

National Construction and Demolition Waste Management Strategy and Implementation Plan

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Acknowledgment



Foreword



Table of Content

ACKNOWLEDGMENT	I
FOREWORD	II
TABLE OF CONTENT	III
LIST OF TABLES	VII
ABBREVIATIONS AND ACRONYMS	VIII
EXECUTIVE SUMMARY	X
BACKGROUND.....	X
CDW MANAGEMENT STRATEGIES AND PLAN.....	X
METHODOLOGY	XI
CONCLUSION	XI
SECTION 1: INTRODUCTION	1
1.1 C&D WASTE OVERVIEW.....	1
1.2 CATEGORIZATION AND CLASSIFICATION OF C&D WASTE	2
1.2.1 <i>CDW Management Levels</i>	2
1.2.2 <i>Categorization of Wastes in Kenya</i>	2
1.3 CONTEXT OF THE STRATEGY AND IMPLEMENTATION PLAN- OBJECTIVES AND SCOPE.....	4
1.3.1 <i>Purpose of the CDWM Strategy and Implementation Plan</i>	4
1.3.2 <i>Objectives of the CDWM Strategy</i>	4
1.3.3 <i>Scope of the CDWM Strategy</i>	4
1.3.4 <i>CDWM Strategic Orientation</i>	5
1.3.5 <i>Strategic Priority Focus Areas</i>	6
SECTION 2: LEGISLATIVE INSTRUMENTS THAT ADDRESS THE CONSTRUCTION AND DEMOLITION SECTOR	8
2.1 INTRODUCTION	8
2.2 INTERNATIONAL AND REGIONAL AGREEMENTS, NATIONAL POLICIES & REGULATIONS, COUNTY POLICIES AND REGULATIONS ..	8
2.2.1 <i>International and Regional Agreements</i>	8
2.2.2 <i>Kenya Constitution 2010</i>	10
2.2.3 <i>National and County Policies on CDW Management</i>	10
2.3 LINKAGE WITH THE KENYA NATIONAL SOLID WASTE MANAGEMENT STRATEGY, 2014.....	14
2.4 LINKAGE WITH THE NATIONAL SUSTAINABLE WASTE MANAGEMENT POLICY, 2020	14
2.5 LINKAGE WITH THE NATIONAL CONSTRUCTION AUTHORITY STRATEGIC PLAN, 2020 - 2025	14
2.6 POLICY GAPS IN CDWM.....	15
SECTION 3: CDWM STRATEGY DEVELOPMENT – THE PROCESS	17
3.1 INTRODUCTION	17

3.2	ASSESSMENT PROCEDURES AND TOOLS.....	17
3.2.1	<i>Initial Stage</i>	17
3.2.2	<i>Second Stage</i>	17
3.2.3	<i>Assessment Tools</i>	18
3.3	TARGET POPULATION AND SAMPLING.....	19
3.3.1	<i>Approach</i>	19
3.3.2	<i>Stakeholder Engagements Targeted Areas, Population and Sampling Plan</i>	19
3.4	CDWM STRATEGY DEVELOPMENT KEY DELIVERABLES.....	21
3.5	RESEARCH ETHICS.....	23
SECTION 4: STAKEHOLDER MAPPING AND ANALYSIS		24
4.1	INTRODUCTION	24
4.2	STAKEHOLDERS MAPPING AND ANALYSIS	24
4.2.1	<i>Upstream Stakeholders – Generators & CDW Control</i>	24
4.2.2	<i>Midstream Stakeholders – Recycling CDW</i>	25
4.2.3	<i>Downstream Stakeholders – Recycled CDW Products Users</i>	25
4.2.4	<i>CDWM Stakeholders Mapping</i>	26
4.2.5	<i>Gap Analysis in the uptake of Recycled CDW Products</i>	30
4.2.6	<i>NCA Mandate at the Up-Middle-Downstream</i>	31
4.3	CONTRIBUTION OF RECYCLED CDW PRODUCTS TO KENYA’S GDP.....	31
SECTION 5: RISK AND ECONOMIC FACTOR ANALYSIS OF CDWM		33
5.1	INTRODUCTION	33
5.2	CDW RISK FACTORS	34
5.2.1	<i>CDW Risk Factor Analysis</i>	36
5.3	CDW ECONOMIC FACTORS	38
5.3.1	<i>Economic Cost Synopsis</i>	38
5.4	PROJECTED IMPACT OF CDW MANAGEMENT PLAN	38
5.4.1	<i>Construction and Demolition Waste Influencers</i>	39
5.4.2	<i>The Value of this CDW Management Plan</i>	39
5.4.3	<i>Global Best Practices in CDWM</i>	40
5.4.4	<i>Promotion of Best CDW Management Practices</i>	49
SECTION 6: CDW MANAGEMENT – SITUATION ANALYSIS.....		51
6.1	OVERVIEW OF THE CONSTRUCTION INDUSTRY IN KENYA.....	51
6.2	GROWTH OF THE CONSTRUCTION INDUSTRY AND THE GENERATION OF C&D WASTES	51
6.3	OUTLOOK OF CDW MANAGEMENT GLOBALLY AND IN KENYA	52
6.3.1	<i>The Global Outlook</i>	52
6.3.2	<i>The National Outlook</i>	53
6.3.3	<i>C&D Waste Management at the Counties</i>	54
6.3.4	<i>C&D Waste Management by Formal Private Firms</i>	55

6.3.5	<i>C&D Waste Management by Informal Private Firms (Waste Pickers & Community Groups)</i>	56
6.3.6	<i>Role of Citizens</i>	57
6.4	TYPES OF CDW STREAMS AND THEIR MANAGEMENT	57
6.5	CURRENT CDWM PRACTICES	59
6.5.1	<i>Planning for C&D Waste Management</i>	59
6.5.2	<i>Deconstruction Instead of Demolition</i>	60
6.5.3	<i>Reusing instead of cutting new materials</i>	60
6.5.4	<i>Recycling what is not Reusable</i>	60
6.5.5	<i>Reducing Packaging</i>	61
6.5.6	<i>Subcontracting C&D Waste Collection, Transportation and Recycling</i>	61
6.6	CHALLENGES IN THE CURRENT CDWM PRACTICES.....	61
6.6.1	<i>Upstream Industry – Sources of CDW</i>	61
6.6.2	<i>Midstream Industry – Recycled CDW Products</i>	63
6.6.3	<i>Downstream Industry - Utilization of Recycled CDW Products</i>	64
6.6.4	<i>Obstacles in Promoting Recycled CDW Products</i>	64
6.7	SWOT ANALYSIS.....	65
SECTION 7: C&D WASTE MANAGEMENT STRATEGIC GOALS, OBJECTIVES, AND TARGETS		67
7.1	INTRODUCTION	67
7.2	STRATEGIC PRIORITY 1: REVIEW AND REVISED CDW MANAGEMENT POLICIES AND REGULATIONS	67
7.2.1	<i>Strategic Objective 1: Strengthen Policies and Regulatory Structures and Systems Involved in C&D Waste Management</i>	67
7.2.2	<i>Strategic Objective 2: Strengthen the Governance and Institutions' Capacity for CDWM Activities at the National and County Levels</i>	69
7.3	STRATEGIC PRIORITY 2: CAPACITY DEVELOPMENT, AWARENESS RAISING AND ADVOCACY.....	70
7.3.1	<i>Mainstreaming Construction Education and C&D Waste Management in Curriculum and Programmes</i>	70
7.3.2	<i>Cadres to be trained</i>	71
7.3.3	<i>Training Needs</i>	71
7.3.4	<i>Proposed Training Contents for C&D Waste Management</i>	72
7.3.5	<i>Follow-up courses</i>	73
7.3.6	<i>Expected Deliverables (Priority 2)</i>	73
7.4	STRATEGIC PRIORITY 3: IMPROVING CDW MANAGEMENT INFRASTRUCTURE	73
7.4.1	<i>Strategic Objective 1: Improving Infrastructure for CDWM System</i>	74
7.4.2	<i>Strategic Objective 2: Standardize Equipment for CDWM at National and County Levels</i>	79
7.4.3	<i>Strategic Objective 3: Increase Access to Emerging CDWM Technologies</i>	81
7.5	STRATEGIC PRIORITY 4: IMPROVING CDWM FUNDING, PARTNERSHIPS AND RESOURCES	81
7.5.1	<i>Expected Deliverables (Strategic Priority 4)</i>	82
7.6	STRATEGIC PRIORITY 5: SUSTAINABLE CDWM THROUGH REGULAR REVIEW, MONITORING, INNOVATION, AND IMPROVEMENT	

7.6.1	<i>Objective and Key Activities</i>	82
7.6.2	<i>Expected Deliverables (Strategic Priority 5)</i>	83
SECTION 8:	C&D WASTE MANAGEMENT IMPLEMENTATION PLAN	84
8.1	INTRODUCTION	84
8.2	IMPLEMENTATION PROGRAMME	84
8.3	IMPLEMENTATION PLAN AND TIMEFRAMES	86
8.3.1	<i>Result Area 1: Review and Revise CDW Management Policies and Regulations</i>	86
8.3.2	<i>Result Area 2: Capacity Development Awareness Raising and Advocacy</i>	87
8.3.3	<i>Result Area 3: Improving CDWM Infrastructure</i>	87
8.3.4	<i>Result Area 4: Improving on CDWM Funding and Resources</i>	89
8.3.5	<i>Result Area 5: Sustainable CDWM through Regular Review, Monitoring, Innovation and improvement</i>	89
SECTION 9:	MONITORING, EVALUATION AND REPORTING	92
9.1	CONTEXT OF MONITORING AND EVALUATION	92
9.1.1	<i>Monitoring</i>	92
9.1.2	<i>Evaluation</i>	92
9.1.3	<i>Context of Monitoring, Evaluation and Reporting</i>	92
SECTION 10:	CONCLUSION	94
	BIBLIOGRAPHY	95
	GLOSSARY OF TERMS	98
	CDWM STRATEGY AND PLAN TERMS OF REFERENCE	100

List of Tables

TABLE 1-1: WASTE CATEGORY AND DESCRIPTION	3
TABLE 2-1: LEGAL GAP RECOMMENDATIONS.....	15
TABLE 3-1: SAMPLE SIZE CATEGORIZATION	20
TABLE 3-2: DELIVERABLES.....	21
TABLE 3-3: CDWM STRATEGY DEVELOPMENT TASKS AND THE EXPECTED MILESTONES	21
TABLE 4-1: SUMMARY CATEGORY OF STAKEHOLDERS.....	26
TABLE 5-1: FACTORS CAUSING WASTES IN CONSTRUCTION & DEMOLITION SECTOR	34
TABLE 7-1: AWARENESS CREATION PLAN FOR C&D WASTE MANAGEMENT:.....	73
TABLE 7-2: FACTORS TO CONSIDER IN CHOICE OF C&D WASTE MANAGEMENT SYSTEM.....	74
TABLE 7-3: C&D WASTE SEGREGATION STANDARD.....	80
TABLE 8-1: C&D WASTE MANAGEMENT IMPLEMENTATION PHASES FRAMEWORK.....	84
TABLE 8-2: C&D WASTE MANAGEMENT IMPLEMENTATION PRIORITY AREA FRAMEWORK.....	85

Abbreviations and Acronyms

3R	Reduce Reuse Recycle
C&D	Construction and Demolition
CDWM	Construction Demolition Waste Management
CDWMO	Construction Demolition Waste Management Officer
CSW	County Solid Waste
FGD	Focus Group Discussion
GoK	Government of Kenya
ICZM	Integrated Coastal Zone Management
IEC	Information, Education and Communication
KABCEC	Kenya Association of Building & Civil Engineering Contractors
KeNHA	Kenya National Highways Authority
KeRRA	Kenya Rural Roads Authority
KFMB	Kenya Federation of Master Builders
KII	Key Informant Interview
KURA	Kenya Urban Roads Authority
KWS	Kenya Wildlife Service
M&E	Monitoring and Evaluation
NCA	National Construction Authority
NDC	Nationally Defined Contribution
NEMA	National Environmental Management Authority
PESTEL	Political, Economic, Social, Technological, Environmental & Legal
POPs	Persistent Organic Pollutants
QMS	Quality Management System
SACCO	Savings and Credit Cooperatives Organization
SDGs	Sustainable Development Goals

SWOT	Strength, Weakness, Opportunity & Threats
TOR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
WEEE	Waste Electrical and Electronic Equipment

Executive Summary

Background

Construction and Demolition Waste generation has been identified as a major issue in rural and urban centers due to its direct impact on the environment as well as the efficient operations of the construction industry. Construction and Demolition Wastes (CDW) as a direct consequence of rapid urbanization is increasing around the world. Aslam, Huang and Cui (2020) review of construction and demolition wastes management in China and USA reveal that the main reason for the inefficiency is due to inadequate understanding of principal factors playing a pivotal role in CDW management and below optimum strategies implemented. To ascertain construction and demolition process quality, Yazdani *et al.* (2021) link construction quality to improving construction and demolition wastes collection service in urban and rural areas through the implementation of an enhanced strategy and plan. This strategy development, therefore, is anchored on the Kenyan National Solid Waste Management Strategy and will act as a guide for planning, implementing, and monitoring C&D waste management activities in the construction industry. This plan is intended to guide the construction industry players at the upstream level (waste generators), midstream (Recycled CDW) and downstream (recycled CDW users).

This strategic plan describes the CDW management on the premise of a desktop review performed on various available secondary data and a correlation with various industry experts and players. Decentralization or devolution of waste management to the counties provides a new and renewed impetus for the construction stakeholders to have a favorable opportunity to address C&D waste management issues from the bottom of the pyramid by addressing the issues at the lowest level of construction and demolition management. This strategic plan recommends a holistic approach to CDW management. These strategies are directed at clear accountability in CDWM, construction site safety programmes, C&D waste avoidance, reduction, reuse, and recycling, segregation of C&D wastes on site, disposal procedures, and documentation of best practices and technology adoption in C&D waste management. This strategic document therefore offers viable options for addressing the challenges in C&D waste management in Kenya.

CDW Management Strategies and Plan

The Kenya Construction and Demolition Waste Management Strategy and Plan have identified the following overarching strategic goals. This strategic plan provides a roadmap of an array of activities to implement at the national level following an outlined strategic action plan. The county governments and other stakeholders in the construction sector are also encouraged to develop their CDW management plan based on this sector strategy and in line with the priority areas that have been identified. The strategic Priority Areas identified are:

Strategic Priority 1:	Review and Revised CDW Management Policies and Regulations
Strategic Priority 2:	Capacity Development, Awareness Raising and Advocacy
Strategic Priority 3:	Improving CDW Management Infrastructure
Strategic Priority 4:	Improving CDW Management Funding and Resources
Strategic Priority 5:	Ensuring Sustainable CDW Management through Regular Review, Monitoring, Innovation, and Improvement.

While focusing on the priority areas, the strategy will also put focus on the areas that include community participation in CDW Management, Construction and Demolition during emergencies, Pollution to the environment and the general human health at the primary C&D waste generation points.

Methodology

The strategy development process applies the two-stage model assessment procedures and tools. The initial stage revolves around literature review, secondary investigations and technical discussions aimed at identifying C&D waste generation mechanisms and the global best practices which fits the construction industry in the Kenyan context (external factors) and the C&D area specific profile (Internal factors).

The second stage on the other hand second stage assesses the performance of CDWM in a broader perspective using a combination of PESTEL, SWOT and the 3R. The stage is characterized by industry-based stakeholder engagements through key informant interviews and townhall discussions to get the reactions and further input to the strategy and its implementation plan.

Conclusion

The strategy proposes concrete measures that are continuous, short-term, and long-term structured to make the change to a circular economy in the CDW. The success of this strategy is dependent on the participation of various stakeholders and the implementation of the measures. While it is important to understand that the proposed measures may instill socio-economic effects, several aspects of the strategy implementation framework would need to be taken into consideration to realize success. The NCA will collaborate with all enablers within the Construction and Demolition value chain and all the stakeholders to realize the implementation of the strategy and its implementation plan.

Section 1: Introduction

1.1 C&D Waste Overview

Construction and Demolition Wastes (CDW) is a priority for many policies at global level due to the high volume of wastes produced and its inadequate management. Aslam, Huang and Cui (2020) while reviewing CDW in China and USA concludes that the high volume of C&D wastes mainly associated with manufacturing processes for new buildings materials has serious effects on the environment. This situation they note, can only be remedied through the concept of circular economy (CE) as it involves the efficient use of resources and energy, which leads to wastes minimization and reduction of the environmental impacts. The construction industry has a strong influence on the three aspects of sustainability: environmental, economic and social. It is a major provider of employment opportunities and a large contributor to gross domestic product (GDP) (Smol et al., 2015). In 2016, the construction sector accounted for 6.2% of world GDP, 6.3% in Europe and 5.7% in Latin America (Eurostat, 2017, FIIC, 2017). However, in addition to its economic and social benefits, the construction sector creates serious environmental problems during the entire lifecycle of buildings, especially during the operation and end-of-life stages. This is mainly due to the generation of construction and demolition waste (CDW) and the manufacturing of building materials (Geng et al., 2017, Ghisellini et al., 2018a).

Because of the negative impacts of CDW on the environment and the high rates of waste produced, the management of CDW has become a priority for sustainable development programs worldwide (Esa et al., 2017). Associated environmental impacts include land degradation, landfill depletion, carbon and greenhouse gas emissions, water pollution, high energy consumption and resource depletion (Akanbi et al., 2018; Ding et al., 2016). Even though there is increasing interest in implementing recovery practices such as reuse and recycling, in most cases the waste management process is inefficient, resulting in large volumes of waste disposed of in landfills or even illegally dumped without environmental protection measures (Esa et al., 2017, Suárez et al., 2016). This situation is evident: only 20–30% of construction and demolition waste is recovered globally (World Economic Forum, 2016). As shown in Fig. 1c, the average recovery rate in the European Union is 46% (European Commission [DG ENV], 2011), although the rate varies from 10 to 90% among Member States, e.g., United Kingdom 89.9%, France 47.5%, Spain 37.9% and Germany 34% (European Commission, 2015a, Eisen, 2015). The average is therefore under the 70% recovery and recycling target by 2020 set in the waste Directive 2008/98/EC.

A recent study by the National Construction Authority (NCA) on **“Construction Waste Management: Towards a Circular Economy model”** found that there is need to improve the quality of recycling and recovery of this waste stream to develop market conditions to increase the demand for secondary raw materials. The study therefore recommended the development of CDWM strategy and its implementation plan to maintain the materials and resources as long as possible in the economy thereby guaranteeing a proper transition towards a circular economy. A circular economy from construction through to demolition

and subsequent reconstruction with materials created from recycled waste is key to leveraging growth in the sector.

1.2 Categorization and Classification of C&D Waste

Construction and Demolition (C&D) Waste includes all wastes generated from construction, renovation, repair and demolition of houses, large building structures, roads, bridges, piers, and dams (NEMA National Solid Waste Strategy, 2015).

The strategy states that construction and demolition wastes comprise of debris, steel, timber, iron sheets, tiles, and ceramics, among others. Further, demolition wastes may include asbestos which is a hazard that can present a health risk when improperly disposed of or reused. Although construction and demolition waste are not classified as hazardous, it is noted as a mixed waste source that requires separation into component parts for the purpose of recycling.

1.2.1 CDW Management Levels

Construction and Demolition waste is managed in Kenya legally and structurally both at the **national** and **county** levels. The **national** level CDWM comprises of institutions with the national mandate to operationalize the available laws on CDWM. These institutions include Government ministries, Agencies, and Departments as well as private and non-profit organizations with a national presence. CDW is generated at the **county** level. The players at this level include the waste generators, the agencies, the regulators, the implementers, the financiers, and others directly involved in the CDWM. More elaborations are done in section 2 on stakeholder management.

1.2.2 Categorization of Wastes in Kenya

The Kenya Sustainable Waste Management Act No. 31 of 2022 defines waste as any substance, material or object that is intended or required to be discarded or disposed of by its holder, whether it can be reused, recycled, or recovered. They include municipal wastes, domestic wastes, wastes from agriculture, construction wastes, commercial wastes, wastes from horticulture, aquaculture and forestry wastes, medical wastes, chemical wastes, hazardous wastes, toxic wastes, industrial wastes, pesticides, e-wastes, and toxic substances but **does not** include radioactive wastes. The Act also defines waste as a substance, material or object that may be designated as waste by the Cabinet Secretary in consultation with NEMA by notice in the Gazette.

On the other hand, the Kenyan Environmental Management and Co-ordination (Waste Management) Regulations, 2006 categorizes wastes as Solid, Industrial, Hazardous, Pesticides and Toxic substances, Biomedical and radioactive wastes in parts I to VII, respectively. It is important to note that this categorization is based on the effect it has on the environment. The CDW will therefore be categorized as per the recommendations of the above regulations with a particular focus pointed to Construction and Demolition area.

The CDW can therefore be described on the synopsis of the above regulations and taking into consideration the Kenyan Sustainable Waste Management Act No. 31 of 2022, the various policies on waste management and international best standards.

Table 1-1: Waste Category and Description

No.	C&D Waste Category	Description	Includes
1.	Solid Wastes	Waste generated during construction, demolition, remodeling and repair of pavements, houses, commercial buildings, roads, and other structures.	Bricks, concretes, asphalt, glass, metals, plastics, timber, papers, and cardboards, excavated rocks and stones, soil, sand and others.
2.	Industrial Wastes	These are wastes produced because of industrial activities which include materials that are rendered useless during the manufacturing process and disposed of on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.	Raw materials in the form of solid materials, toxic raw materials, toxic emissions, and wastes
3.	Hazardous Wastes	These are wastes that have a substantial or potential threat to public health or the environment. Hazardous wastes have properties that make them dangerous or capable of harming human health or the environment.	These are the wastes described on the Fourth Schedule (Regulation 22) of the Environmental Management and Co-ordination (Waste Management) Regulations, 2006.
4.	Pesticides and Toxic Substances	These are unwanted materials in all forms that can cause harm and are usually generated by industries.	The Regulations made under the Pests Control Products Act relating to the classification, registration, labelling, packaging, advertising, importation, exportation, distribution, storage, transportation, handling, and disposal of pesticides shall apply to this Part.
5.	Biomedical Wastes	Also commonly referred to as hospital waste is any kind of waste generated during diagnosis, treatment or immunization of human beings or animals, or in research activities pertaining to the production or testing of biological materials.	These are all the wastes listed and managed as the Kenya's National Healthcare Waste Management Strategy and the Ministry of Health (MOH) Healthcare Waste Management plan.
6.	Radioactive Substances	A type of waste that contains Radioactive materials.	The Provisions of the Regulations made under the Radiation Protection Act in relation to the classification, registrations, labelling, packaging, transportation, importation, exportation, waste disposal and health as well safety requirements about radioactive substances shall apply to this part.
7.	Others	These are wastes of materials, components, and items not yet categorized in use within the construction sector.	

1.3 Context of the Strategy and Implementation Plan- Objectives and Scope

This Construction and Demolition Waste plan and strategy aims at identifying the options for the management of waste arising from Construction and Demolition activities and primarily addressing the current issues within the sector as well as highlighting the possible short-term and long-term measures to be adopted. The objectives of this strategy development are outlined as below:

1.3.1 Purpose of the CDWM Strategy and Implementation Plan

The main aim of this strategy is to develop a National Construction and Demolition Waste Management Strategy. The development should have two major deliverables, which are the National Construction and Demolition Waste Management Strategy and Strategy Implementation Plan for the Construction Sector.

1.3.2 Objectives of the CDWM Strategy

In a bid to improve the circular flow of construction materials and bridge the gap identified, this strategy document develops a National Construction Waste Management Strategy. The strategy intends to achieve the following objectives:

TOR 1:	To identify key stakeholders in the construction sector to be involved in the development of the strategy;
TOR 2:	To consultatively prepare a National Construction and Demolition Waste Management Strategy for the Construction Sector to uphold circular economy principles for socio-environmental sustainability in its different components;
TOR 3:	To develop a Strategy Implementation Plan for the Construction Sector; and
TOR 4:	Conduct a Validation Workshop of the Strategy and Strategy Implementation Plan.

1.3.3 Scope of the CDWM Strategy

The process is mandated by the National Construction Authority with the main purpose of developing a National Construction and Demolition Waste Management Strategy. This document is developed through the application of Result-Based Approach (RBA) to achieve the project objective. The scope of the strategy has been categorized into two, central and extended scope.

1.3.3.1 Central Scope

The central scope of the strategy includes all activities implemented, resources mobilized, outputs produced and the resulting outcome towards developing a National Construction and Demolition Waste Management Strategy.

1.3.3.2 Geographical Scope

The geographical scope of the strategy is Nationwide hence the stakeholders will be drawn from all the regions across the country.

1.3.4 CDWM Strategic Orientation

As Kenya gears towards implementing a circular economy, there will be higher recycling rates which increase the secondary supply, and this should be able to meet the demand. In this context, therefore, NCA shall aim at increasing not only the quantity of secondary raw materials but also their quality, while guaranteeing safety and proper standards for the protection of human health and the environment. The CDWM strategic orientation is leaned to the National Construction Authority Mandate, Vision, Mission, Motto and the Core Values towards achieving the authority's mandate.

NCA Mandate

To regulate the construction industry and coordinate its development.

NCA Vision

An innovative, well-coordinated and prosperous construction industry.

NCA Mission

To regulate, facilitate and build capacity in the construction industry through strategic interventions and partnerships for sustainable socio-economic development.

NCA Motto

Excellence in the construction industry.

NCA Core Values

- **Professionalism** : *To exemplify strong work ethics by demonstrating respect and embracing responsibility in dealing with stakeholders.*
- **Integrity**: *Commitment to accountability and transparency.*
- **Efficiency**: *Result-based approach to operations and resource allocation for enhanced productivity.*
- **Innovation**: *Embracing new technologies and creativity to propel excellence in the construction industry.*
- **Team Spirit**: *Cultivate synergy through cooperation and collaboration between the Board, Management, and employees.*
- **Environmental Stewardship**: *Promoting responsible use and protection of the natural environment through conservation and sustainable practices.*

1.3.5 Strategic Priority Focus Areas

This strategic plan is composed of four (4) interconnected main priority areas (*figure 1*) which are crucial for the successful management of C&D waste.



Figure 1: Strategic Plan Priority Areas

Priority Area 1: Construction, Planning and Design

Targets the construction industry with specific measures aimed at tackling the problem at source by constructing and demolishing in a suitable manner.

Priority Area 2: Waste Management

This section lists the specific measures to improve waste logistics, both at the generation site as well as off-site.

Priority Area 3: Quality Management

This focuses on measures associated with increased confidence in C&D waste management practices as well as improving the quality of C&D re-used and recycled materials.

Priority Area 4: Policy and Regulatory Framework

Dealing with the improvements in policy and framework conditions to break the link between development and waste generation.

Taking measures within each of the priority areas through an ambitious strategic vision, covering the entire construction and demolition sector, can spur growth; create green jobs; enhance innovation as well as improving the overall quality of life through human health and a safe environment.

