

The contribution of solid waste recycling to the achievement of the Sustainable Development Goals 2030

(Theoretical analytical study)

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Abstract:

This study aims to analyze the relationship of the role and contribution of solid waste recycling to the achievement of the Sustainable Development Goals 2030. Achieving the Sustainable Development Goals 2030 (SDGs) is the end pursued by all the world's nations and linked to the recycling of solid waste, as this process has economic, social, and environmental benefits that enable the achievement of these goals. Through this study, we concluded that, despite the low proportion of solid waste recycled in Algeria, this contributes proportionally to achieving some of the 2030 Sustainable Development Goals, especially since Algeria has recently been very interested in revitalizing this area by encouraging investment in the valorization of waste.

Keywords: solid waste, recycling, sustainable development, sustainable development goals 2030.

JEL Classification: Q53, Q10.

Introduction

Algeria is one of the countries on the path to economic growth, with significant increases in consumption and production rates, resulting in resource consumption and depletion and contributing to the deterioration of the environmental and social situation, which has also had an impact on the economic situation. Algeria's growth and the development of urban life have also resulted in dramatic increases in the quantity of waste, leading to environmental, social, and economic problems. Given the growing problem of waste and its impact on sustainable development, its objectives and dimensions, waste recycling came as a modern economic model and an energy alternative to sustainable development. The latter is considered a continuous development aimed at protecting the environment and ensuring the sustainability of natural resources for future generations, while achieving economic growth.

Recycling solid waste is one of the best techniques that contribute to better management of waste, and not only that, it is one of the most important mechanisms through which sources of income can be diversified. Hence, many countries have become dependent on it, including Algeria, which in recent times has focused and encouraged investment in the valorization and recycling of solid waste. This latest process plays an important role in achieving the Sustainable Development Goals of 2030. The Sustainable Development Goals not only address measurable changes in human well-being, economic development and a better environment, but also bring about those changes and enable an environment of conditions for peace, security, inclusion and participation. Recycling waste is one of those systems that contribute to the achievement of 17 sustainable development goals. Hence the problem of this research can be formulated as: **To what extent recycling solid waste plays a role in achieving the 2030 sustainable development goals in Algeria?**

Research Objectives:

This research aims to:

- Introduce solid waste, and the steps of the process of its recycling;
- Define sustainable development and its objectives to be achieved before 2030;
- Highlight Algeria's solid waste production and recycled quantities.

The importance of research

In general, it is important to address how the recycling of solid waste in Algeria contributes to the achievement of the 2030 sustainable development goals.

Approach

The descriptive approach has been used to describe research variables, along with the analytical approach through analysis of results, as well as using the statistical approach through the use of some statistics on the quantities of solid waste produced in Algeria and the quantities recycled

1-1- Solid waste and recycling

1-1- Solid waste concept

There are many different concepts of solid waste, among which we find:

Solid waste is the material that humans or institutions intend to dispose of and throw away, where its present value is less than its original value.(Abbas, al-rekabi, & yousif, 2016, p. 666)

Solid waste is also defined as the substance resulting from humanitarian, institutional, or commercial activity and is thrown into the oceans, which includes plastic, paper, glass, wood, iron, food waste, etc.(Abd Al-kareem, 2014, p. 163)

Thus, solid waste is all the different substances whose original value has been exhausted resulting in its disposal by throwing it, but it can be reused by the recycling process.

1-2- Recycling of solid waste

Since solid wastes are less valuable than their original value, they can therefore be reused by recycling those wastes to be of value and usable.

In this context, solid waste recycling can be defined as that process by which waste can be converted from value-loss materials into new usable products to reduce the depletion of raw materials and energy.(Kouider, 2022, p. 02)

Solid waste recycling has also been identified as one of the most important cleaner production techniques by which solid waste can be reused in a new way. (Amar Bouzid & Hafci Bounebaou, 2021, p. 05)

Based on the above various definitions of the concept of solid waste recycling, recycling is a process whereby new materials of lower value can be produced from original materials of value and reused in everyday life.

1-3- Steps of solid waste recycling process

The recycling process of solid waste takes place through successive steps, beginning with the collection, screening, and dismantling of solid waste and then transporting it to recycling plants and taking it out in the form of new products. These steps can be explained in the following points:

1-3-1- Waste collection: It is the first step through gathering reusable materials from collection and recovery centers after collecting them from the ocean, or by purchasing them, etc.

