

Foreign Trade of Waste and the International Agreements Regulating It: A Case Study of Paper Waste Export by MAG-Emballag Packaging Company

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Abstract:

Waste export is one of the most significant international transactions, experiencing high demand in the global market due to its positive economic, social, and environmental dimensions. This process offers a second chance for waste materials to be transformed into consumable goods and products. This research paper will address the reality of international waste trade in general, with a case study focusing on the export of paper waste by a private Algerian company in the Wilaya of Oran. Through the valorization of paper waste, the company successfully reduced import costs and increased its turnover.

Key Words: International Trade, Waste Import and Export, International Agreements, Paper Waste Valorization, Private Company.

JEL Classification : Q27, Q37, Q52, Q65

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1. Introduction

The ongoing economic and financial transformations worldwide, together with policies of trade liberalization and accelerated economic development, have considerably expanded export and import activities. This applies to raw materials, semi-finished goods and manufactured products alike, all mobilized to secure the goods and services required by national economies. Within this context, waste has increasingly become an integral component of international trade. It has developed into a distinct global market, characterized by growing demand due to its role as a source of secondary raw materials and its contribution to countries' economic revenues and resource diversification.

Against this backdrop, the central research problem of this study can be formulated as follows: **What is the reality of foreign trade in waste and what are the main legal frameworks that regulate it at the international level?** To address this overarching question, the study is guided by the following sub-questions:

- What is foreign trade and what are its main objectives?
- How is foreign trade structured in Algeria and on which pillars does it primarily rely?
- In what forms does foreign trade in waste manifest itself?

Accordingly, the working hypothesis of the study is formulated as follows: H1: The regulated export of non-hazardous industrial waste, such as paper and cardboard, can contribute to reducing the net cost of imported raw materials and to supporting Algeria's export diversification efforts beyond hydrocarbons.

The main aim of this article is to analyse the interaction between international legal frameworks on waste and the actual practices of foreign trade in waste, with a specific focus on the case of paper waste exports by an Algerian industrial company, MAG-Emballag. The importance of the study lies in its attempt to link three dimensions that are often examined separately in the literature: (i) the general theory of foreign trade, (ii) the regulatory architecture governing transboundary movements of waste, and (iii) empirical evidence from a firm operating in a hydrocarbon-dependent economy seeking to diversify its exports through non-hydrocarbon activities and waste valorization. By doing so, the article contributes to understanding how global environmental and trade rules are translated into concrete opportunities and constraints at the microeconomic level.

In line with this objective, the study is structured into five main sections. The first section presents the concept of foreign trade; the second defines and classifies waste; the third examines the international trade of waste; the fourth reviews the principal international agreements concluded on waste exchange; and the fifth analyses a case study of the MAG-Emballag packaging company in the Wilaya of Oran. Methodologically, the research adopts a narrative and descriptive approach, drawing on secondary data and information collected from official websites, Arabic and foreign books, academic journals, conference proceedings and theses.

2. Concept of International Trade

Foreign trade is fundamentally grounded in the exchange of goods and services between at least two countries. It arises, on the one hand, from the relative scarcity of certain materials and products in a given national economy, which generates demand, and, on the other hand, from the existence of a surplus of the same products in other economies, which constitutes the supply (Okasha, 2017–2018, p. 120). Building on this idea, foreign trade can be defined as “a branch of

economics concerned with studying economic transactions occurring across national borders and with the outside world” (Matar et al., 2001, p. 13). Its ultimate purpose is to organise the exchange of goods and services between countries in a way that allows each trading partner to obtain the products it needs and to exploit its comparative advantages in what it produces efficiently (Ali et al., 2002, p. 14).

More recent literature extends this traditional view by emphasising that international trade today also encompasses flows of *secondary raw materials* and *recyclable waste* as part of the transition towards a circular economy. A systematic review by Schroeder et al. (2021) shows that international trade and circular economy policies are increasingly interlinked, particularly through trade in scrap, secondary materials, and waste-based inputs, and that policy coherence between trade agreements and environmental regulation is now a key research and policy concern. Similarly, an OECD report on *International Trade and Circular Economy – Policy Alignment* highlights that circular economy measures (such as recycling targets, extended producer responsibility schemes, or eco-design standards) have important implications for cross-border flows of materials and products, and that trade policy can either facilitate or hinder these circular flows depending on how it is designed (OECD, 2021).

