

Journal of Research and Multidisciplinary

ISSN: 2622-9536 Print

ISSN: 2622-9544 Online

<http://journal.alhikam.net/index.php/jrm>

Volume 9, Issue 1, March 2026, Pages 1143-1156



Pathways to a Circular Economy in Cambodia's Garment Industry: Barriers, Opportunities, and Policy Interventions

Yamuna V Sithambalam

American University of Phnom Penh (AUPP), Cambodia

Email: y.sithambalam@aupp.edu.kh

Abstract

The garment industry in Cambodia is one of the leading contributors to the country's economy. It runs a linear production process with high consumption of materials generating massive textile wastes with very scanty recycling facilities. Since global brands increasingly advocate for sustainable production, Cambodia has been pressured within increasing degrees to implement circular economy (CE) strategies that minimize waste management while optimizing resource utilization and extending total competitiveness in the long run. A resultant aspect focuses on the challenges and opportunities of moving the garment industry in Cambodia toward a circular economy. Through existing literature review, waste stream analysis, and current factory practice assessment, this study not only identifies the technological, economic, and institutional hindrances against circular practice adoption but also reveals opportunities such as a waste segregation system, material-efficient technologies, upcycling initiatives, and possible partnerships with global buyers. Policies towards the recycling investments targeted at governments, factory owners and international brands supporting CE integration are proposed in the form of incentives; namely the waste reporting systems on an industry basis and capacity building programs. This requires an institutionalized multi-stakeholder approach under the findings enabling the garment industry of Cambodia to be put forward in transition movements towards sustainable and circular textile value chains.

Keywords: Circular economy, Garment industry, Cambodia, Sustainable production, Textile waste management

Introduction

The core business of Cambodia's garment sector is growing more aware of the environmental impact and its crucial economic contribution in the nation. Growing sustainability also means moving away from linear-based "take-make-waste" systems to circular systems in garment manufacturing, reducing waste by enhancing resource efficiency as well as social and financial results yielded under that process. Waste has therefore to be reduced by enabling more resource efficiency as well as greater social and financial returns accessible under this method. Governmental support for senior management commitment, advanced technology infrastructure, and particularly the tendency to overlook social aspects

can be examined through lessons learned from other emerging markets in India and Bangladesh. In these contexts, integrated policy actions involving stakeholders, along with new business models that apply circular concepts across supply chains, are essential for overcoming most challenges to adoption. Additionally, their policy legislation is shaping Circular Procurement through incentives and cross-sector collaboration. Addressing these challenges and seizing opportunities will foster sustainable growth in Cambodia's garment sector, while also supporting the global circular economy by mitigating the environmental impact of textile production (Zaidi and Chandra, 2024; Kazancoglu et al., 2020; Amin et al., 2024; Suarez-Visbal et al., 2024). This paper scans feasibility and preconditions for the circular economy that can be adopted in the garment industry of Cambodia, reviewing current waste practices, barriers to circularity, emerging opportunities, and recommendations for the government, industrialists, and international brands. By scanning preconditions for circular transformation, it hopes to inform policy creation and practical implementation pathways that would keep Cambodia competitive amidst shifts in global textile markets.

Literature Review

2.1 Concept and Principles of the Circular Economy

The circular economy is an important shift away from the common linear "take-make-dispose" model to a regenerative model, one where materials are constantly fed back within closed loops. It is in the dominant frameworks of circular economy that circularity happens through reduced resource input, extended lifespans, and material recovery at end-of-life via reuse, repair, remanufacture, and recycling. This concept can be merged with the circular economy (CE) as a sustainability approach that highlights cyclic industrial activities and separation of biological and technical components for their safe and efficient use (Ávila-Gutiérrez et al., 2019). It therefore advocates for a systemic change in product design and supply chain management systems via circular strategies comprising the end-of-life plan, business model innovation, and organizational values preservation aspects to imbed circular principles throughout value chains (Burke et al., 2021). Such transformation potentially enables economic growth to decouple from resource consumption and environmental impacts through both technological and non-technological innovations that might arise out of circular business models and supply chains (Mendoza et al., 2017). Where the extension of product life cycles entails material life cycles, there is no more need for virgin resource extraction; hence, this comes out as a net positive effect from these frameworks because integrated reuse and recycling strategies close material loops which are fundamental steps towards achieving circularity.

