



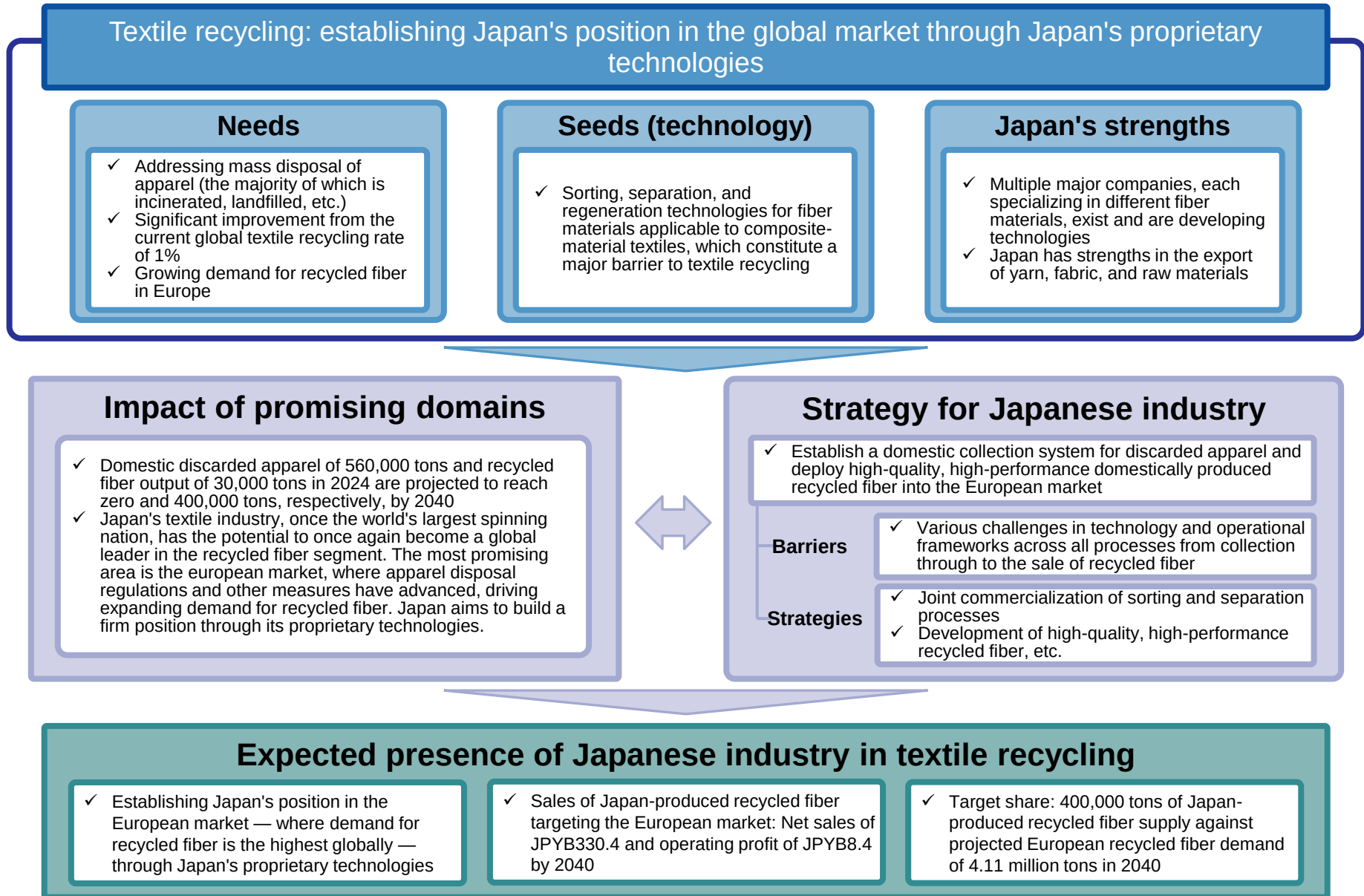
Textile Recycling

The potential of Japan's fiber regeneration technologies in addressing the global waste apparel challenge

March, 2026

Industry Research Department
Mizuho Bank

Strategy for capturing the textile recycling market and the expected presence of Japan in 2040



Transforming the textile industry, which faces a range of challenges including environmental issues, through Japan's proprietary technologies

■ Background and Issues

- The global textile industry faces challenges including large-scale CO2 emissions resulting from the mass production and mass disposal of apparel and other goods. Significant CO2 is emitted at various stages, including cotton cultivation, the manufacturing of synthetic fiber raw materials, the dyeing process which consumes large quantities of chemicals and water, and the incineration of discarded apparel.
- Much of apparel is composed of composite-material fibers, making recycling difficult; the majority of discarded apparel generated in developed countries is incinerated or landfilled. As the appropriate recycling method differs for each fiber type, technological innovation is required, including separation into single-material components. Recycling technologies for composite-material fibers have yet to be established, and the global recycling rate for discarded apparel remains at approximately 1%.
- Japan's textile industry has strengths in recycling technologies for single-material fibers and has the potential to lead in recycling technologies for composite-material fibers. With demand for recycled fiber growing, particularly in Europe, Japan faces the risk of losing its ability to export textiles if it fails to engage in textile recycling; accordingly, Japan's textile industry finds itself in a position where it must take on the challenge of the recycled fiber segment in order to survive.

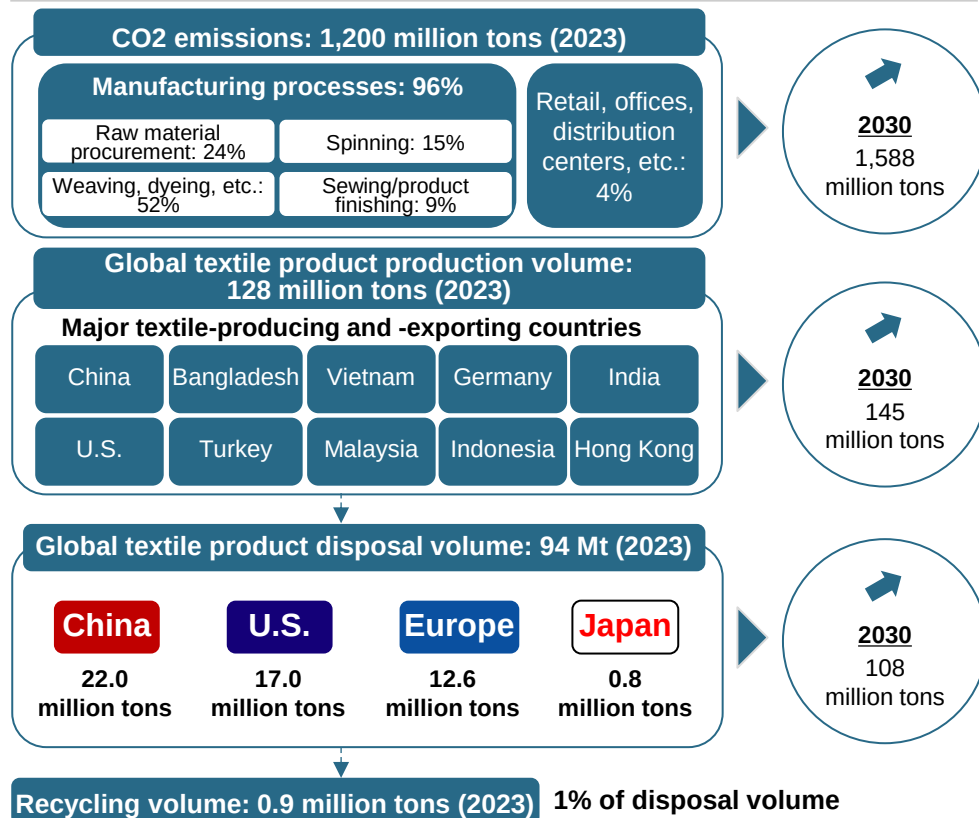
■ Summary

- Japan, once the world's largest spinning nation, is currently at a competitive disadvantage in the commodity segment due in part to China's expansion; however, it maintains competitiveness in high-quality, high-performance fibers.
- Major domestic textile companies have focused on R&D and have refined their proprietary fiber regeneration technologies; fiber regeneration methods for single-material fibers are in the process of being established.
- Domestic textile companies with expertise in respective segments will collaborate closely to establish a framework for textile recycling targeting composite-material fibers — something yet to be realized anywhere in the world. Technology development is particularly required in the separation and regeneration processes, and consortia are also being established domestically toward this end.
- Assuming exports of Japan-produced recycled fiber targeting the European market — where demand for environmentally conscious materials exists among overseas markets — net sales of JPYB330.4 and operating profit of JPYB8.4 are projected by 2040, representing a recycled fiber market capture exceeding the business scale of a major textile trading company.
- Achieving profitability by 2030 will be difficult, given the time required to establish technologies and build the requisite recycling frameworks; however, given expectations that textile recycling technologies will become a future strength of Japan, the significance of engaging in this area over the medium-to-long term with government support is assessed to be high.
- Over the longer term, prospects include providing the discarded apparel regeneration technologies established in Japan to textile companies in Asia, and recycling discarded apparel overseas on a local basis, thereby establishing Japan's position in the new and promising fiber regeneration market over the long term.

Japan-originated advanced recycling technologies expected to address challenges in the global textile industry

- The textile industry continues to face challenges of mass production and mass disposal driven by the rise of fast fashion, resulting in large-scale CO2 emissions, heavy consumption of water resources, and pollution. According to the United Nations Conference on Trade and Development (UNCTAD), it is the second most environmentally damaging industry after the petroleum industry.
- The global recycling rate for textile products is a mere 1%, making the establishment of recycling technologies an urgent challenge. Technologies originating in Japan are expected to enable the use of fibers recycled from discarded apparel, facilitating a departure from the mass production and mass consumption social model.

