ASSESSING THE CURRENT STATUS AND PROPOSED SOLUTION OF SOLID WASTE MANAGEMENT IN CAN SPORTS VIETNAM CO., LTD

Ho Bich Lien[(1)], Le Nguyen Hoai An[(1)]
(1) Thu Dau Mot University
Corresponding author: lienhb@tdmu.edu.vn

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Abstract

Assessing the current status of solid waste management in the leather footwear industry of Can Sports Vietnam Co., Ltd. in particular to identify urgent issues in solid waste management. Through the assessment process, it was found that the company has implemented well the steps of solid waste management from classification, collection and storage, according to the provisions of law and customers. However, there are still difficulties in management arising from workers' awareness, management costs, and facilities when storing waste. With the amount of solid waste increasing according to production needs, the topic has proposed appropriate solutions such as disseminating detailed instructions on the classification process to workers and establishing reward, and incentive mechanisms for improvement projects to help reduce solid waste in production.

Keywords: Can Sports Vietnam Co., Ltd, industrial solid waste, leather footwear industry, solid waste management

1. Introduction

The leather footwear industry plays an important role in the Vietnamese economy. This industry has contributed to shifting the economic structure and labor from agriculture and rural areas to industry; creating jobs, and taking advantage of labor. This is also one of Vietnam's key export industries, one of the industries with a high export turnover and growth rate, playing an important role in the growth of the economy; contributing to the global value chain. Statistics show that in 2022, the export scale of the Vietnamese leather footwear industry ranked 3rd in the world.

In addition to the economic benefits that the leather footwear industry brings, the amount of waste generated by this industry is also not small, mainly emissions and solid waste. Solid waste management faces some difficulties in terms of resources and funding, which is a concern for developing enterprises to be able to both develop the economy and still ensure compliance with environmental protection laws.

In Tay Ninh province, Can Sports VN Co., Ltd. is one of the leather shoe manufacturing companies - a supplier for Nike with a large production scale. With a production scale, processing sports shoes of more than 1,000,000 pairs/year, the amount of solid waste generated every year is relatively large. This is also an issue that the company is very concerned about because the management of emissions as well as the collection and treatment of waste at the company are in charge of the General Department and the Social.

Responsibility Department. From recognizing the opportunities and challenges of waste management, the topic "Assessing the current status and proposed solution of solid waste management in Can Sports Vietnam Co., Ltd" aims to assess the current status of waste management at the company and propose appropriate management solutions for the company to promote production and protect the environment in the region.

2. Methods

2.1. Research object

Research object: Current status of collection and management of Industrial solid waste.

Research scope: Can Sports VN Co., Ltd

2.2. Research methods

Theoretical research method: Collect documents, environmental reports from management agencies, previous studies, and related information such as the current production status of the leather footwear industry. Research and synthesize theories from documents, books, scientific newspapers and previous studies on environmental management, waste treatment technology, and the leather footwear industry, reports of Can Sports VN Co., Ltd.

Method of calculating and forecasting waste generation: Refer to the research topic on emission coefficients of industries to calculate the amount of waste generated based on the company's product output.

Theoretical analysis method: The topic evaluates policies, legal regulations, and related environmental standards such as the Law on Environmental Protection, and ISO standards (ISO 14001). From there, approach the problem from a comprehensive perspective, sources of pollution and environmental management measures.

Statistical analysis and data processing methods: Data processing and text editing on Microsoft Word and Excel software. To analyze influencing factors, evaluate the current status of solid waste collection, transportation and treatment.

3. Results

3.1. Assessment of current status of solid waste management in Can Sports Vietnam Co., Ltd

3.1.1. Assessment of current status of solid waste generation

Table 1 shows the results of the statistics of solid waste volume in Can Sports Vietnam Co., Ltd. A total annual volume of solid waste generated from the company is about 1.654 tonnes/year. Solid waste is divided into three types: domestic solid waste, common industrial solid waste, and hazardous waste, which account for 16.94% (280 tonnes /year), 53.30% (881 tonnes /year), and 29.76% (492 tonnes /year), respectively.

