

CIRCULAR ECONOMY: REUSE AND RECYCLING SOLUTIONS OF A FOOTWEAR COMPANY

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Abstract- The leather and footwear industry in Albania is based mainly on orders from European customers. There are few companies which produce for the local market, such as Donniana shoes, Mali shoes. Based on INSTAT data, the exports and imports of the textile and leather footwear industry in Albania play an important role in the total exports/imports in the country. This industry uses a vary range of different materials such as: textile, leather, rubber, metallic accessories. Taking into account the methods of processing and finishing of the leather and other materials, for footwear production, this industry presents a high negative impact for environmental pollution, causing carbon foot print and damaging rivers lakes and seas. These wastes release harmful gases which causes air pollution. This paper aims to present how the leather footwear defective or overproduction of soles and leftover wastes are processed through reuse and recycling to produce new tires, in "Mali Sh.p.k" Footwear Company in Albania. By reusing and recycling the defective soles, leftovers from production and overstock the company has many benefits such as: a positive impact of the cost reducing, productivity improvement of the company, and producing in circular economy, sustainability.

Keywords: Circular Economy, Leather/Footwear, Waste, Sole, Reuse, Recycle.

1. INTRODUCTION

In leather and footwear production the main raw material is leather. For the footwear production this industry generates a high number of wastes not only leather but also rubber [(TPR), polyurethanes (PU), thermoplastic polyurethanes (TPU), Ethylene vinyl acetate (EVA), polyvinylchloride (PVC)], synthetic textile materials and metallic accessories. Those materials releases and contains a high concentration of harmful pollutants [1, 2]. Considering the construction method of polymers, it is important to study the physical and mechanical properties of linear systems of polymers with amorphous-crystalline structure in production (chemical treatment solutions and dyes due to the use of toxic chemicals that discharge into the ground and lakes, rivers, seas, leading to major environmental pollution [3, 4].

Among the environmentally friendly water purification technologies, ozonation is widely used, consumption and after consumption due to the negative impact on the environment, in having strong physical and chemical effects [2, 3]. Leather tanning process also emits gases. But since these treatments and processes of the leather are not done in our country, the problem is in the waste that comes out during the stages of leather footwear production [1, 2]. The need to respond to the demands of foreign customers, supported by European legislation based on the circular economy and green production, has led some business companies in the clothing and leather footwear sector in Albania, to the concept of the circular economy and the production of eco products [5, 6].

This way of conception and application in these enterprises, investing in technology, minimizing waste, designing products towards a circular economy has brought positive advantages such as: improvement of productivity, quality and delivery in time to the customer according to their requests. Another positive aspect is that by producing eco-friendly products and by reusing and recycling wastes during production, we have a positive impact on environmental pollution [7, 8].

2. EXPORTS/IMPORTS ANALYSIS OF THE TEXTILE AND LEATHER FOOTWEAR SECTOR IN ALBANIA

The leather and footwear production in Albania is an important sector, dominated with CTM production. There are approximately 240 manufacturing companies, with a total of more than 25,000 employees that perform based on EU customer orders. Although most tanneries and footwear companies depend on foreign suppliers and customers, where finished leather is imported from Italy, America, Russia, Egypt, Brazil, Bangladesh or Turkey, again this industry generates a significant amount of waste (leather, synthetic textile materials, rubbers, metallic materials) which cause a huge environmental pollution [2].

The leather footwear industry in Albania produces medium to high quality products, adapting to the needs of customers and the European market. As a result of the favorable geographical positioning of Albania with EU

countries, orders can be delivered quickly. A large part of the factories has the possibility to organize flexible production for small quantities due to the client orders [5]. According to the data collected from Instate, the export level of this industry has remained relatively stable between 2016 and 2022, with a minimum 51,320,276 kg/year and a maximum of 61,823,038 kg/year in 2022, as it is shown in the Table 1.

Table 1. Exports; Textile and leather wastes ton/year

Years	Exports Net Weight	Exports Weight in ton	Exports Waste /ton/year	Exports Waste /ton/year
2016	53,803,164	179,343	35,868	23,314
2017	53,932,728	179,775	35,955	23,370
2018	57,585,515	191,951	38,390	24,953
2019	60,538,698	201,795	40,359	26,233
2020	51,320,276	181,067	36,213	23,538
2021	57,500,397	191,667	38,333	24,916
2022	61,823,038	206,076	41,215	26,789
7 months of 2023	33,118,199	110,393	22,078	14,350

A high level of exports of Leather footwear industry (last column of Table 1), means a high level of waste generated in production in ton/year. The Figure 1 shows the annual net weight for the exports of textile and leather footwear.

