

AN INTEGRATED GREEN COMPUTING AND DISPOSAL
MANAGEMENT SYSTEM

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A Research Project Submitted to the Department of Computer Science in the Faculty of Business
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Award of the degree in Business and Information Technology at St. Paul's University.

2020

Declaration

I hereby declare that this is my original work and it has never been presented for the award of a degree in any other university

Signature:.....Date:.....

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This project has been submitted for examination with my approval as the University Supervisor.

Signed.....Date.....

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Dedication

I dedicate this project to my co-partners, my parents and family, my friends, my lecturer Mr. Samuel for their moral, financial support and consultation. May the almighty God bless you all.

Acknowledgement

I acknowledge the Almighty God for giving me the grace to write this proposal. Specifically, I thank Him for giving me the scholarly ideas and according me good health throughout my studies. Secondly, I thank my family for giving me support and encouragement to pursue this level of study.

I sincerely thank my supervisors for their scholarly guidance in the course of this study. I particularly thank my lecturer Samuel Karuga for creating time to review the drafts meticulously and providing quick response and guidance. I also thank him for his commitment and dedication to work with me during various stages of writing this proposal and for giving it an analytical and professional look.

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Abstract

E-waste distribution has been a global concern over the last decade due to technologies being rendered obsolete due to technological changes of due to end of life. Different countries have adopted different mechanism to cope with the rising trend in e-waste mass flows. This project looks at e-waste management in Kenya and in specific Nairobi county to assume the current situation nationally. The study uses the different data sources like the journals, reports ,conducting an interview and distributing questionnaire in order to dig deep and get all the relevant details that may facilitate in coming up with an effective integrated e-waste and distribution system. The study seeks to come up with an e-waste management and disposal system that will ensure a safe and proper structured process from collection of the waste through a request made by the various system users to the final disposal of the waste.

1 INTRODUCTION

1.1 Background information

Electronic waste (e-waste) by definition refers to electrical or electronic equipment which is waste, including all components, subassemblies and consumables which are part of the product at the time of discarding. It includes computers and entertainment electronics consisting of valuable as well as harmful and toxic components(Khutale, Yadav, Awati, & Awati, n.d.). The growth of the ICT sector has grown adversely as a result of the Kenyan government initiative to enhance competitiveness in the global information society and the fact that it is a major driver of economy. As such the cost of ICT gadgets have increased since the cost of importation is low. As the world moves toward information society, Kenya has not been left behind as it has implemented initiatives like the e-governance and e-education(Ouma, Awuor, & Kyambo, 2013) which has been highly favorable for students in institutions of higher learning during the COVID 19 pandemic. Due to this reasons there has been an increase in the acquisition and use of ICT devices like the computers to support these initiatives.

With increase in growth of use of these devices comes a higher rate of obsolesce due to technological changes to fit the current changing needs and this means that there is need to come up with a mechanism of dealing with the disposal of this large chunks of computers putting in mind social and environmental consequences that arise such as issues to do with health care and pollution of this non-biodegradable equipment's. On a report released by the United Nation, it is estimated worldwide that 50 million tones account for electronic and electrical waste (e-waste) a year with Kenya being cited as one of the e-waste dumping site as a result of lack of legislation that governs the importation of non-functional, non-reusable and obsolete electronics into the country(Arya & Kumar, 2020). As equipment reaches its end-of-life, disposal challenges arise since there are no legislations on how these activities should be carried out from collection to disposal(Songa & Lubanga, 2015). In Kenya for instance, there is no separation between e-waste and other wastes but is all under the classification of solid waste and this poses a threat as e-waste can result in severe health and environmental hazards due to highly toxic substances, such as lead and mercury that contaminate the soil and water when it is disposed of in landfills(Maimba, 2020). The local government of Nairobi has set up collection sites for e-waste that are located in WEEE centre along Kibukuroad, East-leigh e-Waste Collection Centre and MSDP e-Waste Collection Point as stipulated in the national environmental waste regulations that (1)A local government may establish collection centers for the receipt of electrical or electronic waste generated within its jurisdiction. The regulation also puts emphasis on the duty of product steward to receive electrical and electronic waste where (1) A product steward who imports, distributes or sells electrical or electronic products shall receive waste arising from those products. There is therefore a need for a system to ensure that there is a smooth sailing of activities that revolve around collection and disposal of waste.

National environmental management authority (NEMA)'s role as an agency of government is to provide leadership in pollution control, and waste management guidelines(Rithaa, 2013). As such there is need to coordinate and work together with other stakeholders on matters of waste management. It is also in charge of coming up with policies that governs recyclers, downstream vendors and collectors of e-waste to ensure that health and safety measures are adhered to. However E-waste also provides economic value towards the growth of a country through creation of employment opportunities since the gadgets can be dismantled into various parts, some of which are valuable. For instance, circuit boards contain valuable metals, including gold that can be reclaimed(Shaikh, Thomas, Zuhair, & Magalini, 2020).

1.2 PROBLEM STATEMENT

Despite the adverse use of technological devices to achieve an economy that is driven by technology, there has been an alarm raised on what to do with obsolete technology due to lack of a better system

of handling such crisis. There has been an increase in population in last decade for people who have learned to depend on the use of computing devices for their day to day activities making the number of end of life devices high and the only thing people do is store these devices in their stores or give them away to venders at a cost offer. The repair shops in town are becoming overwhelmed with non-functional devices with nowhere to take them and there arises a gap for a system that will help in coordinating a careful and secure collection and disposal of these devices.

