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# Green Reverse Logistics in Sri Lankan Apparel and Textile Industry: A Path Towards Sustainable Manufacturing

[1] **Tharani Dakshina Sooriyaarachchi**
Lincoln University College, Malaysia
Sri Lanka Technology Campus
Sri Lanka

***Abstract***
*Green reverse logistics, a new branch of reverse logistics, is the process of taking back the products from their final destination back to the distributor or manufacturer for rework, replacement, or disposal in an environmentally friendly manner.*
*The apparel and textile industry is a significant contributor to the Sri Lankan economy, and the Sri Lankan economy is heavily dependent on the apparel and textile industry.*
*The industrial manufacturing processes of the apparel and textile industry are chemically aggressive, and the industry generates a heavy amount of post-industrial waste, including chemicals, dyes, fabric pieces, plastics, cardboards, and dyed water, which results in sustainability issues. The textile industry, being an industry that generates a massive amount of post-industrial waste, has been recognized by researchers as an industry that should adopt green reverse logistics to mitigate the generation of post-industrial waste.*
*The study examines the influence of green reverse technologies adopted by Sri Lankan apparel and textile companies in improving environmental sustainability. A qualitative multiple case study based on two leading Sri Lankan apparel and textile manufacturers was employed by the researcher.*
*The research findings highlighted that that production of synthetic fabric from PET polyester yarn, waste upcycling (e.g.: knitting lint-paper manufacturing, fabric rejects – production of rugs, bags etc.), sending out used oil to a certified company for re-refining, re-using the water used in dye machines, and dye clean and re-use projects are the key green reverse logistics practices adopted by Sri Lankan apparel and textile manufacturers. The research findings further indicated that green reverse techniques adopted by apparel and textile manufacturers result in a responsible and sustainable manufacturing process through promoting alternative uses of resources, using alternative energy sources, optimizing materials, and reusing materials.*

**Index Terms**— *Green reverse logistics, Sustainable manufacturing, Apparel and Textile industry*
As per Manage & Dissanayake (2021), despite the Sri Lankan apparel companies being aware about green reverse

## I. INTRODUCTION

The apparel and textile industry is a significant contributor to the Sri Lankan economy, and the Sri Lankan economy is heavily dependent on the apparel and textile industry.
The apparel and textile industry's industrial manufacturing processes are chemically aggressive, and the industry generates a heavy amount of post-industrial waste, including chemicals, dyes, fabric pieces, plastics, cardboard, and dyed water, which results in sustainability issues.
Sustainable development has become a catch phrase and a priority in the apparel and textile industry, with the increasing interest placed by the stakeholders on sustainability and its associated issues.
Herath & Sivarajah (2022) state that in the Sri Lankan context, the apparel and textile industry has the highest adoption of green practices as an industry due to its long history of international business experience and exposure.
Wu (2022) states that the rise of green reverse logistics stalks from the extensive concern placed by the people and organizations on environmental pollution. The researchers further state that

the greatest contribution towards Sustainability and sustainable development on a business level is green reverse logistics (Richnák & Gubová, 2021; Wu, 2022).

logistics and benefits of adopting green reverse logistics and having the relevant knowledge and technical capabilities, the adoption rate lies low due to an array of reasons including high transport cost, high inventory cost, lack of staff, and lack of space.

Therefore, it's worthwhile to examine whether the adoption of green reverse logistics leads to sustainable manufacturing in the Sri Lankan apparel and textile industry.

The study primarily aims to evaluate how the adoption of green reverse logistics by Sri Lankan apparel and textile manufacturers contributes to converting the chemically aggressive and heavy post-industrial waste-generating apparel and manufacturing processes into more sustainable manufacturing processes.

Henceforth, the following research objectives are derived and answered in this study.

1. To identify the green reverse logistics techniques adopted by the Sri Lankan apparel and textile manufacturers.
2. To identify how the green reverse logistics techniques adopted by Sri Lankan apparel and textile manufacturers convert chemically aggressive, high post-industrial waste-generating manufacturing processes into more sustainable manufacturing processes.

## II. LITERATURE REVIEW

### *Apparel and textile industry and its sustainability issues*

As per Asif (2017), sustainability is the main concern for the apparel and textile industry on a global scale. With the heavy focus on the sustainability issues due to the chemically aggressive and post-industrial waste generating apparel and textile manufacturing chains, many fashion designers, models, influencers, and other stakeholders have extended their support to global sustainable fashion campaigns to create a global sustainable apparel and textile industry.