2.1. Objectives of Foreign Trade

Foreign trade arises for a variety of economic and developmental reasons, several of which are highlighted in the classical literature and remain valid today (Nouri Moussa, 2005, pp. 21–22):

- Enhancing economic growth and welfare: By expanding exports, countries increase the value of their Gross Domestic Product and generate foreign exchange revenues, which can raise income levels and improve living standards.
- Access to technology and know-how: Trade in capital goods, intermediate inputs and services enables importing economies to acquire modern technologies and organisational practices, and to benefit from the expertise of more advanced exporting countries.
- Integration into regional and global value chains: Foreign trade contributes to building relationships within regional and international economic blocs, thus deepening economic integration and enabling participation in global value chains.
- Mutual interdependence and cooperation: No country is self-sufficient in all products; foreign trade helps to “build bridges” between economies by allowing each to specialise and to rely on partners for goods it cannot efficiently produce.
- Market diversification for surplus production: Exporting provides an outlet for domestic surpluses, reducing pressure on local markets and smoothing business cycles.
- Reducing unit production costs: By exploiting economies of scale—producing large volumes for international markets—firms can lower average costs and increase competitiveness (Nouri Moussa, 2005, pp. 21–22).

In contemporary debates, additional objectives have emerged. Trade is increasingly seen as a lever to support sustainable development and the circular economy, for example by facilitating access to recycling technologies, promoting trade in environmental goods and services, and enabling cost-effective reuse and recovery of materials across borders (OECD, 2021; Schroeder et al., 2021).

2.2. Algeria's Foreign Trade

Algeria's foreign trade structure is historically characterised by a strong dependence on hydrocarbon exports. Hydrocarbon sales have long accounted for the overwhelming majority of export revenues—over 90 % of total exports according to World Bank estimates. The value of hydrocarbon exports was estimated at around 60 billion US dollars in 2022, before dropping to approximately 20 billion US dollars in 2023, a decline largely attributable to the fall in international oil prices from 104 to 84 US dollars per barrel (elkhabar-press, 2023). This volatility illustrates the vulnerability of a trade structure concentrated in a single commodity group.

In response, the Algerian state has been actively striving to revitalise and diversify foreign trade outside the hydrocarbon sector. During the first eight months of 2020, non-hydrocarbon exports amounted to approximately 1.34 billion US dollars, while for the same period in 2021 they reached nearly 2.9 billion US dollars, representing a substantial increase of about 118 % and accounting for roughly 12.3 % of total exports (commerce, 2021). Among the most dynamic export items, when comparing early 2020 and 2021, are mineral and chemical nitrogenous fertilisers (886 million versus 524 million US dollars, an increase of 69.1 %), iron and steel (595.78 million versus 28.76 million US dollars, an increase of 1 971 %), inorganic chemicals (501.8 million versus 150.1 million US dollars, an increase of 234 %), sugar, sugar preparations and honey (288 million versus 173 million US dollars, an increase of 66 %), and manufactured metal products (190.81 million US dollars, representing 6.54 % of total non-hydrocarbon exports) (commerce, 2021). More recent analyses by the World Bank indicate that non-hydrocarbon exports have continued to expand over the medium term: they have approximately tripled since 2017 and reached about 5.1 billion US dollars in 2023, although this still corresponds to only around 2 % of GDP, which underscores both the progress achieved and the persistence of structural constraints. These exports increasingly comprise semi-finished products (e.g. steel, cement) and selected agri-food items, signalling a gradual move up the value chain and a slow reconfiguration of Algeria's export profile. Algeria's trade openness, measured as total trade as a share of GDP, stood at around 45 % in 2020, underlining the centrality of foreign trade to the national economy.