1.3 OBJECTIVES

1.3.1 General Objectives

The general objective of the study was to assess the e-waste landscape in Kenya and specifically Nairobi and come up with a system solution that will help manage the collection and disposal of e-waste.

1.3.2 Specific Objective

The direct specific objectives of the system are as follows:

- Conduct an analysis on strengths and weaknesses of the current situation in handling e-waste.
- Develop and enlarge the network of relevant stakeholders/key players in the existing 'e-waste scene', including the repair/reuse and recycling industry, the Electrical Electronic Equipment (EEE) supply sector, as well as government administration, parastatal and corporate actors.
- Create awareness of the roadmap through workshop facilitation and media reports as necessary.
- Create a system that matches the user requirement.
- Perform a system testing to validate its functionality.
- System installation.

1.4 JUSTIFICATION

The project will be of great impact as it focuses on an issue that's has been overlooked and given little attention. The main agenda of the project is to come up with e-waste management system that will touch on almost all sectors as ICT is highly embraced within Kenya. The main beneficiaries of this system will be National environmental management authority alongside the municipal council of Nairobi who are actively involved in the collection and disposal of waste.

1.5 Scope

The product scope was limited to IT equipment; specifically personal computers (or desktop PCs), laptops (notebooks), cathode ray tube (CRT) and flat panel monitors, printers, and related computer accessories. The study will focus on one geographical area which is Nairobi which happens to be a heavy consumer of ICT products.

- Limited national capacity to process e-waste.
- Lack of a mechanism to separate e-waste from solid waste.
- Players in e-waste not recognized by the policy and legislative framework.
- Lack of coordinated approach across the Ministries to deal with e-waste.

- Lack of collection systems availability leads to e-waste being stockpiled at homes, offices and repair shops.
- Low national priority for e-waste.
- No or limited extended supplier responsibility.
- Lack of awareness of the need for an e-waste management system .

2 LITRATURE REVIEW

2.1 Theoretical Review

Kenya as a country like many other developing countries has been faced with similar challenge when it comes to e-waste management due to lack of proper regulation regulating the disposal of the waste. This has been as a result of increase in population growth that has necessitated in an increase in importation of these computing devices as the country moves toward a digitally connected society. Most of these devices become obsolete not because they have reached their end of life but because they are outdated as they are an earlier version of the current technologies meaning their performance is power as they are not well equipped to handle current tasks. For instance computers that were imported between the late 90's to the year 2012, a majority are absolute since there are new computing devices that have replaced them that are small in size with high quality performance when it comes to the speed of completing tasks. This has led to these old technologies ending up in stores as there are no proper disposal mechanism or dump sites.

The county government through the municipal council is in charge of collection of all the waste that is originating from Nairobi County and has set dump location where they collect the waste on the scheduled period. When this waste is collected, it's not sorted and with the knowledge of what implication come along with dumping computer devices, it causes more harm than good when these devices end up in landfills like for one they contain toxic chemicals that causes soil poisoning and also air pollution when burned unprofessionally. Electronic waste management is a complex process due to the diversity of the hazardous materials composition which if not handled cautiously may pose adverse effects on aerial, terrestrial, aquatic environments as well as on living beings(Robinson, 2009). Unlike other developed countries that have put in place proper management system such as the use of a dedicated landfill for e-waste, Kenya lags behind as there are no such dedicated sites.

Kenya lacks legislations that control the use of toxic materials in electronic equipment. Such materials include lead, cadmium, mercury, chromium and polybrominated biphenyl ether which is harmful substances and the people involved in the collection of this waste lack awareness of what may happen if they come into contact with this materials. The European Union for instance has a legislation that govern the control of such toxic material with the main aim being creation of collection schemes where people can drop the devices that have reached their end of life at no extra charge(Stenvall, Tostar, Boldizar, Foreman, & Möller, 2013). It is due to this reasons that there is need for an integrated e-waste management system to help in the management of such waste.

2.2 Similar Project

The following are some of the project with similar functionality.

2.2.1 Deposit-refund system

A proposal for an e-waste management system was suggested due to lack of an efficient collection, recycle and reuse system in the U.S. The core concept of the system is that consumers pay a deposit at time of purchase, a variable portion of which is returned when the device is turned in at the end-of-life. The possibility of reuse is also included in this process, in which case consumers may even receive more return than the deposit paid, for example, a functional computer still attractive for the reuse market. If the firm chooses to refurbish or resell the computer in lieu of recycling, the transfer of deposit is deferred until true end-of-life processing. This system is enabled by a cyber infrastructure which includes a radio-frequency identification device(RFID) placed on the product to track economic and material flows(Walls, 2011).