Thus, the analysis results show that the Can Sports Vietnam Co., Ltd. has emitted a large amount of solid waste, of which the source of emissions is mainly from conventional industrial solid waste. This result shows that the amount of solid waste emitted is lower than the results of many other studies. Toofer's research shows that the amount of solid waste generated in leather footwear enterprises is on average about 4,900 tons per year (Toofer, 2003). The amount of solid waste generated significantly in footwear production has also been determined by (Fabio Tatano et al., 2016) to be about 8.500 tonnes of waste per year.

TABLE 1. The content of solid waste types in Can Sports Vietnam Co., Ltd

Solid waste	The Content (ton/year)	%
Domestic solid waste	280	16,94
Common industrial solid waste	881	53,30
Hazardous solid waste	492	29,76
Total	1.653	100

3.1.2. Assessment of the current status of solid waste classification and storage at Can Sports Vietnam Co., Ltd.

Waste collection and separation in companies or factories is an important task that affects both environmental sustainability and operational efficiency (Francesca Bartolacci et al., 2016). Understanding the different types of waste generated during the production stages allows organizations to implement effective strategies for waste minimization, recycling and responsible disposal.

The company has regulations on waste classification at the factory before transporting it to the centralized waste house. At the factory, separate trash bins will be installed for each type of waste. There are a total of 3 types of trash bins: household trash bin, production trash bin and hazardous trash bin. Household trash bin used for domestic solid waste. Production trash bin used for common industrial solid waste, and hazardous trash bin for hazardous solid waste. Production trash bins, and hazardous trash bins will be divided into many small trash bins according to each type.

Household trash bins are divided into 2 compartments for recyclable and non-recyclable trash bins. Household waste bins will be placed in the toilets of the workshops, and production waste bins will be placed in the production lines.

Figure 1 shows that common industrial solid waste contains many components such as paper and paperboard, nylon bags; waste aluminum moulds; waste plastic moulds; plastics and rubber; and wooden pallets at the proportions of 26%, 5.8%, 6%, 52%, and 10.2%, respectively. Among these components, plastic and rubber have the highest emission rate of 52%.

The results of the study are consistent with the findings of Vignesh et al. (2021), industrial solid waste is usually generated during the manufacturing process of products. Solid waste generated in the leather industry usually includes metal scraps, excess plastics, nylon bags; plastics and rubber. The composition of solid waste depends on the main product type produced by the company (Vignesh et al., 2021). The main product of Can Sports is shoes. This results in the highest emissions of plastic and rubber.

Hazardous waste includes materials that are toxic, corrosive, flammable, or reactive, posing significant risks to human health and the environment if not handled properly (Tran Thai Ha Nguyen et al., 2023). Hazardous waste is classified in Can Sports Vietnam Co., Ltd. includes cleaning rags contaminated with solvents, oil residue, packaging contaminated with solvents and acid, and fluorescent bulbs. In addition, the company also produce domestic solid waste. They are divided into 2 types: Organic waste (food waste, biodegradable waste) and other components (packaging, plastic boxes, metal cans).

