

Transition Towards a Circular Economy to Achieve Sustainable Development in Algeria – Presentation of Arab Experiences –

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ABSTRACT

This study explores the extent to which the circular economy contributes to achieving sustainable development through the process of waste recycling, which is a component of the waste management system a fundamental necessity for building a circular economy. This system creates new job opportunities, in addition to protecting the environment and preserving natural resources, thereby strengthening the economic sector and achieving sustainable development.

To illustrate the practical application of sustainable waste management within the circular economy, we highlighted some Arab experiences in this field through the cases of Bahrain, Morocco, and Saudi Arabia.

Keywords: Linear economy, circular economy, waste recycling, sustainable development, Arab experiences.

INTRODUCTION

To ensure that sufficient resources are available for future generations in a world of limited resources, there is an urgent need to develop new economic models. The traditional industrial model of consuming a product and then discarding it is considered an unsustainable economic model, especially in light of the global trend toward adopting comprehensive sustainability concepts. The circular economy aims to use fewer resources in manufacturing processes and to change prevailing practices in product or waste disposal by reusing them, such as repairing, remanufacturing, or recycling products—meaning that products and their components can be repaired, remanufactured, and then recovered as raw materials to initiate a new manufacturing process. The circular economy significantly contributes to reducing environmental degradation, conserving natural resources, preserving biodiversity, utilizing waste in productive projects, and minimizing the risks of climate change.

Based on the above, we can formulate the research problem as follows:

How can the circular economy contribute to achieving sustainable development?

Study Objectives:

This study aims to:

- Define the circular economy and its role in managing environmental resources sustainably.

- Highlight the importance of the global shift toward adopting the circular economy as a new path that ensures optimal resource use.
- Benefit from Arab experiences in transitioning to a circular economy to achieve sustainability.

To cover all aspects of the topic, we have chosen to divide it into the following axes:

- **Axis One:** The Conceptual Framework of the Circular Economy
- **Axis Two:** The Benefits of the Circular Economy and Waste Recycling
- **Axis Three:** Achieving Sustainable Development through the Development of the Circular Economy
- **Axis Four:** Algeria’s Efforts to Transition to a Circular Economy with a Presentation of Arab Experiences

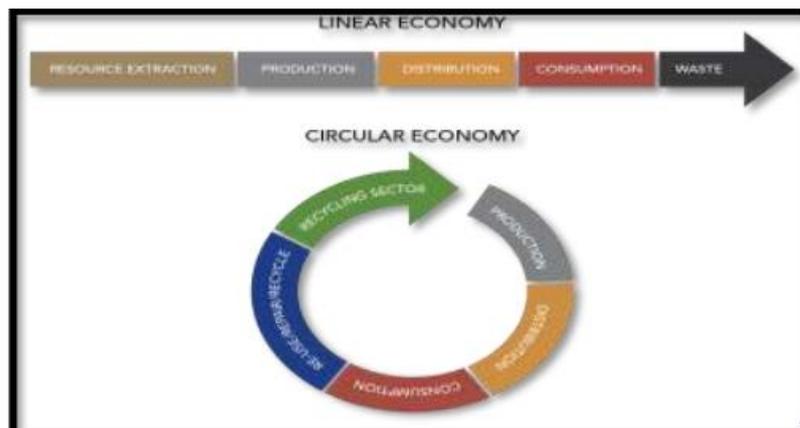
AXIS ONE: THE CONCEPTUAL FRAMEWORK OF THE CIRCULAR ECONOMY

To build a sustainable economy, governments and businesses around the world are now being encouraged to adopt the circular economy in an effort to preserve resources and prevent environmental degradation.

1. From Linear Economy to Circular Economy

The linear economy treats raw materials by transforming them into products, after which their use cycle ends with disposal as waste. In contrast, the circular economy addresses the entire lifecycle of a product—from design and production to consumption and then waste management. In the linear economy, the life cycle of a material begins with its extraction from nature. It is transformed during the production phase, then marketed and consumed, and once the consumer discards it, the material becomes waste that is disposed of. Thus, the industrial linear economy operates on a “take, make, dispose” model, depleting limited raw material reserves to create products that eventually end up in landfills or incinerators.

Figure 01: The Difference Between the Linear Economy and the Circular Economy.



Source : <https://www.weforum.org/agenda/2016/05/can-the-circular-economytransform-the-world-s-number-one-consumer-of-raw-materials/>.

The linear economy goes through four main stages, namely: resource extraction, production, consumption, and finally, waste disposal (Al-Zaabi & Kandouz, 2018, p. 28)

a. Extraction of Natural Resources:

The linear economy model is based on the ease of supplying large quantities of natural resources and energy. For centuries, the global economy has relied on the unrestricted extraction of raw materials, which has increasingly led to resource scarcity. Linear economies not only contribute to the rapid depletion of the natural resource base but also accelerate the degradation of natural ecosystems such as water, air, and soil through polluting emissions.

b. Production:

Production in the linear economy relies on the method of planned obsolescence, meaning that products have a very limited lifespan. This is done to increase production volume and maximize profits, which leads to greater consumption of raw materials and a significant increase in waste generated both from the production and manufacturing process and from the early disposal of defective products by consumers.