In line with global trends and the literature on commodities and development, international organisations such as UNCTAD emphasise that commodity-dependent economies like Algeria need to diversify both their production base and export basket in order to reduce vulnerability to terms-of-trade shocks and to support inclusive, low-carbon growth (UNCTAD, 2023). Within this broader diversification strategy, the development of exports of recyclable materials and secondary raw materials—including specific categories of waste—can be interpreted as part of a gradual transition towards a more circular trade model. This is consistent with emerging agendas on circular-economy and trade alignment, which stress the role of international trade in facilitating cross-border flows of secondary materials, recycling technologies and environmental goods (OECD, 2021; Schroeder et al., 2021)

3. The Concept of Waste

Industrial development, on the one hand, and rapid demographic and urban growth, on the other, have led to a continuous increase in global waste generation. Estimates suggest that total municipal solid waste reached around 2.01 billion tonnes in 2016 and may rise to between 3.4

and 3.8 billion tonnes by 2050 if current patterns persist (mondiale, 2018; UNEP & ISWA, 2024). This growth, combined with inadequate management practices in many regions, has made waste a major environmental, health and economic challenge and, more recently, a central topic in circular-economy debates (Kafle et al., 2025; Rada et al., 2021).

3.1. Definition of Waste

There is no single universally accepted definition of waste; rather, definitions vary across legal systems, international organisations and academic disciplines. In everyday language, the term “waste” often refers to rubbish or discarded items—residues and old materials that are unusable and non-consumable. In the industrial context, waste typically refers to the quantitative and qualitative losses that occur during production, transformation or transport, such as reductions in quantity or deterioration in quality and value.

In the amended decision of the Organisation for Economic Co-operation and Development (OECD, 2009), the definition of waste was refined to reflect both legal and operational realities. According to this decision, waste means materials or objects (1) that have been disposed of or are in the process of recovery; (2) that are intended for disposal or recovery; or (3) that are required, by national legal provisions, to be removed or recovered. This definition emphasises both the *intention* to discard and the *obligation* to manage the material through disposal or recovery operations.

From a more economic and operational perspective, waste can be described as “the remnants of production or transformation processes of various types, sizes and compositions, that is, everything remaining from the production and transformation process—materials, parts or pieces that are surplus to requirements, unusable in their current form, or whose use has become invalid for some reason” (Miloud, 2002, pp. 3–4). Consequently, waste, in general, is any material that its owner (producer) or possessor discards or is legally obliged to discard (JORA, law 01/19 of 15/12/2001, 2001). Recent literature on municipal solid waste management extends this view by framing waste as a *potential resource* that can be valorised through recycling, energy recovery or other circular-economy strategies, provided that appropriate technologies and regulatory frameworks are in place (Kafle et al., 2025; Velis & Brunner, 2023).

3.2. Waste Categories

Waste can be classified in several ways, depending on its degree of hazard, physical nature, potential for valorisation, origin and intended treatment. This plurality of classifications reflects the diversity of waste streams and the need to tailor management strategies to their specific characteristics.

3.2.1. By Source

By origin, four broad categories are commonly distinguished:

- **Household and similar waste**, which arises from consumption processes in homes, restaurants, hotels and other service establishments. This waste can generally be collected and treated without posing unacceptable risks to public health and safety when appropriate systems are in place.
- **Industrial waste**, which includes all residues resulting from production, manufacturing, packaging and transport processes in industrial and artisanal enterprises. Typical examples include scrap metals, plastics, glass, paper and various process by-products (Sheikhi, 2011–2012, p. 199).

- **Medical (healthcare) waste**, comprising all solid and liquid discharges generated within healthcare facilities. This includes infectious, pathological, chemical and pharmaceutical waste, as well as non-hazardous waste from diagnosis, treatment, prevention or health research activities, and from administrative departments, food services, laundry, morgues and operating theatres.
- **Agricultural or “green” waste**, which originates from plants and vegetal residues in parks, gardens and green spaces (grass, branches, leaves, pruning residues, etc.).

3.2.2. By Degree of Hazard

From the perspective of risk, waste is often categorised as hazardous, non-hazardous or subject to specific regulatory regimes:

- **Hazardous waste** refers to waste that presents significant risks to human health or the environment due to its toxic, carcinogenic, corrosive, flammable, explosive, infectious or otherwise dangerous properties. Such waste requires specialised handling, transport, treatment and disposal.
- **Non-hazardous waste** covers waste streams that do not exhibit the above characteristics. Within this group, a further distinction is usually made between **inert waste**, which does not undergo significant physical, chemical or biological transformations (e.g. sand, concrete, certain construction and demolition waste), and **ordinary waste**, such as wood, plastics, textiles and glass, which may be recyclable or recoverable but are not intrinsically hazardous. Household and other urban waste fall largely into this category, though they may contain hazardous fractions if not properly segregated.
- **Waste subject to special regulations** includes categories for which specific executive decrees or dedicated legal instruments define collection, storage, transport, treatment and recovery requirements, and sometimes designate the authorised operators. This group may include hazardous or non-hazardous waste such as hospital waste, waste electrical and electronic equipment, used tyres, used oils and certain packaging waste. In many jurisdictions, these streams are prioritised for separate collection and valorisation due to their environmental impact or resource potential.