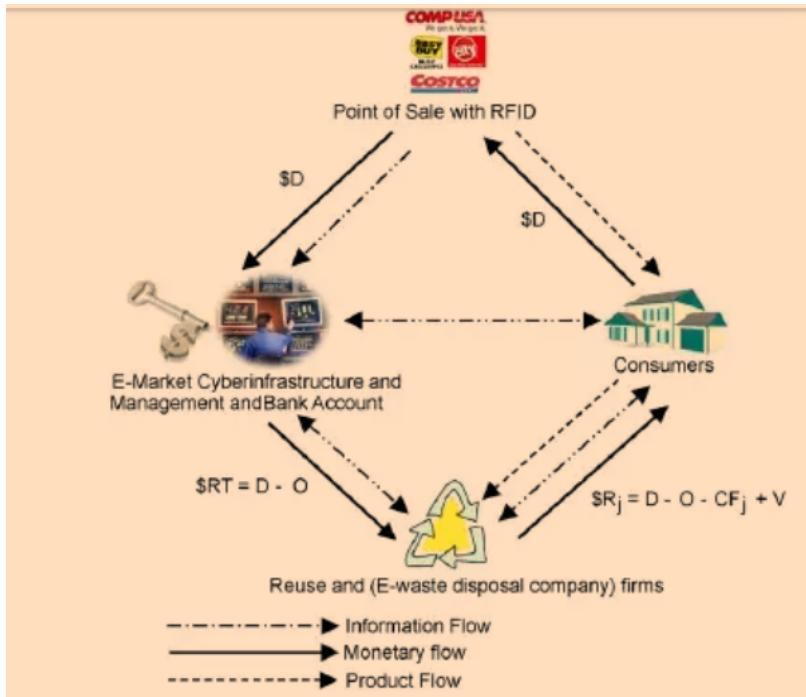


Figure 1: Deposit refund system

2.2.2 Hazardous waste transport management system

A hazardous waste shipment system provides monitoring and control to verify the location and condition of each shipment. Two-way base stations receive status and identification signals from vehicle mounted transponders as the shipments pass by, and the base stations relay the information to a central data bank. The vehicle mounted transponders may receive data from sensors that monitor the load, and may actuate alarms or a message display for operator intervention. The three-tier system also provides notifications, and safety instructions in the event of a mishap, with the base stations relaying instructions or route changes to the vehicle mounted transponders(Hassett, 1994).

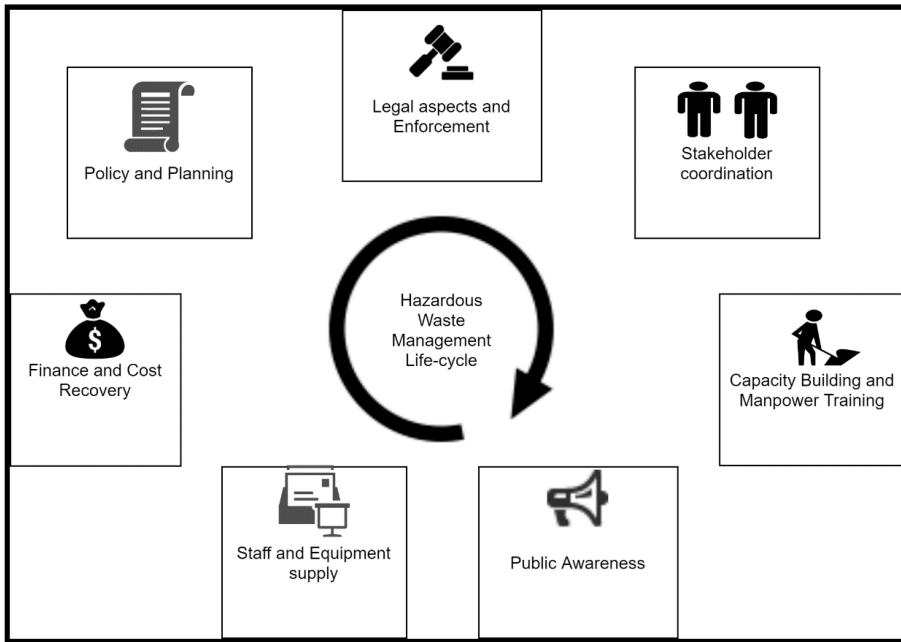


Figure 2: Hazardous waste transport management system

2.2.3 The WEEE management system in Poland

In Poland, the government has adopted a system that deals with a proper management and handling of E-waste materials as they are hazardous to the health of its citizens. The system provides a collection site where the waste is collected and processed where in this case a product may find its way to the market for use till end of life while other products are recycled for the market. The system puts into consideration the legal regulation while conducting these activities while at the same time putting into consideration the environmental aspects like location of proper landfills for e-waste, safe transportation and safety measures for the waste handlers.(Cholewa, Kulczycka, & Smol, 2016).