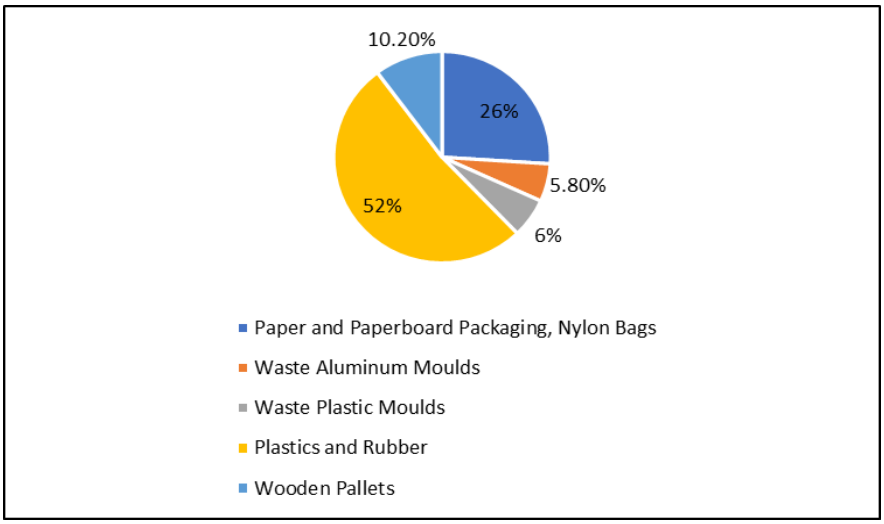

Figure 1. Composition of common industrial solid waste

Waste after being collected and classified is stored. The amount of household waste will be stored in plastic bins with lids in the right place. 120-240L trash bins will be placed in the production workshop, around the factory premises. In the office, 20L trash bins will be used, and household waste will be collected by workers at the end of the working day. The waste collection area has specialized garbage carts (with wheels and covered lids) divided by type to facilitate waste handover. With Common industrial solid waste, the company has arranged 01 warehouses for storing common industrial solid waste with an area of 414m² (23m × 18m). The warehouse is built with a corrugated iron roof and surrounded by brick walls. In the storage area, scraps are neatly stored and divided by type to facilitate waste handover. With hazardous solid waste, the company arranges garbage bins with lids, and warning signs and stored in a separate hazardous waste storage warehouse. The hazardous waste storage facility is built by regulations, with an area of 414m² (23m × 18m), arranged separately from other areas and built by technical requirements such as a tight, leak-proof floor, a barrier to prevent rainwater from flowing in from the outside, a corrugated iron roof, and a surrounding brick wall.

Thus, the classification and storage of industrial solid waste at Can Sports Company has ensured compliance with Article 81 of the Law on Environmental Protection 2020. The Company has classified solid waste into separate groups such as ordinary industrial solid waste, hazardous industrial solid waste, and domestic solid waste. Solid waste after classification is stored separately by type; hazardous waste is not mixed with ordinary industrial solid waste; dust is not emitted or solid waste is leaked into the environment; stored with appropriate equipment, tools, and storage areas in accordance with regulations.

3.2. Assessment of the current status of 4R application in solid waste management at Can Sports VN Co., Ltd.

3.2.1. Wastewater reuse

Wastewater reuse is a sustainable water management strategy that consists of recycling wastewater for various uses, including irrigation for farming, watering green spaces, and certain industrial applications (EPA, 2024). Wastewater after treatment meets column A QCVN 40:2011/BTNMT, suitable for irrigation. The company has reused this water source to irrigate the green areas in the company's campus. The amount of water reused each day for irrigating the green areas is 6.99m^3/day (32%) (figure 2).

In addition, this amount of water is also reused for cleaning 480 toilets in the factories. The amount of water used for this problem is 14.4m^3/day (68%) (figure 2). With this result, it is clear that the company has saved 21.39m^3/day.

Wastewater reuse reduces the dependence on natural sources of irrigation water such as rivers, lakes, and groundwater; Wastewater reuse also reduces the amount of wastewater discharged into the environment, reducing the impact on the biosphere and irrigation systems. This can include reducing the amount of pollutants and temperature of wastewater, as well as preventing the water level in lakes, rivers, and streams from dropping; Wastewater reuse often also reduces the need for energy and raw materials to treat new water, reduces greenhouse gas emissions, and keeps water production and treatment processes more efficient.

Many companies across industries have successfully implemented water reuse systems, realizing both environmental and economic benefits. For example, a beverage manufacturing plant in California installed a water reuse system that recycles wastewater from rinsing and bottling processes, achieving a 40% reduction in freshwater usage (Kaveh Ostad-Ali-Askari and Saeid Eslamian, 2021). Similarly, a chemical processing facility in Texas invested in a membrane bioreactor system that treats wastewater for cooling and cleaning applications, saving millions of gallons of water annually (Eslamian et al., 2015).

