process design, material efficiency and waste prevention.
Make	Recycling rate for textile waste	the proportion of textile waste (e.g., post-consumer, post-industrial) that is successfully recycled into new products or materials, compared to the total amount of textile waste generated in a defined period.	A higher recycling rate reflects stronger circularity by closing material loops and reducing environmental burdens from landfilling or incineration.
Make	Recycled raw material input	the percentage of raw materials entering the production process that are derived from recycled or secondary sources, rather than from virgin resources	A higher share indicates effective integration of circular supply chains and reduces dependency on virgin extraction, a key aim of the circular economy.
Use	Product life cycle expansion	The activities to prolong the usable lifespan of products before they become waste. This can include design for durability, repair, remanufacture, refurbishment and second-life applications. KPIs include the average lifespan of textile products (in years or use cycles), share of products reused or	Prolonging product lifespans slows resource loops, reduces demand for new products and lessens waste generation, embodying a core circular economy mechanism.

		refurbished and reduction in premature disposal rates.	
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These KPIs were selected for their relevance to CE practices, as they are measurable, manufacturing-specific and require only basic data & statistics for tracking and implementation. Moreover, since most Vietnamese textile plants operate under the Cut-Make-Trim model, their limited autonomy in supplier decision-making further supports the focus on indicators that are directly controllable at the factory level.

3.1.3. Benchmarking methodology

The study employs comparative analysis and benchmarking with the following objectives:

- Regional and global benchmarking:
 - Compare Vietnam's performance against key regional countries with significant textile industries.
 - Benchmark Vietnam against global leaders known for advanced technology and established circular economy practices.
 - Assess Vietnam's performance for each KPI against existing policy requirements to identify compliance gaps.
- SWOT analysis:
 - Identify and analyze key enablers and barriers influencing circular economy adoption in Vietnam's textile sector.

After that, for the proposal of the implementation framework, the research uses a phase-based analytical approach that translates benchmarking results and SWOT insights into a structured Circularity Implementation Framework aligned with the Return – Make – Use cycle.

For each phase of the circular economy cycle, the research systematically identifies and evaluates enablers and barriers using a standardized structure:

Table 3: Barriers and enablers structure

Type	Description	Description & Impact on KPI	Improvable?
Internal / External	Operational / Market / Strategic / Policy	Explanation of how the factor influences waste reduction, material recovery, energy intensity, compliance readiness,	Yes/No + justification

production efficiency and product
circularity

This approach enables the research to:

- Understand the root causes affecting circularity adoption across each phase.
- Distinguish between internal capability gaps (e.g., technology, skills, processes) and external systemic constraints (e.g., regulatory clarity, recycling ecosystem, market demand).
- Identify which barriers are actionable within the short term versus those requiring coordinated policy or infrastructure development.
- Highlight enablers that can accelerate circular adoption and directly improve targeted KPIs.

3.2. Data collection method

3.2.1. Data sources

The research utilizes four primary data sources to ensure comprehensive coverage and triangulation:

- a. Government-level regulation and policy documents: Official policy documents from the Vietnamese government and global regulations. These documents in general provide an institutional and regulatory framework governing circular economy implementation.
- b. Organization's annual reports and/or sustainability reports: Publicly available annual reports, sustainability disclosures and ESG reports from major Vietnamese textile manufacturers and industry associations. These sources offer insights into current practices, self-reported circular economy initiatives and performance metrics at the organizational level.
- c. Expert insight reports: Technical reports from multilateral organizations such as the International Finance Corporation (IFC), World Bank, Global Fashion Agenda and industry research by GIZ and WWF focusing on Vietnam's textile sector. These reports provide expert analysis on barriers, opportunities and international best practices applicable to the Vietnamese context.
- d. Academic papers: scholarly articles published in reputable journals focusing on circular economy implementation in textile industries, with specific emphasis on emerging markets and Southeast Asian contexts. The academic literature provides theoretical frameworks, empirical evidence and methodological rigor to support the analysis.

3.2.2. Selection criteria

- a. Timeline: Sources were limited to publications from 2015-2025, ensuring validation with evolving circular economy concepts, recent policy developments and contemporary industry practices. Priority was given to sources from 2020-2025 to capture post-COVID supply chain adaptations and accelerated sustainability requirements.
- b. Search strategy: Document identification employed structured keyword searches using terms including "Vietnam textile circular economy," "EPR policy Vietnam," "textile waste management developing countries," "sustainable textile production Southeast Asia," "circular business models textiles" and "textile-to-textile recycling.
- c. Authority and credibility: Sources were required to originate from recognized authorities including government agencies, established academic institutions, reputable industry associations, internationally recognized NGOs, or companies with verified sustainability certifications. All sources underwent verification for accuracy and credibility.
- d. Relevance classification: Documents were systematically classified into primary categories: "government policy-based" sources providing regulatory and strategic context, "industry practice-based" sources documenting implementation experiences and "technical guidance-based" sources offering specific implementation methodologies. This classification ensured balanced representation across policy, practice and technical domains.
- e. Geographic relevance: While prioritizing Vietnam-specific sources, the selection included comparative examples from countries with similar economic development levels, supply chain structures, or successful circular economy implementations in textile sectors.

In the benchmarking analysis, "regional countries" refer to countries in Southeast Asia, Asia and "global best practices" cites from countries globally with top-notch circular economy practices. Those countries include Europe, America and countries where key market leaders locate.

3.3. **Limitations of the study**

3.3.1. Data availability

The study relies on data "available or obtainable from Vietnamese government sources, industry reports and company disclosures." This creates two problems: (1) Vietnamese textile companies, particularly SMEs, often lack standardized reporting systems, resulting in incomplete or inconsistent data and (2) self-reported metrics from company sustainability reports are vulnerable to reporting bias and greenwashing without independent verification mechanisms.

3.3.2. Framework Adaptation Gap

While the EU CEMF provides methodological rigor, it was designed for the European context with different institutional structures, waste infrastructure and regulatory capacity. The study does not detail how the European framework was adapted to accommodate Vietnam's developing economy context, informal waste sectors and different manufacturing structures, potentially limiting the applicability and relevance of findings to the Vietnamese textile industry's specific operational environment.



IV. Results and Insights

This chapter presents the findings of the qualitative document analysis and constructs a practical framework to guide Vietnam's textile industry transition to a circular economy. The analysis reveals that while Vietnam has established strong policy foundations for circular economy implementation, significant gaps exist between national ambitions and industry-level execution. The framework presented here addresses these implementation gaps through a systematic three-phase approach: 'Return' (waste management and material recovery), 'Make' (resource-efficient production) and 'Use' (sustainable consumption and product lifespan optimization). Each phase is grounded in empirical evidence from the document analysis and designed to provide actionable guidance for industry stakeholders, policymakers and international partners supporting Vietnam's circular economy transition.

4.1. Terms and definitions

During the analysis, some key terms are mentioned and discussed. This part will partly elaborate these terms in a professional way.

Textile industry is a general term used for Textiles, clothing, leather and footwear industries. It includes the transformation of natural and man-made fibers into yarns and fabrics as well as, through the CMT process (Cut, Make and Trim), the production of finished and functional textile articles. Textile products, defined as those products containing at least 80% by weight of textile fibers, include leisure apparel and clothing accessories, household/interior textiles as well as technical textiles. The following products are covered:

- Clothing, handbags, footwear and other clothing accessories,
- Knitted and crocheted fabrics and articles thereof (e.g. socks and pullovers);
- Dressing and dyeing of fur;
- All tailoring (ready-to-wear or made-to-measure), in all textile materials (e.g. leather, fabric, knitted and crocheted fabrics), of all items of clothing and accessories from materials not made in the same unit;
- Household/interior textiles, including household linen, blankets, rugs and cordage.
- Luggage, saddlery, harness, footwear, tanned leather and straps

Circular economy is an economic model encompassing “return-make-use” cycle that aims to keep products and materials in circulation through processes like reuse, repair, refurbishment and recycling, minimizing waste and reducing the consumption of virgin raw materials.

Linear economy is, in opposite of circular, is a traditional production and consumption model characterized by a “take-make-dispose” progression in which raw materials are extracted,

manufactured into products, used and then discarded as waste without reuse or recycling. (European Investment Bank, 2023)

Virgin textiles are textile materials made from raw fibers that have never been previously used, processed, or recycled. Virgin textiles are derived directly from their original source (e.g., cotton from plants, wool from sheep's first shearing, or polyester from petroleum) without any prior manufacturing history.

Recycled textiles are textile materials produced from pre-consumer waste (manufacturing scraps and by-products) or post-consumer waste (used clothing and discarded textile products) that have been collected, sorted and processed to create new fibers or materials for textile production.

Recycled fiber refers to fibers produced by collecting textile waste (pre-consumer scraps or post-consumer garments) and processing it, either mechanically or chemically into new, usable textile fibers

Textile-to-textile refers to the process of converting textile waste of either pre-consumer or post-consumer into new textile fibers and fabrics that can be used to manufacture new clothing or textile products, rather than downcycling into lower-value applications. Also referred to as fiber-to-fiber recycling.

4.2. Return

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4.2.1. Overview

The Return phase covers all processes involved in collecting and returning end-of-use textile products and waste back into production systems, rather than disposing of them in landfills or through incineration. This phase is foundational to enabling closed-loop material flows in a circular economy, ensuring that valuable fibers and materials remain within the value chain for as long as possible. (Schumacher & Forster, 2022)

Some core activities in this phase include:

a. Post-consumer waste collection: This activity involves establishing collection points at retail outlets, community centers and municipal waste facilities to capture used garments and household textiles. Effective collection schemes are often supported by public awareness campaigns and extended producer responsibility (EPR) policies that incentivize consumers to return unwanted clothing. (Schumacher & Forster, 2022).

Waste processing: Collected textiles undergo preliminary sorting by material type, quality grade and contamination level. Mechanical shredding and cleaning prepare mixed fibers for downstream recycling processes. Textile-to-textile (T2T) recycling technologies, mechanical

for cotton-rich blends and thermo-mechanical for polyester, are emerging in Vietnam, albeit at pilot scale, to convert waste back into feedstock for yarn and fabric production (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2025).

Reverse logistics coordinates the transport of collected textiles from collection points to recycling or remanufacturing facilities. Collaboration among brands, third-party recyclers and logistics providers is essential to optimize routing, reduce transportation costs and minimize carbon emissions. Efficient reverse logistics networks form the backbone of any circular textile system. (DHL Express Vietnam, 2024)

Internal take-back programs: Some Vietnamese manufacturers and global brands operating locally have begun implementing in-house take-back initiatives, whereby end-of-use products are returned directly to production sites for reintegration. Although less common in Vietnam compared to developed markets, these programs help companies secure steady streams of recyclable inputs and demonstrate corporate sustainability commitments (Global Fashion Agenda, 2025).

The Return phase delivers three critical benefits within a circular textile economy:

- a. It is the foundation for circularity
Efficient collection and reintegration of textiles establish the material loops upon which all circular economy activities depend. Without high capture rates, downstream reuse and recycling initiatives cannot scale, undermining profitability and sustainability objectives. (Reconomy, 2025)
- b. It reduces environmental impacts
By diverting textiles from landfills and reducing reliance on virgin fibers such as cotton and polyester, the return phase lowers greenhouse gas emissions, conserves water and land resources and prevents microplastic release during production and washing cycles. (Manshoven, et al., 2019)
- c. It increases social responsibilities
Expanding collection and recycling operations creates local employment opportunities in sorting, processing and logistics. The growth of a domestic recycling sector can foster upskilling, technological investment and inclusive economic development in Vietnam's textile hubs (UNEP, 2023)

4.2.2. Performance benchmarking

- a. Post-consumer waste collection

A crucial metric is post-consumer waste collection, which tracks the percentage of textile waste generated during manufacturing processes that is captured for recovery, reuse, or recycling rather than disposed. This encompasses materials like cutting waste, off-cuts and defective items diverted from disposal into circular pathways, directly reducing landfill reliance.

Vietnam currently sees increasing efforts in collection, primarily driven by collection pilots and brand take-back programs supported by multi-stakeholder coalitions. However, nationwide collection coverage remains limited. This deficiency creates a scenario where recyclers report feedstock shortages, which is compounded by local restrictions on importing used clothing as input factors that significantly dampen scalable collection outcomes. (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2025)

In comparison, Vietnam's regional peers face similar fragmentation. India generates 7,793 kilotons of textile waste annually, with over 50% (approximately 3.94 million tonnes) being post-consumer waste from households, but only a small fraction is captured in circular channels due to highly fragmented collection systems.