1-3-2- Transportation: Waste is transported via custom trucks for each type of wastes towards recycling plants or dumpsites.

1-3-3- Screening: It is one of the most difficult stages, in which waste is sorted manually (usually in developing countries), or automatically (this method is used in more developed countries).

1-3-4- Dismantling: By dismantling waste through robots in developed countries.

The last point is the process of recycling through cutting and recycling waste into new products. (Dahou, Lakhdari, & Bahaz, 2022, pp. 394-395)

1-4- Economic and environmental benefits of recycling:

The recycling of solid waste is of great importance because of its considerable environmental and economic benefits. The most important benefits of recycling solid waste are economic and environmental:

1-4-1- Economic benefits of the recycling process

The economic benefits of the solid waste recycling process are:

- Reducing energy consumption because creating new products of solid waste recycling leads to less energy consumption when producing raw products.
- Providing new jobs through enterprises involved in the recycling of solid waste.

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- Reducing the import of raw materials because recycling solid waste enables us to provide raw materials without the need to import them.(Faraj Magram, 2011, p. 693)

1-4-2-Environmental benefits

One of the most important environmental benefits of solid waste recycling we find:

- Reducing pollution and waste damage associated with raw material extraction;
- Reducing emissions of contaminated gases;

Providing a safe, clean, and odorless environment and thereby reducing the proportion of air pollution.(Dahou, Lakhdari, & Bahaz, Op.cit, p. 11)

2- Sustainable development (concept and goals)

2-1- Concept of sustainable development

The concept of sustainable development is broad, encompassing a range of issues related to the economic, social and environmental dimensions. This has contributed to the multiplicity of definitions of this concept, most notably:

Definition of the Portland Conference: “Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (Nation, 1987, p. 44)

It was defined by Pierce, Barbert, and Markandia (1990) as “sustainable development must mean that there will be no generation in the future worse off than the current generation. Implicitly, society must not allow the reduction of well-being over time”.(Trærup, 2010, p. 06)

It can also be said that sustainable development affects all dimensions of economic, social, and environmental life, while not fully utilizing available resources to ensure future generations’ right to and benefit from it in the future.

2-2- Sustainable development goals 2030

It is also known as our World Transformation Map, a set of 17 goals developed by the United Nations and incorporated into the 2030 Agenda for Sustainable Development. The 17 Goals are interrelated to cover a range of

economic, social, and environmental issues and each goal includes a set of targets, which totally reach 169 targets.

Table number (01): SDGs 2030 [the authors]

<p>First goal: Eliminate Poverty. Its target is to eradicate extreme poverty for people around the world and reducing its proportion by 2030.</p>	<p>Second goal: Erase Hunger.Achieve sound waste management throughout its life cycle and significantly reduce its release into water, air, and soil in order to reduce its adverse impact by 2030.</p>	<p>Third goal: Establish Good Health and Well-Being. This goal seeks to reduce the global mortality ratio and end epidemics by 2030.</p>
<p>Fourth goal: Provide Quality Education. One of its objectives is to increase the proportion of young people and adults who acquire the skills and knowledge needed for their entrepreneurship to support sustainable development by 2030.</p>	<p>Fifth goal: Enforce Gender Equality.By empowering and supporting women in domestic work, and providing them with access to economic and financial resources.</p>	<p>Sixth goal: Improve Clean Water and Sanitation.By ensuring everyone’s right to safe and clean drinking water and protection from pollution by 2030.</p>
<p>Seventh goal: Grow Affordable and Clean Energy. One of its goals is to encourage investment in energy infrastructure and clean energy technology, and to ensure access to them</p>	<p>Eighth goal: Create Decent Work and Economic Growth. One of its goals is to achieve full employment and higher levels of economic productivity</p>	<p>Ninth goal: Increase Industry, Innovation, and Infrastructure.By increasing access to small-scale clean and environmentally sound industrial enterprises, encouraging innovation</p>