c. Consumption:

Producing institutions often do not aim to manufacture and sell goods that are durable over time. Moreover, consumers tend to prefer purchasing lower-priced products and do not consider product lifespan during the buying process. As a result, producers rely on programmed or deliberate obsolescence strategies that drive customers to constantly replace their products. One of the main forms of programmed obsolescence is technological obsolescence, which involves integrating new technologies into newer versions of products such as mobile phones and computers.

d. Waste Disposal:

According to Algerian law, waste is defined as “all residues resulting from production, transformation, or usage processes, and more generally, any material, product, or movable property that the owner or holder discards, intends to discard, or is required to discard or eliminate.” The large quantities of waste generated are a matter of concern for environmental stakeholders, especially since disposal often requires burning or burial—both of which have seriously harmful environmental effects.

2. Definition of the Circular Economy:

The term "circular economy" was first used in 1989 by British environmental economists David Pearce and Kerry Turner in their book *Economics of Natural Resources and the Environment*. They indicated that the prevailing open-ended economy (linear economy) developed without incorporating the concept of recycling into its core structure, which led to treating the environment as a waste repository. In contrast, the circular (non-linear) economy is based on the study of systems rich in feedback mechanisms, particularly biological ecosystems. One of its main outcomes is the concept of system optimization rather than component optimization, and the idea of design for compatibility. Generally, the term draws from several more specific approaches, including: cradle-to-cradle, biomimicry, industrial ecology, and blue economy.

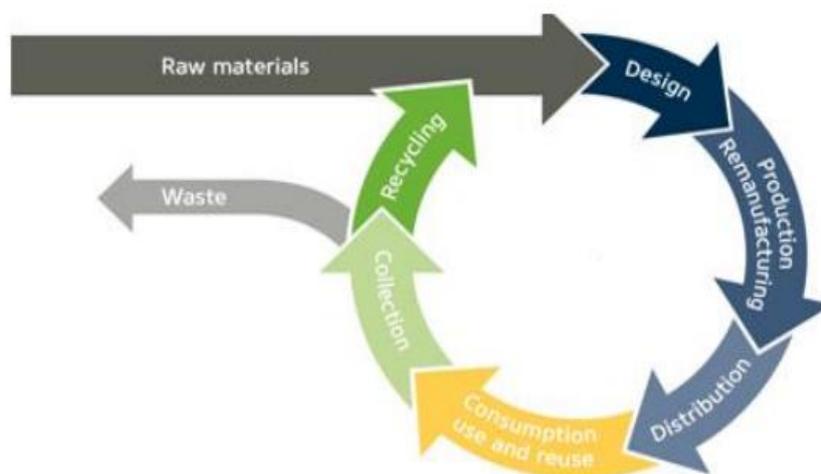
The term "circular economy" refers to an industrial economy that produces no waste or pollution, right from its initial design and intentional creation. It involves two types of material flows: biological materials designed to safely re-enter the biosphere, and the reuse, remanufacturing, and full reuse of products and technical components, which are designed from the outset to be repairable and renewable.

The term encompasses more than just the production and consumption of goods and services. It includes the transition from fossil fuels to renewable energy, emphasizes diversity as a characteristic of resilient and productive systems, and involves discussions on the role of finance as part of a broader debate. Some pioneers of this economy have even called for a renewal of tools used to measure economic performance.

Accordingly, the circular economy is defined as “a bio-economy aimed at changing the way we live by adopting innovation and development in industry and consumption. The circular economy offers many opportunities to ensure sustainability and long-term growth. The concept includes reducing waste by decreasing heavy reliance on raw material imports, increasing resource productivity, creating a more competitive economy, sustainable use of resources, more job opportunities, and reducing environmental impacts.”

The circular economy is one that produces little to no final waste and has no negative environmental impacts. It relies on the circulation of components and products, high-quality reuse and recycling. Goods and products are designed from the outset to be repairable and renewable, ensuring they can be used multiple times, thus guaranteeing optimal and efficient use of available resources and achieving sustainable development. (Ghellab, 2021, p. 446)

Figure 02: Circular Economy Diagram.



Source: Circular Economy | Nordic Ecolabel

www.google.com/search?q=circular+economy&safe=active&client

3. Core Principles of the Circular Economy:

The circular economy is built on several key principles (Saeed, 2019):

