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University Aboubakr Belkaïd – Tlemcen –

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# THESIS

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**By**:

Amel Bouguettaya

Luwemba Abbey

**Subject:**

## Optimizing Construction Waste Management in Algeria Towards a Circular Economy through a Digital Tool.

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# Dedication

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# Dedication

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***LUWEMBA ABBEY***

# List of Abbreviations

| | |
|---|---|
| **DMA** | DéchetsMénagers et Assimilés |
| **DAE** | Les Déchetsd'ActivitésÉconomiques |
| **DI** | DéchetsInertes |
| **DAS** | Les Déchetsd'Activité de Soin |
| **DASRI** | Les Déchetsd'Activités de Soins à RisquesInfectieux |
| **DRCT** | Les Déchets à RisquesChimiques et Toxiques |
| **DSD** | DéchetSpéciauxDangereux |
| **L'AND** | Agence National des Déchets |
| **ONS** | Office National des Statistiques |
| **MODECOM** | Mode de Caractérisation des DéchetsMénagers et Assimilés |
| **ADEME** | Agence de la Transition Écologique |
| **BMC** | Business Model Canvas |
| **GRH** | Gestion des RessourcesHumaines |
| **RH** | RessourcesHumaines |
| **GMAO** | Gestion de Maintenance Assistée par Ordinateur |
| **API** | Automates ProgrammablesIndustriels |
| **SARL** | La Société à ResponsabilitéLimité |
| **3D** | Trois Dimensions |
| **DA** | Dinars Algérien |
| **T** | Tonne |
| **Kg** | Kilogramme |
| **SYMEED** | SyndicatMixted'études pour une Gestion Durable des Déchets |
| **Km** | Kilometre |
| **SPI** | Le Secrétariat Permanent pour les PréventionsIndustrielles |

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# GENERAL INTRODUCTION

Construction wastes refer to the debris, unused materials and by- products generated during construction, demolition and renovation of structures. It includes a variety of materials such as concrete, wood, metal, glass, insulation, asphalt and more. construction activities are significant contributors of waste generation world-wide posing environmental challenges.

Construction waste management is crucial for reducing the environmental burden posed by the construction industry. By carrying out studies of waste generation rates and sources, implementing efficient waste handling practices, promoting sustainability and adhering to regulations, the industry can significantly reduce the impact of waste generation to a more sustainable future.

Our goal research is to establish a start-up, **ReNest** that recycles construction and demolition waste into new products of decent quality, offered at a more competitive price, to reduce the pollution and make a sustainable environment.

In chapter one, we provide a comprehensive overview of Construction & Demolition Waste exploring the various material types, the regulations in different countries, and the critical importance of recycling. Furthermore, we conducted both internal and external analyses of the start-up, including an in-depth market study.

In the third chapter, we discussed waste management strategies aimed at reducing waste generation and maximizing the reuse of materials that would otherwise be discarded.

Finally, we conclude our Master's thesis by providing a detailed explanation of our website.

# Chapter I:

## Definition of Construction & Demolition Waste

## I.1 Introduction

The construction industry stands as a cornerstone of economic activity, wielding significant influence in shaping our modern world. Yet, this progress does not come without its drawbacks. Amidst its rapid advancement, the industry grapples with a myriad of waste sources; spanning from the production process of materials to their utilisation. It's understandable why waste generation is prevalent. This makes sense considering the diverse array of materials employed in construction endeavours. But many people may ask, what exactly are these types of construction waste? Are these types readily discernible? Moreover, do they pose any hazards? It's a common reality that construction projects harbour a mixture of both hazardous and non-hazardous waste. Waste is one of the serious problems in the construction industry. The term wastage refers to the variance, if any, between the estimated and actual consumption of an individual item. Because of this, it is imperative to know the different waste types so you can identify them and be able to properly dispose of them. A pivotal aspect of safety within construction sites hinges upon understanding the hazardous nature of materials and navigating them accordingly. While some materials necessitate disposal through specialised environmental services, others find their way into conventional dumping channels. Additionally, fostering awareness regarding materials amenable to reduction, reuse, or recycling is essential for steering the industry toward sustainability (Burton-Hughes Liz. 2019).

Before any hazardous materials can be relocated, it is imperative that regulatory authorities confirm adherence to safety protocols and restrictions. Consequently, the meticulous management of waste materials originating from construction sites has emerged as an indispensable priority. Managing waste means eliminating waste wherever possible, minimizing waste wherever feasible and reusing materials which could otherwise become waste (Gulghane, A.A. and Khandve, P.V., 2015).

Within this chapter, we will get into the diverse spectrum of construction waste materials, aiming to shed light on their characteristics and management strategies.

## I.2 Types of construction waste

Building materials like wood, concrete, stone, glass, and steel reign as the primary components in construction projects, chosen for various reasons such as cost, project specifications, client preferences, structural and architectural requirements (Kodur, V.K.R. and Harmathy, T.Z., 2016). The increased economic growth as well as urbanization has led into extensive construction activities that generate large amounts of construction wastes. All round the world construction materials generate million tons of waste annually.

The exact quantity and composition of construction waste generated throughout the projects are difficult to be identified as they keep on changing due to the dynamic nature of the construction activities. A different stage of construction generates different types and composition of waste (Gulghane, A.A. and Khandve, P.V., 2015). Nonetheless, the production of construction waste can be anticipated through careful consideration of building design and the acquisition of materials. The composition of waste may vary at different

stages of construction. Thus, waste generation throughout the construction stages needs to be identified, classified and quantified to minimize the wastage. A large and various types of waste with different characteristics are created at all the stages of construction right from site preparation, demolition of existing structures to final product.

## I.3 Typical construction wastes

### I.3.1 Building Materials

Construction relies heavily on building materials, which span a wide range of types and are integral to projects of all kinds, be it basic construction, demolition, restoration, or remodelling (Kodur, V.K.R. and Harmathy, T.Z., 2016). However, along with the utilization of these materials comes the generation of building material waste. Among the most prevalent examples of such waste are nails, wiring, insulation, rebar, wood, plaster, scrap metal, cement, and bricks. This waste often arises due to damage or simply being left unused.
The silver lining lies in the potential for reuse or recycling of many of these materials. Wood, in particular, stands out as a versatile material that can find new life in various construction projects. Disposing of such waste typically involves straightforward methods, yet adherence to proper disposal protocols remains crucial. Materials like cement, plaster, and bricks are commonly crushed and repurposed for future construction endeavours, exemplifying the industry's commitment to sustainability.

### I.3.2 Dredging Materials

Dredging materials encompass items extracted during site preparation for demolition or construction. Essentially, these comprise natural elements like trees, tree stumps, rocks, soil, and occasionally debris (Charles R. Lee et al. 1976). While generally non-hazardous, they should be managed by a waste management company equipped for proper disposal. Certain reusable materials, such as wood from uprooted trees, can be sent to recycling plants. Ensuring the responsible recycling and disposal of these natural resources is critical for handling dredging materials effectively.

### I.3.3 Hazardous Waste

Identifying and managing hazardous waste is paramount in construction projects due to the potential dangers it poses to workers and the public (Akpan, V.E. and Olukanni, D.O., 2020). Hazardous waste often originates from commonly used building materials. Examples include lead, asbestos, plasterboard, paint thinners, strippers, mercury, fluorescent bulbs, and aerosol cans.

### I.3.4 Demolition Waste Materials

Demolition procedures typically remove the whole structure, resulting in more waste material generated than construction activities. Such projects produce specific types of waste that are typically categorized into several subtypes. Older buildings can contain materials no longer used in the construction industry today, resulting in a different waste stream (Jeffrey, C., 2011). Among the major types are asbestos and insulation, both of which pose significant hazards.
Asbestos, known for its ability to produce fine inhalable flakes, heightens the risk of lung disease and cancers upon exposure. Even insulation containing trace amounts of asbestos

remains extremely dangerous. Another sub-type comprises non-asbestos-containing materials such as concrete, bricks, tiles, and ceramics. Recycling reinforced concrete is particularly beneficial, as it can be repurposed onsite for new concrete, reducing transportation costs. A third category encompasses wood, glass, and plastic waste. Proper disposal methods apply, with wood often recycled similarly to concrete. Plastic, constituting a substantial portion of demolition and construction waste (C&D)is prevalent due to its incorporation into various building materials. Among the plastics requiring careful disposal are Styrofoam, PVC siding, and PEX pipes.

Finally, demolition waste is often contaminated with "paints, fasteners, adhesives, wall covering materials, insulation, and dirt". The presence of these contaminants can make demolition materials difficult to recycle (Falk & McKeever, 2004, p. 34).

### I.3.5 Treated Materials Containing Hazardous Substances

Various construction projects utilize specially treated woods, glass, and plastics, often containing hazardous substances. Additionally, bituminous mixtures with coal tar are commonly hazardous. Metals like copper, bronze, brass, aluminium, iron, steel, and tin are generally non-hazardous, but cables containing oil or coal tar are exceptions. Soils and stones can also be contaminated with hazardous substances, such as asbestos fragments. Gypsum materials like drywall and masonry waste may pose hazards if containing dangerous substances. Paints, varnishes, adhesives, and sealants containing solvents are likewise categorized as hazardous waste. It's essential to ascertain the hazardous nature of any treated materials to streamline their disposal process.

Disposal of hazardous materials is tightly regulated by state and federal laws of a country. Non-compliance not only risks exposing people and the environment to toxins but also carries hefty fines and penalties.

## I.4 Classification of Construction Wastes.

Understanding the types of waste your business generates is crucial, as many can potentially be reduced, reused, or recycled. This knowledge also allows for proper segregation, ensuring that waste collectors can safely and effectively remove it from your site. The European Waste Catalogue (EWC), also known as the List of Waste (Low), provides a comprehensive list of different waste types along with their classification codes (Burton-Hughes Liz. 2019).

**How to Create a Waste Classification Description.**

Before you can send off waste for reuse, recycling or disposal, you must create a waste classification description for it. This helps you decide how to handle the waste and provide the necessary paperwork to waste contractors. The classification typically involves categorizing waste based on some key aspects.

### I.4.1 Waste classification description must include the following:

- The name of the substance(s).
- The type of project where the waste was produced.
- The process/stage that produced the waste.
- A chemical composition and physical analysis of the substance(s).

- Whether or not it's hazardous.
- The waste classification code as per country (as described earlier).
- Any special problems, requirements, or knowledge related to the waste.

Efficient waste classification is a fundamental aspect/element of waste management as it helps in understanding the nature of different types of waste, determining appropriate disposal methods, designing effective waste management strategies, facilitating recycling efforts and promoting recycling initiatives, and reducing the environmental impact of waste disposal. It also enables policymakers, waste management professionals, and the public to make informed decisions about sustainable waste practices and resource conservation.

### I.4.2 The waste management hierarchy:

The waste management hierarchy or waste management pyramid is a tool that encourages a shift toward more sustainable and environmentally responsible practices. The hierarchy is designed to guide decision-makers and individuals towards a more sustainable environment by emphasizing reduction of waste and promotion of more friendly options.
The waste management hierarchy consists of the following levels in order of preference:

- Reduce.
- Reuse.
- Recycle.
- Dispose.

Take a look at the following table, which outlines some of the most common types of construction waste you may encounter along with their European Waste Codes (Burton-Hughes Liz. 2019):
*Items marked with* * are classified as hazardous and require separate handling from non-hazardous waste to ensure safe disposal.

*Table 1: Different codes for waste materials in Europe (Burton-Hughes Liz. 2019)*

| **Waste Type** | **EWC** |
|---|---|
| Paper and cardboard packaging | 15-01-01 |
| Plastic packaging | 15-01-02 |
| Wooden packaging | 15-01-03 |
| Metallic packaging | 15-01-04 |
| Composite packaging | 15-01-05 |
| Mixed packaging | 15-01-06 |
| Glass packaging | 15-01-07 |
| Textile packaging | 15-01-09 |
| Concrete | 17-01-01 |
| Bricks | 17-01-02 |
| Tiles and ceramics | 17-01-03 |
| Wood | 17-02-01 |
| Glass | 17-02-02 |
| Plastic (excluding packaging) | 17-02-03 |

| | |
|---|---|
| Treated wood, glass, plastic | 17-02-04* |
| Bituminous mixtures with coal tar | 17-03-01* |
| Other bituminous mixtures | 17-03-02 |
| Coal tar and tarred products | 17-03-03* |
| Copper, bronze, brass | 17-04-01 |
| Aluminium | 17-04-02 |
| Lead | 17-04-03 |
| Iron and steel | 17-04-05 |
| Tin | 17-04-06 |
| Mixed metals | 17-04-07 |
| Cables with oil, coal, tar contaminants | 17-04-10* |
| Other cables | 17-04-11 |
| Soil and stones with hazardous substances | 17-05-03* |
| Other soil and stones | 17-05-04 |
| Dredging soil with hazardous substances | 17-05-05* |
| Other dredging soil | 17-05-06 |
| Insulation containing asbestos | 17-06-01* |
| Other insulation with hazardous substances | 17-06-03* |
| Gypsum materials with hazardous substances | 17-08-01* |
| Other gypsum materials | 17-08-02 |
| Unused / unset cement | 17-09-03* |

## I.5 Worldwide Construction Waste Statistics.

Research on construction waste management and generation over the years has suffered from insufficient quality data to support an informed report/status on construction waste management and generation performance. Most studies and researches have a relatively small sample data collection from construction sites due to the difficulties to carry out a thorough survey (Katz and Baum, 2011, Dahlbo et al., 2015). For example: as cited from Formoso et al. (2002), investigated the occurrence of material waste at 74 building sites located in different regions in Brazil with an average Waste Generation Rate (WGR) of 27.6%, Tam et al. (2007) found a WGR of 15–27% through interviewing construction professionals at 19 sites in Hong Kong. Owing to the small samples, it is not surprising to observe WGRs varying from one study to another without convergence, all justifying that the statistical data collected cannot be used in high confidence for a profound study projection in the future on waste generation rates and management for each nation either in the public or private sectors of the construction industry (W Lu et al. 2016).

### I.5.1 Waste generation rate (WGR) as a performance indicator:

Waste generation rate (WGR) is widely used as an indicator to measure construction waste

management (CWM) performance. WGR can be calculated by dividing the waste in volume ($m^3$) or quantity (tons) by either the amount of virgin materials purchased, or the amount required by the design, or per $m^2$ of gross floor area (GFA) (Formoso et al., 2002). Methodologies adopted for obtaining data for estimating WGRs are diverse and typically include: direct observation (Poon et al., 2001)

National monitoring of C&D waste generation from country to country is different. Here, we delve into the different spectrums of construction waste generation, aiming to uncover the statistical analysis of the data collected in various countries in Europe, Asia and Africa.

### I.5.2 Construction Waste Generation Rates for Some Countries.

#### I.5.2.1 Europe

An extraction of an article gives an overview on waste generation in the European Union (EU) and several non-EU member countries. It draws exclusively on data collected in accordance with Regulation (EC) No 2150/2002 of the European Parliament and Council on waste statistics (Eurostat, 2023).

The share of different economic activities and of households in total waste generation in 2020 is presented below. In the EU, construction contributed 37.5% of the total in 2020 and was followed by mining and quarrying (23.4%), waste and water services (10.8%), manufacturing (10.6 %) and households (9.4%); the remaining 8.2% was waste generated from other economic activities.

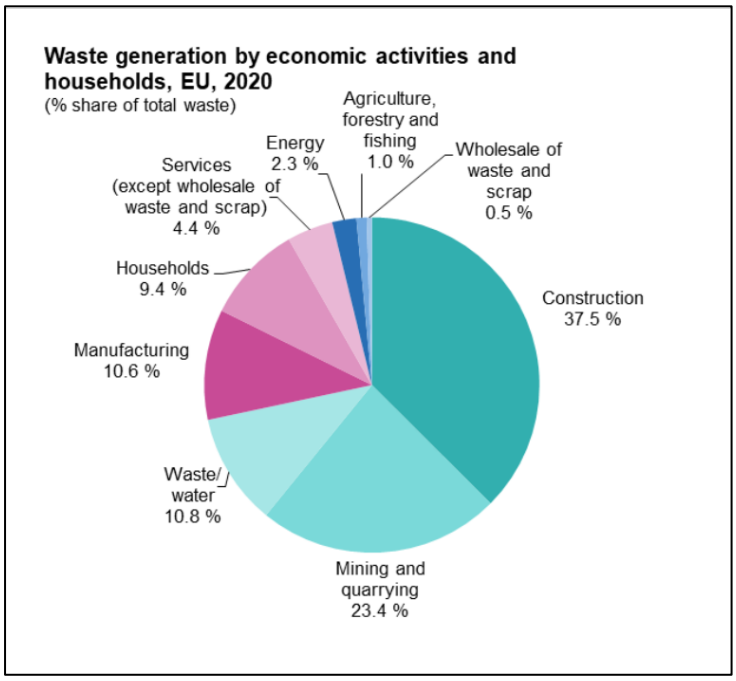



*Figure 1: Waste generation by economic activities and Household (Eurostat, 2023)*

#### I.5.2.2 Asia

Construction waste generation in Asia, like in many other developing regions, has become alarming over the years due to the rapid urbanisation, infrastructure development and industrial growth (Nitivattananon, V. and Borongan, G., 2007). All these contribute to the

substantial amounts of waste generated in Asia.
Here is a summary of the C&D waste generated in some of the Asian countries.

### I.5.2.2.1 India

While we consider the global construction waste statistics, the contribution of C&D waste by major construction industries are as below:

*Table 2: Percentage rates of C&D wastes generated in India. (Geo Thomas, 2020)*

| Project Type | Percentage of C&D waste generated |
|---|---|
| High-rise buildings | 33% |
| Industrial Projects | 19% |
| Small Buildings | 15% |
| Commercial Buildings | 15% |
| Govt. projects | 11% |
| Tunnel and Infrastructure | 8% |

| *Country* | *Annual C & D waste (amount or proportion of the total waste)* | *Strategies and technologies* | *Practices* | *Policy and institutions* |
|---|---|---|---|---|
| India (Pappu, 2007) | 14.5 MT | Recycling and reuse Recycling and reuse of marble wastes in building application | A portion of C & D waste is recycle and reuse in building materials and share of recycled materials varies from 25% in old buildings to as high as 75% in new buildings | • Ministry of Environment and forests has mandated environmental clearance for all large construction projects |
| Hong Kong, SAR (HK EPD, 2007) | 42% | Reuse – done by selective demolition technique | Reuse of C&D waste in lower grade 37 %-80% public filling areas for land reclamation purposes for period 12 years | • Construction Waste Disposal Charging Scheme<br>• Public Works Programs, the contractors are required to formulate waste management plans<br>• adopt low waste construction techniques, selective demolition<br>• reuse of recycled aggregates in road sub-base and low grade concrete<br>• the tracking system for C&D waste disposal<br>• developed to a GPS-and-GIS-integrated construction M&E management system |
| PR China (Jones, 2007) | 17.5 % | Reuse and recycling | | Municipal Construction Waste regulations- Imposes stricter management on waste from municipal construction projects. |
| Malaysia (Begum et al., 2006) | 28.34% (including industrial waste) | Reuse and recycling | Reuse and recycling | Reuse and recycling has been practiced – economic dimension |

| | | | | |
|---|---|---|---|---|
| Singapore (Ofori, 2000) | | Recycling of construction waste such as cement, aluminum, steel and sand into aggregates | Reduce, reuse and recycling | Building and Construction Authority (BCA) established an ISO 14000 Certification Scheme – a surveillance audit for construction firms |
| Sri Lanka (Rameezdeen, 2006) | | Reuse and recycling such as door frames, cabok (lataritte brick), among others | Reuse and recycling industry | • Reuse and recycling has been practiced<br>• Development of Construction Waste Management (COWAM) Centre - for environmental education and information resource, awareness raising of construction waste , involvement and participation of citizens or NGOs in the strategy building, dissemination of information to the public |
| Taiwan (Hsiao et al., 2002) | Approximately 2.4 Million Metric Tons of concrete waste | Recycling – Technology (Recycled concrete and Recycled Concrete Aggregate | Recycled Concrete Aggregate & Recycled Aggregate | • EPA initiated the waste asphalt concrete reutilization program in 1999 to standardize relevant quality requirements<br>• established the Remaining Earthwork Information Service Center |
| Thailand (Carden, 2005) | No available Data | Portion of C & D waste disposed to landfill | Reduce, reuse and recycling | • Development of Construction and demolition waste program<br>• Investigation on recycling and reuse of Debris from the Tsunami Disaster, which will contribute to the formulation of a future Disaster Debris Management Plan for Thailand |
| Vietnam (VEM 2002, cited in Vietnam Environment: Monitor, 2004) | Construction waste and sewage sludge make up for about 8% of municipal waste (2004) | Reuse | construction waste is normally used for back filling | |

*Table 3:C&D waste generated in some Asian Countries (Nitivattananon, V. and Borongan, G., 2007)*

### I.5.2.3 Africa

Sub-Saharan Africa is faced with solid waste generation and management. Solid waste is dumped indiscriminately and seen in huge heaps on any piece of unused land, around buildings, drainage systems, institutions, playing grounds, roadsides, and in the open market places in major cities and towns. Living with solid wastes littered around seems to be an acceptable way of life among the people in this part of the world. However, the factors that influence waste generation and management vary with country but there is a gap in the availability of waste data in Africa limiting the assessment of these factors for sustainability. Moreover, the urbanization happening in Africa is poorly planned (Onibokun, A. and Kumuyi, A. 1999) further limiting the efficiency of managing Waste.

#### I.5.2.3.1 Uganda

The correlation between the increase in waste quantity and population increase in Kampala, Uganda indicates that for every percentage increase in population, there was an almost equal increase in waste generated (Aryampa, S. and al. 2019). This close relationship between waste and population shows that population growth was probably the most influential factor of waste generation in Kampala with minimal influence from other factors known to increase waste generation rates as discussed by Hoornweg et al.