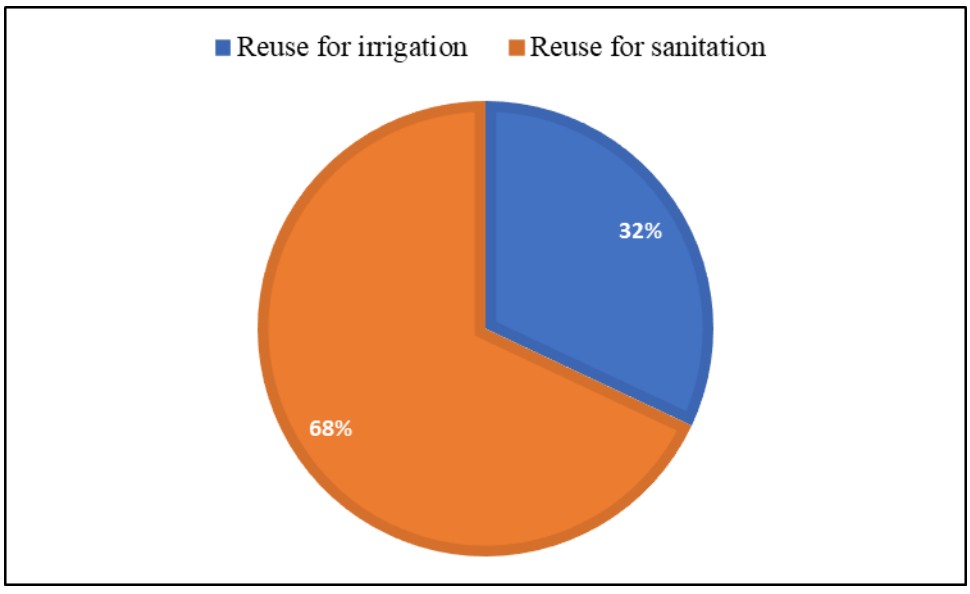

Figure 2. Reusing treated wastewater in Can Sports Company

3.2.2. Solid waste recycle

The amount of solid waste generated daily from the production process is relatively large (1.653 tons/year). If it is completely discarded, the company will spend a lot of money on collection and treatment. The company's NOS (improvement) department has continuously proposed recycling solutions and improved production processes.

The company identifies recyclable solid waste through a waste classification process. If solid waste is not classified, it will not be accepted and will be returned to the factory for classification. This classification helps the company identify types of waste that have the potential to be recycled or sold to an external unit.

Solid waste before disposal will be stored and counted in each workshop's warehouse for reuse. For example, defective products that cannot be used for production will be sewn into product bags used by the QC (inspection) department to transport samples between workshops.

3.2.3. Machinery and equipment repair

The maintenance team in the production areas is highly experienced in repairing machinery. Over the past year, the maintenance team has repaired damaged machinery and improved the design of new machines from previously damaged machines such as punching machines from reinforced presses.

3.2.4. Resources sharing

Taking advantage of the geographical location in Tay Ninh with sunny weather, the company has cooperated with SkyX Solar Energy Company to rent the roofs of 10 factories to install solar panels. The electricity collected from the panels is fed into the national grid. Every month, the unit will come to the company to maintain the system.

The resource sharing model is based on the sharing of goods and assets. This model allows for less resource consumption in the production of commonly used products, while consumers have the opportunity to earn extra income and save money. Many companies have successfully implemented this model (Atalay Atasu et al. 2021). Philips allows hospitals to upgrade their medical equipment (such as MRI and CT scanners) by trading in their old equipment for a discount on the purchase of new systems. Philips refurbishes and upgrades old equipment and resells it. This business model allows hospitals to gain financial returns on their old equipment while efficiently upgrading to the latest technology. Airbnb has proven to be a successful implementation of this model. Airbnb connects people with vacant accommodation with people who want to rent it for short periods of time. This increases occupancy rates, reduces waste of vacant accommodation, and reduces the overall housing requirement.

3.3. Evaluation of advantages and disadvantages of solid waste management system at Can Sports VN Co., Ltd.

3.3.1. Advantages

The company has set strict regulations to ensure proper management of solid waste. Solid waste is classified at the factory before being brought to the disposal warehouse, helping to reduce classification time, and optimize the receiving and storage process.

Waste transportation regulations are specifically regulated for each type of waste, helping the solid waste transportation process not to affect the production process.

Every year, organize waste classification training for all employees twice a year. To remind and guide waste classification and proper disposal. Combined with internal loudspeakers to propagate quarterly waste classification.

Respond to World Environment Day every year through community activities such as cleaning up the area around the company, ... Take advantage of recycled solid waste to produce useful items in the production process such as sample bags, scissors bags, thread bags, scrap material bags, excess, ...

3.3.2. Disadvantages

In addition to the above advantages, in the process of solid waste management, the company also has some shortcomings that have not been overcome.

The first disadvantages are related to the classification. The classification of industrial and hazardous solid waste still faces many problems because workers often cause chemicals to stick to common industrial waste during the process, increasing the amount of hazardous waste. The classification into small parts is usually ignored. Recyclable and non-recyclable waste are not classified, causing difficulties in the classification stage at the garbage house, leading to odors and time-consuming classification.