Section 2: Legislative Instruments that Address the Construction and Demolition Sector

2.1 Introduction

This section outlines the main legal instruments regulating C&D waste as applied at the national and county levels. Other legislations which are also applicable are included and reviewed in perspective to C&D waste management in Kenya.

Kenya has inadequate national laws, policies and regulations relating to the environment and waste management and in particular C&D. The provisions made for Environmental Management and Coordination regulations (Waste Management Regulations), 2006 apply to Construction and Demolition Waste Management (CDWM) but not to specificity. Furthermore, the Sustainable Waste Management Act, 2022 and the National Solid Waste Management Strategy, 2015 give direction to the construction sector to manage waste which is identified as solid waste. Other than the constitution, there are several statutes with general provisions on waste management that encompasses construction and demolition in general, including:

- The Sustainable Waste Management Act, 2022.
- The Public Procurement and Asset Disposal Act, 2015.
- The Public Procurement and Asset Disposal Regulations, 2020.
- Physical Planning Act. Chapter 286. Revised Edition 2012 [2010].
- The Public Health Act, Cap 242.
- The Occupational Safety and Health Act, 2007.
- Environmental Management and Co-ordination Act. Chapter 387. Revised Edition 2012 [1999].
- The Food, Drugs and Chemical Act, Cap 254.
- Relevant Professional Acts.
- Other relevant Acts and International Instruments, which govern the rights of the community, construction workers and the public to ensure a safe and sustainable environment.

2.2 International and Regional Agreements, National Policies & Regulations, County Policies and Regulations

2.2.1 International and Regional Agreements

Kenya is a signatory to several international conventions and agreements on environment and waste management. This includes Kenya being a party to the Rio Declaration on Environment and Development – Agenda 21 for Global Programme of Action on Sustainable Development, 1992. The declaration in chapter 7 provides for sustainable human settlement which includes the provision of basic services such as waste collection and the management of hazardous wastes in chapter 20 and provides for the management of wastes in chapter 21. Kenya is also a party to the Basel Convention on the Control of Trans boundary

Movement of Hazardous Wastes and their Disposal 1992, the Stockholm Convention for Persistent Organic Pollutants (POPs), 1972 and the Minamata Convention on Mercury.

Kenya is therefore actively party to several international and regional conventions that commit the nation to address the sustainable waste management challenge. These agreements focus on waste reduction and sustainable development, the control of hazardous chemicals and electronic wastes, and climate change.

1. **The Bamako Convention:** A treaty amongst African nations that prohibits the importation of any hazardous (including radioactive) waste into Africa. The convention is a response to Article 11 of the Basel convention which encourages parties to enter bilateral, multilateral and regional agreements on Hazardous wastes to help achieve the objectives of the convention.
2. **The Basel Convention:** Ratified in 2000, which addresses the need to control the trans-boundary movement of hazardous wastes and their disposal, setting out the categorization of hazardous waste and the policies between member countries.
3. **The Stockholm Convention:** On Persistent Organic Pollutants (POPs) (ratified in 2004) which seeks to protect human health and the environment from these chemicals that remain intact in the environment for extended periods and have harmful impacts on human health and the environment.
4. **The Rotterdam Convention (ratified in 2005):** This sets out the procedure for Prior Informed Consent in the International Trade of hazardous chemicals and pesticides.
5. **The Montreal Protocol:** This provides for the phase-out of the production and consumption of ozone-depleting substances to reduce their abundance in the atmosphere, and thereby protect the earth's fragile ozone layer.
6. **The Nairobi Convention:** A partnership between governments, civil society, and the private sectors working towards a prosperous Western Indian Ocean Region with healthy rivers, coasts, and oceans.

Kenya has also been a leader in promoting the reduction of Land Based Pollution to the Marine Environment globally and regionally. Kenya adopted the **Sustainable Development Goals of 2015**. Goal 12 requires a strong national framework for sustainable consumption and production that is integrated into national and sectoral plans, sustainable business practices and consumer behavior, together with adherence to international norms on the management of hazardous chemicals and wastes.

Kenya is also an active party to the **United Nations Framework Convention on Climate Change** (UNFCCC) and submitted an ambitious Nationally Determined Contribution (NDC) to the Paris Agreement which includes a commitment to reduce greenhouse gas (GHG) emissions from the waste and industrial sectors.

2.2.2 Kenya Constitution 2010

The Kenyan Constitution prescribes a clean and healthy environment as enshrined in the Bill of Rights, Article 42. It further states that the environment should be protected for the benefit of the present and future generations through legislative and other measures. Chapter 5 (Land and Environment) Article 69 highlights more provisions that are given for the state to protect the environment and it obliges individuals to cooperate with state organs to ensure the sustainable development and use of natural resources. The constitution, therefore, obligates the government to ensure that the right of the Kenyan people towards a free waste environment is protected as enshrined in sections of the constitution (Article 42 and Article 43 (i)).

2.2.3 National and County Policies on CDW Management

2.2.3.1 Sessional Paper No. 6 of 1999 on Environment and Development

The Sessional Paper No. 6 on Environment and Development was published in 1999 by the Kenyan government. The strategy sought to set standards for environmentally sustainable development and to include environmental considerations in national planning and management processes. The policy document outlined issues that needed to be addressed, including the creation of a thorough waste management policy, and set of rules and standards.

2.2.3.2 Sustainable Waste Management Act, 2022

This act advocates for sustainable management of waste and the act in PART III (2) (b) provides for the county governments in consultations with the relevant national government agencies to invest in sustainable waste management including waste collection, separation, treatment, processing, recovery, and sanitary final disposal of waste. Section 12 of the same act advocates for waste segregation into Organic and Non-Organic for all non-hazardous wastes.

2.2.3.3 The Public Procurement and Asset Disposal Act, Revised Edition 2022 [2015]

The PPADA gives effect to Article 227 of the Constitution and provides procedures for efficient public procurement and assets disposal by public entities.

Section 2 of the PPADA defines the public entities and includes a comprehensive list of such entities at both the national and county levels. These are entities established under the constitution and use public money for purposes of procurement and any entity declared to become public entity under the PFMA.

Section 53 of the Act outlines some general rules and principles to be adhered to by every procurement officer in a public entity when conducting a procurement or asset disposal process.

Under Section 165 of the PPADA, a public entity may dispose assets by either of the following methods:

Transfer to another public entity or part of a public entity, with or without financial adjustment.

- Sale by public tender.
- Sale by public auction
- Trade-in; or
- Waste disposal management

Regulation 181 (2) on methods of disposal provides that despite the provisions of Section 165 (1) of the Act, an accounting officer of a procuring entity may use additional methods of disposal as may be gazetted by the Cabinet Secretary from time to time.

2.2.3.4 The KENYA SCRAP METAL ACT CHAPTER 503 Revised Edition 2015 [1972]

THE SCRAP METAL ACT, 2015 is an ACT of Parliament to make provision for the regulation of dealings in scrap metal, to provide for the establishment of a Scrap Metal Council and for connected purposes. Section 14 of the Act restricts the dealing in scrap metal to hours prescribed within the act and at the same time, section 15 gives restriction on disposing or changing shape or form of scrap metal in possession within fifteen days and in case of ferrous scrap metal seven days unless with an express permission from a police officer and not below the rank of an assistant superintendent. The Act also takes into consideration the long-standing Scrap Metal rules of 1959 revised under legal notices 346/1959, 598/1960, 43/1963, 375/1963, and 93/1984.

2.2.3.5 The Public Procurement and Asset Disposal Regulations, 2020

The object and purpose of these Regulations is to operationalize the Public Procurement and Asset Disposal Act, 2015 on the coordination of procurement and disposal procedures by procuring entities. Part III of the regulations provides the responsibilities of the counties with respect to procurement and asset disposal with section 20(c) giving specific responsibility of coordination of procurement and asset disposals at the county.

Part XIV of the regulations provides for disposal of public assets and in section 176 provides the requirement for an annual assets disposal plan with sub-section (3) providing for the disposal plan format which provides for item description, quantity, unit of issue, date of purchase, purchase price, estimated current value, justification for the disposal, lifespan for disposal, lifespan of item for boarding, reference numbers, the envisaged disposal methods and many more.

2.2.3.6 The Environmental Management and Coordination (Waste Management) Regulations, 2006

This is the government's legal instrument dealing with waste management in Kenya and applies to the construction sector and construction and demolition wastes. The act advocates putting in place appropriate interventions to protect human health through standardized waste management and at the same time creates opportunities for employment in the waste management sub-sector.

The Act provides for the establishment of appropriate legal and institutional frameworks for the management of the environment. The Regulations state that any person whose activities generate waste shall collect, segregate, and dispose or cause to be disposed of such waste in the manner provided for under these regulations. It further outlines the segregation of waste - any person whose activities generate waste shall segregate such waste by separating hazardous waste from non-hazardous waste and shall dispose of such waste in facilities as provided for by the relevant local authority.

2.2.3.7 Environmental (Impact Assessment and Audit) Regulations, 2003

This regulation defines waste as any matter whether liquid, solid, gaseous, or radioactive, which is discharged, emitted, or deposited in the environment in such volume composition or manner likely to cause an alteration of the environment.

Part II of the regulation under Project Report 7 states that (1) a proponent shall prepare a project report stating – (e) The materials to be used, products and by-products, including waste to be generated by the project and the methods of their disposal. (f) The products, by-products, and waste generated project.

Part IV of the regulation under the Environmental Impact Assessment Study Report 18 states that (1) a proponent shall submit to the NEMA, the environmental contents of the impact assessment study report incorporating but not limited to the environmental following information - (f) the products, by-products, and waste generated project.

Part V of the regulation under the Environmental Audit and Monitoring, 36 states that (2) an environmental audit report compiled under these Regulations shall contain - (b) an indication of the various materials, including non-manufactured materials, the final products and by-products and waste generated.

2.2.3.8 Draft National Building Regulations (National Building Code) 2020

This draft regulation seeks to prevent construction projects from collapsing by ensuring that the project owner and/or sponsor engage(s) a contractor with technical capabilities to deliver the project. The draft requires all construction works, contracts or projects either in the public or private sector to be registered by NCA. Further, the new code proposes a provision for construction risk management (part 23) in the built environment to prevent disasters. The law also seeks to bridge the gap of non-existence of a law requiring buildings to undergo mandatory inspections by qualified professionals. The draft regulation in its Part 22 outlines the requirements for demolition of buildings and gives specification for: safeguarding of basements; damage to road; duties prior to commencement of demolitions; provision of shoring; electric cable not to remain charged; preventing danger from fire explosion; chute for removal of a material; supervision of demolition works; no floor or any other component to be overloaded; precautions to be taken in relation to cutting of steelwork; and precautions to be taken in removing framing.

2.2.3.9 Draft Construction Industry Policy 2018

This policy takes deliberate steps towards addressing the gaps in the construction and demolition sector by developing a Construction Industry Policy to address the needs of the industry and contribute to sustainable socio-economic development. The policy focuses on creating enabling environment for the growth and development of the industry; promoting the development of human resource capacity improving quality management; promoting research, innovation and development; enhancing coordination for better management of the industry; promoting access and use of data and information in decision making; improving ease of doing business; reducing challenges related to land management and physical planning; promoting environmental integrity and conserve heritage in the industry; protecting workers and the general public from any risk associated with construction and boost risk and disaster management strategies; mainstreaming cross cutting and emerging issues; and strengthening institutions, resource mobilization, and implementation of plans and coordination within the industry.

2.2.3.10 Selected Counties Waste Management Policies

Some counties in Kenya have elaborate waste management policies and these will also form points of consideration during the structuring of the Construction and Demolition Waste Management Strategy.

2.2.3.10.1 Nakuru County Waste Management Policy

The policy lists Construction and Demolition Wastes as one of the waste streams identified within the county and adopts policy measures geared towards ensuring the Construction and Demolition wastes are transported to specific areas approved by the county department responsible for waste management as per the set standards. The policy provides the guiding framework for Waste Management in Nakuru County. The policy guides the county waste management actors in providing effective, efficient, and sustainable services while utilizing waste as an economic resource.

2.2.3.10.2 Integrated Coastal Zone Management (ICZM) Policy

The Integrated Coastal Zone Management (ICZM) Policy, Sessional Paper No. 14 of 2014, includes procedures for waste management and pollution prevention. The policy aims to strengthen county governments' ability to enforce laws governing the management of municipal waste, promote public-private partnerships in waste management and empower county governments to manage urban waste effectively. It also seeks to enforce the Environmental Management and Coordination (Waste Management) Regulations, 2006.

2.2.3.11 Other Applicable Regulations

- The Radiation Protection Act, Cap 243, provides directions on radioactive waste management.

- The National Construction Authority Act No. 41 of 2011. Revised Edition 2012 [2011] which regulates the licensing of private construction companies and individuals in the industry and recognizes the players as the primary generators of C&D wastes.
- The Kenya National E-waste Management Strategy which is a five-year plan covering the period 2019/20 to 2023/24 focusing on resource mobilization for proper E-waste management, resource mobilization, strengthening Kenya's E-wastes coordination structures at national and county levels, putting in place a monitoring and evaluation mechanism for E-waste management, promoting research and innovation in E-waste management and, having a legal and regulatory framework for E-waste management in Kenya.

2.3 Linkage with the Kenya National Solid Waste Management Strategy, 2014

The NSWM Strategy was developed by NEMA to guide the sustainable management of solid waste in the country. The NSWM Strategy builds on on-going waste management efforts, which have been set by NEMA for counties to implement. The minimum requirements include designation, securing and manning of the disposal sites and promotion of efficient collection and transportation of waste. It aims to ensure a clean and healthy environment for all.

The NSWM Strategy is anchored on various laws and regulations that govern the environment and natural resources such as Environmental Management and Coordination Act, 1999, The Constitution of Kenya 2010, Environmental Management and Coordination (waste management) Regulations, 2006, and Occupational Safety and Health Act, 2007, among others. The Construction and Demolition Waste Management strategy will therefore be anchored on the National Solid Waste Management Strategy with a specific focus on the waste generated in the construction sector during the construction and demolition processes.

2.4 Linkage with the National Sustainable Waste Management Policy, 2020

The policy provides for a governance framework for sustainable waste management. The policy also recognizes the inefficient production processes, low durability of goods and unsustainable consumption that leads to high production of waste. To address these challenges, the policy provides for the development of an integrated national waste management strategy, the promotion of use of economic incentives to manage waste and the promotion of facilities and incentives for cleaner production waste recovery, recycling, and reuse.

2.5 Linkage with the National Construction Authority Strategic Plan, 2020 - 2025

Proper management of wastes in the construction sector will play an important role in working towards the authority's strategic key result focus area number 3 aimed at ensuring safety in all construction works including but not limited to buildings, dams, roads, electricals, mechanicals, bridges, and many others. This document also intends to build into the listed focus areas of the strategic plan which includes ensuring an appropriate regulatory environment; promotion of quality assurance in the construction industry with a

focus on mitigating the collapse of buildings; developing and promoting construction standards and best practice guides; and developing and implementing standardization framework on construction techniques and materials.

By providing the way forward to managing construction and demolition wastes, the authority will also be achieving its core mandate of *Regulating the Construction Industry and Coordinating its Development*. This will be achieved if the strategic plan comes up with strategies to ensure sustainable construction and demolition waste management through strengthening investments in waste handling requirements.

2.6 Policy Gaps in CDWM

Even though there are several legislations on solid waste management of which Construction and Demolition Waste is part, it is evident that there are several gaps that exist between the laws and their implementations.

The Environmental Management and Coordination Act (EMCA) 2012 [1999] is noted as a more generic framework that was designed to facilitate a coordinated response to environmental management. Though it had the potential to integrate C&D sector specific provisions, it was not aimed to supersede them but to reinforce them to a better management model of the environment. Therefore, there is a clear overlap between EMCA 2012 [1999] and the C&D sector specific policies, with no indication of policy hierarchy.

In line with the Constitution of Kenya 2010, the National Environmental Policy outlines the responsibilities of the government – what the government must do to protect the environment. The National Solid Waste Management Policy is aimed at establishing a platform for action between stakeholders to systematically improve solid waste management. The integration between Environment Policy and the Solid Waste Management Strategy is a vertical one – policy outlining the core issues and the strategy formulated in it to courses of action. Though the National Solid Waste Management Strategy is a national perspective, it is more linked to repeal EMCA and its regulations than to the National Environmental Policy and more general on Construction and Demolition Wastes.

Table 2-1: Legal Gap Recommendations

No.	Framework	Gap Recommendation
1.	The Sustainable Waste Management Act, 2022.	Collaborate with other agencies to review the Solid Waste Management Act 2022 that give specific provision on CDWM in a circular model consideration.
2.	National Solid Waste Management Strategy, 2014 National Sustainable Waste Management Policy, 2020	Collaborate with NEMA and other agencies to consider in future the consideration of CDW as a component of solid wastes with specific management procedures in its National Solid Waste Management Policy reviews.
3.	The Public Procurement and Asset Disposal Act, 2015 The Public Procurement and Asset Disposal Regulations, 2020	In collaboration with the office of PPOA, review of the disposal methods described in PPADA Act 2022 reflect a circular model in CDW Management.

4.	The KENYA SCRAP METAL ACT CHAPTER 503 Revised Edition 2015 [1972]	In collaboration with other Agencies, review of the Scrap Metal Act 2015 considers the disposal methods for major metals in the construction industry.
5.	The County Government Act No. 17 of 2012 Revised. 2013 The County Government (General) Regulations, 2020.	In collaboration with the Council of Governors ,review of county governments' engagements mandate counties to consider embracing emerging policies in CDWM from NCA in the construction sector.

Section 3: CDWM Strategy development – The Process

3.1 Introduction

Key steps have been taken in preparing this CDWM draft strategy and the implementation plan which involved a team from NCA and the consultants to structure the roadmap for its development. The draft process revolved around secondary data for the basis of its literature review and technical discussions that clarified the current state of waste management systems in Kenya and the major gaps that needed to be addressed.

3.2 Assessment Procedures and Tools

3.2.1 Initial Stage

The initial stage of the strategy process revolved around a literature review, secondary investigations, and technical discussions aimed at identifying the waste generation mechanisms and the global best practices which fit the dynamics of the construction industry in the Kenyan context (external factors) and the C&D area-specific profile (internal factors).

3.2.2 Second Stage

After the initial stage was completed, and to assess the Construction and Demolition Waste Management performance from a broader perspective including the drivers and the barriers, a comprehensive CDW model was developed using a combination of PESTEL, SWOT and 3R. A PESTEL analysis was employed for the external analysis and industry-based assessment, whereas the SWOT and 3R approaches were used for the operational level assessments (CDW Generators). This stage is characterized by industry-broader stakeholder engagements through key informant interviews and town hall discussions to elucidate reactions and further input to the proposed strategy and implementation plan. The methodology is represented in the figure below:

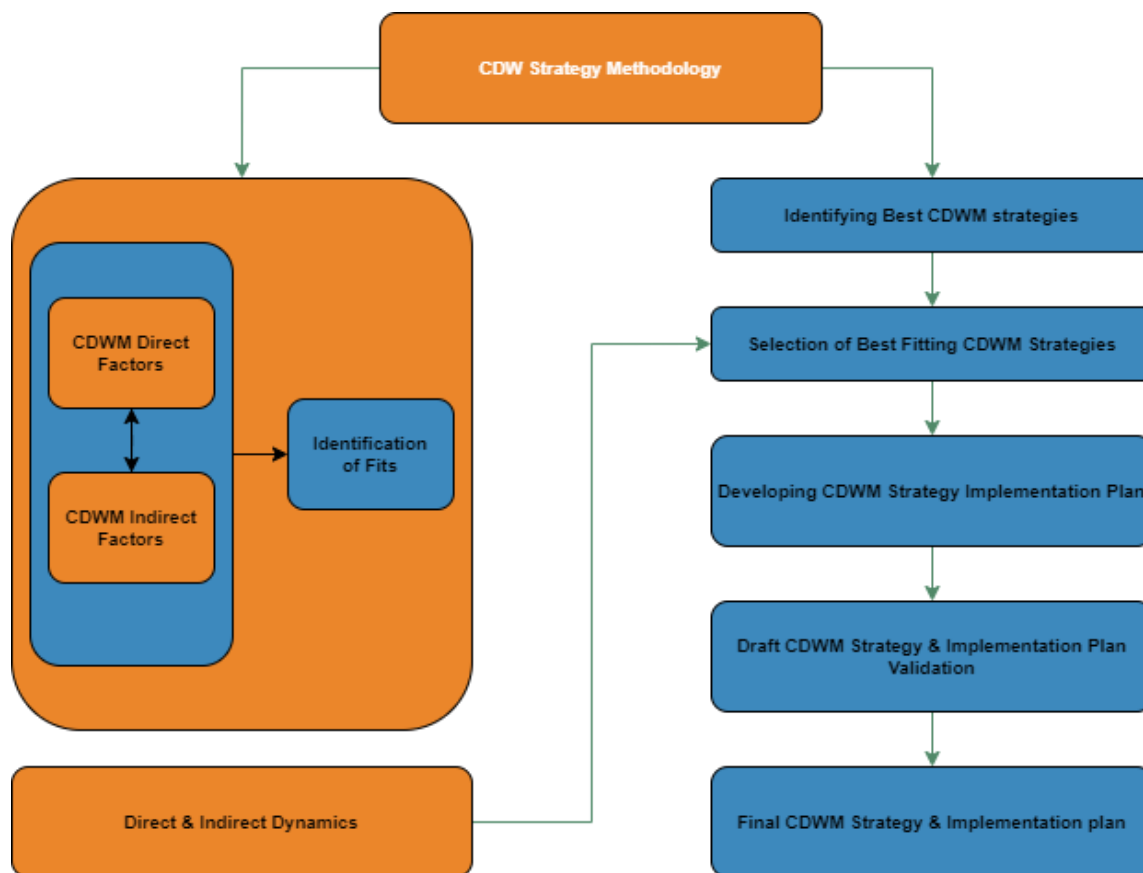


Figure 2: CDW Management Strategy Methodology

3.2.3 Assessment Tools

The development of the CDWM strategy and implementation plan applies various tools targeting stakeholder engagement. The following tools are considered for stakeholder engagement in beefing the CDWM strategy and implementation plan.

3.2.3.1 Focus Group Discussion

The FGD provides a framework for moderation and asking questions to a group of key stakeholders using a guided discussion. This tool is mainly focused on collecting qualitative data in an in-depth interview whose meetings' characteristics are defined by research type, size, composition and interview procedures (Mishra, 2016). For the Focus Group Discussions (FGDs), the assignment will apply semi-structured interview guides and each FGD will have at least 12 to 14 people. (Table 2: Sample Size Categorization). Following Mishra (2016) model, the process involves formatting research questions, developing protocols, soliciting participants, arranging venues, facilitating focus groups, transcribing, analyzing data, and reporting the findings.

The focus during interviews and FGDs with stakeholders will be on:

- if stakeholders and the key generators of CDW are aware of CDW Management strategies and practices.
- if they believe in the 3-R i.e., Recycle, Reuse, and Reduce.
- the most effective and efficient way to reduce, reuse, and recycle CDW.
- if the stakeholders believe they are informed well on CDW management.
- the main reasons not to apply CDW Management.

3.2.3.2 Key Informant Interview

These are qualitative interviews with stakeholders in the construction industry with knowledge on construction and demolition processes (Kumar Mishra & Aithal, 2021) with the main purpose of collecting information from industry experts and knowledge individual who have first-hand information about construction and demolition. The development of the CDWM strategy and implementation plan relies on semi-structured interviews with key informants in the construction industry. Shakya, Bajracharya and Mishra (2020) recommend several (4-6) key informant interviews to obtain sufficient and valid representation of the construction industry (*Table 2: Sample Size Categorization*).

3.2.3.3 Observation Research Tool

An observation research tool collects data through an observer watching interactions in the construction industry in a controlled and an uncontrolled environment, Cushion *et al.* (2012). The observation is conducted through a structured process and a participatory approach. Even though unstructured observations have been used in many research settings, these are unfavored for this research as the development of CDWM strategy and implementation plan requires both practical and theoretical observation approaches. The numbers of observations are listed in table below (*Table 2: Sample Size Categorization*).

3.3 Target Population and Sampling

3.3.1 Approach

The development of the CDWM Strategy and Implementation Plan targets four main elements: tasks; people; formal and informal organizations in the construction industry. The strategy applies both quantitative and qualitative approaches that will involve intensive interviews with a small number of respondents in the second stage as listed above.

3.3.2 Stakeholder Engagements Targeted Areas, Population and Sampling Plan

The CDWM strategy development targets all the stakeholders in the construction industry and particularly those involved in the generation, regulation, and management of Construction and Demolition Wastes in

Kenya. The development applies purposive sampling of information-rich respondents to collect both qualitative and quantitative data. Interview tools with standardized open-ended questions will be used for Key Informant Interviews.

The assignment's sample size for qualitative data will be the minimum sample that is generally accepted as a standard that allows in-depth exploration of Construction and Demolition Waste issues and strategies to saturation level (i.e., when data is collected from additional respondents no longer yields any new information). The sample may be increased if saturation is not reached with the minimum sample.

The most important contributors to waste minimization are Reduce, Reuse, and Recycle which are also known as the 3R strategy. 3R strategy will serve as a general guideline for this assignment as it is the most common in many countries and results in a significant decrease in CDW and especially in high recycling rates. Taking into consideration that the assignment will cover all regions across Kenya, the consultants and the assignment team will also use an observation guide to assess various construction projects to support the data collected qualitatively and quantitatively. The stakeholder engagements to validate and further draw input and reaction to the proposed strategy will be done in the following representative regions across the country.

Table 3-1: Sample Size Categorization

Cluster	Workshop Region	Counties Covered	FGD	KII	Observation
6.	Nairobi Metropolitan	Nairobi, Kiambu, Machakos and Kajiado	01	8	10
7.	Mount Kenya Regions	Nyeri, Nyandarua, Muranga, Kirinyaga and Laikipia	01	6	8
8.	Eastern Region	Meru, Embu, Isiolo, Kitui, Makueni, Marsabit, Samburu and Tharaka Nithi	01	10	8
9.	Western Kenya Region	Kakamega, Busia, Bungoma, Vihiga Homabay, Migori, Kisumu, Siaya, Kisii and Nyamira.	01	12	12
10.	North Rift Region	Uasin Gishu, Trans-Nzoia, Elgeyo Marakwet, Baringo, West Pokot, Nandi, and Turkana	n	10	10
11.	South Rift Region	Nakuru, Narok, Kericho and Bomet	01	5	8
12.	Coastal and Northern Kenya Regions	Mombasa, Kilifi, Kwale, Taita Taveta, Tana River, Lamu, Garissa, Wajir and Mandera.	01	10	12
TOTAL			7	61	68

3.4 CDWM Strategy Development Key Deliverables

The CDWM Strategy development follows specific processes that yield various milestones towards achieving the deliverables. The deliverables of the assignment are defined by the terms of reference.