Circular economy strategies in the textile and apparel industry cover a broad spectrum from durable garment design to recycled fiber use through zero-waste pattern cutting up to collection systems, and sorting systems for used garments. CE also stresses new business models such as leasing, resale, rental, and take-back offers that extend product lifetime while reducing dependence on virgin material input. This has been discussed much in the literature. For instance, research emphasized that business-model innovation is imperative for durable products through leases and rentals as shares, garment collection, resales, and recycling to achieve sustainable circular textile systems (Coscieme et al., 2022). More studies discussed recycled fibers used in fashion and home products stressing the

need for using recycled materials during both design and production phases to obtain a closed-loop circular economy (Leonas, 2016). Zero-waste garment models and reuse models that work toward the total utilization of post-consumer textile wastes further exemplify circular strategies in production (Lewis et al., 2016). Slowing fast fashion down through design for reuse, secondhand retail, and a product-as-a-service model also falls very much within the circular and sustainable values that are endorsed as decreasing the environmental impacts within the textile and apparel industries (Centobelli et al., 2022). It is these studies that collectively go some way to providing a more detailed analysis of CE strategies, including durability design, recycled fiber use, zero-waste cutting, garment collection, and circular business models such as leasing and take-back systems in the textile and apparel sector (Centobelli et al., 2022; Coscieme et al., 2022; Leonas, 2016; Lewis et al., 2016).

2.2 Circular Economy in the Global Fashion and Textile Industry

The world increasingly recognizes the textile industry as one of the most intensive and waste-creating industries among all other sectors of production. This industry significantly contributes to environmental problems with factors such as carbon emission levels, water consumption, and a massive volume of waste generated. Textile production is responsible for about 10% of the world's carbon emissions (Das et al., 2025; Saif et al., 2024). The linear model that currently presides within this industry further encourages such negative impacts because most industries emphasize speed in production and disposal rather than Durability and Recycling. It irresponsibly consumes resources and thus results in a product turning into waste very soon. Sustainable practices must be adopted to lessen the impacts described above. This, in turn, makes high industrial activity a large contributor to environmental degradation since fast fashion means quick lifespans of products and post-consumer textile waste that does not get collected or sorted but rather ends up in landfill.

In fact, up to 85% of textile waste accumulates through the municipal solid waste stream at a global level (Wojnowska-Baryła et al., 2024). Leading textile and fashion companies have shifted strategy increasingly implementing circular economy (CE) strategies to meet attainability toward sustainability goals, the shifting consumer demand for more environmentally sound products, and a more rigorous regulatory environment. CE initiatives reduce resources reused as garments and fibers and recycled materials that extend the life of products with less waste having taken clothes back into use more than one time (Das et al., 2025). These programs were pioneered by European brands where retailers take used textiles back from consumers for recycling or renewal so as to keep the circular material flows always moving between taking recycled and refurbished materials back into use (Saif et al., 2024; Wojnowska-Baryła et al., 2024).

Levi's and Adidas are some of the first large companies to share recycled material and circular product initiatives. Their initiatives include the use of recycled polyester and cotton fiber, garment design for easy disassembly, and applying circular design principles that make reuse or recycling only a step away at the end of life. This reduces waste while lowering significantly the carbon footprints attached to raw material extraction as well as manufacturing-war proves how big brands can integrate circularity into their product development plus supply chain practices (Das et al., 2025). International regulatory

guidelines and policy frameworks- particularly the European Union's Sustainable and Circular Textiles Strategy as part of the wider European Green Deal and Circular Economy Action Plan are what set an agenda for wider recycling of textiles. Their policies have set ambitious targets for sustainable production plus consumption and reduced impacts associated with environmental damage during any stage in a textile lifecycle (Coscieme et al., 2022). Extended Producer Responsibility (EPR) is currently one of major policy tools which will drive a system change by legally binding producers to carry out responsibility on waste textile collection, sorting as well as recycling accompanied by transparent reporting. This will create incentives for designing products that are more recyclable and the development of circular infrastructures such as sorting centers plus recycling facilities hence encouraging suppliers and manufacturers globally to align with circular economy principles (Reike et al., 2022; Wojnowska-Baryła et al., 2024).

The collective impact of these initiatives is playing a pivotal role in revolutionizing the global textile industry, moving it away from a conventional linear model of resource use towards one that prioritizes circularity. This transition is essential for minimizing environmental damage and promoting sustainable growth. Nonetheless, obstacles persist, including technological constraints in textile recycling, fragmented waste collection systems, and the necessity for coordinated actions among stakeholders across the textile supply chain (Reike et al., 2022; Saif et al., 2024). Productive innovations, regulatory support, and cooperation that would assist in widening the scope of circular economy practices toward obtaining industrial sectors' sustainability objectives are also ongoing. Studies found out that obstacles hindering such an application of fashion through the CE concept relate to technology as well as economic and organizational aspects. Current recycling technologies do not include efficient methods: quality may decrease using mechanical recycling, whereas enormous investments in infrastructure are demanded for chemical recycling. Overproduction, short product lifecycles, and complex supply chains that prove traceability and circularity are challenges in the fashion industry. However, it does indicate a growing global trend because leading companies implement CE in new product design sourcing strategies and supply-chain partnerships.