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<p>at affordable cost by 2030.</p>	<p>through diversification.</p>	<p>in developing countries by 2030.</p>
<p>Tenth goal: Reduce Inequality. Reducing inequality within and among countries by encouraging development assistance and contributing to increased foreign direct investment flows, especially to developing countries.</p>	<p>Eleventh goal: <u>Sustainable Cities and Communities.</u> One of its objectives is to reduce the individual negative environmental impact of cities by paying special attention to air quality and municipal and other waste management by 2030</p>	<p>Thirteenth goal: <u>Climate Action.</u> Through the integration of climate change measures into national policies, strategies and planning.</p>
<p>Fourteenth goal: <u>Life Below Water.</u> Conservation and sustainable use of oceans, seas and marine resources for sustainable development by preventing all types of marine pollution, particularly from land-based activities, minimizing and addressing ocean acidification.</p>	<p>Fifteenth goal: <u>Life on Land.</u> Protecting and restoring land-based ecosystems and promoting their sustainable use, managing forests sustainably, combating desertification, halting and reversing land degradation and halting the loss of biodiversity. It is achieved by ensuring the conservation and restoration of land and</p>	<p>Sixteenth goal: <u>Peace and Justice, Strong Institutions.</u> Promote peaceful and non-marginalized societies for sustainable development, universal access to justice, and build effective institutions.</p>

	water ecosystems	
Seventeenth goal: <u>Partnerships to achieve the Goal.</u> Strengthening means of implementation and revitalization of the Global Partnership for Sustainable Development. Promote domestic resource mobilization, and adopt and implement investment promotion systems for LDCs.		

Source: (United Nations, 21 October 2015, pp. 15-26)

3- Contribution of solid waste recycling to the achievement of sustainable development goals

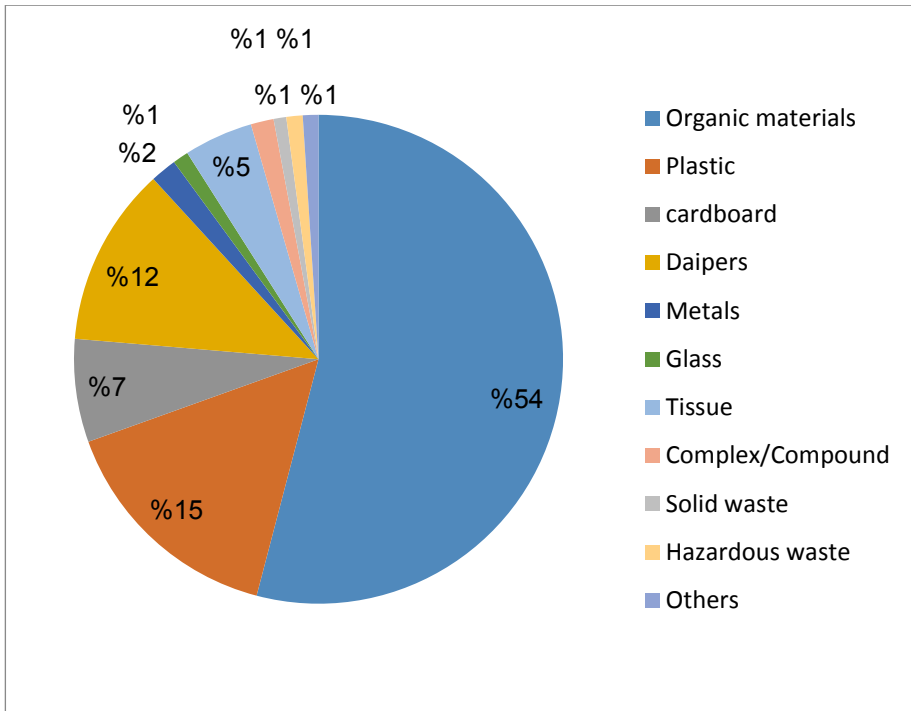
3-1- Overview of waste management in Algeria:

Algeria produces about 13.5 million tons of household solid waste, and the amount of waste produced is expected to increase to 35 million tons in 2035. The northern states are the most productive of waste with an amount ranging from 400 to 600 thousand tons per year, while the amount of waste produced in the central regions reaches 200 to 300 thousand tons per year. The southern regions produce a smaller percentage, which is between 100 and 200 thousand tons per year. The different quantities of waste produced from one region to another are due to population density, as the northern states are denser and becomes lower as we head south.

Waste collection is an important step for the management, recycling and use of waste. Waste collection facilitates the process of classification and understanding of waste composition in order to identify appropriate methods of treatment.(National Waste, Agency, 2020, pp. 30-33)

The composition of solid household waste in Algeria for 2020 is as shown in the following figure:

Figure number (01): Annual average composition of household waste for 2020(the authors).



Source: Prepared by the researchers based on information provided by the National Waste Agency.