Table 3-2: Deliverables

No.	Terms of Reference	Deliverables
1.	Identify key stakeholders in the construction sector to be involved in the development of the strategy.	1.1 A List of Key Stakeholders in the Construction Sector involved in the development of strategy.
2.	Consultatively prepare a National Construction and Demolition Waste Management Strategy for the Construction Sector to uphold circular economy principles for socio-environmental sustainability in its different components.	2.1 National Construction and Demolition Waste Management Strategy Document.
3.	Develop a Strategy Implementation Plan for the Construction Sector.	3.1 A Strategy Implementation Plan for the Construction Sector.
4.	Conduct a Validation Workshop of the Strategy and Strategy Implementation Plan.	4.1 Validation Workshop Input Report for the Strategy and Strategy Implementation Plan.

Table 3-3: CDWM Strategy Development Tasks and the Expected Milestones

No.	Tasks	Milestones
1.	<p>Inception Meeting</p> <ul style="list-style-type: none"> • Introductory meeting with NCA to discuss and interpret terms of reference. • Tools development workshop to: <ul style="list-style-type: none"> ❖ Discuss detailed work plan. ❖ Discuss and develop the methodology to be used, data collection and stakeholder engagement tools. ❖ Agree on documents to be shared and responsibilities thereof. 	<p>Initial Inception Report</p> <ul style="list-style-type: none"> • Agreement on the scope of work. • Established communication mechanisms between GPP and NCA team. • A revised agreed work plan. • Signed non-disclosure agreement. • Data collection and stakeholder engagements tools. • Inventory of documents for literature review.
2.	<p>Inception Report</p> <ul style="list-style-type: none"> • Development of an Inception Report with assignment protocols and a detailed work plan. 	<p>Final Inception Report</p> <ul style="list-style-type: none"> • Finalized study protocols. • Detailed work plan with clear points of action.
3.	<p>Literature Review & Scan for Relevant data on CDW Management</p> <ul style="list-style-type: none"> • Reviewing of relevant documents to CDW Management. • Reviewing operations of CDW Management in countries that have implemented a circular-based CDW management e.g., China, Japan, South Korea, and South Africa. 	<p>Enriched Data for Strategy Analysis</p> <ul style="list-style-type: none"> • Summary of the literature reviewed. • List of circular-based CDW management approaches considered.
4.	<p>Stakeholders Analysis</p> <ul style="list-style-type: none"> • Identifying the relevant players formally and informally. • Assessing the levels of influence on CDW management. 	<p>Detailed Stakeholders Interest Cap</p> <ul style="list-style-type: none"> • Detailed list of stakeholders' interests.

No.	Tasks	Milestones
5.	Draft CDW Management Strategy and Implementation Plan <ul style="list-style-type: none"> • Compiling the strategy with the output from the stakeholder analysis report and relevant literature reviews and scans. • Sharing draft strategy and plan with NCA. • Organization for validation workshops. 	Submitted Draft CDW Management Strategy and Implementation Plan <ul style="list-style-type: none"> • Draft CDW Management strategy submitted. • Draft CDW Management strategy implementation plan submitted. • Validation workshops schedule.
6.	Sensitization/Awareness Campaign <ul style="list-style-type: none"> • Identify key stakeholders. • Bringing integral stakeholders on board. • Sensitizing stakeholders on the assignment. • Communication with key players on the role of the consultants and the consultancy. • Organizing the stakeholders' validation workshops. 	Stakeholders Brought on Board <ul style="list-style-type: none"> • Stakeholders register (list of stakeholders). • Awareness created among key stakeholders. • Circular from NCA publicizing the assignment to the regional offices. • Letter from NCA introducing the consultants and the consultancy. • Stakeholders' workshop schedule.
7.	Pretesting & Revision of Assessment Tools <ul style="list-style-type: none"> • Assessing & evaluating questions and observation areas. • Revising questions & observation areas. 	Final Data Collection Tools <ul style="list-style-type: none"> • Final FGD guide. • Final KII guide. • Final observation guide.
8.	Stakeholder Validation workshops <ul style="list-style-type: none"> • Conducting 7 Workshops Across the country. • Collecting data through FGDs. • Conducting KIIs through one-to-one, online and telephone. • Mining data from documents and reports. • Visits various sites for observations. 	Stakeholder Validation Activities Completed <ul style="list-style-type: none"> • Completed FGDs expanded notes. • Completed KIIs expanded notes. • Completed observation notes.
9.	Quality Control <ul style="list-style-type: none"> • Team leader guide to ensure the accuracy of data collected. • Team leader conducts Daily Review Meeting. 	Quality Control Standard <ul style="list-style-type: none"> • Issues addressed during Review Meeting. • Daily Review Meeting Report.
10.	Data Analysis <ul style="list-style-type: none"> • Quantitative data entered in Excel/SPSS. • Data analysis processes implemented. • Qualitative data transcribed and analyzed using NVivo. 	Analyzed Data <ul style="list-style-type: none"> • Analyzed quantitative and qualitative data. • Strategies identified.
11.	Revised Draft CDW Management Strategy and Implementation Plan <ul style="list-style-type: none"> • Compiling strategy with the analysis report. • Sharing draft strategy and plan with NCA. 	Submitted Revised Draft CDW Management Strategy and Implementation Plan <ul style="list-style-type: none"> • Draft CDW Management strategy submitted. • Draft CDW Management strategy implementation plan submitted.
12.	Validation meeting with client <ul style="list-style-type: none"> • Draft report discussed and validated with the client technical team. • Comments taken and incorporated. • Organizing the national stakeholder validation workshop. 	Completed Client Validation meeting. <ul style="list-style-type: none"> • Minutes of the validation meeting shared. • Revised Draft CDW Management Strategy & Implementation Plan. • National stakeholder validation workshop date set.
13.	National Stakeholder Validation Workshop <ul style="list-style-type: none"> • Discussions and inputs on the CDW Management strategy and implementation plan 	Completed National Stakeholder Validation Workshop <ul style="list-style-type: none"> • Minutes of validation workshop. • Way forward from the validation workshop.
14.	Final CDW Management Strategy & Implementation Plan	Final CDW Management Strategy & Implementation Plan

No.	Tasks	Milestones
	<ul style="list-style-type: none"> Incorporating validation workshop inputs. Submission of final strategy and implementation plan. 	<ul style="list-style-type: none"> Final submitted strategy and implementation plan.

3.5 Research Ethics

The data collected during the stakeholder engagement sessions on draft report will be kept confidential and only accessed by the consultants. No names of informants or organizations will be used anywhere in our reports without the consent or prior approval of the respondents.

The control measures include among others:

- Proper and thorough training of all field staff, including follow-ups to ensure individuals are confident. This shall include up to data submission to the server.
- Role plays to ascertain the individuals and collective understanding of the tools, the processes and confidence in undertaking their roles.
- The data submitted daily will be studied and for each enumerator, comments on how to improve shared before they embark on a new day's work.
- Field monitoring and support to the enumerators, based on needs as assessed during training and pretests.
- The data collected (database) will be cleaned before analysis.

Section 4: Stakeholder Mapping and Analysis

4.1 Introduction

The stakeholders relevant to the CDW Management include national government bodies, local governments, developers, construction companies, construction waste disposal companies, transportation companies, Non-Governmental Organizations in the construction industry and the public. This strategy looks at reports, surveys and analysis covering the aspects of CDW recycling awareness, CDW recycling promotion, CDW recycled products applications, CDW recycling issues and suggestions to promote CDW recycle, reuse and reduce.

4.2 Stakeholders Mapping and Analysis

The CDWM strategy identifies the key stakeholders relating to Construction and Demolition Waste Management. The process involves identifying all individuals and organizations that have an interest and /or impact on the management of Construction and Demolition Waste.

The stakeholders relevant to CDW management include the national government, county governments, developers, construction companies, construction waste disposal companies, transportation companies, research institutions in the construction industry, the media, and the public. The development of the CDWM strategy and plan will include surveys and analysis covering the aspects of CDW recycling awareness, CDW recycling promotion, CDW recycled products applications, issues in recycling and suggestions to promote CDW recycling.

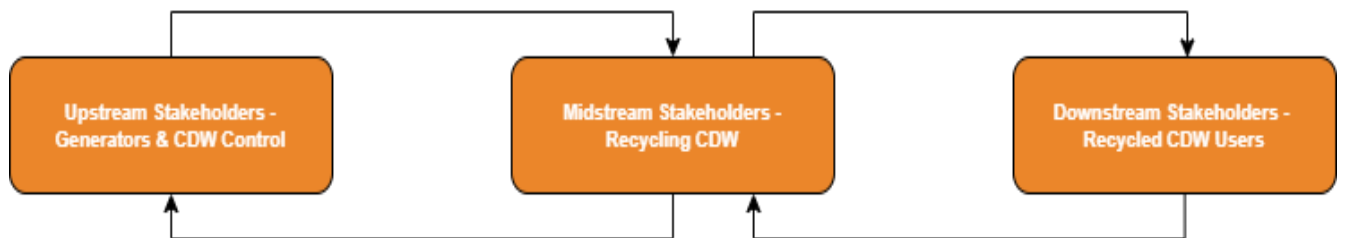


Figure 3: CDW Cycle Stream

4.2.1 Upstream Stakeholders – Generators & CDW Control

These are stakeholders involved at the point of Construction and Demolition Wastes generation and management. They are therefore the sources of CDW and at this point, the public complaints are minor, the environmental and resource conservation awareness may be weak and impacts on public safety may not be considered.

The construction project owner, construction unit, design body and government approval agencies are involved in source generation. At the core of the upstream stakeholders are the requirements for the policy

implementers, the designers, the developers and the construction project administrators and management to minimize waste during the construction process and to provide effective measures to control the same during demolitions. The existing regulations do not provide provisions that are explicitly on CDW management. The existing regulations also do not have any quantitative target on CDW generation, recycling and disposal, standards, and requirements on CDW pollution control hence giving challenges in the actual management of CDW.

The owner of the construction project is the major player during construction and demolition. At the source generation stage, the project owner is at the center. The major concerns of the designers are how to incorporate their ideas into the construction project while meeting the required standards. On the other hand, the construction unit is concerned about how to complete the construction at the fastest rate and with the least resources and cost inputs. The government through the regulatory agencies expects less CDW generation.

4.2.2 Midstream Stakeholders – Recycling CDW

These are stakeholders involved in the recycling of CDW and generally belong to the construction and processing enterprises. The Environmental Management and Coordination Act, 1999 requires every project to undergo Environmental Impact Assessment (EIA) and include an Environmental Management Plan (EMP). However, there is no specific requirement that the EMP must include a section on CDW recycling, reuse, and reduction.

The recycling CDW midstream stakeholder plays a key role as the link between the upstream and downstream without which there would be a heavy presence of CDW. These stakeholders include CDW collectors; transporters; recycling stations; regulating authorities; and others.

At present, looking at the primary data available, the CDW recycling, reuse and reduction industry is still at its primary stage. This is noted majorly due to the diversity and complexity of raw materials of CDW, the underdevelopment and high cost of relative disposal technologies and equipment, as well as the high cost in the environment of investment. The industrialization of CDW recycling requires the involvement of relevant government agencies, demolition units, transport units, and construction units for the development of CDW recycling.

4.2.3 Downstream Stakeholders – Recycled CDW Products Users

These are the stakeholders involved in channeling the recycled CDW products to the final users and the laws, policies, and regulations should require infrastructural investments to incorporate engineering aspects that ensure the recycled CDWM products reach the final users. The stakeholders involved in screening, crushing and other relative treatment processes for the final recycled CDWM products should be taken into consideration to increase the delivery along the CDWM value chain. Currently, the stakeholders featured prominently in CDWM are those involved in recycled aggregates and recycled bricks. This CDWM is

undertaken by the stakeholders but does not follow any standard which eventually leads to future engineering difficulties.

This level of the chain also constitutes the marketers of recycled CDWM products who currently as per the secondary data are informal. The promotion of recycled CDWM products is also dependent on the subsidies made available to the marketers of these recycled products.

Table 4-1: Summary Category of Stakeholders

No.	Stakeholder Category	Stakeholders
1.	Upstream (Generators & CDW Control)	<ul style="list-style-type: none"> • The developers • Contractors • The Regulators • Agencies • National Government • County Governments
2.	Middle (Recycling CDW)	<ul style="list-style-type: none"> • Waste Transporters • CDW Recycling Advocacy Companies • The CDW Recyclers • Research Institutions • The Regulators • National Government • County Governments
3.	Downstream (Recycled CDWM Products Users)	<ul style="list-style-type: none"> • Recycled CDW Product Marketers • Waste Collectors • The Media • The Public • National Government • County Governments • Environmental Activists

4.2.4 CDWM Stakeholders Mapping

The framework below was used to define stakeholders as categorized along the value chain. The colors signify every stakeholder in their influence levels.

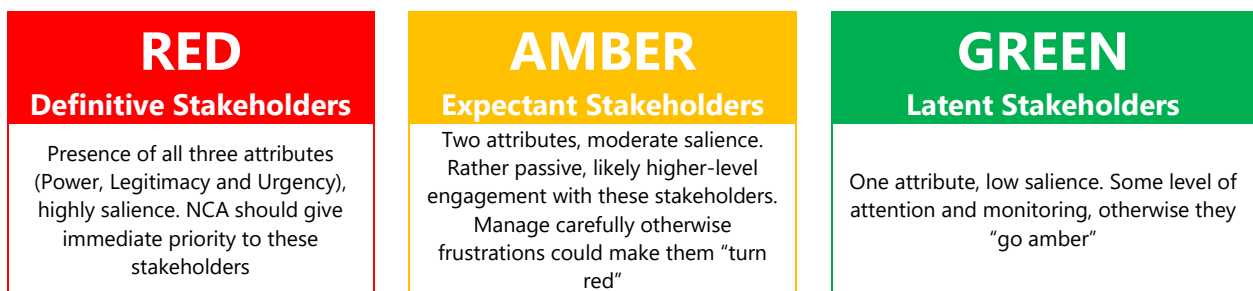


Figure 4: CDWM Stakeholder Mapping Framework

Table 4-2: CDWM Stakeholders Map

Stakeholder	Benefit to NCA	Benefit from NCA	Class	Stakeholder Management Strategy
NCA Board Members	<ul style="list-style-type: none"> Oversight and Strategic Direction 	<ul style="list-style-type: none"> Allowances Leadership Opportunities 	RED	<ul style="list-style-type: none"> Provide relevant and timely CDWM information. Provide a working environment and tools. Timely implementation of board resolutions. CDWM training.
NCA Employees	<ul style="list-style-type: none"> Execute Core Functions & Mandate 	<ul style="list-style-type: none"> Remuneration Training & Development Productive Workforce Enabling Work Environment 	RED	<ul style="list-style-type: none"> Well remunerated. Conducive & enabling environment. Training in CDWM. Job security. Opportunity for career growth.
National Government Treasury	<ul style="list-style-type: none"> Funding and Financing Construction Industry Policy 	<ul style="list-style-type: none"> Stability of Construction Sector 	RED	<ul style="list-style-type: none"> Well budgeted CDWM policies. Utilizing CDWM funds well. Compliance. Lobbying. Assurance of construction industry services programmes.
Ministry of Roads and Transport and apex agencies (KENHA, KURA, KERRA) Ministry Lands, Public Works, Housing and Urban Development	<ul style="list-style-type: none"> Policy Direction and Implementation Support Capital Grants 	<ul style="list-style-type: none"> Growth and Development of the Construction Sector 	RED	<ul style="list-style-type: none"> Budget well. Utilize funds well. Compliance. Lobbying. Assurance of construction sector stability. Implementation of construction industry programmes.
National Parliament	<ul style="list-style-type: none"> Favorable CDWM Legislation 	<ul style="list-style-type: none"> CDWM Inclusion and Access to Circular Model in CDWM 	RED	<ul style="list-style-type: none"> Lobbying Compliance Submit information on CDWM and policy issues.
County Governments	<ul style="list-style-type: none"> Collaboration in Monitoring CDW Consistency in Policy and Legislative Framework for CDWM Support in Implementing 	<ul style="list-style-type: none"> Construction Sector Stability for the Citizens and the Counties 	RED	<ul style="list-style-type: none"> Cooperation on intergovernmental matters. Sharing construction industry information. Spreading of CDWM services to the counties. Capacity Development and technical Support. Advise.

Stakeholder	Benefit to NCA	Benefit from NCA	Class	Stakeholder Management Strategy
	the authority mandate			
Developers Contractors Construction Workers CDW Recyclers C&D Waste Collectors	<ul style="list-style-type: none"> • CDWM Levies • Enhanced CDWM Compliance and Cooperation 	<ul style="list-style-type: none"> • Improved CDWM Management • Public Confidence • Construction Industry Development • Enabling Environment for Construction Sector Growth 	RED	<ul style="list-style-type: none"> • Enhanced collaborative CDWM regulations and compliance to ensure industry stability. • Accountability in CDWM • Thorough implementation of CDWM construction industry programmes.
The Media	<ul style="list-style-type: none"> • Publicity • Collaboration • Market Intelligence 	<ul style="list-style-type: none"> • News Content • Revenue through Adverts • Timely and Adequate Information 	AMBER	<ul style="list-style-type: none"> • Provide relevant and timely CDWM information. • Monitor and manage CDWM published information and respond to it appropriately. • CDWM collaborations.
CDW Recycling Advocacy Companies Bloggers and Social Media CDW Product Marketers	<ul style="list-style-type: none"> • Publicity • Market Intelligence 	<ul style="list-style-type: none"> • News/Advocacy Contents • Revenues through Adverts 	AMBER	<ul style="list-style-type: none"> • Provide relevant and timely CDWM information. • Monitor and manage CDWM published information and respond to it appropriately. • CDWM collaborations.
National Construction Associations (KABCEC, BORAQS, KFMB, ACMK)	<ul style="list-style-type: none"> • Critical Partnerships • Industry Good Will and Lobbying • Constructive Engagement in Development and Implementation of CDWM policy. • Construction Industry Capacity Development 	<ul style="list-style-type: none"> • Construction Industry Development 	GREEN	<ul style="list-style-type: none"> • Assurance of construction industry stability. • Thorough implementation of CDWM programmes in the construction sector. • Collaboration in dealing with industry, legal and other matters. • Joint industry lobbying.
General Public	<ul style="list-style-type: none"> • Information and Feedback 	<ul style="list-style-type: none"> • Assurance and public protection • CDWM Education • Complaints Resolution 	RED	<ul style="list-style-type: none"> • Assurance construction industry stability. • Provide relevant and timely CDWM information. • Addressing public complaints and concerns on CDWM. • Support innovation of relevant construction industry CDWM products.

Stakeholder	Benefit to NCA	Benefit from NCA	Class	Stakeholder Management Strategy
Regional and International Affiliates (AFCCA, CTA)	<ul style="list-style-type: none"> Exchange of CDWM Information and Benchmarking 	<ul style="list-style-type: none"> Learn from NCA 	AMBER	<ul style="list-style-type: none"> The trail blaze CDWM regulation and development becomes a global benchmark. Collaboration. Provide relevant and timely CDWM information.
Development Partners and International Funding Partners (WB, IMF, FSD)	<ul style="list-style-type: none"> Funding Support Technical Assistance CDWM Capacity Development 	<ul style="list-style-type: none"> Exchange of Information Efficient Utilization of Resources Support Realization of their Mandate 	AMBER	<ul style="list-style-type: none"> Assurance of construction industry stability. Provide relevant and timely information. Proper budgeting and utilization of funds. Effective implementation of joint industry programmes.
Research and Training Institutions (Universities, Colleges, TVETs, TTIs, etc.)	<ul style="list-style-type: none"> Exchange of Information Construction Industry CDWM Capacity Development 	<ul style="list-style-type: none"> Exchange of Information and Data 	GREEN	<ul style="list-style-type: none"> Collaborative research, knowledge generation and dissemination. Developing and executing CDWM training programmes.
Construction Industry Peer Regulators and Authorities (NEMA, etc.)	<ul style="list-style-type: none"> Knowledge and Information Exchange Peer Review and Benchmarking Brand Growth Policy Formulation and Lobbying 	<ul style="list-style-type: none"> Knowledge and Information Exchange Benchmarking Consolidated CDWM Supervision and Partnerships 	AMBER	<ul style="list-style-type: none"> Collaborative development of CDWM interventions. Assurance of construction industry stability. Collaborative CDWM training and research.
Suppliers	<ul style="list-style-type: none"> Goods and Services 	<ul style="list-style-type: none"> Revenue 	AMBER	<ul style="list-style-type: none"> Good supplier relationship management including timely payments. Transparency in procurement.
Standard Setting Bodies (KEBS, etc.)	<ul style="list-style-type: none"> Access to Continuous Learning Opportunities Provide Industry Standards Influence on Policy 	<ul style="list-style-type: none"> Career Opportunity for their Professionals Policy/Standards Setting Support. 	AMBER	<ul style="list-style-type: none"> Collaboration in policy and standards. Internship and employment opportunity of professionals from these bodies.
Pressure Groups (COFECK, COTU)	<ul style="list-style-type: none"> Market Intelligence Publicity Influence Policy 	<ul style="list-style-type: none"> Information Consumer Protection 	GREEN	<ul style="list-style-type: none"> Collaboration. Lobbying. Assurance of construction industry stability.
Other State Agencies (NACADA, AG, KENAO,	<ul style="list-style-type: none"> Guidance on Policy Formulation and Implementation 	<ul style="list-style-type: none"> Information Compliance 	RED	<ul style="list-style-type: none"> Collaboration. Lobbying Assurance of construction industry stability.

Stakeholder	Benefit to NCA	Benefit from NCA	Class	Stakeholder Management Strategy
EACC, PSC, KRA)	<ul style="list-style-type: none"> • Collaboration • Provide Oversight Role 	<ul style="list-style-type: none"> • Support Implementation of their Mandate 		

4.2.5 Gap Analysis in the uptake of Recycled CDW Products

The uptake of recycled CDW products can be viewed from the various parts of the waste management value chain, involving the influence of macro-level policies, micro-level policies and problems arising in the development of enterprises in the value chain. The gap in the uptake of recycled CDW products can then be analyzed in the context of elements of the waste value chain and the promotion that exists from the perspective of the whole of CDW recycling.

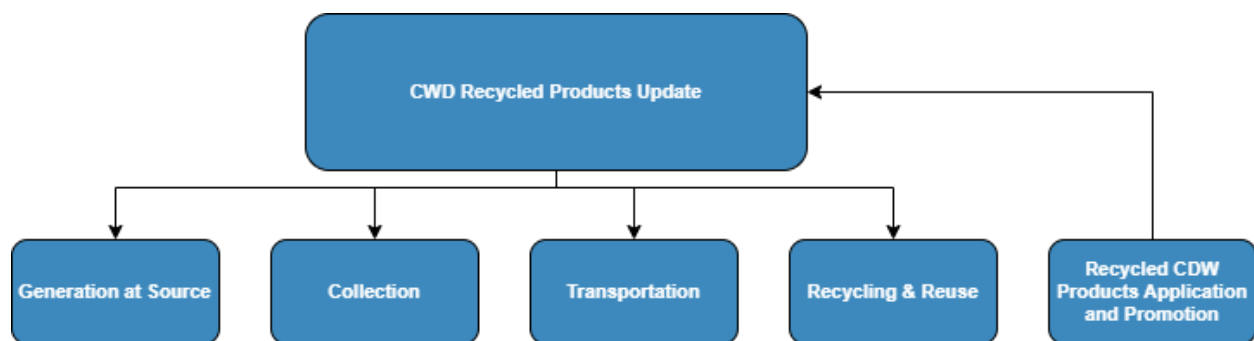


Figure 5: CDW Recycled Products Uptake Full Life Cycle Analysis Diagram

The gaps in the sector can therefore be outlined as follows:

- Lack of capacity to handle an enormous quantity of waste.
- Difficulty in estimating the quantity and composition of waste.
- Inadequate dumping sites and coordination among different parties involved.
- Financial incapability and lack of technical people in Construction and Demolition Waste Management area.

It is generally accepted that proper waste management is essential for public well-being and environmental protection. There are key stakeholders whose roles and responsibilities would propel the uptake of CDW recycled products. The table below analyzes the roles and responsibilities of stakeholders in CDW recycling.

Table 4-3: Role of Stakeholders in CDW Recycling

No.	Stakeholder Category	Role of Stakeholders in CDW Recycling
1.	Upstream (Generators & CDW Control)	<ul style="list-style-type: none"> • Set clear goals and policies on recycling. • Conduct or support sorted collection of CDW for their re-use and recycle. • Implement measures with emphasis on workability and public consensus building. • Provide cooperation on the sorted collection of CDW.

No.	Stakeholder Category	Role of Stakeholders in CDW Recycling
		<ul style="list-style-type: none"> • Use environmentally friendly products.
2.	Middle (Private and Public CDW Recycling Companies)	<ul style="list-style-type: none"> • Provide basic facilities for the storage of recyclable materials. • Collection of CDW efficiently. • Transporting the recyclable materials to users.
3.	Downstream (Recycled CDWM Products Users)	<ul style="list-style-type: none"> • Manufacture, distribute and sell recycled CDW products. • Provide cooperation between manufacturing industries. • Promote CDW recycling technology development.

4.2.6 NCA Mandate at the Up-Middle-Downstream

Waste Management is a devolved function according to the Kenyan Constitution of 2010. NCA being a national government agency charged with the responsibility of regulating, streamlining and building capacity in the construction industry through the registration of projects, provision of supervisors, workers and contractor accreditation. Therefore, NCA is mandated to ensure compliance in the construction and demolition sector through provision of regulations, streamlining and building capacities geared towards achieving a circular economy in the sector.

4.3 Contribution of Recycled CDW Products to Kenya’s GDP

CDWM is a priority for many policies at the global level due to a high volume of CDW that is produced and its inadequate management. This leads to serious environmental effects because of new building materials having low product recovery rates (Ferronato et. El., 2022). In this context, the Circular Economy is a potential solution in the construction and demolition sector as it involves more efficient use of resources and energy leading to waste minimization and the reduction of environmental impacts of product cycles.

The construction industry has a strong influence on the three aspects of sustainability – environmental, economic, and social. It is a major provider of employment opportunities and provides a large employment base for the youth (Mbusi, 2020). The construction industry is also a major contributor to the Gross Domestic Product (GDP). In 2020, the construction sector accounted for 6.2% of the world GDP according to a World Bank report (2021). The contribution to the GDP by the construction sector is expounded by the recycling of CDW. In the European Union, the CDW accounts for 36% of the total solid waste produced and is approximated at 924 million tonnes in a survey done by Eurostat (2018). Recycling the CDW (Oyuga, Gwaya and Njuguna, 2023), therefore, contributes majorly to boosting the GDP through regeneration although the sector is considered one of the key sectors with the greatest potential for Circular Economy (CE) adoption, CDW is identified in CE policies as a priority (European Commission, 2015). The implementation is one that is challenging and requires drastic changes in the structure of the industry and society in relation to CDWM. According to World Bank (2021), Kenya is the fastest-growing economy in Sub-Saharan Africa and the performance of the Kenyan economy has been boosted by a stable macro-economic environment, positive investor confidence and resilience services sector. Further, the World Bank lists the construction sector in Kenya as the fastest growing sector hence the need to tap into its full potential to contribute to the GDP.