#### I.5.2.3.2 Algeria

The yearly output of non-reactive waste, primarily stemming from Civil Engineering

activities like Construction & Demolition Waste, totals around 11 million tons (as of 2012). While this waste could serve as a valuable resource, it's crucial to explore and implement efficient, sustainable, and economically viable alternatives to maximize its potential benefits. (KEHILA Youcef, 2014)

*Table 4: Average amount of waste generated in France. (Source : SDES, enquêtedéchets-déblais 2014)*

| Activity | Average quantity of waste per site in tons | Average amount of waste per work unit |
|---|---|---|
| Public works/civil engineering | 127 | 285 |
| Demolition | 167 | 328 |
| Maintenance-improvement | 4 | 18 |
| New construction | 15 | 34 |
| Total | 26 | 90 |

***Work Unit**: Each work unit can be considered as equivalent to one employee (for establishments without employees, it is counted as 1).*

In 2014, the construction sector generated an estimated 227.5 million tons of waste. The vast majority of this waste (215.5 million tons, or 95%) originates directly from construction sites, while the remainder is linked to internal operations and other economic activities of establishments. Among the waste generated by construction sites, new construction and maintenance-improvement represent 28.3 and 17.3 million tons respectively, accounting for 21% of the total waste in the construction sector.

In building construction, demolition activities are the most waste-generating per site (167 tons per site). In contrast, new construction produces 15 tons of waste per site, and maintenance-improvement generates 4. The smaller sizes of these sites only explain a small part of the difference compared to demolition activities. When considering the quantity of waste per work unit, building demolition remains significantly more waste-generating than new construction and maintenance-improvement, with 328 tons of waste per work unit. New construction, however, produces 34 tons of waste per work unit, compared to 18 for maintenance-improvement.

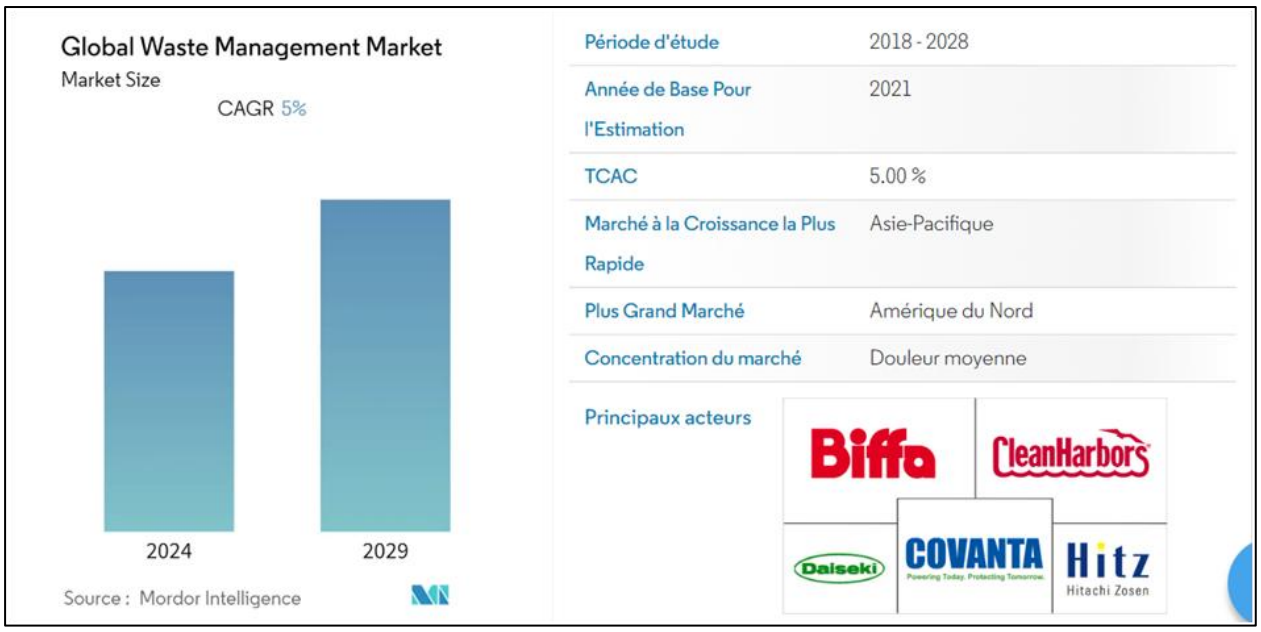



*Figure 2: Global Waste Management Market projection. (source: Mordor intelligence, 2019)*

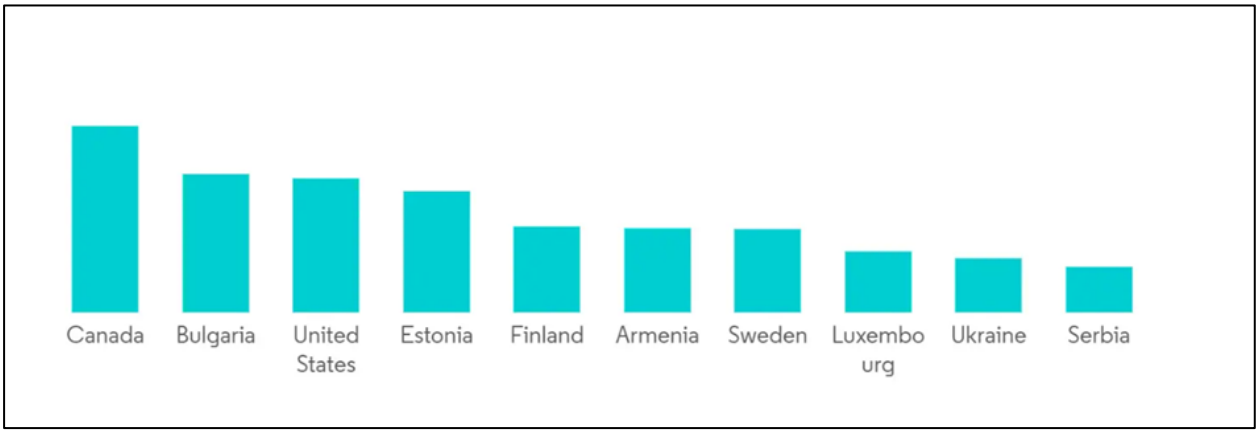



*Figure 3: Largest waste producing Countries per Capita in Metric Tons. (Source: Industry Association. 2019)*

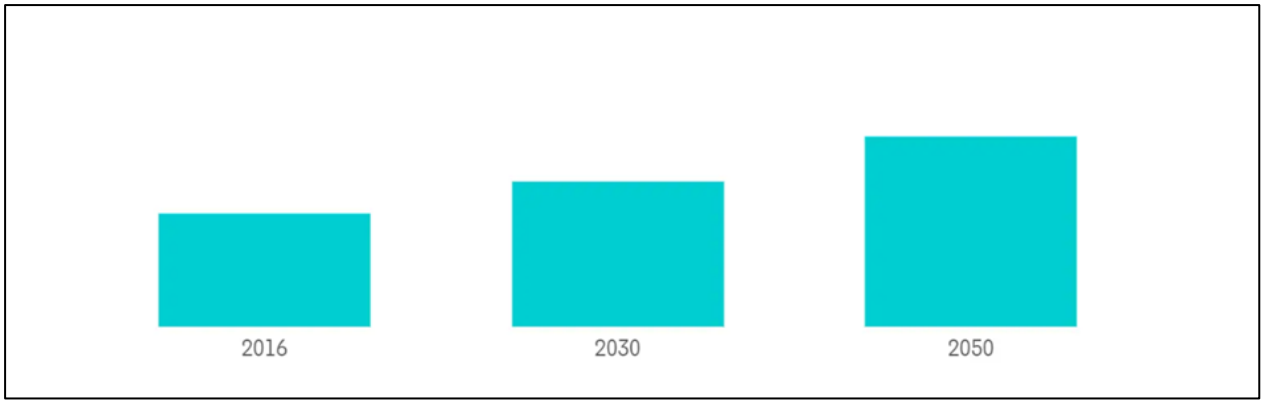



*Figure 4: Projection of Municipal Solid Waste in Metric Tons, 2016-2050. (Source: World Bank, 2019)*

## I.6 The Impact and the consequences of construction waste

### I.6.1 How Does Construction Impact the Environment?

The construction of new buildings exerts various detrimental effects on the environment. Among these are:

- **CO2 Emissions**: The construction industry is responsible for a significant portion—ranging from 25% to 40%—of global carbon emissions, as reported by an article in Bold Business.
- **Pollution**: Construction activities contribute to both air and water pollution. The utilization of harmful chemicals during construction poses risks to workers and ecosystems alike.
- **Waste Generation**: Construction processes generate substantial amounts of waste, much of which ends up in landfills, exacerbating environmental concerns.
- **Fossil Fuel Combustion**: The construction phase necessitates the burning of fossil fuels, releasing greenhouse gases that further degrade the environment.
- **Energy Consumption**: Newly constructed buildings consume energy, amplifying their adverse environmental impact.
- **Habitat Destruction**: Clearing vegetation and excavating during construction can lead to the destruction of wildlife habitats, posing threats to biodiversity.

### I.6.2 What are the significant repercussions on both ecosystems and human health of Wastes?

Inadequate waste management or illegal dumping profoundly affects certain ecosystems, particularly marine or coastal ones. The issue of marine littering goes beyond mere aesthetics, as it poses serious threats to numerous marine species through entanglement in nets and ingestion of debris. Additionally, waste can have indirect environmental effects by squandering raw materials and inputs across the production, transportation, and consumption phases of a product, leading to a cumulative environmental impact greater than the sum of its individual waste management stages.

The impacts of waste on human health and well-being are manifold. Methane emissions contribute to climate change, atmospheric pollutants are released, freshwater sources become contaminated, crops are grown in polluted soils, and toxic compounds ingested by fish eventually enter the human food chain. Moreover, illicit activities such as unauthorized dumping, incineration, or exportation of waste also contribute to these issues, though quantifying their extent or impact presents challenges.

### I.6.3 Environmental Challenges Arising from Waste Generation:

Since the 1970s, humanity has increasingly grappled with the global issue of planetary pollution stemming from human-generated waste. This concern has been exacerbated by rapid technological progress and societal advancement, leading to a stark rise in annual waste production. The detrimental effects of waste are primarily observed through three distinct forms of environmental degradation:

### I.6.3.1 Air Pollution:

Emissions from waste significantly degrade the quality of the air we breathe, posing severe health risks due to prolonged exposure to pollutants. This persistent inhalation of contaminated air has resulted in millions of annual deaths worldwide, contributing to a myriad of cardiovascular, respiratory, and reproductive ailments.

Landfill sites emerge as key contributors to air pollution, housing a diverse array of waste, including organic materials. Alternatively, incineration presents a more environmentally conscious waste disposal method, involving the combustion of waste in large furnaces fuelled by various sources.

Moreover, daily household activities, such as the use of cleaning agents, disposable batteries, and mercury-containing thermometers, further exacerbate air pollution by releasing toxic vapours, whether within households or within landfill sites.

### I.6.3.2 Water Pollution:

Modern consumption patterns introduce a plethora of water-contaminating materials, including waste, thereby significantly impacting freshwater and marine ecosystems. Human waste disposal remains the primary contributor to freshwater pollution, while vast quantities of diverse waste are annually deposited into oceans, resulting in visual pollution and the contamination of aquatic life.

Exposed landfill sites pose significant environmental risks, especially during rainfall, as biodegradable waste mixes with water, generating organic carbon and leading to acid rain. This acidification adversely affects water bodies such as rivers, lakes, and oceans, compromising their ecological integrity.

Furthermore, industrial waste disposal exacerbates water pollution in various water bodies, including lakes, rivers, and seas. Industrial waste, comprising a wide range of hazardous materials such as debris, concrete, scrap metal, chemicals, and solvents, poses significant health and environmental hazards if not managed properly.

### I.6.3.3 Soil Pollution

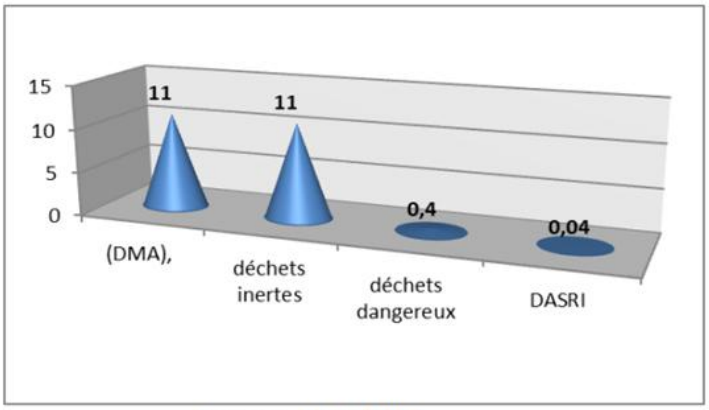
Soil pollution induced by waste arises through multiple mechanisms, resulting in a range of adverse effects, including the depletion of organic matter and soil impermeability. Acid rain, primarily caused by organic carbon emissions from landfills and industrial activities, represents a significant source of soil pollution, further compounded by waste discharge from industrial operations.

The presence of disposal sites significantly alters soil conditions, as pollutants are absorbed into the earth, further exacerbating the environmental burden associated with waste generation.

### I.6.4 Report of Construction waste in Algeria.

| Année | 1960 | 1970 | 1980 | 2000 | 2011 | 2014 | 2016 | 2019 |
|---|---|---|---|---|---|---|---|---|
| Population | 11. 05 | 14. 46 | 19. 22 | 31. 04 | 36.3 | 39.1 | 39.6 | 43,424 |

*Table 5: Evolution of the population of Algeria, 1960-2019. (Source: Tableau établis sur la base des données de I'ONS)*

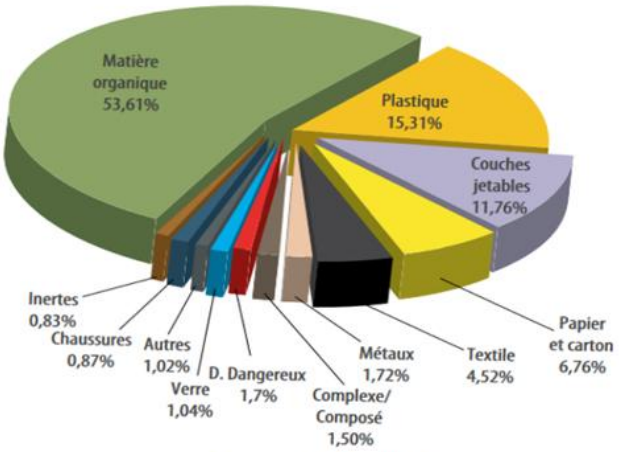



Source : AND 2014

| Année | 2011 | 2014 | 2016 | 2018 |
|---|---|---|---|---|
| Population Mh | 36.3 | 39.1 | 39.6 | 43.22 |
| DMA/ MT | 3.9 | 11 | 11.6 | 13 |

Source : ONS et AND

*Figure 5: Evolution of the Population with waste materials generated. (Source: AND 2014.)*




Source : AND , 2019

*Figure 6: Composition of Waste Materials in 2019. (Source: AND, 2019)*

| | 2018 | 2035 |
|---|---|---|
| Habitant/ Millions | 43.22 | 54,5 |
| Déchets M/T | | 73 |
| DMA / Millions de tonnes | 13 | 17,9 |
| Taux de Collecte | 70% - 80% | 100% |
| Compostage | 1 % | 50% |
| Recyclage | 10% | 25% |

Source : Auteur sur la base des données (SNJID, 2018)

*Table 6: Prevision de la gestion des Dechets. (Source: Auteur sur la base des Données (SNJID, 2018))*

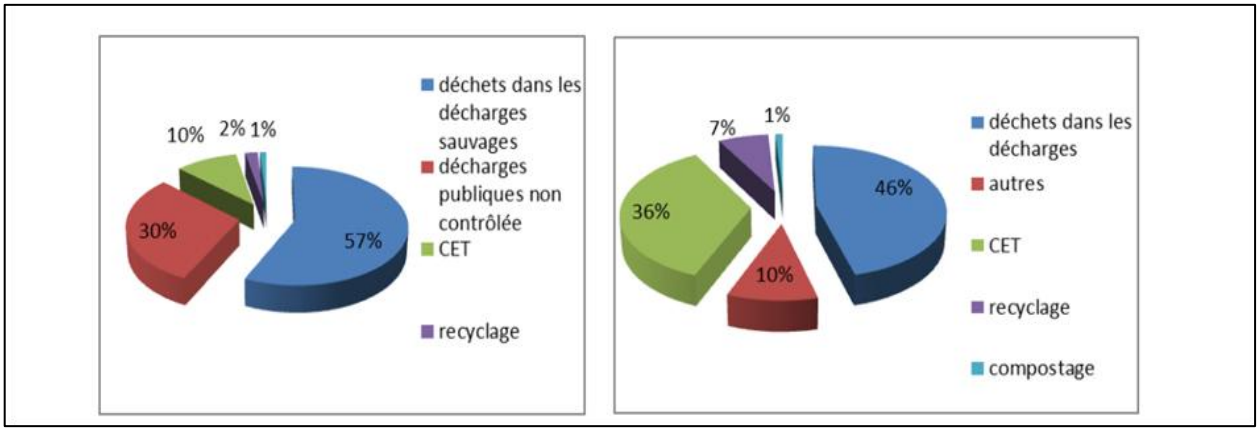



*Figure 7: Treatment of Waste Materials in 2004 & 2014*

### I.6.5 Strategies to lessen the environmental impact of construction wastes

- Implementing sustainable design principles in construction projects.
- Enhancing building energy efficiency through innovative techniques.
- Utilizing eco-friendly construction materials and practices.
- Establishing targets for reducing emissions throughout the construction process.
- Implementing measures to minimize pollutant discharge into the environment.

Preserving the environment from degradation is paramount. Embracing green building practices and striving to reduce carbon emissions in construction endeavours are crucial steps towards safeguarding our planet for future generations.

## I.7 The reuse of construction & demolition waste in buildings, public work and research

### I.7.1 Examination of Waste as a Constructive Resource

The proliferation of industrialization and economic advancement globally has led to a notable surge in solid waste generation, encompassing items such as plastics, metal cans, glass bottles, and paper. These materials often find their way into oceans and landfills, posing environmental hazards (Vicelj, Sandanayake& Yap, 2022). Lesotho, like many regions,

grapples with a significant challenge in waste management, with a mere 20% of waste being systematically collected, while the remaining 80% is illicitly disposed of. This dilemma is exacerbated by escalating commercial and household activities, culminating in a surge of waste production (UNDP, 2021).

The strategic directives of the Lesotho government, as delineated in the National Environmental Policy 1998 and the Environmental Act 2008, underscore the necessity for environmentally conscientious waste disposal and treatment systems that advocate recycling. Notably, the construction sector is witnessing a paradigm shift towards sustainable material utilization, necessitating the adoption of cost-effective and eco-friendly materials and technologies to mitigate the depletion of non-renewable resources and curb environmental degradation. Consequently, Lesotho stands at a vantage point to repurpose waste materials like glass bottles, metal cans, and plastics in construction endeavours, thereby addressing the exigency of waste management (UNDP, 2021).

### I.7.1.1 Classification of Waste Materials for the Construction Sector

This discourse dives into four prevalent waste materials - glass bottles, metal cans, plastic waste, and paper - evaluating their potential utility in construction based on the following criteria:

- Viability and/or documented usage as construction materials
- Local availability
- Sustained accessibility of the material at an "affordable" scale
- Environmental repercussions of repurposing waste into construction materials

### I.7.2 Glass Bottles as Construction Components

To tackle Lesotho's housing shortages and waste management conundrums, leveraging glass as a construction material presents a viable recourse (UNDP, 2021). This practice, harking back centuries, finds historical precedence in ancient Roman architecture, where empty glass receptacles were employed to alleviate concrete usage and lighten structural loads (Fatima, 2017). Contemporary initiatives, exemplified by Kevin Kimwelle's glass houses in South Africa, epitomize the integration of sustainable housing solutions with 80% recycled materials.

Glass bottle construction entails meticulous collection and sorting, with approximately 14,000 bottles of uniform dimensions required for a two-bedroom dwelling (Fatima, 2017). Typically, walls are erected using a foundation laden with reinforcing bars for stability, with walls typically one or two bottles thick (Fatima, 2017). These structures serve as thermal masses when bottles are laden with dark materials like sand, harnessing solar radiation by day and radiating heat by night. This feature bolsters thermal comfort, albeit necessitating caution in hotter climates to avert overheating.

Advantages of glass bottle construction encompass affordability, reduced binding material usage, and diminished landfill volumes (Fatima, 2017). Additionally, aesthetic versatility and near-modular construction present appealing attributes, potentially rendering housing more accessible to economically disadvantaged demographics (Rukami, 2021).

Conversely, glass's susceptibility to impact and thermal conductivity poses challenges,

mandating tempering and structural reinforcement to avert breakage and thermal discomfort (Khanlari et al., 2023). Moreover, maintenance complexities and security concerns warrant consideration in design deliberations.

### I.7.3 Metal Cans as Structural Elements

Metal cans, constituting 15% of urban waste in Lesotho, offer promise in construction innovation, with applications pioneered by individuals like Michael Hönes (UNDP, 2021). The Earthship wall technique, characterized by horizontal stacking of cans within a concrete matrix, exemplifies an effective utilization method (Khanlari et al., 2023). Notably, metal cans confer durability, insulation, and environmental sustainability, albeit posing challenges concerning load-bearing capabilities and susceptibility to corrosion (Khanlari et al., 2023).

### I.7.4 Plastic as Building Material

Plastic, comprising 69% of Lesotho's solid waste, holds immense potential as a construction resource, with applications spanning plastic bricks and bottle-based structures (Kumar et al., 2020). Plastic brick manufacturing entails a specialised process involving waste collection, treatment, and moulding, yielding bricks with commendable strength, durability, and thermal insulation properties (Kumar et al., 2020). Similarly, plastic bottles, when filled with soil or sand, serve as viable building blocks, offering affordability, durability, and thermal efficiency (Froese, 2017). However, concerns linger regarding plastic's environmental impact, necessitating meticulous waste management and regulatory frameworks to ensure sustainable utilisation (Sharma & Chandel, 2017).