- **Waste is Nutrient:** Waste does not exist; biological and technical components are intentionally designed to be part of material cycles.
- **Diversity is Strength:** Products, materials, and systems that are diverse and interconnected across scales are more resilient to external shocks than those built merely for efficiency.
- **Energy Must Come from Renewable Sources.**
- **Systems Thinking:** Understanding things as interrelated parts of a whole, considering components within the contexts of infrastructure, environment, and society.
- **Prices and Other Feedback Mechanisms Must Reflect True Costs:** In the circular economy, prices function as signals and must reflect full costs, including negative externalities, to be effective.
- **Biomimicry:** According to Janine Benyus, this involves studying and imitating natural systems and designs to solve human problems—for example, studying a leaf to invent a better solar cell. It is based on three principles: nature as model, nature as measure, and nature as mentor.
- **Industrial Ecology:** The study of material and energy flows through industrial systems with the aim of creating closed-loop systems in which waste is viewed as input, eliminating the idea of undesirable by-products. It is regarded as the "science of sustainability."
- **Cradle to Cradle:** A principle coined by architect and economist Walter Stahel, as a counter to the "cradle to grave" concept that reflects the dominant economic model of moving from resources to waste. In the late 1970s, Stahel developed the "closed loop" approach to production and co-founded the Product-Life Institute in Geneva, aiming to achieve industrial sustainability through extending product service life, reusing, repairing, remanufacturing, and technologically upgrading philosophies as they apply to industrial economies.
- **The Blue Economy:** An open-source movement founded by Belgian entrepreneur Gunter Pauli. It originated from a foundational report and official manifesto that included a number of specific case studies and 21 founding principles. These include using available resources in cascading systems, turning the waste of one product into input for another, designing solutions based on local environmental, physical, and ecological characteristics, and focusing on waste as a primary source of energy.

4. Importance of the Circular Economy:

The circular economy contributes to the following (The Circular Economy: Satisfying Capitalism While Preserving the Environment, 2016)

- Preserving the value of products and managing natural, human, manufactured, and financial capital and inventory.
- Extending the lifespan of products during the usage phase by maintaining their value and eliminating harmful by-products such as toxic substances, thereby creating an ideal environment for environmentally innovative companies.

- Minimizing the need for new material and energy inputs as much as possible, which reduces the environmental pressure associated with the product life cycle—from resource extraction, through production and consumption, to end-of-life.
- Recycling is considered the best option for reuse, as it involves dismantling the composition of original materials—unlike traditional recycling, which typically results in lower-value products.

5. Objectives of the Circular Economy:

The circular economy aims to address the challenge of meeting growing consumption needs while preserving resources as much as possible. It revolves around four main programs (Saeed, *The Circular Economy... An Industrial Economy Beyond Sustainability*, 2019)

- Resource protection,
- Sustainable production,
- Rationalized consumption,
- Value creation through transformation and recycling.

Based on the above, the circular economy seeks to reuse products and services to reduce waste and loss, and to improve resource efficiency throughout the value chain—from raw materials to products, and then the reuse of resources at the end of the product's life. Thus, it fosters innovation and promotes environmentally friendly production, rational consumption, and recycling. This circular approach not only aims to create a new dynamic, but also reinforces a culture of coexistence with industrial ecosystems and cooperation with communities.

AXIS TWO: BENEFITS OF THE CIRCULAR ECONOMY AND WASTE RECYCLING

This section is dedicated to studying the expected benefits of transitioning to a circular economy and the benefits of waste recycling.

1. Expected Benefits of Transitioning to the Circular Economy: (Al-Wahhab & Bouteib, 2018, p. 09)

There are many benefits to be gained from the transition to a circular economy, both for the environment and for economic growth, as well as for society as a social value. This transition to the circular economy is a process of innovation and transformation in business models, which, despite its highly positive impact, is not without its flaws. While it may benefit stakeholders, there could be some downsides, and it is possible to find both beneficiaries and those negatively impacted by this alternative economic approach, particularly among companies whose value chains will be affected.

a. Environmental Benefits, Protection of Natural Resources, and Reducing the Risk of Depletion

The circular economy offers an efficient use of material value, where high demand can be met with fewer resources by reusing waste as a resource. In this way, the risk of depleting natural resource reserves is addressed. In the scenario of transitioning to a circular economy, conservative changes

in product designs and reverse cycles are assumed. The Ellen MacArthur Foundation predicts an annual cost saving of up to 301 billion USD at the European level for high-capacity product industries. This includes eight sectors of medium-life complex products that represent the contribution of the manufacturing industry to Europe's gross domestic product.

b. Reduction of Supply Risks and Price Volatility of Natural Resource Stocks

The prices of natural resource stocks have become high and volatile due to increased demand and the depletion of easily accessible resource reserves. For example, raw natural resources cost the European Union several times more than it imports, posing risks for the EU. Therefore, controlling circular material flows will reduce Europe's dependence on resources, freeing it from this dependency. Furthermore, the decrease in demand resulting from the availability of natural resources may balance the rising prices and volatility of these resources.

c. Reducing Greenhouse Gas Emissions (Carbon Dioxide) Due to Increased Resource Efficiency

The unsustainable consumption of goods (products) has caused significant damage to the planet, such as climate change, acid rain, pollution, and global warming resulting from increased carbon dioxide emissions due to the burning of fossil fuels. Therefore, consuming fewer materials and using them in closed loops will reduce negative outputs or emissions and the associated costs. It is also expected that carbon dioxide emissions from the transport system, food systems, and construction sectors will decrease by 48% by 2030 and by 83% by 2050, compared to the emission levels of 2013. Thus, the circular economy works to change the ways resources are used and disposed of, meeting individual needs with a smaller amount of resources, which results in minimal waste. As a result, this change will positively affect the Earth's carrying capacity.

d. Creating Economic Value and Providing Employment, Improving the Trade Balance, and Ensuring Access to Strategic Resources