Similarly, Bangladesh exhibits minimal domestic collection of post-consumer textiles, with post-consumer flows remaining largely unmanaged, as Bangladesh's textile and sector is characterized by the predominance of informal waste management. (Alam, Reaz, & Schröder, 2025)

The Global benchmark is set by the European Union (EU), which generated roughly 6.95 Mt of textile waste in 2020 (~16 kg per capita), of which 4.4 kg per capita was separately collected as a baseline. Crucially, the EU has mandated that all Member States must operate separate collection systems from January 1, 2025. This transition is financed through mandatory Extended Producer Responsibility (EPR) schemes, which shift the financial burden of collection and sorting onto producers. Leading EU nations like France report a higher maturity, achieving approximately 31% separate collection relative to volumes placed on the market in 2022. (SGS, 2025)

In summary, Vietnam's performance in post-consumer collection is currently above Bangladesh and roughly on par with early-stage India pilots, but it lags behind EU leaders and Japan's brand-led networks. Achieving EU-style performance requires mandatory policy implementation (EPR) and consistent, formalized drop-off locations for discarded items.

b. Recycling rate

Complementing the Return phase is recycling rate, measured as the share of fiber input that is certified recycled compared with the total fiber input amount. This KPI provides an

immediate measure of how much end-of-life material, whether pre- or post-consumer, successfully re-enters the supply chain as raw material, illustrating the operational success of recycling infrastructures.

Vietnam's recycling efforts are focused primarily on pre-consumer industrial waste. The textile and apparel industry generates approximately 250,000 tonnes of pre-consumer textile waste annually. Of this, about 60% is captured and directed towards recycling, predominantly via basic mechanical and thermo-mechanical routes, which results in downcycling into lower-quality products. The remaining 40% is directed to waste-to-energy facilities or other disposal methods, highlighting existing sorting quality gaps. (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2025) Post-consumer sorting is expanding from a low base, necessitating the adoption of Near-Infrared or other automated upgrades to effectively raise the material recovery rate.

Regionally, Japan sets a high standard for quality recovery, utilizing advanced chemical recycling to convert used polyester clothing into virgin-equivalent resin, such as the technology employed by JEPLAN Group. (JEPLAN Group, 2025). "BRING Technology™", operated by JEPLAN, works with various brands to collect clothes no longer used by consumers. Clothes made of 100% polyester fiber are recycled into recycled polyester BRING Material™ using JEPLAN Co., Ltd.'s proprietary chemical recycling technology "BRING Technology™" and are reborn as raw materials for new clothes, etc. This processing strength lifts the quality and end-market value of the recycled material, although mixed-fibre streams still present systemic challenges.

On the other hand, Bangladesh, the country with similar textile landscape, still suffers from underdeveloped domestic sorting and processing infrastructure, leading to much of the waste being downcycled, exported, or handled by less formal sorting networks. (Business & Human Rights, 2025)

On the global scale, EU textile recycling rate performance demonstrates a significant technology-to-execution gap: while installed recycling capacity reaches 1.25-1.3 million tonnes annually across 17 major companies (1 million tonnes mechanical + 250,000 tonnes chemical), the actual recycling rate stands at only 4.9% fibre-to-fibre and 12% overall (recycling & reuse combined), constrained primarily by collection infrastructure inadequacy rather than technical limitations. (The Brussel Times, 2024) Advanced automated sorting technology using near-infrared spectroscopy achieves >95% fiber identification accuracy, processing ~900 kg per hour with 98-99% fibre purity enabling virgin-equivalent material production. (Du & Jiahui Zheng, 2022).

However, only 12% of the EU's textile waste enters separate collection channels, with 76.7% incinerated or landfilled. France exemplifies this gap: despite consuming 800,000 tons of textiles annually, the country collected only 260,000 tons in 2022, representing 31% of products placed on market, while advanced facilities like Nouvelles Fibres Textiles demonstrate technical capability to produce virgin-equivalent polyester through automated sorting achieving 98-99% fibre purity. (The textile Industry's Producer Responsibility Organisation, 2022) (Wilson, 2024) The constraint reflects collection system deficiency rather than recycling capability. The EU's mandatory separate collection mandate effective January 2025 and coordinated European Circular Textile Coalition initiatives target closing this infrastructure gap, aiming to progressively increase recycling rates toward alignment with technological capacity. (European Environment Agency, 2025)

Vietnam is performing quite above the regional average, demonstrating stronger initial processing than Bangladesh and comparable rates to pre-pilot stage India. However, it trails EU leaders and Japan in automated sorting and high-value fiber-to-fiber processing, particularly for complex materials like polyester. Scaling verified sorting capacity (by fiber and color) is the necessary step to unlock higher material recovery value.

4.2.3. Barriers in Return phase

a. Policy and Regulatory Gaps

Vietnam currently lacks a mandated nationwide system for collecting post-consumer textiles. This absence of formalized collection streams results in most discarded garments entering municipal solid waste systems, creating severe feedstock shortages for recyclers despite growing demand. (European Environment Agency, 2025) The lack of EPR legislation for textiles exacerbates this issue, leaving producers without incentives or obligations to manage end-of-life products. Consequently, the KPI for post-consumer waste collection remains critically low. This barrier is highly improvable through the introduction of EPR schemes and separate collection mandates, which have proven effective in the European Union and other advanced markets.

b. Waste Import Prohibition

Vietnamese regulations prohibit the formal import of textile waste, a policy designed to prevent environmental risks but inadvertently limiting feedstock availability (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2025). Domestic supply alone cannot meet the scale required for high-value recycling operations, forcing recyclers to rely on inconsistent local sources or informal cross-border flows from neighboring countries. This restriction directly impacts the post-consumer waste collection KPI, as the inability to supplement domestic waste with high-quality imported feedstock constrains recycling

capacity. Regulatory review to allow controlled imports of pre-sorted textile waste under strict compliance could significantly alleviate this barrier.

c. Contamination and Poor Segregation

Although Vietnam generates approximately 250,000 tonnes of pre-consumer textile waste annually, much of it exits factories as mixed or contaminated waste containing non-textile materials. This contamination reduces the quality of input for recycling, resulting in 60% of recovered material being downcycled into low-value products rather than fiber-to-fiber applications. The impact on the recycling rate KPI is substantial, as contamination prevents the achievement of high-value recycling goals. This barrier is highly improvable through mandatory segregation standards at the manufacturing stage and enforcement mechanisms to ensure compliance.

d. Technological Gap

Vietnam's recycling sector is dominated by basic mechanical and thermo-mechanical processes, which are inadequate for handling blended fibers that constitute nearly 45% of pre-consumer waste. The absence of advanced sorting technologies such as Near-Infrared (NIR) systems and chemical recycling capabilities severely limits the production of high-quality recycled fibers. This technological bottleneck keeps the recycling rate KPI low and restricts Vietnam's ability to meet global sustainability benchmarks. Targeted foreign direct investment (FDI) and government incentives for technology adoption are essential to overcome this barrier.

The summary of the analysis is available in Appendix B.

4.2.4. Key enablers in Return phase

a. Pre-existing Local Network

Vietnam benefits from a decentralized network of over 230 waste collectors and pre-processors, alongside 40 operational recyclers primarily focused on industrial waste. This infrastructure provides a strong foundation for scaling post-consumer textile collection. Formalizing these networks through legal recognition and financial integration could enable Vietnam to bypass collection bottlenecks faced by more industrialized nations. This enabler directly supports improvements in the post-consumer waste collection KPI.

b. External Market Pressure

Mandatory EPR schemes in key export markets, such as the European Union, require Vietnamese producers to finance end-of-life management for textiles. This external pressure incentivizes local manufacturers to develop domestic collection and recycling systems to

maintain market access. While Vietnam cannot alter this factor, it indirectly strengthens the feasibility of achieving higher post-consumer waste collection rates.

c. High Volume of Pre-consumer Scrap

The textile export industry generates a consistent and substantial volume of pre-consumer waste, estimated at 250,000 tonnes annually. This reliable feedstock underpins the current recycling sector and provides a sufficient base to justify investment in advanced processing facilities. Although this enabler does not directly improve post-consumer collection, it stabilizes the recycling ecosystem and supports the recycling rate KPI.

The summary of the analysis is available in Appendix B.

4.3. Make

4.3.1. Overview

The “make” phase represents the critical production stage where manufacturing processes are redesigned to minimize waste, use recycled inputs and enable recyclability. This phase serves as the operational core where circular economy principles translate into tangible manufacturing practices that address both environmental sustainability and economic competitiveness in Vietnam's textile sector. Manufacturing processes in the circular economy's make phase are characterized by three fundamental objectives: eliminating virgin raw materials where possible, reducing material inputs through efficient design and establishing closed-loop production systems. In the context of Vietnam's textile industry, this phase encompasses the entire value-added process of transforming raw materials into finished garments and clothing items, while simultaneously integrating sustainable technologies and practices throughout the production lifecycle.

This phase represents a separation from conventional linear manufacturing approaches by embedding circularity considerations directly into production operations. Rather than viewing waste as an inevitable byproduct, circular manufacturing treats material flows as valuable resources that must be optimized, recovered and reintegrated into production cycles. This conceptual shift requires manufacturers to reconsider fundamental assumptions about material inputs, production efficiency and waste management.

The implementation of circular economy principles during the Make Phase involves three interconnected activity domains that collectively enable sustainable textile manufacturing:

a. Material innovation and recycled input

The transition from virgin to recycled materials represents the foundational activity within this phase. Vietnam's textile industry has increasingly adopted recycled materials including

bamboo fibers, recycled cotton and single-fiber polyester compositions as alternatives to conventional synthetic inputs. This material substitution strategy addresses multiple sustainability challenges simultaneously: reducing dependency on fossil-based resources, minimizing extraction of virgin raw materials and creating demand for recovered textile waste.

Pre-consumer textile waste which comprises scraps, by-products and production rejects generated during manufacturing serves as a particularly valuable feedstock for circular manufacturing systems. Vietnam's textile sector generates approximately 250,000 tonnes of pre-consumer textile waste annually, representing a significant resource pool for closed-loop production. The mechanical and thermo-mechanical recycling technologies deployed in Vietnam enable this waste to be processed into recycled fibers that can be reintroduced into production, effectively closing material loops at the manufacturing stage.

The adoption of mono-material designs such as 100% cotton or 100% polyester garments facilitates end-of-life recycling by eliminating the complex separation processes required for blended fabrics. This design-for-recyclability approach exemplifies how Make Phase decisions influence the entire circular value chain, extending considerations beyond immediate production to encompass product end-of-life scenarios.

b. Scrap generation and closed-loop production

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The generation of pre-consumer waste during textile manufacturing, in particular scrap and by-product materials from cutting, trimming and production processes creates both challenges and opportunities for circular economy implementation. Unlike post-consumer waste, pre-consumer materials possess higher quality characteristics, more consistent composition and lower contamination levels, making them particularly suitable for closed-loop recycling applications.

Vietnamese textile manufacturers have increasingly implemented on-site waste segregation systems that separate pre-consumer waste by composition (pure cotton, pure polyester, pure polyamide, or blended textiles) and color during production. This systematic sorting enables subsequent recycling processes to achieve higher quality output while minimizing material degradation. Several vertically integrated manufacturers in Vietnam have initiated internal closed-loop recycling systems for pre-consumer cotton waste, with some projects advancing from trial phases to production stages.

The establishment of closed-loop production systems requires manufacturers to develop comprehensive material tracking and management capabilities. Digital tools and monitoring systems enable real-time visibility into waste generation patterns, material flows and

recycling performance across production lines. This data-driven approach supports continuous optimization of manufacturing processes to minimize waste generation while maximizing recovery and reuse opportunities.

c. Production monitoring

Advanced digitalization technologies play an increasingly critical role in enabling circular manufacturing practices by providing the monitoring, tracking and optimization capabilities necessary for closed-loop systems. Digital production monitoring systems enable manufacturers to track waste generation in real-time, identify opportunities for waste reduction and optimize material utilization across production processes.