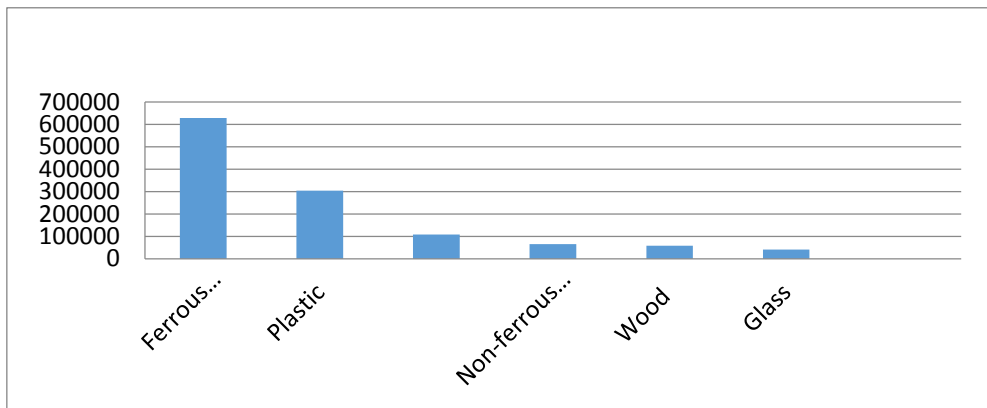
We find that household waste and the like consist of organic waste in large proportions represented by 54%, followed by plastic, which represents 15%, followed by diapers by 12%, then paper and cardboard by 7%. While the proportion of glass, metal, textile and other types represents small percentages.

Moreover, about 60% to 65% of household and similar waste is disposed of in a random manner by land dumps, compared to 35% to 40% in technical dumps as confirmed by National Economic, Social and Environmental Council President, Redha Tir.

According to Samira Hamidi, a member of the National Economic, Social and Environmental Council, the percentage of recycled waste does not exceed 7%, which is very small compared to the amount of waste produced, as Algeria can recycle about 45% of the waste, equivalent to 6.1 million tons, according to a recent report by the Cedir Center. (alarab, 2021)

3-2- Quantity of Recyclable Household Waste 2020

Figure number (02): Quantity of Recyclable Household Waste 2020(the authors).



Source: Prepared by the researchers based on information provided by the National Waste Agency.

Through the information provided, the largest amount of recyclable waste is represented in ferrous metals with an amount of 628915 tons for the year 2020, followed by plastic with an estimated amount of 304321 tons, then paper and cardboard with 108396 tons, then non-ferrous metals with a value of 66392 tons. While the quantities of wood and glass represent the lowest recoverable values; 58895 tons of wood are recovered, and glass in the last rank with 41724 tons.

3-3- The role of solid waste recycling in achieving sustainable development goals

3-3-1- Waste recycling and poverty eradication

The recycling of solid waste indirectly reduces poverty rates because many people work in this area. According to the Director of the National Waste Agency, Karim Ouamane, there are no statistics itinerant waste buyers, but the recycling of 3.6% of plastic bottles will create about 15

thousand jobs. (<https://www.aps.dz>, 2019) Approximately, 14 thousand enterprises are also active in the waste management sector between collection, recycling, and all types of waste treatment, as confirmed by the head of the Agency's customer relations department, Hamid Allab. Moreover, each enterprise employs at least about 100 workers. (Algeria, 2019)

Incentives are also given to young people by ANSEJ to help create micro-enterprises with triple funding related to the circular economy, with the participation of both young investors, the Bank, and ANSEJ, which will greatly contribute to the provision of new jobs and the reduction of unemployment rates. (Algeria, <https://www.aps.dz>, 2019)

3-3-2- Recycling organic solid waste and food security

Organic waste accounts for 54% of the quantity of household and similar waste produced in Algeria, according to the Household Waste Classification Study of 2020. Re-evaluation and recycling of three tons of organic waste allow the production of one ton of fertilizer, which is a source of agricultural and economic sector development and reduces the bill for importing chemical and biological fertilizers. (Algeria, <https://www.aps.dz>, 2020)

3-3-3- Solid waste recycling and power generation

Waste is one of the third renewable sources of energy after solar and wind energy. Since organic waste accounts for 54% of Algerian household waste, it can be recovered using aerobic digestion technology in order to convert it into inexpensive biogas and then convert it into methane gas or exploit it in the form of heat or electricity.