Each country and region should naturally benefit from the overall effects of transitioning to a circular economy. Moreover, more advanced countries are taking the lead in the transition to a circular economy, as it is seen as an environmental advantage. Additionally, countries are expected to benefit from securing strategic resources, improving their trade balance (while avoiding certain imports), and creating job opportunities and growth.

e. Protection Against the Shortage of Strategic Resources

This refers to the abundance of waste that can be used as resources instead of fresh raw materials, which will free the economy from dependency. The Environmental University [Birkenfeld] in Germany is the best example of this, as it is the first campus in Europe to be completely emission-free.

f. Creation of Jobs and Growth Opportunities

Economic growth will undoubtedly be impacted by the circular economy, and new jobs will indeed be created in specific sectors driving the transition, such as waste sorting and recycling, thermal rehabilitation of buildings, and the development of alternative transportation means. In general, it is not easy to determine the overall outcomes or to judge whether the final balance will be positive or

negative; however, recent studies suggest that the circular economy will have a positive impact on employment.

For example, in France, estimates indicate that the circular economy sector accounts for approximately 800,000 full-time jobs, which represents 3% of the total workforce, not including other activities related to the circular economy, such as the leasing and reuse/recovery sector. These jobs are mostly represented by the repair and leasing sectors, particularly in the automotive industry.

A study conducted at the macroeconomic level by the European Commission predicts that every percentage point reduction in resource usage through increased efficiency will save between 23 to 62 billion euros and create between 211,000 and 611,000 jobs across Europe. Moreover, at the microeconomic level, the impact on employment can already be seen. For example, a study conducted in the Île-de-France region (Paris area) indicates that every ton of household waste sorted and recycled generates ten times more jobs than if it were incinerated, and thirty times more than if it were deposited in a landfill.

g. Innovative Services at Low Costs, New Revenue Sources, and Total Reduction in the Cost of

Owning Certain Goods: From the consumer's perspective, the circular economy will bring new opportunities, which directly benefit producers of goods and services, ultimately leading to the offering of new products at lower prices.

For example, environmentally friendly mobile phones: these new designs extend the product lifecycle and increase the potential for repairing these products, all of which benefit the consumer. Circular economy practices in areas such as the agricultural food industry can also have a significant impact on health. One example of this is organic farming, which is gaining popularity and attention in Europe as it prevents the use of artificial and chemical products. With the growing demand for fresh, locally produced, and healthy food in cities, organic and semi-urban agriculture are evolving. These systems are characterized by short distribution channels between local farms and consumers, aiming to reduce food spoilage or agricultural product waste caused by long distances or transportation, and preserving product freshness. Finally, it can be said that developing the circular economy represents an opportunity to create added value for consumers, either by providing the same quality or service at a lower price or with additional functions.

2. The Circular Economy and Waste Recycling:

Direct recycling has been practiced for many years by producers of waste materials (scrap), which is the basic form of recycling. However, in the 1990s, with the emergence of the circular economy as a new branch of economics, the concept of indirect recycling began, where waste materials are manufactured into other products relying on the same raw material, such as recycling glass, paper, plastic, aluminum, and other materials that are now being recycled.

Recycling waste is considered one of the four pillars of waste management, known as the R4 golden rule, which means the following: (Jalal, 2017, p. 81)

- **Reduce (Réduire):** This refers to reducing the raw materials used, and consequently reducing waste. This can be achieved by using fewer raw materials or using raw materials that produce

less waste or by limiting materials used in packaging processes, such as plastic, paper, and metals.

- **Reuse of Waste (Réutilisation des déchets):** For example, reusing plastic for bottled water after sterilization reduces the volume of waste.
- **Recycling (Recyclage):** This refers to using waste to produce other products of lower quality than the original product.
- **Thermal Recovery (Récupération thermique):** Thermal recovery technology is used in many countries by burning waste under specific operating conditions, that is, at a certain temperature, while controlling emissions and ensuring compliance with environmental laws. This method leads to the disposal of 90% of solid waste and converting it into thermal energy, which can be used in industrial processes, steam generation, or electricity production.

This system creates new job opportunities through tasks such as collection, sorting, processing, recycling, and selling the products derived from it, in addition to protecting the environment and preserving natural resources like metals, paper, and glass, thus strengthening the economic sector and achieving sustainable development.

3. Benefits of Waste Recycling

An economic study published by the Arab League in 2012 indicates that the annual losses of Arab countries due to their neglect of waste recycling amount to approximately 5 billion USD. The total waste quantity is about 89.6 million tons annually, which is enough to manufacture around 14.3 million tons of paper worth 2.145 billion USD, produce 1.8 million tons of steel valued at 135 million USD, and around 75,000 tons of plastic worth 1.4 billion USD, along with approximately 202 million tons of fabric.

The aforementioned study shows that the losses for the Arab countries are not limited to the value of products that could be obtained from recycling processes, but also extend to the high costs paid by Arab countries for waste disposal and managing the resulting damage. These countries spend about 2.5 billion USD annually on this matter.

In this context, Laura Tok, Vice President of the World Bank for Sustainable Development, stated: "Poor waste management harms human health and the local environment, while also exacerbating the climate challenge... Unfortunately, the poorest people in society are often the most negatively affected by inefficient waste management. This should not be the case. We must use our resources and then continuously reuse them so they do not end up in landfills" (Al-Arab, 2016, p. 07).