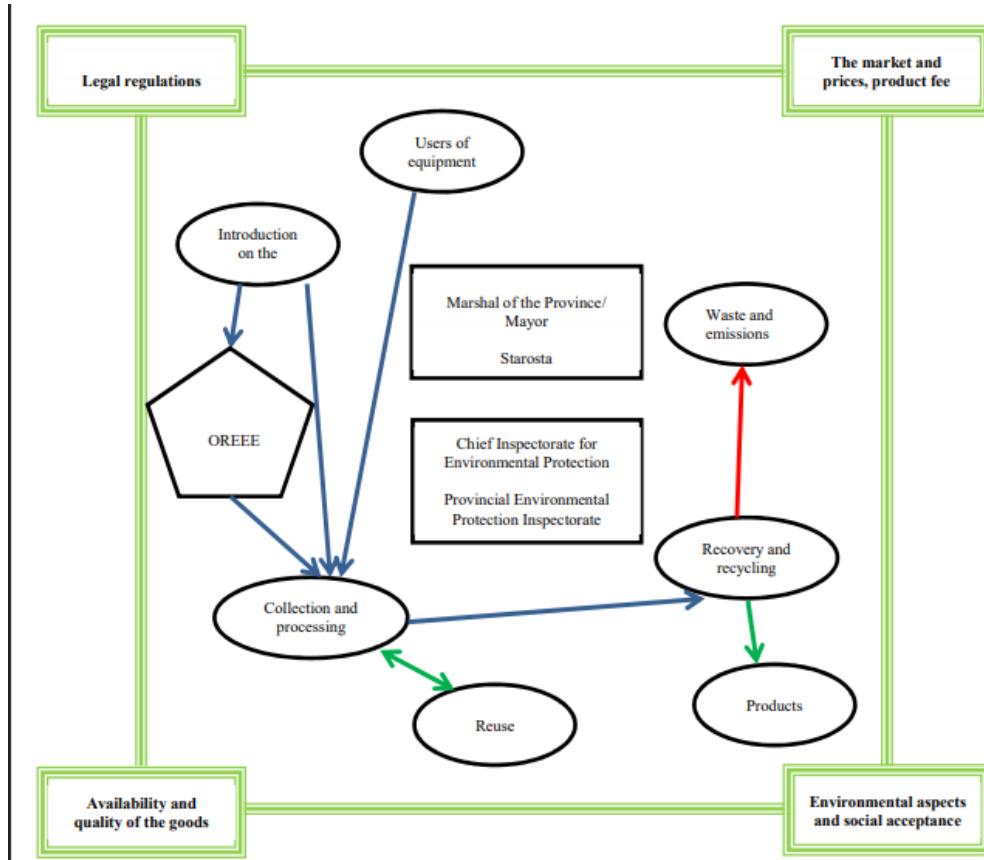


Figure 3: E-waste system in Poland

2.3 Conceptual framework

The focus for the conceptual framework is on E-waste management that has been a common problem around the world. The framework put emphasis on five main agendas which are; the resources needed, the processes from collection to disposal, the key stakeholders who will include the municipal counsel, the producers of these devices and repair shops since they are the most affected by load overload , the sources of e-waste and finally the legal framework that will govern on how electronic waste should be handled and what role every stake holder should play. The processes that will be involve while conducting the activity of collection, transportation, recycling, disassemble, extraction, incineration and disposal will heavily rely on the availability of resources such as labor, land and capital available to facilitate this activities. The figure bellow illustrates the actual framework for the system.

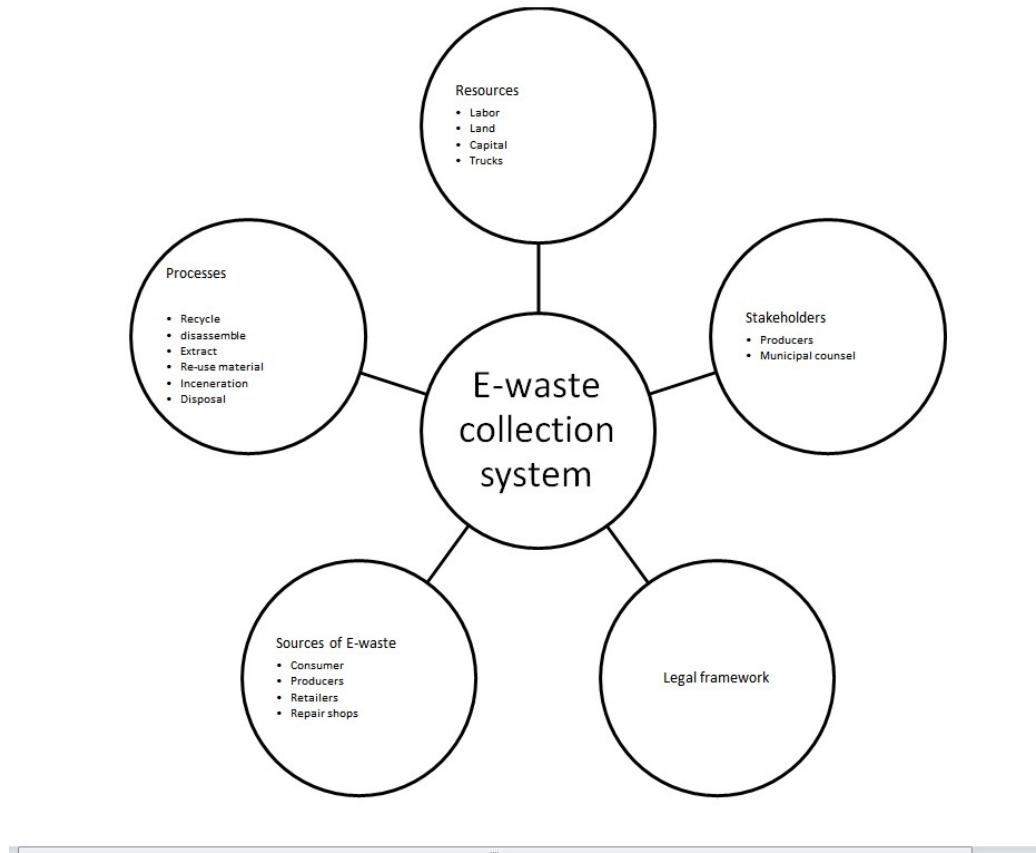


Figure 4: proposed conceptual framework

3 METHODOLOGY

3.1 Data sources

The project incorporated both the primary and secondary data sources such as the use of face to face interviews, observation by conducting site visits, use of questionnaires, journals, research articles and other publications on e-waste management in Kenya and in other countries in order to assess what needs to be done in order to manage the problem at hand.