### I.7.5 How to use Cellulose Paper Fibre

Cellulose fibre, derived from recycled paper, emerges as a sustainable insulation alternative, offering commendable thermal performance and environmental compatibility (Hurtado et al., 2015). Despite its advantages, challenges pertaining to moisture absorption, settling, and sagging underscore the necessity for quality control and installation precision (Hurtado et al., 2015).

### I.7.6 Debris

Is rubble/wreckage or scattered remains of something destroyed. Debris waste means solid waste resulting from land clearing operations. Debris waste includes, but is not limited to, stumps, wood, brush, leaves, soil, and road spoils.

### I.7.7 Soil

Is the loose surface material that covers most of the land. It consists of inorganic particles and organic matter. Soil provides the structural support for plants used in agriculture and is also their source of water and nutrients. Soils vary greatly in their chemical and physical properties.

### I.7.8 Concrete

Mixture of broken gravel, sand cement and water. Concrete is resistant to burns, rust, and rot. It can also stand up to vibrations, water, wind, fire, and even earthquakes. Not only does this reduce costs, but it keeps people safe. It is considered to be the most resistible material when it comes to natural calamities.

### I.7.9 Wood

Fibrous material that forms the main part of the trunk. Wood is a versatile organic material, and the only renewable construction material. Wooden structures have certain properties that make them durable and strong. With an adequate fire-retardant treatment, wood can be a reliable construction material with a long service life.

### I.7.10 Asphalt

Mixture of bituminous with gravel used in road construction. Asphalt used as road construction and road maintenance material is relative elastic. It is produced by adopting principles such as minimum cracking and minimum deformation against the loads on it. Thanks to its slip-resistant, porous structure, it provides the opportunity to quickly drain water from its surfaces

### I.7.11 Insulation material

Material used to reduce heat flow like cellulose, fibreglass.

### I.7.12 Roofing material

outermost material layer of a building. Some of the most common types of roofs include gable, hip, flat roofs. The type of roof construction that is chosen for a building will depend on a variety of factors, including the building's design, location, and intended use.

### I.7.13 Paints and solvents

These are petroleum-based chemicals used as pigment agents for buildings. They come in different colours.

## I.8 Regulations and Ultimate Waste Storage Centre

### I.8.1 Algerian regulations.

In Algiers, the Ministry of Environment and Renewable Energies, led by Minister Fazia Dahleb, has embarked on the process of revising legislation pertaining to waste management, regulation, and disposal. This revision aims to integrate the principles of circular economy, as announced by Minister Dahleb during an event held in Algiers on Tuesday. The occasion, which marked the inauguration of an awareness day at the National Higher School of Public Works (ENSTP) focusing on waste recycling and circular economy within the construction industry, was attended by prominent figures including Minister of Higher Education and Scientific Research, Kamel Baddari, and the Secretary General of the Ministry of Public Works and Basic Infrastructure, Mr. Ali Boulerbah.

Minister Dahleb elaborated on the ministry's initiative, stating that the revision process of Law 01-19 concerning waste management, regulation, and disposal has been initiated to incorporate circular economy principles. She emphasized that this legal adaptation aims to align infrastructure and management practices with evolving economic, social, and environmental paradigms. Currently, the proposed revisions are undergoing comprehensive evaluation in collaboration with various governmental departments and stakeholders, with plans for submission to the government for official endorsement.

Furthermore, Minister Dahleb underscored the national strategy formulated by the environmental sector, targeting waste valorisation by the year 2035, thus prioritizing resource recovery over conventional disposal methods. This ambitious objective includes the

utilization of 30% of household waste, 30% of special waste, and 50% of inert waste. Additionally, she highlighted the strategic integration of innovative technologies, such as digitization and advanced recycling mechanisms, facilitated by the establishment of electronic platforms to streamline waste collection processes and facilitate engagement with specialized entities.

Emphasizing the imperative of public awareness regarding recycling practices and product utilization, Minister Dahleb emphasized the pivotal role of waste recycling within the government's agenda. She emphasized its potential to generate economic prosperity, foster employment opportunities, and stimulate national economic growth.

Addressing the pressing issue of Technical Landfill Centres (TLC) saturation, primarily driven by the escalating volume of waste and land scarcity constraints, Minister Dahleb advocated for the widespread adoption of circular economy principles as a sustainable solution.

Moreover, Minister Dahleb referenced a comprehensive study conducted by the National Waste Agency (NWA), shedding light on waste generation trends across the nation. Notably, the study revealed an average daily waste generation rate of 0.68kg per person in 2021, resulting in an annual waste output of 11.1 million tons. To manage such significant volumes, the Ministry of Interior, Local Communities, and Territorial Development have mobilized substantial resources, including 185,742 bins and 5,704 trucks deployed nationwide.

The collaborative efforts between ENSTP and the Establishment for TLC Management of the Algiers Province (EPIC GECETAL) culminated in a knowledge-sharing event featuring presentations by students and academics. These presentations emphasized the imperative of construction material recycling and advocated for the exploitation of this sector, highlighting its multifaceted environmental and economic benefits.

Algerian law:

- Décretexécutif n° 19-10 du 16 Joumada El Oula 1440 correspondant au 23 janvier 2019 réglementantl'exportation des déchetsspéciauxdangereux. 2019-01-23
- Décretexécutif n º 07-205 du 30 juin 2007 fixant les modalités et procéduresd’élaboration, de publication et de révision du schéma communal de gestion des déchetsménagers et assimilés. 2007-06-30
- Décretexécutif nº 05-314 fixant les modalitésd’agrément des groupements de générateurs et/oudétenteurs de déchetsspéciaux. 2005-09-10
- Décretexécutif nº 05-315 fixant les modalités de déclaration des déchetsspéciauxdangereux. 2005-09-10
- Décretexécutif nº 04-410 fixant les règlesgénéralesd'aménagement et d'exploitation des installations de traitement des déchets et les conditions d'admission de cesdéchets au niveau de ces installations. 2004-12-14
- Décretexécutif n°04-409 fixant les modalités de transport des déchetsspéciauxdangereux. 2004-12-14
- Décretexécutif nº 04-210 définissant les modalités de détermination des caractéristiques techniques des emballagesdestinés à contenirdirectement des produitsalimentairesou des objetsdestinés à êtremanipulés par les enfants. 2004-07-28
- Décretexécutif nº 03-478 définissant les modalités de gestion des déchetsd'activités de soins. 2003-12-09
- Décretexécutif nº 03-477 fixant les modalités et les procéduresd'élaboration, de

publication et de révision du plan national de gestion des déchetsspéciaux. 2003-12-09

- Décretexécutif n° 02-372 relatif aux déchetsd'emballages. 2002-11-11
- Décretexécutif nº 02-175 portantcréation, organisation et fonctionnement de l'Agencenationale des déchets. 2002-05-20

### I.8.2 The Focus on Managing Ultimate Waste: Facilities, Functions, and Effects

Effectively handling ultimate waste remains a crucial issue for both environmental preservation and public health. Within this piece, we'll explore the workings of ultimate waste storage facilities (UWSFs), examining their regulatory framework, environmental consequences, and potential substitutes.

### I.8.3 Regulations and Oversight

Ultimate Waste Storage Centres (UWSCs) are governed by stringent regulations set forth by the appropriate governing bodies. These regulations predominantly focus on the management of leachate, the liquid byproduct of waste decomposition, and the biogas produced during the decomposition process. Additionally, facilities are required to establish safety barriers to mitigate pollution risks and safeguard nearby residents.

Routine inspections are conducted to verify adherence to these standards and uphold the protection of environmental and public health.

### I.8.4 Conclusion

This chapter provides an overview of various types of construction waste, their classification, and global waste generation rates. Emphasises the global environmental and health impacts of construction waste, with a particular focus on Algeria, and proposes strategies to mitigate these effects through reuse and sustainable practices.

# Chapter II:

## The Internal and External study of the Start-up

# II The Internal and External Study.

## II.1 Introduction

In this chapter, we undertake a comprehensive estimative study to lay the groundwork for establishing our recycling company and outlining the various processes to valorise construction waste (including market analysis, technical assessments, human resource considerations, economic and financial analyses, as well as legal and social studies).

## II.2 Territory and population of Algeria

Algeria stands as a formidable presence in the northern expanse of the African continent, nestled between the borders of Morocco and Tunisia. Spanning a grand territory that surpasses 2,381,000 square kilometres, its landscape unfolds into three distinct realms: the vast Sahara which takes 80% of the landscape veiled in aridity; the elevated plateaus, graced with a semi-arid temperament; and the Tellian domain in the north. These delineations, as elucidated by the National Office of Statistics (ONS), underscore the rich geographical diversity and complexity that define Algeria. (Chemsa, Khelifi,2020)

The overwhelming majority of the population resides in the far northern reaches of the country, tracing the contours of the Mediterranean Coast, as evidenced:

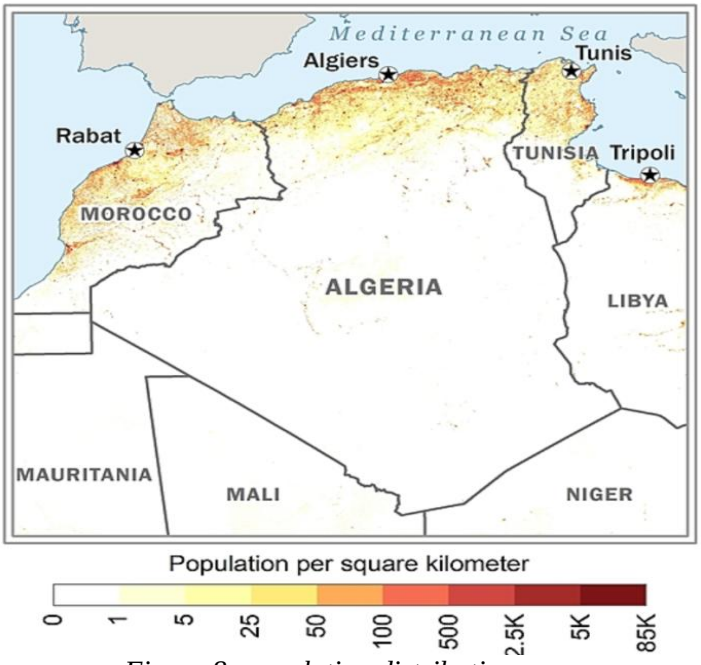



*Figure 8: population distribution map*

the total Population in Algeria is 44,758,398 (2023 est.) and 65 % of this population Primarily concentrated in the northern region

## II.3 Western Algeria Municipal solid waste management.

The effective management and valorisation of municipal solid waste (MSW) hinges upon a comprehensive understanding of its composition and physicochemical attributes. This study

focuses on characterizing and assessing various physicochemical parameters—such as density, combustion loss, electrical conductivity, pH levels, moisture content, lower calorific value (LCV), total and organic carbon, and nitrogen—in order to develop MSW valorisation models tailored to Mostaganem city in Western Algeria.

Our findings reveal that organic matter comprises 64.6% of the waste stream, followed by paper-cardboard (15.9%), plastic (10.5%), glass (2.8%), textile (2.3%), metals (1.9%), and miscellaneous materials (2%). These proportions closely resemble those found in developing countries, particularly when considering organic matter, paper, and plastic, but diverge from patterns observed in developed nations, underscoring disparities in lifestyle and consumption patterns between the two contexts.
Key parameters used to construct potential valorisation models exhibited the following average values: combustion loss (63%), ash content (37%), pH (6.1), electrical conductivity (2.39 ms cm−1), total carbon (29.5%), nitrogen (1.5%), LCV (1028.6 kcal/kg), density (0.36), C/N ratio (19.7), and moisture content (58.9%). Notably, approximately 31.1% of paper-cardboard, plastic, glass, and metal waste demonstrated potential for recycling. While MSW incineration with energy recovery proved suboptimal due to its relatively low LCV (1028.6 kcal/kg), the waste stream exhibited significant methane yield, reaching up to 1852.4 equivalent tons of oil per year. Moreover, favourable agricultural attributes, C/N ratios, moisture levels, pH levels, and Tanner diagram analyses collectively advocate for compost production as a viable route for MSW valorisation. (N. Guermoud and Al,2009)

## II.4 Definition of a Start-up company

A start-up, born from the creative spark, sets out on a bold expedition to craft, polish, and validate a scalable business blueprint. These nascent enterprises are driven by a singular vision: to conceive a groundbreaking product or service, unveil it to the world, and establish its indispensability and uniqueness in the hearts of consumers.

Fundamentally rooted in innovation, a start-up relentlessly pursues the enhancement of existing products or the creation of entirely new market segments within the vast landscape of goods and services. In this quest, start-ups defy conventional boundaries, igniting transformative waves that ripple across entire industries. (Baldridge,R 2022)

## II.5 The steps to create a business

To construct a business start-up project and enhance its chances of success, it is recommended to proceed methodically, adhering to chronological steps:

Firstly, conceive a business idea, then ascertain its alignment with professional aspirations and the requirements inherent in realizing this concept. The idea will gradually evolve into a project, then into a business if a thorough market study confirms its potential appeal to a sufficient clientele.

Thorough analysis of the target market enables validation of the project's feasibility and determination of the future company's projected revenue.

Developing financial forecasts - or projected financial statements - is imperative to ensure the profitability of the start-up project and prevent navigating blindly. Drafting financial statements and integrating them into a business plan facilitates fundraising efforts, securing assistance, and future company management.

Choosing a legal structure is essential to enable the business to operate legally, determining the registration formalities necessary to bring the company to life. Establishing the business and commencing operations are the final stages of the start-up process.

Of course, an excellent understanding of the profession, industry sector, and the fiscal, accounting, and social obligations of the new business are crucial factors for navigating the initial months successfully and maximizing the chances of success. At the end of each stage, a written synthesis will prepare for the drafting of the business plan. (LAAMECHE, 2016)

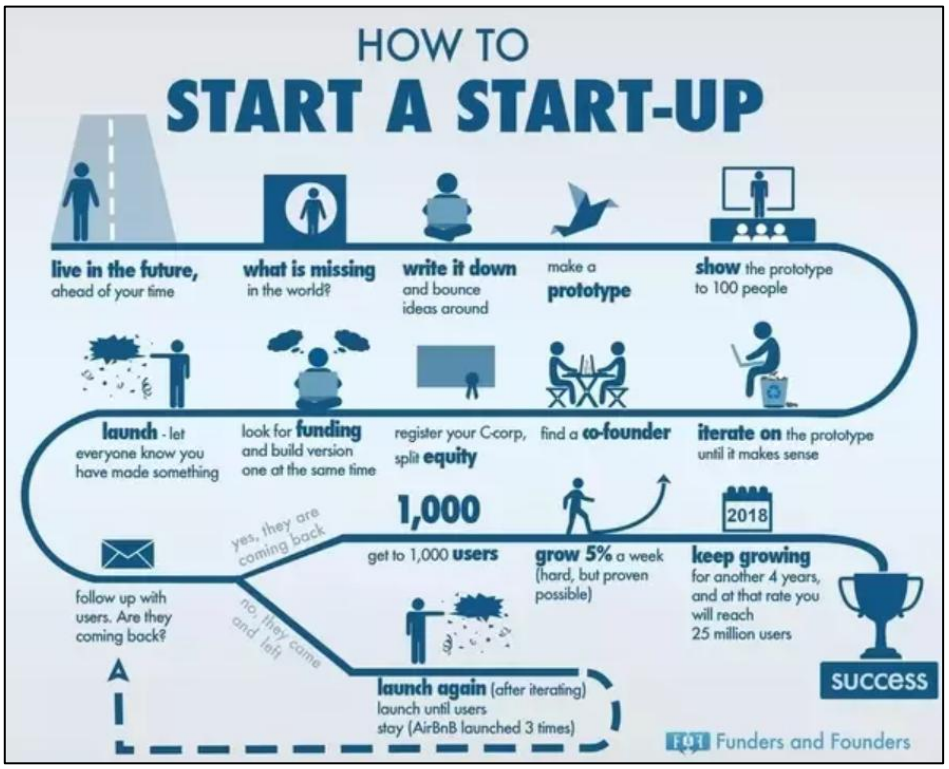



*Figure 9:* *How to start a Start-up*

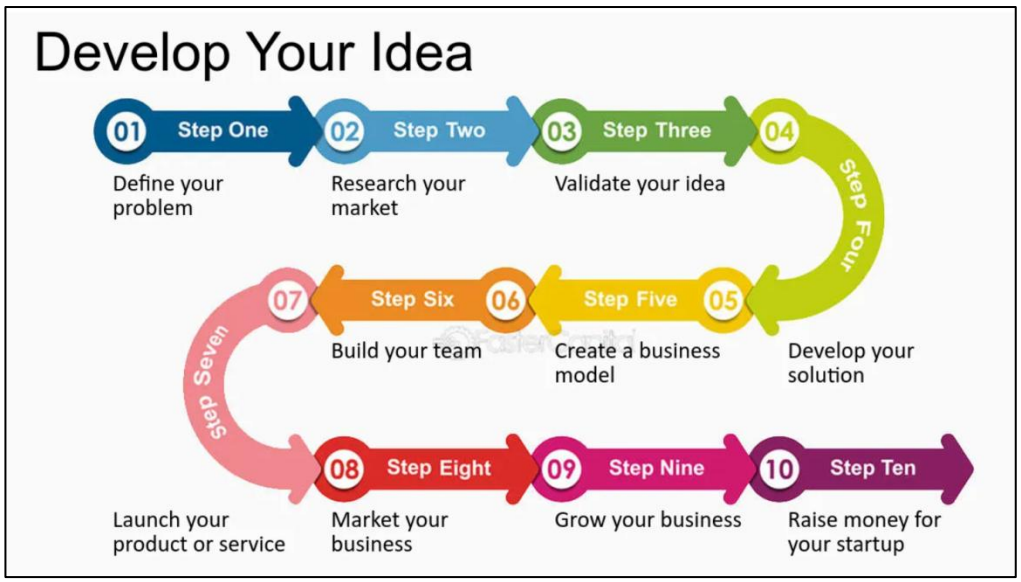



*Figure 10: Develop your idea to Create a Start-up*

### II.5.1 The Idea to create a Start-up:

The inception marks the genesis of any entrepreneurial endeavour. However, not every idea translates into a viable business opportunity, for an idea devoid of a market or failing to address a need holds no value. An idea emerges as an opportunity only when it addresses an unmet or poorly met need.

We conceived the notion of establishing a recycling enterprise with a platform to connect all the other recycling companies within our Country, our aim is to breathe new life into all forms of discarded construction waste, while also streamlining accessibility for individuals seeking these materials. (Laameche.S and AL.2016)

### II.5.2 The Market Research.

#### II.5.2.1 Fundamental Principles

Market research is a crucial step towards the success of a business creation project. It involves the collection and analysis of information pertaining to a specific market. The objective is to understand all its characteristics thoroughly. Indeed, having a good initial idea is not sufficient to establish a profitable business. It is equally essential to have a deep understanding of the market in which one intends to operate. (Business, 2019)

The preparation of market and management studies typically requires the expertise and technical support of specialists such as managers, technical-commercial executives, entrepreneurs, or professionals experienced in business structuring, including notaries. Through our market study endeavours, businesses are compelled to address several key questions:

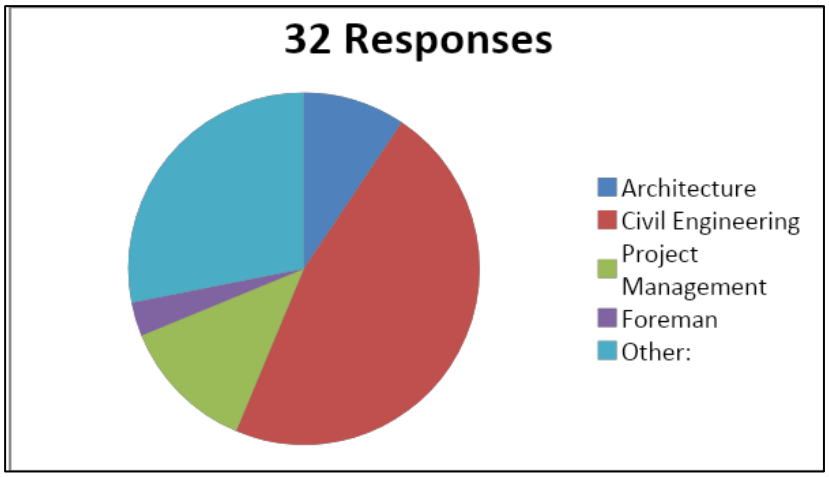
A. What is the primary material?
B. What are the implications of reusing the primary material?
C. What quantity is being collected?
D. What is the quality of the collected products?
E. Who are our customers?
F. Who are our suppliers?

G. What is the level of competitive intensity?
H. What is the potential of our market?
I. How does it operate within the Algerian market?

### II.5.2.2 The analysis of the questions:

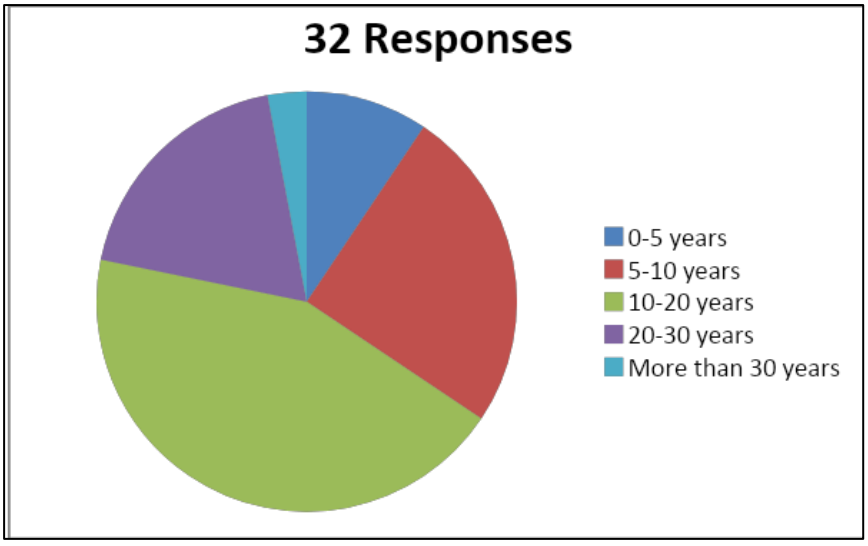
1. Which area of the construction industry do you work in?