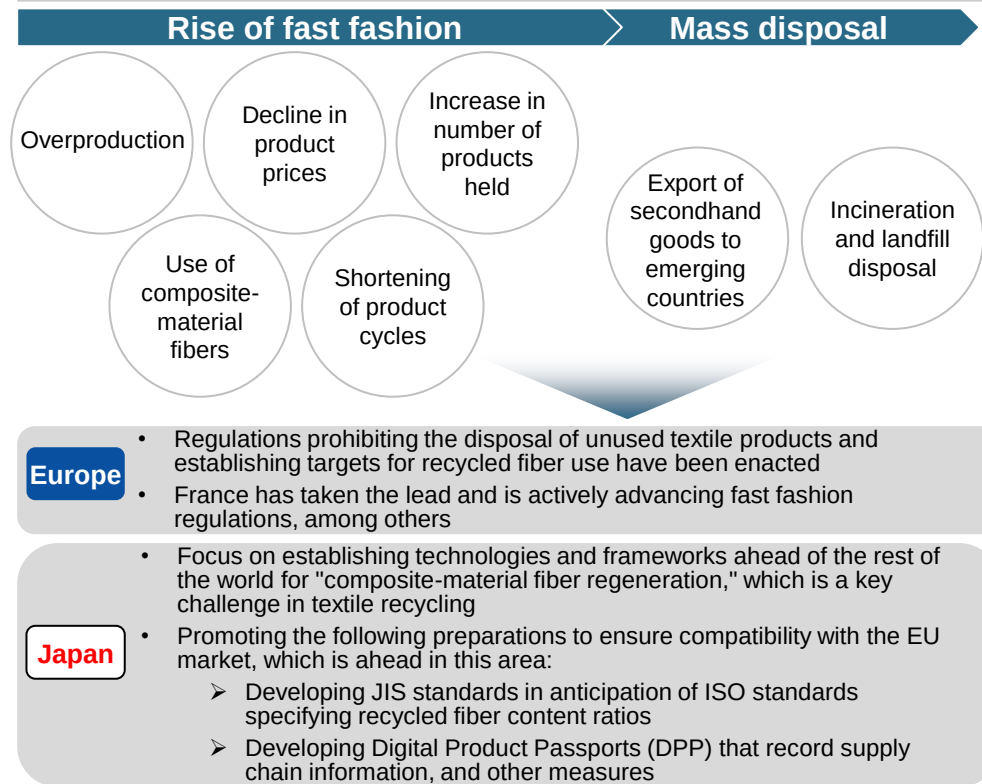
Overview of environmental burden, production volume, and recycling volume in the global textile industry



Note: Textile products: textile goods including apparel, household items, and industrial materials made from cotton, synthetic fibers, blended fibers, etc.

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Frost & Sullivan, *Growth Opportunities for Sustainability and Circular Economy in the Global Textile Industry*, and other sources

Social impact of the textile industry and EU/Japan policy approaches to social challenges



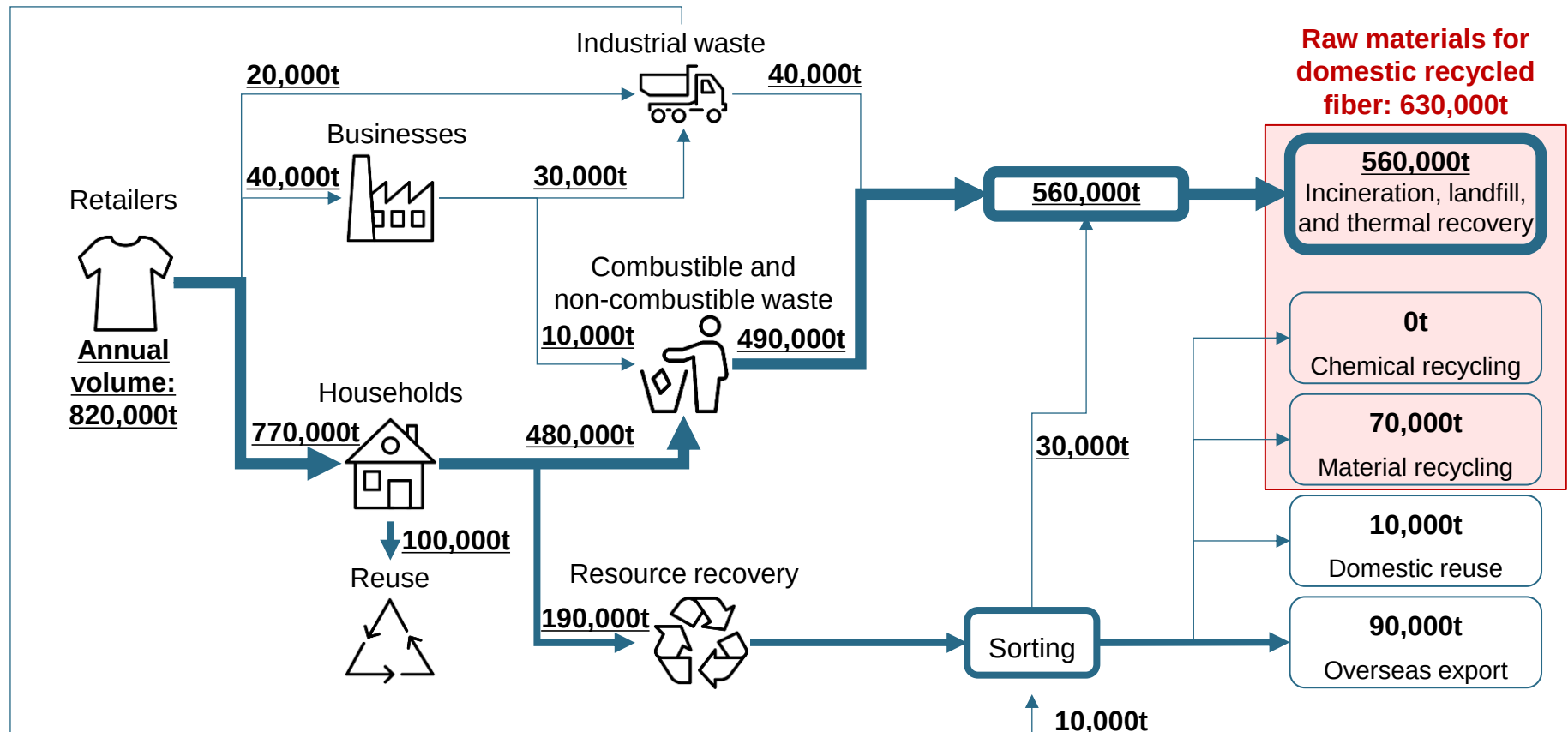
Note: DPP: Digital Product Passport: a certificate recording various types of information to ensure traceability

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Ministry of the Environment, "Current Status toward Building a Resource Circulation System for Apparel" (October 2025); Ministry of Economy, Trade and Industry, "Progress of the Resource Circulation Roadmap for Textile Products" (January 2026); and other sources

Material flow of domestic apparel in 2024: 560,000 tons incinerated, landfilled, or subject to thermal recovery without recycling or reuse

- Of the 820,000 tons of domestic apparel disposed in 2024, 560,000 tons were subject to incineration, landfill, and thermal recovery, with virtually no recycling taking place.
 - The total pool of discarded apparel that could potentially serve as raw materials for domestic recycled fiber production is 630,000 tons (560,000 tons subject to incineration and landfill, etc. + 70,000 tons subject to chemical recycling and material recycling).

Material flow of domestic discarded apparel (2024)

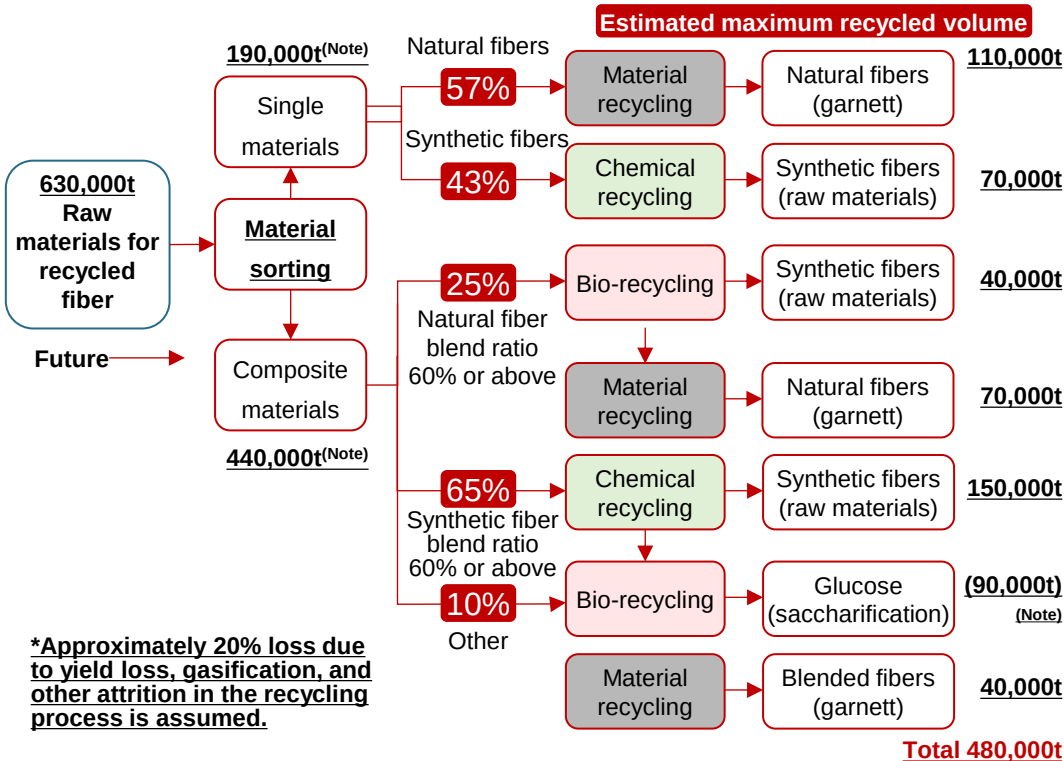


Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Ministry of the Environment materials, and other sources

Recycling technologies suited to each material composition exist for fibers, and maximizing recycled volume through full utilization of single-material recycling technologies

- As apparel is manufactured from a variety of materials, selecting the appropriate recycling method according to material composition to maximize recycled volume is critical.
 - If all domestically discarded apparel in 2024 could be recycled, the recycled fiber volume is estimated at 480,000 tons, representing the potential for a significant increase from the current level of 30,000 tons.
- Major domestic textile companies are developing fiber recycling technologies in their respective areas of expertise, and a range of methods are in the process of being established.