3.2 Collection tools

The following data collection tools were used to obtain the data required:

3.2.1 Face-to-Face Interview

A face to face interview with respondents was conducted from all the concerned sectors such as the government institutions, the private institution , the non-governmental organizations and all other parties that are affected by the current situation of E-waste management due to lack of a structured system of e-waste collection. Some of the key issues that were addressed included :

- The availability modes of e-waste collection.
- Internal procedures of dealing with e-waste equipment.
- Major sources of e-waste management within each sector.
- The availability of policies on extended user responsibility.

3.2.2 Questionnaires

The project also adapted the use of questionnaires which were divided into three sets with the first set focusing on the key stakeholders such as the customers, importers, distributor, refurbishes and recycler. The second set will focus on the house holds that are located around the dump sites with the third set of questionnaire focusing on international bodies that are in charge of e-waste management Some of the data collected from the adaption of this methodology included:

- The effects of waste disposal to member living around the dump sites.
- Establishment of guidelines and policies on e-waste disposal.
- The mode of e-waste collection.
- Type of e-waste.
- Availability of policy on extend user responsibility

3.2.3 Observation

Site visits were conducted especially in second hand markets and repair shops to assess and observe the current situation and made recordings based on the situation on the ground. Some of the data collected included and not limited to the following:

- an assesment of the kind of e-waste available.
- Handling provedures for e-waste.

3.3 Architectural Framework

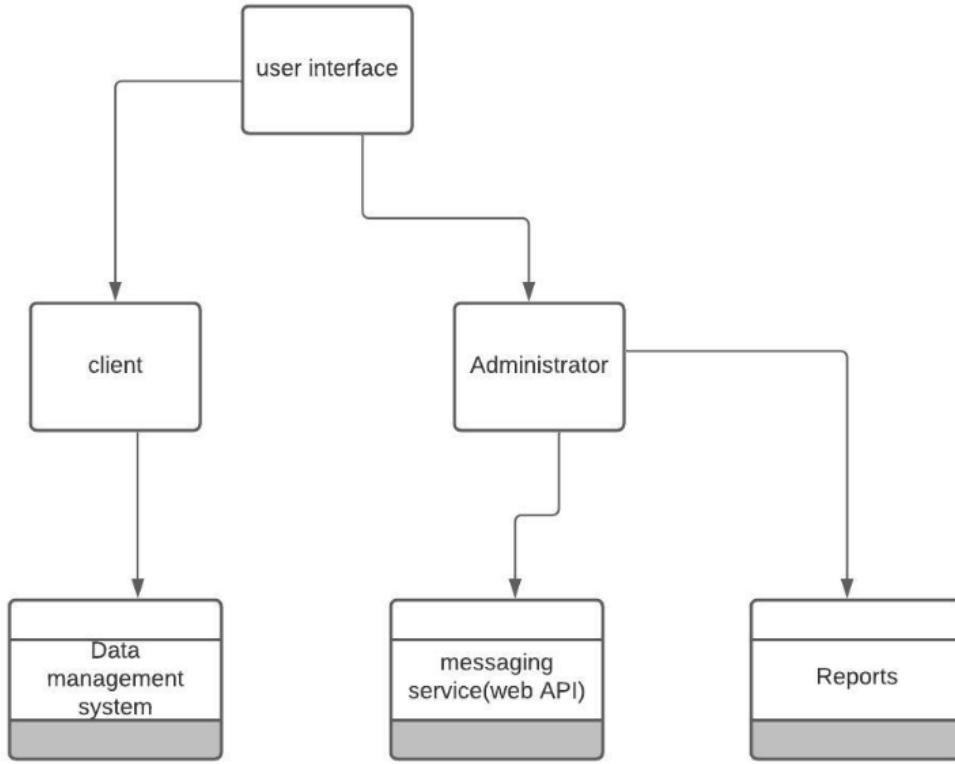


Figure 5: Architectural framework

Efforts towards e-waste management are increasingly raising concerns but there are proper handling systems that have been developed to cope with the issue uniquely since e-waste management and monitoring is not systematic. The system is web based and aim at reducing the level of e-waste. This system acts as a link between the users of the system and the recycling and disposal agencies with emphasis being put on the need for extended user responsibility policy. From this system, the different users are able to register and login with the basic login details via the user interface. The registration details are recorded and stored in the database. When the users login to the system, they will be presented with a page from where they select the item they wish to dispose from the three main categories namely computers, laptops and computer accessories. .

3.4 Relationship Between Conceptual Framework and Architectural Framework

The relationship between the conceptual and architectural framework will come into practice as the stakeholder will use the user interface to make requests for collection of e-waste by giving a detailed specification of the kind of waste they want to dispose. The database will store the requests and generate the status of the requests made, the geographical locations for the pickups making it easier for the personnel in charge of collection as the system generates a pickup location.