Architecture
Civil Engineering
Project Management
Surveying
Foreman
Other:




2. How long have you worked in this field?

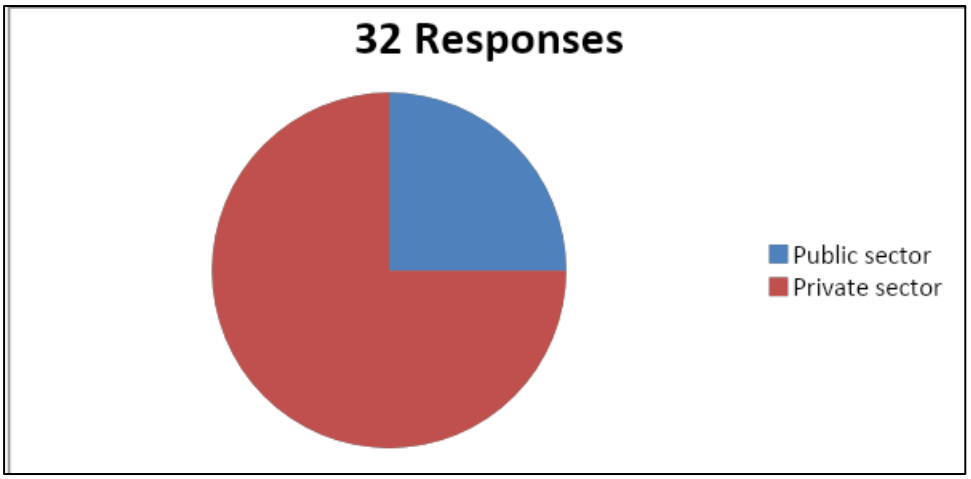
0-5 years
5-10 years
10-20 years
20-30 years
More than 30 years



3. Do you work in the public or private sector?

Public sector

Private sector




4. What are the most common types of construction waste you encounter on site? (You can choose more than one option)

Unused construction materials

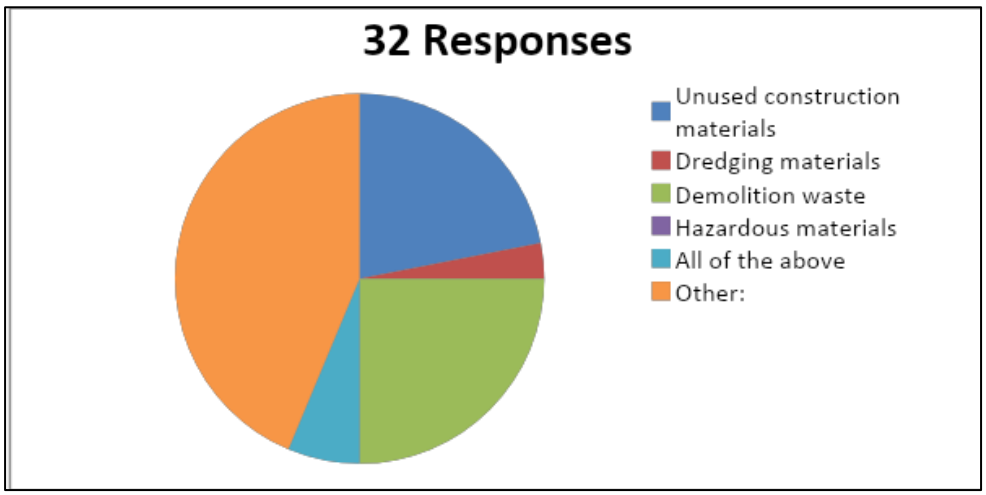
Dredging materials

Demolition waste

Hazardous materials

All of the above

Other:




5. What are the current methods of construction waste management used at your workplace? (You can choose more than one option)

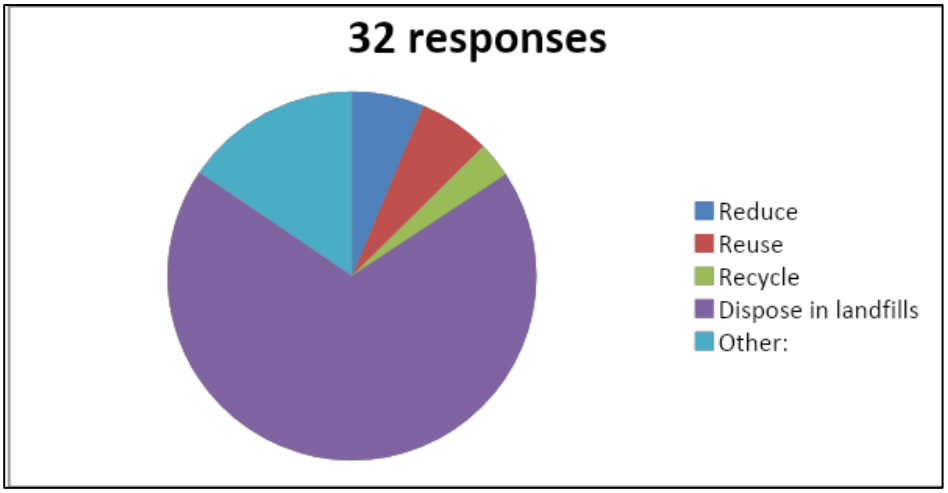
Reduce

Reuse

Recycle

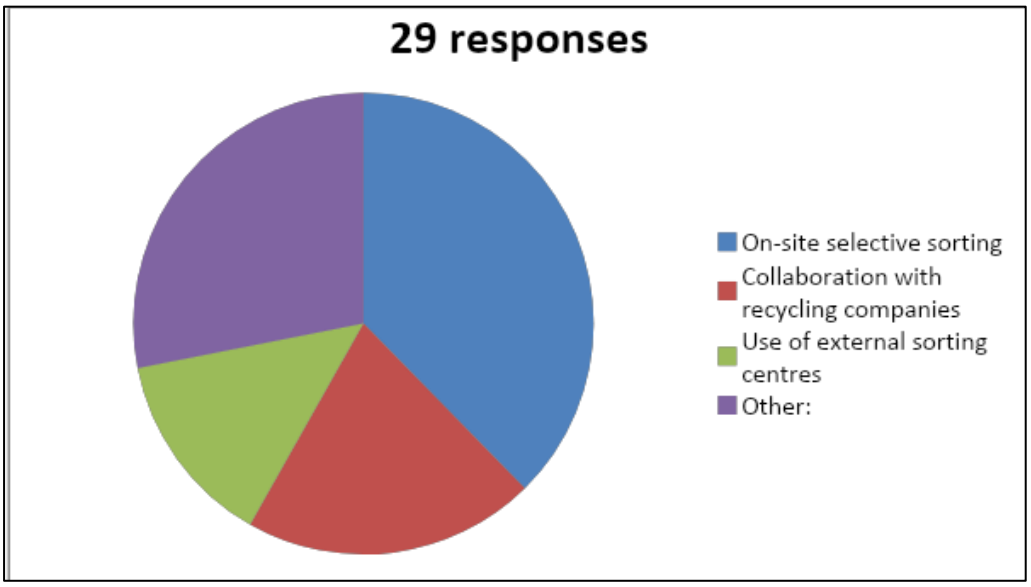
Dispose in landfills

Other:



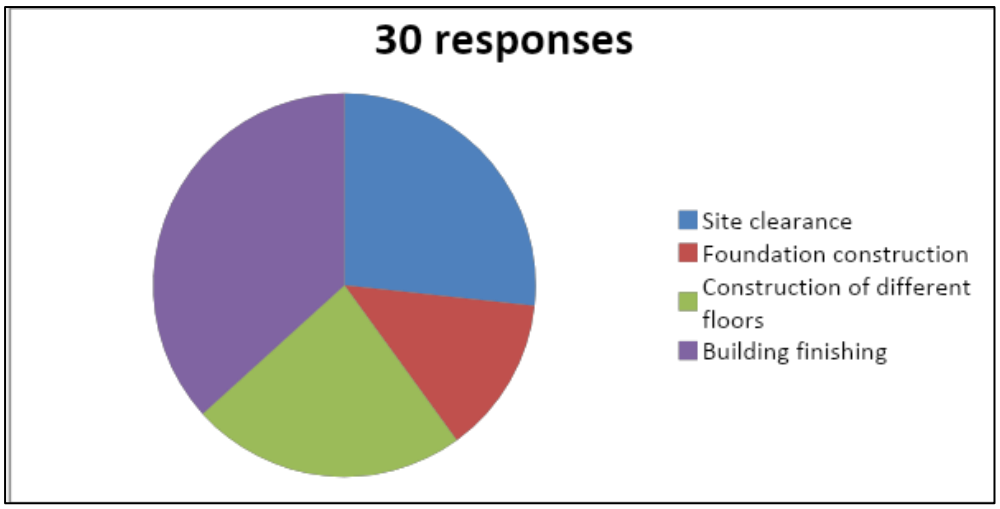

6. How do you manage the sorting, recycling, and disposal of construction waste materials?

On-site selective sorting
Collaboration with recycling companies
Use of external sorting centres
Other:



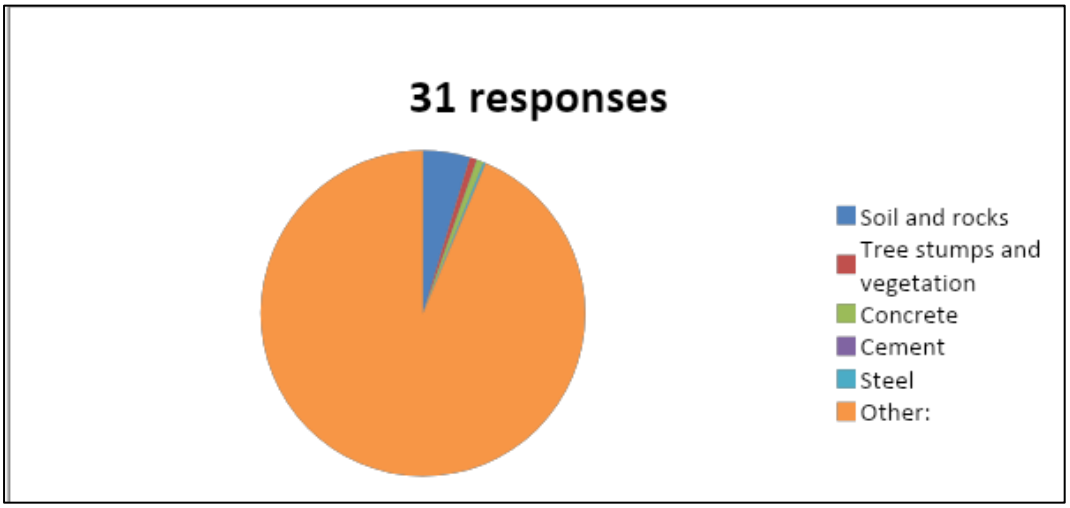

7. At what stage of the building construction phase is the most waste generated?

Site clearance
Foundation construction
Construction of different floors
Building finishing



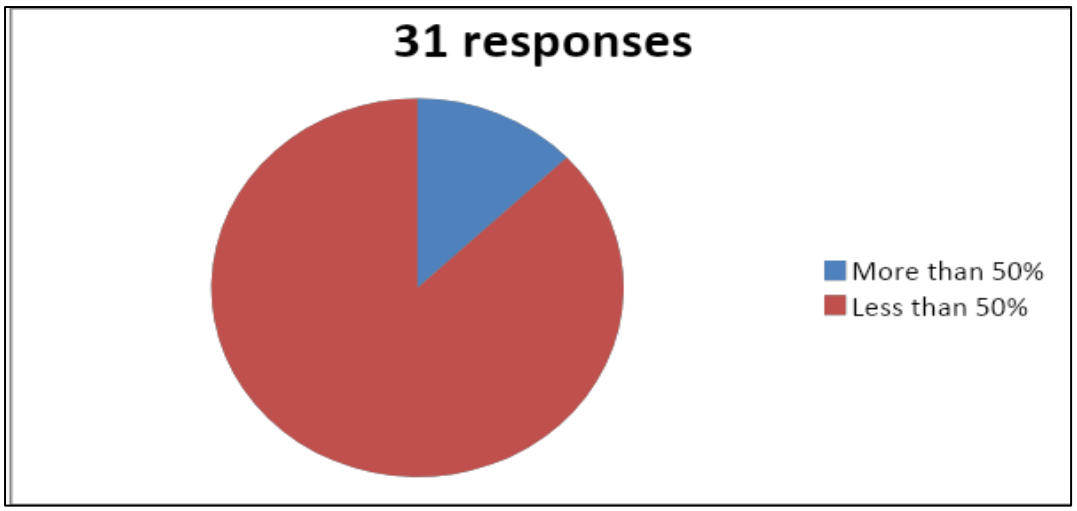

8. Among the following types of waste, which is most common during site clearance?

Soil and rocks
Tree stumps and vegetation
Concrete
Cement
Steel
Other:




9. Approximately what proportion of construction site waste is recyclable?

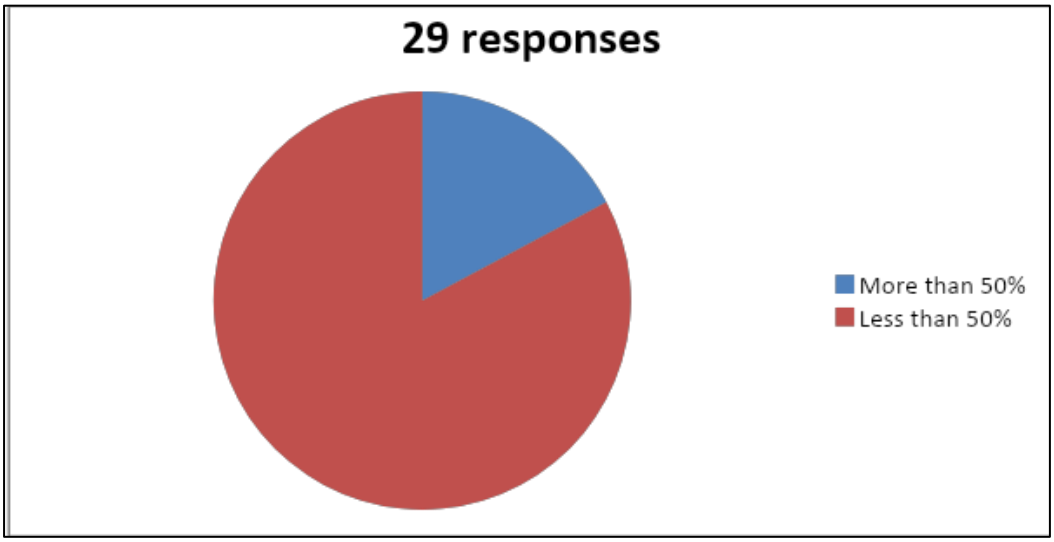
More than 50%
Less than 50%




10. Approximately what proportion of construction site waste is reusable?

More than 50%

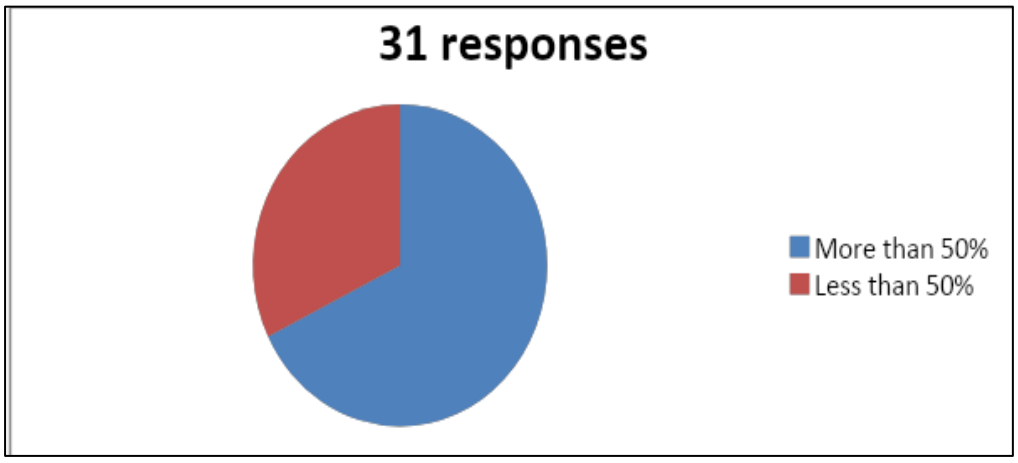
Less than 50%




11. Approximately what proportion of construction site waste is disposed of in landfills?

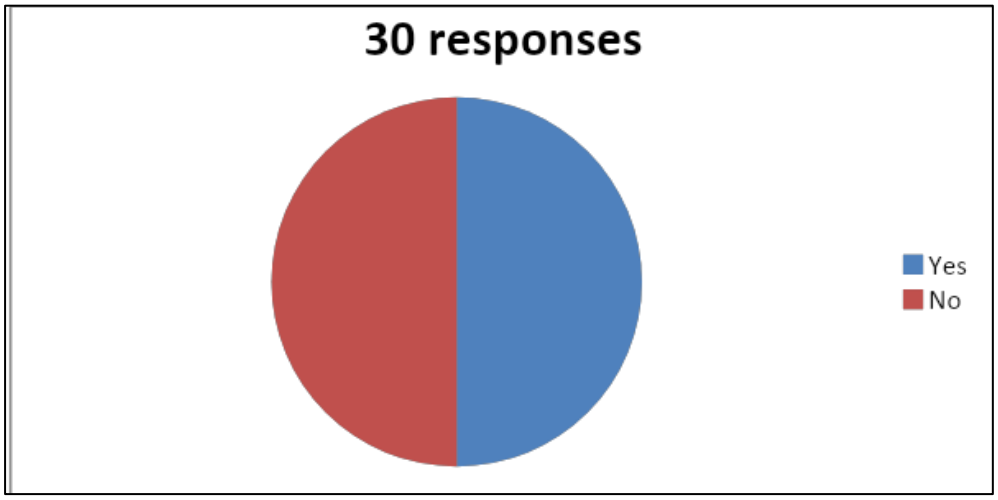
More than 50%

Less than 50%



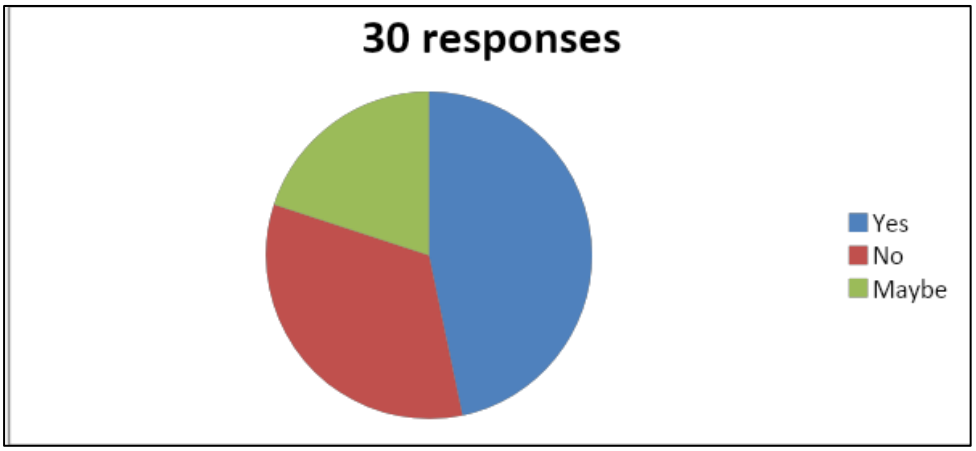
12. Are you familiar with the environmental regulations and standards concerning construction and demolition waste management in your country?