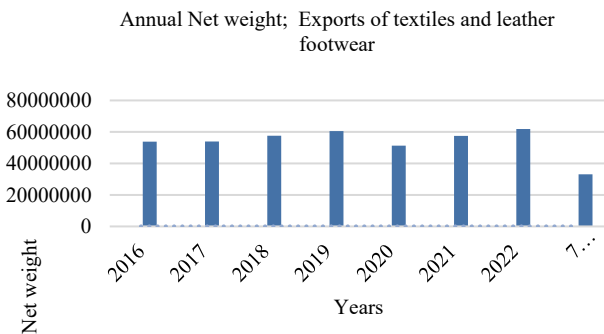


Figure 1. Annual Net weight; Exports of textiles and leather footwear

Referring to the figure, it is noticed that the level of exports of textile and leather footwear sector in kg/year, has been stable from 2016-2022 with an average 56, 643 kg/year. The situation was stable, even in the post Covid period.



Figure 2. Wastes /ton/year for the Textile and leather footwear (Exports)

This is related to additional competitive advantages, such as: the stability, know how, geographical position of our country, short lead delivery times, compared to China and other third level countries. In the Figure 2 is shown the waste generation, from exports of textile and leather footwear sector in ton/year, in Albania. Based on the figures shown, it is noticed that this industry generates a huge number of wastes, especially during 2022, with an amount of 41,215 ton/year wastes. In the figure 3 we have presented separate the wastes of leather footwear industry in order to be more conscious about the level of pollution this industry causes due to the finishing processes that leather footwear goes.

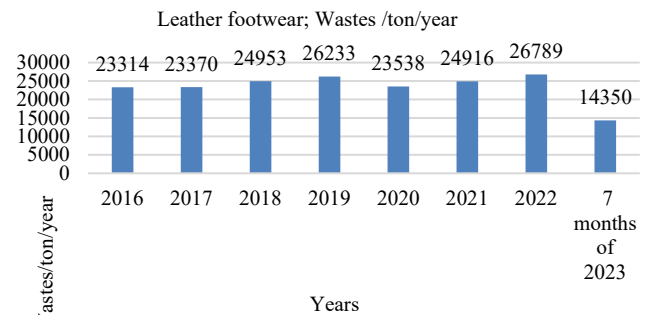


Figure 3. Wastes /ton/year for the Leather Footwear (Exports)

It is evident that every year the leather footwear industry generates a high level of wastes, which are very harmful and unfriendly to the environment.

2.1. Imports of Textile and Leather Footwear

Considering the fact that the majority of textile and leather footwear companies produce shoes for European clients, it was deemed necessary to take the import to make an analysis of the import and export of this sector, in order to make a detailed analysis on the waste caused by this sector. According to the preliminary data collected from INSTAT, on the imports of this sector in quantity for the years 2021-2023, we extracted the textile and leather footwear wastes, caused by this sector in tons/year as it is shown in Table 2.

The Figure 4, shows the annual net weight for the imports of textile and leather footwear.

Table 2. Imports of textile and leather footwear in Albania

Years	Textile and Leather footwear Imports	Textile and Leather footwear Imports	Textile and Leather footwear Imports	Leather Footwear Imports
	Net Weight	Weight in ton	Waste /ton/year	Waste /ton/year
2016	84,113,741	280,379	42,057	14,71995
2017	88,687,475	266,062	44,3435	15,520225
2018	96,559,324	289,677	48,2795	16,897825
2019	79,558,382.00	238,675	39,7795	13,922825
2020	77,576,475	232,729	38,788	13,5758
2021	91,718,425	275,155	45,859	16,05065
2022	83,681,765	251,045	41,8405	14,644175
First 7 months of 2023	34,921,063	104,763	17,4605	6,111175

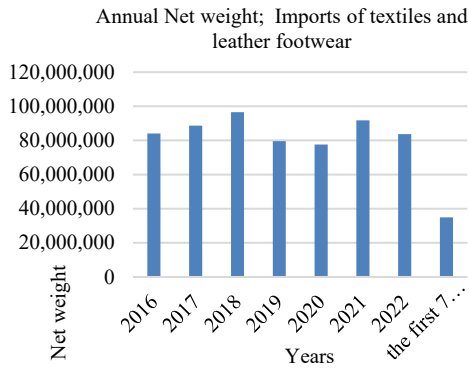


Figure 4. Annual Net weight; Imports of textiles and leather footwear

Referring to Figure 4, it is noted that the level of imports, as it was for exports in the textile and leather footwear sector in kg/year, has been stable from 2016-2022. In the Figure 5 it is shown the waste generation, from exports of textile and leather footwear sector in ton/year, in Albania.