Projected future recycling flow for domestic discarded apparel based on 2024 results



*Approximately 20% loss due to yield loss, gasification, and other attrition in the recycling process is assumed.

Note: Of the combined 630,000 tons of industrial waste and combustible/non-combustible waste, single materials are assumed to account for approximately 30% and composite materials for approximately 70%. Other ratios are also assumed based on Ministry of the Environment surveys, etc. Saccharification is not included in recycled volume as it does not directly regenerate into fiber.

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Ministry of the Environment materials, published materials from each company, and other sources

Recycling technology development trends among major domestic textile companies

Kurabo Industries	• Garnetting (cotton): Producing high-quality recycled cotton primarily by crushing and napping offcuts from factories
Nikke (The Japan Wool Textile Co., Ltd.)	• Garnetting (wool): Producing high-quality recycled wool by cutting, crushing, and napping products such as coats
Toray Industries	• Fishing net-to-fishing net: Developed recycled nylon yarn for fishing nets using discarded fishing nets as raw materials, with physical properties comparable to those of virgin materials
Teijin Frontier	• Developed a new BHET method^(Note) that enables suppression of discoloration, which was difficult with the conventional BHET method
Toyobo	• Separation of PET and cotton using hot water: cotton yarn strength decreases at higher processing temperatures (40% of pre-treatment strength at 220° C)
Nisshinbo Textile	• Developed a technology to recycle 100% cotton fabric into regenerated cellulose fiber using ionic liquids

Note: BHET method: one of the chemical recycling methods that chemically decomposes used polyester

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on published materials from each company, and other sources

Material recycling and chemical recycling as the mainstream fiber regeneration technologies

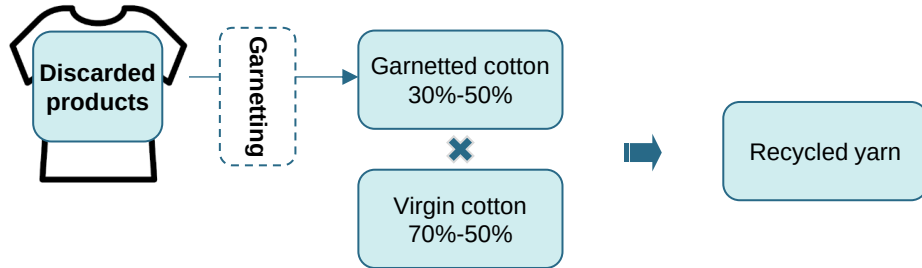
- Fiber recycling is broadly divided into material recycling, which regenerates discarded apparel without breaking down the molecular structure through physical processes such as loosening of fibers or melting into pellets, and chemical recycling, which breaks down fibers via chemical reactions to return them to raw materials (such as monomers).
- Material recycling is mechanical and inexpensive due to its simple process, but the accumulation of additives and adhered substances limits the number of recycling cycles and renders post-recycling quality unstable. Chemical recycling can achieve quality close to virgin materials but is high-cost and high-energy.

[Material recycling] technologically established / commercialized

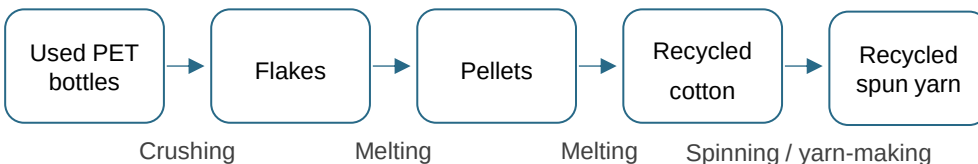
Garnetting

- Description: Primarily targets natural fibers. Apparel and other items are mechanically crushed and napped with needles to regenerate the material into a fibrous cotton-like state.
- Characteristics: With current technology, the regenerated fibers are short, making spinning difficult.
- Cost: A low-cost recycling method with low introduction costs.

1 Spinning recycled cotton yarn by blending garnetted cotton with virgin cotton



2 [Other material recycling example] synthetic fibers regenerated into fiber form through thermal melting



Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on published materials from each company, and other sources

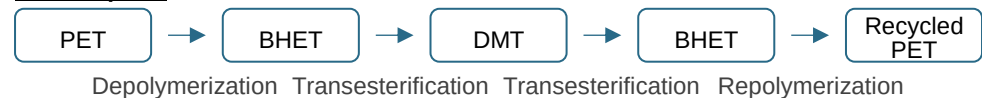
[Chemical recycling] technologically established / commercialized

Depolymerization, etc.

- Description: Primarily targets synthetic fibers. Chemical treatment returns them to raw materials.
- Characteristics: The quality of recycled fiber is high. However, for composite-material fibers blended with natural fibers, the natural fibers are damaged and currently disposed of.
- Cost: High burden for both capital investment and running costs.

1 Examples of methods that regenerate to quality equivalent to virgin materials through chemical decomposition^(Note)

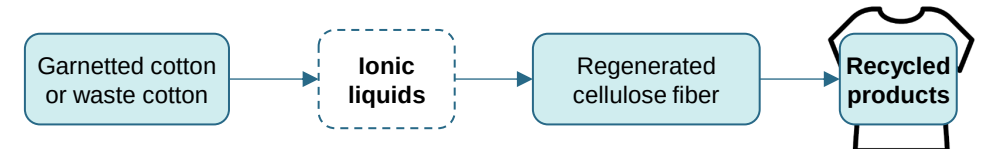
[DMT method] Minimal quality degradation through recycling, but high energy consumption



[BHET method] Quality decreases due to residual foreign matter such as dyes and discoloration, but energy-efficient



2 [Other chemical recycling example] regeneration of cellulose fiber using ionic liquids



Note: PET refers to PET bottles, polyester fibers, etc.; BHET refers to the intermediate raw material bis(2-hydroxyethyl) terephthalate; DMT refers to dimethyl terephthalate; depolymerization refers to decomposition into monomer units; transesterification refers to a reaction in which esters and alcohols react and the main chain is replaced.

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on published materials from each company, and other sources

Development of bio-technology-based recycling methods underway as new fiber recycling approaches

- To recycle each fiber by its optimal method, it is necessary to first separate composite-material fibers into single materials. As this is difficult with existing material and chemical recycling technologies, companies are developing new approaches, such as separating only specific fibers using bio-technology.
- As separation into single materials progresses through the use of bio-technology, the volume of fiber that can be regenerated from textile waste — previously disposed of due to inapplicability of existing recycling technologies — is expected to increase.

[Bio-Recycling] Not yet technologically established / not yet commercialized

Decomposition and saccharification using enzymes and microorganisms

- Description: Targets composite-material fibers. Uses microorganisms and enzymes to decompose specific fibers.
- Characteristic 1: Decomposes synthetic fibers from composite-material fibers without damaging natural fibers.
- Characteristic 2: Saccharifies cotton and other materials damaged by chemical recycling to produce glucose (used as raw material for ethanol, etc.).
- Cost: Highest burden in both capital investment and running costs.

1 Increase in the volume of garnetted natural fibers from composite fibers that could not be recycled through chemical treatment

- When blended fibers of synthetic fibers with cotton or wool are subjected to chemical recycling, the cotton or wool is damaged and cannot be regenerated as fiber. By decomposing only the synthetic fibers with bio-technology, the remaining natural fibers can be recycled through existing material recycling methods such as garnetting.

2 Expanded use of ionic liquids through bio-technology-based removal of impurities adhered to fibers

- Regeneration of cellulose fiber using ionic liquids requires high-purity cellulose raw materials. By using bio-technology to remove resin processing agents and other substances adhered to fibers, the volume of regenerated cellulose fiber increases.

Development trends in fiber-related bio-technology being pursued by major domestic textile companies and others

Teijin Frontier

- Establishment of mass production technology using chassis microorganisms with PET separation/useful-chemical production capabilities

Toray Industries

- Development of mass production technology for chassis microorganisms with PET separation/fiber raw material production capabilities

RITE

- Establishment and advancement of innovative bio-upcycling technology based on bio-separation and bio-conversion of composite fiber materials

Kurabo Industries

- Conversion of natural fiber separation components, primarily cellulose-based fibers, into fiber raw materials
- Development of decomposition enzymes for natural fiber dyes and development of reaction systems

Nisshinbo Textile

- Development of enzymes and construction of reaction systems for converting natural fiber separation components, primarily cellulose-based fibers, into fiber raw materials
- Development of pretreatment technology and resource recovery technology for cotton-blended apparel

Nikke (The Japan Wool Textile Co., Ltd.)

- Development of pretreatment technology and re-resourcing technology for wool-blended apparel
- Development of separation and resource recovery technology for cotton-based products

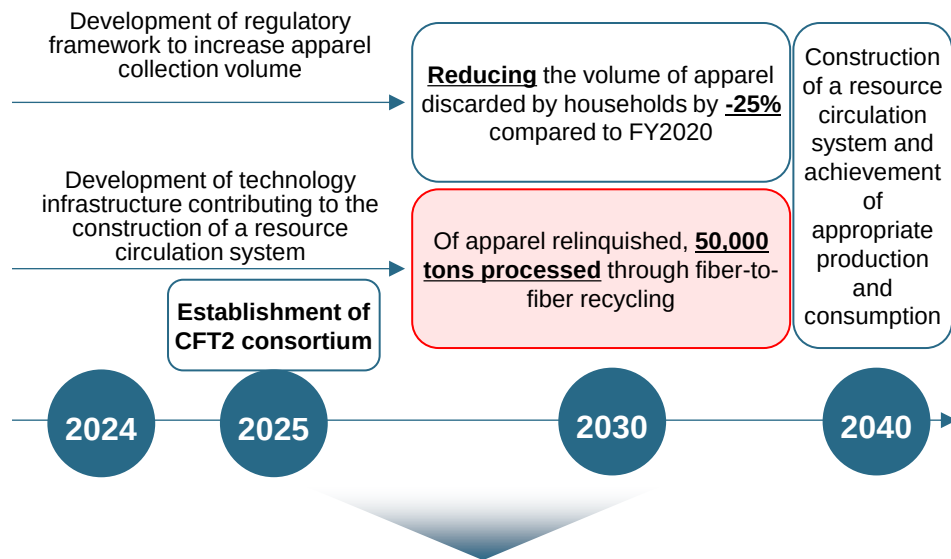
Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on published materials from each company, and other sources

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on published materials from each company, NEDO materials, and other sources

Projected production volume of recycled fiber from domestic discarded apparel: 400,000 tons by 2040

- The Resource Circulation Roadmap for Textiles established by the Ministry of Economy, Trade and Industry sets a target of producing 50,000 tons per year of fiber recycled from apparel by 2030.
- Based on the trend in annual per-capita apparel disposal volume, the 2040 disposal volume is estimated at 4.7 kg/person. Based on the domestic population forecast, domestic discarded apparel is projected to reach 530,000 tons per year by 2040. If all of this could be circulated as a resource for recycled fiber, 400,000 tons of recycled fiber are expected to be produced annually.