She also points out that good waste management systems are essential for building a circular economy, where products are designed and optimized for reuse and recycling. The adoption of circular economy principles by national and local governments will help enhance efficient economic growth while reducing environmental impact.

AXIS THREE: ACHIEVING SUSTAINABLE DEVELOPMENT THROUGH THE DEVELOPMENT OF THE CIRCULAR ECONOMY

In this section, we will study the concept of sustainable development and its main objectives.

1. The Concept of Sustainable Development:

Sustainable development is development that achieves a balance between the ecological, economic, social, and technological systems. It contributes to maximizing growth and improving the quality of human life, all within the carrying capacity or ecological limits of the surrounding environment. At its core, it is based on the following points:

- Emphasizing the need for optimal utilization of available resources and capabilities.
- Protecting the environment by minimizing, as much as possible, the negative impacts of economic and social activities on economic resources and the environment.
- Striving to achieve balanced economic development capable of narrowing the gaps in living standards among different social groups.

We can say that sustainable development seeks to utilize natural resources rationally and attempts to preserve them for a long time to ensure the needs of future generations. There must be a rational use of non-renewable resources, and for renewable resources, their use should be regulated with the aim of finding alternatives to these resources for long-term utilization. This means that resources should be used in both cases in a way that does not lead to environmental depletion, due to the close relationship between sustainable development and the environment. (Qushti, 2023, p. 04)

2. The Main Objectives of Sustainable Development:

The Sustainable Development Goals (SDGs) are a set of objectives established by the United Nations, also known as the 2030 Global Agenda. These goals represent a global vision and call to action aimed at eradicating poverty, protecting the planet, and ensuring that all people enjoy peace and prosperity by 2030 (Federal Competitiveness and Statistics Centre, n.d.)

The United Nations has developed a list of 17 goals, including:

- Eradicating poverty and hunger.
- Achieving better standards for education, health, water quality, and sanitation.
- Promoting sustainable economic development while providing opportunities for building strong economies.
- Overcoming the impacts of climate change, pollution, and other environmental factors that harm people's health, livelihoods, and lives.
- Ensuring sustainability that encompasses the health of the earth, air, and oceans.

Figure 03: The Seventeen Sustainable Development Goals.

Source: <https://fcsc.gov.ae/ar-ae/Pages/SDGs/The-Global-Goals.aspx> .

3. Achieving Sustainability Lies in Developing the Circular Economy:

The concepts of sustainability and the circular economy have become widely discussed in international policies, United Nations sustainability conferences, and European Union meetings. After the 1990s, the perspective shifted from the idea of recycling individual products to a more integrated and comprehensive concept. It now involves addressing the entire production process, from production and distribution to consumption. This led, for example, to the concept of integrated product policy.

Every year, global consumption increases compared to what the earth produces in resources due to demographic and economic growth. Therefore, the challenge to address is meeting the growing consumption needs while preserving resources as much as possible. The World Bank report states that global annual waste generation will rise from 2.01 billion tons in 2016 to 3.4 billion tons over the next 30 years. While high-income countries represent 16% of the world's population, the East Asia and Pacific region is responsible for generating nearly a quarter (23%) of all waste. By 2050, it is expected that waste generation in Sub-Saharan Africa will more than triple current levels, while South Asia will see its waste flow more than double.

The report emphasizes that waste management is crucial for sustainable, healthy, and inclusive cities and communities, yet it is often neglected, especially in low-income countries. While over a third of waste in high-income countries is recovered through recycling and composting, only 4% of waste in low-income countries is recycled.

Thanks to the circular economy, waste has become a resource rather than a burden, thanks to techniques that convert environmentally beneficial waste into resources.

According to the World Economic Forum report, the circular economy will save the world a trillion dollars by 2025 and generate 100,000 new jobs over five years. The European Commission report states that the circular economy will reduce carbon emissions in the European Union alone by approximately 450 million tons annually, achieving a benefit of 1.4 trillion euros by 2030.

According to the Chinese Sustainable Development Research Association, developing the circular economy in China will contribute to launching seven new industries: environmental industry, waste recycling, energy saving and reduction, renewable energy, health, service economy, and creative designs and concepts.

Axis Four: Some Arab Experiences in Sustainable Waste Management in the Circular Economy

In this section, we will examine some Arab experiences in sustainable waste management within the circular economy and Algeria's efforts to transition to the circular economy.