Figure 5. Imports; Wastes in ton/year for the textile and leather footwear

Based on the Figure 5, it is noted that this industry generates a huge number of wastes, especially during 2022, with an amount of 41,840 ton/year wastes. These figures are slightly higher compared to exports in this sector.

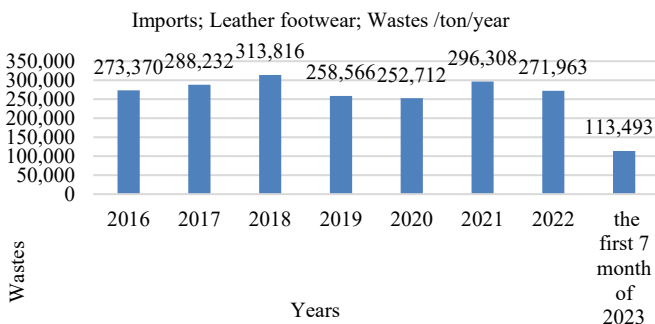


Figure 6. Imports; Wastes in ton/year; Leather footwear

In the Figure 6 we have presented separately the wastes of leather footwear industry in order to be more conscious about the level of pollution this industry causes due to the finishing processes that leather footwear goes.

Based on statistical data from imports and exports of textile and leather footwear in Albania, and the processing of this data further for leather footwear sector, it is evident that this sector is responsible for generating a significant amount of waste each year.

2.2. Materials and Methods

This study is conducted in "Mali Shpk" Leather Footwear Company in Lezha district, Albania. The company was founded in 1998, with Administrator Alfred Mali. In 2016, was built the second company of "Mali Shpk" for the Italian and European market. Currently, the company employs 453 workers, a considerable number for the district of Lezha and the surrounding villages. The gradual growth of the company has made the steps safe and solid both for the business itself and for the employees.

The company is one of the few brands which produce for foreign customers as well as for local market. This company has implemented the circular design of shoe production, which include the concept of reuse and recycle of the wastes during the leather and footwear production. In this case study we have presented how this company reuses and recycles overstock and defective tires, as well as leftovers wastes in production, as an excellent sustainability initiative and operating as a circular economy-based company. The study is carried out in two phases: In the first phase, some samples were taken to determine the composition of the soles that the company uses. Furthermore, the study continued with the processes that the company implements for the reuse and recycling of defective or overproduced soles as well as leftovers.

2.2.1. Chemical Analyses of EVA Sole

The two samples taken from "Mali Shpk" company (leftovers during the production of sole and granules as a raw material), were analyzed to determine their composition (as it is shown in the Figure 7).

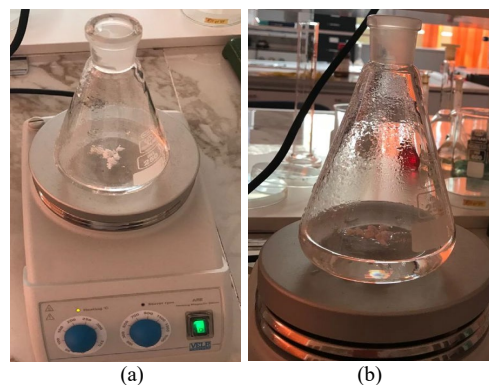


Figure 7. a, b) Samples treated with chemical reagents tetrachloride ethylene and xylene

The chemical analyzes of the sole composition were made at the Laboratory of the textile and leather/chemical section, at the Textile and Fashion Department (PUT). The samples were treated with tetrachlorethylene and xylene solution (1g sample/100ml tetrachlorethylene

and xylene), based on CSN EN 12934 standard. These two chemical reagents acted on the samples, so the samples were dissolved, which leads to the conclusion that the composition of the soles is vinyl ether-acetate. Based on chemical analysis, the rubber composition is EVA (Vinyl ether-acetate).

2.2.2. Reuse and Recycle of EVA Sole and Leftovers

The process of reusing and Recycling of the defective overproduction of soles and leftovers in "Mali Shpk" production goes through these steps:

A) Collection and Sorting: of defective soles and leftover or overstock soles from the production line. After they sorts the materials based on their quality, type, and suitability for recycling. In Figures 8a, 8b, are shown the first step of collecting and sorting of defective soles, overproduction soles and leftovers during the production.