A number of common special waste streams are typically managed under these specific regulations, for example used oils (which must be collected by authorised operators and disposed of at approved facilities), used tyres (which should be returned to authorised collectors and preferably recycled), end-of-life vehicles (which must be treated by approved facilities) and packaging waste (which should not be mixed with other waste, disposed of in landfills or burned, but instead recovered through recycling or reuse, often under formal contracts with specialised service providers).

3.2.3. By Nature

Finally, waste can also be categorised according to its physical state:

- **Liquid waste**, including sewage, industrial effluents, wastewater from factories, mining operations and various commercial activities.
- **Gaseous waste**, consisting of gases released from human activities, such as carbon monoxide (CO), carbon dioxide (CO₂), nitrogen oxides and other pollutants. In 2016, CO₂ emissions from waste treatment were estimated at about 1.6 billion tonnes, representing nearly 5 % of global greenhouse gas emissions (Banque & mondiale, 2022).

- **Solid waste**, encompassing all waste with a coherent and rigid structure, including municipal solid waste, industrial solid waste and many of the special waste streams mentioned above.

Recent global assessments emphasise that understanding these categories and their interactions is essential for designing effective waste-management systems and circular-economy policies, as different streams require tailored collection, treatment and valorisation pathways (UNEP & ISWA, 2024; Kafle et al., 2025).

Table No. 1: Examples of Some Special Wastes

Nature of Special Waste	Special Instructions	Behaviors to Avoid
Used Oils	- Collected by authorized collectors. - Disposed of at approved facilities..	-
Used Tires	- Return used tires to authorized collectors. - Try to recycle them.	- Do not leave in the natural environment. - Do not burn.
Unused Vehicles	Unused vehicles must be processed by approved companies.	-
Packaging Waste	- Recovered through recycling or reuse. - Signing waste contracts with service providers.	- Do not mix packaging waste with other waste. - Do not dispose of it in landfills. - Do not burn.

Source: Prepared by the researchers based on <https://www.legifrance.gouv.fr/loda/id/LEGIARTI000006210420/2002-04-20/#LEGIARTI000006210420> accessed on 12/06/2025 at 10:50 AM.

3.2.3By Nature:

a- Liquid Waste: This includes sewage, water resulting from factories, mining operations, and so forth.

b- Gaseous Waste: These are gases produced from various human activities, including carbon monoxide (CO) and carbon dioxide (CO₂). In 2016, CO₂ emissions from waste treatment reached 1.6 billion tons, representing nearly 5% of greenhouse gas emissions (Banque & mondiale, 2022), as well as nitrogen oxides, etc.

c- Solid Waste: This refers to all waste with a coherent and rigid structure.

3. International Waste Trade :

The trade in waste has created a new type of exchange between the world's countries, with recoverable waste dominating these exchanges. The share of waste in global trade is constantly increasing day by day, with an estimated average annual growth in volume of 6.7%. In terms of value, the growth rate is much higher, averaging an estimated 23% annually.

This is due to the fact that waste initially has a "negative profit," where the cost of collection, recovery, and treatment is higher than the value of the recovered materials. It becomes "positive" when the cost is lower than the value of the recovered materials. For this reason, the economic value of waste depends on technological advancements in the recovery and reclamation sectors, which are "green activities" that add value to waste after it is returned as secondary raw materials to be integrated into the production chain.

The rise in prices and scarcity of raw materials has helped develop the waste recovery sector. A large number of foreign exchanges involve processed waste that can replace scarce raw materials. However, some observers fear that rapid development may be accompanied by environmental drawbacks, especially in countries lacking a legal framework for environmental protection (Bernard & al, 2012, p. 32). The exchange process is attributed to several factors, including:

- Scarcity of raw materials and their rising prices.
- The increasing quantity of waste worldwide and the difficulty of disposal.
- Efforts to reduce waste treatment costs.
- Eliminating waste management problems for a specific country and its high costs.
- A shortage of qualified labor and the technology required for waste valorization.