3.5 Project Implementation

While implementing the project, various programming languages were used for the various modules as illustrated below;

3.5.1 User Interface

When implementing the user interface, two programming languages were used namely HTML IV and CSS. This was achieved with the help of Dreamweaver which is a powerful tool for coding.

3.5.2 Data management system

The data management system was implemented using PHP programming Language. PHP is an open source server side scripting language therefor apache webserver was installed to help in running PHP. In order to use apache, I installed XAMPP software package.

3.5.3 System Database

The system database was implemented using MySQL which is an open source relational SQL database management system which with the aid of its different APIs facilitated in the creation, accessing, managing, searching and replicating the data.

3.6 Testing

3.6.1 User Interface Testing

The table below is a representation of the user interface. The data type for this field has been specified as string therefor the user should strictly insert values whose data type is string for the operation of login to be successful. This means that if the data type is not string, the operation will fail therefor not gaining the user access to the system.

Table 1: User interface testing

Test	Action	Input	Results	Status
User login	pass string name, char(10) password	string name, password	access granted	pass
User login	pass string name, char(10) password	string name, password char(13)	access denied	fail
User login	pass string name,char(10) password	integer name, password	access denied	fail

3.6.2 Data Management System Testing

The database management from the table below represents an alert table. When a collection is conducted following a request, the system passes a string status as a job commissioned but if it is assigned a different data type as integer, the outcome will be a fail as that is not the data type that is required for this field.

Table 2: Data management system testing

Test	Action	Input	Results	Status
Alert table	pass string status	commissioned	complete	pass
Alert table	pass string status	integer value	incomplete	fail

3.6.3 System Database Testing

The system database is in charge of storage, creation of tables, managing and searching for the data. In the case below, the alert tabulation is assigned a data type integer for the ID which is the primary key. The table will only accept values that are of integer data type for it to accept the data. If it is assigned a data type string, the table is bound to reject the value.

Table 3: System database testing

Test	Action	Input	Results	Status
Alert table	pass int ID	int ID	value accepted	pass
Alert table	pass int ID	string ID	value rejected	fail

4 Project Implementation

4.1

Frontend software details

The frontend of the project is developed elegantly to support a user interface that is interactive in nature and simple to use for any user.

The technology stack used for developing the front end application are as follows:

- HTML
- CSS

4.2

Backend software details

The backend of the project is running on local machine and the database is connected to a local host. The database stores/views and retrieves the details collected from each client. The technology stack for developing backend application is:

- MySQL
- PHP
- Apache (Xampp server)

4.3

Sample screenshots of the project

4.3.1

Frontend

- Home

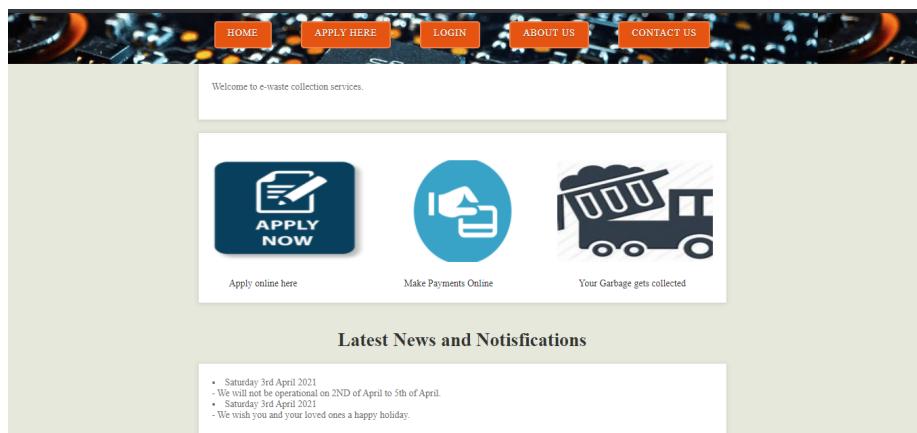


Figure 6: Home page

- About Us



Figure 7: About us

- Contact Us



Figure 8: Contact Us

- Sign-in

Figure 9: Sign in

- Login

Figure 10: Login Page

- Admin panel

The admin can make, publish and delete notifications from this page.

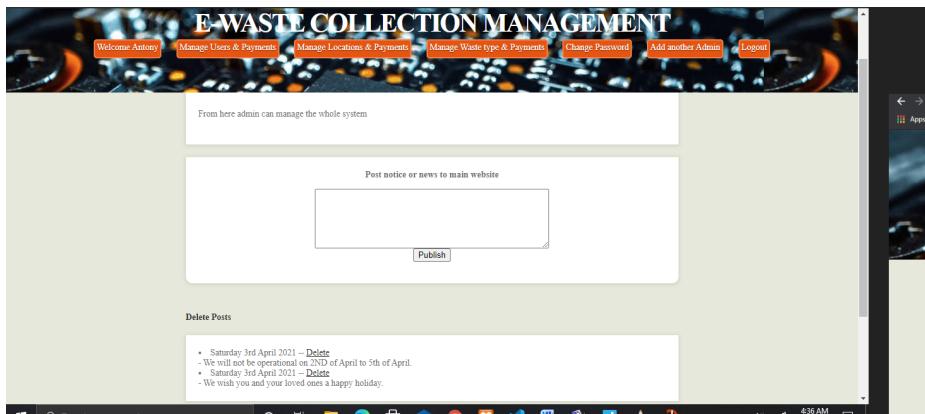


Figure 11: Admin panel

- Admin manage users and payments.