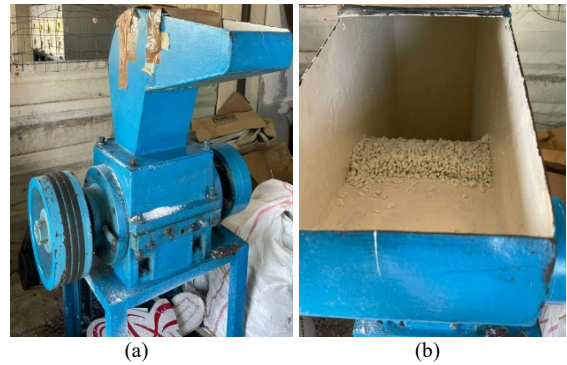
(a)



(b)

Figure 8. Defective soles and overproduction (a), leftovers (b)

B) Processing defective tires, overstock soles, and leftovers. The defective tires, over product and leftovers were recycled and processed in the machinery shown below by shredding and grinding them, to create crumb rubber (Figure 9).



(a)

(b)

Figure 9. Shredding and grinding machinery of defective soles and leftovers

C) Production of the new soles of sneaker production for the local market. The rubber granules or crumb rubber were incorporate in the "LIDER MAKINA" production process to create new shoe soles for sneaker, ensuring that the manufacturing process maintains the quality and performance of the final products as it is shown in the Figures 9 and 10.



(a)

(b)



(c)

(d)

Figure 10. Rubber granules in two colors white and black (a), (b), crumb rubber (c), (d)

The LIDER MAKINA worked with these parameters in order to produce the final sole:

- Melting temperature: The temperature of 140-160 degrees Celsius is crucial to ensure that the shoe sole is in a hardened state and suitable for use. This contributes on creating a high-quality product.
- Product exit time: The short product exit time, just 1 minute and 15 seconds, indicates a fast production process. This is an advantage in delivering shoe soles in the shortest possible time after customer orders.
- Product colors: They only produce the product in two colors, white and black.

The final product, is the new sole of the sneaker production for the local market, in two colors, as it is show in Figure 10.

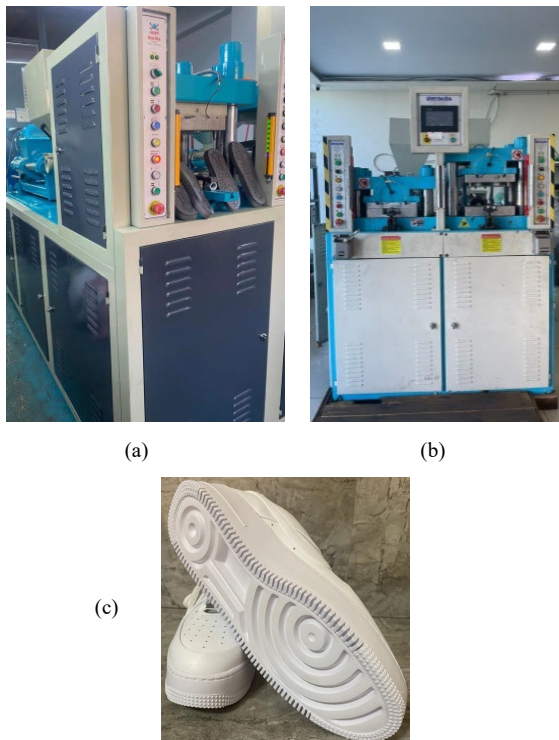


Figure 10. a, b, c) LIDER MAKINA EVA Injection machine for the production of EVA soles in two colors

6. CONCLUSIONS

Based on the INSTAT data, and in their further processing data, on leather footwear exports/imports, it resulted that leather footwear production enterprises in Albania generate a large amount of waste, thus leading to environmental pollution. Since Albania is a candidate for the EU, in order to stay in the EU market, it should start implementing EU Directives for green and eco products. This means to invest in clean technology, green manufacturing and training. Although there are a few garment and leather footwear companies in Albania, which have embraced the concept of the circular economy, most of them are still in the initial stages, of orienting their activity towards the circular economy, through the management of waste and waste in the resource phases.

Nowadays this is not enough. Albania cannot be called a country with free labor force, nor low cost due to the devaluation of the euro against the local currency. The companies need to be sustainable, so it is necessary for them to change the production concept and switch to circular design with a closed loop. The "Made in Albania" label is still in its early stages. There are very few companies that have embraced this concept of production. One of this companies which has implemented circular economy by designing, reusing, recycling, and reproducing new soles for sneakers for local market is "Mali Shpk".

This method has led the company to reduce costs and thus increase productivity. Also, the company has become more stable in the market against the challenges that this sector faces. Another positive impact of redesigning, reuse and recycling is related to the environment protection by designing green products.

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BIOGRAPHIES



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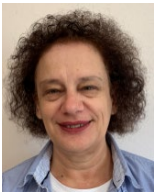
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