Government target for domestic recycled fiber from discarded apparel: 50,000t per year by 2030

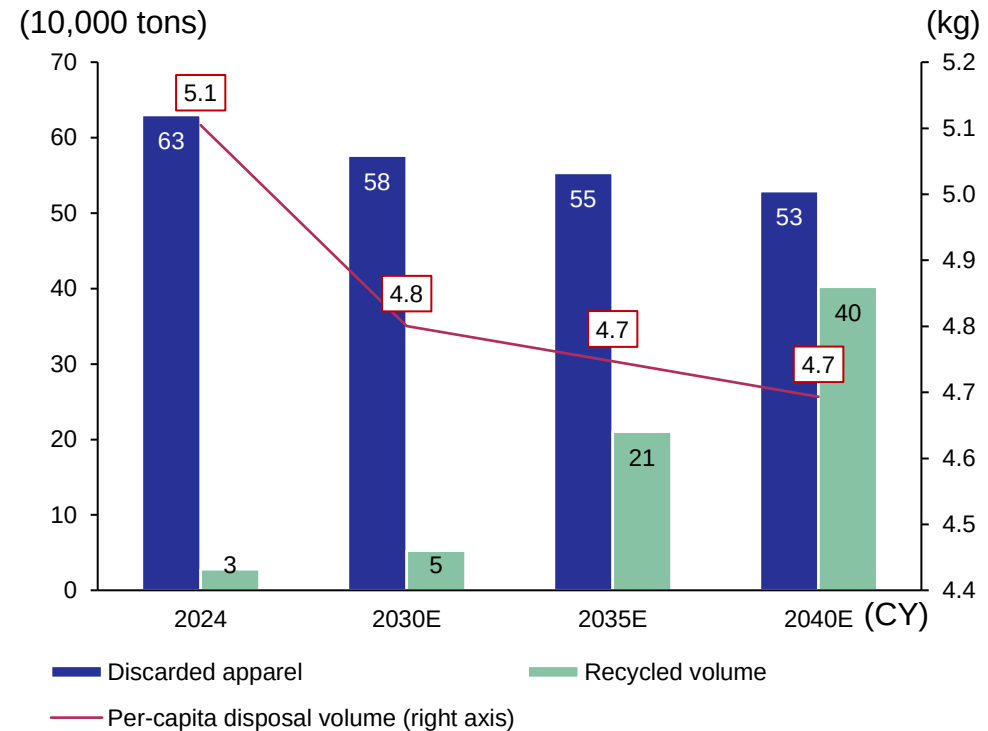


[Assumptions for the simulation of domestic fiber recycled volume (right chart)]

- Discarded apparel: Per-capita disposal volume × population forecast
- Disposal volume per person: Estimated from disposal volume per person for 2009, 2020, 2022, and 2024
- Recycled volume: Domestic recyclable maximum based on p.4 estimated as the potential
 - 2030: Government target for 2030 of "fiber-to-fiber 50,000 tons" (recycling rate: 9%)
 - 2035: CFT2 establishes its technology by 2032, accelerating the expansion of recycled volume (recycling rate: 50%)
 - 2040: Achievement of CFT2's target of "zero discarded apparel" (recycling rate: 100%)

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Ministry of Economy, Trade and Industry materials, and other sources

Simulation of domestic fiber recycled volume through 2040



Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Ministry of the Environment materials, and other sources

Textile Recycling Impact of Promising Domains (Quantitative Aspects)

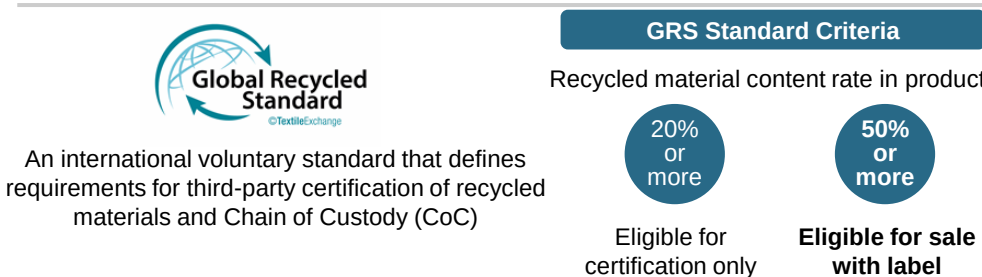
If Europe sets a 50% recycled fiber content rate for textile products through regulation, demand reaches 4.11 million tons by 2040

- The level of "significant use of recycled fiber in textile products" to be defined by EU regulations is yet to be determined. The Global Recycle Standard (GRS), an international certification, designates products containing 50% or more recycled materials as eligible for labeling, and an equivalent level may potentially be required.
- If the recycled fiber content rate reaches 50% by 2040, demand for recycled fiber in the European market is projected to reach 4.11 million tons, making the European market a promising market for Japan.

Content and implementation process of the EU Ecodesign for Sustainable Products Regulation (ESPR)

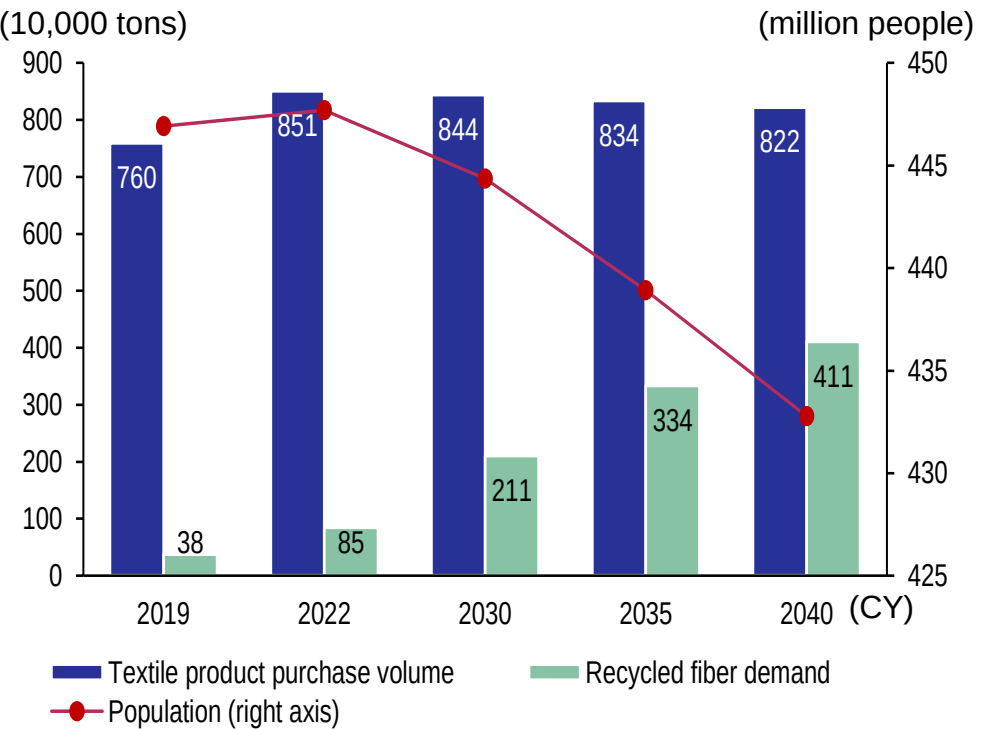
- 2022/3 The European Commission announced the proposed **Ecodesign Regulation**. Targets were set for textile products sold within the EU by 2030, requiring durability, recyclability, **significant use of recycled fiber**, environmental considerations, and so forth.
- 2022/12 The European Council and European Parliament reached provisional political agreement on the **"proposed Ecodesign Regulation"** prohibiting the disposal of unused textile products.
- 2024/5 The **"Ecodesign for Sustainable Products Regulation (ESPR)"** was adopted by the European Council, establishing provisions including the provision of information to consumers via Digital Product Passports (DPP) and a future prohibition on the disposal of unused products.
- 2024/7 The **"Ecodesign for Sustainable Products Regulation (ESPR)"** entered into force.
- 2025/4 The European Commission announced its first Working Plan, designating textile products among the priority product groups to be addressed by 2030.

International certification related to textile/apparel: Global Recycle Standard (GRS)



Source: Both figures compiled by Industry Research Department, Mizuho Bank, Ltd. based on publicly available materials from the Ministry of the Environment, and other sources

Simulation of EU textile product purchase volume and recycled fiber demand through 2040



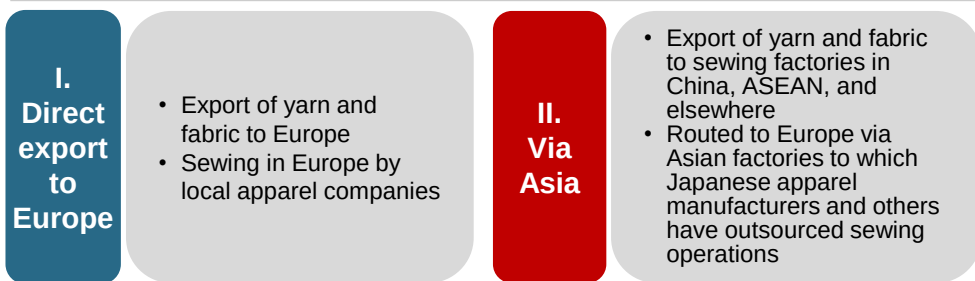
Note: The recycled fiber content rate is assumed to rise in stages, reaching 5% in 2022, 20% in 2030, and 50% in 2040.