As per Shen et al (2017), integrating sustainability into the supply chain is rapidly rising to the top of the priority list for many of the biggest textile and apparel companies. In the textile and apparel sector, sustainable supply chain management is typically developed through the adoption of green reverse logistics, corporate social responsibility activities, sustainable product strategy, sustainable investment, sustainable performance evaluation, and environmental management systems.

Several prominent researchers further suggest that the greatest contribution towards sustainability and sustainable development on a business level is the adoption of green reverse logistics (Richnák & Gubová, 2021, Wu, 2022).

### *Green reverse logistics in the apparel and textile industry*

The key researchers in the field highlight that the apparel and textile manufacturing chain's industrial processes are chemically aggressive, and the textile industry produces a significant amount of post-industrial waste, such as chemicals, dyes, fabric fragments, plastics, cardboard, and dyed water, which leads to sustainability problems (Souza et al, 2022; Pinheiro et al, 2018; Garcia et al, 2019).

The existing literature further emphasize that one of the most important success elements for businesses in the apparel and textile manufacturing industry in attaining sustainable supply chain management inside their organizations is the adoption of green reverse logistics (Bouzon & Govindan, 2015; Beh, et al., 2016).

As per Mugoni et al (2023), in comparison with forward logistics, which focuses on delivering goods to customers, reverse logistics is concerned with regaining lost value from the goods that were returned by customers through either re-processing of the returned goods or responsible disposal of the returned goods.

The salient research defines green reverse logistics as the opposite of the conventional logistics

system or the associated logistics activities of product returns, product replacements, material re-use, disposal of waste, material and work in progress reprocessing, remanufacturing and any other processes in a green manner while maximizing the utility of a product after its end-of-life or end-of-use. The basic concepts of green reverse logistics have been defined as that product retravel, collection, transportation, receive, inspection, disposition, repair, resell, scrap, reuse, refurbishment, and recycle are the basic concepts of reverse logistics. Various disposal techniques, such as repairing, reusing, recycling, remanufacturing, and incinerating, are employed in reverse logistics, where products flow upstream from the customers after they are returned for recycling or reuse (Paras & Pal, 2021). (Wu & Zhao, 2022; Wu, 2022;
Alkahtani; 2021, Jalil, 2017; Grabara et al , 2014; Rogers & Lembke, 2001).
Further, the salient literature establishes that reverse logistics have become a competitive need for sustainability and that clients have started demanding a higher quality in the reverse logistics services provided by organizations and that customer satisfaction depends on the sustainable reverse logistics service quality (Dabees et al; 2023)
Moreover, the prominent researchers establish that the following crucial success factors affect the success of reverse logistics practices in the apparel industry: strategic partnership and collaboration, information access, regulatory and legislative tools, consumer relationship management, awareness improvement, optimal recovery systems and channels, product design with second life consideration, and the management's tone (Paras & Pal, 2021, Bernon et al, 2018).
As per Manage & Dissanayake (2021), despite the Sri Lankan apparel companies being aware about green reverse logistics and benefits of adopting green reverse logistics and having the relevant knowledge and technical capabilities, the adoption rate lies low due to an array of reasons including high transport cost, high inventory cost, lack of staff, and lack of space.

***Green reverse logistics for a sustainable apparel and textile manufacturing industry***

As per Zhang et al (2011), the main concerns of supply chain in terms of manufacturing firms are waste management, and material recovery and green reverse logistics is an ideal solution as it is aimed at reduction of both material & resource consumption of the industrial manufacturing process, and the industrial & hazardous waste created by industrial manufacturing processes.
Garbara et al (2014), claims that by encouraging alternate resource and energy sources, product and process re-engineering for efficient material consumption, and material utilization restructuring, reverse logistics can help manufacturers save up to 60% of their material and resource expenditures.
Manage & Dissanayake (2021), states that green reverse logistics results in a reduction in the use of virgin materials and other resources as green reverse logistics promotes the use of recycled material. Further, the researchers emphasize that the usage of recycled materials over virgin materials positively impacts the environment as the resource usage is more efficient and more sustainable.
Moreover, the prominent authors in the area Kousar et al; 2022, Akter et al.; 2022, and Garbara et al 2014 has identified that green reverse logistics practices including the use of alternative energy sources, use of sustainable materials, reuse of materials, optimization of materials, and sustainable flow layouts for apparel companies to minimize material wastage and resource consumption.