1. Bahrain's Experience:

Bahraini legislation supports and encourages the conservation of resources, waste recycling, and effective management using methods that ensure environmental protection. The Kingdom of Bahrain adopts several policies and measures that support the circular economy as follows: (Al-Mahrous, 2023)

a. Adoption of Legislation and Standards to Promote Recycling: Some of the key regulations include:

- Ministerial Decision No. 5/2021 on the Management of Electronic and Electrical Waste
- Ministerial Decision No. 2/2019 on the Ban of Importing Plastic Waste
- Ministerial Decision No. 1/2021 on the Management of Cooling and Air Conditioning Units

b. Supporting Industrial Companies to Invest in Recycling: This includes:

- Processing smelting cell residues instead of landfilling, with a capacity of up to 35,000 tons
- Recycling aluminum scrap with a capacity of up to 120,000 tons
- Establishing a recycling center for refrigerant gases and transitioning to refillable cylinders

c. Studying and Adopting the Use of Waste in the Following Areas:

- Construction and demolition waste in road building
- Iron slag in road construction
- Glass waste in the production of ready-mix concrete
- Copper slag in the production of concrete and bricks

d. Future Studies on the Use and Recycling of Waste:

- Using ash from burning sewage sludge in construction

- Using processed aluminum slag in construction and steel production
- Developing the sector for recycling electronic, electrical, and plastic waste

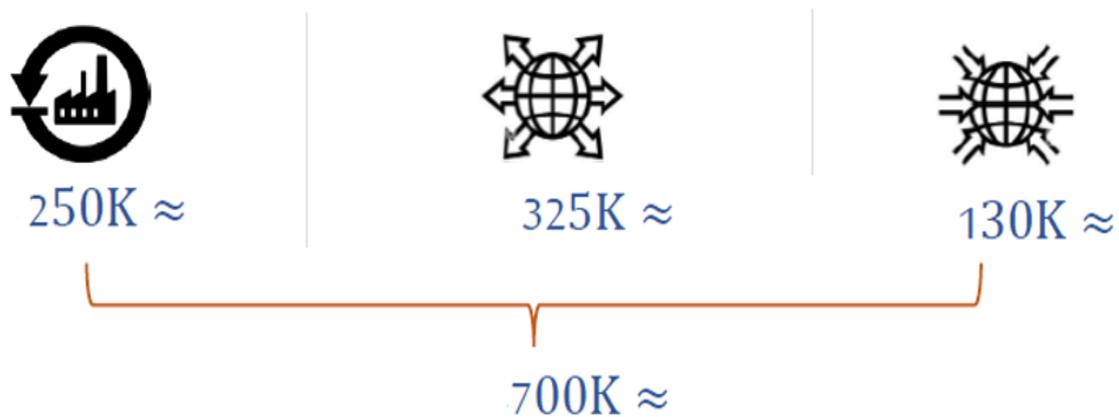
e. Supporting Community Partnership as an Industrial Responsibility:

- A total of 531,505 tons of plastic were collected and recycled through a partnership project with the Parents and Friends of Disabled Children Association from 2019 to 2022.

f. Volume of Locally and Externally Recycled Materials and Imports:

- According to 2021 statistics, the volume of recycled materials amounted to approximately 700,000 tons, as shown in the figure.

Figure 04: Volume of Locally and Externally Recycled Materials and Imports.



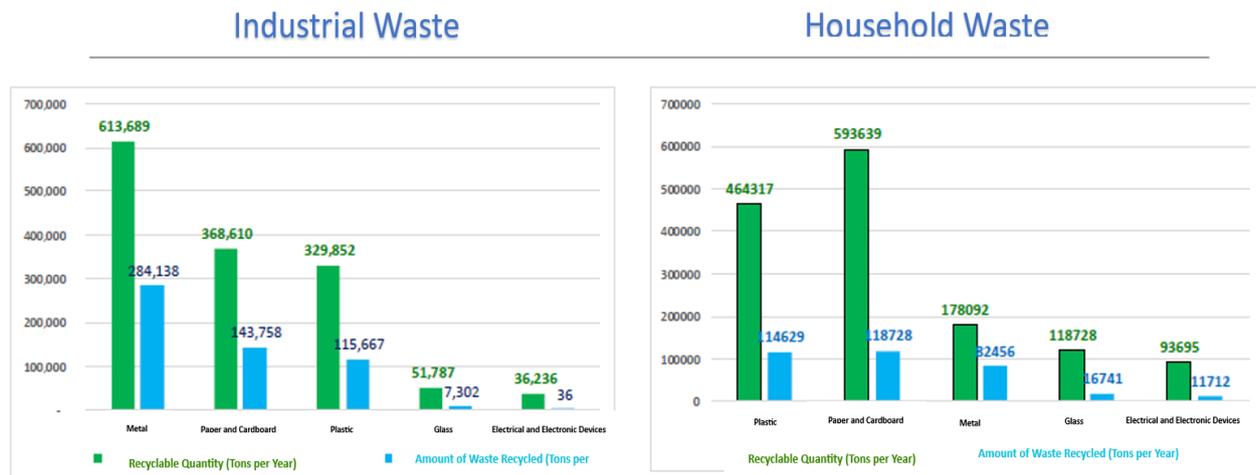
Source: Lama Al-Mahrous, Transition to the Circular Economy in the Kingdom of Bahrain, Supreme Council for Environment, Bahrain, March 2023.

2. Morocco's Experience:

The total waste quantity at the national level in Morocco in 2015 was estimated at approximately 26.8 million tons, distributed as follows:

- Household and similar waste in urban areas: 5.9 million tons
- Household and similar waste in rural areas: 1.5 million tons
- Industrial waste: 5.4 million tons
- Construction and demolition waste: approximately 14 million tons.

The total amount of waste is expected to rise from 26.8 million tons in 2015 to 37 million tons by 2030, representing an increase of 46%.