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on European Environment Agency materials, and other sources

Deployment of domestic recycled fiber to the European market assumed via direct export and Asian sewing factories, in line with existing commercial distribution

- Fibers such as yarn and fabric produced in Japan are currently deployed as textile products to the European market through direct export to Europe as well as via Asian factories to which Japanese apparel manufacturers and others have outsourced sewing operations. Recycled fiber is assumed to follow the same supply chain.
- Demand for recycled fiber at overseas production bases is expected to increase among companies deploying products to Europe and other overseas markets, with Fast Retailing aiming to shift 50% of all materials used to recycled materials by 2030, and Ryohin Keikaku advancing the local incorporation of production management bases, among other initiatives.

Assumed supply chain for exporting domestic recycled fiber to the European market



***Figures represent 2025 export volumes**



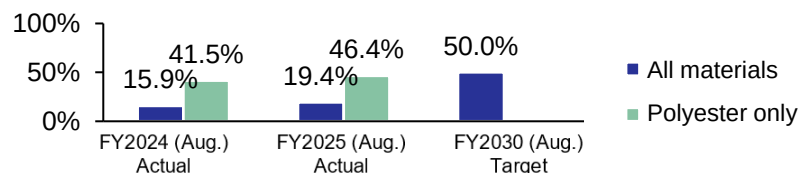
Note: Export figures are textile products (HS codes 50-63) from 2025 trade statistics.
Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Global Trade Atlas, and other sources.

Production bases and recycled material demand of apparel companies targeting overseas markets

Fast Retailing

- Most production outsourced to factories in China, Vietnam, Bangladesh, Indonesia, and India
- Aims to achieve a recycled material content rate of 50% by 2030

Recycled Material Content Rate by Category

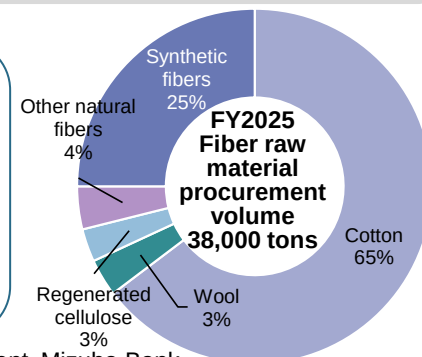


Ryohin Keikaku

- Holds development and production management bases in China, Vietnam, Cambodia, Indonesia, and India, with production outsourced to each location; bases in Europe and the U.S. also under consideration
- Aims to achieve 100% procurement of "environmentally conscious materials" under its proprietary standard by 2030

100% procurement of environmentally conscious materials by 2030

- 100% use of certified organic cotton, recycled cotton, and similar materials
- 100% use of non-mulesing wool and recycled wool only
- Use of recycled or plant-derived raw materials in all products using synthetic fibers



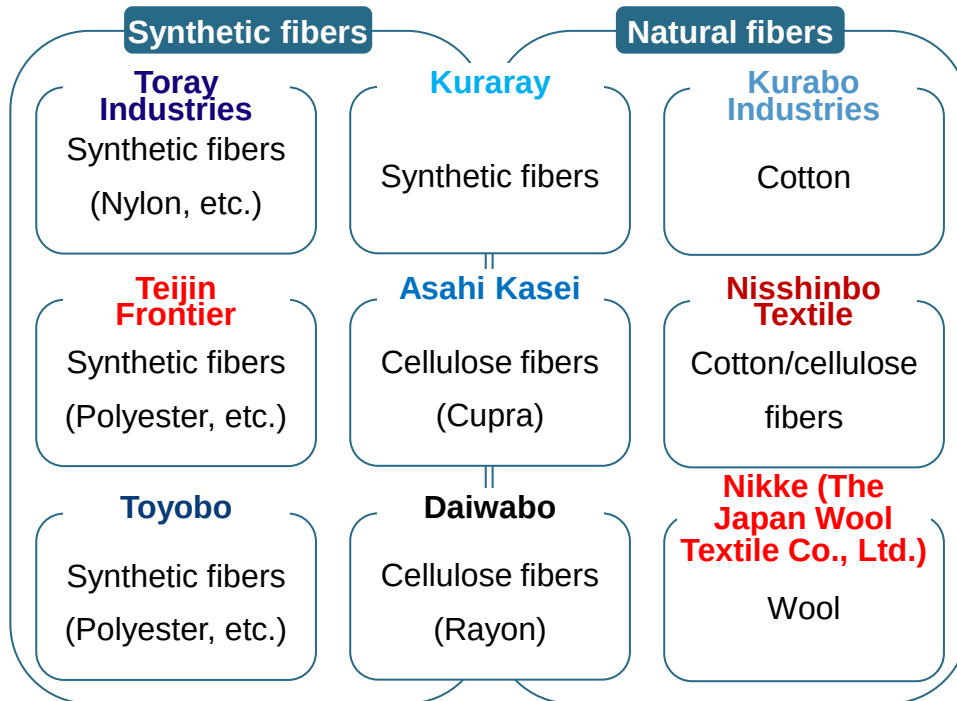
Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on published materials from each company, and other sources

Major Japanese textile companies possess specialized expertise in their respective areas and develop proprietary fiber technologies

- Japan's textile industry has large companies in each area, with strengths in the development of highly functional fiber materials. For example, Toray Industries, together with UNIQLO, developed fibers with moisture-absorbing heat generation and thermal insulation functions, creating HEATTECH, and successfully differentiated it as a competitive high-performance fiber.
- While Japan's share of apparel product exports is smaller compared with other countries, its share of yarn, fabric, raw materials, and similar exports is notably high. For Japan, with its strengths in material exports, advancing domestic production of recycled fiber represents the winning strategy for further expanding the export business.

Specialization areas of major domestic textile companies

- Synthetic fibers: Toray Industries, Teijin, Toyobo, etc.
- Natural fibers: Kuraray Industries and Nisshinbo, which specialize in cotton; Nikke (The Japan Wool Textile Co., Ltd.), which specializes in wool; and others
- Semi-synthetic fibers: Daiwabo and Asahi Kasei, which specialize in cellulose fibers such as rayon



Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on published materials from each company, and other sources

Toray's functional fiber developed for UNIQLO's HEATTECH

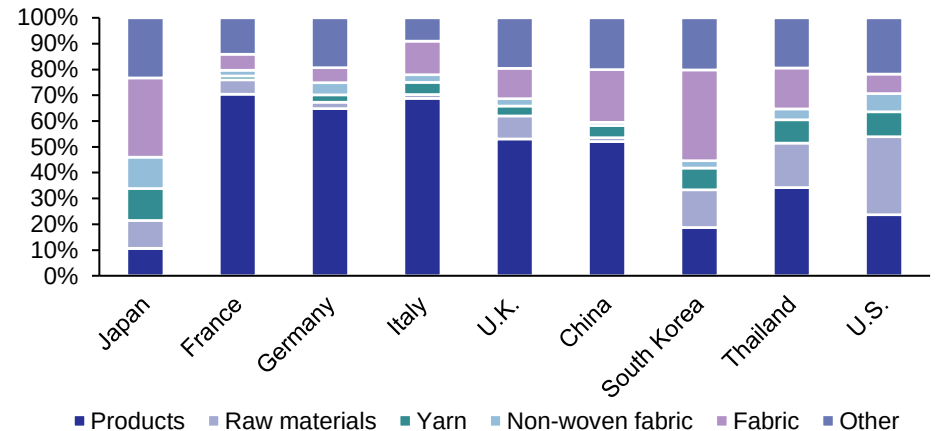
HEATTECH

- Functional expansion including heat generation/thermal insulation, moisture retention, stretch, and shape retention
- Various prototypes totaling more than 10,000 iterations
- Uniform dyeing and sewing of yarns with differing properties



Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on published materials from each company, and other sources

Breakdown by Category of Textile Product Exports in Each Country (2023)

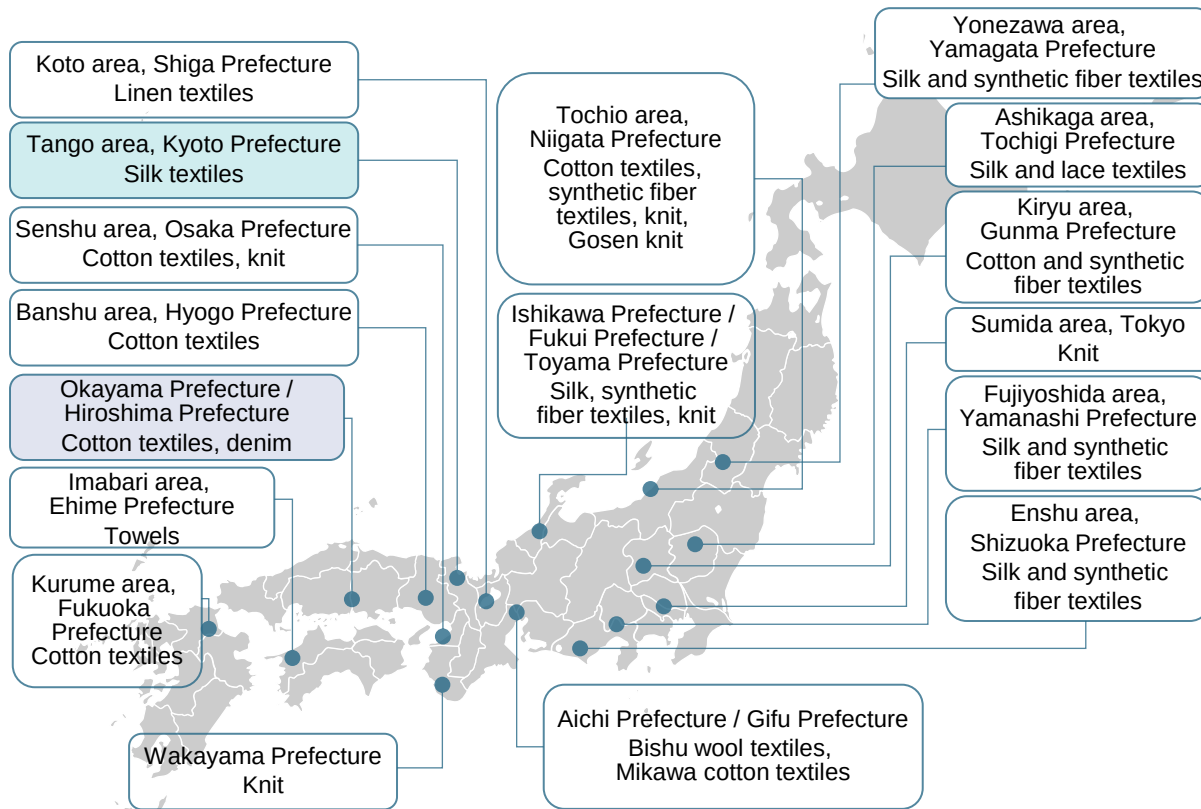


Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Ministry of Economy, Trade and Industry materials, published materials from each company, and other sources

High-quality, premium fiber materials leveraging the distinctive strengths of textile production regions across Japan highly valued in the European luxury market

- Japan retains textile production regions across the country with the technology to produce distinctive, high-value-added textile products rather than mass-produced goods. In contrast, European textile production regions that have supported the market to date are gradually losing both labor and machinery, leading the European luxury market to focus on the strengths of Japan's textile production regions.
- The luxury market tends to prioritize quality, and fabrics such as high-quality, premium recycled fiber × woven or knit textiles produced in Japan's production regions are expected to demonstrate higher competitiveness compared with those of other countries.