In 2018, the volume of global exchanges reached 182 million tons. Each year, economic activities and households in the European Union produce over 2000 million tons (Eurostat & European Environment Agency, 2024) of waste, including plastic, whose volume reached 16.3 million tons in 2021 (eurostat, 2018/2024). In 2022, the Netherlands topped the list of plastic exporting countries with a quantity of 675.92 tons, followed by Japan with 563.46 tons, and Belgium ranked third with an estimated 391.26 tons (Statista & Research, 2024)

Overall, the European Union exports approximately 32.7 million tons, a 75% increase since 2004, with Turkey being by far the largest destination for EU waste exports (13.7 million tons), followed by India and the United Kingdom (European Commission data, 2020). Meanwhile, 70 million tons are traded within the EU, with metallic waste, specifically iron and steel, leading these exchanges at an estimated 19.48 million tons in 2021. In contrast, 5.5 million tons were imported in the same year.

The following table illustrates some of the imported and exported waste in the European Union in 2021 (Eurostat & Agency, 2024):

Table No. 2: Some Wastes Exported and Imported in the European Union in 2021

Types of Waste	Export Volume (Million Tons)	Import Volume (Million Tons)
Paper and Cardboard	4.37	2.41
Non-Ferrous Metals	2.12	1.44
Textiles	1.52	0.41
Metals	1.47	1.42
Plastic	1.14	0.74
Rubber	0.94	0.11
Wood	0.72	2.38
Organic Materials	0.4	1.06

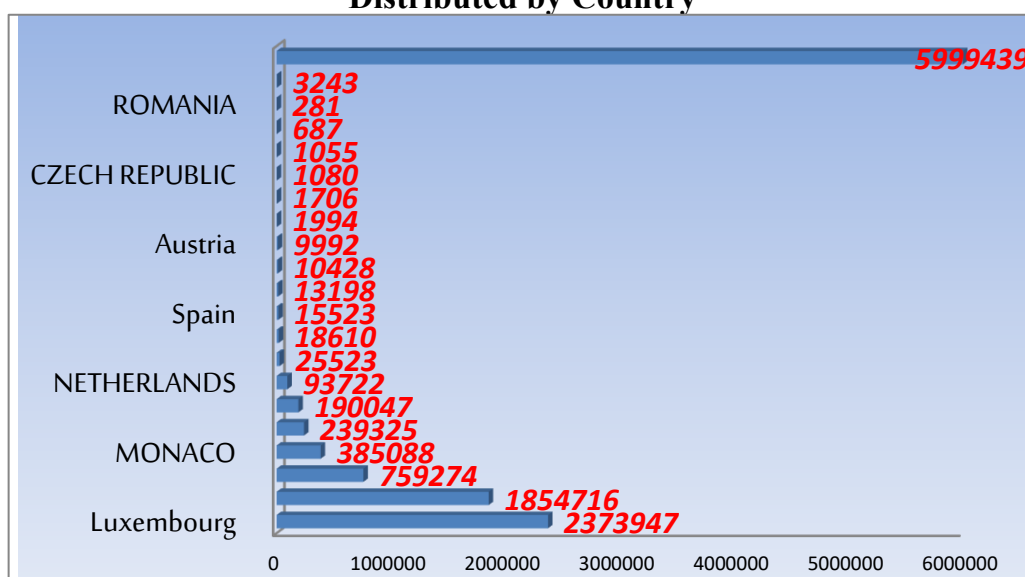
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Glass	0.37	0.71
Other Waste	0.46	3.58

Source: Prepared by the researchers based on data from <https://www.consilium.europa.eu/fr/policies/waste-trade/#0>

In 2022, France imported approximately 6 million tons of waste subject to prior notification procedures. In the same year, it exported nearly 2.9 million tons. Its exchanges were largely distributed among EU countries and some other nations, as illustrated by the following representation: a graphical representation of French waste imports subject to prior notification procedures in 2022 (Scribe & SDES, 2024)

Chart No. 01: French Waste Imports Subject to Prior Notification Procedures in 2022, Distributed by Country



Source: Prepared by the researchers based on data from the National Pole for Transboundary Waste Transfers (PNTTD). **Treatments:** SDES, 2023.