The World Bank reports that since there is a rapid growth curve, there is an opportunity to thrive by creating systems for a resilient social environment. The focus, therefore, needs to shift from solving CDW problems to redesigning, innovating, and investing in CDW. The Circular Economy is growing in Kenya and the construction industry needs to get ready for the CE approach and look CDWM value chain following the circular rethink, redesign, reduce, reuse, repair, refurbish, remanufacture, and recycle thinking approach.

Section 5: Risk And Economic Factor Analysis Of CDWM

5.1 Introduction

Worldwide, Construction and Demolition Waste (CDW) is becoming a major environmental problem due to depletion of disposal sites to manage the huge number of wastes generated. The construction industry in Kenya is consuming a considerable number of resources, from the most common material sand to valuable natural assets like timber. There are various wastes generated during construction which may include both structure and finishing wastes.

For purposes of construction wastes risk factor analysis, construction waste is defined as any material by-product of human and industrial activity that has no residual value while waste is a product or material that is unwanted. For this purpose, the construction and demolition wastes are clustered into two groups: physical and non-physical construction wastes.

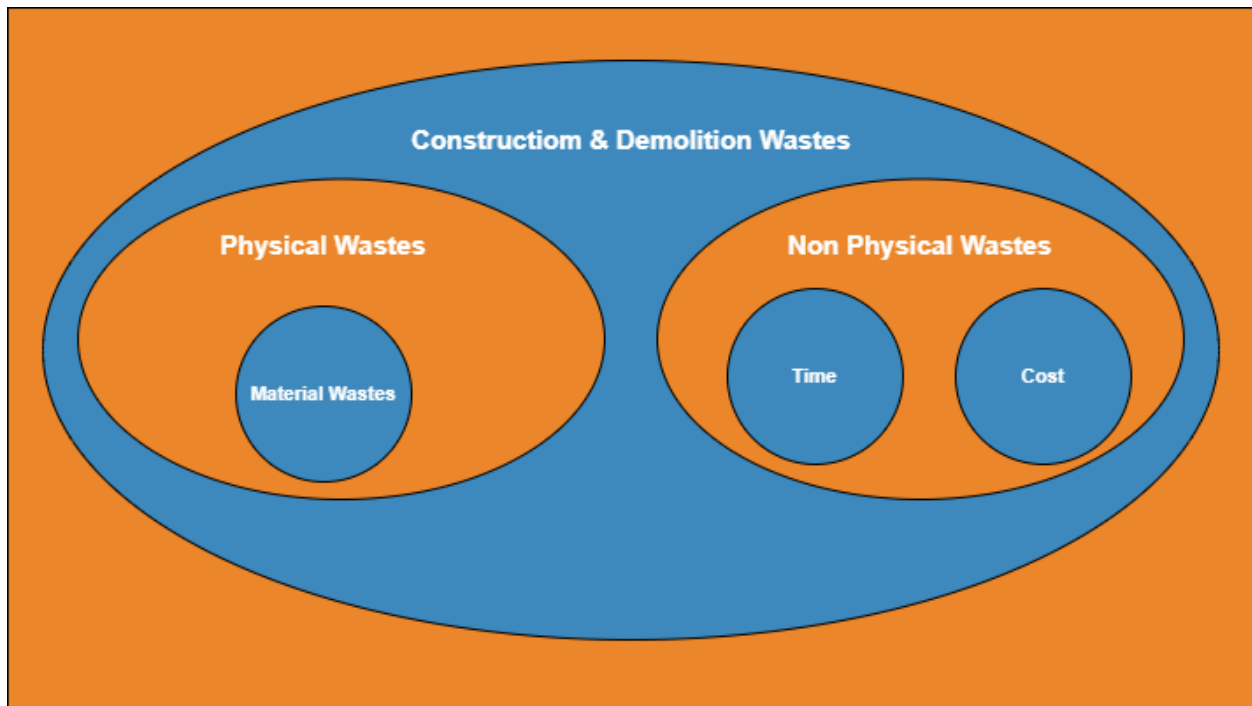


Figure 6: Physical and Non-Physical Construction & Demolition Wastes

Physical construction and demolition wastes are wastes from construction, demolition, and renovation activities that include land excavation or formation, civil and building construction, site clearance, demolition activities, roadwork, and building renovations.

The non-physical wastes on the other hand occur during the construction process and by contrast with material waste, these waste types are time and cost overrun for construction projects. It is also defined as waste related to other activities that may include repair, waiting time and delays.

5.2 CDW Risk Factors

Materials that cannot be reused are very likely to be recycled and it should be noted that the waste is also generated not only through construction and demolition processes but also by the employees. The waste management process must therefore include the waste minimization process which may be one or a combination of the following: using only those materials that you need; decreasing the number of materials that must be disposed of as trash; and diverting materials from disposal to reuse or recycling.

The waste management factors for this study will be classified into the following categories:

- ❖ Design
- ❖ Handling
- ❖ Contractor Workers' Mistakes
- ❖ Management
- ❖ Procurement
- ❖ Site Condition
- ❖ External Factors

From secondary data, the above CDW management factors are considered based on cross-referencing. The factors causing waste in the construction and demolition sector can then be listed.

Table 5-1: Factors Causing Wastes in Construction & Demolition Sector

No.	Construction & Demolition Waste Factors	Description
1.	Design	Design errors. Inexperience designer. Frequent design changes. Interface issues. Lack of design information. Last-minute client requirements. Poor coordination of parts during the design stage. Complicated design. Low drawing distribution. Poor design quality. Error in contract documentation. Incomplete contract.

No.	Construction & Demolition Waste Factors	Description
2.	Handling	<p>Damage during handling. Equipment failure. Inefficient methods of unloading. Poor material handling. Poor material quality. Materials supplied in loose form. Tools not suitably used. Delays during delivery. Wrong storage of materials.</p>
3.	Contractor Workers' Mistakes	<p>Lack of awareness. Lack of experience. Lack of workers' enthusiasm. Too much overtime for workers. Workers' mistakes during construction. Shortage of skilled workers. Poor workmanship. Poor attitudes of workers. Damage caused by workers. Inappropriate use of materials. Incompetent workers. Insufficient training workers. Inventory of material not well documented.</p>
4.	Management	<p>Lack of coordination among parties. Communication problem. Inappropriate construction methods. Poor planning. Poor control. Poor site management. Poor supervision. Resource problems. Rework. Long project durations. Scarcity of equipment. Waiting periods, Lack of influence to contractors. Lack of knowledge about construction. Lack of waste management. Late information flows among parties. Non-availability of equipment. Outdated equipment. Poor quality of information.</p>
5.	Procurement	<p>Ordering errors. Suppliers' errors. Wrong material delivery. Waiting for replacement. Different methods used for estimation. Over allowance. Error in shipping. Frequent variation orders. Item not compliance with specifications. Mistakes in quality surveys.</p>

No.	Construction & Demolition Waste Factors	Description
6.	Site Condition	Lighting problem. Congestion of the site. Interference of other crews on site. Waste resulting from packaging. Unforeseen ground condition. Poor site condition. Difficulties accessing construction & demolition site. Leftover materials on site.
7.	External Factors	Pilferage. Unpredictable local conditions. Damages caused by third parties. Accidents. Effects of weather. Festival celebrations and holidays. Lack of legislative enforcement.

The most common categories of risk factors have been given by the World Bank as design, construction and commissioning, operation, and demand risks, among others. Several risk factors may be similar to the significance in diverse types of CDW. However, the World Bank lists the following as the FIVE most common factors contributing to construction wastes:

- ❖ Rework
- ❖ Lack of Experience
- ❖ Lack of Waste Management
- ❖ Wrong Material Storage
- ❖ Poor Workmanship

5.2.1 CDW Risk Factor Analysis

The factor analysis is based on the FIVE factors as identified by the World Bank which in their study used the Varimax rotation matrix as their norm for Exploratory Factor Analysis while choosing critical factor for likewise exclusion and categorization. The risk factors therefore considered for this study are therefore listed as follows:

5.2.1.1 Factor 1: Management Risk Factors

These are factors related to management issues at the site as the primary cause of construction and demolition wastes due to lack of vigilance regarding waste management practices and methods. These are factors that include *Rework, Poor Supervision, Lack of Waste Management, and Poor Site Management.*

5.2.1.2 Factor 2: Construction & Demolition Site Risk Factors

The criteria under these factors are concerned with the site conditions during construction and/or demolition activities. These factors include construction site conditions, workers congestion on site, and poor site access, among others.

5.2.1.3 Factor 3: Workers Risk Factors

This includes workers-related issues and is composed of Workers - Lack of awareness, Workers - Inappropriate use of materials, and Workers - Lack of experience.

5.2.1.4 Factor 4: Handling Risk Factors

This is more related to the workers handling the materials at the site, and it comprises of Handling - Damage during handling, Handling - Improper material handling, and Handling – Incorrect material storage. How the construction and demolition waste is handled determines how they can be avoided.

5.2.1.5 Factor 5: Design Risk Factors

This combines the design and workers category, and it comprises Design – Design errors and Work – Lack of awareness. This may also include incomplete design and lack of ability to detail the requirements during the construction and demolition process.

Table 5-2: CDWM Risk Factors Analysis

CDW Risk Classification	Anticipated Risks	Mitigation Measures
Management Risk Factors	<i>Rework, Poor Supervision, Lack of Waste Management, and Poor Site Management</i>	<ul style="list-style-type: none"> • Effective and continuous stakeholders' engagement. • Enhanced supervisory and regulatory oversight.
C&D Site Risk Factors	<i>Site Conditions, Workers Congestion on Site, and Poor Site Access among Others.</i>	<ul style="list-style-type: none"> • Compliance with statutory OSHA guidelines. • Establishing CDWM desk at NCA county offices and attendant policies to inform site operations.
Construction Workers Risk Factors	<i>Workers-Lack of awareness, Workers - Inappropriate use of materials, and Workers - Lack of experience.</i>	<ul style="list-style-type: none"> • Strengthen enforcements. • Regular issuance of guidelines on CDWM key areas. • Intensive on-site and off-site surveillance.
CDW Handling Risks Factors	<i>Handling-Damage during handling, Handling - Improper material handling, and Handling – Incorrect material storage.</i>	<ul style="list-style-type: none"> • Awareness creation and continuous engagement and management of the various stakeholders. • Observing due process in CDW handling procedures. • Compliance with disposal codes.

CDW Risk Classification	Anticipated Risks	Mitigation Measures
Design Risk Factors	<i>Design errors and Work – Lack of awareness.</i>	<ul style="list-style-type: none"> • Continuous and effective supervision of design process in the construction sector. • Adoption of prompt correctional actions to address emerging issues in design phases of construction stages. • Consolidate supervision with other regulators.

5.3 CDW Economic Factors

The world, Kenya included, is experiencing a serious threat of global warming and actions should be taken to reduce excessive consumption of materials, develop sustainable agriculture, and apply politics to find solutions. Due to this urgency, it is important to increase corrective measures in all areas of solid wastes that include construction and demolition wastes and recycle as much as possible. Construction, Demolition and Renovation activities generate large amounts of wastes which harm the environment having a significant impact on global warming thereby causing economic turmoil to a country's GDP.

Construction and Demolition Waste (CDW) has acquired relevance in Africa and Kenya in the context of environmental sustainability. The construction and demolition wastes generated in Kenya account for one of the country's most significant waste flows as depicted by the number of construction development ongoing or completed. Construction and demolition building materials at the end of the original life cycle are therefore increasingly important feedstock for the preparation of new building products. The re-use, recycling and recovery of construction and demolition wastes is essential for the construction industry that strive to improve levels of efficiency.

5.3.1 Economic Cost Synopsis

Various costs simulation have been done in different countries with the most recent being Egypt which concluded that construction and demolition waste disposal is not economically viable as a solution to managing the wastes. Therefore, regulations should be put in place to promote recycling as an alternative for the disposal of CDW. As for Kenya, it will serve as a substitution for primary raw materials and eventually lead to preservation of raw materials.

5.4 Projected Impact of CDW Management Plan

Kenya is seeking to provide a resource-efficient country through delivering zero waste by helping organizations in the private, third and public sector thereby reducing energy, water and raw materials in use and managing wastes efficiently. The CDW Management plan will provide best practice advice to help with the prevention and reduction of waste as well as the recycling of materials on construction and demolition sites. In the construction industry, the construction and demolition wastes may be managed by a third party or parties responsible for managing their own wastes.

5.4.1 Construction and Demolition Waste Influencers

All people on construction and demolition sites are perceived to have some influences on waste management. The various groups can either have a direct responsibility to manage the waste or have no known responsibilities. These can be categorized into two:

Group 1: These are those who produce construction and/or demolition wastes and have a direct responsibility for managing the waste e.g., the supervisor or the contractor who sets the tone for waste management in the site and have a responsibility for delivering against budget and KPIs; and

Group 2: Those who produce construction and/or demolition wastes but do not have responsibility for it e.g., a sub-contractor who may be at an on-site for a few days to fulfill a specific role and use the wider sites' waste management facilities to comply with the site rules.



Figure 7: CDW Management Influencers

5.4.2 The Value of this CDW Management Plan

This CDW Management plan seeks to bring changes to the way waste is managed in construction and demolition sites to reduce, re-use and recycle. The true cost of CDW is usually underestimated and especially when materials and labor costs are not factored in. If this is looked at, it will give a significant potential to improve purchasing efficiency for every project based on waste prevention and re-use. Managing and monitoring different waste streams on a construction site requires careful planning. Understanding how waste occurs in the first place will help you prevent and manage it more cost-effectively. Waste streams vary according to the phase of construction, the method and the type of building making it important to adapt waste management practices to suit the specific site and phase of construction. Most waste is

produced on-site through over-ordering; damage by mishandling materials; off-cuts; inadequate storage of materials; and unnecessary packaging of construction materials, e.g., plastics and cardboard.

Implementing CDW Management saves money, along with many other benefits:

- Enriched corporate social responsibility.
- Conservation of natural resources.
- Reduced costs by purchasing fewer materials and maximizing waste management strategies of materials.
- Regulatory compliance with duty of care requirements.
- Less accidents on construction and demolition sites through correct material storage and following site waste management protocol.
- Income generation from collecting the construction and demolition wastes for re-use.

5.4.3 Global Best Practices in CDWM

There are several countries that have implemented best standard practices in the management of Construction and Demolition Wastes (CDW). However, these countries are in the category of developed economies with South Africa being the only country with a structured CDWM system in Africa according to World Bank Report (November 2022). The Sustainable Development Report (Sachs *et al.*, 2022) lists Germany, Austria, South Korea, Wales, and Switzerland as the top countries with the most effective waste management and a consideration for circular construction waste management. The same report lists Canada, Bulgaria, United States of America, Estonian Republic, and Finland as the largest world waste producers. In Africa, South Africa is listed as among the top waste recyclers with Africa being reported as only recycling 4% of its wastes with a collection rate of 55% and disposing more than 90% of the waste generated (World Bank Report, November 2022).

5.4.3.1 Circular Construction and Demolition Waste Management in Germany

Construction and Demolition Wastes represent a major component of solid wastes ranging from 15 – 25% in quantity and only second to paper in Germany. The C&D debris plays a critical role in solid waste composition with recycling becoming increasingly important (Brooks & Adamst, 1994). Germany has a mature CDWM recycling infrastructure where economic and regulatory incentives promoting recycling are provided to the key players by the government. Germany categorizes its construction wastes into excavation materials; demolition debris; scarifying; and construction debris. Excavation materials at 75% forms the largest composition of construction wastes while the construction debris at 4.6% forms the lowest construction wastes.

CDW Management Practices in Germany

Overall, CDW Management has been in place for several decades now in Germany and many initiatives are in place, both on state and local levels. For instance, the initiative “Kreislaufwirtschaft Bau” (Circular Economy in Building) unifies six main market factors to enhance the circular economy in the construction sector. Their works are documented in monitoring reports, which are published every two years. One project example on the regional level is the “lighthouse project,” which enhances the use of recycled concrete in Rhineland Pfalz and Baden-Württemberg. The following are the major CDW management practices in Germany geared towards a circular economy:

- **Advanced practices and a well-established network:** German CDW management practices are among the most advanced in Europe and have been improving for decades. The initiative “Kreislaufwirtschaft Bau” is a well-established network, which was setting waste reduction targets in its early days and is now monitoring and quantifying the overall waste arising and treatment. It can be seen as one of the main reasons for the high recovery rates that are observed today.
- **Responsibility of the public sector:** Public tenders that value recycled materials at least the same way as primary raw materials or even of explicit favors, the use of recycled construction materials are an important driver for sustainable CDW management. This is happening in some regional projects but is to be elaborated on in the future.
- **Universally accepted certificates:** Certificates are an important driver for sustainable CDW management. For instance, the German Sustainable Building Council (DGNB2) assesses buildings and urban districts, which demonstrate an outstanding commitment to meeting sustainability objectives.
- **Public perception and acceptance:** Recycled materials are still perceived to have a lower quality compared to primary materials, although primary and secondary materials must fulfil the same standards, DIN or EN norms. Scientifically proven information, quality control and education can drive the increased use of recycled materials. Such projects with educational characters already exist but would need further elaboration.
- **Norms:** DIN and EN norms do not constitute any barriers for CDW recycling and could instead act as drivers (e.g., to be pointed out in public tenders).

Table 5-3: C&D Waste Regulations in Germany

C&D WASTE REGULATIONS IN GERMANY
<p>German Federal law</p> <p>Germany's first uniform national waste disposal act, the Abfallbeseitigungsgesetz (AbfG), was adopted in 1972. The Circular Economy Act (KrWG), which is currently Germany's main waste disposal statute (and the successor to the KrW-/AbfG act), incorporates the main structural elements of the Kreislaufwirtschafts- und Abfallgesetz (KrW-/AbfG). Disposal of specific types of product waste (end-of-life vehicles, used batteries and end-of-life electronic and electrical devices) is governed by the ELV regulation (AltfahrzeugV), Batteriegesetz (BatterieG) and Elektro- und Elektronikgerätegesetz (ElektroG).</p>
<p>European laws</p> <p>Waste disposal is governed by several European regulations and directives, whereby the former automatically apply to each of the member states, while the latter must be separately transposed into national law by each member state. The basis of this legal framework is the Waste Framework Directive (2008/98/EC), which defines the main waste-related terms, lays down a five-step waste hierarchy, and contains key provisions for German waste disposal law.</p>
<p>State law of Bundesländer</p> <p>The Circular Economy Act (KrWG) is further differentiated by the Circular Economy Acts of the Bundesländer. However, since, under the German Constitution, the federal government is charged with regulating waste disposal related matters (Article 74(1)(24)), the regional states only have jurisdictions over those aspects of waste disposal that are not already regulated by federal law. Hence, legal prescriptions in the state's law tend to address implementation related matters such as the following: determining which entities are subject to waste disposal obligations; the authorizing bodies for waste disposal matters; and municipal waste disposal ordinances.</p>
<p>Municipal waste disposal law</p> <p>The collection and recovery of household waste at the municipal level are governed by municipal ordinances concerning matters such as usage and integration into the public system, as well as municipal garbage collection charges.</p>
<p>The Circular Economy Act (KrWG)</p> <p>Germany's Circular Economy Act (KrWG) entered into force on 1st June 2012. The KrWG, which was enacted as Article 1 of the law titled "Gesetz zur Neuordnung des Kreislaufwirtschafts- und Abfallrechts", supersedes the law titled Kreislaufwirtschafts- und Abfallgesetz (KrW-/AbfG) and transposes Directive 2008/98/EC into German law. The Circular Economy Act (KrWG) is intended to tighten resource, climate, and environmental protection regulations (see Article 1 of the Act).</p>

The Key Provisions of the Circular Economy Act (KrWG)

The Circular Economy Act (KrWG) adopts and expands the definition of waste in the Waste Framework Directive (Article 3(1)), whereby the restrictive wording "moveable property which the holder discards or intends or is required to discard" is replaced by "all substances or objects." However, by virtue of having excluded elements such as "non-excavated soils and constructions," the law still applies solely to moveable property.

The law contains a new provision concerning the distinction between waste on one hand, and by-products that do not fall within the scope of the law on the other (Article 4). A by-product is a substance that is produced in connection with the manufacture of another substance or product and is thus not the focus of

the manufacturing process. For an element to qualify as a by-product, it must also meet the following criteria:

- It must be possible to reuse the substance.
- Pre-processing exceeds the normal industry standard scope thus found unnecessary.
- Production of the substance is inherent to a manufacturing process.
- Reuse of the substance complies with all applicable laws concerning the following: product, environmental and health protection requirements; and the substance not being an environmental or health hazard.

The new provision as to when a given product or substance is no longer regarded as waste clarifies the definition of "waste." Pursuant to Article 5, a substance no longer qualifies as waste as far as the following criteria are met:

- A recycling and/or a reclamation process has been carried out.
- The substance is used for a specific purpose.
- There is a demand or a market for the substance.
- Specific technical and legal requirements are met.
- Use of the substance engenders no harm.

One of the core provisions of the Circular Economy Act (KrWG) is the five-step (previously three step) hierarchy pursuant to Article 6, according to which the following ranking of waste management measures applies:

- Prevention
- Preparation for recycling
- Recycling
- Other types of recovery, particularly use for energy recovery.
- Disposal

5.4.3.2 CDW Management in Japan

Japan produces an average of 77 million tonnes of construction and demolition wastes per year and recovers about 62 million tonnes (80.5%) of the wastes (Yonetani, 2018). Japan is also one of the leading countries in construction and waste recycling with 68% of wood wastes recycled as raw materials, 97% concrete waste and 100% steel recycled.

Yonetani (2018) studied Japan's Construction and Demolition Waste Management and notes that Japan must deal with waste management as it has a limited landmass and landfill disposal sites thus having difficulties. Japan has therefore developed a system to collect and transport wastes, process it through intermediary treatment by incineration and other methods, then dispose it in landfills at a sanitary manner

to prevent environmental pollution. Japan promotes a sound material-cycle society in which the consumption of natural resources is minimized, and the environmental load is reduced as much as possible by promotions of reduction, reusing, recycling, heat recovery and appropriate disposal.

Japan's Sound Material-Cycle Society has key features which are fundamental for the success of construction and demolition waste management. These features are:

- Reductions in the generation of waste.
- Appropriate recycling and waste disposal.
- Encouragement of the use of recycled products and materials.
- Assessment of products and packaging regarding the "3Rs".
- Implementation of economic measures such as taxes and levies.
- Establishing waste management facilities.
- Education.
- Facilitating the activities of non-governmental organizations.
- Research and development.
- International collaboration.

Table 5-4: C&D Waste Regulations in Japan

C&D WASTE REGULATIONS IN JAPAN		
Waste Management Law	Key Features	Background
Waste Sanitation Law (1900)	<ul style="list-style-type: none"> • Main target: Night soil. • Individual municipalities made. • Responsible for the waste disposal. 	<ul style="list-style-type: none"> • Beginning of rapid urbanization.
Public Cleansing Act (1954)	<ul style="list-style-type: none"> • Target changed from night soil to solid waste (hereafter referred to as "waste"). • Clearly stipulated that the purpose of the law was to promote the speedy removal of waste from places where people are engaged in their daily life. • In principle, waste should be incinerated. 	<ul style="list-style-type: none"> • Increase in the amount of waste being generated because of the economic revival after the end of World War II.
Waste Management and Public Cleansing Law (1970)	<ul style="list-style-type: none"> • Clarification of the responsibility for waste disposal : <ul style="list-style-type: none"> ○ Industrial waste: waste generator ○ Municipal waste: municipality • Setting criteria for waste disposal. • Promotion of the reduction of waste discharge, and sorting and recycling. • Promotion of the construction of safe and appropriate facilities, through public sector involvement. • Thorough implementation of the responsibility for waste disposal. • Environmentally conscious and appropriate waste treatment. 	<ul style="list-style-type: none"> • Increase in the amount of, and change in of the quality of, the waste derived from business activities, because of Japan's high economic growth. • Responding to environmental conservation measures relating to waste disposal. • Growing concern within society regarding the emission of Dioxins after incineration. • Pressing situation regarding residual volume of the final disposal sites
Amendment to Waste Management and Public Cleansing Law (1976)		
Amendment to Waste Management and Public Cleansing Law (1991, 97)		
Basic Environment Law (1993)		
Containers and Packaging Recycling Law (1995)		
Home Electric Appliances Recycling Law (1998)		
Dioxins Control Law (1999)		
Basic Law for Establishing a Sound Material- Cycle Society (2000)	<ul style="list-style-type: none"> • Promotion of the 3R (Reduce, Reuse and Recycle) concept to support the establishment of a sound material-cycle society. • Strengthening industrial waste. • Disposal measures. • Strengthening the anti-illegal dumping measures. 	<ul style="list-style-type: none"> • Growing awareness of the need for effective utilization of resources, and of the global scale of environmental pollution. • Further deterioration in the situation, regarding the securing of final disposal sites.
Construction Material Recycling Law (2000)		
Food Waste Recycling Law (2000)		
End-of-Life Vehicles Recycling Law (2000)		
Amendment to Waste Management and Public Cleansing Law (2003-06, 10, 15, 17)		
Small Home Electric Appliances Recycling Law (2013)		

5.4.3.3 Circular Construction and Demolition Waste Management in Croatia

Circular Economy Approaches in Solid Waste Management incorporates the CE concept into the future Waste Management Plan of the Republic of Croatia for the period 2023-2028. Croatia produces about 6 million tonnes of waste annually, which corresponds to an average of about 1.5 tonnes per person every year. Most of this waste comes from the construction sector and households. Currently, the waste management system in Croatia relies mainly on landfilling. Despite recent progress, 58% of the municipal waste produced in Croatia in 2021 still went to one of the country's 80 active landfills.

“Waste management, including the collection and treatment of waste, is central for increasing circularity in Croatia, as well as reducing the negative impacts of landfills on human health and the environment,” highlighted Mile Horvat, State Secretary at the Ministry of Economy and Sustainable Development. “Waste management is also closely linked to sustainable products policy. An incentive for circular design of products that includes reduced consumption, product re-use and recycling, brings forward a business model that will prevent the harmful effect of products on the environment and strengthen the extended producer responsibility. Such sustainable product policy reduces waste significantly. What is important is that when waste can be avoided, its economic value must be recovered, and its harmful effects on the environment and climate change minimized.”