## III. RESEARCH METHOD

The deductive research approach is used by researchers who identify the existing theoretical knowledge by reading the previously published literature, plan a study based on that knowledge, and then collect data to test the discovered pre-established theories (Saunders et al., 2009).The salient
research suggests using a qualitative research methodology involving multiple case studies to research areas of this nature. (Yin, 2014).
Therefore, this study uses a qualitative deductive approach since its goal is to investigate how the

adoption of green reverse logistics practices transforms the manufacturing processes of Sri Lankan apparel and textile manufacturers.

A multiple-case study based on Sri Lankan apparel and textile industry was conducted where one leading apparel manufacturer and one leading textile manufacturer was taken as the sample using purposive sampling (the two pioneer firms who adopted green reverse logistics).

Data was gathered by means of observations of thefactories, semi-structured interviews with managers, staff and local community, referring the content included in the sustainability reports and other company reports,. A content analysis was conducted on the data gathered through the reports and the data collected from the interviews were subjected to a thematic analysis. Data collected from all the resources were subjected to Data Triangulation to derive at the conclusion.

## IV. RESEARCH FINDINGS

*Green reverse logistics techniques adopted by the Sri Lankan apparel and textile manufacturers*

The following sub sections discuss the green reverse logistics techniques adopted by the selected apparel manufacturer and the textile manufacturer separately.

### *A. Textile Manufacturer*

The observations of the researcher, content analysis from the reports, and the interviews conducted revealed that production of synthetic fabric from PET polyester yarn, waste upcycling (e.g.: knitting lint-paper manufacturing, re-using the fabric rejects and production of rugs and bags , repurposing the fly ash generated from the coal used to power the production plant by paving block manufacturing, repurposing the bottom ash – manure, re-purposing waste plastic chemical containers as electrical junction boxes, water & effluent treatment sludge incineration, sending out used oil to a certified company for re-refining, usage of low sulphur containing coal in the coal power plant to avoid hazardous emissions, re-using the water used in dye machines, ensuring that all chemicals purchased are verified for their non-hazardous nature as per the industry regulation, dye clean project ( water used in the light shade dye baths are reused for dark shade dye baths. new salt use in the dye process is avoided by adding only the additional salt required in the dye baths of the re-used water) are the key green reverse logistics practices adopted by the selected textile manufacturing company.

**Given below are a few extracts of the statements from the interview respondents.**

“As a supplier supplying textile to an array of reputed international eco-conscious brands, we have developed a roadmap to sustainability which is in line with the UN SDG 2030 agenda which comprise of three pillars: responsible consumption “Doing more with less”, Responsible discharge “waste to wealth” & support thriving planet “To earth with love”. We have adopted certain expensive green reverse technologies that are not yet adopted by many other Sri ankan players in the market” (Deputy General Manager, Engineering and Sustainability)

“Green reverse logistics practices adopted by us include sustainable environmental procedures built into conventional supply chains, such as reduce, reuse, recycle. We assure our wastes have been reused, recycled, or disposed of through CEA and BOI authorized parties, including hazardous and non-hazardous solid wastes, which comply with the company’s 5R concept, circular economy & Zero Waste Landfilling journey” (Executive, Engineering and Sustainability).

“As a company serving international brands, we often pay a premium and purchase our polyester yarn manufactured by a local manufacturer who manufactures polyester yarn from recycled PET bottles collected from the Beire lake rather than purchasing polyester yarn at a low cost from elsewhere. We are committed to safeguarding our planet” (Senior merchandiser)

### *B. Apparel Manufacturer*

The observations of the researcher, content analysis from the reports, and the interviews conducted revealed that procurement of fabric made from recycled PET materials at a premium price, procurement of fabric made from post-consumer and post-industrial textile waste at a premium, product take back programs, biodegradable and sustainable materials, circular waste management, recycling, developing infrastructure for sludge recovery and eco-brick production, and upcycling of used garments, reutilization of pre-consumer waste are the main green reverse logistics practices adopted by the selected apparel manufacturer

Given below are a few extracts of the statements from the interview respondents.