2.3 Circular Economy in Developing and Manufacturing Economies

For major players among the developing economies in the garment-producing sector such as Bangladesh, Vietnam, India, and Indonesia, the implementation of circular economy practices has not gone beyond its nascent stage. Cost-cutting policies adopted by factories in these regions lead to a limitation of investment for green technologies and innovations on a circular basis. Therefore, there is practically no infrastructure for proper waste collection and recycling; management of textile wastes depends largely on informal waste pickers who are hardly regulated. This constitutes structural weakness that impedes the effective recovery and circular processing of textile wastes (Rashid et al., 2024; Salman et al., 2025). However, pilot projects emerging in these countries have good prospects. For example, industry-led initiatives supported by development partners piloted systems in Vietnam for sorting textile waste and some basic recycling to increase the value from the waste and reduce dependence on dumping it into landfills. Bangladesh has experimented with mechanical recycling cotton waste from spinning mills and achieved high-value recycled yarns for export markets. This is proof, by demonstration, of possible ways to circularize the existing industrial process (Le et al., 2019; Salman et al., 2025).

It has been found that the effective implementation of CE in such contexts requires coherent policy measures across various domains. The most important among these are the immediate strengthening of policy incentives to support circular transitions, methodical improvement of textile waste data collection systems to enable focused intervention where most needed, setting up technology transfer systems for sustaining production, and placing workforce development as a top priority to build up essential skills. Other requirements include creating partnerships between local producers and foreign brands for knowledge sharing and resource mobilization as well as joint adoption of circular business models based on international best practices (Rashid et al., 2024; Salman et al., 2025). This is extremely relevant to Cambodia, whose apparel sector is characterized by low cost of production, informal waste management systems, and socio-economic problems that at the moment impede circular textile initiatives from making any headway. With pilots and policies in other neighboring developing countries from which lessons can be drawn, Cambodia will be able to solve its problem and move on to a sustainable and circular textile sector (Arnold & Han Shih, 2010).

2.4 Existing Research on the Garment Sector in Cambodia

The research in Cambodia's garment sector has pertained primarily to labor conditions, economic development, and global value chain dynamics rather than environmental sustainability. Existing studies confirmed inefficient resource use, explosive textile waste problem, and slow adoption of green technologies as well as circular practices in the industry (Eppinger, 2022; Ramírez-Escamilla et al., 2024). Better Factories Cambodia, which offers training on energy efficiency, waste minimization, and safer chemical management to numerous garment factories, along with the German development agency's GIZ FABRIC project, does not constitute an initiative toward a circular economy. It certainly does not represent a systematic integration of circularity throughout Cambodia's industry (Eppinger, 2022). A significant shortcoming noted in the literature is the absence of a comprehensive and standardized system for managing textile waste. The fact that most garment factories do not practice source segregation of textile waste results in recyclable and hazardous materials being mixed. A significant portion of textile waste ends up in informal channels, either being sold without regulation or ultimately discarded in landfills, leading to environmental harm and a loss of resources. (Tang, 2023; Wagaw & Babu, 2023).

In situations where waste management systems are dysfunctional, recycling potentials will also be low and this underscores the urgent need for an integrated approach toward collection, sorting, and recycling that should be made mandatory through regulation and capacity building (Saif et al., 2024). The systemic challenges have nevertheless not been a major deterrence to companies like tonlé from Cambodia which turns pre-consumer factory waste into zero-waste clothing lines. They prove that circular economy can take place even in resource-limited settings within tough infrastructure. The operations also go on to show that green products can emerge through creative design paths using material reuse and the invention of new ways of making things, which could be translated into economic value (Butturi et al., 2025). Scaling up such circular initiatives meets a lot of challenges that also call for wider institutional support through policy incentives on investment in recycling technologies and supply chain transparency, as well as collaboration from a wide range of different stakeholders to implement circular

approaches across the whole garment industry (Ramírez-Escamilla et al., 2024; Saif et al., 2024).