The admin has the ability to view client detail along with the transactions made so that he can approve the collection of the waste upon payment.

National ID	Name	Amount	Location	Mobile No	Garbage Type	Application Date	Mpesa Code	Approve/Delete
32980336	Teresa	700	Ponda Mali	0716349235	Cathode ray tube (CRT)			Approve or Del
0	Rkk	0	Kasarani	0716349235	Printers			Approve or Del
32980339	Aisha	1200	Makongeni	0716349235	Laptops	April 8, 2021	NKJH345fGVF	Approve or Del
11429139	Sam	800	Ponda Mali	0798376215	Computer accessories	April 8, 2021	NKJH345fGVF	Payments Settled UnSettle

Figure 12: manage users and payments

- Admin manage location and payments.

Here the admin can add and delete a location and also make changes on the different charges that apply to the different location charges.

Location	Charges	Delete
Thika town	470	Delete
Makongeni	500	Delete
Ponda Mali	400	Delete
Landless	900	Delete
Kasarani	500	Delete
Nakuru Town	870	Delete
Langalanga	500	Delete
Area	Charges	
	Add	

Figure 13: manage location and payments

- Admin manage waste type and payment.

The admin is able to add a waste type with its distinct price for collection. This page gives the admin the ability to change the prices for the waste along with the waste type. He/she is able to perform the functionality of update and deletion.

Garbage Type	Charges	Delete
Laptops	700	<input type="button" value="Delete"/>
Computer accessories	400	<input type="button" value="Delete"/>
Printers	450	<input type="button" value="Delete"/>
Flat panel monitors	300	<input type="button" value="Delete"/>
Cathode ray tube (CRT)	330	<input type="button" value="Delete"/>
Desktop PCs	500	<input type="button" value="Delete"/>
Garbage type		<input type="button" value="Add"/>

Figure 14: manage waste type and payment.

- Admin manage password.

Each admin is able to manage individual password for security purposes.

Change Admin Password

New Password Confirm New Password

Delete Posts

- Saturday 3rd April 2021 – [Delete](#)
We will not be operational on 2ND of April to 5th of April.
- Saturday 3rd April 2021 – [Delete](#)
We wish you and your loved ones a happy holiday.

- Admin manage other admins.

From this page the admin is able to add or remove another admin from the system.

ID	Username	Delete
1	Admin	Delete
6	Boaz	Delete
7	Anto	Delete
Admin Name		<input type="password"/>
Create account		

Figure 15: Manage other admins

- Client panel.

Upon login, the client gets to this page that indicate some of the details they provided during the application period.

Payments Status	Not Settled
Location:	Nakuru Town
Location Charges:	\$70
Garbage Type:	Flat panel monitors
Garbage Type Charges:	300
Total:	Ksh 1170/-

Figure 16: Client pannel.

- Client manage location.

The client can change the location where the waste is to be picked if for one reason or the other they indicated the wrong location during the application period. This gives them the chance to revert to a location of their choice.

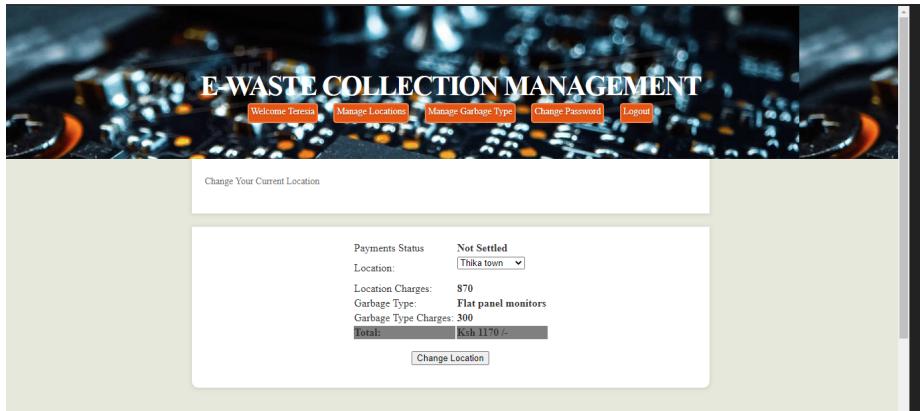


Figure 17: Manage location

- Client manage waste type.

From here the client can edit the waste type as indicated in the differences in the prices on fig18 and fig19 respectively with the change in amount paid per the waste type.