Workers' lack of knowledge in the process of collecting, classifying, and treating waste has caused many difficulties in the solid waste management system at the company. Workers do not clearly understand the importance of waste classification at source, leading to the mixing of domestic, production and hazardous waste, increasing treatment costs.

Operational disadvantages of the company also create to the limitations of the system that hinder the implementation of solid waste management. The amount of hazardous waste is still quite high compared to the company's target because the chemical distribution process is not closely monitored, often generating excess chemicals that cannot be reused. Besides, the company lacks machinery to facilitate the collection process.

Waste management budgets and resources are still quite limited, leading to overload when receiving waste during peak production periods, causing time-consuming procedures for weighing and transporting waste to storage cells.

3.4. Proposing solutions for solid waste management in Can Sports VN Co., Ltd.

3.4.1. Proposing solutions to reduce at source

Nowadays, to contribute to environmental protection, businesses, especially those in the footwear industry, are increasingly focusing on minimizing waste generation. One of the important approaches in this context is source reduction. According to the European Union (2010), the solution of waste reduction at source is not limited to municipal solid waste, but it should be considered for different types of industrial waste originating from production (Fabio Tatano et al., 2016).

To minimize recyclable waste such as leather, fabric, rubber, paper, etc., Can Sports VN Co., Ltd. needs to have separate solutions for each production stage. The selected materials must be suitable for the order so that when producing, there will be no excess fabric or substandard fabric. Single-sided paper should also be reused to store internal records. The process of using disposable plastic items in the canteen should be replaced with reusable items. The company increases the application of digital technology in the process of signing documents and records. Provide employees with training on waste minimization practices, fostering a culture of environmental responsibility and conscientious waste management.

Thus, by adopting source reduction, this business can significantly reduce the amount of solid waste, thereby minimizing the impact on the environment. Furthermore, source reduction helps the company create a good impression with consumers about its products as being sustainable and environmentally friendly, thereby further enhancing the company's brand.

3.4.2. Proposing solutions for recycling and reuse

Recycling and reusing waste materials for reuse in the manufacturing process is a necessary solution. Some solid wastes, such as fabrics and rubber, should be sorted and recycled for the production process. Damaged equipment and machine parts are disassembled and replaced for slightly damaged machines or applied to machine renovation projects. Defective fabrics from printing and heat pressing processes are recycled into useful products such as bags and shirts. Damaged office equipment, such as tables, chairs, and cabinets, is repaired and repainted by the maintenance department and used for training and education areas instead of being discarded.

Materials reused in the recycling process serve as an alternative to raw materials obtained from increasingly scarce natural resources such as petroleum, natural gas, coal, and mineral ores. Recycling can help reduce the amount of solid waste going to landfills, which is becoming increasingly expensive. Recycling also reduces air, water, and soil pollution caused by waste disposal (Jerry Nathanson, 2023).

3.4.3. Proposing policy solutions

In solid waste management, a legal approach is necessary to avoid violations of environmental protection laws. The company needs to comply with legal requirements, regulations on solid waste management and treatment as well as other environmental requirements applicable to all activities of the footwear company. The company should issue policies for improving and preventing environmental pollution from solid waste. Promote effective environmental reduction measures, the company develops environmental management goals from the input material purchasing process, and selects raw materials suitable for the order.

In Can Sports VN Co., Ltd., the awareness of workers on solid waste management is still very poor and the company’s efforts in raising awareness are still very low. Therefore, the company needs to organize training courses to raise awareness and responsibility to participate in environmental protection for all current and future workers. In parallel, the company should also develop and issue detailed procedures for waste collection, classification, treatment and disposal; establish incentive mechanisms and rewards for projects that reduce solid waste, or improve processes that help reduce waste in the company.

4. Conclusion

During the management process, the company has continuously sought solutions to reduce, recycle, and reuse waste to reduce costs for waste treatment as well as contribute to environmental protection for the locality and industry. Although there are many difficulties and challenges arising from human factors and implementation costs, these are also opportunities for the company's leadership to improve management processes to propose appropriate solutions. From simple solutions to reduce at the source, change processes, choose suitable materials to build programs and policies to reward and

encourage effective solid waste reduction improvement projects for employees. From these improvement projects, the company has found initial solutions suitable for the company's scale, helping the company to bring its own mark to customers and partners.

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