Traceability systems represent a particularly important digitalization application within circular manufacturing, enabling complete visibility of material flows from raw inputs through production processes to finished products. These systems support compliance with emerging regulatory requirements while simultaneously enabling manufacturers to verify the recycled content, material composition and sustainability credentials of their products. For Vietnam's export-oriented textile industry, robust traceability capabilities are becoming essential for accessing international markets where sustainability standards and circular economy requirements are increasingly stringent.

Artificial intelligence and machine learning technologies are being deployed to optimize waste classification, support dynamic collection routing for textile waste and generate real-time analytics on recycling performance. These advanced digital capabilities enable manufacturers to transition from reactive waste management approaches to proactive circular economy strategies that systematically minimize material losses and maximize resource productivity.

The “Make” phase is significant within a circular textile economy due to its:

a. Direct value-added activities and economic impact

Manufacturing processes constitute the primary value-creation activities within the textile value chain, transforming raw materials into finished garments and clothing items that generate economic returns. By embedding circular economy principles directly into these value-adding activities, manufacturers can simultaneously pursue environmental sustainability objectives and economic performance goals rather than treating them as competing priorities.

The integration of recycled materials into production processes creates economic value by reducing dependency on imported virgin materials, enhancing resource security and

potentially lowering production costs as virgin material prices increase. Vietnam's textile manufacturers adopting closed-loop practices have reported both environmental benefits through waste reduction and economic advantages through improved material efficiency and reduced disposal costs.

Furthermore, circular manufacturing capabilities are increasingly becoming sources of competitive advantage in global markets where brands and consumers demand sustainability credentials. Vietnamese manufacturers developing advanced recycling capabilities, sustainable material expertise and closed-loop production systems position themselves favorably to capture market share in the growing sustainable fashion segment and meet stringent environmental requirements imposed by export markets.

In the below benchmark analysis, 2 main indicators from mentioned activities will be benchmarked for Vietnam performance. They are byproducts generation during manufacturing and recycled content ratio.

4.3.2. Performance benchmarking

a. Byproducts generation

The efficiency of textile manufacturing is measured by the Scrap rate & byproducts generation during manufacturing, defined as the mass of pre-consumer textile waste generated per kg of finished product. A lower rate indicates optimized pattern making, reduced cutting losses and minimized defective outputs, which are critical for resource conservation.

Vietnam demonstrates relatively strong performance compared to regional peers, with an estimated scrap rate of 10–15% during cutting processes. The country generates approximately 250,000 tonnes of pre-consumer textile waste annually, primarily from export-oriented production. Composition analysis reveals 35% polyester-rich waste, 20% cotton-rich waste and 45% blended materials, which complicates recycling pathways. Currently, 60% of this waste is sorted and recycled, though predominantly downcycled into lower-value products such as insulation or industrial rags, while 40% is directed to waste-to-energy or disposal.

In regional level, some outstanding countries have more significant results compared to Vietnam:

- Bangladesh: Scrap rates are significantly higher, with 20–30% classified as Jhut/Jhoot waste, resulting in 500,000–700,000 tonnes of pre-consumer waste annually. Recycling rates remain low at 5–25%, indicating a substantial performance gap compared to Vietnam's 60% recycling rate.

- China: As the world's largest textile producer, China generates over 100 million tonnes of pre-consumer waste annually, yet only 10% is recycled, reflecting systemic inefficiencies despite scale advantages.
- Thailand & Indonesia: Data is limited, but projections suggest Indonesia could generate 3.9 million tonnes of textile waste by 2030, with sustainability initiatives still in early stages.

On global scale, EU emphasizes post-consumer waste management, which accounts for 82% of total textile waste, but provides limited data on pre-consumer scrap rates due to lower production volumes. However, EU policy frameworks prioritize waste prevention and recycling, with mandatory separate collection for textiles by 2025 and strict adherence to the waste hierarchy.

In short, Vietnam exhibits lower scrap generation (10–15%) compared to Bangladesh (20–30%) and significantly higher recycling rates (60% vs. 5–25% in Bangladesh and 10% in China). However, the predominance of downcycling and absence of closed-loop textile-to-textile recycling remain critical gaps. Policy intervention and technological investment are essential to transition from downcycling toward true circularity.

b. Recycled content ratio



The commitment to circular materials is captured by the recycled content ratio, which is the share of total fiber input that is certified recycled. This metric is fundamental, demonstrating the industry's shift away from virgin resources and its adoption of fibers derived from recycled textiles or other waste streams.

There are many standards that govern the certification of recycled textiles, each playing a crucial role in ensuring transparency and credibility within the circular economy. Among the most widely recognized are the Global Recycled Standard (GRS) and the Recycled Claim Standard (RCS), both developed by Textile Exchange, a leading non-profit organization in sustainable fibers and materials. (Intertek, n.d.) These standards verify the proportion of recycled fiber input in textile products and ensure traceability throughout the supply chain. The GRS goes further by incorporating environmental, social and chemical processing criteria, while the RCS focuses primarily on content verification. Certification under these standards is conducted by independent third-party bodies such as Intertek, TÜV SÜD, SCS Global Services and ICEA Certifica, which audit and validate recycled claims based on strict chain-of-custody protocols. (TÜV SÜD, n.d.) (SCS Global Services, n.d.)

These certifications are essential for brands and manufacturers aiming to substantiate their sustainability claims and contribute meaningfully to circularity in the textile sector. By

adhering to these standards, companies can reliably report their recycled content ratio the share of total fiber input that is certified recycled, thus supporting responsible sourcing and reducing reliance on virgin materials.

Current recycled content ratios in Vietnam vary widely, ranging from 1–50% recycled PET in feedstock, primarily sourced from PET bottles rather than textile waste. Pilot initiatives aim for 30% textile-to-textile recycled content, but large-scale implementation remains limited. Most advanced recycled polyester yarns and fabrics are imported, highlighting a domestic capability gap.

- Some countries with similar economy context:
 - Bangladesh: Focuses on developing recycling infrastructure but lacks significant progress on recycled content ratios, with most efforts concentrated on pre-consumer waste recovery rather than fiber-to-fiber recycling.
- China: Pursues chemical recycling technologies and fiber-to-fiber solutions but faces challenges in scaling these innovations across its vast manufacturing base.
- European Union: Current recycled content in textiles averages 4%, with projections of 14-15% by 2030 and 43% by 2035, supported by mandatory collection and circular design policies.
- Japan: Achieves 34% recycling or reuse of discarded clothing, targeting 50,000 tonnes of recycled fiber production by FY2030, driven by government-led initiatives and advanced chemical recycling technologies.
- Global Standards: GRS requires 50% recycled content for consumer-facing labels, while RCS mandates a minimum of 5%, encouraging higher adoption rates.

Through comparison, it is spotted that Vietnam lacks binding targets for recycled content, relying on voluntary brand commitments and pilot programs. In contrast, the EU and Japan enforce progressive targets and invest heavily in chemical recycling technologies, setting benchmarks for Vietnam to emulate.

In short, Vietnam demonstrates emerging capability but remains far behind global best practices. While some recyclers achieve up to 50% recycled content, most domestic production relies on PET bottles rather than textile waste. The absence of large-scale textile-to-textile recycling and compliance with international standards (e.g., GRS minimum 50%) underscores the need for policy support, technological investment and supply chain integration.

4.3.3. Barriers in Make phase

- a. Lack of source segregation

In most Vietnamese textile factories, waste exits as “contaminated waste,” mixing fabric scraps with dust, paper and plastic. This lack of segregation significantly reduces the purity and economic value of pre-consumer waste, forcing approximately 60% of recycled scrap into downcycling pathways rather than high-value fiber-to-fiber recycling. The impact on the scrap rate KPI is indirect but critical: while capture rates are high, the quality of recovered material remains low, limiting its potential for closed-loop applications. This barrier is highly improvable through mandatory segregation protocols and enforcement mechanisms at the factory level.

b. Low economic priority for waste prevention

Vietnam’s textile sector operates on a high-volume, low-margin, cut-to-pack model, driven by export quotas and competitive pricing. The low intrinsic cost of virgin materials and the emphasis on speed and cost reduction mean that waste prevention and fabric yield optimization are often secondary considerations. This economic structure sustains a scrap rate of 10–15%, reflecting inefficiencies in cutting and pattern-making processes. Introducing financial incentives, such as reduced EPR fees for manufacturers to achieve certified material efficiency, could shift this calculus and promote waste minimization.

c. Limited domestic fiber-to-fiber capacity

Vietnam’s recycling infrastructure is dominated by basic mechanical processes, which primarily produce downcycled fibers for low-value applications. The country lacks large-scale facilities for textile-to-textile recycling, particularly chemical recycling technologies capable of handling blended fibers. As a result, the recycled content ratio KPI remains low, with most advanced recycled polyester yarns and fabrics imported rather than produced domestically. Targeted foreign direct investment (FDI) and government-backed R&D programs are essential to build high-value recycling capacity.

4.3.4. Enablers in Make phase

a. Consistent Economic Incentive for Capture (Structural/Economic Enabler)

Vietnamese manufacturers have an established practice of selling or transferring fabric waste to scrap buyers and waste collectors. This market mechanism ensures a high capture rate for pre-consumer waste (approximately 60% of 250,000 tonnes annually), providing a reliable feedstock base for the recycling sector. Enhancing this incentive structure by linking scrap prices to purity and segregation levels could further improve material quality and support higher-value recycling.

b. Government Modernization Mandate

Vietnam's national strategy aims to transform the textile sector into a high-tech, innovative industry by 2030, reducing dependence on low-skilled labor. This modernization agenda indirectly supports investments in digital cutting technologies and advanced manufacturing processes that minimize cutting scrap and production errors. However, the effectiveness of this enabler depends on setting measurable targets and providing financial support tied to waste reduction outcomes.

c. External Regulatory Market Pull

Key export markets, notably the European Union, are implementing regulations such as the Ecodesign for Sustainable Products Regulation (ESPR) and Extended Producer Responsibility (EPR) directives. These policies mandate that products sold in the EU must be durable, repairable, recyclable and contain a significant proportion of recycled fibers. This external pressure compels Vietnamese exporters to increase certified recycled content to maintain market access, creating a strong incentive for circular material adoption.

The summary of the analysis is available in Appendix B.

4.4. Use

4.4.1. Overview

During product usage, there is a prevalent consumer mindset favoring low-cost, trend-driven clothing, which encourages frequent purchasing and disposal, thereby reducing overall product longevity. The industry's current market incentives prioritize volume over durability, reinforced by consumer expectations for newness and affordability.

The Use phase aims to maximize the utility and longevity of textile products while they are in the hands of the consumer. A primary measure of longevity is Product life span, calculated as the average duration (in months or years) that a garment remains in active use before disposal or recycling. Extending this time-based duration is key to slowing resource throughput. Equally important is maximizing the value extracted from the garment, measured by garment utilization intensity (frequency). This KPI captures the average number of times a garment is worn or used before disposal, relative to its design potential. High utilization intensity signifies that consumers are effectively extracting value from the product, often through extended personal use, repair, or shared ownership models, thereby delaying the garment's entry into the waste stream.

4.4.2. Performance benchmarking

a. Product life span

Product life span refers to the average duration (in months or years) that a garment remains in active use before disposal or recycling. It is calculated from the point of acquisition to the

point of discard or transfer to secondary use. Extending garment life span is one of the most effective strategies for reducing environmental impact in the textile sector. Longer use reduces demand for new production, lowers resource consumption and minimizes waste generation. This KPI is central to circular business models such as resale, rental and repair services.

Vietnam-specific data on garment life span is extremely limited, as most research focuses on Vietnam's role as a manufacturing hub rather than domestic consumption patterns. Available insights include:

- Consumption Patterns: Vietnamese consumers purchase approximately 13.3 pieces per person annually (2025 projection).
- Behavioral Trends: 81.3% of consumers aged 18–45 report purchasing or using sustainable fashion products, with growing engagement in second-hand and thrift markets.
- Market Context: Vietnam's apparel market is valued at \$4.66 billion (2024), with a projected 12.8% CAGR growth through 2034, indicating rising consumption and potential risk of shortened garment lifespans due to fast fashion trends.