Major textile production regions in Japan



Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Ministry of Economy, Trade and Industry materials, published materials from each company, and other sources

Examples of the LVMH Group's collaborations with Japanese production regions

- Advancing the traditional industry succession project "LVMH Métiers d'Art" in Japan, with activities commenced in 2022 focusing on materials and technologies in Japanese production regions

Kyoto: Silk textiles

Hosoo Co., Ltd.

Founded: 1668

- Concluded a partnership in 2023 with Hosoo, a Kyoto Nishijin-ori weaver
- Handles the highest-grade silk in Japan, deploying its technology and expertise both domestically and internationally; aims to revitalize the silk industry both in Japan and abroad

Okayama: Denim

Kuroki Co., Ltd.

Established: 1974

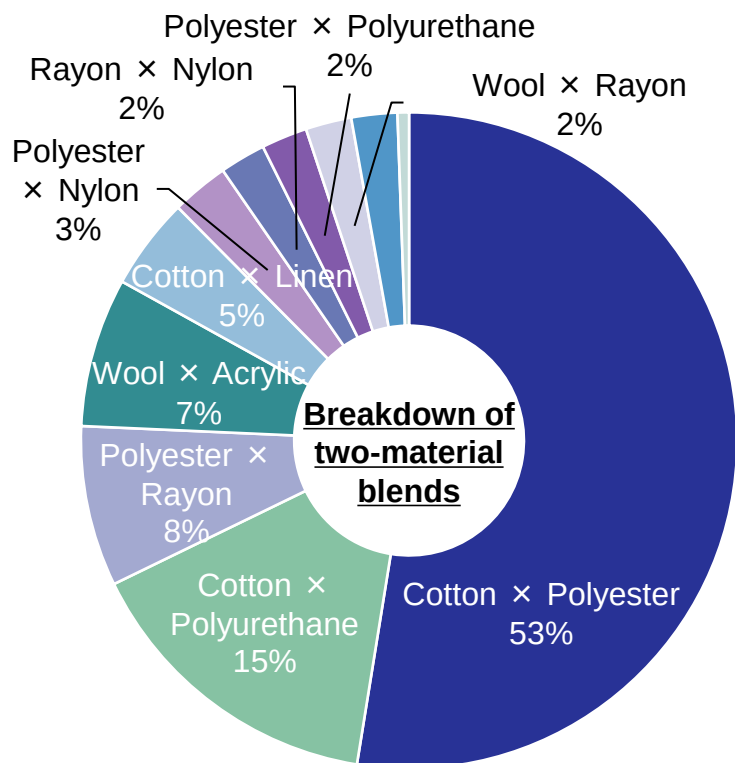
- Concluded a partnership agreement in 2023 with Kuroki, a denim manufacturer
- Conducts integrated in-house production from dyeing and weaving through to finishing, delivering high-quality denim materials and products to the world

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on published materials from each company, and other sources

Development of composite-material fiber recycling technology is difficult for a single company; collaboration aims to establish a world-first technology

- Approximately 70% of discarded apparel is composed of composite-material fibers, and the development of bio-technology to separate materials requires considerable time; accordingly, advancing technology development domestically is the top priority. Following the establishment of the technology, deploying technology exports to the world represents one option.
- Regarding the top-priority technology development, as the materials composing domestic discarded apparel are highly diverse, recycling technologies for each material are required, making it difficult for a single company to handle alone. Cooperation among companies with differing areas of expertise is indispensable.

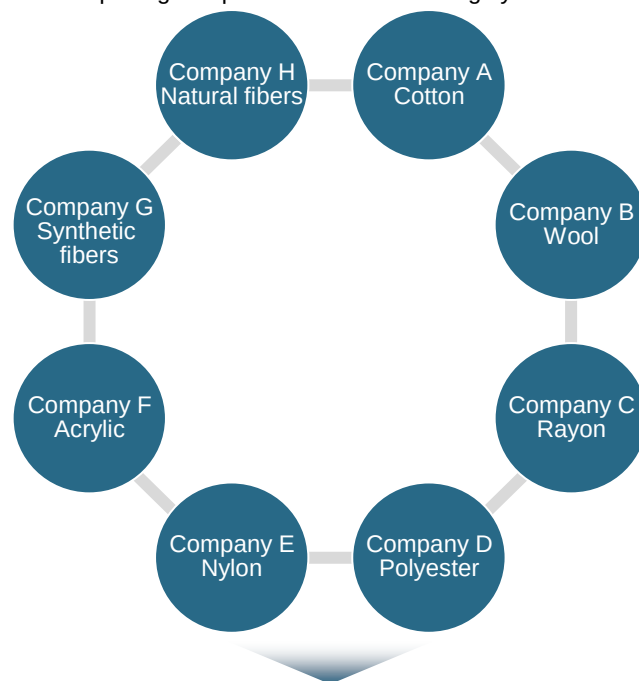
Breakdown of two-material fiber blends obtained from 1 ton of apparel waste (2022)



Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Ministry of Economy, Trade and Industry materials, and other sources

Recycling of composite-material fibers requires collaboration among companies with distinctive strengths in each area

- Approximately 70% of domestic discarded apparel is composed of composite-material fibers
- The materials composing composite fibers are also highly diverse



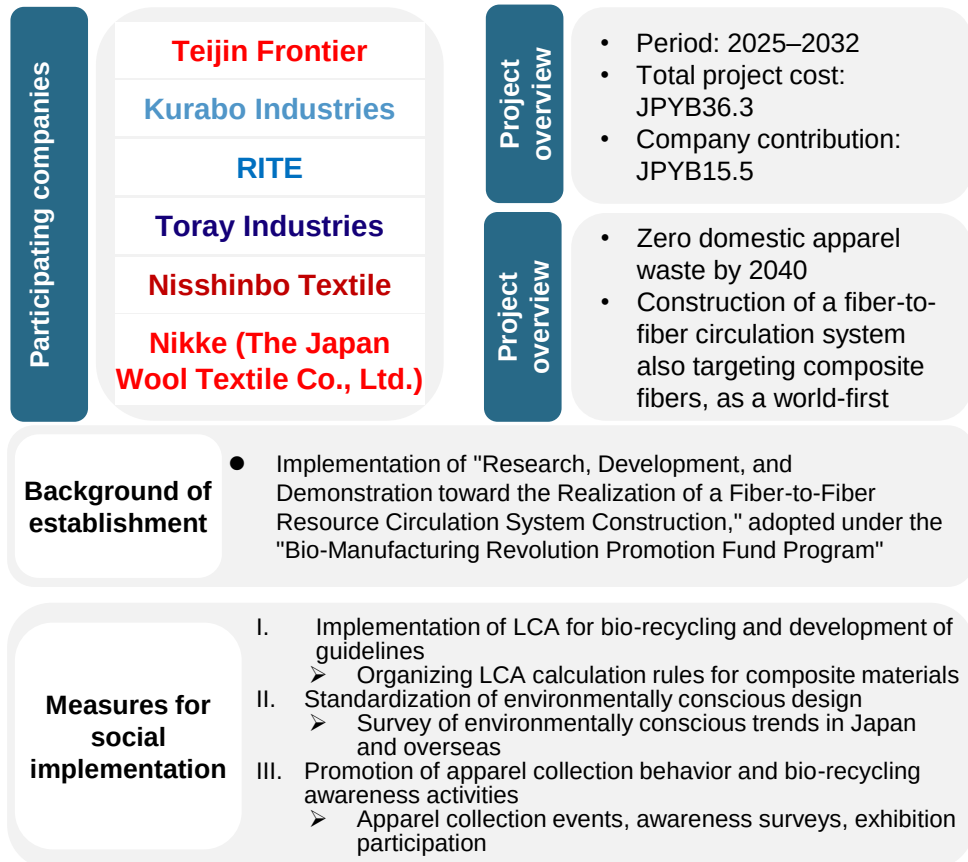
Development of separation technology for composite fibers is difficult for a single company to handle.
Cooperation among companies with differing areas of expertise is indispensable.

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd.

Major domestic textile companies establish consortium to consider countermeasures addressing not only technology development but various other challenges

- In October 2025, the "CFT2" consortium was launched with a core of five major textile companies with specialized expertise in their respective areas, aimed at the social implementation of fiber-to-fiber recycling. Having also been adopted as a NEDO program, it aims to achieve zero domestic apparel waste by 2040 through public-private collaboration.
 - CFT2 aims to realize fiber-to-fiber recycling that also targets composite fibers as a world-first, and is a groundbreaking consortium gathering competitors with differing technologies.