The circular businesses and specific sustainability programs occur amid great challenges to the garment sector in Cambodia from the side of environmental sustainability. This initiative is, therefore, to be followed by further policies, support infrastructure for innovation capacity building, and multi-stakeholder management in textile waste management and controlling ecological impact, which will later on translate into resilient economic opportunities in the garment manufacturing sector of Cambodia.

2.5 Research Gap

There is an enormous body of literature at the global level about the circular economy. Regional studies have been insightful but practically applicable opportunities and challenges in Cambodia's garment industry have not yet been assessed. Consistent with global trends, Cambodia produces huge volumes of textile waste as a byproduct of fast fashion-this articulates a common challenge across the globe since production cycles are determined by the seasons. Hence there is inadequate and disorganized system support toward waste collection and sorting. Hence, inefficiency barriers to managing both post-consumer and post-production wastes effectively. There is, therefore, inadequate infrastructure as well as awareness among stakeholders on adequate separation and recycling processes. Technologically, Cambodia faces barriers in acquiring high-tech recycling technologies, especially when there is mixing of fibers at the garment stage. This results in technological fragmentation that does not allow scaling up recycling initiatives added to limited financial investment and a deficit gap on such a scale of institutional innovation capacity(Charnley et al., 2024; D'Adamo et al., 2022; Luoma et al., 2022; Saif et al., 2024; Salman et al., 2025; Subramanian et al., 2021).

Institutional weak frameworks, poor coordination, and gaps in policy enforcement are the factors that hinder facilitating circular practices to this industry. Other factors include lack of collaboration between manufacturers, government agencies, and communities toward building consolidated strategies for circularity promotion. However, opportunities exist in the waste streams that can be valorized through upcycling and fiber regeneration wastes which encourage value-added products to decrease dependence on virgin input. New recycling technologies such as bio-based, enzymatic, and thermochemical methods together with digital lifecycle tracking tools and supply chain transparency support channels for a circular transition further developed. Therefore, policy instruments focusing on capacity building intervention towards stakeholder engagement, incentive schemes, regulatory enforcement as institutional gap-filling serve market-based opportunities such as second-hand and rental clothing segments widening to foster circular consumption. Thus, through the technological challenge, institutional strengthening and appropriate policies, the garment industry of Cambodia will be able to tap effectively the principles of the circular economy customized to its peculiar type of industrialization towards achieving models of production and consumption on a sustainable basis (Charnley et al., 2024; D'Adamo et al., 2022; Luoma et al., 2022; Saif et al., 2024; Salman et al., 2025; Subramanian et al., 2021).

Policy Recommendations

To successfully implement the circular economy into the garment sector of Cambodia, there should be a comprehensive list of government, factory owner, and international brand policy recommendations. The circular economy would require multi-stakeholders to effectively address technological, economic, and institutional barriers that currently block its way into the industry (Reike et al., 2022). Therefore, strong policy incentives in the form of subsidies, or tax breaks and grants for investment in safe and circular technologies and business models are needed to encourage circular transitions.

Such systems will ensure transparency and accountability at all levels. A policy on data-driven decisions that can enhance waste management practices in all sectors of industry should also be considered as part of important measures, apart from technology upgrading and skills training wherein there is also a need to develop the awareness of factory workers and managers on resource use efficiency and waste minimization methodology (Tong et al., 2024).

The training must be participatory, localized, and reflect the real situation of Cambodian manufacturers to achieve the purpose (Reike et al., 2022). International brands have to work alongside local producers so as to educate them through knowledge-sharing about circular business models since partnerships might open up avenues for best practice sharing as well as introduce new solutions. Access to such circular supply chains will foster innovation in sustainability. Circular procurement policies should put in place a framework that gives preference to products and services capable of being reused, recycled, or resource efficient. It is only by way of cross-sector collaborations involving governments at all levels, industry associations, and academic institutions that the crucial systemic change can be achieved through a combination of incentives, resource sharing, and harmonized standard practices (Reike et al., 2022).