Countries with similar consumer patterns include Southeast Asia countries, China, Japan or South Korea, where rapid digitalization, social media influence and the proliferation of e-commerce platforms have accelerated fast-fashion adoption:

- Thailand & Indonesia: Both markets exhibit strong fast-fashion influence driven by social media and e-commerce platforms, leading to shorter garment lifespans.
- China: Studies show an average 5.3 years for first user and 12.7 years with second user, despite rapid consumption growth (30 pieces per person annually).
- Japan: Similar findings indicate 5.3 years average lifespan, though cultural shifts toward fast fashion are reducing traditional longevity.
- South Korea: No precise lifespan data, but K-fashion trends and online platforms (Musinsa, ABLY) suggest shorter use cycles among younger demographics.

Globally speaking, the figures are more positive:

- United Kingdom: Average garment lifespan is 5.3 years for single user, extending to 12.7 years with second user. However, lifespan has declined 36% over the past 15 years, reflecting fast fashion's impact.
- EU Average: Clothing purchases increased 40% between 1996–2012, while garment use-time fell by 36%, with less than 30% of wardrobes actively worn in some markets.

- United States: Fast fashion dominance results in shorter lifespans despite high purchase volumes (53 pieces per person annually).
- Australia: Among the highest consumption globally, with 27 kg purchased and 23 kg discarded annually, indicating extremely short garment lifespans.

Vietnam's garment life span remains largely unquantified, making this KPI a limitation in terms of reference sources, but regional trends and market growth suggest increasing risk of shortened use cycles. Establishing baseline data through wardrobe surveys and consumer behavior studies is critical for setting realistic circular economy targets.

b. Garment utilization intensity

Garment utilization intensity measures the average number of times a garment is worn before disposal, relative to its designed or optimal use potential. This KPI captures consumer behavior and the effectiveness of circular business models.

Direct data on utilization frequency is unavailable. However, indicators suggest high turnover and short use cycles:

Purchase Volume: 13.3 pieces per person annually, signaling frequent wardrobe refreshes.

Behavioral Trends: Growing interest in second-hand shopping among Gen X and Gen Y, with thrift stores expanding both online and offline.

Market Dynamics: Rapid e-commerce growth and social media influence are likely to accelerate fast-fashion adoption and reduce utilization intensity.

For regional and global benchmarks, it is also quite limited in terms of measurable facts, however trends can be detected:

- Southeast Asia: Heavy social media engagement (e.g., 9+ hours daily in the Philippines) drives trend-based purchases and short wear cycles.
- Indonesia: Pandemic shifted demand toward casual wear, but overall utilization remains low due to fast-fashion turnover.
- Thailand & Malaysia: High e-commerce penetration and trend-driven consumption patterns mirror Vietnam's trajectory.
- UK & EU: Studies indicate garments are worn 7 times on average before disposal in fast-fashion contexts, far below the optimal benchmark of 82 wears for new garments.
- United States: Similar patterns, with rapid turnover and declining utilization intensity.
- Japan: Cultural norms historically supported longer use, but fast fashion adoption is reducing utilization frequency.

Vietnam likely falls below global benchmarks for utilization intensity, with patterns resembling fast-fashion markets. Immediate research priorities include:

- Wardrobe surveys tracking wear frequency.
- Consumer behavior studies disposal and purchase motivations.
- Longitudinal tracking of use-time trends as income and fashion access grow.

However, without baseline data, Vietnam cannot effectively measure progress toward circular economy goals in Use phase.

4.4.3. Barriers in Use phase

a. Fast Fashion and Psychology

The continuing trend of low-cost, trend-driven clothing, amplified by aggressive social media marketing, has fostered a culture of psychological obsolescence among Vietnamese consumers. Studies indicate that 43% of consumers discard clothing after wearing it only once, while 27% report product life spans of less than one year. This behavior drastically reduces garment utilization intensity and accelerates waste generation. The barrier is highly improvable through consumer education campaigns and policy interventions such as eco-modulation in EPR schemes, which incentivize durability and reuse.

b. Low purchase price and quality compromise

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Vietnam's domestic market is saturated with affordable, lower-quality textiles, often polyester-based, driven by manufacturers prioritizing cost and speed. Low purchase prices diminish perceived garment value, making disposal easy and incentivizing frequent replacement rather than repair or sustained use. This undermines product life span KPI, as garments fail durability standards. Introducing mandatory durability labeling and eco-design requirements such as minimum cleaning cycles would raise quality benchmarks and support longer lifespans.

c. Lack of formal reuse/repair infrastructure

Vietnam lacks a robust ecosystem for garment extension services, including professional repair, rental and official take-back programs. When garments tear or trends change, consumers have few convenient alternatives to disposal, contributing to the estimated 85% of household textile waste entering general waste streams (based on EU analogs). This barrier is highly improvable through fiscal incentives for repair businesses, subsidies for second-hand platforms and integration of rental models into mainstream retail.

4.4.4. Enablers in Use phase

a. Second-hand consumption

Vietnamese Generation Z consumers exhibit growing interest in second-hand and reused clothing, motivated by uniqueness, affordability and sustainability values. This trend represents a critical enabler for extending garment life span and utilization intensity. Formalizing and scaling the second-hand market through digital resale platforms and trusted physical retail spaces can mainstream this behavior and embed it within the circular economy infrastructure.

b. High consumer sustainability awareness

Surveys reveal that 74% of Vietnamese consumers are willing to pay up to 20% more for products made from recycled or sustainable materials, signaling strong aspirational awareness. This openness creates fertile ground for behavioral shifts toward longer garment use and circular business models. However, converting intent into action requires trust and transparency, achievable through Digital Product Passports and verified sustainability claims.

In summary, Vietnam's Use phase faces significant behavioral and structural barriers, including fast-fashion-driven psychological obsolescence, low garment durability and inadequate reuse infrastructure. Yet, cultural trends such as youth engagement with second-hand fashion and high sustainability awareness offer strong enablers for change. Policy interventions, consumer education and investment in reuse and repair ecosystems are essential to transform these enablers into measurable improvements in product life span and garment utilization intensity, aligning Vietnam with global circular economy objectives.

All factors being discussed are summarized in Appendix B.

V. Circular economy framework for Vietnam textile industry

By definition, a framework is a structured system of processes and guidelines that provides an organized approach to understanding, planning and implementing complex initiatives or solving multifaceted problems. It serves as a blueprint or skeleton that establishes the logical sequence, relationships and dependencies between components.

This framework is called the Circularity Implementation Framework for Vietnam Textile Industry, a prescriptive, expert-level blueprint designed to leverage performance benchmarking across environmental, social and economic pillars, thereby translating national net-zero commitments into measurable operational reality.

The transition toward a circular economy is no longer a voluntary measure for the Vietnamese textile sector but a fundamental requirement for maintaining global market access and long-term competitiveness. Vietnam, as a highly open economy and a leading global textile exporter, faces intense pressure from major export markets to decarbonize and increase resource efficiency.

5.1. Vision & objectives

By 2035, Vietnam will be able to reach apparel industry standards, serving as an inspiration to the world, as an emerging economy, by establishing comprehensive policies, state-of-the-art recycling facilities and a collaborative network that transforms every scrap of textile waste into valuable resources, positioning itself as the premier destination for sustainable apparel and leading the way towards achieving zero waste

Aligned with Vietnam's National Action Plan for Circular Economy by 2035, this framework addresses:

1. Environmental Impact: Resource efficiency, waste reduction, emissions reduction, pollution prevention
2. Social Impact: Green job creation, skills development, just transition, community well-being
3. Economic Impact: Cost savings, new revenue streams, competitiveness, innovation, investment attraction

5.2. Framework baselines

5.2.1. Stakeholder roles and accountability

Effective implementation of circular economy requires clear accountability and a unified regulatory structure that harmonizes national standards with global compliance demands.

The framework relies on the coordinated action of four Vietnamese primary government and industry organizations:

1. Ministry of Industry and Trade (MOIT): This Ministry leads the economic and industrial aspects of the transition. Its core responsibility includes developing policies, regulations and standards related to sustainable production, energy efficiency and green growth within the textile sector. MOIT ensures that industrial practices align with international requirements and climate change response strategies. (Ministry of Industry and Trade Web Portal (MOIT), 2024)
2. Ministry of Natural Resources and Environment (MONRE): MONRE holds the critical mandate for environmental protection, waste management and, most importantly, the development and enforcement of the national Extended Producer Responsibility (EPR) scheme. (Ministry Of Agriculture And Environment, 2025)
3. Vietnam Textile and Apparel Association (VITAS): As the industry representative body, VITAS is crucial for disseminating information, driving industry coordination and promoting capacity building. It is tasked with facilitating education and training in waste management techniques and enhancing supply chain traceability among its members. (Circular Fashion Partnership)
4. Ministry of Labor, Invalids and Social Affairs (MoLISA): MoLISA is responsible for the social dimension, including labor market readiness. Its roles include anticipating the demand for green skills and green jobs based on sectoral strategies, adapting the labor market information system and integrating these new skill requirements into the Vocational Education and Training (VET) system.

5.2.2. The reflection of National Extended Producer Responsibility (EPR)

The foundation of Vietnam's circular economy effort is the national EPR mandate, governed by the 2020 Environmental Protection Law. This law places specific recycling responsibilities on organizations and individuals that produce and import products and packaging into the market. EPR acts as a market-based environmental policy designed to transition the country toward a circular economy. (MINISTRY OF AGRICULTURE AND ENVIRONMENT, 2025)

Under the framework, producers and importers have two primary options for compliance: they can either organize the recycling of their products directly or contribute financially to the Vietnam Environmental Protection Fund (VEPF). The VEPF is intended to provide a stable financial source for the recycling industry, serving as a powerful catalyst for the development of Vietnam's nascent recycling capacity. (Vietnam Metal Recycling Forum, 2025)

5.2.3. Compliance to standards

A credible circularity framework requires robust, enforceable technical standards. Vietnam distinguishes between mandatory technical regulations and voluntary standards.

a. National Technical Regulation (QCVN)

It is recommended that manufacturers ensure mandatory adherence to National Technical Regulations (QCVN), such as QCVN 13-MT:2015/BTNMT, which sets the national technical regulations on textile and dyeing industrial wastewater. Compliance is non-negotiable for legal trade and is foundational for mitigating the sector's high pollution profile.

b. Technical Standards (TCVN)

Manufacturers also should adopt Vietnam Standards (TCVN) as best practices for resource efficiency and chemical management, even though they are voluntary. As the government plans to elevate critical TCVNs to mandatory QCVNs to raise the sector's performance floor, proactive compliance now ensures future readiness and competitiveness.

c. International Benchmarks for Market Access

Besides Vietnam's common standards, manufacturers should also observe closely external markets where export values are most dominant. For export markets, it is advisable to adopt and certify products against recognized international standards to ensure market access and brand trust :

- Global Organic Textile Standard (GOTS): Use GOTS to verify high-level environmental and social criteria across the supply chain for organic fibers.
- Recycled Claim Standard (RCS) and Global Recycled Standard (GRS): These are essential for tracking and verifying the content of recycled materials in the final product. Adopting GRS/RCS enables transparency, ensures accurate labeling and is vital for securing lower financial contributions under the forthcoming EU eco-modulation regulations.

5.3. Framework details

5.3.1. Environmental Impact (resource efficiency, waste, emissions)

The environmental pillar focuses on aggressively reducing resource consumption and maximizing the value recovery from waste streams. This pillar focuses mainly in "Make" phase where carbon footprint is the highest in the value chain of manufacturing.

For this pillar to take place efficiently, manufacturers must prioritize input efficiency and move beyond basic compliance to achieve absolute reductions in resource intensity. These

activities below will provide guidance for basic implementation elements that impact environment.

a. Water and wastewater management

Invest in water recycling: Move beyond compliance with wastewater discharge limits (QCVN 13-MT:2015/BTNMT) (Vietnam Environment Administration; Department of Science and Technology; Department of Legislation, 2015) by making significant capital investment in advanced water recycling and reuse technologies. (School), et al., 2022) The goal is to lower the liters-per-kilogram of fabric intensity.

Process optimization for water usage efficiency: Implement water-efficient dyeing processes as mandated by the National Action Plan on Circular Economy (NAPCE). (Singh, 2025)

b. Energy and emissions reduction

- **Target Scope 1 and 2:** Address direct emissions (Scope 1) and indirect energy emissions (Scope 2) by adopting energy-efficient technologies and prioritizing a shift toward renewable energy sources. There are already some successful case studies regarding addressing carbon footprint in corporate reports.
- **Adopt GHG Accounting:** Utilize comprehensive Greenhouse Gas (GHG) accounting methodologies to assess emissions across all scopes.
- **Calculate Scope 3 for Competitiveness:** Major exporters should adopt verifiable Scope 3 calculation protocols within the initial phase of the CIF-VT rollout. Calculate emissions using intensity metrics, such as carbon dioxide weight per functional unit (e.g., per wear cycle).²² This advanced transparency is critical for meeting international obligations and securing premium market share.