The chart illustrates the distribution of French waste imports subject to prior-notification procedures, showing a strong concentration among a few European partners. Luxembourg, Germany, and Belgium dominate the flows, jointly accounting for the overwhelming majority of imports, with Luxembourg alone exceeding 2.3 million tonnes, followed by Germany at 1.85 million tonnes. In contrast, countries such as Romania, Tunisia, Malta, and Austria contribute negligible volumes, each well below 5,000 tonnes. The United Kingdom, the Netherlands, and Ireland occupy a mid-range position, supplying several tens of thousands of tonnes. Overall, the data highlight a high geographical concentration of French waste imports, largely integrated within intra-European trade networks, reflecting logistical proximity and harmonised regulatory frameworks within the EU.

4. International Agreements Concluded on Waste Exchange

Legally traded waste is considered to have zero hazard. However, the exchange of waste deemed hazardous is governed by international agreements such as the Basel Convention of 1992. Below, we will briefly present the main international and European regulations related to the transboundary movement of hazardous waste.

✓ **At the International Level:**

a) Basel Convention of 1989 (OCDE, 2009):

This convention concerns the control of transboundary movements of hazardous wastes and their disposal. It entered into force on May 5, 1992, after being ratified or acceded to by 20 countries. By May 2008, 170 European countries were parties to it. Its main goal is to achieve environmentally sound management free from hazardous and other wastes. Among its stated objectives are:

- Minimizing waste generation, both in quantity and potential hazard, while considering social, technical, and economic aspects.
- Treating and disposing of hazardous waste as close as possible to its source of generation.
- Ensuring the availability of adequate facilities or means for its disposal wherever it may be.
- Protecting individuals involved in waste management and ensuring that necessary steps are taken to prevent pollution through administrative management.
- Reducing the transboundary movement of hazardous and persistent wastes within their sound environment and ensuring effective management.
- Controlling the movement of hazardous wastes across territories by regulating and preventing illegal traffic, based on a series of lists allowing states to classify waste according to its degree of hazard.

b) OECD Decision of 1992 (C(92)39/FINAL):

Amended in 2001, this decision regulates waste exchange among OECD countries and distinguishes between non-hazardous waste (green list) and hazardous waste (orange and red lists), to which the Basel Convention applies.

c) Rotterdam Convention:

This refers to the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade. It entered into force on February 24, 2004, and has been approved by 154 countries. The Conference of Plenipotentiaries adopted the text of the Rotterdam Convention on September 10, 1998. The Conference of the Parties subsequently amended the text at its meetings: its first session (Geneva, September 20-24, 2004), fourth (Rome, October 27-31, 2008), fifth (Geneva, June 20-24, 2011), sixth (Geneva, April 28 – May 10, 2013), seventh (Geneva, May 4-15, 2015), and eighth (Geneva, April 24 – May 5, 2017) (convention, 2020).

✓ **At the European Union Level:**

a) Waste Shipment Regulation (EC/1013/2006):

This regulation entered into force in July 2007. It replaces and strengthens the previous Regulation EC/259/93 of February 1, 1993, by incorporating the vision adopted by the OECD in 2001, as well as the Basel ban, and by streamlining and specifying existing procedures.

b) WEEE Directive:

The WEEE (Waste Electrical and Electronic Equipment) Directive No. 2002/96/EC of December 2006 sets a minimum annual selective collection rate of 4 kg per inhabitant (for households) and the RoHS (Restriction of Hazardous Substances in Electrical and Electronic Equipment) Directive, which restricts the use of certain hazardous substances. The 2002/95/EC

materials, which, since July 1, 2006, restrict the use of 6 hazardous substances in electrical and electronic equipment: lead, mercury, cadmium, chromium, PBB (polybrominated biphenyls), and PBDE (polybrominated diphenyl ethers).

✓ **At the African Level:**

We refer to the Bamako Convention (1991), which entered into force in 1996, concerning the ban on the import of hazardous wastes and the control of their transboundary movements in Africa.

All these and other agreements aim at one goal: to reduce the volume of transboundary exchanges of hazardous waste produced by developed countries, thereby imposing protection on developing countries. They also aim to protect the environment and limit pollution, as well as to foster economic cooperation and technological exchange between countries.