The two-year project of the Ministry of Economy and Sustainable Development and the World Bank contributed to the creation of policy incentives for reduced consumption, intensified product use, and extended lifetimes of products and components. The ministry chose the construction and demolition waste sector as a priority for the development of a five-year Circular Economy Action Plan 2023-2027 due to the sector's large material and carbon footprint, as well as its socio-economic value. The decision to focus initially on this sector was also prompted by the devastating earthquakes of 2020 and the related surge in construction and demolition waste. The other sectors identified as areas that would substantially benefit from the application of circular solutions were plastics, food, and textiles.

The Strategies:

The proposed Circular Economy Action Plan for Construction Waste Management provides a roadmap for reducing waste generation and achieving the EU goal of 70% construction waste recovery, including recycling and other types of waste usage. Also, it highlights the needs to strengthen the market for secondary raw materials and by-products, improve construction waste data collection, reduce illegal construction waste dumping, and increase waste recovery. The plan was created through a participatory process in consultation with key stakeholders including the public sector, businesses, academia and civil society.

5.4.3.4 Circular Construction and Demolition Waste Management in China

Construction and Demolition Wastes Management in China is managed through the 3R principle (Huang *et al.*, 2018). CDW accounts for about 30% to 40% of the total amount of wastes in China. The most common waste disposal method is the landfills and the average recycling rate of CDW in China is only about 5%. The World Economic Forum (July 2021) on analyzing how China is addressing its waste problem notes that China’s municipal solid waste will double that of the US by 2030. As a result, China has instituted several strategies to manage this waste including banning the importation of foreign garbage from other nations desperate to offload their trash elsewhere, but this has not eliminated fully the wastes.

China has strengthened the supervision and management responsibilities of the government and introduced several initiatives around waste exclusion. It has imposed obligations on waste generators, focused enforcement, and on product stewardship, along with the ban on foreign waste. China has also introduced a target to reuse 60% of its urban household waste by 2025.

Table 5-5: China National and Regional Policies on Waste Management

China National Policies on CDW Management	
Waste Management Law	Key Features
[2003] Urban construction waste and engineering sediment management regulation [City construction and appearance letter No. 5]	Determine the City Appearance and Environmental Sanitation Administrative Department oversees the management of CDW.
[2005] Provisions on the Administration of Urban Construction Garbage [Ministry of Construction No. 139]	Specify that producers of construction and demolition waste should bear the responsibility to treat and dispose the wastes.
[2008] Financial subsidies for energy saving building materials [Financial building No. 677]	Provide financial subsidies (including low interest loan) for CDW recycling.
[2009] Technical specifications for construction waste disposal [CJJ 134-2009]	Provide guidance for construction waste design and management of collection, transportation, utilization, and landfill.
[2011] Bulk solid waste comprehensive utilization plan [Resource Conservation and Bulk solid waste comprehensive utilization plan [Resource Conservation and Environmental Protection No. 2919]	Develop demonstration projects for resource utilization of construction and demolition waste.
[2014] Implementation plan of predominant resource recycling project [Resource Conservation and Environmental Protection No. 3052]	Suggest main building demolition technologies, construction, and demolition waste classification technologies, recycled aggregate treatment technologies, etc.
China Regional Policies on CDW Management	
[2014] Notice on adjusting the fees for non-resident garbage disposal in Beijing [Beijing Development and Reform Commission No. 2662]	CDW transportation fee is set as 6 RMB/tonne within six kilometers, and an additional 1 RMB/tonne per kilometer will be charged when exceeding six kilometers. CDW disposal fee is adjusted to 30 RMB/tonne.
[2015] Construction waste and engineering sediment disposal regulations [Government of Shanghai Municipality No. 50]	Require construction organizations to include CDW disposal fees and transportation costs in the construction budget before applying construction waste disposal permit.

[2016] Provisions on the Management of Construction Waste in Shanghai(draft) Government of Shanghai	Strengthen the establishment of data service platform to better improve service and management efficiency.
[2014] Transportation and disposal of construction waste management [Government of Shenzhen Municipality No. 260]	CDW organizations shall obtain a specific transport permit. Construction waste disposal organizations should establish a comprehensive information platform for the management of construction waste disposal.
[2013] Municipal and rural construction waste recycling management regulations [Qingdao Housing and Urban Construction Department No.13]	CDW disposal fee can be fully returned by the Ministry of Housing and Urban-Rural Development if recycling rate of concrete, brick, mortar, and planting soil can reach 30%, 20%, 10% and 10% respectively.

5.4.3.5 Circular Construction and Demolition Waste Management in South Africa

Berge and Von Blottnitz (2022) study on Construction and Demolition Wastes in South Africa indicates that C&D wastes quantities generated in South Africa is enormous. The South African National Waste Management Strategy (NWMS) seeks a common platform for action between stakeholders to systematically improve waste management in South Africa. South Africa is faced with a rapidly growing, urbanization and consumerist population but our environment has a finite ability to absorb solid and liquid waste. The NWMS is a legislative requirement of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), hereafter referred to as the "Waste Act". The purpose of the NWMS is to achieve the objectives of the Waste Act, which defines its scope and specifies its contents. Organs of state and affected persons are obliged to give effects to the NWMS.

Promoting the re-use, recycling or recovery of waste materials will be achieved through:

- Producer responsibility initiatives in which industry takes responsibility for the lifecycle of products that they produce establishes methods and funding mechanisms to manage the products once they become waste, and sets targets for re-use, recycling or recovery in IndWMPs.
- Mandatory Extended Producer Responsibility (EPR) schemes declared by the Minister where IndWMPs have been ineffective, and the Minister wishes to determine how certain waste streams are to be managed.
- Collection and sorting of general recyclable waste materials are supported by a recycling infrastructure. General recyclable waste collection systems will be coupled to existing waste collection services and disposal sites transformed into waste management sites. Material recovery facilities and buy-back centers will be established in different municipalities, and space will be provided to sort waste into re-useable and recyclable waste.
- Nationally coordinated awareness campaigns which support separation of recyclables from the domestic waste streams at source for all households, businesses, and organizations.
- Diverting waste streams from landfill within prescribed periods as provided for by the draft Standard for Disposal of Waste to Landfill.

- Local control measures for general waste entering landfill sites will reinforce diversion of recyclable waste from these sites. Municipalities will take responsibility for diverting organic waste which they can be composted or used in biogas digesters.
- Some waste management activities which stimulate the re-use, recycling and recovery of waste will be listed as activities that do not require a waste management license, thereby decreasing regulatory constraints on these activities. Applications must demonstrate that the proposed waste management activity be implemented and conducted consistently and repeatedly in a controlled manner without unacceptable impact on, or risk to the environment and health.
- For waste types that cannot be re-used or recycled, various options exist for energy recovery, including biogas projects and methane gas from landfills. The Renewable Energy White Paper²⁰ will set out the mechanisms that government will implement to facilitate renewable energy technologies, including the Renewable Energy Feed-in Tariff. Thermal treatment of waste must conform to air emissions standards to mitigate the impact on health and the environment.
- In some instances, the Minister of Environmental Affairs will declare a required percentage of recycled materials in a product to actively promote markets for recycled materials. The Waste Act provides for such a declaration.

A fundamental change in waste disposal practices is supported by the development of a national recycling infrastructure through partnerships among the various role-players. The infrastructure will enable separation of sources having organic waste, hazardous waste and clean general recyclable waste, and the collection of waste types that contaminate general household waste through specialized infrastructure.

5.4.4 Promotion of Best CDW Management Practices

Construction and demolition projects should always plan and design to avoid waste being produced on site. However, where this is not possible, this strategy plan proposes that the waste hierarchy be followed.

The design stage is an important influencing factor as to why construction and demolition wastes are produced in construction projects. Ensuring design decisions not only prevent waste from being produced in the first place but also positively improves the recycled content and future recyclability of the project during the demolition phase. **Designing out construction and demolition waste** is encouraged on the following guideline principles:

- ❖ Designing for waste-efficient procurement.
- ❖ Designing for materials optimization.
- ❖ Designing for off-site construction.
- ❖ Designing for re-use and recovery.
- ❖ Designing for demolition and flexibility.

This waste management plan therefore advocates for best practices in managing construction and demolition wastes while observing the guiding principles. These practices are given in a hierarchy from **best favored practice** to the **least favored option** as indicated below:



Figure 8: CDW Management Hierarchy

The waste management plan also puts a focus on the areas of importance in achieving construction and demolition waste management reduction, re-use, and recycling. This CDW management plan does not focus on disposal as an option as it seeks to ensure zero waste to achieve a circular economy.

Table 5-6: Construction & Demolition Waste Management Hierarchy Areas of Focus

CDW Management Hierarchy	Areas of focus
CDW Reducing	Material delivery planning, material storage, excess avoiding, damaged materials, minimizing material movement, returning materials to suppliers, eliminating excess packaging.
CDW Re-Using	Deconstruction, making best use of materials, plan in re-use.
CDW Recycling	Material segregation, engaging waste recycling contractor, staff/sub-contractor training, storage of materials, any other additional consideration.
CDW Disposal	Discouraged, following guidelines by NEMA and other agencies.

Section 6: CDW Management – Situation Analysis

6.1 Overview of the Construction Industry in Kenya

The Kenyan construction industry is valued at \$16.6 billion in 2021 by the renowned global data report which also categorizes the key sectors in the Kenyan construction market as commercial, industrial, infrastructure, energy & utilities, institutional, and residential constructions.

- **Commercial Construction:** The sector's output over the forecast period will be supported by investments in the leisure, hospitality, and retail buildings, amid a rebound in tourism activities which is one of the leading sources of foreign exchange for Kenya.
- **Industrial Construction Market:** The industrial construction sector's output over the forecast period is supported by a rebound in manufacturing and export activities, coupled with investments as part of the Kenya Manufacturing Vision 20 by 30 plan.
- **Infrastructure Construction Market:** The infrastructure construction sector expands in real terms and the growth is supported by the government's plan to develop transport infrastructure.
- **Energy & Utilities Construction:** The sector's output is driven by rising demand for electricity, coupled with investments in renewable energy, and telecommunication infrastructure projects.
- **Institutional Construction:** The sector's output is supported by investment in the health, education, and research sectors.
- **Residential Construction Market in Kenya:** The sector's output is supported by the government's focus on addressing the housing deficit in the country, coupled with investment in building affordable housing units.

6.2 Growth of the Construction Industry and the Generation of C&D Wastes

According to the country's economic outlook, the construction industry is one of the main areas that will and is attracting investors to the country. There are numerous investment opportunities, especially in the areas of slum and informal settlement upgrading, urban renewal, middle and low-income housing development, and the manufacture and supply of building materials and components.

Infrastructure growth is a key component of Kenya's Vision 2030, and GDP from construction in Kenya increased to 83989 million KES in the third quarter of 2020 from 72888 million KES in the second quarter of 2020. According to the Kenyan National Bureau of Statistics (KNBS) Economic Survey, approximately 148,000 people are formally working in the domestic building and construction industry.

The sector's players range from local micro-enterprises to international multinational civil engineering and construction behemoths. Even though building and construction contractors must be licensed with the National Construction Authority (NCA), many unregistered contractors work in the informal sector.

According to the BMI Research report, the local construction industry will expand by 8.7 percent this year and will remain stable until 2026, with an average growth rate of 6.2 percent putting Kenya ahead of all Sub-Saharan African countries. Kenya's construction market is expected to grow significantly by 2026 as it has the current **Kenya Kwanza government** support on affordable housing with several housing construction projects being launched in various parts of the country. Significant funding for the sector is therefore anchored on the Kenya Kwanza government budget, which will be backed up by foreign investment in the country's expected infrastructure growth. This in turn means there will be huge generations of construction and demolition wastes which if not controlled will lead to degradation of the environment.

6.3 Outlook of CDW Management Globally and in Kenya

6.3.1 The Global Outlook

The United Nations Environmental Programme (UNEP) global assessment on the state of waste management and call for action to the international community establishes the rationale and the tools for taking a holistic approach towards waste management and recognizing wastes and resource management as a significant contributor to sustainable development and climate change mitigation. The outlook prepared as a follow-up to the Rio+20 Summit and as a response to UNEP governing council decision GS 27/12, focuses on governance issues which need to be addressed to establish a sustainable solution.

The Global Waste Management Outlook reports that the Global Waste Management Market was valued at USD 889.58 billion in 2021 and is expected to grow at a CAGR of 5.4% during the forecast period. UNEP Report (2021) reports that the behavior of generating garbage is too dangerous not only for today's generation but also for future generations. The report suggests that it is critical to educate people and encourage them to practice recycling, reuse, and reduce instead of producing waste. Waste disposal should therefore be a priority for county and national government alike. Construction and Demolition Wastes Management (CDWM) reduces the effect of waste on the environment, health and general human nature. The management of construction and demolition wastes helps reuse or recycle resources such as paper, cans, glass, etc. There are various types of waste management include the disposal of solid, liquid, gaseous or hazardous substances.

In Africa, the Construction and Demolition Wastes is a social, economic, and environmental problem and to achieve the Africa Agenda 2030 for sustainable development, Construction and Development Waste Management approaches must be environmental and health imperative deserving major priorities. Current reasons for poor Construction and Demolition Waste Management in Africa includes weak organizational structures, lack of appropriate skills, inadequate budget, weak legislations, lack of enforcement, low public awareness, corruption, political instability, conflict, and lack of political goodwill. Even though there are gaps, there are technological and Africanized innovations emerging in the management of CDW. These innovations recognize the opportunity that wastes provide as a secondary resource and notes that diverting

wastes away from dumpsites and landfills towards reuse, recycling and recovery can improve the livelihood of the informal waste reclaimers, while at the same time creating new job opportunities.

6.3.2 The National Outlook

According to the Kenyan National Sustainable Waste Management Policy, the production of solid waste which includes construction and demolition wastes is expected to triple between the periods of 2009 to 2030. Kenya generates an estimated 22,000 tonnes of solid waste per day calculated by assuming an average capita waste generation of 0.5 kilograms for a current population of 45 million translating to 8 million tonnes annually. The UNEP report (2021) on built environment notes that it is difficult to give exact figures of construction wastes produced on a typical construction site, but that this is estimated that it is as much as 30% of the total weight of building materials delivered to a building site. In Kenya, it is estimated that 5,500 tonnes of construction and demolition wastes are generated daily given by the standard approximation that this waste forms a quarter of the solid wastes generated.

It is estimated that 40% of the construction and demolition wastes is generated in urban areas and that as urbanization increases by 10% by 2030, the Kenyan urban population will be generating an estimated 5.5 million tonnes of wastes every year which will be three times more than the waste generated in 2009 (Kenya National Solid Waste Policy, 2020). The major construction and demolition wastes are listed as glass, plastics, wood and steel, surplus mortar, surplus concrete, broken stones and bricks, green wastes (grass and bushes) and excavated soil. With the increase in urbanization, construction and demolition wastes have many side effects including environmental degradation. The exact amount of construction and demolition waste in urban and rural areas is still unknown, but EPA (2019) report showed that demolition represents 90% of the C&D waste while construction represented only 10% of the total.

Past inventories in Kenya estimated that 60% to 70% of wastes generated were organic, 20% plastic, 10% paper, 1% medical wastes and 2% metal. The reason for these wastes has been recorded as inefficient production processes, low durability of goods, unsustainable consumption and production patterns leading to excessive waste generation. These data however are just estimates indicating that there are no systematically collected data on waste streams in Kenya including data on C&D wastes. The major sources of C&D waste are recorded as commercial, industrial, infrastructure, energy & utilities, institutional, and residential constructions. Despite efforts to encourage reduction, reuse, recycling and recovery, the amount of C&D waste generated remains high and appears to be on the increase.

Kenya has made significant commitments to environmental protection under Article 42 in the Kenyan Constitution of 2010 which guarantees every person the right to a clean and healthy environment. The Kenyan Vision 2030 sought to establish sustainable waste management systems in Nairobi, Kisumu, Eldoret, Nakuru, Thika, and Mombasa by the year 2030. This led to the promulgation of the Kenya National Solid

Waste Management Strategy in the year 2015 and the burn on polythene carrier bags in 2017 which has contributed to minimizing the C&D waste generation.

However, there is need to conceptualize the C&D waste management approach with the aim of maximizing the generation of value from C&D wastes through reduction, reusing, and recycling. This, in turn, will maximize job creation from the sector, and minimize the fraction of the waste streams that are destined for disposal. The Constitution of Kenya 2010 devolved waste management to the 47 county governments. Although many counties are working to improve waste management in their territories, they are hampered by inadequate waste management infrastructure, county laws and regulations, and capacity and technologies to effectively carry out this devolved function.

6.3.3 C&D Waste Management at the Counties

The most recent United Nations estimates indicate that Kenya's urban population will expand to 50 million by the year 2030, accounting for 62.7 percent of the national population further straining the capacity of Kenyan cities to provide critical waste management services to urban residents.

It is estimated that 34.8% (i.e., 10 million) of the total population of Kenya reside in the urban centers, with the largest five cities (Nairobi, Mombasa, Kisumu, Nakuru and Eldoret) accounting for a third of the urban population. It is estimated that they produce 2400, 2000, 1000, and 500 tonnes of solid waste daily respectively, and as the scale of future urbanization increases, waste management will pose growing socio-economic, environmental, and institutional challenges for if adequate measures are not put in place.

Waste management is a devolved responsibility under the Constitution of Kenya 2010. However, most counties lack adequate infrastructure, governance mechanisms and dedicated funding for effective sustainable waste management. Many have not set aside land for building waste management factories.

It is estimated that only about 40% of the population in many parts of major cities receive waste management services; in many cities, low income and informal settlements do not have waste collection systems at all. All counties in Kenya currently have uncontrolled waste dumpsites where leachate pollute waterways and underground aquifers, and where burning waste emit toxic air and noxious fumes that contaminate the air (Sibanda, Obange & Awuor, 2017 December). There is no systematic waste segregation at the source and the recovery of recyclable items like plastics, papers, glass, and metals is done by informal waste picker groups who recover only a fraction of the total recyclable materials, mostly directly from the dumpsite. Informal waste pickers at these dumpsites are exposed to toxic chemicals (from batteries and other waste and burning plastics) air pollution and pests that spread disease.

County governments have not to date taken advantage of economies of scale by partnering with neighboring counties in the metropolis clusters to pool their resources for more cost-effective and efficient waste management. Additionally, most counties do not to date have waste laws or plans to guide efficient, sustainable waste management, nor a dedicated county waste fund to support investment in waste

management programs (Sibanda, Obange & Awuor, 2017, December). Impressive local and small-scale action is being taken in counties across the country. Waste pickers are organized into cooperatives. Programs to create jobs in waste collection, sorting and recycling for youth and women are being created. In some areas, Kenyan entrepreneurs have launched small scale production of organic compost from organic waste. Small-scale, artisanal recycling of glass, plastic and metal is converting some waste into crafts for the domestic and international market.

6.3.4 C&D Waste Management by Formal Private Firms

Both the public and private sectors sponsor construction projects development and most certainly use, if not all, most of the same pool of contractors and sub-contractors, which are all private companies freely competing in the market (Kibowen, 2018). Under the same set of environmental regulations and construction standards and codes requirements, the private firms should be able to perform the same with the public sector without an apparent reason for disparity in their CDWM efficiency. Private sector participation in C&D waste management should be viewed as an opportunity and not a panacea.

In situations whose existing service delivery is either too costly or inadequate, Del Pero et al., (2020) notes that the private sector participation should be examined as a means of enhancing efficiency (and thus lowering costs) and mobilizing private investment (and thus expanding the resources available for urban infrastructure and equipment). To decide whether to have private sector participation, many factors need to be analyzed, such as cost recovery, efficiency, public accountability, management, finance, economies of scale, legislation, institutions, and cost. Cost factors should be analyzed separately for the different components of solid waste service - collection, cleansing, disposal, and transfer (Kibowen, 2018). Methods of private sector participation most common to C&D waste management are **contracting**, **concession**, **franchise**, and **open competition**. These participatory forms are experienced at the county government levels as waste management is a devolved function.

Contracting	The government awards a finite-term contract to a private firm for the delivery of C&D wastes collection services, the collection of recyclables, transfer station operations, disposal site operations or fleet management. The contract award is made after a competitive procurement process and the private firm is paid for service by the government under the terms of the contract.
Concession	The government awards a concession to a private firm to set up a facility that utilizes the county government owned resources – refuse. This concession enables the private firm to recycle the C&D materials (paper, plastic, metal, glass) from refuse to recover resources. In others, the private firm may transfer ownership and operation of the facility to the government after a specified period of private ownership and operation.
Franchise	The government awards a finite-term zonal monopoly (a franchise) to a private firm for the delivery of the C&D wastes collection service. The private firm recovers its costs and profit through direct charges to the construction firms and establishments that are served.
Open Competition	The government freely allows qualified firms to freely compete for C&D waste collection, recycling, or disposal services. In this case, no singular firm holds a monopoly within the same area.

The suitability of each of these methods may also vary for collection, cleansing, disposal, and transfer services.

At the county government levels, private firms have been majorly contracted to collect garbage, transport, and dispose of it to government-approved waste disposal sites. These private firms are not necessarily restricted to C&D waste but generally to solid wastes. It is also notable that the franchising method for waste collection has been tried by several counties whereby a county is zoned, and private sector firms are assigned to deliver waste management services to the designated zones and oversee both fee and waste collection. This approach has not been efficient as the firms compete for contracts in the wealthier areas but decline to service poorer areas and are vulnerable to corruption (Kenya National Solid Waste Policy, 2020).

The system is heavily reliant on the under-resourced public sector for enforcement. Mountains of garbage are still a common feature in most residential areas, marketplaces, and roadsides. In addition, the private sector waste management companies involved in the collection of waste are accused of illegal disposal of waste in rivers, by roadsides, in quarries as well as illegal disposal at dumpsites. There is no framework to guide fees charged by private waste management companies, thus most charge a high fee that most of the Kenyan population, especially marginalized urban areas cannot afford.

Waste recycling companies have indicated that extracting recyclable materials is often impossible in practice as most household waste is not sorted and is comprised of 60 percent organic waste, and cleaning recyclables that have been comingled with waste is expensive. Recycling companies are also faced with challenges including opaque regulatory requirements, a multiplicity of licenses and charges, lack of distinction in licensing of waste collection and recycling companies, and the fact a lack of sufficient controls at recycling sites are frequently leading to their use as dump sites rather than materials recovery centers. Private sector investment is slowly expanding in waste collection, transportation, waste sorting at material recovery facilities, recycling, and production of marketable products from recovered materials.

The high level of privatization of waste management services by counties without proper regulation and enforcement has also led to the uncoordinated delivery of waste services to citizens. Strict regulation and enforcement of waste services provision by the private sector in Kenya is crucial.

6.3.5 C&D Waste Management by Informal Private Firms (Waste Pickers & Community Groups)

Community waste management initiatives established by community-based organizations, youth and women's groups are engaged in C&D wastes collection, sorting, enhancing reuse and recycling. These initiatives create jobs for community members, women and youth but face significant challenges that includes lack of infrastructure (collection points, transfer stations, material recovery facilities) for collection, sorting and recycling, lack of access to markets for recyclable materials, lack of training, and limited access to finance. Many communities across the country do not receive basic waste collection and disposal services,

driving them to dispose of their C&D wastes in an unorthodox way that includes burning their waste - with damaging health and air quality impacts. Informal waste pickers, typically from impoverished and marginalized groups, work in hazardous and sometimes deadly conditions to eke out a living from reclaiming a tiny fraction of the recyclable waste. Waste pickers working at the nation's uncontrolled dumpsites are exposed to toxic chemicals (from batteries and other waste and burning plastics) air pollution and pests that spread disease. Waste pickers cooperatives have been formed in some counties under the national Sacco societies, or cooperatives law, to improve labor conditions and livelihoods.

6.3.6 Role of Citizens

Citizens are key players in the management of waste. They are consumers of goods and services, generators of C&D waste, and main players of waste minimization and sorting at the source. Their participation or lack of participation thereof determines the success or failure of the adoption and implementation of C&D waste management initiatives. The shift from mixed disposal at the construction site level to "sorting of waste at source" of recyclable materials, organic and other waste recoverable streams will be key in the realization of sustainable waste management. Citizens are also key stakeholders to monitor compliance and report illegal waste dumping.

6.4 Types of CDW Streams and their Management

This is waste that is generated because of new construction works, remodeling or demolition. Construction waste comprises debris, steel, timber, iron sheets, tiles, and ceramics, among others. Although construction and demolition waste are not classified as hazardous, it is a mixed waste source that requires separation into component parts for the purposes of recycling. These wastes currently end up in disposal sites or are used for backfilling in our road networks.

- **Asbestos:** Demolition wastes may include asbestos which is hazardous and can present a significant health risk when improperly disposed of or reused. NEMA has developed guidelines on the safe management and disposal of Asbestos hence this strategic document adopts the management strategies outlined.
- **Asphalt:** Waste generated during replacement of road surfaces can also be wasted because of civil road construction. Asphalt is noted to be 100 percent recyclable. Currently, this is used to recarpet small roads within communities and estates with light tonnage specifications coupled with low traffic.
- **Bricks:** Brick waste is generated because of demolition and may be contaminated with mortar and plaster. Brick waste is sometimes blended with other materials like timber and concrete. Currently, bricks are recycled by crushing and using as filling materials.
- **Concrete:** Concrete wastes can be generated due to demolition of existing structures and testing of concrete samples, etc. commonly recycling measures of concrete wastes are used crushed concrete as aggregate. The crushed concrete aggregate can be used as a replacement for natural

aggregate in a new concrete, and it also has been employed in the construction of road base and trenches.

- **Excavated Rocks and Stones:** Materials because of site preparation and depending on the geology of an area, a great deal of excavated rocks and stones can be produced as a by-product. Materials found on site that are not part of a previous construction (raw materials like clay, limestone, and rock) that are not reused or re-processed for benefit, or an open market product is considered land clearing debris. Construction in urban areas implies the use of construction materials from quarries and the excavation of soil and rock. From a resource perspective, there could be benefits from using excavated soil and rock as construction materials.
- **Glass:** Since glass is chemically inert, has high intrinsic strength and low gas permeability, the use of recycled glass cullet as a replacement of aggregates in construction is an attractive recycling option. Capabilities should be explored to apply waste glass from construction sites in cement mortar, Ordinary Portland Cement (OPC) concrete, paving blocks, and other areas in the construction industry.

However, there is no specific standard set for metal wastes recycling and due to its lucrative nature created by the ability to export scrap metals from Kenya, it had a huge informal base scavenging for metals from construction sites and even vandalism. However, a moratorium was placed by the Kenyan government on the export, buying and selling of scrap metals to tame runaway vandalism.