In Vietnam, there are some well-known foundational GHG accounting frameworks, (International Labour Organization, 2021) namely as below:

Table 5.1. Foundational GHG Accounting Frameworks in the Vietnamese Textile Sector

Framework/Standard	Primary Scope Focus	Purpose in Vietnam	Adoption Driver	Key Limitation

GHG Protocol (Corporate Standard)	Scope 1, 2, 3	Organizational Inventory, Regulatory Compliance	Global Brand Mandate (Scope 3)	Scope 3 data accuracy
Life Cycle Assessment (LCA)	Product (Cradle-to- Grave)	Product Carbon Footprint, Material Selection	Eco-Efficiency and Technical Optimization	Resource intensive, high skill requirement
ISO 14064-1:2018	Corporate (Verification)	External Assurance and Verification	Standardized Reporting, Investor Confidence	Requires high data maturity

c. Minimizing Pre-Consumer Waste

The current cut-and-sew process generates 10–15% fabric scrap.²³

Actionable Guidance:

- **Mandatory Training:** Institute mandatory staff training in minimizing offcuts.
- **Optimization Software:** Implement advanced pattern optimization software.

d. Developing Recycling Infrastructure and Circular Flow

- **Industrial Symbiosis: This is a long-term action.** Actively engage in industrial symbiosis networks, where your waste streams (e.g., polyester offcuts) can serve as raw material inputs for another sector or facility, maximizing resource utilization. (Singh, 2025)
- **Leverage High-Tech FDI:** Participate in the supply chain to utilize the planned high-tech recycling facilities, such as the 250,000 tons/year polyester complex planned in Binh Dinh (Ministry of Agriculture and Environment of The Socialist Republic of Vietnam, 2025) which use high-tech U.S. and EU standards for mechanical and chemical recycling.
- **Condition Export Subsidies:** Lobby for a policy mechanism that links government export subsidies or trade facilitation programs strictly to achieving measurable environmental efficiency targets (e.g., the waste reduction goal) and verified

adherence to GRS or RCS standards. (Kennemer, 2025) This aligns economic benefit with environmental performance.

5.3.2. Social Impact (skills, just transition)

Manufacturers must ensure the transition is inclusive and equitable, minimizing social disruption and maximizing worker benefits. This ensures not only a circular model but also a long-term sustainable model for textile industry. This aspect of circularity for developing countries is particularly critical given the imperative for a just and fair transition that centers workers' voices and livelihoods. In Vietnam, where 79% of textile workers remain unskilled or minimally trained, (International Labour Organization, 2024) the circular economy transition demands substantial investment in reskilling and upskilling programs to equip the workforce with green skills for emerging roles in textile recycling, sorting, refurbishment and sustainable production technologies.

The transition must prioritize the creation of quality green jobs, which is projected to reach 164,000 positions by 2030 in Indonesia's textile sector alone, with 75% filled by women, while simultaneously addressing the vulnerabilities of informal workers who currently operate in precarious conditions without social protection or collective bargaining rights. (Global Green Growth Institute, 2024). A just transition framework requires moving informal workers into formal employment arrangements that provide occupational safety, healthcare access, fair wages and union representation, ensuring that the burden of green transformation is not shifted onto those already most vulnerable.

Some guidance for a socially responsible company includes:

a. **Guidance for Defining and Measuring the Green Workforce**

- **Anticipate Needs:** Proactively anticipate the demand for "green skills" and "green jobs" within your organization based on your circular strategies. (Doan, Luu, Nguyen, & Safir) It is stated that Green jobs comprise only a small share of total employment: 3.6%; accounting for 1.7 million jobs in Vietnam.

Table 5.2. List of top 10 green occupations in Vietnam identified by the task-based approach (World Bank, 2021)

VSCO 2020	Occupational title	GTI (green)	Share of employment in 2021 (%)

2133	Environmental protection professionals	85.7	0.01
2143	Environmental engineer	83.3	0.03
9612	Refuse sorters	83.3	0.16
2112	Meteorologists	77.8	0.00
2445	Rangers (professionals)	75.0	0.04
9611	Garbage and recycling collectors	75.0	0.11
3132	Incinerator and water treatment plant operators	50.0	0.01
3355	Rangers (associate professionals)	50.0	0.01
7124	Insulation workers	50.0	0.03
3119	Physical and engineering science technicians not elsewhere classified	40.0	0.01

- **Internal Alignment:** Prepare your internal labor market information system to monitor the need for these new skills, aligning with the official definition and measurement methodology being developed by the Ministry of Planning and Investment (MPI) and the General Statistics Office (GSO) (Doan, Luu, Nguyen, & Safir)

b. Guidance for Upskilling for Digital and Green Transformation

The industry faces a dual skills challenge from automation and greening processes.²⁶

Actionable Guidance:

- **Dual Skills Investment:** Implement comprehensive training for workers in two areas. First one is technology skills, which means Proficiency in managing and utilizing new technologies such as automation, robotics, AI and big data analytics for production optimization. Alongside trending skills, green transformation requires workers to improve their sustainability awareness and management skills. These skills apply best in industry of raw material management, waste management, chemical handling, energy saving and efficient resource use, which textile industry performance heavily rely on. (Asia Garment Hub, 2024)
- **Specifically, Environmental Management Skills are crucial for efficiency excel in green jobs:** Improved environmental awareness and technical skills covering raw material management, complex waste sorting, chemical handling, energy saving and efficient resource use. (Asia Garment Hub, 2024)
- **Utilize Industry Programs:** Engage with industry bodies like Vietnam Textile and Apparel Association (VITAS) to access and implement education programs for manufacturers focusing on practical skills such as effective waste sorting and management techniques.

c. Ensuring a fair and just transition

This guidance section focuses on long term strategy to build a sustainable workforce.

- **Retraining Investment:** Mobilize incentives within your enterprise to invest in greener business models and worker retraining. (International Labour Organization, 2022) This is critical to mitigating the risk of job displacement due to automation. The ILO study shows that 86% of Vietnamese workers in the textile-garment sector are likely to lose their jobs to automation. (KIS Vietnam Securities Corporation, 2018) One Vietnamese enterprise (VitaJean) expects to replace 60-80% of its employees with machines, reducing workers from 1,800 to 450. (Lan, 2020)
- **Sustain Ethical Compliance:** Maintain strong enforcement of labor laws, ensuring fair wages, safe working conditions. According to Circular 22/2016/TT-BYT (which replaced Decision 3733/2002/QĐ-BYT), Vietnam's official lighting standards for textile industry workplaces are up to 750 LUX for Sewing, fine knitting and taking up stitches. (The Ministry of Health, 2016). Besides, TCVN 7114-1:2008 (Vietnamese national standard) also specifies similar lighting requirements for textile operations. (TCVN, 2008). In general, comprehensive occupational safety and health compliance is mandatory under Vietnam's Law on Occupational Safety and Health (2015), which requires employers to provide Personal Protective Equipment (PPE) free of charge to

all workers and implement standardized safety protocols across the textile production process.

- Enterprises must also establish robust mechanisms to enforce workers' rights to collective bargaining and freedom of association, aligned with CPTPP and EVFTA labor standard commitments that require Vietnam to comply with International Labour Organization (ILO) core conventions. Furthermore, compliance should be verified through a combination of government labor inspections conducted by MoLISA's Department of Labor Inspections and mandatory annual self-inspections reported by enterprises through the national labor law compliance system, with penalties imposed for violations ranging from administrative fines to operational suspension.

5.3.3. Economic Impact (cost savings, new revenue, competitiveness)

The economic objective of circular economy adoption is to decouple revenue growth from virgin resource consumption, transforming sustainability from a compliance burden into a sustainable competitive advantage. For Vietnamese textile manufacturers, this transition is not only environmentally necessary but economically imperative, particularly as global importers increasingly tighten requirements for sustainable sourcing. Adherence to green standards is becoming a prerequisite for market access, rather than a marketing bonus.

a. Monetizing efficiency and waste reduction

The 10-15% fabric scrap rate in the cut-and-sew process represents substantial untapped value for most manufacturers. (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2025) Most Vietnamese manufacturers conducting waste sorting reported immediate economic benefits, with waste handlers compensating manufacturers for sorted textile waste or manufacturers offsetting collection costs through material revenue. (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2025) This represents a short-term opportunity with immediate financial returns. Some actionable guidance are:

- **Capture cost savings indicator:** Immediately focus on achieving cost savings by aggressively targeting the 10-15% fabric scrap rate in the cut-and-sew process. To achieve this rate, some action plans are recommended, including:
 - On-site pre-sorting and baling equipment to optimize collection and transportation costs
 - Establishing contracts with waste handlers where manufacturers are compensated for sorted materials rather than paying disposal fees

- Implementing digital cutting pattern software to minimize cutting waste before it occurs

Manufacturers should engage with waste management aggregators and collectors (Vietnam has over 200 registered waste facilities (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2025)) and technology providers specializing in digital cutting and waste optimization software to identify site-specific opportunities. Consultation with industry associations like the Vietnam Textile and Apparel Association (VITAS) can provide benchmarking data on waste reduction ROI across facility types.

- **Mobilize Green Finance:** Actively leverage Vietnam's commitment to net-zero emissions by 2050 and the expanding EPR mechanism to attract green capital from multiple sources:
 - Development Banks or Commercial banks: development banks offer concessional financing for circular economy projects with long payback periods (The Star, 2025). Also, Vietcombank, HDBank and others offer dedicated green credit packages totaling on average 4,200 billion VND specifically for textile enterprises meeting international sustainability standards (GlobalGAP, WRAP, ISO 14064). (FPT IS, 2025)
 - Vietnam Environment Protection Fund (VEPF): Collects financial contributions from non-compliant producers. (Huld, 2024) These funds support recycling infrastructure that manufacturers can access.
 - Private Investors: Increasing green bonds and sustainable investment products targeting circular textile projects

The mandatory EPR framework is being formalized with a projected 5-10% annual recycling target starting 2025-2026. Early adoption positions manufacturers to access preferential financing rates and government incentives before the compliance deadline, while late adopters will face higher eco-modulation fees (currently ~1,500 VND/kg of plastic content). (Vietnamnet global, 2025)

Manufacturers should engage with banks' sustainability lending teams, the Vietnam State Bank, international development finance institutions (ADB, World Bank) and environmental consultants to structure financing packages aligned with manufacturer-specific circular projects. Government agencies like MoLISA and the Ministry of Industry and Trade offer guidance on EPR compliance financing.

b. Shift to Circular Business Models (CBMs)

Circular business model, which are relevant to rental, resale, repair and remaking are being actively adopted by global leaders, namely Patagonia, ZARA, H&M (Bayern Innovativ, 2025). It represents a significant growth opportunity for Vietnamese ODM/OBM manufacturers shifting away from low-margin cut-make-trim contracts. For instance, Vinatex's strategic shift from CMT to FOB/ODM/OBM models has enabled premium pricing and increased profitability, demonstrating the long-term strategic value of CBMs. (Vietnamnews, 2025). CBM is beneficial to Use phase in terms of integrating product lifecycle management into manufacturing strategies.