Yes
No



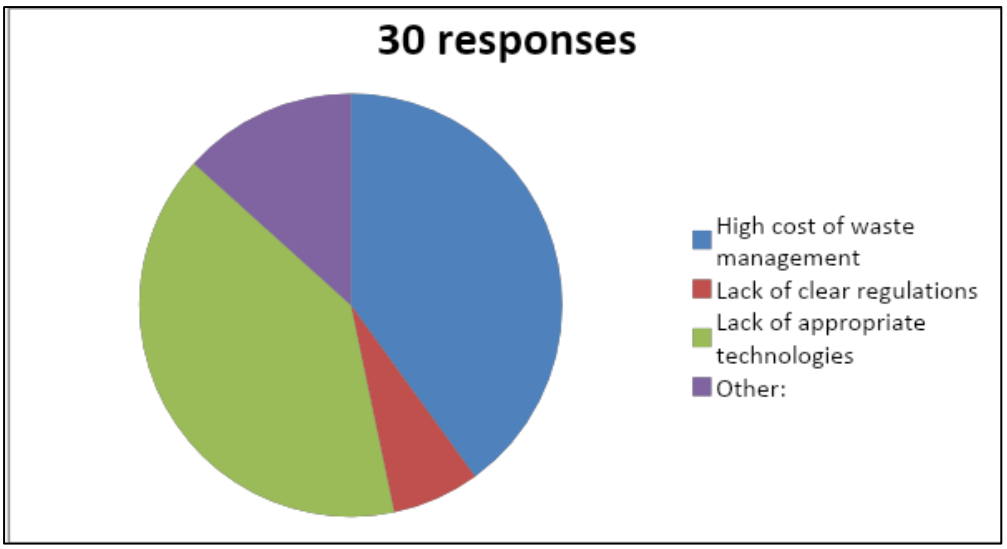

13. Do you encounter regulatory challenges or compliance issues in managing construction waste?

Yes
No
Maybe




14. What are the main obstacles you face in effectively managing construction waste?

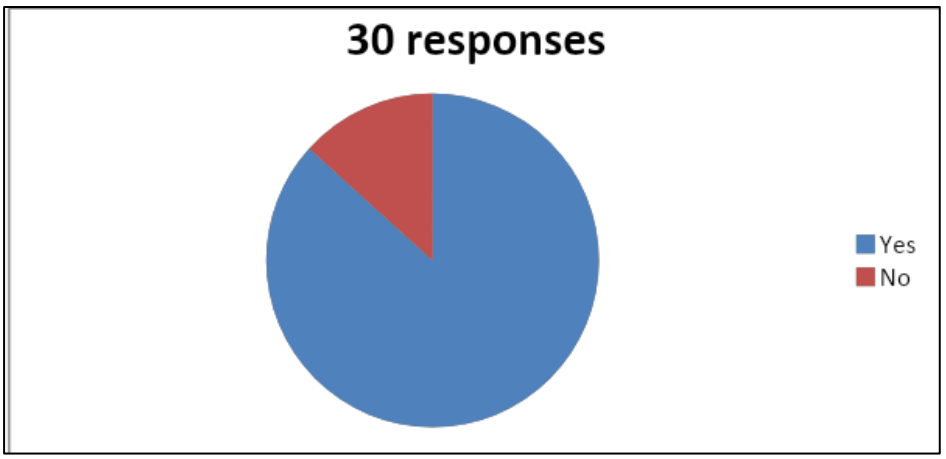
High cost of waste management
Lack of clear regulations
Lack of appropriate technologies
Other:




15. Are you currently working with external partners or service providers for waste management?

Yes

No



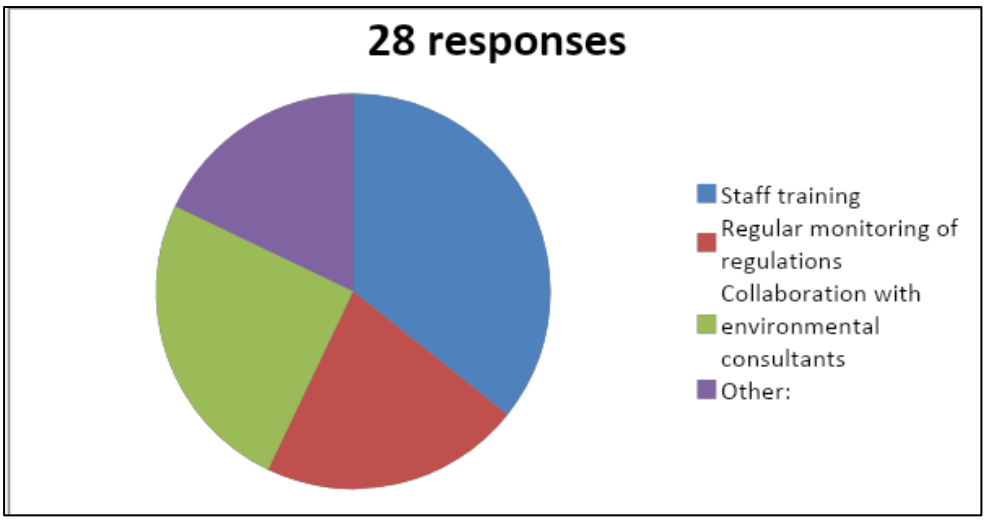

16. How do you ensure compliance with waste management regulations and environmental standards?

Staff training

Regular monitoring of regulations

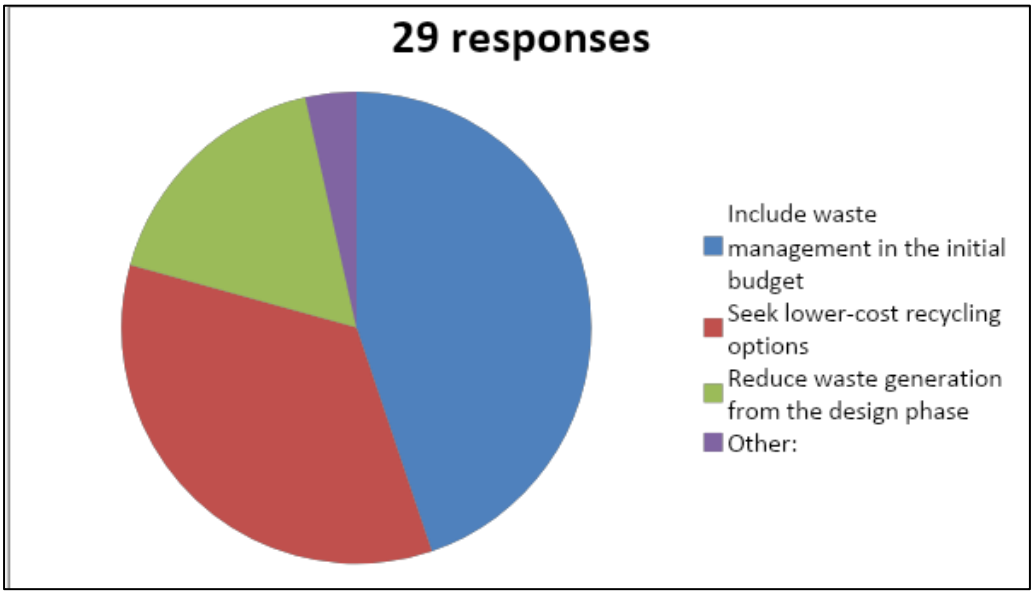
Collaboration with environmental consultants

Other:



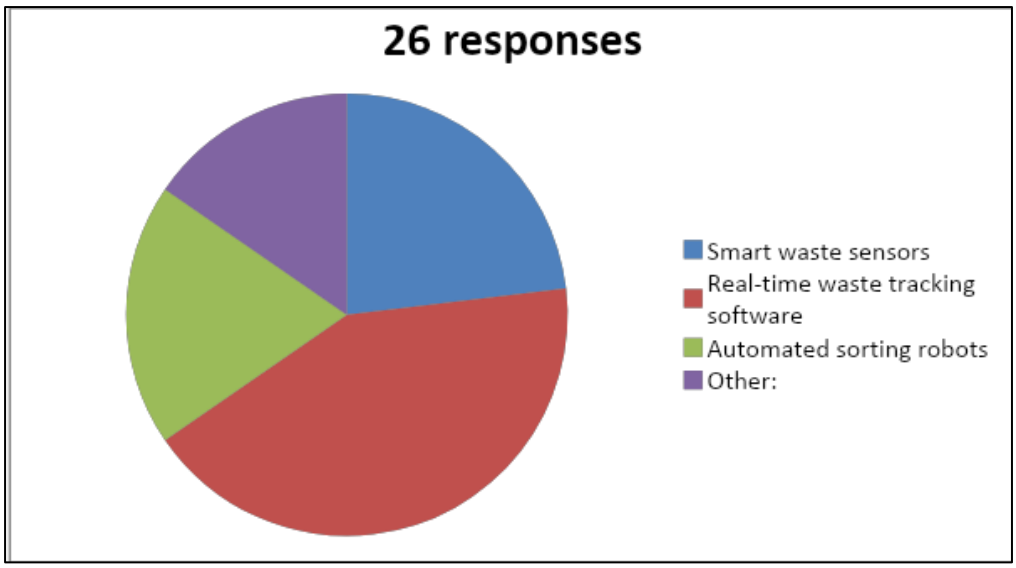

17. How do you balance the cost of waste management with other project expenses?

Include waste management in the initial budget
Seek lower-cost recycling options
Reduce waste generation from the design phase
Other:



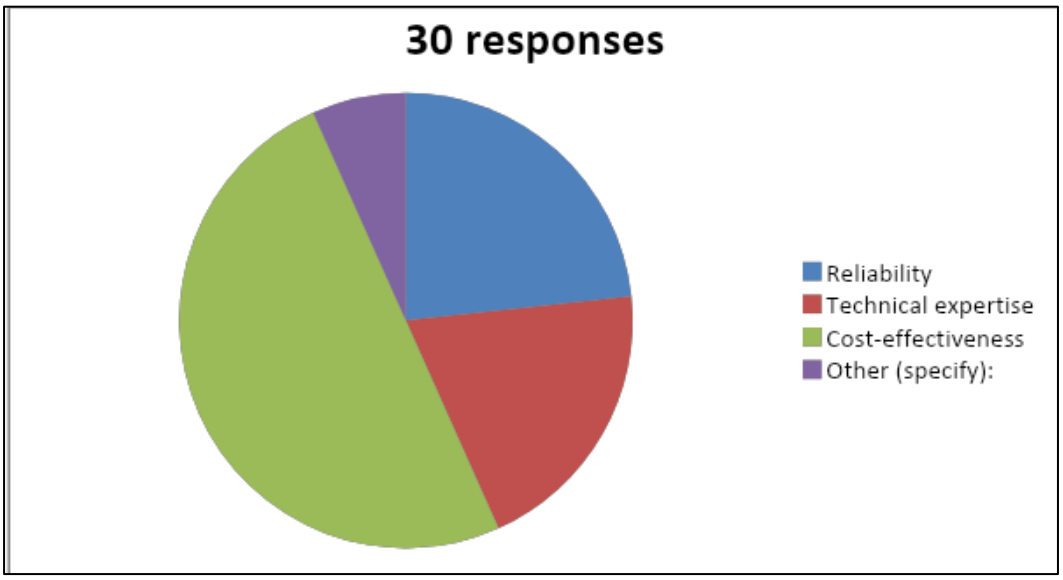

18. What technologies or tools do you think could improve efficiency in waste management?

Smart waste sensors
Real-time waste tracking software
Automated sorting robots
Other:




19. What qualities do you look for in a waste management partner or solution provider?

Reliability
Technical expertise
Cost-effectiveness
Other (specify):




20. Do you have any suggestions for a startup aiming to tackle challenges in this space? _____ (open response)

16 responses

- construction companies encourage these small businesses
- advertise your work
- professional training
- encourage young businesses by motivating them, more presence of secretarial services to enforce the law
- benefit from previous and international experiences in this field
- specify the type of waste you want to recycle, then conduct a cost estimation study

for recycling

- first, you need to know the construction materials well in order to recycle them correctly
- a startup representing sustainable and ecological construction, using recycled materials
- the work of recycling concerns the interior of homes for each of us, it should be considered as a way of living
- not really
- create a profitable market for all stakeholders
- a startup in this field is essential and collaboration with the concerned dealers to do good for the economy and the environment
- the transition from a linear economy to a circular economy
- name
- work on household waste
- NO
- no

21. How can a newcomer like us better support your waste management needs? _____ (open response)

14 responses

- Provide training for recycling waste
- Encourage recycling companies
- Professional relationships
- Revise the entire system
- Training
- Education
- Management
- Political will
- Vary the types of protections in waste recycling (e.g., hazardous chemical products), lack of experience in this field in Algeria
- Good organization
- Prioritize the awareness of workers and labourers. Then try to innovate with software while respecting regulations
- Waste management requires a significant investment in material and human resources
- According to the type of waste and the quantity
- Gather information between waste producers and consumers while trying to find a new product that benefits both parties
- First, contact and use technology
- Through web development "a website (and/or an application) that deals with construction waste"
- Maybe intelligent waste sensors
- Good communication for timely waste collection
- YES

- No

### II.5.2.3 Conclusion

The start-up ecosystem thrives on innovation and collaboration coupled with a strong business model and adaptability. The journey will remain one of learning and continual adaptation. With the right vision, determination and support, it can grow into a sustainable business that can shape the future of the construction industry reducing the construction and demolition waste generation rate in Algeria.

# Chapter III:

The concept of waste Management.

# III The Concept of waste Management

## III.1 Introduction

Efficient waste management stands as a cornerstone of sustainable construction practices. Within this realm, waste management entails not just the elimination of waste where viable, but also the concerted efforts to minimise its generation and harness materials that would otherwise be discarded. The principles of solid waste management underscore the paramount importance of reducing, recycling, and repurposing waste to ensure the sustainable stewardship of our resources.

## III.2 The principles of waste management

### III.2.1 Eliminating Waste:

Innovative strategies exist to significantly diminish waste produced during construction endeavours. Consider, for instance, opting for robust modular metal form systems tailored for concrete construction. These systems boast the advantage of being easily disassembled and repurposed for future projects, thereby circumventing the excess wood waste typically tied to formwork fashioned from plywood and lumber. The elimination of waste not only fosters a healthier environment but also mitigates adverse effects on human well-being.

### III.2.2 Minimising Waste:

Efforts to reduce building-related waste can be significantly enhanced. For instance, opt for construction materials meticulously designed and manufactured for minimal packaging, thereby curbing excess waste. Additionally, prioritise the selection and utilisation of recyclable materials and products, unlocking substantial potential to diminish waste output.

### III.2.3 Reusing Materials:

Certain materials hold the potential for reincarnation. Take, for instance, doors and windows that boast impeccable quality; they can seamlessly replace the need for fresh items or find new purpose through donation or sale, enriching another project—an exemplar of advantageous recycling.

However, materials and products that resist efficient elimination, minimization, or reuse inevitably accumulate. Without proper management, they are destined for disposal at the most economical route. Across various regions, landfill disposal fees far exceed the costs associated with segregation, recovery, and even the disposal of remnants.

### III.2.4 Federal Regulations:

For Example: ***Décret exécutif n°04-409 fixant les modalités de transport des déchets spéciaux dangereux.***

- Section 1: Preliminary Dispositions

**Article 3**

The transportation of hazardous special waste is subject to:

overarching requirements regarding packaging, means of transportation, and safety protocols;

specific conditions concerning the authorization for transporting hazardous special waste and the documentation required for the movement of this waste category.

- Section 2: Conditions pertaining to the conveyance of hazardous special waste

**Article 7**

The transportation methods for hazardous special waste must be meticulously crafted and tailored to match the nature and specific hazard characteristics of the waste being transported.

**Article 8**

The transportation methods for hazardous special waste undergo compliance checks and periodic technical inspections in accordance with current regulations.

**Decree No. 14-138 of March 11, 2014**, establishing the management channels for construction and demolition waste (CDW).

**Order of June 29, 2014**, specifying the conditions for the production, collection, transportation, storage, valorisation, and disposal of construction and demolition waste (CDW).

### III.2.5 Management.

Construction and demolition debris primarily originates at the project level, thus falling under the purview of various laws and regulations at local, state, provincial, and federal levels. In the United States, this debris is legally defined at the state level, while in Canada, it's defined provincially. To ensure compliance, it's essential to consult the specific regulations applicable to your locality, state, or province.

Local practices governing the handling and disposal of such debris are often influenced by factors such as the availability of suitable disposal sites, prevailing economic conditions, societal priorities, the existence of recycling and reuse markets, transportation infrastructure, and the adaptability of local construction businesses and labour forces in managing waste during demolition processes.

Effective management of construction and demolition wastes involves considerations at multiple levels, including project planning, organizational strategies, and the final disposition of the debris.

#### III.2.5.1 Advantages of construction waste management

**Enhanced management of construction waste yields numerous advantages:**

- Compliance: Adherence to the Waste (England and Wales) Regulations 2011 is not just advisable, but legally mandated for businesses involved in waste production, import, export, transportation, storage, treatment, or disposal.

- Elevated Health and Safety Standards: Implementing proper waste handling and segregation safeguards both workers and the public from potential accidents. This proactive approach mitigates risks such as materials being irresponsibly placed, posing threats like falling hazards or trip risks.

- Cost Reduction: Strategic construction waste management leads to financial savings through various channels. By embracing material reuse and averting double expenditures—wherein materials are wasted and then incur additional costs for removal—overall expenses are notably diminished.

- Corporate Social Responsibility (CSR): Conscientious waste management practices enable companies to curtail waste generation and ensure responsible processing post-site removal. Such efforts contribute to the preservation of natural resources and minimize the energy expended in waste transportation and reprocessing, aligning with broader environmental sustainability objectives.

- Enhanced Reputation: Businesses that actively demonstrate their commitment to environmental stewardship cultivate positive reputations, fostering stronger bonds with customers and clients. Moreover, such initiatives can open doors to lucrative opportunities, including government-funded projects that often demand stringent waste management protocols.

- Heightened Company-wide Awareness: The adoption of safe, sustainable waste management practices within the workplace not only promotes occupational safety but also instils a sense of responsibility that extends beyond professional realms. Employees who embrace these principles at work are more likely to integrate them into other facets of their lives, fostering a culture of environmental consciousness.

## III.3 Waste collection

The collection of construction waste is a significant aspect of sustainable development. Indeed, these waste materials constitute a substantial volume and can pose adverse environmental impacts if not managed appropriately.

The process of gathering construction waste:

- Waste segregation on the construction site
- Containerization
- Collection by an authorised collector
- Waste valorisation

Example of Source and pattern of CDW generation in Chennai (Hammadhu, H and AL 2024)

*Table 7: Metrics of CDW recycling plants in Chennai.*

| **Category** | **Average no. of projects per year** | **Highly active zones** | **Other Findings** |
|---|---|---|---|
| Construction | 528 | 9,10,13- High Rise residential<br>9,15,13-Non-High Rise residential<br>1,3,4-Industrial & | 77 % - non-high-rise residential<br>13 % - high-rise residential<br>10 % - industrial |

| | | | |
|---|---|---|---|
| | | Institutional | and institutional buildings |
| Demolition | 656 | 9,10 and 13 | Zone 9,8,12 and13 together has more than 50 % of the registration<br>1, 2, 3 and 15 together have less than 5 % registration. |
| Demolition and reconstruction | 3120 | 10, 6,7,8,9 | 97 % are from residential buildings |

**Various methods of waste collection exist: (TAFLIS.M (2015).)**

- **Multi-material collection**: involves gathering at least two non-polluting waste types in the same container, facilitating efficient sorting afterward. This method is primarily used for non-hazardous industrial waste.
- **Mono-material collection**: focuses on a single material type, directed straight to a valorisation channel.
- **Voluntary drop-off collection**: where the waste holder brings their waste to a designated location for grouping and centralization.
- **Selective or separative collection**: waste is segregated based on its characteristics and stored in specific containers (glass, paper, cardboard, organic waste, wood, etc.) to prevent contamination by other potentially polluting waste, products, or materials. This aims at subsequent valorisation or specific treatment after prior transportation. These terms also encompass all operations from waste removal in specific containers to their delivery to a sorting, treatment, or storage centre.
- **Simultaneous collection**: involves picking up two or more waste fractions simultaneously in a compartmentalized container during the same round. This is often a bin for household waste with recyclables.
- **Standard collection**: the traditional collection where waste is mixed in the bin (non-recyclable waste).
- **Door-to-door collection**: waste is collected by refuse collectors in bin trucks at the user's residence.

## III.4 Sorting samples

Effective waste sorting is pivotal in bolstering both the quantity and quality of recycled materials. Whether it's the conscientious efforts of individual households or the management of sizable commercial waste streams, each entity contributes significantly to the efficient sorting of waste.

### III.4.1 Advanced sorting techniques for construction and demolition waste:

Utilizing a blend of near-infrared detection, electromagnetic sensing, and visible colour imaging technologies facilitates the precise sorting of construction and demolition (C&D) waste. This meticulous approach ensures the purity levels necessary for recycling them into premium-grade products.


*Figure 11: Different sizes of the crushed material after sorting.*

## III.5 Transportation of construction& demolition waste:

Different Transportation Container Options for Construction Debris Removal

When embarking on a construction project, much attention is typically given to hiring skilled workers and procuring high-quality materials. However, effective waste management is equally critical for project success. Without proper waste handling measures, a project can face delays and compromise its overall quality.

Engaging a professional construction debris removal company is essential for successful project management. These companies offer various transportation container options tailored to your waste disposal needs. Below are insights into some containers best suited for transporting construction waste:

**Rectangular Roll-Off Containers:**

- Available in heavy, medium, and light-duty grades.
- Versatile open-top design accommodates irregularly-shaped items.
- Tarps may be added for containment and protection against contaminants and water.
- Tub-style containers, similar to rectangular roll-offs, feature tapered sides for easier waste dumping.
- Dewatering Containers:
- Designed to separate liquids from solid waste, simplifying waste classification.
- Permanent or temporary steel baskets facilitate liquid drainage.
- Water separated from solid waste can be reused onsite, promoting cost savings and environmental sustainability.
- Rolling Roof Containers:
- Also known as clamshell containers, equipped with sealed lids and tailgates.
- Safely transports hazardous waste like asbestos, mercury, and lead.
- Single or double covers prevent environmental contamination and ensure safe

containment during transportation.

- Sealed and Sludge Containers:
- Available in tub and rectangular styles for hauling liquid waste.
- Sealed tailgates with slider-style hinges prevent leakage.
- Suitable for both liquid and solid waste transportation, offering enhanced containment compared to traditional roll-off containers.
- Vacuum Tank:
- Fully enclosed container designed for transporting sludge and liquid waste.
- Features suction capability for efficient loading of liquids onsite.
- Minimizes loading time and costs associated with liquid waste transportation.
- Poly and Poly Box Tanks:
- Constructed from corrosion-resistant heavy-duty plastic polymers.
- Sealed tailgates and rounded corners ensure leak-proof transportation and easy cleaning.
- Ideal for transporting acidic materials and corrosive liquids common in construction projects.
- Considering waste disposal is often overlooked in construction planning, it's crucial to utilize specialized transportation containers for waste removal. Using construction vehicles for waste hauling can result in fines and potential vehicle damage due to exposure to hazardous substances. Opting for professional waste management companies like Junk King, which offer comprehensive debris removal services, can streamline waste management processes from collection to disposal.

### III.5.1 Types of Solid Waste Transportation

- Dump trucks and trailers
- Landfill tippers
- Storage and treatment tanks
- Walking floor trailers
- Bulk pneumatic tanker
- Heavy equipment

### III.5.2 The recycling process:

The recycling process encompasses three distinct methodologies, each sharing a common triadic framework:

- Collection and Segregation of Recyclable Materials: This initial phase involves the systematic gathering and segregation of recyclable materials from the waste stream. Materials such as plastics, paper, and glass are identified and separated to facilitate subsequent processing.

- Implementation of Recycling Procedures: Following collection and segregation, recyclable materials undergo one of three established recycling procedures. These procedures, detailed below, are instrumental in transforming waste into reusable raw materials.