One of the key policy focuses in transition should include EPR as it sets producer responsibility as a standard to collection, sorting, and recycling textile waste at disposal stages-consider end-of-life disposal stages (Reike et al., 2022; Tong et al., 2024). Research validated from successful EPR schemes indicative of fostering both competition and collaboration between all supply chain actors alongside innovative eco-design practice relating to improved downstream recycling performance-show that those schemes could develop new ways how to improve recycling outcomes (Tong et al., 2024). EPR has left very positive imprints on material use rates within the circular economy and can fast-track recycling infrastructure development along with municipal waste management service lines (Zhidebekkyzy et al., 2024). Difficulties of fund collection in places where informal markets dominate and possible over-reporting of collections to take advantage of subsidies may be the challenges when EPR is implemented in a developing country like Cambodia. This, therefore, calls for stringent regulatory enforcement and monitoring accompanied by complementary policies on matters such as smuggling and the protection of intellectual property (Kojima et al., 2009). In addition to this, governments must mandatorily integrate frameworks with the use of digital technologies for better information sharing and lifecycle management to enforce eco-design and end-of-life disposals within EPR guidelines (Gu et al., 2018). Furthermore, companies have shown improved EPR behavior when subjected to stricter regulations and government oversight, highlighting the importance of well-

balanced incentive and constraint mechanisms in policy design to promote responsible production.

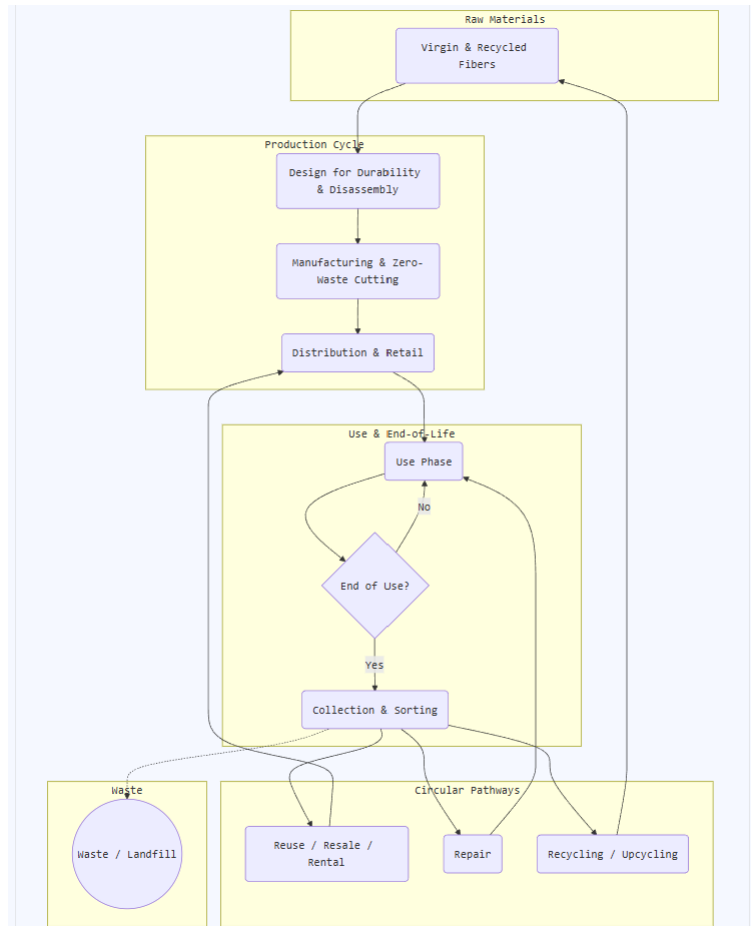
It is imperative to relentlessly pursue recovery and sustainability targets beyond a single product lifecycle. By embracing openness and championing strategies that extend product longevity, one can achieve unparalleled circularity and sustainability benefits from EPR systems (Peng et al., 2019; Campbell-Johnston et al., 2020). This strategy not only optimizes resource efficiency but also places manufacturers at the forefront of environmental stewardship, committing to transformative journey and lead the way toward a more sustainable future.

In summary, coordinated multi-stakeholder policies with strong incentives, capacity-building and collaboration as well as circular procurement together with comprehensive EPR regulation that supports innovation will definitely lead to great results for the garment industry in Cambodia. It will not be viewed only as an attempt to address a current issue but also seen as a move to facilitate innovation through establishing a competitive and sustainable circular textile industry in alignment with environmental commitments at the international level (Reike et al., 2022; Tong et al., 2024; Zhidebekkyzy et al., 2024).

Conceptual Framework

Presently, there is no study that defines a particular conceptual framework diagram about the circular economy in Cambodia's garment industry. However, the basic ideas and concepts of the circular economy are what would base such a framework and are shown in Figure 1 below. The CE model is defined as describing systems change from the old linear "take-make-waste" model to a regenerative system.

Figure 1: Circular Model (Conceptual Diagram):



This framework is founded on principles designed to minimize resource consumption, extend product lifespan, and recover materials through strategies such as reuse, repair, remanufacturing, and recycling. It requires systemic changes across product design and supply chains, incorporating end-of-life considerations and innovative business models to decouple economic growth from resource consumption.