Implementing CBM is crucial due to:

- **Market reality:** By 2030, business models that secured market leadership in the past may no longer succeed in the EU due to new regulatory requirements (EU textile strategy mandates take-back and recycling obligations from 2026 onwards) and observable changes in consumer behavior. (Bayern Innovativ, 2025)
- **Revenue diversification:** CBM-based revenue streams including product-as-a-service (PaaS), resale platforms and repair services provide additional touchpoints with consumers and unlock premium pricing models. (Deloitte., 2024)
- **Competitive positioning:** Companies embedding circularity end-to-end (from design through consumer engagement) are positioned as innovation leaders in an increasingly environmentally conscious global market. (Deloitte., 2024)

Guidance for this aspect includes:

- **Expand Service Offering:** Expand your business proposition beyond simple manufacturing and shipping. Integrate 'remaking' (upcycling post-industrial waste) and 'repair/refurbishment' services directly into your B2B offering. (Vietnamnews, 2025). Remaking means establishing in-house upcycling operations to repurpose pre-industrial waste and post-consumer textiles into high-value products (pillow covers, accessories, technical textiles). Repair means to develop take-back programs enabling customers to return garments for repair, refurbishment, or remanufacturing, which generate an increasingly expected service among major global brands.
- **Design for Durability:** To secure high-value contracts and customer satisfaction in rental and resale markets, products must be designed for multiple lifetimes. Mandate the use of rigorous, standardized testing protocols for durability, including:

- Bursting Strength (ASTM D3787): Measure force required to rupture fabric under multidirectional stress, which is critical for high-use garments in rental markets.
- Pilling resistance (BS EN ISO 12945-2:2020) helps ensure fabrics maintain appearance through repeated washing cycles (ISO, 2020)
- Standardized measurement of garment dimensions (ISO 18890:2018) ensure dimensional consistency across production batches to maintain fit and value in resale/rental markets (ISO, 2018)
- **Avoid the Circularity Trap:** It is important to ensure CBM strategies are central to your business model, not only "add-ons" that risk fueling further virgin production. Manufacturers should engage with global brand sustainability teams and sourcing managers to understand specific CBM requirements, digital platform providers (blockchain for traceability, resale technology integrations), international consultants specializing in durability and circular design and third-party sustainability certification bodies (GRS, GOTS, OEKO-TEX) to validate product lifecycle claims.

CBM development requires 12-24 months from strategy to market launch, making this a medium-term strategic initiative that should commence immediately align with 2026 EU regulatory deadlines and emerging buyer requirements

In summary, regarding three aspects that a textile company is advised to follow, activities are clustered into different implementation duration, complexity and timeline:

- Short-term actions (0-12 months): Implement waste reduction and capture immediate cost savings through improved sorting and pre-processing. Initiate green finance applications and RCS certification.
- Medium-term actions (12-24 months): Develop circular business model pilots (repair, resale, or remaking services); achieve GRS certification; expand recycled content sourcing.
- Long-term positioning (24+ months): Transition manufacturing model from CMT to higher-value ODM/OBM; achieve certifications; establish full closed-loop production systems capturing premium market positioning and sustainable competitive advantage.

By systematically addressing all three dimensions: cost savings, CBM development and market certification, Vietnamese textile manufacturers can ensure that circularity translates directly into enhanced profitability, regulatory compliance and long-term market competitiveness

5.3.4. Implementation timeline

The strategic deployment of the framework requires a carefully sequenced, three-phase roadmap that systematically addresses regulatory, financial and technical challenges. First, the thesis emphasizes again the key mandates

Table 4: Key regulations to implement by phase

Phase	Timeline	Primary Focus Area	Key Actions & Deliverables
I: Foundation & Measurement	First 2 years of roadmap	Regulatory Compliance & Baseline Data	MONRE finalizes EPR decree for textiles and defines mandatory recycling rate; MPI/GSO establish official National Green Jobs definition and baseline; MOIT mandates adoption of GHG Scope 1, 2 and 3 (intensity metrics) reporting; Launch pilot industrial symbiosis networks among industrial parks
II: Investment & Capacity	Next 2 years of roadmap	Industrial Transition & FDI Mobilization	Operationalization of major recycling hubs; MoLISA fully integrates green skills (waste management, automation) into national VET system; MOIT converts 3 key TCVNs on efficiency into binding QCVNs; Launch dedicated Circular Skills Fund.
III: Scale & Competitiveness	Next 3 years of roadmap	Market Integration & Policy Maturity	Full enforcement of textile EPR collection and financial mechanism; Sector-wide achievement of 50% reduction in pre-consumer waste. Full harmonization and utilization of international standards (GRS, GOTS)

5.4. Expected outcomes

Here is a breakdown of the expected achievements for manufacturers after the successful completion of each phase.

1. Phase I: Foundation & Measurement (first 2 years)

This initial phase focuses on establishing the necessary data, systems and regulatory clarity to de-risk major future investments.

Table 5: Phase I summary

Manufacturer Achievement	Context and Impact
Regulatory and financial certainty	Manufacturers gain clarity on their long-term Extended Producer Responsibility (EPR) obligations once the mandatory recycling rate

	for textiles is defined. This allows for accurate financial planning and de-risks capital expenditure on recycling infrastructure.
Environmental performance baseline	Manufacturers complete initial Greenhouse Gas (GHG) reporting (Scope 1, 2 and 3 intensity metrics) using standardized methods. This data is essential for meeting forthcoming international transparency requirements, such as the EU's Corporate Sustainability Reporting Directive (CSRD)
Early waste reduction	Manufacturers participate in pilot industrial symbiosis networks, enabling them to identify and divert non-hazardous production waste (like polyester offcuts) to other industries or facilities. This reduces waste disposal costs and creates initial, minor new revenue streams.
mandatory compliance readiness	Manufacturers ensure strict adherence to existing mandatory regulations, such as QCVN 13-MT:2015/BTNMT for wastewater discharge, establishing a secure legal foundation for continued operation and export.

2. Phase II: Investment & Capacity (next 2 years)

This phase focuses on capital investment, developing physical recycling capacity and solving the critical labor skills gap.

Table 6: Phase II summary

Manufacturer Achievement	Context and Impact
Secure domestic recycling channel	Manufacturers gain a reliable, high-capacity domestic channel for textile waste off-take through the operationalization of major recycling hubs. This secure supply chain is vital for achieving verifiable recycled content goals.
Access to green-skilled labor	Manufacturers gain access to a larger pool of workers with specialized green skills, as the Ministry of Labor, Invalids and Social Affairs (MoLISA) integrates green and digital skills (e.g., waste management, automation) into the national Vocational Education and Training (VET) system
Just transition support	Manufacturers can leverage the newly launched Circular Skills Fund (financed in part by EPR contributions) to fund targeted retraining programs, minimizing social disruption and retaining valuable staff during automation-driven transitions.
Leveled competitive field	The conversion of key voluntary efficiency standards (TCVNs) into mandatory National Technical Regulations (QCVNs) ensures that all competitors must adhere to a high national standard for resource efficiency, rewarding manufacturers who invested early in sustainable technology.

3. Phase III: Scale & Competitiveness (next 3 years – long term)

The final phase focuses on maximizing economic returns and establishing Vietnam as a high-value, sustainable sourcing destination.

Table 7: Phase III summary

Manufacturer Achievement	Context and Impact
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Maximum material cost savings	Manufacturers realize maximum efficiency gains by achieving the target for pre-consumer waste reduction. By cutting fabric scrap from the typical 10–15% range, input material costs are significantly lowered, driving increased profitability.
Favorable eco-modulation fees	With the full enforcement of the EPR mechanism, manufacturers who actively incorporate certified recycled content (GRS/RCS) [16] and demonstrate high circularity will benefit from lower financial contributions under the EU's eco-modulation fee structure, securing a measurable competitive advantage over less sustainable exporters.
New revenue from circular models (CBMS)	Manufacturers successfully launch and scale up Circular Business Models (CBMs) such as repair, remaking and rental servicing. This diversification of income streams de-couples revenue growth from the production of new clothing volumes.
Premium market access	Manufacturers demonstrate full harmonization with stringent international standards (GOTS, GRS, OEKO-TEX) [7, 16], securing premium contracts and bolstering brand appeal to major global retailers and consumers committed to sustainability.

The framework, in summary, provides a structured, quantitative pathway for the sector's transition. It addresses the simultaneous demands of global regulatory compliance (EU EPR, CSRD) and national economic necessity (maintaining export competitiveness and achieving net-zero by 2050). The successful execution of this framework hinges on two immediate, high-leverage policy actions that manufacturers should lobby for: the rapid definition of the mandatory recycling rate (\$R\$) for textiles under the national EPR mechanism, which is necessary to de-risk and attract the required FDI in recycling infrastructure; and the creation of a robust Circular Skills Fund and definition of Green Jobs by MoLISA and MPI, which is essential to mitigate the social disruption caused by technological automation. By proactively elevating resource efficiency standards, rigorously adhering to prescriptive technical standards and strategically investing in skills for new circular business models, Vietnam can ensure that sustainability becomes its core, long-term competitive advantage in the global textile value chain.

VI. Conclusion

6.1. Summary

This thesis analyzes the application of circular economy practices in Vietnam's textile industry using the Return-Make-Use framework, with a special focus on bridging the gap between ambitious sustainability targets and practical implementation capacity at the local level.

The research benchmarks Vietnam's performance using the European Commission's Circular Economy Monitoring Framework (CEMF 2023), assessing eight key indicators across waste management, resource efficiency and product lifecycle management.

In this paper, some key findings are:

Key findings in Return phase:

- Vietnam's post-consumer textile waste collection is moderate and driven largely by brand-led take-back pilots; however, there is no nationwide system yet in place.
- The country achieves a strong 60% recycling rate for pre-consumer waste, outperforming comparable nations like Bangladesh (5–25%) and China (10%), but this is mostly downcycling, not textile-to-textile closed-loop recycling.
- Vietnam's textile sector generates about 250,000 tons of pre-consumer waste per year, with 45% being blended fibers, complicating future recycling upgrades.

Key findings in Make phase:

- Vietnam's manufacturing scrap rates are 10–15% during cutting, significantly lower than many regional competitors.
- Despite efficiency, the use of recycled content in domestic textiles remains critically low, with most recycled material sourced from PET bottles instead of textile waste.
- Large-scale textile-to-textile recycling facilities and robust compliance with international standards like the Global Recycled Standard (GRS) are still lacking, representing key policy and technical gaps.

Key findings in Use phase:

- Data on garment lifespan and usage is particularly limited, but patterns suggest growing fast-fashion consumption (average 13.3 pieces per person annually).
- Short use cycles and the rise in e-commerce heighten risks of accelerated textile waste generation.
- Although 81.3% of consumers ages 18–45 purchase sustainable products, hard data on garment longevity is still missing.

The Framework for Vietnam textile industry circularity developed through this paper provides a prescriptive, three-phase roadmap expanding 5 years which systematically addresses regulatory compliance, investment mobilization and market integration.

- Phase I (2 years): Build data infrastructure for tracking, finalize EPR rules with MONRE and begin mandatory GHG intensity reporting.
- Phase II (2 years): Invest in recycling infrastructure, embed green skills into national vocational education (VET) and start converting key voluntary (TCVN) standards into mandatory (QCVN) regulations.
- Phase III (3 years and more): Achieve full EPR enforcement, realize a 50% reduction in pre-consumer waste and position Vietnam globally as a premium circular textile sourcing destination.

The framework integrates most practical guidance of environmental, social and economic aspects. It should be noted that these aspects are of equivalent importance.

- Environmental: Emphasize advanced water recycling, expand renewables, adopt comprehensive Scope 1–3 GHG accounting and promote industrial symbiosis within textile clusters.
- Social: Prioritize dual skilling in digital and green transformation; have MoLISA lead the integration of waste and sustainability skills into national VET curriculum.
- Economic: Accelerate fabric scrap reduction for immediate savings, mobilize green finance through the VEPF and development banks, expand circular business models (rental, resale, repair, remaking) and pursue GRS/RCS certification for EU market eco-modulation benefits.

6.2. Implications and applications

The findings and framework developed in this research carry significant implications for multiple stakeholder groups and offer practical applications across policy, industry and academic domains.

6.2.1. Implications: what the finding means for stakeholders

a. For textile industry

The paper provides textile manufacturers with a structured roadmap for transitioning from reactive compliance to proactive competitive advantage. The framework's phased approach enables manufacturers to allocate investments strategically: establishing environmental baselines and regulatory compliance in Phase I, securing domestic recycling channels and accessing green-skilled labor in Phase II, and realizing maximum material cost savings and premium market positioning in Phase III.