Figure 05: Quantities of Recyclable Waste and Waste Recycled in 2015 (Tons).

Source: Loubna Al-Abed, Strategic Directions for Achieving the Transition to the Circular Economy in Morocco, Ministry of Energy Transition and Sustainable Development, Kingdom of Morocco, March 3, 2023.

Morocco has adopted several measures, programs, and strategies within the National Charter for the Environment and Sustainable Development under Law 12-99 to promote sustainable development, with a focus on environmental issues, as a cornerstone of green growth and the new economy.

a. Legislative and Regulatory Measures:

These measures aim to prevent and combat all forms of pollution and harm, including: (Loubna, 2023)

- Updating the legislative framework for waste management to enhance aspects related to waste reduction at the source.
- Implementing a selective waste collection system, including unstructured waste pickers in a structured system through a defined organization (e.g., self-employed contractors, cooperatives, etc.).
- Developing waste recovery technologies through the primary use of recycled materials (transforming waste into raw materials) and producing recyclable materials (eco-design).
- Introducing the principle of extended producer responsibility by shifting responsibility to the source (whether material or economic, fully or partially) from communities to producers.
- Ecological management of hazardous waste.
- Creating an environmental tax system consisting of ecological fees and tariffs imposed on activities characterized by high levels of pollution and the consumption of natural resources.

b. The National Program for Waste Valorization in Morocco:

This program includes the following initiatives: (Loubna, 2023)

- The establishment of 10 sorting and waste valorization centers at controlled landfills.
- Preparation of studies for the selective waste sorting project in the Al-Machouar Kasbah district in Marrakesh.
- Preparation of a master plan for the management and valorization of end-of-life cars and trucks.
- Signing of 7 partnership agreements with the private sector for managing and valorizing waste from electrical and electronic equipment, paper and cardboard, used motor oils, used cooking oils, batteries, used tires, and plastics.
- Implementation of a national action plan for the valorization of metal waste and the rehabilitation of closed mining sites to mitigate their negative impacts on the environment and public health.

c. National Strategy for Reducing and Valorizing Waste: Strategic Directions Toward 2030

Core Objectives	Strategic Axes
<ul style="list-style-type: none"> ✓ Achieving 20% of waste valorization for household waste. ✓ Achieving 10% of energy valorization of waste. ✓ Reaching 60% of controlled disposal for construction and demolition waste. ✓ Achieving 40% to 80% of valorization of various wastes through valorization systems. ✓ Reaching 50% integration of the informal sector of waste pickers. 	<ol style="list-style-type: none"> 1.Strengthening the legislative and regulatory framework for waste reduction and valorization. 2.Strengthening institutional frameworks. 3.Financing sustainable waste management. 4.Encouraging waste reduction. 5.Developing a circular economy suitable for creating green jobs. 6.Supporting planning and performance at the territorial level. 7.Enhancing research and development. 8.Communication, awareness, and public education.

3. Saudi Experience:

The waste management sector in Saudi Arabia previously faced several issues at various levels, as follows: (MWAN)

a. Organizational Level:

- Overlap in regulations and legislation, and lack of comprehensive coverage for various types of waste.
- Absence of an integrated business model for the sector.
- Incomplete licensing and monitoring system.

b. Social Level:

- Low awareness of proper waste production and management practices.
- Failure to hold waste producers accountable for waste management costs.
- Limited employment opportunities for national workforce.

c. Economic Level:

- Complete reliance on the government budget without any returns.
- Limited participation of the private sector.
- Informal sector relying on waste picking, which weakens investment attractiveness.

d. Technical Level:

- Lack of planning and integrated management for various types of waste.
- Absence of infrastructure that allows for waste utilization.
- Limited data necessary for investing in the sector.

e. Environmental Level:

- Spread of random and unengineered landfills.
- Limited percentage of waste recovery.

The Kingdom has sought to implement a transformation in the sector, where the transformation in the waste management sector requires institutional integration at the system level and technical integration to manage various types of waste. The goals of this transformation at all levels are as follows:

a. Organizational Level:

- Building a comprehensive, integrated, and transparent regulatory and legislative framework.
- Clearly defining roles and responsibilities.
- Implementing the regulatory and legislative framework and ensuring compliance monitoring.

b. Social Level:

- Changing societal behavior and applying the principles of waste reduction, reuse, and recycling.
- Holding waste producers accountable for waste management costs.
- Creating job opportunities for the national workforce.

c. Economic Level:

- Ensuring the sustainability of the sector and transforming waste from a burden into added value.
- Creating investment opportunities to involve the private sector and attract the informal sector.