Specifically, for the textile industry, the framework encompasses several key strategies:

- Design : Creating garments for durability and utilizing recycled fibers.
- Production : Implementing zero-waste pattern cutting.
- End-of-Life : Establishing systems for collecting, sorting, and recycling used garments.
- Business Models : Adopting innovative models such as leasing, resale, rental, and take-back systems to extend product life.

In visual terms, this concept can be represented as a cyclical process, contrasting with the linear model characterized by the sequence Take → Make → Waste.

Conclusion

The Cambodian garment industry is highly significant in the country's economy through its linear production model with high material input and output as textile waste. This is a take-make-waste model and thus, inefficiency and environmental damage consequentially are associated with it being regarded as unsustainable to the sector amid increasing global trends toward green manufacturing (Koszewska, 2018). The international movement for sustainable production is growing stronger pressure with more emphasized advocacy on circular economy (CE) principles that pertain to less waste and better usage of resources within the whole chain of value in textiles (Saha et al., 2024). The challenges in the transformation of Cambodia's garment industry from a linear to a circular model are multifaceted. There are technological barriers since there is no state-of-the-art recycling plant and effective waste sorting systems in place. In most cases, inadequate segregation protocols for materials lead to contamination of recyclables (Saif et al., 2024). Besides, the country's institutional and regulatory frameworks are still developing leading to regulatory gaps that hinder incentives through policies and enforcement mechanisms that are very important in CE adoption (Kazancoglu et al., 2020).

These have equally been the challenges in other developing economies' textile industries as they struggle to come to terms with financial constraints, technological inadequacies, and managerial resistance to circular economy (CE) principles (Saha et al., 2021; Salman et al., 2025).

However, the positive opportunities that can be derived from this sector are high. For example, companies like tonlé prove that better waste management and upcycling efforts create more value for a company with less harm towards environmental degradation. Material Efficient Technologies include new recycling procedures together with sustainable product design which focuses on both the durability and recyclability of products to promote circular practices (Butturi et al., 2025). Therefore, the integration of sustainability-oriented innovation is predicted to improve resource recovery as well as reduce environmental impact during garment manufacturing (Butturi et al., 2025; Saif et al., 2024). Problems at the techno-institutional level can best be addressed through multi-stakeholder systemic approaches. Governments must, therefore, as noted by Koszewska, immediately align policies on sustainability with infrastructure development on recycling and waste management (Koszewska, 2018). Circular business strategies sharing data as a commitment between and among nations supported by international collaboration in technology, funding, and best practice initiatives can fill the gap in policies enhance methodologies in sorting wastes and advance green technology (D'Adamo et al., 2022; Saha et al., 2021). The drive toward digitization and adoption of technologies related to the fourth industrial revolution also accelerate the move to a sustainable economy in garment production. Digital tools are capable of enhancing efficiency at different lifecycle stages of a product, providing traceability as well as ensuring optimum resource utilization and recycling (Hassan et al., 2024). Such initiatives amply prove the circular economy's ability to reduce material input and waste output. To sum up, shifting the Cambodian garment industry from its existing linear model to practice real circular economy needs a combination of collaborative effort in policymaking, infrastructure investment, and innovations toward sustainability. The transformation is needed not only as a requirement in exercising environmental and social responsibility but equally important as a condition

that must be met for long-term competitiveness while global sustainable practice trends continue to intensify (Daño et al., 2020; Koszewska, 2018).