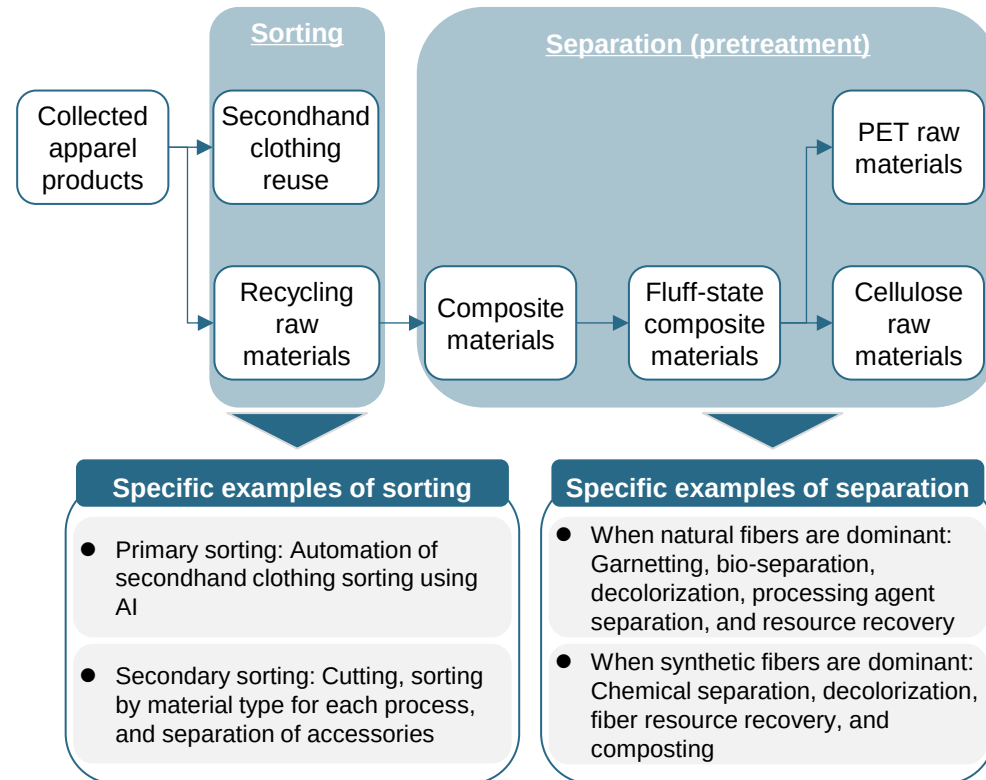
CFT2 consortium (consortium for fiber to fiber)



Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Ministry of Economy, Trade and Industry materials, NEDO materials, and other sources

CFT2's focus areas

- The technical challenges in establishing fiber-to-fiber recycling are sorting and separation technologies

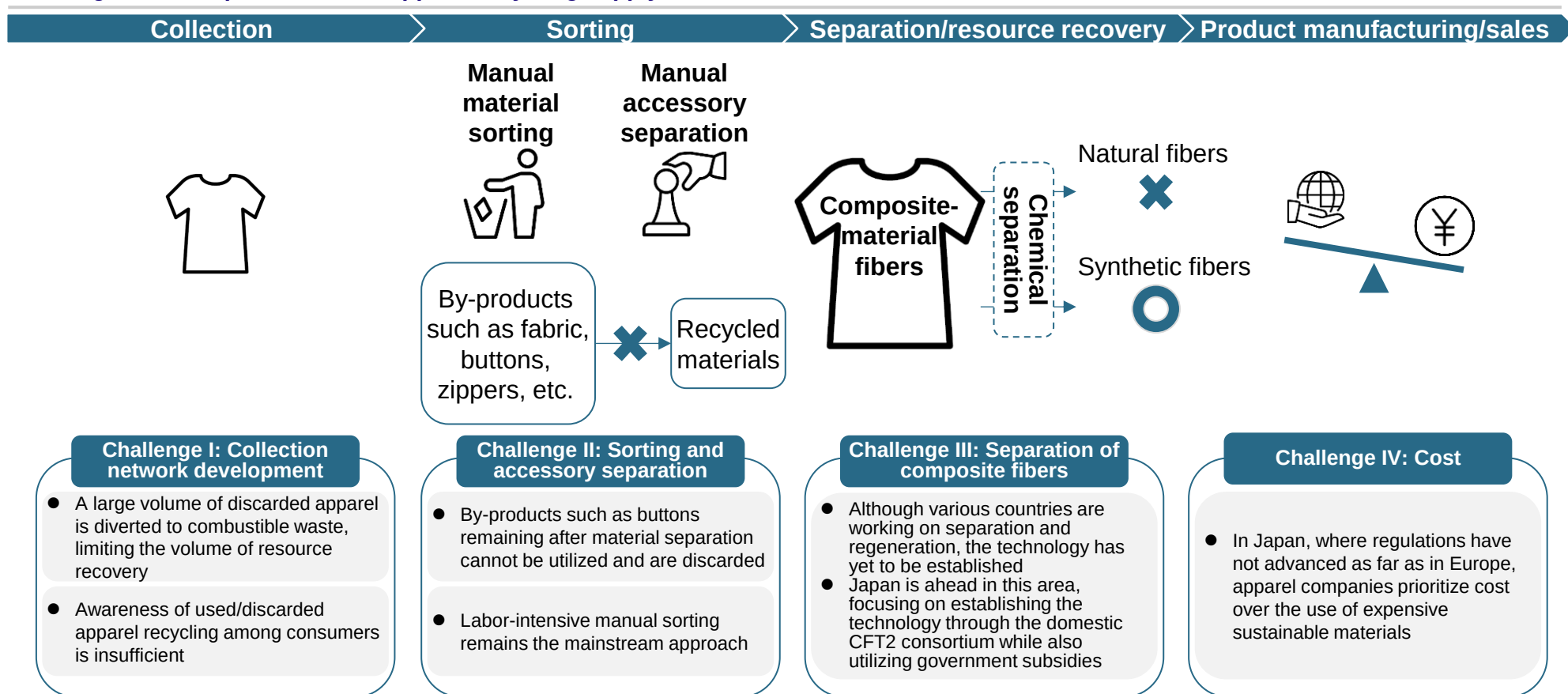


Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Ministry of Economy, Trade and Industry materials, published materials from each company, and other sources

The supply chain from apparel collection through regeneration to sales presents multiple challenges beyond separation technology, acting as barriers

- While CFT2 primarily focuses on the development of sorting and separation technologies, addressing the challenges in upstream and downstream processes is also important.
- Beyond the separation technology required to achieve single-material conversion, various challenges difficult for a single company to resolve alone exist across the long supply chain encompassing apparel collection, material sorting as a pretreatment process, resource recovery, and product manufacturing and sales.
 - The challenges include collection network development, sorting and accessory separation, composite fiber separation, and cost; addressing these through collaboration among stakeholders is critical.

Challenges in each process of the apparel recycling supply chain



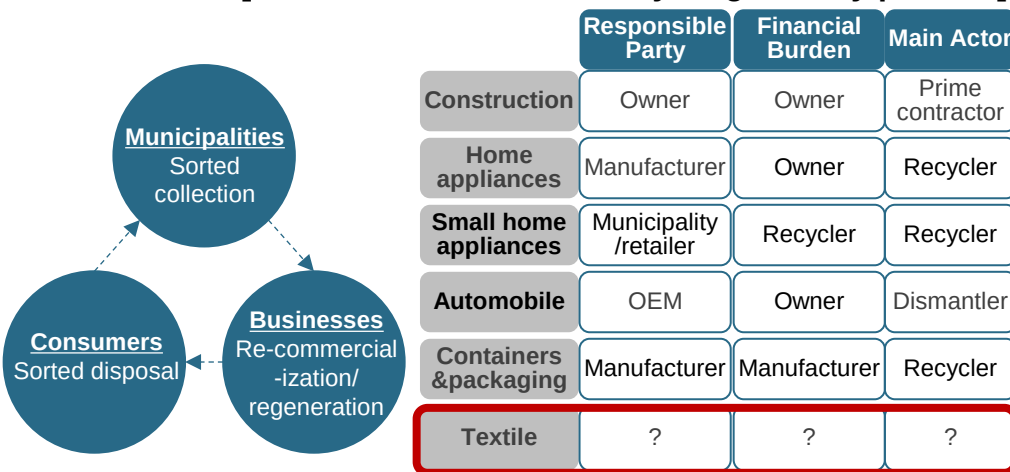
Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on Ministry of the Environment materials and published materials from each company

Enactment of individual recycling laws and joint commercialization of sorting and separation processes are also options

- In the collection process, the legal development of frameworks for handling discarded apparel and collection networks by municipalities and local areas is indispensable. Following the model of the Containers and Packaging Recycling Law, establishing a recycling law for textile products is critical for increasing the volume of apparel collected from households.
- In the sorting and separation processes, the burden of a single company holding assets such as factories alone is significant; the joint commercialization of operations through the establishment of a JV to distribute costs and risks represents one possible measure.