"We are dedicated to making this change and integrating sustainability into our production process and end product across our value chain. We search for sustainable raw materials, practise clean production, and repurpose recycled and discarded items into clothing. Given our growing capabilities, we are excited to work with businesses who share our commitment to sustainability". (Deputy General Manager, Environmental Sustainability)

"We are always coming up with new ways to make our production process and supply chain more environmentally friendly. For instance, one such program was launched to offer a sustainable solution for the significant amounts of waste generated by cutting fleece material, which is made up of cotton and polyester. We were able to recycle the fleece fabric material and repurpose it into yarn by effectively separating it at its source. This then becomes the backing yarn to knit the same fleece material and produce the same result. This program was made feasible with the help of our clients and a number of value chain partners in the same region.." (Manager, Environmental Sustainability)

"Every aspect of our operations is firmly rooted in sustainability, particularly in terms of sourcing materials, resource consumption, waste management, total water footprint control. We as a company always go beyond our way in ensuring that we are a sustainable company sustainably catering our clients" (Senior Manager, Merchandising

### *C. Green Reverse technologies adopted by the Sri Lankan Apparel and Textile manufacturers*

The research findings mentioned above were subjected to data triangulation and it was revealed that sourcing recycled materials, waste upcycling, waste re-purposing, waste re-using, product take back initiatives, re-using the resources, ensuring that all chemicals purchased are verified for their non-hazardous nature as per the industry regulation, and creation of closed loop supply chains are the main green reverse logistics actions taken by the Sri Lankan apparel and textile manufacturers. These findings align with the findings of the salient research (Rogers & Lembke; 2001, Mugoni et al; 2023, Kinobe et al; 2012, and Jalil; 2017).

*Transformation of conventional manufacturing processes into sustainable manufacturing processes due to the adoption of how the green reverse logistics techniques by Sri Lankan apparel and textile manufacturers*

The following sub-sections discuss how the green reverse logistics techniques adopted by the selected apparel manufacturer and the textile manufacturer has created sustainable manufacturing processes.

### *A. Textile Manufacturer*

The observations of the researcher, interviews, and the reports of the organization revealed that the company has developed a green reverse logistics framework for their use based on several existing models including Basic Reverse Logistics model by Alkahtani et al (2021), Economic and environmental sustainability dimensions of a fashion supply chain: A quantitative model by Bottani et al (2020), The framework for aligning Circular Economy and Retail Reverse Logistics by Bernon et al (2018), and Sustainable reverse logistics service quality (SRLSQ) theoretical framework by Dabees et al (2023).

Further, the research findings indicated that the company has transformed the conventional

manufacturing process of the company to incorporate green reverse logistics technologies including reuse, re-purpose, recycle, refurbishment, etc., which has resulted in a significant reduction in material and resource consumption and the industrial waste generation.
Given below are a few extracts of the statements from the interview respondents.
"Adoption of Green Reverse Logistics has helped our company to reduce the material consumption by 7% and energy consumption by 5% since the adoption. Though these achievements are very minor compared to our ultimate goals of achieving 100% water reuse, 100% product sustainability, and 100% sustainable energy usage, we are proud to say that we are contributing towards creating a sustainable world for the future through the implementation of such practices" (Manager, Engineering and Sustainability).
"With the adoption of green reverse logistics, we started monitoring the sustainability performance of the manufacturing process including material and resource consumption (mainly water and energy usage), and industrial waste generation. In addition, with the heavy monitoring mechanisms in place we got ourselves certified via ISO certifications including ISO 14064 for managing emissions, ISO 50001 for energy management, 14001: Global Recycle Standard, ISO 14064: Global Organic Standard".
(Deputy General Manager – Engineering and Sustainability)

### *B. Apparel Manufacturer*

The interviews conducted, the content analysis of the reports of the company, and the observations of the researcher indicated that the company has integrated green reverse logistics technologies into the supply chain function of the company. The research findings further indicated that the diverse ecosystem of the company across a range of apparel business units scattered across multiple countries is set on a journey of achieving a sustainable apparel manufacturing.
Given below are a few extracts of the statements from the interview respondents.
"It's a pleasure to announce that we as a company is 100% landfill-free status and our waste disposal profile is 23% reuse, 45% recycle, 10% internal energy recovery, and 33% external energy recovery. Further, almost all our waste transformed into valuable resources and we are giving a second life to our waste and green reverse logistics played a huge part in this transformative journey of sustainability that we have walked". (Deputy General Manager – Environmental Sustainability)
"We have experienced a significant reduction in material consumption, energy consumption, and industrial waste generation after adoption of the green reverse logistics". (Manager – Sustainability)

### *C. Transformation of conventional manufacturing processes into sustainable manufacturing processes due to the adoption of how the green reverse logistics techniques by Sri Lankan apparel and textile manufacturers*