- Conversion of Raw Material into Finished Products: The final step in the recycling process involves the conversion of raw materials, obtained through recycling procedures, into finished products. This transformation represents the culmination of efforts to reintegrate recycled materials into the production cycle.

Recyclable materials can be repurposed through three distinct recycling methodologies:

### III.5.2.1 Mechanical Recycling

Among the most widely employed methods globally, mechanical recycling serves as a cornerstone for repurposing materials such as plastics, paper, and glass. This approach entails mechanically processing waste materials to generate new materials while preserving their original chemical compositions.

Mechanical recycling processes typically involve grinding, washing, separation, drying, re-granulation, and compounding, particularly in the case of plastic waste. Notably, a significant portion of plastic recycling worldwide relies on mechanical recycling methodologies.

Ideally, mechanical recycling enables the reintroduction of materials into a closed-loop system, wherein recycled materials are reincorporated into the same application, akin to the recycling of glass. However, certain materials, notably plastics, may undergo degradation after multiple recycling cycles, resulting in diminished product quality. This phenomenon, known as "cascade recycling," underscores the imperative of exploring alternative recycling strategies to mitigate quality degradation in recycled products.

### III.5.2.2 Chemical Recycling in Polymer Waste Management

Chemical recycling represents an innovative technological approach aimed at restoring materials to their original, high-quality state, thus contributing to a circular economy model. This method serves as an umbrella term encompassing various processes designed to dismantle polymers, the fundamental building blocks of plastic materials, into their constituent parts for reutilization.

#### III.5.2.2.1 Pyrolysis: A Pathway to Synthetic Oil

Pyrolysis, the foremost chemical recycling process, involves subjecting polymers to high temperatures in the absence of oxygen. This thermal treatment induces polymer breakdown into smaller molecular components, yielding a synthetic oil akin to petrochemical naphtha. This synthetic oil serves as valuable feedstock in the petrochemical industry, facilitating the production of diverse chemicals, synthetic rubber, and various plastics.

#### III.5.2.2.2 Gasification: Harnessing Syngas for Chemical Synthesis

Gasification represents another viable avenue for chemical recycling, wherein polymers undergo controlled heating in the presence of oxygen and water vapor. This process yields syngas, a gaseous mixture rich in carbon monoxide and hydrogen, which serves as a versatile chemical feedstock in industrial processes.

#### III.5.2.2.3 Depolymerization: Reshaping Plastic Waste into Monomers

Depolymerization, feasible for specific plastic types, involves the cleavage of polymers into monomers. Unlike pyrolysis and gasification, depolymerization directly yields monomeric

compounds suitable as raw materials for the production of new plastics. However, subsequent polymerization steps are necessary to transform these monomers into finished plastic products.

#### III.5.2.2.4 Energy Recycling: Transforming Plastic Waste into Energy

Energy recycling emerges as an alternative approach exclusively applicable to plastic waste, wherein plastics undergo incineration to generate both thermal and electrical energy. By harnessing the heat released during combustion, this method converts plastic waste into a valuable energy resource. Notably, energy recycling finds favour in densely populated urban areas facing space constraints for traditional landfill disposal.

Historically perceived negatively due to emissions concerns, energy recycling has undergone significant improvements in recent decades. Modern incineration facilities adhere to stringent environmental regulations, employing catalytic converters and other advanced technologies to mitigate emissions and ensure compliance with environmental standards. As such, energy recycling represents a viable waste management strategy with the potential to address both energy demands and waste disposal challenges in urban environments.

### III.5.3 Conclusion:

Here, we explore the concept of waste management, focusing on its core principles and the benefits of effective construction waste management. It covers key aspects such as waste collection, sample sorting, and different methods of solid waste transportation. The chapter also provides an in-depth look at the recycling process and various recycling techniques, highlighting the importance of efficient waste management in promoting sustainability within the construction industry.

# Chapter IV:

## The Digital tool

# IV Digital tool

## IV.1 Introduction

In this chapter we will explain the features of the website. We have used "wix.com" as a website builder.

## IV.2 Definition of a website

A website is a compilation of files accessible via a web address, focusing on a specific topic or theme, and overseen by an individual or entity. Its initial page is termed the home page. Situated on servers linked to the internet, a website is capable of organizing and disseminating data requested by users worldwide, round the clock, seven days a week. Typically employing HTML, website's structure and display information, offering navigation tools to facilitate seamless movement both within the site and across the internet.

## IV.3 Features of the website

**a) Logo**

The name should be prominently displayed on your website's home or landing page, it should be presented clearly alongside your logo, a graphic design that visually represents your brand.

**b) Domain name**

The website's domain name is the URL that appears in the browser's address bar. It should be concise and closely related to your brand.

**c) Contact & social media info.**

Contact information and social media links allow people to reach out if they have queries about your business or want to collaborate. Include your relevant information, such as a phone number and email address.

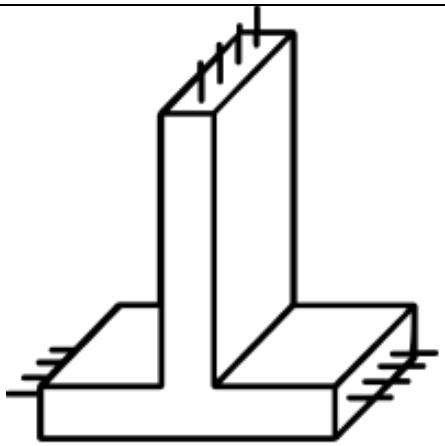
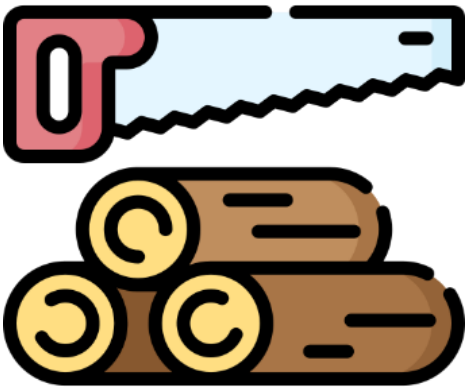
**d) Blog**

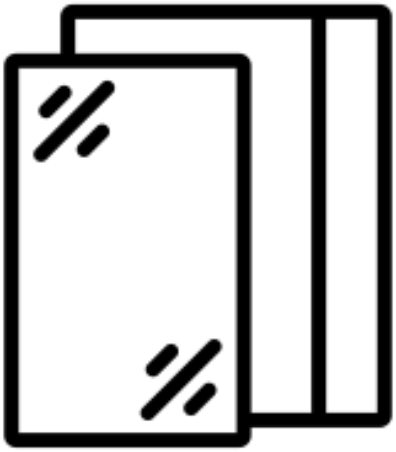
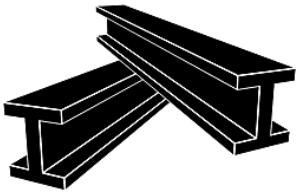
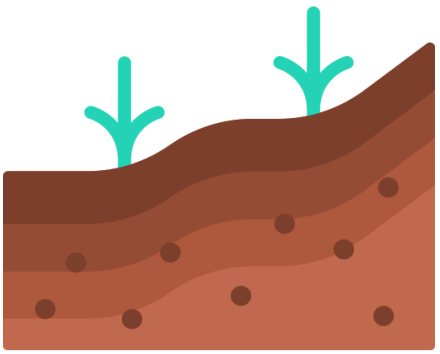
A blog, short for weblog, is a dedicated page that contains thought leadership and content on niche topics that appeal to a specific target audience. Including a blog is a great digital marketing strategy, as it allows you to find potential customers through search engine queries.

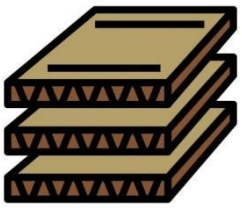
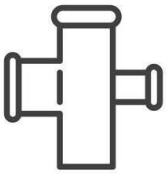
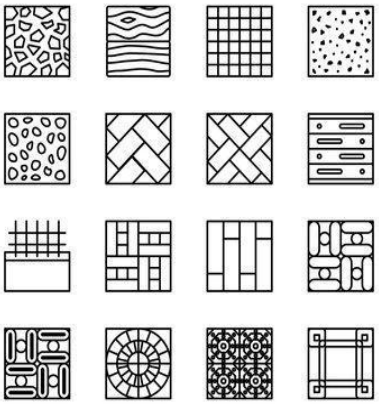
**e) About us page**

The about us page is the place to share your brand's story, mission, and long-term goals. List your company's founders, executives and managers, and team members.

*Table 8: Different materials of a structure that can be recycled and reused.*

| MATERIAL | ICON |
|---|---|
| **Concrete** |  |
| **Rebars** |  |
| **Wood** |  |

| | |
|---|---|
| **Glass** |  |
| **Steel** |  |
| **Soil** |  |

| | |
|---|---|
| **Cardboards** |  |
| **PVC pipes** |  |
| **Tiles** |  |

## IV.4 Materials in a Building to be Demolished

This document shows different materials of a structure that can be reused. These will be quantified in different units and categorised based on the type of building to be demolished.

*Table 9: Different materials of a structure that can be recycled and reused.*

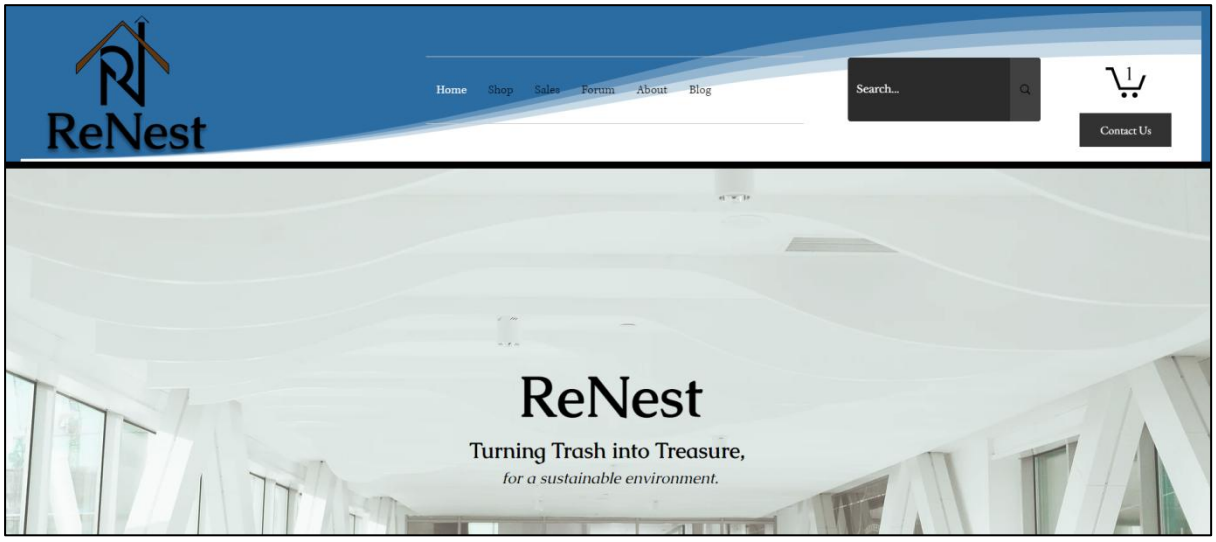
| **ITEMS** | DESCRIPTION |
|---|---|
| Furniture | *Furniture can be categorised as office, school and residential (bathroom accessories, kitchen, bedroom and lounge)* |

| | |
|---|---|
| • Doors<br>• Windows<br>• Tables<br>• Notice Boards<br>• Chairs<br>• Beds<br>• Cabinet & shelves<br>• Wooden countertops | |
| Appliances | Gas Cookers, cylinders |
| Accessory elements | These include gutters, metallic ladders, louvers |

## IV.5 The website

Below is the link of our website:
**https://nalweyiso007.wixsite.com/ReNest**

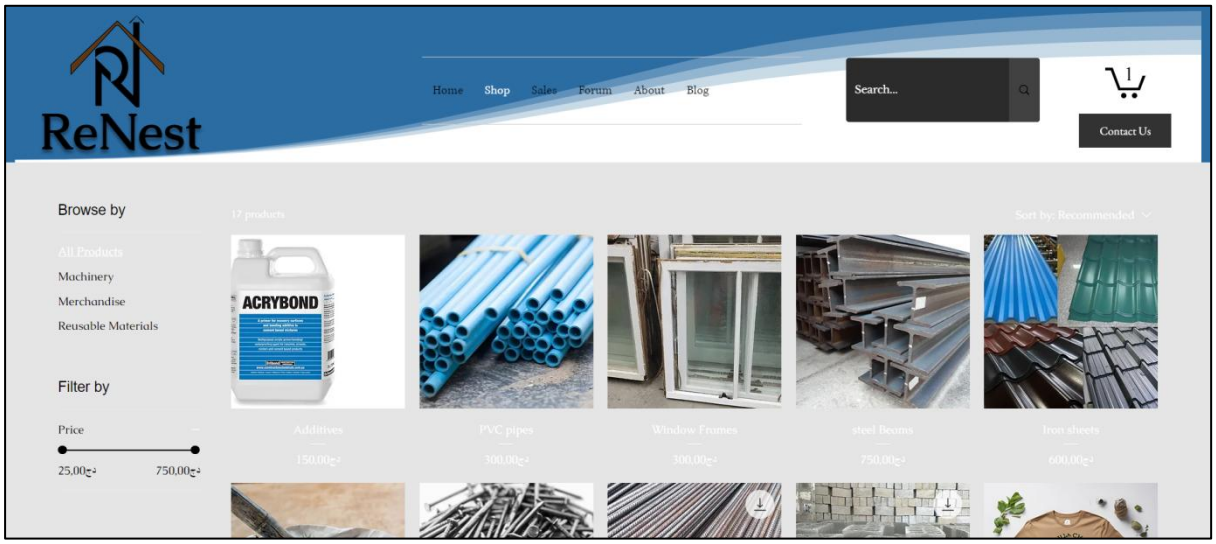
## ***THE HOME PAGE***



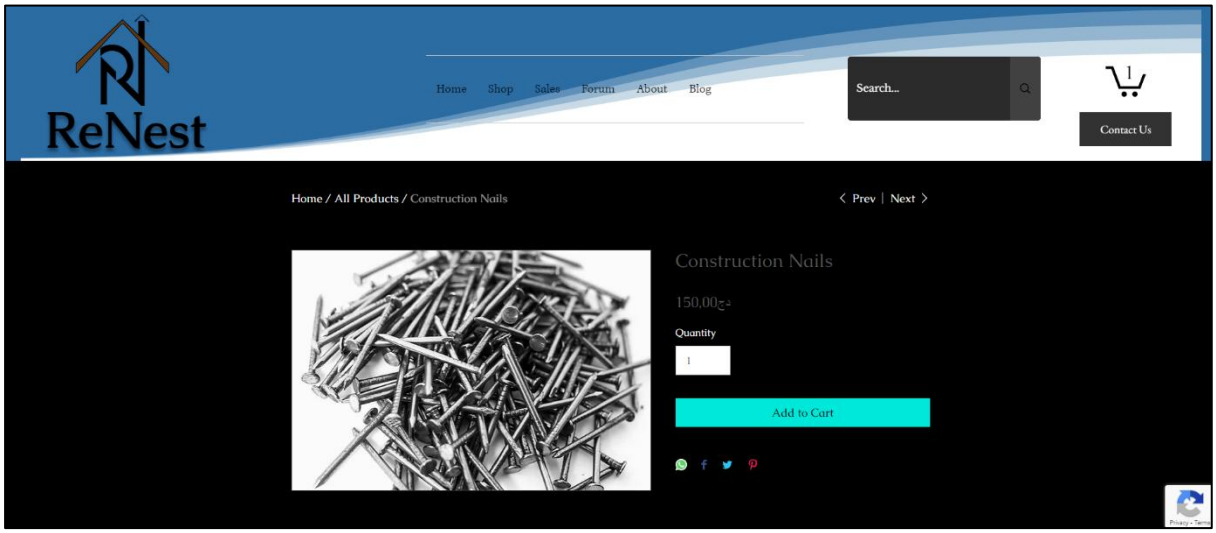

This includes testimonies from our clients and our partners.

Our partners vary from the university of Tlemcen such as the professors and the materials laboratories. Where the research on the recycled materials manufactured can be tested for their resilience resistance and capacity. You can join and stay informed by our newsletters when you submit your email on our home page.

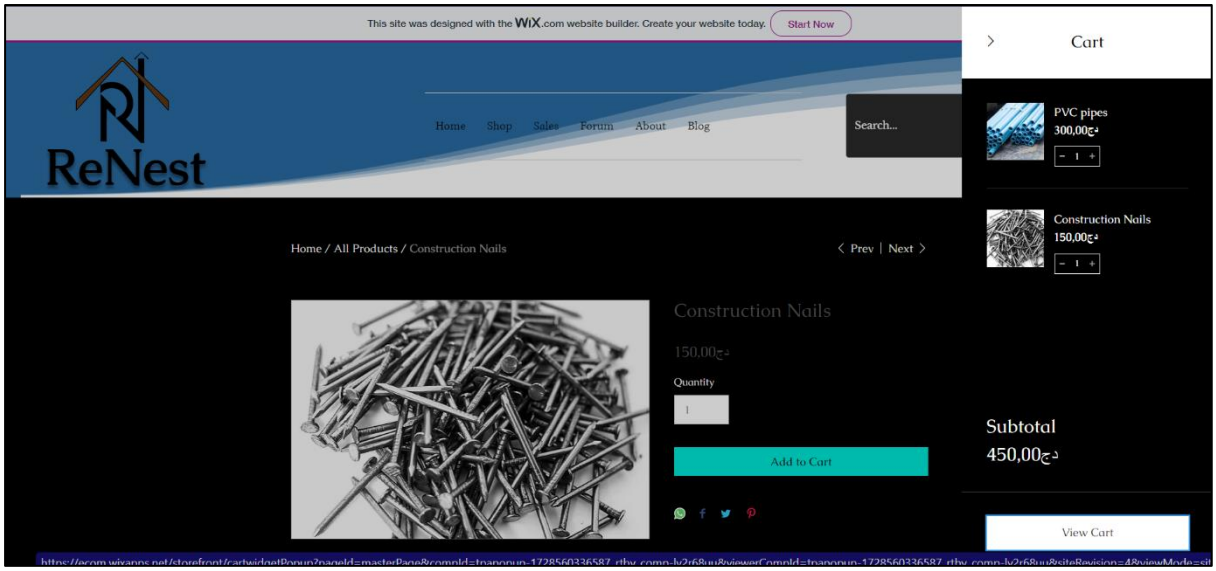
## ***SHOP***




Here our customers can check out the products they are able to buy and also book the products they need.
We have divided this page into five categories. You can start by clicking on all products and you will get all the products with their corresponding prices. If you desire to specify your need you can click in machinery, reusable materials or merchandise. Also, you can search based on your budget by clicking 'Filter by price'

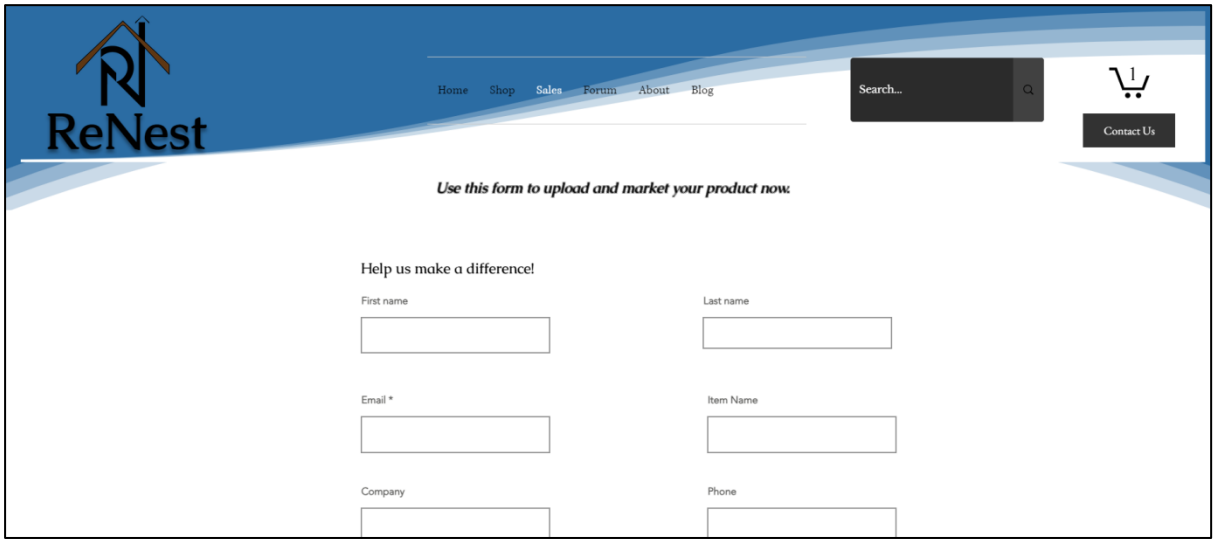



After browsing and finding what you need you can click on the item and you will find more details about what you want and whether or not you are interested in adding it to the cart clicking on next or previous you will get the other products we shared on our website.