According to analysis result, reducing fabric scrap rates from the typical 10–15% to below 7% could save approximately 12,500–18,750 tons of fabric annually from Vietnam's 250,000 tons of pre-consumer waste, translating to millions in raw material cost savings. Manufacturers incorporating certified recycled content will benefit from EPR eco-modulation structures, with potential fee reductions of 20–50% as seen in France's textile EPR scheme. For Vietnamese exporters to the EU market (12–16% of total exports), these represent substantial competitive advantages.

b. For manufacturers

The framework in this paper enables development of closed-loop systems for pre-consumer waste, investment in advanced sorting technologies (NIR, automated systems) to process the 45% of blended textile waste, and implementation of comprehensive traceability systems to verify recycled content and meet CSRD transparency requirements. For SMEs comprising 70% of the sector, the framework identifies accessible entry points including mandatory staff training in pattern optimization to reduce 10–15% cutting scrap, participation in industrial symbiosis networks to monetize waste streams, and leveraging VEPF financing for efficiency upgrades rather than requiring large upfront capital investments.

Manufacturers who target EU and US markets gain specific guidance on achieving market access requirements: increasing verified recycled content to meet Global Recycled Standard (50% minimum) and Recycled Claim Standard (5% minimum) thresholds, adopting comprehensive GHG accounting to calculate Scope 3 emissions using intensity metrics (CO₂ per functional unit), implementing design for durability protocols using standardized testing (ASTM D3787 for bursting strength, BS EN ISO 12945-2 for pilling resistance), and securing GOTS, GRS, and OEKO-TEX certifications to demonstrate environmental credentials and secure lower eco-modulation fees under anticipated EU regulations.

6.2.2. Applications: how to implement the findings

a. Academic research

The thesis develops a sector-specific adaptation of the EU CEMF framework for a developing economy context, providing methodological insights for researchers studying circular economy implementation in emerging markets. The systematic barriers and enablers analysis framework, distinguishing internal/external and operational/strategic/policy factors, offers a replicable methodology for other industries and countries facing similar transition challenges.

b. Industry sectors application

Other Vietnamese manufacturing sectors facing similar sustainability pressures, including electronics, leather and footwear, and plastics can refer to the paper as general guidance. The three-phase implementation logic including foundation/measurement, investment/capacity, scale/competitiveness provides a generalizable approach for industries characterized by export dependence, SME dominance, technology gaps, and international regulatory pressures. The stakeholder coordination model involving multiple ministries (MOIT, MONRE, MoLISA) and industry associations offers a template for orchestrating complex multi-stakeholder transitions.

6.3. Future works

This research establishes foundational understanding and provides a practical implementation framework, yet several critical areas require further investigation to advance circular economy adoption in Vietnam's textile industry and comparable contexts.

a. Quantitative impact assessment studies

The most priority for future research is quantitative studies. Future research should develop robust studies tracking actual implementation outcomes across environmental, social and economic dimensions. Specifically, researchers should establish baseline measurements and track changes in:

- material intensity ratios (kg raw material per kg finished product) across different factory sizes and production types
- actual recycled content ratios achieved in commercial production, distinguishing between mechanical and chemical recycling inputs
- pre-consumer and post-consumer waste generation rates with detailed compositional analysis by fiber type
- GHG emissions intensity (Scope 1, 2 and 3) per functional unit across different textile subsectors.

In the paper, it is already identified a 60% recycling rate for pre-consumer waste and a 10–15% fabric scrap rate during cutting. Future quantitative studies could establish whether targeted interventions can reduce scrap rates to below 7% (matching EU best practices) and increase textile-to-textile recycling from current negligible levels to 25–30% by 2030, potentially reducing CO₂ emissions by an additional 15–20% beyond current projections.

b. Product lifecycle studies

Consumer behavior and product lifecycle studies addressing the Use phase knowledge gaps identified in this research require urgent attention. Future research should conduct comprehensive wardrobe studies surveying representative samples across demographic segments (age, income, urban/rural) to establish baseline metrics for:

- average garment lifespan in months/years by product category (formal wear, casual wear, outerwear)
- utilization frequency (number of wears before disposal) and reasons for disposal (physical deterioration, style preferences, size changes)
- awareness and engagement with circular consumption behaviors (repair, resale, donation, rental)
- customer willingness to pay premiums for durable, repairable, or sustainably produced garments.

With Vietnamese consumers purchasing an average of 13.3 garments annually and 81.3% expressing interest in sustainable products, lifecycle studies could determine whether circular business models (repair, rental, resale) can extend average garment lifespan from the current estimated 2–3 years to 5–7 years. (Maldini, Klepp, & Laitala, 2025)

Evidence suggests that tripling garment lifespan reduces carbon footprint and water use by 65–66%, while extending average clothing life by nine months alone could save billions in resource costs. Increasing wears per garment from typical levels (109) to best practice (400) can decrease environmental impacts by 60–68%.

c. Regional expansion research

Region-wise research can include comparative cross-country research expanding beyond Vietnam's borders. Comparative cross-country research could identify whether policy instruments successfully implemented in Vietnam such as EPR frameworks and green skills integration can be adapted to achieve similar improvements across Southeast Asian textile economies. The Asia Pacific textile recycling market is projected to grow from USD 4.86 billion (2024) to USD 6.42 billion by 2033, with countries like South Korea achieving 80% textile recovery rates through EPR policies. If Vietnam's framework is replicated regionally, recycling rates could increase by 15 to 20% points within a 5-year implementation window. (Ho & Lin, 2025) Future research can conduct structured comparisons examining:

- how different policy instruments drive circular economy adoption across contexts with varying governance capacity
- what technological and business model innovations transfer successfully between developing and developed economies versus adaptations required

- how different industry structures (vertical integration versus cut-make-trim specialization) shape circular economy implementation pathways
- and what financing mechanisms effectively mobilize investment in different financial system contexts.



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Appendix

Appendix A: Benchmarking analysis result

Phase	KPI	Vietnam's Performance	Regional Benchmark (2-3 countries):	Global Benchmark
Return	Post-consumer waste collection	Collection pilots and brand take-back are increasing, supported by multi-stakeholder coalitions, but nationwide collection coverage remains limited; recyclers also report feedstock shortages and restrictions on importing used clothing as inputs—both dampen scalable collection outcomes.	India: ~3.94 Mt/yr of post-consumer textile waste are generated; only a small fraction is captured in circular channels due to fragmented collection. Bangladesh: Public evidence indicates minimal domestic collection of post-consumer textiles; post-consumer flows remain largely unmanaged	EU: In 2020, the EU-27 generated ~6.95 tonne textile waste (~16 kg per capita), of which ~4.4 kg/capita were separately collected for reuse/recycling (baseline). From 1 Jan 2025 all Member States must run separate collection systems; several (e.g., France, NL) deploy EPR to finance collection & sorting. France reports ~31% separate collection relative to 2022 placed-on-market volumes—illustrating higher maturity than the EU average
Return	Recycling rate	On the pre-consumer side, ~250,000 t/yr arise, with ~60% going to basic (mostly down-cycling) routes and ~40% to WtE/other—pointing to sorting quality gaps; post-consumer sorting is expanding from a low base and needs NIR/automated upgrades	Japan: Chemical recycling converts used clothing polyester to virgin-equivalent resin (e.g., JEPLAN, BRING), a processing strength that lifts quality and end-market value; however, mixed-fibre streams still face system challenges.	EU: The EEA (European Environment Agency) mentioned that while separate collection is expanding, sorting & recycling capacity must scale to avoid diversion to export/incineration. the EU runs multiple automated sorting and fibre-to-fibre initiatives (e.g., Sorting for Circularity)

		to raise material recovery rate.	Bangladesh: Sorting and processing remain under-developed domestically; much waste is down-cycled or exported, and reports document social risks within informal sorting networks	projects) that underpin high processing rates in leading countries.
Make	Scrap rate & byproducts generation during manufacturing	<p>Scrap Rate: 10-15% waste ratio to fabric used during cutting processes</p> <p>Annual Generation: Approximately 250,000 tonnes of pre-consumer textile waste from export production (2022 estimate)</p> <p>Composition: 35% polyester-rich, 20% cotton-rich, 45% blended materials</p> <p>Current Management: 60% sorted and recycled (predominantly downcycling); 40% directed to waste-to-energy or disposal</p>	<p>Bangladesh:</p> <p>Scrap Rate: 20% classified as Jhut/Jhoot waste with 30% total material loss throughout the entire production process</p> <p>Annual Generation: 500,000-700,000 tons of pre-consumer textile waste annually</p> <p>Recycling Rate: Only 5-25% currently recycled</p> <p>Performance Gap: Bangladesh generates significantly higher waste (20-30% vs Vietnam's 10-15%) but has much lower recycling rates (5-25% vs Vietnam's 60%)</p> <p>China:</p> <p>Annual Generation: Over 100 million tonnes of pre-</p>	<p>EU Focus: Primary emphasis on post-consumer waste (82% of total textile waste)</p> <p>Pre-consumer Data: Limited specific manufacturing scrap rate data; EU has lower production volumes but stricter waste management regulations</p> <p>Collection Rate: Currently 12% average capture rate for textile waste, with separate collection mandatory from 2025</p> <p>Waste Hierarchy: Strong policy framework prioritizing waste prevention, reuse, and recycling over disposal</p>

			<p>consumer textile waste annually (as major global manufacturer)</p> <p>Recycling Rate: Approximately 10% of fiber waste is recycled</p> <p>Performance Gap: While China is the world's largest producer, its pre-consumer recycling rate (10%) is significantly lower than Vietnam's (60%)</p> <p>Thailand & Indonesia:</p> <p>Limited specific pre-consumer waste generation data available</p> <p>Thailand: Growing market with focus on sustainability initiatives</p> <p>Indonesia: Estimated 3.9 million tonnes total textile waste by 2030; 2.3 million metric tonnes in 2021</p>	
Make	Recycled content ratio	<p>Current Range: 1-50% recycled PET from fabric waste in feedstock (varies significantly by recycler)</p> <p>Pilot Initiatives: Target of 30% recycling content from textile-to-textile recycling in development</p>	<p>Bangladesh:</p> <p>Currently focuses on developing recycling capacity rather than achieving specific recycled content ratios</p> <p>Major infrastructure gap</p>	<p>EU: Current State (2024):</p> <p>4% recycled content achievable without any changes to current practices (based on 38% collection rate)</p> <p>Current mono-material fraction: 22% of total</p>

		<p>Limitation: Most textile-to-textile recycled polyester materials (yarn and fabric) are currently imported; Vietnam produces recycled polyester fiber from PET bottles but not yet from textile waste at scale</p>	<p>with only 5-25% of pre-consumer waste being recycled</p> <p>China:</p> <p>As major manufacturer, working on circular economy policies but limited specific recycled content ratio data available</p> <p>Focus on expanding chemical recycling capabilities and fiber-to-fiber technologies</p>	<p>garments in EU market</p> <p>Progressive Targets:</p> <p>2027: 60% collection rate projected → supports higher recycled content</p> <p>2030: 80% collection rate → 14-15% recycled content achievable</p> <p>2035: 100% collection rate → 43% recycled content projection</p> <p>Minimum Target: Realistic 15% recycled content achievable with careful waste management</p> <p>Japan:</p> <p>Current: 34% of discarded clothing recycled or reused</p> <p>Target: 50,000 tons of recycled fiber production by FY2030</p> <p>Government-led initiatives promoting textile-to-textile recycling technologies</p> <p>Global Standards:</p> <p>Global Recycled Standard (GRS): Minimum 50% recycled content for consumer-facing labels;</p>
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				20% for business-to-business transactions Recycled Claim Standard (RCS): Minimum 5% recycled content tracked; encourages higher proportions
Use	Product life span	<p><i>Vietnam-specific data on garment lifespan and utilization intensity is extremely limited in academic and governmental sources. Most available data focuses on Vietnam as a production hub rather than consumption patterns. The benchmarking therefore relies on:</i></p> <p><i>Regional Southeast Asia consumption trends</i></p> <p><i>Global wardrobe studies from comparable countries</i></p> <p><i>Vietnam's stated consumer behavior patterns</i></p> <p>Direct Data: No academic or governmental statistics available on average garment lifespan in years</p> <p>Consumption Patterns: 13.3 pieces purchased per person annually (2025)</p>	<p>Common Pattern: Heavy social media influence (9+ hours internet daily in Philippines) driving fast fashion turnover</p> <p>Thailand: Fashion consumption heavily influenced by online trends; K-fashion wave driving purchases</p> <p>Indonesia: Pandemic increased casual/sporty clothing; children's apparel showing faster growth due to higher birth rates</p> <p>Malaysia: High e-commerce adoption for fashion; growing middle-class driving consumption</p> <p>Trend: All Southeast Asian markets showing shorter use-time patterns due to social media and online shopping influence</p> <p>China:</p>	<p>United Kingdom:</p> <p>Lifespan: Study shows 5.3 years for single user; 12.7 years with second user</p> <p>Wardrobe Size: UK adults own average 118 items</p> <p>Non-Use Rate: 26% of garments unworn for 1+ year; 1.6 billion items unworn in UK wardrobes</p> <p>Trend: Garment lifespan declined 36% over past 15 years</p> <p>EU Average:</p> <p>Consumption: Europeans consume ~27kg of textiles/clothes annually</p> <p>Growth: 40% increase in clothing purchases per person between 1996-2012</p> <p>Lifespan Decline: Use-time reduced 36% in past 15 years</p> <p>Active Use: Less than 30% of wardrobes actively worn</p>