5. Case Study: MAG-Emballag Packaging Company

Methodologically, this section adopts a descriptive single-firm case study in order to illustrate empirically the hypothesis formulated in this article regarding the contribution of waste exports to reducing the net cost of imported raw materials. The analysis is based on quantitative secondary data obtained from MAG-Emballag's internal records (production statistics, import and export statements, and accounting data) for the period 2014–2018. For each year, we compiled the quantities and values of imported paper-based raw materials, the quantities of paper and cardboard waste exported, and the corresponding export revenues. On this basis, we constructed a simple indicator labelled “percentage decrease in cost”, which represents the ratio of annual revenues from waste exports to the annual value of raw material imports; this ratio approximates the share of import costs that is effectively offset by waste export revenues. The data are analysed using basic descriptive statistics (year-on-year comparison, trend observation and ratio analysis), which are appropriate given the limited number of observations and the exploratory objective of the study.

MAG-Emballag is a private Algerian joint-stock company (SPA) with a capital of 1,300,000,000 DZD. Its core activity is the production of corrugated cardboard for packaging. The company was originally established in 1948 as a producer of barrels. After independence, in 1969, it was acquired by seven partners. In 1974, the first Spanish-made corrugating machine was installed, with an initial annual capacity of 6,000 tons of cardboard. Driven by growing demand, the company subsequently expanded its operations several times, acquiring more advanced equipment and establishing production and conversion branches in the Sannai 01 and Sannai 02 industrial zones. Today, it employs around 500 workers. MAG-Emballag converts corrugated cardboard into various types of boxes and cartons used in different sectors, notably food industries and agriculture, according to customer specifications (candy boxes, pizza boxes, fruit and vegetable boxes, refrigerator boxes, etc.).

The company's experience in exporting paper and cardboard waste began in 2013. Before that date, waste was sold domestically to companies or individuals as semi-finished paper sheets no longer suitable for conversion into bags or boxes, or as defective boxes and bags from the production and conversion process, at very low prices. With the growing international interest in waste—especially paper waste—due to its environmental importance in preserving forest resources, large international firms turned to recovering and valorizing this material and transforming it into secondary raw material suitable for reinjection into the production cycle.

Among the most prominent of these partners is Saica in Spain, which is both a main supplier of raw materials to MAG-Emballag and a buyer of its paper waste, purchasing between 30,000 and 60,000 tons annually.

Table No. 3: Quantity and Value of Raw Material Imports (in Tons) between 2014-2018

Years	2014	2015	2016	2017	2018
Quantity/ Ton	30317.663	40141.035	53365.66	46004.99	60001.9
Value (Billion DZD)	2.0007	1.995	3.49	2.5	3.033

Source: Company Data 2014-2017

Table 3 presents the quantities and values of raw material imports over the period 2014–2018. Import quantities vary mainly in response to fluctuations in demand for the company's final products, while the value of imports is also influenced by the exchange rate and the international price of paper-based raw materials, in addition to imported volumes. The process of exporting paper waste involves several steps: preparation of the export invoice, customs declaration, shipment of the cargo and verification of the legal documents required for cross-border transport, in compliance with national and international regulations on waste transfers.

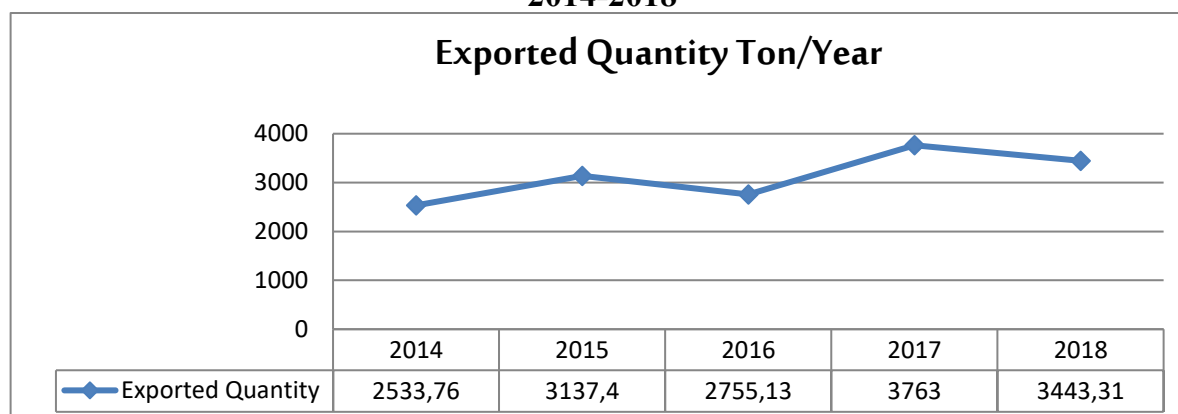
The process of exporting waste requires several steps: preparing the export invoice, customs declaration, and cargo shipment, along with certain legal documents to permit the cross-border transit of the consignment. The following table illustrates the value and quantity of paper waste exports abroad:

Table No. 4: Quantity and Value of Paper Waste Exports to Spain Between 2014-2018

Years	2014	2015	2016	2017	2018
Quantity / Ton	2533.76	3137.40	2755.13	3763	3443.31
Revenues Million DZD/Year	21.396	33.518	36.257	56.659	47.090

Source: Company Data 2014-2017

Chart No. 02: Quantity of Paper Waste Exports to Spain (Saica Company) Between 2014-2018



Source: Prepared by the researchers based on company data

Table 4 shows the quantities and values of paper waste exported to Spain between 2014 and 2018, and Chart 2 graphically illustrates the evolution of exported quantities to Saica. The exported volumes fluctuate over the period, which is consistent with the fact that they are directly linked to the company's production level and the quantity of imported raw materials; a clear positive association can be observed between these variables. Moreover, years with higher import volumes (such as 2016–2018) tend to coincide with higher waste export levels, confirming that exportable waste is largely driven by upstream production activity. This pattern supports our working hypothesis that the regulated export of non-hazardous paper waste contributes to partially offsetting the cost of imported raw materials, even if the effect remains relatively modest in absolute terms.

Table No. 5: Percentage Decrease in Cost During the Period 2014-2018

Years	2014	2015	2016	2017	2018
Value of Raw Material Imports (Billion DZD)	2,0007	1,995	3,49	2,5	3,033
Waste Export Revenues (Million DZD/Year)	21,396	33,518	36,257	56,659	47,09
Percentage Decrease in Cost	1,069425701	1,680100251	1,038882521	2,26636	1,552588197

Source: Prepared by the researchers based on company data.

Table 5 reports the “percentage decrease in cost” indicator for the same period. By comparing export revenues from paper waste with the value of imported raw materials, the results show that the company achieved a reduction in its effective raw material cost every year. For example, in 2016, the cost of purchasing raw material was reduced by about 1.03% through revenues from waste exports, with higher ratios observed in some other years. The variation in this indicator reflects changes in production volumes, international prices and the exchange rate, and confirms that, under appropriate regulatory conditions, the export of non-hazardous paper waste can contribute—albeit modestly—to improving the cost structure of an industrial firm such as MAG-Emballag.

5. CONCLUSION

This study showed that international waste trade, when framed by clear legal instruments such as the Basel and Bamako Conventions and EU regulations, can transform certain categories of non-hazardous waste into secondary raw materials that support both trade and environmental objectives. The analysis confirmed that waste flows are driven by scarcity and price of primary resources, growing waste volumes, and unequal technological capacities, making regulated waste trade an important lever for countries seeking to diversify their exports beyond traditional products such as hydrocarbons.

The case of MAG-Emballag demonstrated empirically that exporting paper and cardboard waste generates additional revenue that partially offsets the cost of imported raw materials over the period 2014–2018, with the percentage cost reduction varying according to production

volumes, international prices and exchange rate movements. These results indicate that industrial waste valorization can improve firms' cost structure and contribute, even modestly, to Algeria's non-hydrocarbon export revenues, provided that exports comply with international and national rules on waste classification and transboundary shipments.

Based on these findings, it is recommended that Algerian public authorities integrate industrial waste valorization into their export diversification strategy and strengthen the effective implementation of international conventions in national legislation and customs control procedures. At the firm level, companies similar to MAG-Emballag should formalize internal systems for measuring, sorting and preparing exportable waste in order to maximize recovery rates and economic returns. Finally, partnerships with foreign recycling companies should be encouraged to transfer technology and good practices, thereby enhancing the competitiveness and environmental performance of Algerian waste exports.

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