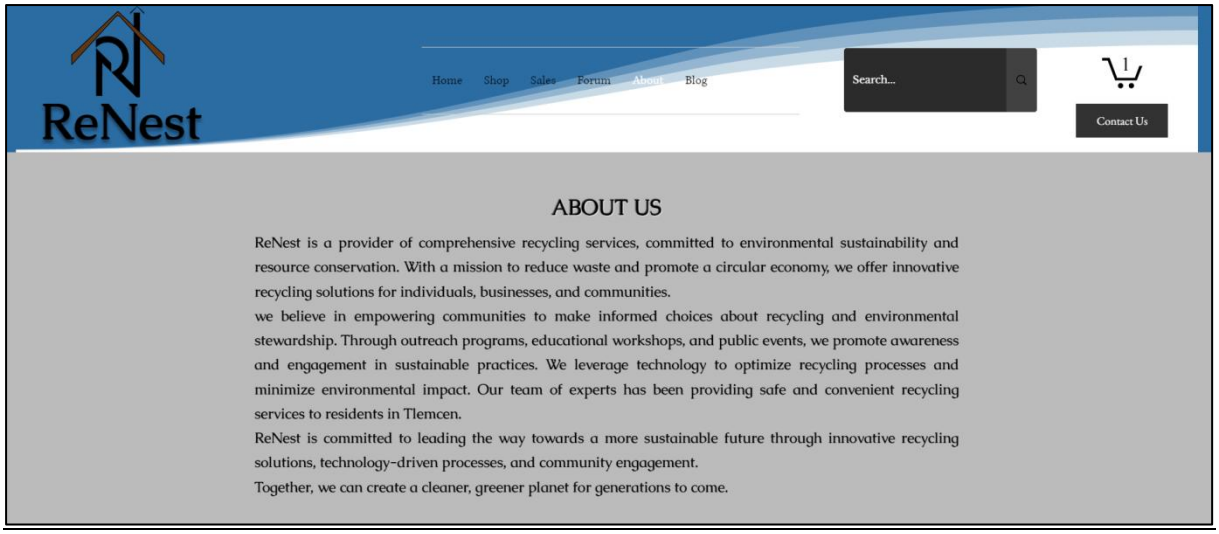

After purchasing your product here, you can see your cart showing what you have in your basket with a subtotal of your payment. After clicking on view cart, we get to my cart which is mention below.

## ***SALES***

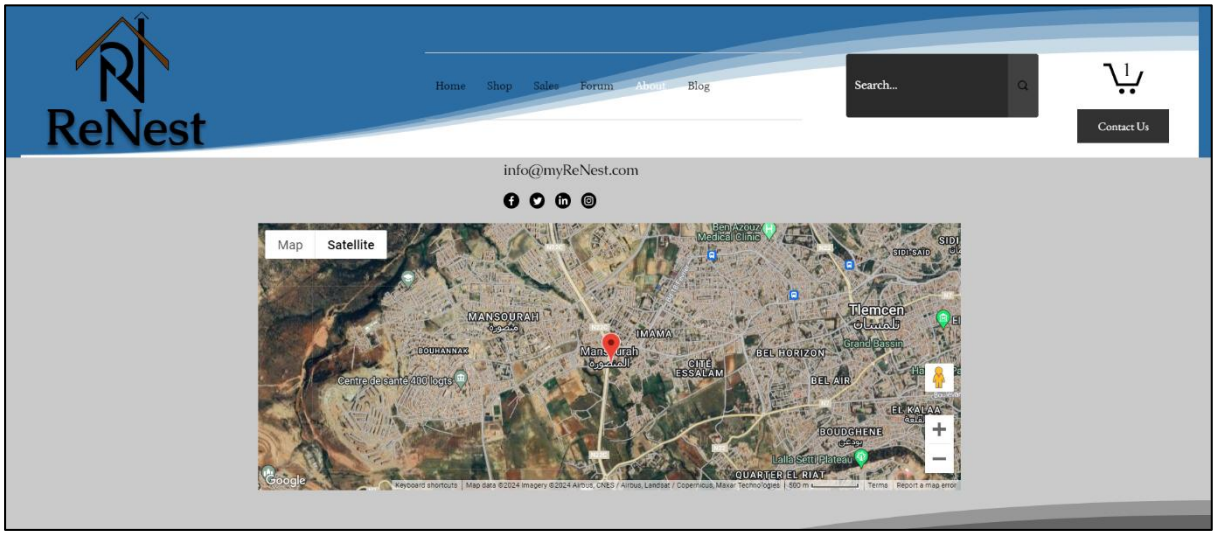



Here, sellers of products can upload a product they desire to sell to other people on our website by following the steps included. A future edit to this page is still in progress where our clients can upload an image of the product they are selling.

## ***ABOUT***

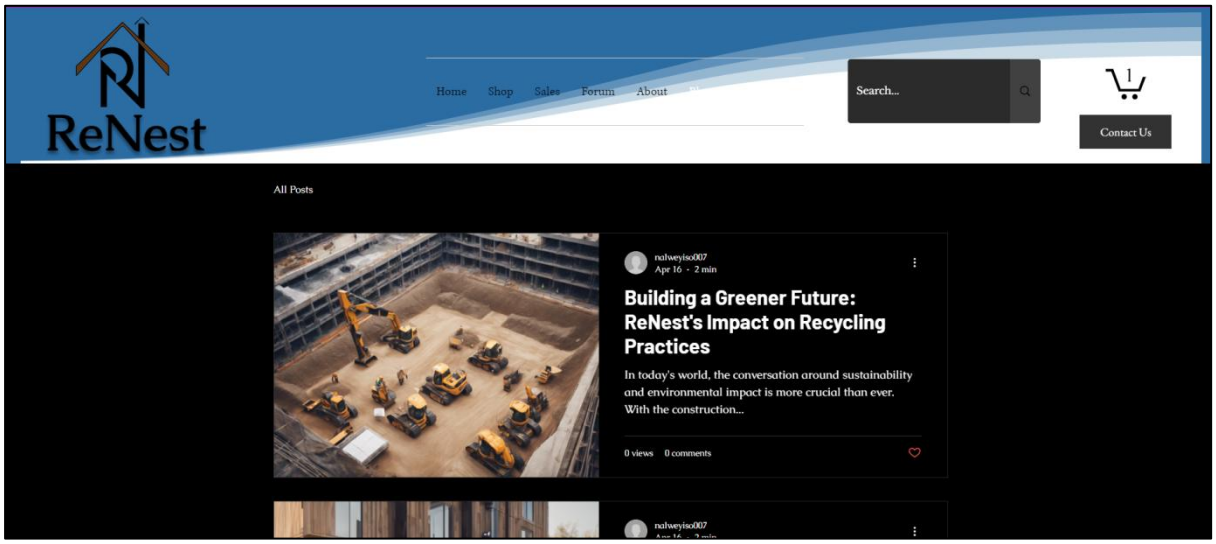



This Page talks about our team, vision and mission.




We have included here the map which can direct you to our enterprise location

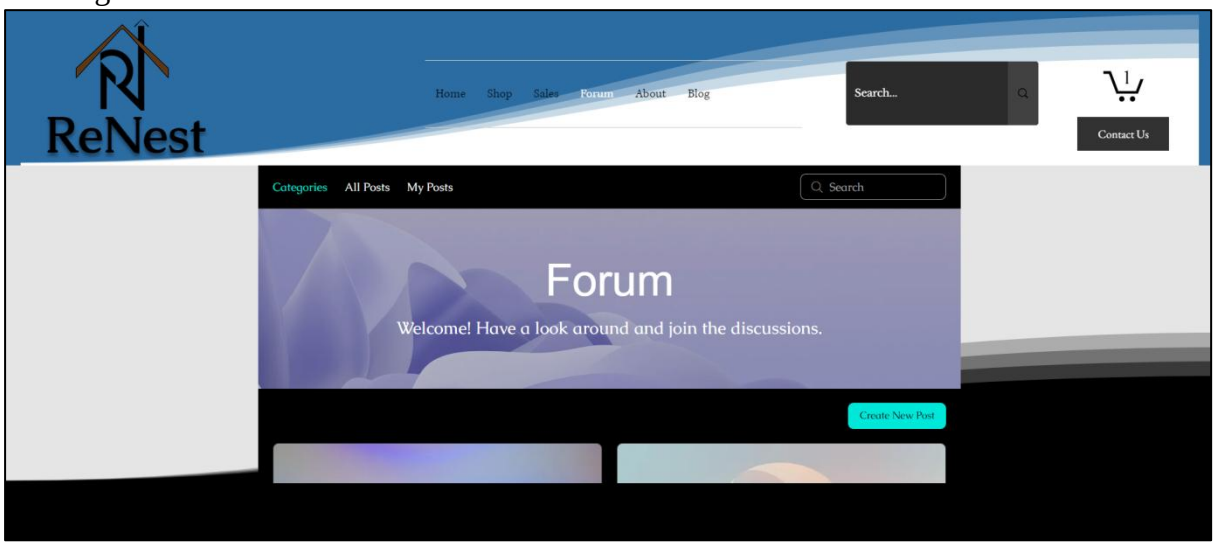
## ***BLOG***




Here we put out all our latest discoveries and those in the industry to keep you up to date with the current advancements in the construction industry.
It also allows the professors to give their own research discoveries to guide the student or anyone interested in the sustainability practice in construction of structures.

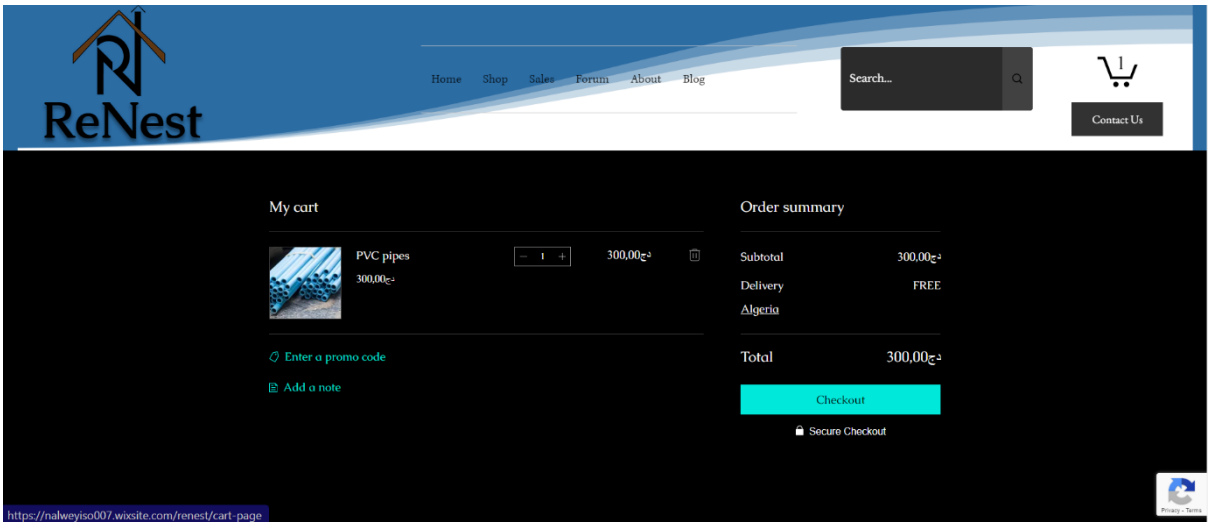
## ***FORUM***

In this section, access will be given to all students, researchers and enterprise owners interested in taking remote classes given by university lectures and professors specializing in Eco construction.
We will arise an awareness and lessen the need for employees to operate without knowledge of the environmental regulations and how to manage construction & demolition waste challenges.



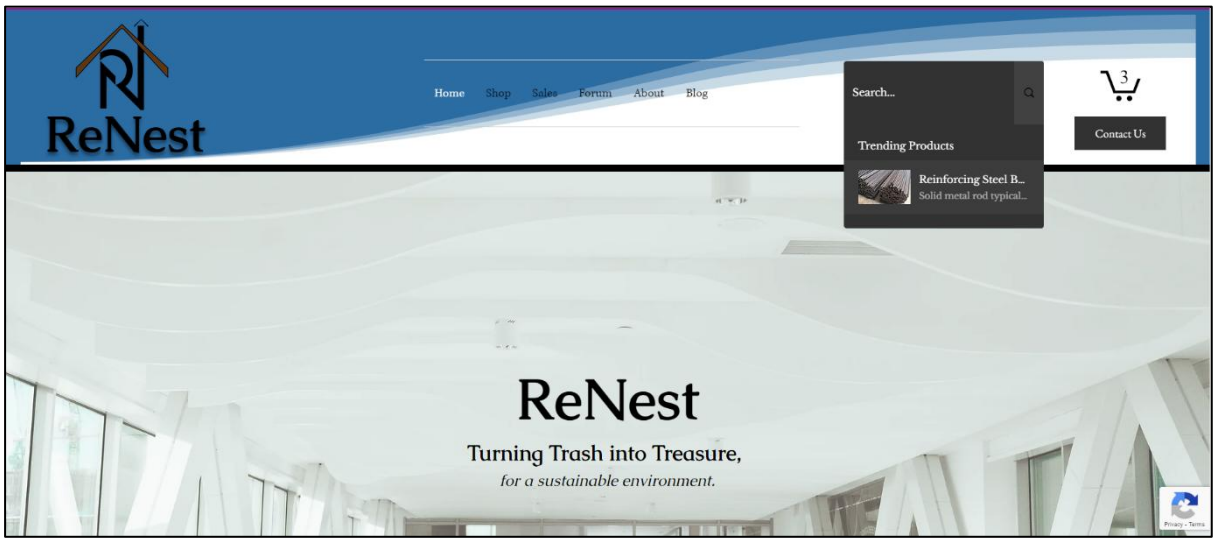

We are allowing our users to write their own ideas.

## ***SHOPPING CART***

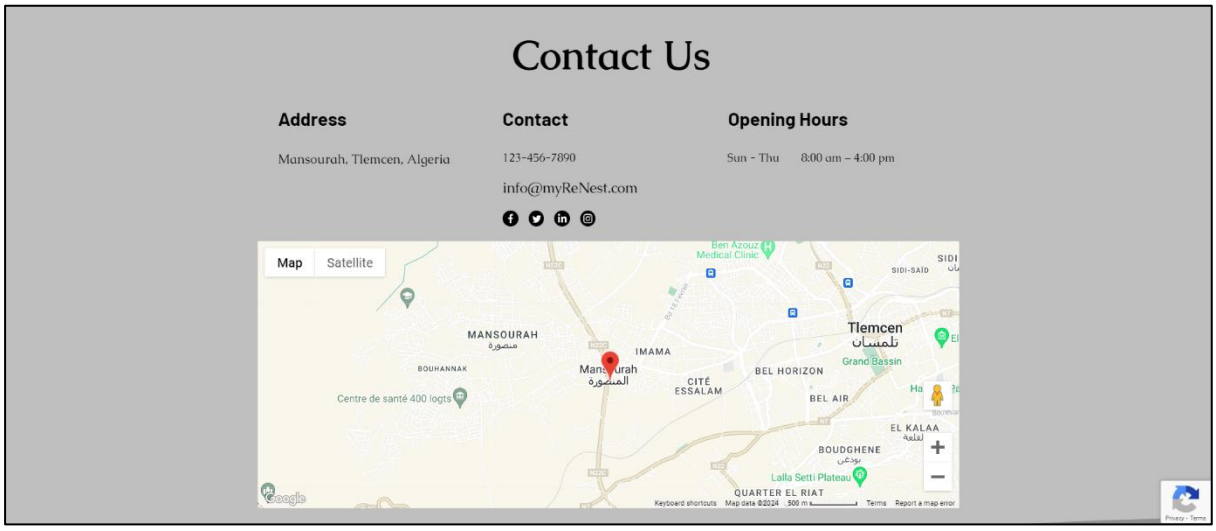

After purchasing your end product, you can click on the cart section to make your check out also allowing a promo code to making a discount. Our other summary shows the subtotal delivery fees and total cost of your product you can increase the amount of your pieces you need by clicking on the plus sign and decrease it by clicking on the minus when you click at add the note, we are allowing you to place a special request to add there. If you desire to cancel your order, click on the garbage can icon.

***SEARCH***




If you want to make it easy for you to find what you want, the search icon will facilitate that for you by combining all sections at once to get to your target.

***CONTACT US***




When you click on the contact us you will get to this section. Here you can find the address, email, Instagram, Facebook page, opening hours and days of work just to allow you to know and facilitate it for you to communicate and reach out to us.

## IV.6 Conclusion

The website is our online platform where we are to display and spread the whereabouts of our products to our future customers. This has been developed as a prototype to show how best our business idea shall develop hand in hand with the technological advances.

# General Conclusion

The construction industry in Algeria, like many other parts of the world, faces significant challenges related to waste management. The traditional linear model of "take, make, dispose" is no longer sustainable in the face of environmental concerns, resource scarcity, and economic inefficiencies. This Master's thesis explored the potential of transitioning towards a circular economy in the construction sector in Algeria, leveraging a digital tool designed to enhance waste management practices.

Our research has underscored the pressing need for effective construction waste management strategies that not only mitigate environmental impact but also promote resource efficiency and economic sustainability. By analysing current waste management practices through our survey, we have noticed that most of them dispose the wastes into the landfills and less than 50% are recyclable materials while only 50% are familiar with environmental regulations.

Most of them encounter regulatory challenges in managing construction waste and the main obstacle they face is high costs of waste management. By identifying key areas for improvement, we have demonstrated the potential benefits of adopting a circular economy approach. This involves rethinking waste as a valuable resource that can be reused, recycled, and reintegrated into the production cycle.

Our website proposed in this Master's thesis aims to facilitate this transition by providing a comprehensive platform for optimising construction waste processes.

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# Abstract

This groundbreaking Master's thesis takes us deep into the world of recycling construction and demolition waste, shedding light on sustainable waste management practices. It powerfully underscores the far-reaching environmental and health impacts of construction waste, emphasising its effects on ecosystems and human well-being, particularly in the unique context of Algeria. The Master's thesis puts forth a range of dynamic strategies to combat these impacts, including innovative approaches to reusing waste in building construction, public works, and research. Ultimately, the thesis passionately advocates for efficient construction waste management as a pivotal step towards environmental sustainability.


Keywords: ***Recycling, construction and demolition waste, eco-system.***



# Résumé

Cette thèsenovatrice explore enprofondeur le recyclage des déchets de construction et de démolition, enmettanten lumière des pratiques de gestion durable des déchets. Elle soulignepuissamment les impacts environnementaux et sanitaires considérables des déchets de construction, eninsistant sur leurseffets sur les écosystèmes et le bien-êtrehumain, notamment dans le contextespécifique de l'Algérie. La thèse propose unesérie de stratégiesdynamiques pour contrerces impacts, y compris des approchesinnovantes pour réutiliser les déchets dans la construction, les travaux publics et la recherche. En fin de compte, elleplaide avec passion pour une gestion efficace des déchets de construction, essentielle à la durabilitéenvironnementale.


Mots-clés :**Recyclage, déchets de construction et démolition, écosystème.**



# الملخص

*تتناول هذه الأطروحة الرائدة بعمق موضوع إعادة تدوير نفايات البناء والهدم، مسلطةً الضوء على ممارسات الإدارة المستدامة للنفايات. وتبرز بقوة الآثار البيئية والصحية الواسعة لنفايات البناء، مع التركيز على تأثيرها على النظم البيئية وصحة الإنسان، خاصة في السياق الفريد للجزائر. تقدم الأطروحة مجموعة من الاستراتيجيات الديناميكية لمواجهة هذه الآثار، بما في ذلك طرق مبتكرة لإعادة استخدام النفايات في البناء والأشغال العامة والبحث. في النهاية، تدعو الأطروحة بشغف إلى إدارة فعّالة لنفايات البناء كخطوة أساسية نحو الاستدامة البيئية*


*الكلمات المفتاحية:* ***إعادة التدوير، نفايات البناء والهدم، النظام البيئي***

# Annexes

People's Democratic Republic of Algeria
وزارة التعليم العالي و البحث العلمي
Ministry of Higher Education and Scientific Research
جامعة أبو بكر بلقايد– تلمسان
University Aboubekr Belkaid – Tlemcen
Faculty of Technology
Department of Civil Engineering

# Business Model Canvas

# BMC

**Project Name: Optimizing Construction & Demolition Waste Management in Algeria Towards a Circular Economy through a Digital Tool.**

Project No: **FT-055**



| | | | |
|---|---|---|---|
| Supervisor | Assia Benchouk | Professor | University of Tlemcen– Algeria |
| Supervisor | Zahera Benadela | Professor | University of Tlemcen- Algeria |
| Researcher | Amel Bouguettaya | Student | University of Tlemcen- Algeria |
| Researcher | Luwemba Abbey | Student | University of Tlemcen- Algeria |

Table of Contents

# 1.Value proposition

## a) What problems are we solving for our customers?

**ReNest** is a forward-thinking company dedicated to environmental sustainability through innovative recycling solutions and reuse. Our primary goal is to minimize demolition and construction waste and conserve resources by efficiently collecting, processing, and repurposing reusable construction materials.

Through cutting-edge technology and strategic partnerships, we aim at diverting as much waste as possible from landfills, reducing environmental impact, and fostering a cleaner world. We are committed to promoting a circular economy where materials are reused and recycled contributing to a more sustainable world.

To do all this mentioned above, we looked at some of our customer's problems and tried to tackle each at a time through a team collaborating with the current technology. Below is a list of the customer problems we are trying to solve through **ReNest;**

**Creating an awareness through publicity and blogging;**

The world is a small place we like to say. Through the cutting-edge technology **ReNest** has adopted, we can now easily connect our community of motivated customers to come in contact with each other like they live next door.

**Decreasing the effort and time to market;**

Our customers are not only purchasers but also sellers. **ReNest** provides a platform through the website to showcase the products our clients want to put out there for sale to other people. Through a few clicks of a button, we reduce the effort to search and showcase your products.

**Improving market share;**

Most of our customers are in search of the availability of the market for the products but do not know where to look. Through our website, we provide a variety of products available to them to purchase hence bringing the market to them at their device; only a click away.

**Creating a clean and safe place to live for generations;**

Self is what is killing most of us, at **ReNest** we not only look at the short-term goals and benefits of the company but also build a sustainable environment for our young ones.

**Developing new products;**

Change is difficult to adapt to but with it, we get to experience something different. ReNest looks at the development of new products through recycling hence bringing a new experience of products to customers and giving a distinct taste of what can come out of waste.

## b) What needs of our customers do our services satisfy?

The most successful salespeople are the ones who find pressing customer problems and do something to solve them in a way that is convenient, cost-effective, or timely. Top salespeople find issues that customers are facing and are ready to solve them, then they work hard to solve them. Of course, finding those problems and then delivering good solutions for them requires a well-planned and organized effort. These problems then translated to the customer's required needs. Here we discuss the needs that we are reaching out for our clients;

**Creating an awareness through market sharing and blogging;**

Lack of knowledge can cripple anyone, at ReNest we nullify that through creating an awareness that brings our customers to a place where they can impact proper environment living and also source the different products being put out there to be sold. These include doors, windows, cardboard, etc.