The research findings mentioned above were subjected to data triangulation and it was revealed that the adoption of green reverse logistics has resulted in integration of sustainable elements into the supply chain and the manufacturing processes of the selected apparel and textile manufacturers. Further, it was revealed that reduction of material purchases through re-purposing the PET polyester yarn to produce synthetic fabric, reduction in material consumption through waste upcycling, reduction of energy consumption due reduction in machine time due to repurposing industrial waste, reduction in industrial waste to sending out used oil to a certified company for re-refining, reduction of water usage due to re-using the water used in dye machines, and reduction of industrial waste are the key indicators which indicates that manufacturing processes have transformed to be more sustainable as a result of the adoption of green reverse technologies. These findings agree with the findings of Garbara et al (2014), and Zhang (2010), where it has been identified that green reverse logistics contributes to the reduction of material consumption through promoting alternative uses of resources, alternative energy sources, product, and process re-engineering for efficient material consumption, and restructuring of material usage resulting in a sustainable manufacturing

process.

## CONCLUSION

The research examined the influence of green reverse technologies adopted by Sri Lankan apparel and textile manufacturers in transforming conventional manufacturing processes to sustainable manufacturing processes.

The research findings highlighted that that production of synthetic fabric from PET polyester yarn, waste upcycling

(e.g.: knitting lint-paper manufacturing, fabric rejects – production of rugs, bags etc), sending out used oil to a certified company for re-refining, re-using the water used in dye machines, and dye clean and re-use projects are the key green reverse logistics practices adopted by Sri Lankan apparel and textile manufacturers.

The research findings further indicated that green reverse techniques adopted by apparel and textile manufacturers result in a responsible and sustainable manufacturing process through promoting alternative uses of resources, use of alternative energy sources, optimization of materials, and reuse of materials.

## REFERENCES

1. Asif, A. K. M. a. H. (2017). An overview of sustainability on apparel manufacturing industry in Bangladesh. Science Journal of Energy Engineering, 5(1), 1.
2. https://doi.org/10.11648/j.sjee.20170501.11
3. Beh, L.-S., Ghobadian, A., He, Q., Gallear, D. and O'Regan, N. (2016), "Second-life retailing: a reverse supply chain perspective", Supply Chain Management, Vol. 21 No. 2, pp. 259-272. https://doi.org/10.1108/SCM-07-2015-0296
4. Bouzon , M. and Govindan, K. (2015) 'Reverse Logistics as a Sustainable Supply Chain Practice for the Fashion Industry: An Analysis of Drivers and the Brazilian Case', in Sustainable Fashion Supply Chain Management: From sourcing to retailing. Cham: Springer.
5. Chowdhury, N. R., Chowdhury, P., & Paul, S. K. (2022). Sustainable practices and their antecedents in the apparel industry: A review. Current Opinion in Green and Sustainable Chemistry, 37, 100674.
6. https://doi.org/10.1016/j.cogsc.2022.100674
7. De Brito, M. P., & Dekker, R. (2004). A framework for reverse logistics. In Springer eBooks (pp. 3–27). https://doi.org/10.1007/978-3-540-24803-3_1
8. De Souza, E.D. et al. (2022) "Performance evaluation of green logistics: Paving the way towards circular economy," Cleaner Logistics and Supply Chain, 3, p. 100019. Available at: https://doi.org/10.1016/j.clscn.2021.100019.
9. Garcia, S. et al. (2019) 'Reverse logistics and waste in the textile and clothing production chain in Brazil', IFIP Advances in Information and Communication Technology, pp. 173–179. doi:10.1007/978-3-030-30000-5_23.
10. Grabara, J., Man, M. and Kolcun, M. (2014) "The benefits of Reverse Logistics," International Letters of Social and Humanistic Sciences, 26, pp. 138–147. Available at: https://doi.org/10.18052/www.scipress.com/ilshs.26.138.
11. Herath, P and Rajumesh, S, (2022), Green Supply Chain Management and Organizational Performance: A Study of Sri Lankan Apparel Manufacturing Organizations, Management Research and Practice, 14, issue 4, p. 19-36, https://EconPapers.repec.org/RePEc:rom:mrpase:v:14:y:2022: i:4:p:19-36
12. Joel R. Kinobe, Girma Gebresenbet and Björn Vinnerås, 2012. Reverse Logistics Related to Waste Management with Emphasis on Developing Countries—A Review Paper.
13. Khairul Akter, M.M. et al. (2022) "Textile-apparel manufacturing and material waste management in the circular economy: A conceptual model to achieve sustainable development goal (SDG) 12 for Bangladesh," Cleaner Environmental Systems, 4, p. 100070. Available at: https://doi.org/10.1016/j.cesys.2022.100070.
14. Khairul Akter, M.M. et al. (2022) "Textile-apparel manufacturing and material waste management in the circular economy: A conceptual model to achieve sustainable development goal (SDG) 12 for