- **Metals:** These are metallic wastes from construction sites and demolition sites. These are categorized as either ferrous or non-ferrous metals. Steel, which is a ferrous metal, is reported as making a major part of construction and demolition wastes while non-ferrous metals which include copper, aluminum, lead, and zinc make a smaller component. Currently, metal wastes form the major form of recycled C&D wastes by both formal and informal entities as it is highly profitable. Metal construction products are therefore inherently low waste products through all phases of the design, production, and construction and deconstruction process. Designers and specifiers are confident that, by choosing metal construction products and systems, material resources are optimized, waste is minimized, and recycling is maximized.
- **Oil and Paints:** Much of the waste comes from common construction materials with prominent examples of the hazardous wastes coming from lead, asbestos, plasterboard, paint thinners, strippers, mercury, florescent bulbs, and aerosols cans. These types of construction waste will be managed as the regulations given under Waste Management Regulations (2006) which provides for provisions applicable for the management of hazardous and non-hazardous wastes chemicals.
- **Paper and Cardboards:** Paper and paper board is another type of waste material which is estimated to comprise one-third of construction and demolition waste by volume. These waste materials are recycled and reprocessed to produce new paper products.

- **Plastics:** The plastic waste is best possible for recycling if these materials are collected separately and cleaned. Recycling is difficult if plastic waste is mixed with other plastics or contaminants. Plastic may be recycled and used in products specifically designed for the utilization of recycled plastic, such as street furniture, roof and floor, PVC window noise barriers, cable ducting, panel.

Reuse is by far the most environmentally friendly E-waste disposal technique and many charities will gladly accept old electronic devices that can then be refurbished and redistributed to people in more disadvantaged communities. Recycling remains the most effective way to keep E-waste from damaging our environment and our health.

- **Silt and Sludge:** During the construction and demolition phase, especially in the water sector, silt and sludge interception should be carried out on all runoffs and pumped water from sites.
- **Tiles and Ceramics:** Majority of Tiles and Ceramics generated as part of the construction and demolition works are expected to be clean, inert material and should be reused and recycled where possible.
- **Timber:** Timber waste from construction and demolition works is usually in large quantities. All the timber arising from these wastes can still be re-used in other construction projects after cleaning and de-nailing and sizing.
- **Waste Electrical and Electronic Equipment (WEEE):** E-waste is a popular, informal name for electronic products nearing the end of their "useful life." Computers, televisions, VCRs, stereos, copiers, and fax machines are common electronic products. Many of these products can be found in construction and demolition wastes and can be reused, refurbished, or recycled.
- **Other C&D Wastes:** There are other constructions and demolition wastes which are still at their emergent stages and have not been properly identified using any standards hence can only be considered past their emergent stages. These waste types and their management strategies can be considered in line with various advisories and studies undertaken by their modelers.

6.5 Current CDWM Practices

6.5.1 Planning for C&D Waste Management

Project developers are responsible for coming up with a development plan before the commencement of the project. Through planning, some developers have been able to organize their construction and/or demolition projects hence making fewer mistakes leading to fewer wasted materials on construction and demolition sites. Before the process of construction and demolition is implemented, a detailed waste plan is done that incorporates the following to reduce waste disposal:

- Account for potential waste
- Provide jobsite with recycling, compost, and waste bins.
- Calculate the exact number of materials, only order what is needed.

- Identify recyclable materials.
- Educate workers on sorting waste as produced.

6.5.2 Deconstruction Instead of Demolition

Deconstruction is an alternative to demolition and has been applied by a few developers as a reuse strategy. The process of deconstruction is selectively disassembling a building, piece by piece to preserve materials, and eliminate waste. These salvaged materials are reusable and transformable into valuable resources that can be sold to future construction projects.

A standard demolition uses a deconstruction process to remove high-valued and reusable materials. Deconstruction optimization should be encouraged to ensure there are higher chances of recovering reusable materials as opposed to focusing on material disposal hence benefiting more than just the environment.

6.5.3 Reusing instead of cutting new materials

To reduce construction waste, most construction sites have implemented the reusing of materials as much as possible. This is done following the construction site waste management processes which may include all or some of the following:

- Placing materials that are in good condition in another location to keep them safe and out of the way.
- Examining the reuse pile to see if more waste can be reduced. For example, do not cut a 15-foot piece of lumber for a smaller part if there are shorter pieces in a pile.
- Chopping wood can be used as mulch if it is not stained or painted.
- Directing subcontractors to collect and save scrap at cutting and fabricating locations.

6.5.4 Recycling what is not Reusable

Most of the C&D waste is generated during the initial construction phase and during the demolition of development projects. This is either done by individual developers at the individual level or by contractors who are the major waste generators.

Very few individuals segregate wastes during construction or demolition processes at the household level.

There is also minimal waste segregation at major construction and demolition sites within urban and rural areas by contractors undertaking these processes. Recovery of recyclable items which includes concrete, bricks, asphalt, plastics, paper & cardboard, glass, metals, E-wastes, and others is done increasingly by informal waste collectors and groups.

Construction sites are slowly embracing the placing of recycling bins on jobsites for workers to sort materials. However, for most construction sites, there is a designated location for all waste referred to as the waste collection center or point where all wastes are heaped irrespective of their type and then the segregation is done at the point of disposal.

6.5.5 Reducing Packaging

It is estimated that 10-12% of construction waste comes from paper and cardboard. While it is important to protect new materials to the site, most construction site managers and developers can direct their suppliers and the sub-contractors to reduce non-essential packing and packaging. Currently, the paper and cardboard waste management practices are listed as:

- Purchasing materials in bulk amounts and avoiding individual packaging with purchases in volume amount.
- Using returnable containers and packaging materials.
- Reusing non-returnable containers as much as possible. That includes using tubs, barrels, and buckets to hold materials.
- Donating non-returnable containers that are not in use to community organizations e.g., community service groups, schools, shelters, and youth groups can use them.

6.5.6 Subcontracting C&D Waste Collection, Transportation and Recycling

Some construction sites have contracted local C&D waste collectors who collect transport and recycle the waste materials for their market niche. The contractor can contract a contractor that deals with specific materials generated as waste within the sites or contract a general waste contractor that provides a one-stop service that takes separate receptacles for recycling materials and waste.

6.6 Challenges in the Current CDWM Practices

Due to a variety of circumstances, waste management in Kenya has remained a significant concern. These include issues with waste management procedures, a lack of information, a lack of understanding and practices, a lack of political will, and a lack of technical and financial resources. The challenges are experienced from the upstream to midstream and finally the downstream stakeholders.

6.6.1 Upstream Industry – Sources of CDW

6.6.1.1 Gaps of Legal System and Lack of Supervision of the Market

It is generally believed that CDW is an inert material, non-toxic and odorless and public complaints are minor. Environmental and resource conservation awareness is weak and impacts on public safety are not considered. For example, the construction laws and government solid waste announcements do not consider CDW but rather categorize them as part of solid waste generally, and there are no provisions on

building demolition. The law is more focused on construction and its various processes but overlooks C&D wastes. There is a lack of waste prevention and minimization concepts. There is no CDW generation statistical system or unified calculation standard. The existing regulations do not have any quantitative targets on CDW emission, recycling and disposal, or standards and requirements on CDW pollution control, which brings difficulties in the actual management. The existing management is basically following the mode from the era of planned economy, i.e., the CDW administrative units bear the responsibilities of qualification approval and shoulder the tasks of supervision and law enforcement. This kind of arrangement mixes administration and enforcement and weakens the effectiveness of macro management functions, which has seriously limited the development of CDW recycling.

6.6.1.2 Unsorted CDW affects resource treatment costs and product quality.

Currently, waste demolition is not mandatorily separated from recycling and reuse: the management of demolition waste is not regulated, and there is a lack of evaluation of both construction and demolition waste and detailed management. Specifically, engineering demolition is generally done by a demolition company. Due to the absence of regulation on sorting and storage, (except metals), demolition enterprises will store waste concrete, broken brick, soil, wood, and plastic together, sometimes also with domestic garbage. The CDW recycling enterprises must sort the waste. This significantly increases the treatment cost, and the quality of recycled products is also affected.

6.6.1.3 Lack of appropriate provisions, randomly dumping hard to stop.

At present, the development plans do not make it mandatory to include construction waste disposal costs but have construction waste collection fees only, which has not changed for many years and is generally low. At the same time, random dumping of construction waste has not been recognized as a serious crime, attracting just simple low fines, and most contractors are more interested in short-term profits. Most CDW is dumped directly even though the CDW recycling enterprises suffer from a lack of materials.

6.6.1.4 Stakeholder Analysis

The project owner, construction unit, design consultants and government are involved at source generation. The project owner is the major player during demolition and construction; at the source generation stage, the project owner is in the center. The major concerns of design consultants include incorporating their ideas into the building while meeting the requirements of the project owner, completing as many works as possible in the shortest time, and accomplishing work which complies to the standards. The construction unit is concerned about how to complete the construction at the fastest rate and with the least resources and cost inputs. The government expects less CDW generation. Their expectations, responsibilities and obligations should be properly coordinated.

6.6.2 Midstream Industry – Recycled CDW Products

6.6.2.1 Management of the construction waste transportation industry

The construction waste disposal administrative licensing and other construction licenses are not bound to each other. Approval documents, engineering drawings and other relative materials of the construction project are submitted to the approval authority, i.e., the local and national government for the administrative licenses. However, the relative procedures and filings required are not aligned appropriately in compliance with the regulations. Uncontrolled dumping of CDW while CDW recycling plants suffer from shortages of material is quite common. The cooperation and linked enforcement mechanism is insufficient between functional departments of governments at the local and national. Traffic police, public security, housing construction, urban authorities and highways authorities are all involved in CDW transportation. Nevertheless, the departments lack cooperation and information sharing, which results in low efficiency.

6.6.2.2 Difficulties in land use approval for CDW recycling

At present, CDW land use is not guaranteed. The high cost of CDW transport results in reliance on nearby land. However, the CDW recycling land is not included in the urban construction plan in many urban centers and the investment for CDW recycling does not meet the marketization standard. Thus, the land problems hinder CDW recycling development.

6.6.2.3 Environmental assessment approval for the CDW recycling project is difficult

The products of CDW recycling enterprises are mainly construction materials, belonging to the “construction and processing enterprise” category. Construction material processing enterprises are forbidden to build factories in urban areas by the environmental authorities and environmental departments of many local governments in compliance with the laws and regulations, which may add difficulties for the factories to obtain authorization under the EIA process. Meanwhile, to demonstrate the environmental friendliness of CDW recycling, as well as to facilitate the administrative permit, if the word “waste” remains in the project name, the residents disagree with the construction of such facilities and the negotiation with the residents is difficult.

6.6.2.4 High costs and investment in CDW recycling

At present, the Kenyan CDW recycling industry is still in the primary stage. Due to the diversity and complexity of the raw materials of CDW, the underdevelopment and high cost of relative disposal technologies and equipment, as well as the costly environmental investment, recycled CDW products are high price and consequently cannot achieve good sales. Although it may involve the government administrative departments, demolition units, transport enterprises, construction units, using unit for the development of CDW recycling, the industrialization for CDW recycling needs negotiation and coordination among the entire industry chain.

6.6.3 Downstream Industry - Utilization of Recycled CDW Products

6.6.3.1 Lack of mandatory regulations for recycled CDW products

Government should require that the infrastructure engineering investment by governments (including roads, landscaping, public toilets, garbage buildings, pavements, river channels and embankments) use a certain percentage of recycled CDW products according to the relative proportion of the region. However, the execution of the regulations remains to be enacted, in which the recycled CDW products will be more than demand and products for public infrastructure are unavailable. Meanwhile, the above regulations will widen the application scope of recycling products, which expands the actual application.

6.6.3.2 Lack of completed standards for recycled CDW products

Although the production standards are generally complete, the corresponding evaluation and product certification standards for recycled CDW products are incomplete and insufficient, which prevents construction units from judging the current products correctly, resulting in reduced use of recycled CDW products.

6.6.3.3 Lack of price competitiveness for recycled CDW products

Screening, crushing and other relative treatment processes are needed for recycled CDW products, which increases the labor and relative processing costs. Also, the promotion costs are rising considering the lack of subsidies, which decreases the price competitiveness of recycled CDW products.

6.6.3.4 Traditional conception hinders the use of recycled CDW products

Recycled CDW products are mainly recycled aggregate, recycled brick, and recycled concrete, which illustrates the products' characteristics well. But this kind of nomenclature is not in accordance with any current standards, which increases the engineering difficulties. Also, developers do not agree to use words like "recycled" and "garbage" when describing construction materials, as it is unacceptable for the public and may influence the sales of houses.

6.6.4 Obstacles in Promoting Recycled CDW Products

Based on the above analysis, the obstacle to the market promotion of CDW recycling comes from various parts of the construction industry value chain, involving not only influences of macro-level policies, but also micro-level problems arising in the development of enterprises.

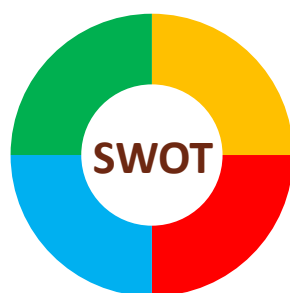
6.7 SWOT Analysis

To lay the groundwork for our future actions, this part analyzes the complete range of the situational analysis of waste management in Kenya by identifying the strengths, weaknesses, opportunities, and threats (SWOT).

To evaluate the current state of CDWM practices in Kenya, the SWOT analysis method was used. The steps used in the SWOT analysis can be described as follows: collect and evaluate data and information from relevant stakeholders, classify the collected information into four SWOT factors: strengths, weaknesses, opportunities, and threats, develop a SWOT matrix, and develop strategies as defined in the SWOT matrix.

The matrix examination is provided in the figure below.

Figure 9: SWOT Analysis



STRENGTHS

- I. Strong awareness at the county governments for the promotion of waste management.
- II. The county government has established an environmental department headed by members of the county committee (CEC).
- III. Most county governments have inspection units for ongoing constructions and demolitions.
- IV. County governments are increasingly investing in Construction waste management.
- V. County governments have designated waste disposal sites.
- VI. There are by-laws governing general waste management in the counties.
- VII. NEMA has licensed several waste management companies to deal with diverse waste streams which include construction and demolition wastes.
- VIII. There is a growing public-private-partnership (PPP) in the waste management sector.
- IX. The public is increasingly embracing waste management systems of reuse, segregation, collection, transportation, recovery, and disposal.
- X. The public is increasingly becoming aware of their collective right to a clean and healthy environment therefore increasingly agitating for this right to be addressed.

OPPORTUNITIES

- I. Increased employment opportunities through varied C&D waste-based enterprises focused on C&D waste recovery, reuse, and recycling.
- II. Adoption of emerging technologies in CDW management.
- III. Increased public awareness on C&D waste management and related opportunities that comes with reduction, reuse, and recovery.
- IV. Investment opportunity in C&D energy recovery.
- V. Increased involvement of the private sector.
- VI. A growing economy focused on job creation.
- VII. Good relationship with the development partners in C&D waste management.
- VIII. Improved governance at the national and county government.
- IX. Inclusion of building code within the NCA Act 2011.
- X. The Government Priority of the MTP4 (2022-2027) and the Bottom-up agenda.

WEAKNESSES

- I. Inadequate training personnel in CDWM.
- II. Inadequate political goodwill at both the national and county governments.
- III. Low priority to construction waste management hence low budgetary allocation by the national and county governments.
- IV. Poor capacity of construction and demolition units at county and national governments.
- V. Poor public perception of individual responsibility towards CDW management
- VI. Inappropriate location of Recycling and Disposal sites.
- VII. Poor and inadequate machinery for CDW management at the county governments and private firms.
- VIII. CDW is not recognized as a land use hence no land is set aside for its management therefore limited to the designated general wastes disposal sites.
- IX. Tolerance by the public to live in a CDW environment.
- X. Intolerance of the host communities to new CDW management firms and organizations.
- XI. Poor infrastructure hinders the collection of C&D waste in informal settlements.
- XII. Land grabbing of land set aside for waste sites by the national and county governments.
- XIII. Political patronage towards CDW management facilities including private entities.

THREATS

- I. Grabbing of disposal sites.
- II. Illegal gangs in the waste management sector have instilled insecurity.
- III. The conflict in land use between waste management and other competing uses.
- IV. Political interference and patronage.
- V. Civil strife leads to damage of existing waste management systems.
- VI. Slow rate of technology adoption for C&D waste management.
- VII. Cross-cutting issues such as insecurity, HIV/AIDS, COVID-19, and corruption.
- VIII. Non-compliance of various stakeholders with the set construction standards.
- IX. Foreign contractors being major players in the construction industry.
- X. Lack of legal framework on C&D waste management and collaborations between the national and county governments.
- XI. Misconstrued understanding of NCA mandate and that of various departments within the county government.

Section 7: C&D Waste Management Strategic Goals, Objectives, and Targets

7.1 Introduction

The Kenya Construction and Demolition Waste Management Strategy and Plan have identified the following overarching strategic goals. This strategic plan provides a roadmap of an array of activities to implement at the national level following an outlined strategic action plan. The county governments and other stakeholders in the construction sector are also encouraged to develop their CDW management plan based on this sector strategy and in line with the priority areas that have been identified. The Strategic Priority Areas identified are:

Strategic Priority 1:	Review and Revised CDW Management Policies and Regulations
Strategic Priority 2:	Capacity Development, Awareness Raising and Advocacy
Strategic Priority 3:	Improving CDW Management Infrastructure
Strategic Priority 4:	Improving CDW Management Funding and Resources
Strategic Priority 5:	Ensuring Sustainable CDW Management through Regular Review, Monitoring, Innovation, and Improvement.

While focusing on the priority areas, the strategy will also put focus on the areas that include community participation in CDW Management, construction and demolition during emergency situations, pollution to the environment and general human health at the primary C&D waste generation points.

7.2 Strategic Priority 1: Review and Revised CDW Management Policies and Regulations

This strategic priority focuses on the development, review and revising of CDW Management policies, guidelines, and standards to strengthen and promote C&D Waste Management in a circular economy at the national and county levels.

7.2.1 Strategic Objective 1: Strengthen Policies and Regulatory Structures and Systems Involved in C&D Waste Management

The management of Construction and Demolition wastes in Kenya remains elusive as there is no clear process as to how these wastes should be managed and more so to achieve a circular economy in the construction sector. The Solid Waste Management Act aims to guide all the stakeholders involved in handling all forms of solid waste, including construction and demolition wastes. The act is aimed at protecting the community from poor disposal and handling practices of these wastes however there is a need to strengthen and, in some instances, provide regulatory structures that streamline the management of these wastes in Kenya.

7.2.1.1 Disseminating the National Waste Management Strategy and the Strategy Implementation Plan for the Construction Sector

The National Construction Authority (NCA) together with its partners at the national level will strive to disseminate the National Waste Management Strategy and the accompanying strategy implementation plan for the construction sector with a view to facilitating a clear framework for the management of construction and demolition wastes geared towards a circular economy.

7.2.1.2 In collaboration with other Government Agencies develop and Review Legal and Regulatory Frameworks at the National and County Levels

- **Develop and Review National Guidelines for C&D Waste Management:** This is to enable the stakeholders involved to use the guidelines as a focal point for the management of C&D wastes geared at a circular economy in the construction sector. There is also a need to develop standards of practice for managing C&D wastes and in this context, a standard code of practice for C&D waste generators and handlers should be developed and implemented at the source level.
- **Developing and Reviewing Existing National Policies, Regulations and Guidelines:** This is to enable in identifying the existing rules that should guide the C&D waste management and further promote the realization of the circular economy in the construction sector. Also, it is important that through NCA, the national government develops a prototype County C&D Waste Management Bill.

7.2.1.3 Standardizing the C&D Waste Management Practices

- **Developing a National C&D Waste Management Standard Practices for the Construction Sector:** The standard procedure should require that the C&D waste generators put in place acceptable procedures for C&D waste management and the requirements for C&D waste disposal embracing the circular economy. The NCA is to develop and review standard operating procedures to be used during the construction and demolition process. With this in place, every person involved in C&D waste management can be defined by the role they play and their responsibilities. This should form a baseline for which the C&D waste management can be monitored. It is important for the construction sector and particularly the waste generators to develop standard operating procedures on C&D waste management that is consistent with the national standards of practice. The standards of operations adopted in C&D waste management should endeavor to harmonize the operations of C&D waste management across the construction industry and be able to reinforce the realization of a circular economy in the sector.
- **Regulating C&D Waste Management Practices:** NCA having attained the Quality Management Systems (QMS) certification ISO 9001:2015 standard which was awarded in 2017 by KEBS as the certifying body and having renewed this in 2021, strives to regulate standards in the delivery of services

in the construction sector through quality assurance strategies. Among the strategies is the provision of required resources to allow for quality work and mainstreaming of both staff motivation and staff competence. The limiting factors to C&D waste management include but not limited to inadequate training, lack of resources, and lack of standard guidelines both at the national and county government levels. The provision of a National Standard for C&D waste management should therefore be accompanied by the required resources to achieve success in realizing a circular economy in the industry.

7.2.1.4 Expected Deliverables (Strategic Objective 1)

- Disseminated Strategic Plan on C&D Waste Management.
- Developed CDWM Policy targeting developers, contractors, and construction workers.
- Developed National CDWM guidelines.
- Collaborative update of legal frameworks for the implementation of CDWM for developers, contractors, and construction workers.
- Standardized CDWM Practices amongst developers, contractors, and construction workers.

7.2.2 Strategic Objective 2: Strengthen the Governance and Institutions' Capacity for CDWM Activities at the National and County Levels

As a result of the weaknesses in institutional capacities identified, NCA is advised to establish a unit responsible for the C&D waste management and provide resources to this office for the implementation of this strategic plan and the annual operations of the unit. There should be a secretariat driving C&D waste management issues at NCA and should be drawn from the relevant units. This office domiciled at the NCA should coordinate the operations of the unit responsible for C&D at the national level. There is a need to identify the person in charge of CDWM Coordination at the national level and should be an officer based at the unit responsible for CDWM. This will strengthen and enhance the coordination and implementation of CDWM across the national and county levels.

7.2.2.1 Strengthening the National C&D Waste Management Coordination

- **Designate a County C&D Waste Management Officer:** A C&D Waste Management Officer (CDWMO) in charge of County C&D waste management should be designated in all counties across the country. The county CDWMO will be responsible for the day-to-day operation and monitoring of the C&D waste management system. It is therefore essential that the officer has direct access to all the relevant units in charge of C&D waste management and facilitates this in close liaison with other relevant government agencies at the county level.
- **Training and Information:** Involves strengthening the capacity of the designated County C&D Waste Management office through training and provision of information on CDWM and its relevance towards achieving a circular economy.

- **Health and Safety Practices for C&D Waste Generators:** C&D waste management plan and policies should include provisions for continuous monitoring of waste generators' health and safety through the observation of occupational health and safety measures. The designated County CDWM office should ensure that:
 - *Personal Protective Equipment (PPE) is provided.*
 - *Construction workers are properly trained in C&D waste management and particularly on the 3-R to waste management.*
 - *An effective occupational health programme that includes an established avoidance of waste.*
 - *There is a need for C&D waste handlers to be trained in how to manage critical and hazardous C&D waste.*

7.2.2.2 Expected Deliverables (Strategic Objective 2)

- Strengthen CDWM national and county coordination structures to continuously monitor, coordinate, and evaluate C&D waste management and implementation.
- Strengthening the partnership between various stakeholders involved in CDWM, enhancing leadership skills for CDWM at all levels of the C&D waste management systems.
- Developing and disseminating tools to assist CDWM planning will be expected to be implemented during the implementation period.

7.3 Strategic Priority 2: Capacity Development, Awareness Raising and Advocacy

Environmental education and information campaigns are critical in raising public awareness about the importance of C&D waste management and effectively motivating the industry players to engage in waste avoidance and the 3Rs which are both fundamental to achieving the goals set out. However, the lack of awareness about proper C&D waste management practices as well as the low motivation of these industry players impedes efficient integration of C&D waste management systems with the knock-on effects for Information, Education, and Communication (IEC) programmes. A policy for the management of C&D waste can only be effective if it is applied carefully and consistently at all levels of government. It is also through capacity development that standardization of C&D waste handling practices and its management can be achieved.

7.3.1 Mainstreaming Construction Education and C&D Waste Management in Curriculum and Programmes

Local policymakers, practitioners and stakeholders in the construction industry require capacity building on good C&D waste management practices and planning. Empowered local actors, particularly the county-level officers in charge of C&D can translate to an enhanced organization and implementation of C&D waste management strategy in line with specific needs and challenges. Therefore, to capacitate both the

national and county level C&D waste management, knowledge and sharing should be widely promoted, in addition to supporting the education and training of public, private, and civil society partners.

Accordingly, this strategy seeks to implement the following with a view to achieving the objectives:

- Supporting curriculum development or integration of construction education and C&D waste management topics as required.
- Collaborating with other actors involved in promoting C&D waste management education in schools to strengthen C&D waste management and 3-R activities in organizational policies and to enhance collaboration between schools and local stakeholders.
- Developing standardized training modules and instructional guides and competency-based learning materials for coordination with inter-agency bodies.
- Assist educational institutions in integrating construction management education and C&D waste management into tertiary, technical, vocational, and training curricular and community advocacy programmes.
- Establishing incentive/award system aimed at incentivizing best practices in C&D waste management; set criteria for selecting good practices and case studies, record of best practices learned using documentation and channels of communication for dissemination.
- Monitoring and evaluating construction management and C&D waste management practices with a view towards continuous improvement and replication.

7.3.2 Cadres to be trained.

Training activities should be targeted to the following main categories of C&D waste management stakeholders:

- The NCA national and county officers are responsible for implementation of C&D waste management plans and regulations.
- Both public and private developers, contractors, and construction workers.
- C&D waste collection and disposal firms.
- C&D Waste Management Champions, Volunteers and Advocators.
- Pre-service students in Construction and Waste Management.

7.3.3 Training Needs

At the National level, a Trainer of Trainers course should be carried out for National Construction Management officers who will in turn train staff in their areas of jurisdiction. Since training is continuous, the training needs for the construction sector with a focus on C&D waste management should be provided through:

- Inclusion of approved C&D waste management in the curricula of all Construction Management professionals.
- Establishment of a CDWM plan that should progressively lead the construction sector players into considering CDWM as a routine issue.
- Developing a CDWM National Training package for all stakeholders under the continuous industry education mechanisms.
- Creation of CDWM participative and practical training of trainers.
- Organizing regular initialize training on CDWM during the mega construction project launch.

7.3.4 Proposed Training Contents for C&D Waste Management

The contents of the C&D waste management should be specifically designed towards advocating for waste avoidance and the 3-Rs of waste management. The proposed package should therefore contain the following:

- Justification for all aspects of construction and demolition waste management policy.
- Explanation of the role and responsibilities of various players in the implementation of the construction and demolition strategy plan.
- Technical instructions relevant for the target group in C&D waste management should be under all or some of the headings below:
 - Definition of construction and demolition wastes.
 - Importance of proper disposal of C&D waste.
 - Classifications of C&D Wastes.
 - Handling of C&D wastes at the generation stage.
 - Handling of C&D waste at the transportation stage.
 - Handling of C&D waste at the recycling stage.
 - Safe measures when handling C&D waste.
 - C&D waste Management in a Circular economy.
 - Segregation of C&D wastes and Circular economy.
 - C&D waste disposal methods.
 - Recording and reporting accidents.
 - Laws relating to C&D waste management.
- Education on safe disposal practices and methods to all C&D waste. The public has a right and responsibility to know how to handle home-based construction & demolition waste.
- Education of health risks associated with C&D wastes to construction workers and professionals including members of the public through information education and communication materials in all media platforms.
- Monitoring and evaluation.