References

- Arnold, D., & Han Shih, T. (2010). A Fair Model of Globalisation? Labour and Global Production in Cambodia. *Journal of Contemporary Asia*, 40(3), 401–424. <https://doi.org/10.1080/00472331003798376>
- Ávila-Gutiérrez, M. J., Aguayo-González, F., Martín-Gómez, A., & Córdoba-Roldán, A. (2019). Standardization Framework for Sustainability from Circular Economy 4.0. *Sustainability*, 11(22), 6490. <https://doi.org/10.3390/su11226490>
- Burke, H., Zhang, A., & Wang, J. X. (2021). Integrating product design and supply chain management for a circular economy. *Production Planning & Control*, 34(11), 1097–1113. <https://doi.org/10.1080/09537287.2021.1983063>
- Butturi, M. A., Mercalli, F., Gamberini, R., & Neri, A. (2025). Sustainability-Oriented Innovation in the Textile Manufacturing Industry: Pre-Consumer Waste Recovery and Circular Patterns. *Environments*, 12(3), 82. <https://doi.org/10.3390/environments12030082>
- Campbell-Johnston, K., Calisto Friant, M., Thapa, K., Lakerveld, D., & Vermeulen, W. J. V. (2020). How circular is your tyre: Experiences with extended producer responsibility from a circular economy perspective. *Journal of Cleaner Production*, 270, 122042. <https://doi.org/10.1016/j.jclepro.2020.122042>
- Centobelli, P., Abbate, S., Nadeem, S. P., & Garza-Reyes, J. A. (2022). Slowing the fast fashion industry: An all-round perspective. *Current Opinion in Green and Sustainable Chemistry*, 38, 100684. <https://doi.org/10.1016/j.cogsc.2022.100684>
- Coscieme, L., Manshoven, S., Gillabel, J., Grossi, F., & Mortensen, L. F. (2022). A framework of circular business models for fashion and textiles: the role of business-model, technical, and social innovation. *Sustainability: Science, Practice and Policy*, 18(1), 451–462. <https://doi.org/10.1080/15487733.2022.2083792>
- D'Adamo, I., Lupi, G., Settembre-Blundo, D., & Morone, P. (2022). Towards the circular economy in the fashion industry: the second-hand market as a best practice of sustainable responsibility for businesses and consumers. *Environmental Science and Pollution Research*, 29(31), 46620–46633. <https://doi.org/10.1007/s11356-022-19255-2>
- Daño, F., Drábik, P., & Hanuláková, E. (2020). Circular Business Models in Textiles and Apparel Sector in Slovakia. *Central European Business Review*, 9(1), 1–19. <https://doi.org/10.18267/j.cebr.226>
- Das, A. K., Khan, B. U., Akter, M., Asad, M. A. Z., Rahman, M. M., & Hossain, M. F. (2025). Circular economy: A sustainable model for waste reduction and wealth creation in the textile supply chain. *SPE Polymers*, 6(1). <https://doi.org/10.1002/pls2.10171>

- Eppinger, E. (2022). Recycling technologies for enabling sustainability transitions of the fashion industry: status quo and avenues for increasing post-consumer waste recycling. *Sustainability: Science, Practice and Policy*, 18(1), 114–128. <https://doi.org/10.1080/15487733.2022.2027122>
- Gu, F., Guo, J., Hall, P., & Gu, X. (2018). An integrated architecture for implementing extended producer responsibility in the context of Industry 4.0. *International Journal of Production Research*, 57(5), 1458–1477. <https://doi.org/10.1080/00207543.2018.1489161>
- Hassan, R., Acerbi, F., Rosa, P., & Terzi, S. (2024). The role of digital technologies in the circular transition of the textile sector. *The Journal of The Textile Institute*, 116(12), 1–14. <https://doi.org/10.1080/00405000.2024.2414162>
- Kazancoglu, I., Yarimoglu, E., Kahraman, A., & Kazancoglu, Y. (2020). A conceptual framework for barriers of circular supply chains for sustainability in the textile industry. *Sustainable Development*, 28(5), 1477–1492. <https://doi.org/10.1002/sd.2100>
- Kojima, M., Sasaki, S., & Yoshida, A. (2009). Difficulties in applying extended producer responsibility policies in developing countries: case studies in e-waste recycling in China and Thailand. *Journal of Material Cycles and Waste Management*, 11(3), 263–269. <https://doi.org/10.1007/s10163-009-0240-x>
- Koszewska, M. (2018). Circular Economy – Challenges for the Textile and Clothing Industry. *Autex Research Journal*, 18(4), 337–347. <https://doi.org/10.1515/aut-2018-0023>
- Le, Q. A., Tran, V. A., & Nguyen Duc, B. L. (2019). The Belt and Road Initiative and Its Perceived Impacts on the Textile and Garment Industry of Vietnam. *Journal of Open Innovation: Technology, Market, and Complexity*, 5(3), 59. <https://doi.org/10.3390/joitmc5030059>
- Leonas, K. K. (2016). The Use of Recycled Fibers in Fashion and Home Products (pp. 55–77). Springer Singapore. https://doi.org/10.1007/978-981-10-2146-6_2
- Lewis, T. L., Park, H., Netravali, A. N., & Trejo, H. X. (2016). Closing the loop: a scalable zero-waste model for apparel reuse and recycling. *International Journal of Fashion Design, Technology and Education*, 10(3), 353–362. <https://doi.org/10.1080/17543266.2016.1263364>
- Mendoza, J. M. F., Heyes, G., Azapagic, A., Sharmina, M., & Gallego-Schmid, A. (2017). Integrating Backcasting and Eco-Design for the Circular Economy: The BECE Framework. *Journal of Industrial Ecology*, 21(3), 526–544. <https://doi.org/10.1111/jiec.12590>
- Peng, B., Wang, Y., Elahi, E., & Wei, G. (2019). Behavioral game and simulation analysis of extended producer responsibility system's implementation under environmental regulations. *Environmental Science and Pollution Research*, 26(17), 17644–17654. <https://doi.org/10.1007/s11356-019-05215-w>
- Ramírez-Escamilla, H. G., Padilla-Rivera, A., Martínez-Rodríguez, M. C., Campos-Villegas, L. E., & Domínguez-Solís, D. (2024). Advancing Toward Sustainability: A