**Sustainable environment;**

Creating a sustainable environment involves nurturing ecosystems and conserving resources to ensure the well-being of both current and future generations. We achieve this by implementing effective waste management strategies such as recycling and reuse minimizing landfills reducing pollution and conserving valuable resources.

**Providing a marketplace;**

Through our platform, we provide a marketplace for our customers to buy, sell, or even window shopping through.

**Offering cheap and quality products;**

With the provision of a market, we offer fairly cheap prices to our customers who are looking at buying reusables such as doors or windows.

**Connectivity;**

ReNest through its platform provides a connection between the buyer and the seller. Here to make commerce easy.

## c) What is our offering different from that of our competitors?

**Sustainability and conservation;**

Creating a sustainable environment involves nurturing ecosystems and conserving resources to ensure the well-being of both current and future generations. We achieve this by implementing effective waste management strategies such as recycling and reuse minimizing landfills reducing pollution and conserving valuable resources.

## d) What is our unique proposition?

Our unique proposition over competitors is dependent on various factors. Below is a detail of some of these factors;

**Sustainability and eco-friendliness**: environmental sustainability is a growing concern in the construction industry. We prioritize eco-friendly practices throughout the operations from sourcing the materials to how to dispose and produce reusable products.

**Innovative technology and solutions**: as a recycling company we are developing and implementing cutting-edge technology in the industry to reduce the carbon footprint and reduce waste dumping in society.

**Community engagement and social responsibility**: we demonstrate a strong commitment to social responsibility and community engagement through contributions to local causes and creating a platform where we can interact and share ideas.

**Exclusive partnerships and collaborations**: through our one-on-one and community relations we create partnerships with our customers, and influencers in the industry, and this makes our customers participators in our service delivery.

**Value-added services**: At **ReNest** we provide value-added services such as educating our customers on creating an eco-friendly environment and the possibilities to reuse and recycle construction waste products.

# 2. Customer segments

## a) Who are our main customers?

Our main customers range from government-owned construction companies to individuals involved in construction works or projects.

Overall, our main customers are those who align closely with our value proposition, derive significant value from our services, and contribute to our revenue. To specify it to the latter we look to target civil construction-related workers and clients indulged in building.

## b) What are the different customer segments we target?

We target customers based on their **geographic location**, such as country, region, city, or even neighborhood. This segmentation takes into account factors like climate, cultural differences, and local preferences. This helps us to tailor our marketing efforts to specific needs of our customers in different locations leading to more effective marketing strategies.

We also target our customers on **psychological characteristics, interests, and personalities.** This allows us to target customers with similar preferences through our platforms. This can also extend to behavior such as purchasing patterns, usage rate, and response to marketing messages.

For example: our online services through the website can target frequent shoppers and personalize their recommendations.

As a company, we also target **other businesses rather than individual customers**; these include construction enterprises, and manufacturing companies in the line of construction. By understanding these different segments, businesses can better our ability to reach our customers' needs and preferences and also increase awareness amongst them together with sales.

In summary, the segments can be categorized into geographic, psychological, behavioral, and business-to-business.

## c) What are the specific needs of each customer segment?

**Geographic segmentation:**

This is a marketing strategy that involves dividing a market into different geographical units, such as countries, regions, cities, or neighborhoods.

Under this segmentation, we make an effort to understand the local preferences and traditions which can help tailor products and marketing strategies to resonate with customers in specific geographic areas.

**Psychological segmentation:**

This is a marketing strategy that divides consumers into different segments based on psychological characteristics. This approach considers factors such as lifestyle, personality traits, values, attitudes, interests, and opinions.

Beliefs and values tend to draw our customers into what they tend to buy. They may seek products that align with their principles such as sustainability which are looked at as a company. Lifestyle can also come under this segment, one who desires a sustainable environment will sign up for our products because we look at enforcing this through our business.

**Business-to-business segmentation:**

B2B helps companies understand and address the diverse requirements of their business clients leading to more effective marketing strategies and improved business relations.

Based on the construction industry, specific regulations and compliance requirements tend to govern the needs of these businesses. Having a clean environment and ensuring a proper disposal of construction wastes is a regulation under which all enterprises involved in construction need to follow so we meet that need through connectivity to potential buyers.

**Technographic segmentation:**

This is the process of dividing a market based on consumer's use and adaptation to technology.

Through our online platform, we have already reached out to this segment and provide ease of use to different customers and ensure compatibility.

Understanding these different segments and the needs that we are tackling helps us to tailor their offerings and experiences to deliver maximum value and satisfaction.

**Business to Consumer segmentation:**
This involves dividing a market of individual consumers into distinct groups based on various characteristics to tailor marketing efforts and products to meet the specific needs and preferences of each segment.

People like changing so they like to enhance what they see as being ancient to something modern, or to change the architecture of the structure this will cause waste and when they don't know about the regulations, they will throw the waste wherever they want without considering the pollution of the environment this is why we will provide information on our website about the regulation and to help them to find a place to throw their rubbish. Also, when it comes to finding materials that are on budget people find it a hard thing so we will provide materials on their budget.

### d) How can we categorize our customers into distinct groups?

**Defining segmentation criteria**: helps to locate variables we can use to segment our customer base. This can include geographic location, income levels, interests, purchase history etc.

**Collecting data:** on our customers too has helped to reach this. We have sourced various places to categorize these through website analytics and demographic databases.

**Data analysis:** helps to identify patterns and similarities among our potential and ready customers. Using different techniques helps to group customers into distinct segments.

**Monitoring and adapting:** to the behaviors and feedback to track the effectiveness of our segmentation approach.
With such a categorization we can improve customer satisfaction and drive business growth.
**Community-engaged;** customers in this relationship are made to feel a part of a huge community creating a sense of belonging and encouraging the sharing of common interests and opinions to better our platform.

## 3. Consumer Relationship

### a) What type of relationship does each customer segment expect from us?

**Transactional relationship**; this is primarily transactional and focused on providing efficient service to fulfill their immediate needs.

**Personal-oriented relationships;** are characterized by a focus on building trust, loyalty, and long-term engagement.

**High value / Dedicated personal relationship**; this is highly strategic and mutually beneficial. We provide this relationship through tailored experiences and are dedicated to maintaining their loyalty.

**Co-creation relationship:**
Collaboration among various stakeholders to achieve sustainable waste management practices such as construction companies, and waste management firms.

### b) How can we currently maintain relationships with our customers?

- Provide exceptional customer services (After sell services, incentives)
- Offering discounts to our loyal clients
- Personalize interactions
- Communicate regularly
- Send and listen to feedback
- Engage customers in community building; here we facilitate interactions and collaborations through our online forum.
- Being transparent and authentic
- Continuing to innovate and evolve through our customer's feedback.
- Follow up and show appreciation for previous feedback.

### c)How can we personalize our interactions with our customers?

- Listen and respond to feedback
- Provide tailored content and experiences
- Collecting some customer data(testimonies)
- Segment customers

## 4. Channels

### a) Through what channels do our customers want to be reached?

**Online channels;**

- Online booking and buying
- Website
- Delivering products to our customers: when people choose their products we will deliver it to them.

### b) Which channels are most effective in reaching each customer segment?

**Email**: using email to communicate with customers to tell us about what they need, and the problem they face with our website or products so we take a step to help them.

**Social media**: using social media to show people what we are doing and how we are developing our ReNest.

**website**: our website is going to be accessible for everyone and for free they can share their information about what they know about pollution and how to get a clean environment. We also made some groups so they can share their thoughts on it and to see what they need in our products to make it for them. We will also share our products at the website to make it easier for them to choose what to buy.

### d) How can we integrate the different channels to improve the customer experience?

**Unifying customer data**; collecting and analyzing data from various channels into a centralized customer relationship management.
We can allow customers to transition between channels without having to repeat information. For example, one may start by browsing products on the website and purchase through a mobile app.
Consistent marketing of the company (branding)

## 5.Key partnerships

### a) Who are our key partners?

**Suppliers and vendors**; provide the raw materials necessary to operate the business.

**Strategic alliances:** involving partnering with companies or organizations to achieve mutual goals for example: ASPEWIT, local contractors

**Financial partners**: who provide funding to support the business' growth and operation.

**Marketing and advertising specialists:** who help to promote the products or service through various channels such as digital marketing.

**Logistics and transportation partners:** who facilitate the movement of goods from suppliers to customers.

**Research and development partners:** to help develop new products for the consumers these may include laboratories and environmental administrations, CTC.

### b) What partnerships help us reduce costs, access new resources or improve our service proposition?

**Suppliers and vendors**; provide the raw materials necessary to operate the business.

**Strategic alliances** involving partnering with companies or organizations to achieve mutual goals.

**Financial partners** who provide funding to support the business' growth and operation.

**Marketing and advertising partners** who help to promote the products or service through various channels such as digital marketing.

**Logistics and transportation partners** who facilitate the movement of goods from suppliers to customers. People with trucks can be helpful by lending or sell them to us for use in the transportation of the goods

**Research and development partners** to help develop new products for the consumers may include the university.

### c) How can we align our interests with those of our partners?

Investing in market research to understand customer/partners' needs and preferences as well as data analytics to gain insights into customer needs.

Prioritizing customer satisfaction and emphasizing the importance of putting them first.

Communicating transparently and honestly

Personalizing customer experiences across different channels and taking note of their reactions to them.

Acting on feedback received through surveys and reviews across different channels

Building long term relationships

The things that will be getting for; our enterprise is;

the facility to obtain the product they want with a lower price

making their construction with a resistance product and eco friendly to the environment

making a clean and sustainable environment without polluting earth

the facility to get rid of their construction waste with ReNest website

the things we will get;

building trust and good reputation

getting a revenue from the sales

## 6. Key Activities

### a) What key actions do we need to take to deliver our value proposition?

- Recycling construction waste: the aim of this startup is to recycle construction waste we will start by one product and we will develop to various materials, this company will start by the most polluted material to eliminate the carbon on the environment

**Recycling Concrete:**

Summary Report on procedure of recycling Concrete:
Many structures are built using concrete and have to be renovated and modernized to meet

current needs this leads to demolition hence construction wastes.
The Procedure;

1. Rubble is collected from the site using trucks.
2. Tools such as a hydraulic chisel break up the concrete blocks.
3. An excavator dumps the material into a crusher, the crusher processes the parts
4. into recycling material with a particle size of up to a particular diameter (60mm)
5. A screening unit consisting convey belts then separates the gravel in various
6. particle sizes.
7. A magnetic belt removes the reinforcement steel bars.
8. Equipment required;
9. Concrete saw & Chisel
10. Crusher
11. Pulverizing machine: to size the concrete
12. Scalping screens and conveyor belts
13. Water trailers

- Conducting a thorough market research and customer analysis to gain insights into the needs. This helps us to understand what drives value for our customers.
- Highlighting the unique benefits and value that we are offering through the product.
- Making sure that products reach the promises made in the value proposition.
- Delivering quality products to the customer.
- Ensuring prioritization of customer services at every stage and relationship level of our journey.
- Making sure that the pricing strategy with the value delivery is aligning.
- Continuous improvement as the customer feedback, market trends, and competitive dynamics come up.
- Building trust and credibility; to deliver as promised.
- Providing an easy connectivity channel between the buyers and sellers

## b) What operations are essential for our business?

- Strategic planning and management for guiding and directing the growth of the business.
- Quality management; ensuring that the sold or marketed product is up to standard.
- Leveraging technological advances to improve efficiency and enhance competitiveness in today's age
- Recruiting talented employees to build a skilled and motivated workforce for the business
- Supply chain management to ensure proper flow of goods and services from suppliers to customers.
- Managing financial resources, budgeting and forecasting are essential for maintaining financial health and achieving long-term sustainability.
- Providing exceptional customer service and support is crucial for building customer loyalty and trust.

## c) What activities create the most value for our customers?

- Providing high-quality products and services that meet their expectations is essential.
- Offering innovative products that can solve customer problems
- Making it easy for customers to access the products, navigate processes, and complete transaction
- Providing responsive, helpful, and personalized customer experiences throughout our entire customer journey.
- Offering educational resources, tutorials, and information to help customers and bring them to an awareness.
- Communicating openly and honestly with customers about products creates value by building trust and credibility.
- Building a sense of community across the platforms through which people reach out to us

# 7. Key resources

## a) What are the tangible and intangible human resources?

Tangible resources are physical assets that a company owns and can be quantified and seen.

Examples of these are:

1. Inventory: it's the materials we need to make our new products such as: raw materials, construction trash (construction and demolition waste)
2. Technology: it's the required machines for making our products: computers, softwares, trucks, chisel machine, concrete crushers
3. Financial resources: our company also needs a fund to start the business and the solution to get it is through: money from personal savings and investments, bank loans and credit, family and friends, Strategic Partnerships

Intangibles are non-physical assets that contribute to the value of a company but cannot be seen.

These include;

1. Human capital: this involves skills, knowledge and capabilities of employees.
2. Strategic partnerships with other companies that provide access to resources

Both resources are important for a company's success and effectively managing and leveraging these resources can provide a competitive advantage in the marketplace.

## b) What tools, technology or partnerships do we need to succeed?

**Suppliers and vendors;** provide the raw materials necessary to operate the business.

**Strategic alliances:** involve partnering with companies or organizations to achieve mutual goals.

**Financial partners:** who provide funding to support the business' growth and operation.

**Marketing and advertising partners:** help to promote the products or services through various channels such as digital marketing.

**Logistics and transportation partners:** who facilitate the movement of goods from suppliers to customers.

**Research and development partners:** to help develop new products for the consumers these may include the university.

**E-commerce Platforms**: E-commerce platforms enable us to sell products or services online, reach a global audience, and manage online transactions, payments, and inventory. E-commerce solutions include website builders, shopping carts, payment gateways, and digital marketing tools.

### c) What are the main competitive advantages of our resources?

**Cost advantage:** the goal is to recycle and reuse products so we can produce and offer goods at a lower cost than our competitors who manufacture new goods.

**Partnership advantage**: this allows us to leverage our connection with other companies and customers to gain an advantage over our competitors.

**Innovation:** offering innovative products from waste materials has provided a competitive advantage.

## 8. Structure Cost

### a) What are the fixed and variable costs associated with our economic model?

The fixed costs are incurred regardless of whether the business produces or doesn't generate revenue. They are associated with maintaining the capacity to produce goods.
Some of these for our business model include;

- Payment of equipment
- Salaries
- Depreciation of fixed assets
- Rent
- License fees (ISO 9001)
- Maintenance expenses for any facility or equipment
- Distribution costs of trucks
- Buying land

## Variable costs

These costs are expenses that fluctuate in direct proportion to changes in production. These costs increase as production levels increase.
These include the following;

- Raw materials and components
- Direct labor costs
- Packaging and shipping costs
- Utility costs directly related to production activities

**The financial projection for the first 5 years of a construction waste recycling startup in Algeria:**

**Financial Projection for Years 1-5:**

| Expense Category | Year 1 (in DA) | Year 2 (in DA) | Year 3 (in DA) | Year 4 (in DA) | Year 5 (in DA) |
|---|---|---|---|---|---|
| Machinery and Equipment | 10,000,000 DA | - | - | - | - |
| Land Acquisition | 3250000 DA | 9,245,000 DA | - | - | - |
| Facility Rent | 2,000,000DA | 2,000,000DA | 2,000,000DA | 2,000,000DA | 2,000,000DA |
| Employee Salaries | 3,000,000 DA | 3,500,000 DA | 4,000,000 DA | 4,500,000 DA | 5,000,000 DA |
| Distribution Trucks | 2,000,000 DA | - | - | - | - |
| Operational Costs | 1,500,000 DA | 1,800,000 DA | 2,000,000 DA | 2,200,000 DA | 2,400,000 DA |
| Compliance and Permits | 100,000 DA | 100,000 DA | 100,000 DA | 100,000 DA | 100,000 DA |
| Marketing and Promotion | 800,000 DA | 800,000 DA | 800,000 DA | 800,000 DA | 800,000 DA |
| Administrative Expenses | 500,000 DA | 600,000 DA | 700,000 DA | 800,000 DA | 900,000 DA |

**Total Estimated Expenses:**

- **Year 1: 23,150,000 DA**
- **Year 2: 18,050,000 DA**
- **Year 3: 8,850,000 DA**
- **Year 4: 9,850,000 DA**
- **Year 5: 10,350,000 DA**

## b) What are the biggest costs of our business?

Marketing and Advertising Expenses: Investing in marketing and advertising strategies to attract customers, and promote products or services. These help to attract customers and build brand awareness making them significant costs for business, Expenses included are advertising campaigns, digital marketing, print materials, and marketing stuff.

**Inventory Costs**

Taxes and Regulatory Compliance: In cases of taxes and regulatory compliance, meeting tax obligations, complying with regulatory requirements, and paying fees or licenses associated with operating a business are necessary expenses that can vary depending on the industry and location.

Research and Development: (R&D) Expenses; For businesses that invest in innovation and product development, R&D expenses include costs associated with research activities, prototype development necessary, testing process, and intellectual property protection.

## c) How can we reduce costs or improve the efficiency of our operations?

Conducting a comprehensive analysis of current expenses to identify areas where the costs are high.

- Negotiating with suppliers to obtain better costs
- Optimizing inventory management practices
- Optimizing labor costs reduces the labor costs
- Investing in technology and automation tools to streamline operations and reduce labor costs.

# 9. Revenue

## a) What products or services are our customers willing to pay for?

- Recycled products
- Reusable products
- Delivery and marketing of reusable products

## b) What are the different ways we can generate income?

Providing a platform where we can bring awareness on different sustainability ways

Selling reusable and recycled products

## c) What is our pricing model?

**Cost-Plus Pricing:** Cost-plus pricing involves setting prices based on the cost of production or service delivery, plus a markup or profit margin. The markup percentage is typically determined by adding a fixed percentage or dollar amount to the cost of goods sold (COGS) or total production costs.

**Value-Based Pricing:** Value-based pricing focuses on the perceived value of the product or service to the customer rather than the cost of production. Prices are set based on the value that customers are willing to pay for the benefits or solutions provided by the product or service.

**Revenue Projection for Years 1-5:**

**Assuming an average fee per ton of recycled construction waste and an estimated volume of waste processed per month, the revenue projection for Years 1-5 could be as follows:**

| Revenue Source | Year 1 (in DA) | Year 2 (in DA) | Year 3 (in DA) | Year 4 (in DA) | Year 5 (in DA) |
|---|---|---|---|---|---|
| Recycling Product Fees | 20,000,000 DA | 21,000,000 DA | 22,000,000DA | 23,000,000DA | 24,000,000DA |
| Sales of Recycled Products | 10,000,000 DA | 11,000,000 DA | 12,000,000DA | 13,000,000DA | 14,000,000DA |
| Delivery Fees | 5,000,000 DA | 6,000,000 DA | 7,000,000DA | 8,000,000DA | 8,000,000DA |
| Advertising Revenue | 1,000,000 DA | 1,000,000 DA | 1,300,000 DA | 1,400,000DA | 1,500,000DA |

**Total Estimated Revenue:**

- **Year 1: 36,000,000 DA**
- **Year 2: 39,000,000 DA**
- **Year 3: 42,300,000DA**
- **Year 4: 45,400,000DA**
- **Year 5: 47,500,000DA**

## Net Income Projection for Years 1-5:

| Revenue | Year 1 (in DA) | Year 2 (in DA) | Year 3 (in DA) | Year 4 (in DA) | Year 5 (in DA) |
|---|---|---|---|---|---|
| Total Revenue | **36,000,000** | **39,000,000** | **42,300,000** | **45,400,000** | **47,500,000** |
| Total Expenses | **23,150,000** | **18,050,000** | **8,850,000** | **9,850,000** | **10,350,000** |
| Net Income | 12,850,000 | 20,950,000 | 33,450,000 | 35,550,000 | 37,150,000 |
| Net Income in % | 35.69% | 53.72% | 79.08% | 78.30% | 78.21% |

# Business Model Canvas: BMC

## Partenairesclés
## Key Partnerships
## الشراكة الرئيسية

- Suppliers and vendors
- Strategic alliances
- Financial partners
- Marketing and advertising specialists
- Partner companies in logistics and transport

## Activitésclés
## Key Activities
## الأنشطة الرئيسية

- Recycling construction waste.
- Research and development
- Market study
- Ensure that the products meet the promises
- Quality control

## Ressourcesclés
## Key resources
## الموارد الرئيسية

- Inventory materials (construction and demolition waste)
- Technology the required machines (trucks..)
- Financial resources (bank loans and credit)
- Human capital (capabilities of employees)
- Strategic partners with other companies that provide access to resources

## Proposition de valeur
## Value Proposition
## القيمة المقترحة

- Create awareness through expansion and blogging
- Sustainable environment
- Provide a marketplace
- Connectivity
- Sustainability
- Innovative technology and solutions
- Community engagement
- Exclusive partnerships and collaboration
- Cheaper products

## Relation clients
## Consumer Relationship
## علاقة مع العملاء

- Reputation
- Transactional relationships
- Clients oriented towards relationships
- High-value clients
- Client information
- Reduce product costs for loyal clients
- Social media email

## Canaux de distribution
## Channels
## قنوات التوزيع

- A website to make Online orderwith a delivery
- Social Media Marketing
- Partnerships with Construction and Public Works Institutions
- Publicity on television and radio

## Segment client
## Customer Segment
## انواع العملاء

- Customers interested in eco-friendly products for construction.
- Customers involved in road construction.
- Customers looking for good quality but cheap materials
- Customers involved in public works and are in need of lightweight materials.

## Coûts
## Cost structure
## التكاليف

- Machines
- Rent
- Expenses
- Employee salaries
- Distribution trucks (rent).

Total Estimated Expenses: **23,150,000 DA**

## Revenue streams
## مصادر الارادات

- Advertising for other companies by promoting their work.
- Revenue from products sold
- Profit from delivery
- Total Estimated Revenue:**36,000,000 DA**
- Net Income: +12,850,000DA 35,69%