Bangladesh," Cleaner
15. Environmental Systems, 4, p. 100070. Available at: https://doi.org/10.1016/j.cesys.2022.100070.
16. Kousar, S. et al. (2022) "Sustainable Energy Consumption Model for textile industry using fully intuitionistic fuzzy optimization approach," Computational Intelligence and Neuroscience, 2022, pp. 1–12. Available at: https://doi.org/10.1155/2022/5724825.
17. Lewis, J., Ritchie, J., Ormston, R. and Morrell, G., 2003. Generalising from qualitative research. Qualitative research practice: A guide for social science students and researchers, 2(347-362).
18. M. Saunders, P. Lewis, A. Thornhill Research Methods for Business Students, Seventh, Harlow Pearson Educ (2016)
19. Manage, D.S. and Dissanayake, K. (2021) "How green the supply chain of apparel manufacturing companies in Sri Lanka," Journal of Business Studies, 8, p. 51. Available at: https://doi.org/10.4038/jbs.v8i0.67.
20. Mugoni, E., Nyagadza, B. and Hove, P.K. (2023) 'Green reverse logistics technology impact on agricultural entrepreneurial marketing firms' operational efficiency and sustainable competitive advantage.', Sustainable Technology and Entrepreneurship, 2(2), p. 100034.
21. doi:10.1016/j.stae.2022.100034.
22. Paras, M.K. and Pal, R. (2020) 'Reverse logistics in the Sustainable Fashion Supply Chain', Supply Chain Management and Logistics in the Global Fashion Sector, pp. 216–232. doi:10.4324/9781003089063-12.
23. Pinheiro, E. et al. (2019) "How to identify opportunities for improvement in the use of reverse logistics in clothing industries? A case study in a Brazilian cluster," Journal of Cleaner Production, 210, pp. 612–619. Available at: https://doi.org/10.1016/j.jclepro.2018.11.024.
24. Richnák, P. and Gubová, K. (2021) 'Green and reverse logistics in conditions of sustainable development in enterprises in Slovakia', Sustainability, 13(2), p. 581. doi:10.3390/su13020581.
25. Rogers, Dale & Lembke, Ronald. (2001). An Examination of Reverse Logistics Practices. Journal of Business Logistics. 22. 129 - 148. 10.1002/j.2158-1592.2001.tb00007.x.
26. Sarasi, V. et al. (2023) "Sustainable Supply Chain of indonesia's Textile & apparel industry: Opportunities and challenges," Research Journal of Textile and Apparel [Preprint]. Available at: https://doi.org/10.1108/rjta-08-2022-0091.
27. Seroka-Stolka, O. (2014) "The development of Green Logistics for Implementation Sustainable Development Strategy in companies," Procedia - Social and Behavioral Sciences, 151,
28. pp. 302–309. Available at: https://doi.org/10.1016/j.sbspro.2014.10.028.
29. Shen, B., Li, Q., Dong, C., & Perry, P. (2017b). Sustainability issues in textile and apparel supply chains. Sustainability, 9(9), 1592. https://doi.org/10.3390/su9091592
30. Taifa, I.W., Twaha, I. and Mwakibambo, M.A. (2021) 'Critical analysis of material consumption and cost reduction techniques for the apparel cutting processes', Tanzania Journal of Science, 47(5), pp. 1689–1700. doi:10.4314/tjs.v47i5.17.
31. Taifa, I.W.R., Twaha, I. and Mwakibambo, M.A. (2021) "Critical analysis of material consumption and cost reduction techniques for the apparel cutting processes," Tanzania Journal of Science, 47(5), pp. 1689–1700. Available at: https://doi.org/10.4314/tjs.v47i5.17.
32. Wu, J. (2022) "Sustainable development of green reverse logistics based on Blockchain," Energy Reports, 8, pp. 11547–11553. Available at: https://doi.org/10.1016/j.egyr.2022.08.219.
33. Zhang, Y.M., Huang, G.H. and He, L. (2011) 'An inexact reverse logistics model for Municipal Solid Waste Management Systems', Journal of Environmental Management, 92(3), pp. 522–530. doi:10.1016/j.jenvman.2010.09.011