Algeria started activating a pilot project in the municipality of Eucalyptus in Algiers and then moved it to El Kharoub in the state of Constantine. A digestive unit is expected to be established to treat 50,000 tons of recoverable household and similar waste. This will contribute significantly to energy savings since according to the literature, the treatment of 15,000 tons of waste per year allows to cover the consumption of about 100 landfills or 60 urban transport buses, provide heating for 700 houses or hot water for 500 houses, and provide specific electricity for 1,300 houses, which will greatly help in achieving sustainable development in Algeria. (Kahila & Ouamane, 2020, pp. 9-11)

3-3-4- Solid waste recycling and climate change

The waste sector is one of the sectors contributing to greenhouse gas emissions. According to the report of the Intergovernmental Panel on Climate Change (IPCC), the waste sector is the third most emitted sector by 10% in Algeria. (National Waste, Op.cit, p. 134) This increase is due to the proportion of recycled waste ranging from 9% to 10% annually, which is very little compared to the amount of waste produced in Algeria as a whole, which amounts to about 25 million tons, including 13.5 million tons of household, as well as the failure to improve the functioning of the waste technical landfill centers, as the waste remains for a long time, in addition to the number of random empties.

3-3-5- Waste recycling and sea preservation

Algeria has an enormous coastline estimated at 1,600 km. The population is largely concentrated there, which has led to increased economic and industrial activities. This has direct repercussions on the environment due to the flow of valleys and rivers that drift all kinds of waste into the sea.

Plastic is one of the most widespread materials in the seas and beaches. According to the National Waste Agency, it is very difficult to recycle solid waste in the sea, especially plastic, due to its loss of specificity. All these factors make identifying, sorting, and isolating waste impossible and therefore impossible to recycle it.

Although it is impossible to recycle some kinds of deep-sea solid waste, the collection and sorting of marine waste significantly contributes to the protection of the sea and its diverse wealth. (National Waste, Ibid, pp. 122-127).

Conclusion

Waste recycling is one of the most important mechanisms and methods that greatly contribute to the treatment of waste and reduce its quantities and risks. Algeria's endeavor to increase the rate of recycling contributes to the achievement of development goals that seek to realize a safe environment and the conditions of integration and participation.

Results

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- Algeria is seeking to encourage investment in waste recycling given the process's consequences for reducing production costs and conserving natural resources.
- The recycling of solid waste plays a significant role in achieving the goal of sustainable development concerned with eradicating poverty and reducing unemployment through the opening of jobs by establishing recycling institutions. This makes this goal progressively realized.
- The low recycling rate and the large-scale collection of waste in random landfills and technical backfill centers hamper the achievement of addressing climate change due to the large release of greenhouse gases.
- The process of recycling organic waste in Algeria contributes to reducing the bill for importing fertilizer, and providing organic fertilizer secures the process of agriculture which contributes to achieving the goal of food security.
- The recycling process of solid waste may obviate Algeria from energy waste because recycling contributes to energy saving. If properly reused, large quantities of waste will clearly contribute to achieving the goal of energy exploitation and consumption. Algeria has begun to embody projects to contribute to this goal.
- Deep-sea solid waste cannot be recycled because of its value loss, but the removal of this waste from the sea and beaches helps to achieve the goal of protecting marine wealth.
- The lack of statistics on those interested in solid waste recycling who do not work in the formal sector and the inability of the concerned departments to study whether this has an impact on the health of random waste collectors and child labor. It is not possible to determine whether there has been a role for solid waste recycling in achieving the above-mentioned goals, as well as for the goal of women's empowerment.
- The difficulty of solid waste management in Algeria will not make Algeria's cities more sustainable and thus Goal 11 of the Sustainable Development Goals 2030 will be difficult to achieve, as will the difficulty of achieving Goal 12 of ensuring sustainable consumption and production patterns, given the problem of solid waste release into soils and oceans persists significantly.

Recommendations

As discussed in this paper, we have reach a number of recommendations:

- Developing new laws that stimulate the recycling of solid waste and revive previous laws on waste management.
- Spreading the culture of recycling throughout society because Algerian society still does not recognize the value of that wealth, which it wastes due to a lack of interest in the subject, and does not even understand the true meaning of the 2030 Sustainable Development Goals.
- Encouraging young people to innovate and invent significantly in the field of solid waste recycling due to its economic, environmental, and social importance.
- Providing all material support and accompanying investors in the field of solid waste recycling, as well as their friction with leading foreign experiences in the field of recycling in order to activate this sector and raise the recycling rate in the country.

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