		<p>projection)</p> <p>Consumer Behavior: 81.3% of Vietnamese consumers aged 18-45 have purchased or utilized sustainable fashion products; growing engagement with second-hand and thrifted items</p> <p>Market Context: Vietnam apparel market valued at \$4.66 billion (2024), projected 12.80% CAGR growth through 2034</p>	<p>Lifespan Data: Study participant data shows 5.3 years average for first user; 12.7 years with second user</p> <p>Consumption: 30 pieces purchased per person annually; 62kg CO2e/capita fashion footprint (2030 projection)</p> <p>Pattern: Rapid growth in consumption correlating with shorter lifespans</p> <p>Japan: Lifespan Data: Study participant data shows 5.3 years average for first user</p> <p>Consumption: 26 pieces purchased per person annually</p> <p>Recycling: 34% of discarded clothing currently recycled or reused; government target of 50,000 tons recycled fiber by FY2030</p> <p>Cultural Shift: Traditional longer-lifespan culture shifting toward fast fashion patterns</p> <p>South Korea: Limited Data: No specific lifespan statistics available</p>	<p>in some EU markets</p> <p>Belgium</p> <p>Wardrobe Size: Average 169 garments owned per person</p> <p>Essential: Only 90 garments (53%) deemed essential; 138 garments (81%) used in past year</p> <p>Range: Essential wardrobe ranged from 36-275 garments (28%-98% of total wardrobe)</p> <p>Germany, France:</p> <p>Lifespan: Study participant data: 5.3 years average for first user</p> <p>Price Trend: Clothing prices dropped 30% (EU) to 70% (Germany) from mid-1990s to mid-2010s</p> <p>United States:</p> <p>Lifespan: Study participant data: 5.3 years for single user; 12.7 years with second user</p> <p>Purchases: 53 pieces per person annually purchased; 88.9 pieces/person volume in 2025</p>
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			<p>Market Influence: K-fashion driving regional trends; Korean platforms (Musinsa, ABLY, NUGU) expanding rapidly in Asia</p> <p>Pattern: Fast fashion adoption increasing among younger demographics</p> <p>Bangladesh: Focus: Major production hub; limited consumption pattern data available</p> <p>Note: As primary garment manufacturer for global brands, focus is on production efficiency rather than domestic consumption</p>	<p>Fast Fashion: Dominant fast fashion culture with declining garment lifespans</p> <p>Australia:</p> <p>Consumption: Highest among G20: 27kg purchases, 23kg discards annually</p> <p>Carbon Footprint: 503kg CO2e/capita/year from fashion—highest globally</p>
Use	Garment Utilization Intensity (Frequency)	<p>Direct Data: No academic or governmental statistics available on average number of wears</p> <p>Consumption Volume: 13.3 pieces purchased per person annually</p> <p>Consumer Behavior: Growing interest in second-hand shopping among Gen X and Gen Y; proliferation of thrift stores</p>	<p>Southeast Asia General:</p> <p>Social Media Impact: Fashion choices heavily influenced by online content; prolonged internet browsing (>9 hours daily in some markets) stimulates purchasing demands</p> <p>Pandemic Shift: Increased demand for casual/sporty clothing;</p>	

		<p>both physical and online</p> <p>Market Growth: Rapid expansion indicates high turnover and shorter utilization cycles</p>	<p>decreased demand for workwear (-7% for dresses in Indonesia)</p> <p>E-commerce: Fashion categories (especially women's apparel, accessories) consistently top bestsellers on Shopee, Lazada, TikTok</p> <p>Pattern: High purchase frequency driven by social media trends; shorter utilization before replacement</p>	
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Appendix B: Barriers and enablers factors

Type	Description	Impact on KPI	Phase	Factor
Internal	System Gap	Vietnam currently lacks a mandated nationwide system for collecting post-consumer textiles (discarded household clothing), which is a major policy deficiency. This failure to formalize a consistent collection stream means most post-consumer textiles enter the general municipal solid waste stream, leading directly to feedstock shortages for local recyclers, despite high demand.	Return	Barrier
Internal (Policy)	Waste Import Prohibition	Vietnamese regulations do not permit the formal import of textile waste. While this policy aims for environmental control, it acts as a significant barrier by limiting the potential scale of feedstock supply. This forces local recyclers to rely on inconsistent domestic supply or, in the south, an informal flow of cotton-rich waste from neighboring countries like Cambodia to meet production demand.	Return	Barrier
Internal (Structural)	Pre-existing Local Network	Vietnam possesses a decentralized, established network of over 230 waste collectors and pre-processors, and 40 operational recyclers focused on industrial waste. This existing logistical infrastructure is a major advantage. It indirectly supports post-consumer collection pilots and can be formalized under a government-backed system, allowing Vietnam to potentially bypass collection bottlenecks faced by more industrialized nations.	Return	Enabler
External	External Market Pressure	The mandatory Extended Producer Responsibility (EPR) schemes in key export markets, such as the European Union (EU), require Vietnamese producers exporting to these regions to cover the costs of end-of-life management (collection, sorting, recycling). This indirectly pressures producers to ensure a local recycling infrastructure exists and functions,	Return	Enabler

		enhancing the long-term feasibility of domestic collection.		
Internal (Operational)	Contamination and Poor Segregation	Pre-consumer waste, while high volume (250,000 tonnes/year), frequently exits factories as mixed or "contaminated waste" containing non-textile materials, paper, plastic, and dust.[4] This low-quality input means that 60% of the currently recycled waste is channeled into low-value processes, predominantly downcycling into lower-quality products, directly impeding the achievement of high-value fiber-to-fiber recycling goals.	Return	Barrier
Internal (Technical)	Technological Gap	Current recycling methods are dominated by basic mechanical and thermo-mechanical processes. The lack of investment in advanced sorting technologies like Near-Infrared or automated systems prevents the efficient separation of mixed-fiber textiles (which account for 45% of pre-consumer waste) This technological bottleneck severely restricts the ability to produce high-quality, certified recycled fiber for new apparel, keeping the net recycling rate low.	Return	Barrier
Internal (Structural)	High Volume of Pre-consumer Scrap	The textile export industry generates a consistently high and reliable volume of pre-consumer waste, estimated at 250,000 tonnes annually. This guaranteed, large-scale feedstock directly enables the existence of the current domestic recycling sector (40 companies) and provides a sufficient volume base to justify future investment in advanced, high-capacity sorting and processing facilities.	Return	Enabler
External (Technical)	Global Innovation Models	Global leaders like Japan are actively converting used polyester clothing into virgin-equivalent resin through chemical recycling. The existence of these proven, high-quality chemical recycling models provides a clear technological roadmap for Vietnam	Return	Enabler

		to invest in, overcoming the local challenge of blended materials.		
Internal (Operational)	Lack of Source Segregation	In most factories, little to no segregation occurs at the source. Waste exits as "contaminated waste," mixing fabric scraps with dust, paper, and plastic.[1] This directly limits the purity and value of the material, meaning 60% of recycled scrap is forced into downcycling rather than high-value fiber-to-fiber routes.	Make	Barrier
Internal (Structural/Incentive)	Low Economic Priority for Waste Prevention	The textile sector operates primarily on a high-volume, low-margin, cut-to-pack model, driven by export quotas. The low intrinsic cost of virgin materials and the focus on maximizing output volume mean that waste prevention and maximizing fabric yield are often secondary to speed and cost reduction, indirectly influencing the 10–15% scrap rate.	Make	Barrier
Internal (Structural/Economic)	Consistent Economic Incentive for Capture	Manufacturers have an established practice of selling or giving fabric waste to scrap buyers and waste collectors. This existing market mechanism ensures a high capture rate for pre-consumer waste (approximately 60% of the 250,000 tonnes generated annually), providing a guaranteed and reliable base volume for the recycling sector.	Make	Enabler
Internal (Strategic)	Government Modernization Mandate	The national strategy aims to transform the textile sector into a high-tech, innovative industry by 2030, shifting away from low-skilled labor dependence. This strategic goal indirectly supports investment in efficiency improvements, digital cutting technologies, and processes that naturally reduce cutting scrap and production errors.	Make	Enabler

Internal (Technological)	Limited Domestic Fiber-to-Fiber Capacity	The majority of domestic recycling relies on basic mechanical processes, resulting in downcycled fiber. Vietnam's capacity to produce high-quality, certified recycled polyester fiber from textile waste at scale is low; most advanced T2T recycled materials currently used are imported. This directly limits the national "recycled content ratio" KPI for high-value products.	Make	Barrier
Internal (Technical/Regulatory)	Input Material Toxicity and Composition	Achieving certified recycled content requires the original material inputs to be "safe and non-toxic," avoiding substances like hazardous dyes and synthetic additives. The continued use of these chemicals in conventional, low-cost fabrics compromises the ability to recycle the material into new high-quality apparel, preventing closed-loop production.	Make	Barrier
External (Market Pressure)	External Regulatory Market Pull	Key export markets, notably the EU, are introducing the Ecodesign for Sustainable Products Regulation (ESPR) and the Extended Producer Responsibility (EPR) directive. These policies mandate that products sold in the EU must be "durable, repairable, and recyclable," and "to a great extent made of recycled fibres." This external pressure directly compels Vietnamese exporters to use higher certified recycled content to maintain market access and competitiveness.	Make	Enabler
External (Technical)	Global Innovation Roadmap	The existence of commercially viable chemical recycling technologies globally, particularly in countries like Japan (converting used polyester to virgin-equivalent resin), provides a clear, proven technological path for Vietnam to adopt.[[6]], This allows Vietnam to potentially leapfrog intermediate mechanical recycling stages to overcome the challenge of mixed-fiber textiles.	Make	Enabler

External/Internal (Cultural/Market)	Hyper-Fast Fashion and Psychological Obsolescence	The proliferation of low-cost, trendy clothing and aggressive promotion through social media platforms fuels an acute culture of psychological obsolescence. This directly causes the alarming finding that 43% of Vietnamese consumers discard clothing after wearing it only once, dramatically pushing the average utilization intensity down and shortening product life span to less than a year for 27% of consumers.	Use	Barrier
Internal (Market Structural)	Low Purchase Price and Quality Compromise	The domestic market is saturated with affordable, lower-quality textiles, often polyester-based, driven by manufacturers prioritizing cost and speed. The low purchase price reduces the consumer's perceived value of the garment, making disposal easy and incentivizing frequent replacement rather than repair or sustained use. This directly undermines durability, a key requirement for product lifespan.	Use	Barrier
Internal (Structural/Service Gap)	Lack of Formal Reuse/Repair Infrastructure	The ecosystem for garment extension services, such as professional repair, rental, and official take-back programs, is underdeveloped. When a garment tears or trends change, consumers lack convenient, profitable, or reliable alternatives to disposal, leading to the estimated 85% of household textile waste ending up uncollected in the general waste stream (based on typical EU figures).	Use	Barrier
Internal (Socio-cultural)	Youth Interest in Second-Hand Consumption	Young Vietnamese consumers (Generation Z) are showing a growing trend and interest in purchasing second-hand and reused clothes, often driven by uniqueness and value. This willingness to engage in reuse represents a crucial, organic market enabler for extending the number of users per garment and extending the overall product life span.	Use	Enabler

Internal (Socio-cultural)	High Consumer Sustainability Awareness	A significant portion of Vietnamese consumers (74%) express a strong willingness to pay up to 20% more for products made from recycled or sustainable materials. This high aspirational awareness indicates that consumers are receptive to behavioral shifts and are willing to support brands that credibly facilitate longer product life spans and lower environmental impact.	Use	Enabler
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