Table 7-1: Awareness Creation Plan for C&D Waste Management:

Target Group	Awareness Building Strategy
General Public	Radio, TV, posters, participatory education, and targeted pamphlets.
Developers, Contractors and Construction Workers	Distribution of Pamphlets and brochures on CDWM. Distribute acceptable code of practice for CDWM in construction and demolition sites. Use of relevant video clips, workshops and seminars that are targeted.
C&D Waste Scavengers, Recyclers, and Re-users	Public education awareness on the general benefits of 3-R and advocacy for circular economy in the construction sector. Use of participatory awareness training that is targeted to a specific group.

7.3.5 Follow-up courses.

A follow-up refresher training should be undertaken to provide new insights as well as orientation for both old and new players in the construction sector. This training is to update the target group on new knowledge because of policy changes and assess the new technologies in C&D waste management.

7.3.6 Expected Deliverables (Priority 2)

1. CDWM integrated to the NCA strategic plan for Construction Services delivery.
2. CDWM job aids, Information, Education and Communication (IEC) materials, and media advertisements developed.
3. Improved awareness on CDWM in Kenya.
4. CDWM awareness creation plan developed.
5. Cost of non-compliance with regulations – EIA/EA and EMCA 2012 [1999] costed.
6. Budgeting for CDWM at county budgets.

7.4 Strategic Priority 3: Improving CDW Management Infrastructure

This strategic priority focuses on improvement, standardization and enhancing access to new technologies for infrastructure, commodities, and equipment supply in the CDWM system at the national and county levels.

On improvement, the expected output will improve CDWM equipment and technical assistance on the implementation of CDWM system. Additionally, partnerships between various levels of waste generators for C&D waste pooling will be established and enhanced during the implementation planning. It will also be important to revise requirements for construction and demolition firms to have plans that incorporate CDWM infrastructure in initial designs. In ensuring that this priority 3 is achieved with effective CDWM systems the focus will be on the following objectives.

7.4.1 Strategic Objective 1: Improving Infrastructure for CDWM System

Construction and Demolition wastes are usually transported by means of one or two-wheeled loaders and lorry trucks with a special design for the waste to be transported. The transportation model is considered after reviewing several factors which include the C&D waste type, the quantity of waste to be generated, the distance to the disposal and/or recycling site, and any special condition to be taken into consideration, among others.

7.4.1.1 Determinants of C&D Waste Management Systems

The determinants of C&D waste management system, their design, development, and operations are dependent on institutional, social, financial, economic, technical, and environmental factors. However, the C&D waste management option should be efficient, safe, and environmentally friendly to protect people from voluntary and accidental exposure to the wastes when collecting, handling, storing, transporting, recycling or re-using or disposing of the wastes. Important activities include identification of available centralized C&D waste management and disposal resources. The final choice of C&D waste management system should be made carefully and based on various factors, many of which depend on the local conditions.

Table 7-2: Factors to Consider in Choice of C&D Waste Management System

Factor	Consideration
Institutional	Laws and policies allowing the implementers of C&D waste management to effectively implement an integrated C&D waste management system. This can be achieved through: <ul style="list-style-type: none"> • Establishing national and county policies on C&D waste management standards and practices. • Identifying the roles and responsibilities of each level of National and County governments. • Ensuring that the county governments have the authority and resources to implement CDW Management plan.
Social	Involves local customs and cultural/religious practices which can generally be affected or altered by sustained public education campaigns. The knowledge of these factors can determine how C&D waste is generated and disposed of. The national and county government must ensure there is stakeholders' participation in all phases of CDW management planning to help gain community awareness, input, and acceptance.
Financial	This is the most important factor to consider when implementing the CDWM plan. The sources of funds must be identified and/or created to help finance the CDWM plan. The National and County governments should identify sources that can provide funding for CDWM, including the general revenues or user fees, the private sector, and the government and international agency grants and loans and many others.
Economic	These should be differentiated from the financial factors as they are precisely the economic output of the CDWM plans which may include job creation, enhancement of public trade and tourism, political mileage, and many others. To be able to evaluate these factors, the National and county governments must calculate the initial capital investment requirement and the long-term operating and maintenance costs associated with the various C&D waste management activities.

Factor	Consideration
	In addition, there must be an evaluation of the public's ability and willingness to pay for the services and evaluate the activities based on effectiveness in handling C&D waste management for potential job creation.
Technical	<p>These are factors that will be considered when determining the equipment and facilities required for the implementation of the CDWM plan and the location where this equipment and relevant facilities will be kept.</p> <p>The determination of these factors will be dependent on geological factors, transport distances, and the project waste generation which will then become the basis for siting and designing various equipment and facilities.</p>
Environmental	<p>Every CDWM plan has a deep impact on the natural resources, human health, and the environment in general. All CDWM activities such as landfilling, or combustion must take into consideration the environmental cost of these activities and strive to minimize their effects on human health and natural resources of the area.</p> <p>In this regard, the National and County government must establish procedures to verify the protection of groundwater and drinking water and monitor compliance with the national standard to ensure that human health risks are minimized.</p>

7.4.1.2 C&D Waste Management Options

During the process of construction and demolition, rehabilitation, refurbishment, or enlargement of buildings, and other infrastructures, the construction and demolition wastes are mainly generated and composed of materials like mixtures of concrete, tiles, wood, plastic, bricks, and ceramics. It also has mixtures of bitumen, other tar products, and metals consisting of alloys. Soil is excavated from contaminated zones, dredged soil, and stones, materials used for insulation, and materials used in construction containing asbestos; materials based on gypsum and other materials mixed in construction and demolition waste. Most of the construction and demolition waste is inert, that is, non-dangerous since it does not experience any significant physical, chemical, or biological transformation at all when exposed to the outside environment in a landfill. The inert waste is not soluble and combustible and reacts neither physically nor chemically also not in any other way. The construction waste of infrastructure is non-biodegradable and doesn't affect any material which is in contact with it, also does not produce any contamination that can harm the environment or human health.

A. Supply Reduction/Reducing Materials Use

Source reduction is very effective in lessening the life cycle of material usage, energy usage, and C&D waste generation. The National Environmental Management Authority (NEMA) through the Solid Waste Management Act 2021 offers it the best priority for addressing solid waste problems that include C&D wastes. Reuse and recycling are vital strategies to sustainably manage C&D waste. Once waste has already been generated, supply reduction prevents waste from being generated within the initial place. Some examples of C&D supply reduction measures embrace the preservation of existing buildings instead of constructing new ones; optimizing the scale of naive buildings; coming up with designing of

new buildings for the ability to prolong their essential lives; usage of construction strategies that permit dismantlement and facilitate reuse of materials; using different framing techniques; and reducing interior finishes.

B. Salvaging and Reusing C&D Materials

Demolishing existing buildings and the removal of debris is not always resource economical but if undertaken, it is important to segregate the valuable C&D waste materials for more use later in a more efficient way hence economizing on the protective natural resources.

- **Deconstruction for Reuse:** Deconstruction is the method of fastidiously disassembling buildings to salvage elements for reuse and recycling. This should be applied on many levels to salvage usable materials and considerably cut waste. Deconstruction of the infrastructure has various advantages; also, it maximizes the recovery of materials, conserves finite, old-growth forest resources and provides employment and job coaching opportunities. Traditional demolition strategies permit communities to form native economic activities around producing or reprocessing salvaged materials. Diverting demolition junk should be considered for disposal and preserving resources through reuse.

C. C&D Waste Materials to Reuse

The major advantage of reusing materials is that the resource and energy use that is saved is avoided by reducing the assembly of native materials. Some items can be easily removed including doors, hardware, appliances, and fixtures of construction and demolition materials. These can be salvaged for donation or use throughout the make or for alternative jobs. Wood cut-offs can be used for cripples, lintels, and obstruction to eliminate the necessity to chop full-length lumber. Scrap wood can be broken on-site and used as mulch or ground cover. Brick, concrete, and masonry can be recycled on-site as fill, molding material, or route bedding. Excess insulation from exterior walls can be employed in interior walls as noise-deadening material. Paint can be remixed and employed in garage or storage areas, or a coat of paint on alternative jobs. Packaging materials can be sent to suppliers for application.

D. Recycling of C&D Materials

Many C&D infrastructure elements can be recycled wherever markets exist. Asphalt, and concrete, can be recommended to be recycled into aggregate or new asphalt and concrete. Wood can be recycled into engineered wood products that include furniture, mulch, and or compost. The metals embraced by steel and copper are valuable commodities that can be recycled. Additionally, though cardboard packaging from home-building sites is not classified as a C&D material, it has its method in the mixed C&D stream, and markets exist for recycling this material. The recycling of C&D wastes should follow the government's laid down procedure and standards that are recognized by this CDWM plan.

Holders or creators of demolition and construction waste, who are responsible for it must pay a significant amount for the disposal of such wastes, while otherwise dangerous, unsorted waste must incur a higher cost to avoid contamination and thus discourages mixing. The site which is to be used for landfilling should be managed properly and the dumping which takes place illegally should be banned and penalties assessed as per the prevailing regulations. Facilities like sorting and/or crushing should be made available for treating the inert part of construction and demolition waste for recycling purposes. There should be tacit acceptance by the potential users of recycled aggregates as an alternative to virgin aggregates and there should not be any discrimination which is based on the origin of aggregates.

The following special considerations should be made in recycling C&D wastes:

- Promoters of C&D wastes should include a specific budgetary allocation for C&D waste management and facilitate waste management plans by including them in the technical specifications or by making provisions for the use of recycled materials.
- The national and county government levels should imply the steps of C&D waste management which are approved standards recognized for the industry.
- The national government through the National Construction Authority (NCA) should fully develop a technical standard for the management of C&D waste.
- Monitoring companies in construction industry to fulfill their obligations in the management of C&D waste through legislative frameworks that encourage the same.

E. Rebuying C&D Materials

Buying the construction and demolition materials that are already used and recycling the content product to be used in native construction buildings or other infrastructure can enhance the local economy as recovered materials are usually regionally sourced. This can also lower construction and renovation prices while maintaining building operation and performance. Guarantee materials collected from recycling and reusing programs can be used once more within the manufacture of products and/or new construction, thereby totally realizing the advantages of recycling and reuse efforts.

7.4.1.3 Final Disposal Methods for C&D Wastes that fails the 3-R options.

1. Landfilling

There are two basic forms of land disposal in developing countries including Kenya: Controlled and Uncontrolled. In this process, the C&D waste that cannot be reused or recycled is separated out and spread as a thin layer in low-lying areas across towns. A layer of soil should be added after each layer of C&D waste.

Once this process is complete, the area should be declared unfit for construction of buildings for the next 20 years and instead can be used as a playground or a park.

2. **Incineration**

This process of controlled combustion should be used for C&D waste that is hazardous in nature to reduce them to incombustible matter such as ash and waste gas. The exhaust gases from this process may be toxic hence should be treated before release into the environment. This process has been noted to reduce the volume of C&D waste by at least 90 percent and is considered one of the most hygienic methods of waste disposal. In some cases, the heat produced is used to produce electricity. However, reservations should be made where possible due to the emission of greenhouse gases such as carbon dioxide and carbon monoxide.

3. **C&D Waste Compaction**

C&D Wastes such as glass, metal cans, and plastics can be compacted into blocks and sent for recycling. This process is encouraged as it prevents the oxidation of metals and reduces airspace needs hence making transportation and positioning easy.

7.4.1.4 **Priorities for Managing C&D Wastes**

- **Promoting the Adoption of C&D Waste Management:** In promoting the adoption of C&D waste management, strategies should be put in place that directly target builders, architects, developers, demolition companies, and other generators of C&D waste. These strategies should encourage reduction, re-use, and recycling (3Rs) that also promote the protection of human health and the environment.
- **Campaigning for Market Acceptance of C&D Waste Products Reuse and Recycling:** Priority should be put in place to ensure there is a market for C&D waste products that have been either recycled or for reuse.
- **Exploring C&D Wastes as the new source of Renewable and Clean Energy:** Several technologies are used for recovering energy from the portion of C&D wastes to the related waste streams that cannot be source reduced, reused or recycled.
- **Protection of Human Health and Safety, Natural Resources, and the Environment:** To maintain a C&D waste management system infrastructure which meets all the regulatory standards required for the protection of human health safety, natural resources, and the environment. This requires the utilization of C&D waste management facilities as efficiently as possible for recovery and disposal of C&D waste.

7.4.1.5 **Expected Outputs (Strategic Objective 1)**

- Improved CDWM equipment, supplies and commodities.
- NCA Technical teams to provide guidance on implementation of the CDWM strategy at the National and County levels formed.

- Partnerships to be established with developers, contractors and construction workers in C&D waste management.
- Revised future standard operating procedures for developers, contractors and construction workers to incorporate CDWM infrastructure in the initial designs.
- Increase the number of developers, contractors and construction workers with effective CDWM systems.

7.4.2 Strategic Objective 2: Standardize Equipment for CDWM at National and County Levels

The specification and standardization for CDWM equipment will be developed during the period of this and where possible updated and then disseminated. It will also be important to strengthen capacity at all levels to quantify CDWM equipment needs and develop annual procurement plans.

The standards should address the need for uniform practice in C&D waste containment, storage, transportation, recovery and disposal. Peculiarities in the construction sector and their levels of operations as identified by the Contractor licenses provided by the NCA should be taken into consideration. The waste management practices by the construction companies, both public and private, play a critical role in the overall management of C&D waste. Some of the key measures that should be adopted during the procurement process include waste minimization; waste segregation; labeling wastes collection areas; internal transport; internal storage; special storage; and waste treatment.

7.4.2.1 Minimizing C&D Waste Generation and Production

Waste minimization usually benefits waste generators in terms of costs for the purchase of goods, waste treatment and disposal of hazardous wastes. It is important to investigate options for wastes minimization or reduction, recycling, and disseminating information to the construction companies and the stakeholders explaining feasible options. The procurement department of construction companies and the relevant agencies in the construction industry should be involved in making these important decisions on the choice of CDWM equipment for use. At the national level, consultations should be done with professional bodies in the construction sector to explore options in applicable areas.

Significant wastes reduction and waste generated in construction and demolition sites may be encouraged by the implementation of certain policies and practices such as:

- **Source Reduction:** Measures such as purchasing restrictions to ensure the selection of methods of supplies that are less wasteful or generate less hazardous waste.
- **Recyclable Products:** Use of materials that may be safely recycled either on-site or off-site.
- **Good management and control practices:** Apply particularly to the purchase and use of materials by frequent ordering of small quantities and using available materials first. Can be achieved through construction companies purchasing just enough for the required work and only reordering when required.

7.4.2.2 C&D Waste Segregation

The key to minimization and effective C&D waste management is segregation and identification of the wastes. Appropriate handling, management, and disposal of C&D wastes by type can help reduce costs and do much in protecting the members of the public. Segregation should be the responsibility of the C&D waste generator and should take place as close as possible to the place where the waste has been generated and maintained in storage areas during transport.

Since the construction sector is seeking to standardize its operations, it is important that the same system of waste segregation should be in force throughout the country. The construction and demolition companies should display the segregation charter at the source of waste generation.

However, challenging it may be, waste segregation can succeed in the construction sector when there is commitment amongst the stakeholders and if the approach chosen for waste segregation meets the local needs.

The segregation of C&D wastes on site will be based on the type of waste. Every site will therefore be required to have a **Material Recovery Station (MRS)** which is a waste sorting station where a variety of co-mingled C&D wastes materials are sorted for reuse, recycling, and disposal. At this station, a combination of both mechanical and hand-separation procedures is to be used to sort the co-mingled materials.

The Kenyan Construction and Demolition companies will adopt the following C&D waste types as the waste segregation system with their respective codes provided:

Table 7-3: C&D Waste Segregation Standard

C&D Waste Type
Asphalt
Bricks
Concrete
Debris (Mixture of several waste types)
Excavated Rocks & Stones
Glass
Metals
Oil and Paints
Paper & Cardboard
Plastics
Silt & Sludge
Soil, Sand & Dust
Timber
Tiles & Ceramics
Waste Electrical and Electronic Equipment
Other C&D Wastes

7.4.2.3 Expected Deliverables for Strategic Objective 2

- Specifications and standards for CDWM were generated and disseminated.
- CDWM Waste segregation standard with respect to waste types adopted.
- Strengthened capacities at the national and county levels on the need to develop an annual procurement plan by developers, contractors and construction workers to minimize wastes at source,

7.4.3 Strategic Objective 3: Increase Access to Emerging CDWM Technologies

To increase access to emerging CDWM technologies at the National and County levels, it will be important to link with various researchers in the identification and fostering of new technologies in CDWM infrastructure system. To achieve this, the agency will strive to introduce appropriate and effective technologies that reduce the impact on the environment and protect human health and natural resources.

7.4.3.1 Expected Deliverables for Strategic Objective 3

- Linkage with researchers in the construction industry and waste management in identifying technologies in CDWM that foster better infrastructure.
- Introduction of appropriate and effective technologies that reduce the impact on the environment and protect human health in handling C&D waste generated.

7.5 Strategic Priority 4: Improving CDWM Funding, Partnerships and Resources

Every Construction and Demolition company according to the “polluter pays” principle should be financially liable for the safe management of C&D waste generated. The cost of waste containment, collection, segregation, on-site handling, and storage should be internal to the waste generators and paid as labor and supplies costs. The cost of off-site waste management should be paid to the contractors providing the services. Most construction companies have not adequately given CDWM the serious profile it deserves in terms of budgeting towards waste management activities.

On this basis, developers, and contractors are required to regularly dedicate funds to their budget and during proposals for C&D waste management. Since it is not clear how much funds are used in the management of C&D wastes, it is important to:

- Collaborate with key agencies that are supporting C&D waste management activities in Kenya and other development partners willing to support the sector plan. It is also logical for the NCA together with the Counties’ Ministry of Transport to bring together all its development partners interested in supporting C&D waste management to enable their areas of support defined and roles allocated to achieve synchrony and avoid duplication of activities.
- Determine the costs associated with all the action items in the C&D Waste Management Plan. The plan should be drawn up, and costs itemized in a logical framework analysis. Some of the items in the plan

should include the installation of infrastructure, provision of waste generation monitoring and transportation equipment for developers, contractors and construction workers.

- Define the funding available in the CDWM vote head within NCA and establish a plan for raising additional funds needed to execute the plan. The resource gaps contained in the NCA implementation plan can be filled with funds from the development partners.
- Develop a multi-year budget to accomplish the activities in the CDW Management Action Plan. The development of the multi-year budget should consider a logical development sequence of events rolled out incrementally.

7.5.1 Expected Deliverables (Strategic Priority 4)

- CDWM budget integrated into the annual operational plan budget in the county and NCA facility levels.
- Key partnerships with various developers, contractors and construction workers.
- CDWM stakeholders' forum created at the National and County level.
- Consistent and Adequate funding for CDWM activities at the National and County Levels
- Budget code and line for CDWM created at the NCA National and County Offices
- Kenya CDWM resource-mapping report
- Framework for partner support in CDWM to include public-private-partnerships (PPPs)

7.6 Strategic Priority 5: Sustainable CDWM through Regular Review, Monitoring, Innovation, and Improvement

Monitoring system performance is fundamental for ensuring proper functioning of the overall C&D waste management system and ensuring strategy goals are achieved. Key system performance indicators should be reviewed, monitored and or measured on a regular basis to track system performance and the effectiveness of identified initiatives. In ensuring that the best practices are replicated and sustained across the country by the counties, NCA will develop a toolkit on how to implement best practices and techniques in CDWM. This practical toolkit is expected to be properly disseminated to relevant stakeholders to carry out an evaluation to pick out lessons learnt and best practices and innovations.

7.6.1 Objective and Key Activities

The objective is to ensure sustainable services through regular review, monitoring and improvement in C&D waste management at the National and County levels.

This general objective is synchronized to the following key objectives and respective activities.

- **Establishing Data Collection Mechanisms in C&D waste management at the National and county levels**
 - Instituting a coordinating committee comprising of key departments and stakeholders to review the progress of C&D waste management at the National and County levels.

- Establishing procedures for collection of relevant data on daily, monthly and or annually from the concerned stakeholders.
- Designating a data management team for tracking progress associated with implementing CDWM strategic plan.
- **Establishing a Reporting Mechanisms**
 - Present reporting of monitoring activities as an annual CDWM report
 - Prepare an overview of each proposed objective, target and activity and their achievements, challenges, and how these challenges are addressed.
- **Establishing a Communication Mechanism to Ensure Regular Consultation among Key Stakeholders**
 - Disseminate information to Kenyan citizens including via print media, hotlines, websites, radio and television, presentations, and other products and tools to be communicated in various public for a.
 - Allocate sufficient budget for monitoring and communication activities.
- **Establishing a CDWM Desk at NCA**
 - In partnership with other stakeholders the National Construction Authority (NCA) should establish a **CDWM desk** charged with the responsibility of reviewing all development projects' Environmental Impact Assessment (EIA) and specifically on CDWM before approval by the National Environmental Management Authority (NEMA).

7.6.2 Expected Deliverables (Strategic Priority 5)

The expected deliverables under this strategic priority relate to the practical implementation of CDWM plan and best practices at the National and county levels and should include the following:

- Improving management support and oversight of CDWM in line with the best practice focus
- Establishing and supporting model CDWM systems at the National and County Levels that demonstrate best practices and replicate the practices for developers, contractors and construction workers.
- Strengthening and implementing CDWM guidelines, standards, and SOPs to incorporate best practices in CDWM for developers, contractors and construction workers.

Section 8: C&D Waste Management Implementation Plan

8.1 Introduction

The plan is based on the analysis of the "Risk and Economic Analysis of CDWM" presented in section 5 and the subsequent priorities arrived at in the preceding chapters. This section gives detailed short and long-term national plans of action, coordination and supervision structures, indicators for achievement and cost implementations. The section also provides recommendations for the implementation of each priority identified.

8.2 Implementation Programme

Establishing a proper system for the management of C&D waste is important as it generates a multitude of advantages. The implementation programme consists of four priority areas which are crucial in achieving the overall aim of this strategy of identifying options for the management of waste arising from construction and demolition activities with a view to embracing the circular economy and sustainable C&D waste management. The below-listed measures shall be implemented in phases in short and long-term depending on the specific requirements.

Table 8-1: C&D Waste Management Implementation Phases Framework

Code	Implementation Phase	Explanation
1	Ongoing (O)	Measures marked in green are being implemented
2	Short-term (ST)	Measures marked in yellow will be implemented in the short-term between 2022 – 2026
3	Long-term (LT)	Measures marked red will be implemented in the long-term between 2027-2031

NCA shall periodically review the timeframes for each measure to potentially change the implementation timeframes of the measures to adapt to the changing circumstances and operational needs.

Table 8-2: C&D Waste Management Implementation Priority Area Framework

Code	Implementation Priority Area	Target Areas
	Planning & Design (PD)	<ul style="list-style-type: none"> • To improve design to ensure reuse, recycling and recovery. • To increase the recyclability of the materials at the design stage. • To improve the market for recycled C&D materials.
	Waste Management (WM)	<ul style="list-style-type: none"> • To increase the collection of separately collected C&D waste. • To reduce the amount of C&D waste generated. • To move up the waste hierarchy. • To innovate and incentivize the recycling industry.
	Quality Management (QM)	<ul style="list-style-type: none"> • To ensure better products are placed on the market. • To achieve a circular economy for construction industry materials. • To instill a behavioral change for stakeholders within the construction and demolition sector. • To develop technical standards for the construction and demolition sector.
	Policy and Regulatory Framework (PRF)	<ul style="list-style-type: none"> • To better regulate the management of C&D waste. • To enforce C&D regulations. • To cater for appropriate infrastructure for the recycling of raw materials.