- Increasing the contribution to local content.

d. Technical Level:

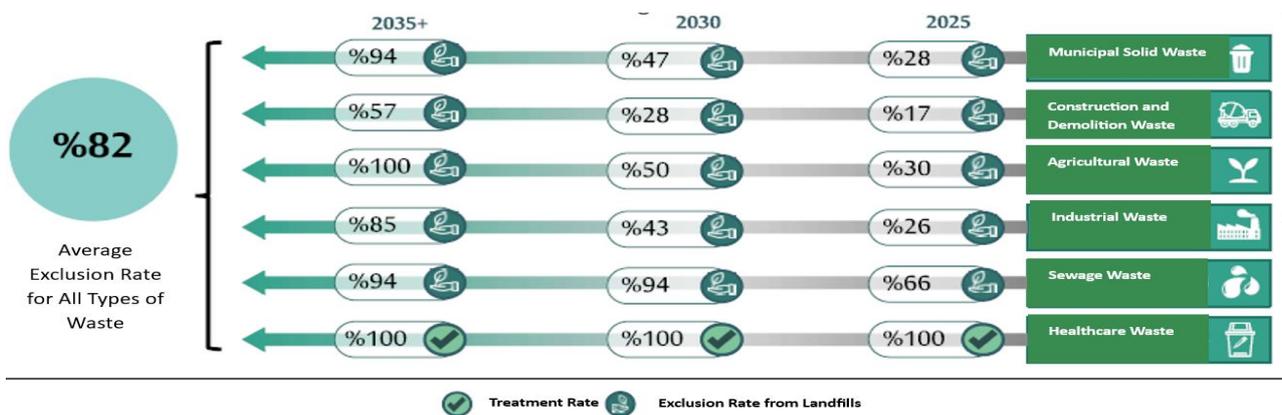
- Applying integrated waste management for various types of waste.
- Adopting circular economy principles.
- Building infrastructure that allows for waste utilization.
- Establishing a smart digital sector and a unified database.

e. Environmental Level:

- Reducing greenhouse gas emissions.
- Reducing environmental degradation through waste management.
- Increasing the percentage of waste diverted from landfills.
- Preserving natural resources.

The transformation in the waste management sector aims to divert 82% of all types of waste, while targeting a 94% diversion rate for municipal solid waste by 2035

Figure 06: Targets for Different Types of Waste.



Source: National Waste Management Center (MWAN), Advancing Waste Management in the Kingdom of Saudi Arabia Towards the Adoption of the Circular Economy Principle, Kingdom of Saudi Arabia, without year.

The National Waste Management Center in the Kingdom has launched more than 60 initiatives and projects to enable the transformation in the waste management sector, including the following:

- Initiative for organizing the import and export of waste
- Awareness campaigns to reduce waste at the source and encourage reuse
- Study of slaughterhouses and preparation of a comprehensive plan for managing waste from slaughterhouses and abattoirs of all types
- National Waste Management Platform

- National Industrial Integration Initiative for the Waste Management Sector
- Initiative for the transformation of the informal waste sector
- Specifications and standards for recycled materials
- Comprehensive strategic plan for waste management in the Kingdom
- National Waste Management Strategy
- Guideline documents

4. Algeria's Efforts to Transition to the Circular Economy:

The launch of the first industrial waste exchange by the National Waste Agency in 2015 facilitated the creation of an online platform aimed at fostering connections between industrial waste owners and investors. This initiative allows industrialists and investors to search for new opportunities and develop new environmentally related professions, as part of efforts to diversify the economy.

According to a study conducted by the German Cooperation Office in Algeria in 2014, there are more than 273,202 green enterprises, including 3,407 in waste recovery and valorization, 1,470 in water management, 168,648 in green building, and 68,631 in green space management. There are 600,000 green jobs, including 30,085 in services related to the environment, such as auditing, studies, consulting, and training, with an expected creation of 1.4 million jobs by 2025 (Council, 2015, p. 151).

Algeria produces 16 million tons of waste annually and, like many African countries, uses plastic packaging and plastic bags in stores. For example, the country uses 5 million plastic bags, and only 5% of waste is recycled. In contrast, Tunisia has banned the use of single-use plastic bags to reduce plastic waste.

According to the "National Agency of Waste," the value of the waste recycling market could reach 530 million dollars, which presents a significant business opportunity, alongside the country's gas-related industries.

CONCLUSION

Adopting the circular economy approach contributes to designing products and materials that can be used, remanufactured, and recovered, thereby keeping them in the economy for as long as possible. This is achieved through recycling, reducing waste volumes in an environmentally sustainable manner, while also generating returns for the national economy—making it an integrated process.

For many years, direct recycling by reprocessing waste into the same product was the primary form of remanufacturing. However, since the 1990s, the focus shifted to indirect recycling, meaning the recycling of waste into other products. Such processes can help reduce raw material costs and overall manufacturing costs, thereby conserving economic resources.

Findings:

- Sustainable resource management involves creating an efficient infrastructure for waste management and recycling, encouraging extended product life cycles, sustainable product

design, and reducing regulatory barriers that hinder the development or adoption of value retention processes.

- International exchanges, shared expertise, capacity building, financing, and collaboration can assist in implementing the circular economy approach to achieve sustainable consumption and production.
- The circular economy provides opportunities for more efficient consumption and production practices, with less resource intensity, environmentally sound technologies and infrastructure, while supporting livelihoods.
- Governments' adoption of the circular economy will help enhance economic growth and reduce environmental impact.
- The sustainable and health-related importance of waste management for business organizations in cities and communities, especially in low-income countries.
- Collaboration between the public and private sectors is crucial in transforming challenges into opportunities at the national, regional, and global levels, particularly as circular economies have a promising commercial future.

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