[Collection measures] Establishing a textile recycling law following the establishment of the technology in the future

[Roles under individual recycling laws by product]



Key points

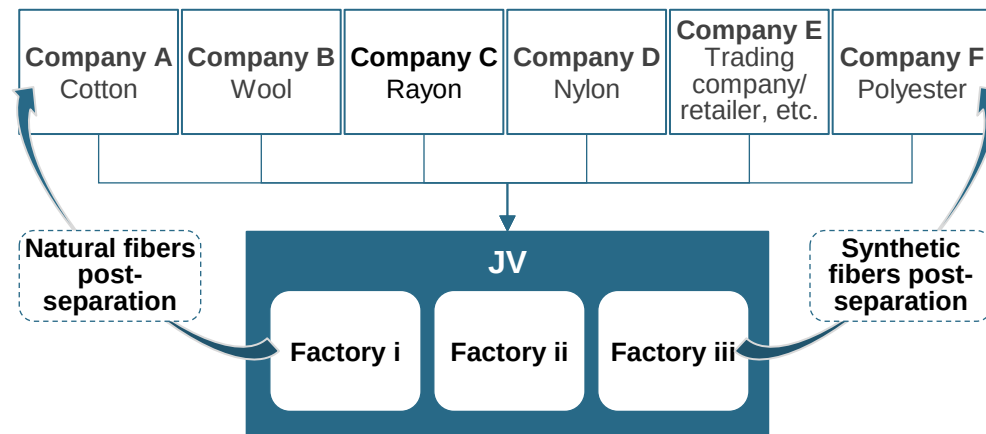
- Following the establishment of regeneration technology, separately enact a new textile recycling law to increase the volume of apparel collected that is discarded from households

Discussion points

- Who bears the costs associated with collection
- In Japan, where the overseas import ratio for products is 98%, the extent to which responsibility should be assigned to domestic operating companies
- Designing incentives for businesses and consumers is critical

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on various publicly available materials

[Sorting and separation measures] Joint commercialization of fiber sorting and separation processes



Key points

- Reducing asset burdens through joint operation of the business by all companies
- Mutual complementarity through sharing resources amid labor shortages

Discussion points

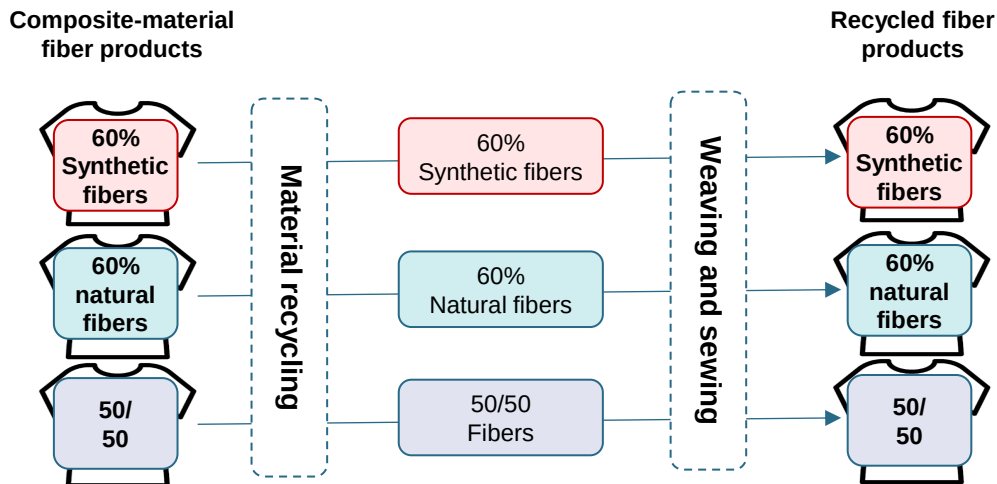
- As development costs and resources differ depending on the recycling technology handled by each company, adjustments are required to enable burden-sharing without a sense of unfairness
- Consideration of equity ratios, taking into account room for other companies to participate, when looking ahead to future scale expansion

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd.

Developing high-quality, high-performance recycled fiber capturing the needs of apparel manufacturers

- As the establishment of bio-technology requires time, regenerating discarded apparel composed of composite-material fibers directly back into fiber as composite-material fibers, without separating by material, is also effective for the time being.
- In sales, by developing high-quality, high-performance recycled fiber through close coordination with apparel manufacturers on the demand side, Japan can establish its position as a material supplier of recycled fiber products that are difficult to substitute with overseas commodity products from China and elsewhere.

[Product manufacturing and sales measures] recycling composite-material fibers with their composition preserved



Key points

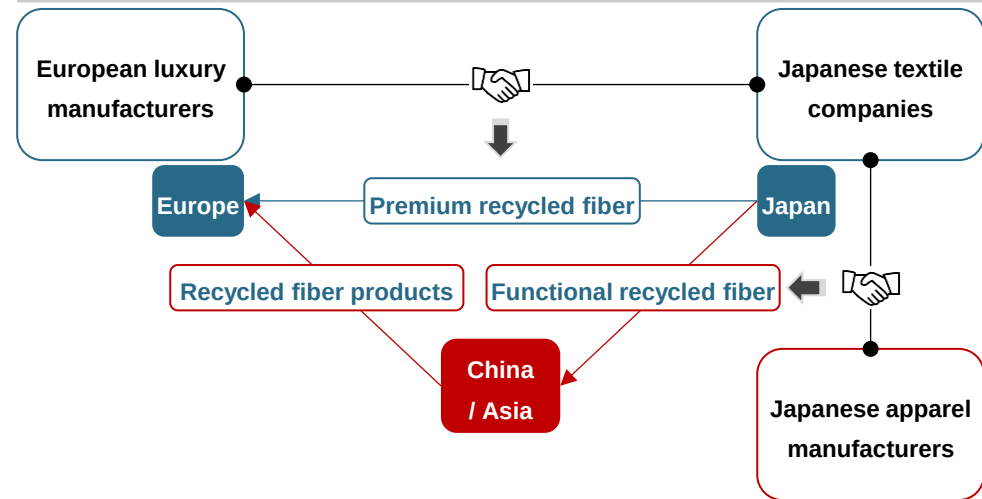
- Until separation technology for composite-material fibers is established, regenerate composite-material fibers with their composition preserved

Discussion points

- Mass production at a consistent quality equivalent to virgin materials is difficult
- Constructing a supply chain with apparel manufacturers on the demand side is critical, so that even small volumes and fibers with differing appearances can be stably supplied
- If China or other countries focus primarily on this approach, Japan may be unable to compete on production volume and may face severe cost competition

Source: Compiled by Industry Research Department, Mizuho Bank, Ltd.

[Sales measures] differentiating from overseas commodity products by enhancing quality and functionality



Key points

- Deploying high-quality recycled fiber developed through close coordination with European luxury manufacturers, as well as recycled yarn with strength surpassing virgin materials developed jointly with Japanese apparel manufacturers

Discussion points

- Capturing the needs of domestic and overseas apparel manufacturers deploying to the European market, the development of high-quality, functional recycled fiber is required
- As a joint sales strategy leveraging existing relationships with apparel companies, it is critical to establish brand value and product lineups dedicated to recycled fiber

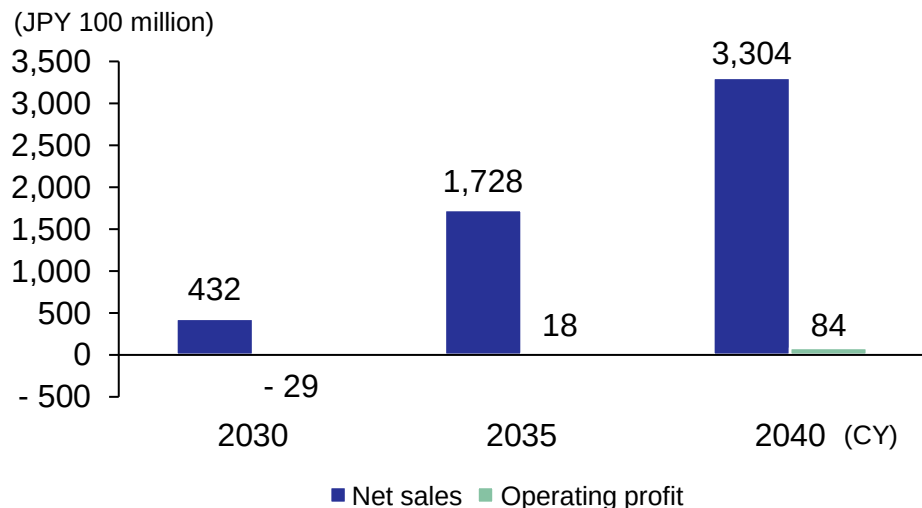
Source: Compiled by Industry Research Department, Mizuho Bank, Ltd.

Exporting domestically produced recycled fiber to the European market, where demand for environmentally conscious fiber materials is high, is an option

- Assuming sales targeting the European market, net sales of JPYB330.4 and operating profit of JPYB8.4 are projected by 2040. While the establishment of the technology requires time and achieving profitability by 2030 is difficult, given expectations that this will become a future winning strategy for Japan, the significance of engaging in this area over the medium-to-long term with government support is substantial.
- Over the longer term, prospects include providing the discarded apparel regeneration technologies established in Japan to Asian companies, with expectations of establishing Japan's position in the new and promising fiber regeneration market over the long term. To secure reliable demand, the creation of a domestic market is also critical.

Projected net sales and operating profit in overseas markets

Investment amount	Total investment from 2025 to 2040 is assumed to be JPYB72.3, centered on capital investment in CFT2 and domestic fiber recycling factories
Net sales	Domestic recycled fiber production volume on p.8 × market price for each fiber material
Operating profit	Operating profit margin of 3.8% for the textile business segments of major domestic textile companies held flat
Commercial distribution	Per p.10, includes exports of yarn, raw materials, and fabric to the European market, as well as exports to Asian regions producing products for the European market



Source: Compiled by Industry Research Department, Mizuho Bank, Ltd. based on various publicly available materials

Future prospects: technology exports to Asia and overseas local business

Prospect I: Licensing out	Prospect II: Global recycling business
After mass production technology is established in Japan, if the costs of recycled materials can be passed on to end consumers, demand for recycled fiber will also expand in Asian markets ➤ <u>Providing licenses for recycling technology to textile companies in Asia is also an option</u>	Expanding beyond Japan-produced recycled fiber to also expand the production of overseas-produced recycled fiber using overseas discarded apparel as raw materials ➤ <u>Local-production-for-local-consumption textile recycling business also envisioned through JVs with local companies</u>

Creation of a domestic market is also critical, given the uncertainty of overseas markets

- For Japan's textile industry to prevail, securing reliable demand domestically is also critical, and the policy-driven creation of a recycled fiber market within Japan is also necessary
 - Policy measures such as imposing obligations or providing incentives for the manufacture and use of recycled fiber are also options

Obligation	● Also, for domestic textile products, establish regulations stipulating restrictions on the disposal of unused inventory and the significant use of recycled fiber in products ➤ <u>[Reference example]</u> The EU Ecodesign for Sustainable Products Regulation (ESPR) mandates the significant use of recycled fiber and prohibits the disposal of unused inventory
Incentive	● Although there are hurdles to providing price-gap support on a continuous basis, establish subsidies for products of domestic apparel companies that use recycled fiber ➤ <u>[Reference example]</u> Under the Clean Energy Vehicle Introduction Promotion Subsidy, vehicles from manufacturers adopting green steel receive an additional subsidy of up to JPY50,000

Source: Both figures compiled by Industry Research Department, Mizuho Bank, Ltd.

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