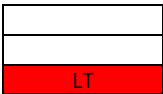
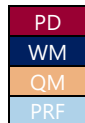

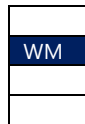
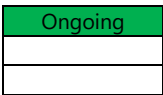
8.3 Implementation Plan and Timeframes

Generic (Based on the five priority areas of the C&D Waste Management strategy)

Priority Area	Implementation Timeframe	Year of Implementation Start	Proposed Measures	Indicators	Enablers	Approx. Budget (Kshs.)	Budget Source	
8.3.1 Result Area 1: Review and Revise CDW Management Policies and Regulations								
Strategic Objective 1: Strengthen Policies and Regulatory Structures and Systems Involved in C&D Waste Management								
1.	<div style="border: 1px solid black; padding: 2px;"> <div style="background-color: #800000; color: white; padding: 2px;">PD</div> <div style="background-color: #000080; color: white; padding: 2px;">WM</div> <div style="background-color: #FF8C00; color: white; padding: 2px;">QM</div> <div style="background-color: #ADD8E6; color: white; padding: 2px;">PRF</div> </div>	<div style="border: 1px solid black; padding: 2px;"> <div style="background-color: #FFFF00; text-align: center; padding: 2px;">ST</div> </div>	2023	<ul style="list-style-type: none"> Disseminating the National Waste Management Strategy and Strategy Implementation plan for the Construction Sector. Develop National CDWM Guidelines for developers, contractors and construction workers. Developing and Reviewing Legal and Regulatory Frameworks at the National and County Levels Standardizing the C&D Waste Management Practices for developers, contractors and construction workers. 	<ul style="list-style-type: none"> Disseminated Strategic Plan on C&D Waste Management Developed CDWM Policy Developed National CDWM Guidelines for developers, contractors and construction workers. Collaborative updating of legal frameworks for CDWM implementation at National and County Levels Standardized CDWM Practices 	NCA Counties Partners	30M	GoK Partners
Strategic Objective 2: Strengthen the Governance and Institutions Capacity for CDWM Activities at the National and County Levels								
2.	<div style="border: 1px solid black; padding: 2px;"> <div style="background-color: #800000; color: white; padding: 2px;">PD</div> <div style="background-color: #000080; color: white; padding: 2px;">WM</div> <div style="background-color: #FF8C00; color: white; padding: 2px;">QM</div> <div style="background-color: #ADD8E6; color: white; padding: 2px;">PRF</div> </div>	<div style="border: 1px solid black; padding: 2px;"> <div style="background-color: #FFFF00; text-align: center; padding: 2px;">ST</div> </div>	2023	<ul style="list-style-type: none"> Strengthening the National C&D Waste Management Coordination. <ul style="list-style-type: none"> Designating county C&D Waste Management Officer Strengthening Capacity of C&D Waste Management Office through Training & Information. Designing Health & Safety Practices for Waste Generators 	<ul style="list-style-type: none"> Designated County C&D Waste Management Office. Strengthened National & County C&D Waste Coordination Structures Strengthened partnerships between various stakeholders involved in CDWM. Health & Safety Standard for C&D Waste Generators 	NCA Counties Partners	50M	GoK Partners
RESULT AREA 1 SUB - TOTAL						80M		

Priority Area	Implementation Timeframe	Year of Implementation Start	Proposed Measures	Indicators	Enablers	Approx. Budget (Kshs.)	Budget Source					
8.3.2 Result Area 2: Capacity Development Awareness Raising and Advocacy												
3.	<div style="display: flex; flex-direction: column; gap: 2px;"> <div style="background-color: #800000; color: white; padding: 2px;">PD</div> <div style="background-color: #000080; color: white; padding: 2px;">WM</div> <div style="background-color: #FF8C00; color: white; padding: 2px;">QM</div> <div style="background-color: #ADD8E6; color: white; padding: 2px;">PRF</div> </div>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="height: 15px;"> </td></tr> <tr style="background-color: yellow;"><td style="text-align: center;">ST</td></tr> <tr><td style="height: 15px;"> </td></tr> </table>		ST		2023	<ul style="list-style-type: none"> Support curriculum development and integration of Construction Education & C&D Waste Management topics. Collaborate with partners to promote CDWM education in schools to strengthen CDWM and 3-R activities. Develop Standard Training Modules and Instructional Guides and Competency-Based materials for coordination with other collaborating agencies. Establish incentive/reward system aimed at incentivizing best practices in CDWM for developers, contractors and construction workers. Monitoring & Evaluating Construction management and CDWM practices towards continuous improvement & replications. 	<ul style="list-style-type: none"> CDWM integrated into NCA strategic plan for Construction Services Delivery CDWM job aids, information, education & communication (IEC) materials, and media advertisements developed. Improved awareness on CDWM in Kenya CDWM Awareness creation plan developed. Cost of non-compliance with regulations including EA/EIA cost. Budgeting for CDWM at the county budgets 	NCA Counties	100M	GoK Partners	
ST												
RESULT AREA 2 SUB - TOTAL						100M						
8.3.3 Result Area 3: Improving CDWM Infrastructure												
Strategic Objective 1: Improving Infrastructure for CDWM System												
4.	<div style="display: flex; flex-direction: column; gap: 2px;"> <div style="background-color: #800000; color: white; padding: 2px;">PD</div> <div style="background-color: #000080; color: white; padding: 2px;">QM</div> <div style="background-color: #FFFFFF; color: black; padding: 2px;"> </div> <div style="background-color: #FFFFFF; color: black; padding: 2px;"> </div> </div>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="height: 15px;"> </td></tr> <tr><td style="height: 15px;"> </td></tr> <tr style="background-color: red;"><td style="text-align: center;">LT</td></tr> <tr><td style="height: 15px;"> </td></tr> </table>			LT		2024	<p>Determine CDWM Systems for various C&D Wastes</p> <ul style="list-style-type: none"> Institutional Social Financial Technical Economic Environmental 	<ul style="list-style-type: none"> A standard for CDW Management System determinants for developers, contractors and construction workers 	NCA Partners	Dependent on county needs and policy plans developed for the same	GoK Partners
LT												

Priority Area	Implementation Timeframe	Year of Implementation Start	Proposed Measures	Indicators	Enablers	Approx. Budget (Kshs.)	Budget Source
			Outlining CDWM Options <ul style="list-style-type: none"> Supply reduction / reduce material use. Salvaging & Reusing CDW materials CDW Materials for Reuse Recycling CDW materials Rebuying CDW Materials 	<ul style="list-style-type: none"> A standard outline for available CDWM options for each type of CDW. Improved CDWM Equipment and materials Partnerships established at various levels of stakeholders in CDWM 	NCA Partners	Dependent on county needs and policy plans developed for the same	GoK Partners
			Outlining the Final Disposal Methods for CDW <ul style="list-style-type: none"> Landfilling Incineration C&D Waste Compaction 	<ul style="list-style-type: none"> A Standard outline for Final CDW Disposal Methods 	NCA Partners	5M	GoK Partners
			Setting Priorities for CDWM <ul style="list-style-type: none"> Promoting the Adoption of CDWM Campaigning for CDW market acceptance for Reuse & Recycling Exploring CDW as new source of Renewable Energy Protecting Human Health Safety, Natural Resources, and the Environment 	<ul style="list-style-type: none"> A Standard Priority Listing for CDWM NCA Technical team providing guidance on CDWM strategy implementation formed at National and County levels. Revised SOP for Developers, Contractors, and Construction workers to incorporate CDWM. Increased number of Developers, Contractors, and Construction workers with effective CDWM 	NCA Partners	10M	GoK Partners
Strategic Objective 2: Standardize Equipment for CDWM at National and County Levels							
5.			2024	Minimizing CDW Generation & Production through: <ul style="list-style-type: none"> Source Reduction Recyclable Products Good Management & Control Practices 	<ul style="list-style-type: none"> Strengthened capacities at National & County Levels to reduce CDW at source 	NCA Counties Partners	
			Establishing a Waste Segregation Standard <ul style="list-style-type: none"> Establishing a Material Recovery Station (MRS) Adoption of CDW types as segregation Method 	<ul style="list-style-type: none"> Specifications & Standards for CDW generated & disseminated. CDW Segregation Standard with respect to Waste Types adopted 	NCA Counties Partners		

Priority Area	Implementation Timeframe	Year of Implementation Start	Proposed Measures	Indicators	Enablers	Approx. Budget (Kshs.)	Budget Source	
Objective 3: Increase Access of Emerging CDWM Technologies								
6.			2024	<ul style="list-style-type: none"> Increase emerging CDWM technologies at the National and County Levels 	<ul style="list-style-type: none"> Established linkage with researchers in Construction & Waste Management. Availability of appropriate and effective technologies that reduce impact on the environment and protect the human health in handling C&D wastes generated. 	NCA Researchers Partners	Dependent on the linkage potential as well as the kind of support required.	GoK Partners
RESULT AREA 3 SUB - TOTAL						VARIED		
8.3.4 Result Area 4: Improving on CDWM Funding and Resources								
7.				<ul style="list-style-type: none"> Linking up with agencies supporting CDWM activities Determining the costs associated with all the actions of CDWM Plan. Defining funding available in the CDWM vote head with NCA. Establishing a plan of raising additional funds from development partners Developing a multi-year budget to accomplish activities in the CDWM Action Plan. 	<ul style="list-style-type: none"> CDWM budget integrated into the NCA annual operational plan budget at the National and County Levels of NCA operations. National and County stakeholders' forum for CDWM created. Established NCA CDWM funding at the National and county levels realized. Kenya CDWM resource-mapping report Framework for partner support in CDWM including PPPs 	NCA Partners	Dependent on the cost of funding source	GoK Partners
RESULT AREA 4 SUB - TOTAL						VARIED		
8.3.5 Result Area 5: Sustainable CDWM through Regular Review, Monitoring, Innovation and improvement								
8.			2023	<ul style="list-style-type: none"> Establishing Data Collection Mechanism in C&D waste management at the National and county levels <ul style="list-style-type: none"> Instituting a coordinating committee comprising of key departments and stakeholders to review the progress of C&D waste 	<ul style="list-style-type: none"> Established and supported CDWM system models at the National and County levels. 	NCA County Government Partners	200M	GoK Partners

Priority Area	Implementation Timeframe	Year of Implementation Start	Proposed Measures	Indicators	Enablers	Approx. Budget (Kshs.)	Budget Source								
			<p>management at the National and County levels.</p> <ul style="list-style-type: none"> Establishing procedures for collection of relevant data on daily, monthly and or annually from the concerned stakeholders. Designating a data management team for tracking progress associated with implementing CDWM strategic plan 												
9.	<table border="1"> <tr><td></td></tr> <tr><td>WM</td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>		WM			<table border="1"> <tr><td>Ongoing</td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>	Ongoing			2023	<ul style="list-style-type: none"> Establishing a Reporting Mechanisms for CDWM <ul style="list-style-type: none"> Present reporting of monitoring activities as an annual CDWM report Prepare an overview of each proposed objectives, targets and activities and their achievements, challenges, and how these challenges are addressed 	<ul style="list-style-type: none"> Strengthened and implementing CDWM guidelines, standards, and SOPs to incorporate best practices in CDWM. 	NCA Partners	100M	GoK Partners
WM															
Ongoing															
10.	<table border="1"> <tr><td></td></tr> <tr><td>WM</td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>		WM			<table border="1"> <tr><td>Ongoing</td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>	Ongoing			2023	<ul style="list-style-type: none"> Establishing a Communication Mechanism to Ensure Regular Consultation among Key Stakeholders. <ul style="list-style-type: none"> Disseminated information to Kenyan citizens including via print media, hotlines, websites, radio and television, presentations, and other products and tools to be communicated in various public fora. Allocated sufficient budget for monitoring and communication activities. 	<ul style="list-style-type: none"> Improved management support and oversight of CDWM in line with the best practice focus 	NCA Partners	100M	GoK Partners
WM															
Ongoing															

Priority Area	Implementation Timeframe	Year of Implementation Start	Proposed Measures	Indicators	Enablers	Approx. Budget (Kshs.)	Budget Source	
11.	<div style="display: flex; flex-direction: column; gap: 2px;"> <div style="background-color: #800000; color: white; padding: 2px;">PD</div> <div style="background-color: #000080; color: white; padding: 2px;">WM</div> <div style="background-color: #FF8C00; color: white; padding: 2px;">QM</div> <div style="background-color: #ADD8E6; color: white; padding: 2px;">PRF</div> </div>	Ongoing	2023	<ul style="list-style-type: none"> • M&E Plan <ul style="list-style-type: none"> ○ Develop M&E Plan and Disseminate to Counties 	<ul style="list-style-type: none"> • M&E Plan Developed • M&E Plan Disseminated at National & County Levels 	NCA Partners	30M	GoK Partners
12.	<div style="display: flex; flex-direction: column; gap: 2px;"> <div style="background-color: #800000; color: white; padding: 2px;">PD</div> <div style="background-color: #000080; color: white; padding: 2px;">WM</div> <div style="background-color: #FF8C00; color: white; padding: 2px;">QM</div> <div style="background-color: #ADD8E6; color: white; padding: 2px;">PRF</div> </div>	Ongoing	2023	<ul style="list-style-type: none"> • M&E Tools <ul style="list-style-type: none"> ○ Develop & Adopt the M&E Tools ○ Disseminate M&E Tools to counties (Tracking Tools, C&D Site Inspection) CDWM checklist. ○ Include CDWM as part of NCA checklist 	<ul style="list-style-type: none"> • List of CDWM Tools developed. • Training Orientation & Induction& Reporting developed 	NCA Partners	30M	GoK Partners
13.	<div style="display: flex; flex-direction: column; gap: 2px;"> <div style="background-color: #800000; color: white; padding: 2px;">PD</div> <div style="background-color: #000080; color: white; padding: 2px;">WM</div> <div style="background-color: #FF8C00; color: white; padding: 2px;">WM</div> <div style="background-color: #ADD8E6; color: white; padding: 2px;">PRF</div> </div>	Ongoing	2023	<ul style="list-style-type: none"> • Integrate CDWM indicators into Construction Information System 	<ul style="list-style-type: none"> • Integrated CDWM indicators 	NCA Partners	20M	GoK Partners
14.	<div style="display: flex; flex-direction: column; gap: 2px;"> <div style="background-color: #800000; color: white; padding: 2px;">PD</div> <div style="background-color: #000080; color: white; padding: 2px;">WM</div> <div style="background-color: #FF8C00; color: white; padding: 2px;">WM</div> <div style="background-color: #ADD8E6; color: white; padding: 2px;">PRF</div> </div>	Ongoing	2023	<ul style="list-style-type: none"> • Undertake Periodic M&E <ul style="list-style-type: none"> ○ Conduct national baseline on CDWM, mid-term & end-term review of CDWM PLAN 	<ul style="list-style-type: none"> • Mid-term review report • End-term review report 	NCA Counties	50M	GoK Partners
15.	<div style="display: flex; flex-direction: column; gap: 2px;"> <div style="background-color: #800000; color: white; padding: 2px;">PD</div> <div style="background-color: #000080; color: white; padding: 2px;">WM</div> <div style="background-color: #FF8C00; color: white; padding: 2px;">QM</div> <div style="background-color: #ADD8E6; color: white; padding: 2px;">PRF</div> </div>	Ongoing	2023	<ul style="list-style-type: none"> • Operational Research <ul style="list-style-type: none"> ○ Initiate a Baseline study on CDWM in Kenya ○ Initiate and Support a Market uptake CDW uptake towards a circular economy. ○ Performance evaluation of CDWM systems ○ PPPs in CDWM 	<ul style="list-style-type: none"> • CDWM Baseline Study Report • Market Research Report on CDW Uptake towards a circular economy • CDWM Systems Performance Evaluation Report • PPPs Initiatives in CDWM 		80M	
RESULT AREA 5 SUB - TOTAL						VARIED		
THE GRAND TOTAL FOR ALL COMPONENTS OF THE CDWM PLAN IS KSHS. VARIED								

Section 9: Monitoring, Evaluation and Reporting

The Construction and Demolition Waste Management plan review the processes, implementation, and coordination framework. The plan also provides mechanisms to assess progress as implementation is undertaken with a view of either taking corrective measures or sustaining the positive trends during the implementation process.

9.1 Context of Monitoring and Evaluation

9.1.1 Monitoring

Monitoring involves the routine tracking of construction and demolition services geared towards achieving the objective of this plan which is Zero waste to achieve a circular economy. The monitoring and evaluation plan consists of systematic tracking of services and action areas to report progress. Progress shall be measured against specific targets and indicated in a performance matrix. This ensures:

- ❖ Improved waste management performance
- ❖ The Authority accomplishes its objective of a circular economy in the construction and demolition of waste management.
- ❖ There is better utilization of human resources, infrastructure and finances.
- ❖ Better management of policies, programs, and project implementations.

9.1.2 Evaluation

This involves taking a broader view while considering progress towards the construction and demolition waste objective of achieving circular economy. The evaluation provides a guideline on the following principles:

- ❖ Relevance
- ❖ Effectiveness
- ❖ Efficiency
- ❖ Impact Sustainability

9.1.3 Context of Monitoring, Evaluation and Reporting

The successful implementation of the construction and demolition waste plan depends on how effectively the plan activities, the outputs and outcomes are monitored and evaluated and finally reported. The Monitoring Evaluation and Reporting (MER) provides an avenue for tracking progress and providing an informed decision for accountability, effective service delivery, policy direction, and resources allocation.

The mechanisms to achieving the MER includes the preparation of consistent, concise and informative reports to provide performance information that can be used in decision making in new and improved ways of CDW management.

Monitoring, Evaluating and Reporting for the CDW management plan involves the steps indicated in the table below:

Table 9.1: Monitoring, Evaluation and Reporting Steps

No.	Steps	Actions
1.	❖ Collecting data and monitoring performance	<ul style="list-style-type: none"> Monitoring the performance
2.	❖ Analyzing and drawing conclusions	<ul style="list-style-type: none"> Identification of performance level Enabling data driven discussions around performance
3.	❖ Reporting and Information Sharing	<ul style="list-style-type: none"> Reporting on progress made in achieving the CDW management plan objectives. Reporting on underachievement and the reasons Reporting on areas of difficulties and the alternative solutions.
4.	❖ Improving Performance	<ul style="list-style-type: none"> Identifying and implementing improvement actions Continuously reviewing the strategy

As part of the process of achieving the MER, it is important to have a generic tool that can be used to accomplish the process. The tool below can be applied as the generic tool that can be used:

Table 9.2: Monitoring, Evaluation and Reporting Evaluation Tool

STRATEGIC ISSUE	STRATEGIC OBJECTIVE	STRATEGY	TIMEFRAME	STATUS OF STRATEGY	VARIANCE & WHY	IMPROVEMENT PROGRAMMES

Section 10: Conclusion



The strategy proposes concrete measures that are continuous, short-term, and long-term structured to make the change to a circular economy in the CDW. The success of this strategy is dependent on the participation of various stakeholders and the implementation of the measures.

While it is important to understand that the proposed measures may instill socio-economic effects, several aspects of the strategy implementation framework would need to be taken into consideration to realize the success. The NCA calls on all enablers within the Construction and Demolition chain and all the stakeholders to commit to the implementation of the strategic plan.

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Glossary of Terms

Regulators	These are government agencies, departments and levels within the Construction and Demolition Waste Management value chain charged with the responsibility of ensuring that the Construction and Demolition industry players follow the prescribed rules and laws.
Construction and Demolition Industry/Sector	Refers to industrial branch of manufacturing and trade relating to buildings, repairs, renovations, maintaining, demolition of infrastructures.
Construction and demolition (C&D) materials	means any substance, matter or thing which is generated because of construction and demolition work. It is a mixture of materials arising from site clearance, excavation, construction, refurbishment, renovation, demolition, road works, pipes and structural works.
Construction and demolition debris	Rubbish generated during construction and demolition such as cement, concrete, rubble, timber, and steel.
Construction and Demolition Wastes	Construction and Demolition Waste' includes but is not limited to waste building materials, asphalt, concrete, drywall, metals, electronic materials, glass, roofing materials, soils, wood, packaging, and rubble resulting from construction, remodeling, repair and demolition operations on pavement, houses, commercial, industrial or institutional buildings and other properties or structures
County Solid Waste (CSW)	commonly known as trash or garbage, consists of everyday items discarded by the public, many of which could be recycled, including durable goods, non-durable goods, containers and packaging and other waste.
Electronic or E-Waste	Waste that consists of electronic products nearing the end of their useful life. Many e-waste products can be reused, refurbished or recycled, and government mandates often ensure e-waste is recycled rather than sent to landfill.
End User	The consumer of products for the purpose of recycling, excluding products for re-use or combustion for energy recovery.
Green Waste	Urban landscape waste generally consists of leaves, grass clippings, weeds, yard trimmings, wood waste, and other miscellaneous organic materials.
Hazardous Waste	: waste that poses substantial or potential threats to public health or the environment and consists of four key traits: ignitability, reactivity, corrosivity, and toxicity.
Incineration	A method for the destruction of waste by controlled burning at high temperatures.
Land filling	Refers to depositing or placement of C&D materials as fill material on land, which results in an elevation of ground level. Land filling activities are usually carried out for purposes of filling up ponds; leveling off uneven ground surfaces; forming site for development e.g., landscaping, roads, village houses, car parks or recreation facilities; stockpiling in the form of a fill bank; or depositing of C&D materials onto land as dumping ground. Illegal land filling takes places on land without proper authorization of the Government authorities or consent from the landowners/occupiers.
Recyclable Materials	: waste materials that can be readily separated from the waste stream and collected for use as a substitute for new "virgin" raw materials.

Recyclables	: items that can be reprocessed into feedstock for new products. Common examples are paper, glass, aluminum, corrugated cardboard and plastic containers.
Segregation	The systematic separation of C&D waste into designated categories.
Sustainability	Meeting the needs of the present without compromising the ability of future generations to meet their own needs.
Waste Diversion	The act of preventing waste from being disposed into landfills and incinerators.
Waste Generation	The weight or volume of materials and products that enter the waste stream before recycling, composting, landfilling, or combustion takes place. Also, can represent the amount of waste generated by a given source or category of sources.
Waste management hierarchy	A ranking of waste management operations according to their environmental or energy benefits. The purpose of the waste management hierarchy is to make waste management practices as environmentally sound as possible.
Waste Reduction or Minimization	All means of reducing the amount of waste that is produced initially and that must be collected by solid waste authorities. This ranges from legislation and product design to local programs designed to keep recyclables and compostable material out of the final waste stream.
Waste Stream	The total flow of C&D Wastes waste from homes, businesses, institutions, and manufacturing plants that is recycled, burned or disposed of in landfills, often broken into different waste stream types.
Zero Waste	Designing and managing products and processes to reduce the volume of waste and conserve or recover all resources, so that 90 percent or more of an organization's waste stream is diverted from landfills or incinerators. Achieving a Zero Waste goal successfully eliminates 90 percent of discharges to land, water or air that may be a threat to planetary, human, animal or plant health.
Electronic Waste	E-waste is discarded electronic devices such as computers, TVs, microwaves, and other electronic appliances. This type of waste is also known as Waste Electrical and Electronic Equipment (WEEE).
Materials recovery facility (MRF)	A special facility for separating recyclable materials mechanically or manually. The waste is placed in different categories like glass, plastic, paper, and metal.

CDWM Strategy and Plan Terms of Reference

TERMS OF REFERENCE FOR DEVELOPMENT OF NATIONAL CONSTRUCTION WASTE MANAGEMENT STRATEGY

INTRODUCTION

The National Construction Authority (NCA) is a State Corporation established by an Act of Parliament NCA Act No. 41 of 2011. Section 5(2) (a) and (h) of the NCA Act 2011, mandates the Authority with promoting and stimulating the development, improvement and expansion of the construction industry as well as with encouraging the improvement of construction techniques. In realization of this mandate, the Authority is implementing recommendations of the research on “Construction Waste Management: Towards a Circular Economy Model” conducted in the Financial Year 2019/2020. In this regard, there is a planned development of a National Construction Waste Management Strategy which was identified as one of the gaps in the aforesaid study for improving circular flow of construction materials. NCA hereby calls for eligible and qualified consultancy firms/consortium as per the Terms of Reference included herein to Express Interest to develop the strategy.

PROJECT DESCRIPTION AND COMPONENTS:

Project description

The growth of the construction and demolition recycling market is driven by the Authority’s proactive measures to reduce illegal dumping. Based on the findings from the NCA research of 2019, the Authority aimed at developing training and capacity building programs, informing construction waste management interventions and policies. The study evaluated 6 factors: Financial, technical, environmental, institutional, socio-cultural, legal and external factors. The relationship between construction waste management practices and the six group factors were found to be significant. In addition, the findings indicated that interventions on legal factors will most significantly ameliorate construction waste management practices in Kenya. The study further established that in the presence of sector specific legal instruments to support sustainable construction waste management practices, creation and presence of construction waste markets is critical to influence behavior change in managing construction waste. Metal waste was found to have a nearly closed loop flow of materials as there exists a thriving scrap metal market in Kenya whose vibrancy in some cases has a perverse incentive for vandalism. This implied that developing a strategy and creating a virtual waste market for the construction waste materials will greatly support sustainable construction waste management for a circular economy in Kenya.

PURPOSE OF THE CONSULTANCY

The Main aim for this consultancy is to develop a national construction waste management strategy. The consultancy objectives and in this case the Terms of Reference (TORs) shall be as follows:

1. Identify key stakeholders in the construction sector to be involved in the development of the strategy.
2. Consultatively prepare a National Construction and Demolition Waste Management Strategy for the construction sector to uphold circular economy principles for socio-environmental sustainability in its different components.
3. Develop a Strategy Implementation Plan for the construction sector; and
4. Conduct a validation workshop of the Strategy and Strategy Implementation plan.

SCOPE OF WORK

The scope of the service shall include the execution of all necessary tasks and services to achieve the objectives described above.

Task One: Identify key stakeholders in the construction sector The consultant shall carry out a detailed stakeholder mapping who will be involved in developing of the Strategy.

Task Two: Consultatively prepare a National Construction Waste Management Strategy for the construction sector to uphold circular economy principles for socio-environmental sustainability in its different components. The consultant is expected to prepare a National Construction Waste Management Strategy consultatively and iteratively for the sector to uphold circular economy principles for socio-environmental sustainability in its different components.

The consultant is expected to conduct desk surveys, organize stakeholder workshops at the consultant's cost, carry out FGDs (12-14 people per FGD) and public consultation meetings countrywide, relevant data collection & analysis then produce a detailed national construction waste management strategy. For this task, the consultant can refer to external credible sources of information in relation to construction waste management and can also refer to the study by NCA on "Construction Waste Management; Towards a Circular Economy model" study report and enrich the Strategy where necessary in consultation with NCA, Manager, Research & Business Development. The Strategy will include but not necessarily be limited to:

1. Background of the Strategy
2. Objectives of the Strategy
3. Legal and institutional Framework
4. Scope of the Strategy
5. SWOT and PESTEL analysis
6. Current Status of Construction Waste Management in Kenya
7. Current Global Best practices in construction waste management (at least 4)
8. Circular economy targets/goals for the construction sector
9. Strategies for sustainable construction waste management in Kenya
10. Strategies/guidelines of implementing reduce, reuse and recycle in the project sites.

11. Sample Construction and Demolition Waste Management Plan
12. Strategy Implementation Plan Task three: Develop a Strategy Implementation Plan for the construction sector.

The consultant is expected to develop a three-year implementation plan of the Strategy.

The implementation plan shall feature the following:

- Strategies
- Respective indicators for implementation of each strategy
- Key Actors in implementation of each strategy
- Time frame in implementation of each strategy
- Budget approximation in implementation of each strategy

PROJECT GOVERNANCE

Obligations of the consultant

- i. The Consultant shall carry out this assignment as outlined in a professional manner in keeping with internationally accepted standards, using qualified and appropriate staff. The agreed deliverables and timelines should be observed.
- ii. S/he shall endeavor to provide services with diligence and within the time agreed upon in the contract. In this regard, the consultant shall submit the full curriculum vitae of each of the members of the team it proposes for the project. The consultant shall endeavor to maintain staff presented and considered qualified for nomination.
- iii. The Consultant shall be responsible for arranging for all workshops, necessary office and living accommodation, transportation, equipment and supplies, surveys, investigations, materials, secretarial services, related to the performance of this project.
- iv. The consultant shall call and organize review meetings in order to do presentation to the NCA. The meetings shall take place one week after submission of reports.
- v. The consultant shall be responsible for providing his/her staff with all their financial requirements for successful implementation of the project.
- vi. The consultant shall gather/procure all necessary data, information and equipment needed in the execution of the assignment and realization of the desired outputs.
- vii. The Consultant shall be responsible for the printing of all reports and other necessary materials required for the execution of this activity.
- viii. The consultant shall be liable to pay all duties and taxes in connection with this project including VAT and other taxes payable under the Laws of Kenya. No tax or duty exemption shall be given to the consultant. The consultant shall be deemed to have taken the above into consideration while preparing his/her financial proposal.

- ix. At the completion of the assignment, the consultant shall submit all reports and documents in soft and hard copy, working files, calculations and computer data properly organized in the English language. These reports shall include the workings, assumptions, any surveys conducted, source of obtaining information, different methodology used for reaching logical conclusion. These documents shall remain the property of the National Construction Authority (NCA) and will not be used for any other purpose other than those intended under this tender unless prior written permission is obtained from NCA. The Authority will issue a completion certificate to this effect after successful completion of the assignment.

Note:

The issues listed in these Terms of Reference are not exhaustive. While performing the services, the consultant is encouraged to use their professional judgement and experience to review all relevant factors and to bring these to the attention of the Client.



This Draft Strategy was created for the National Construction Authority by GPP Consulting Limited.



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