- Systematic Review of Circular Economy Strategies in the Textile Industry. *Recycling*, 9(5), 95. <https://doi.org/10.3390/recycling9050095>
- Rashid, K. H. O., Aziz, R. A., Karmaker, C. L., Bari, A. B. M. M., & Raihan, A. (2024). Evaluating the challenges to circular economy implementation in the apparel accessories industry: Implications for sustainable development. *Green Technologies and Sustainability*, 3(2), 100140. <https://doi.org/10.1016/j.grets.2024.100140>
- Reike, D., Hekkert, M. P., & Negro, S. O. (2022). Understanding circular economy transitions: The case of circular textiles. *Business Strategy and the Environment*, 32(3), 1032–1058. <https://doi.org/10.1002/bse.3114>
- Saha, K., Dey, P. K., & Papagiannaki, E. (2021). Implementing circular economy in the textile and clothing industry. *Business Strategy and the Environment*, 30(4), 1497–1530. <https://doi.org/10.1002/bse.2670>
- Saha, K., Dey, P. K., & Kumar, V. (2024). A comprehensive review of circular economy research in the textile and clothing industry. *Journal of Cleaner Production*, 444, 141252. <https://doi.org/10.1016/j.jclepro.2024.141252>
- Saif, M., Blay-Roger, R., Zeeshan, M., Bobadilla, L. F., Reina, T. R., Nawaz, M. A., & Odriozola, J. A. (2024). Navigating the Legislative Interventions, Challenges, and Opportunities in Revolutionizing Textile Upcycling/Recycling Processes for a Circular Economy. *ACS Sustainable Resource Management*, 1(11), 2338–2349. <https://doi.org/10.1021/acssusresmgmt.4c00242>
- Salman, S., Uday, R. M., Rahman, R., & Shanta, M. H. (2025). Circular Economy Transition in Bangladesh's Ready-Made Garments Sector: Investigating the Key Barriers Through a Fuzzy DEMATEL Analysis. *Business Strategy and the Environment*, 34(4), 3982–4000. <https://doi.org/10.1002/bse.4181>
- Suarez-Visbal, L. J., Rosales-Carreón, J., Corona, B., Hoffman, J., & Worrell, E. (2024). Transformative circular futures in the textile and apparel value chain: Guiding policy and business recommendations in the Netherlands, Spain, and India. *Journal of Cleaner Production*, 447, 141512. <https://doi.org/10.1016/j.jclepro.2024.141512>
- Tang, K. H. D. (2023). State of the Art in Textile Waste Management: A Review. *Textiles*, 3(4), 454–467. <https://doi.org/10.3390/textiles3040027>
- Tong, X., Wang, T., Li, J., & Wang, X. (2024). Extended producer responsibility to reconstruct the circular value chain. *Circular Economy*, 3(1), 100076. <https://doi.org/10.1016/j.cec.2024.100076>
- Wagaw, T., & Babu, K. M. (2023). Textile Waste Recycling: A Need for a Stringent Paradigm Shift. *AATCC Journal of Research*, 10(6), 376–385. <https://doi.org/10.1177/24723444231188342>
- Wojnowska-Baryła, I., Bernat, K., Zaborowska, M., & Kulikowska, D. (2024). The Growing Problem of Textile Waste Generation—The Current State of Textile Waste Management. *Energies*, 17(7), 1528. <https://doi.org/10.3390/en17071528>

Zhidebekkyzy, A., Kotaskova, A., Temerbulatova, Z., & Németh, P. (2024). Catalysing responsible production: Evaluating the impact of EPR system on manufacturing enterprises. JOURNAL OF INTERNATIONAL STUDIES, 17(2), 178–190. <https://doi.org/10.14254/2071-8330.2024/17-2/9>

dated July 5, 2018.