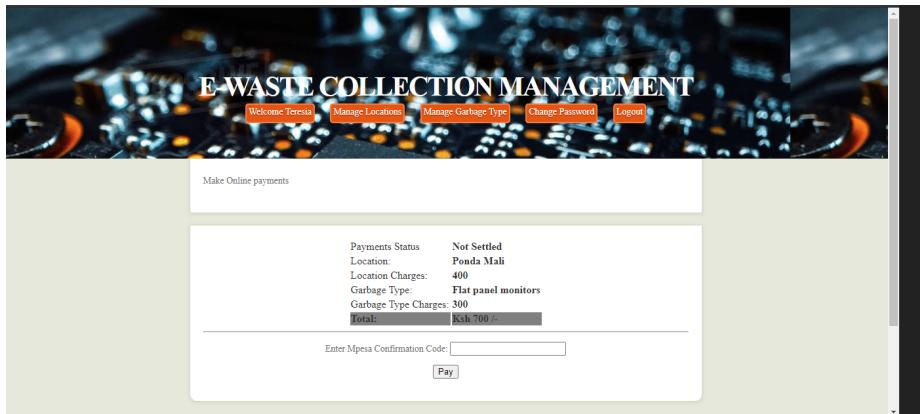


Figure 18: Client manage waste type



Figure 19: Client change waste type successfully

- Client manage password.
The client has the ability to change the passwords

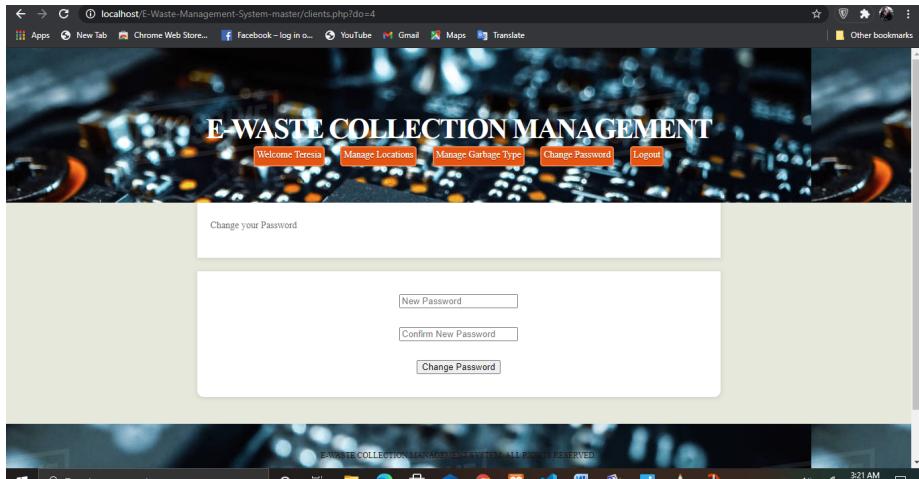


Figure 20: Client manage password

4.3.2 Backend database structure

- Admin table.

The screenshot shows the 'Table structure' tab for the 'admin' table in the 'gabbage' database. The table has three columns: 'id' (int(11), primary key, auto-increment), 'username' (latin1_swedish_ci), and 'password' (latin1_swedish_ci). The 'id' column is set as the primary key (PRIMARY) with a BTREE index. The table structure is displayed in a grid format with columns for #, Name, Type, Collation, Attributes, Null, Default, Comments, Extra, and Action.

- Client table.

The screenshot shows the 'Table structure' tab for the 'clients' table in the 'gabbage' database. The table has twelve columns: 'id' (int(11), primary key, auto-increment), 'nat_id' (int(11)), 'password' (text), 'f_name' (text), 'l_name' (text), 'location' (text), 'mobile_no' (text), 'gabbage_type' (text), 'application_date' (text), 'confirmation_code' (text), 'payment_status' (text), and 'amount' (int(11)). The 'id' column is set as the primary key (PRIMARY) with a BTREE index. The table structure is displayed in a grid format with columns for #, Name, Type, Collation, Attributes, Null, Default, Comments, Extra, and Action.

- Garbage type table.

The screenshot shows the phpMyAdmin interface for the 'garbage' database. The left sidebar shows the database structure with 'garbage' selected. The main panel displays the 'garbage_type' table structure. The table has three columns: 'id' (int(11)), 'name' (text), and 'charges' (text). The 'id' column is defined as AUTO_INCREMENT. There is one primary key index named 'PRIMARY' on the 'id' column.

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	<input type="checkbox"/> id	int(11)			No	None	AUTO_INCREMENT		<input type="checkbox"/> Change <input type="checkbox"/> Drop <input type="checkbox"/> More
2	<input type="checkbox"/> name	text	latin1_swedish_ci		No	None			<input type="checkbox"/> Change <input type="checkbox"/> Drop <input type="checkbox"/> More
3	<input type="checkbox"/> charges	text	latin1_swedish_ci		No	None			<input type="checkbox"/> Change <input type="checkbox"/> Drop <input type="checkbox"/> More

Indexes

Action	Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
<input type="checkbox"/> Edit <input type="checkbox"/> Drop	PRIMARY	BTREE	Yes	No	id	3	A	No	

Create an index on 1 columns Go

- Location table.

The screenshot shows the phpMyAdmin interface for the 'garbage' database. The left sidebar shows the database structure with 'garbage' selected. The main panel displays the 'location' table structure. The table has three columns: 'id' (int(11)), 'location' (text), and 'charge' (text). The 'id' column is defined as AUTO_INCREMENT. There is one primary key index named 'PRIMARY' on the 'id' column.

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	<input type="checkbox"/> id	int(11)			No	None	AUTO_INCREMENT		<input type="checkbox"/> Change <input type="checkbox"/> Drop <input type="checkbox"/> More
2	<input type="checkbox"/> location	text	latin1_swedish_ci		No	None			<input type="checkbox"/> Change <input type="checkbox"/> Drop <input type="checkbox"/> More
3	<input type="checkbox"/> charge	text	latin1_swedish_ci		No	None			<input type="checkbox"/> Change <input type="checkbox"/> Drop <input type="checkbox"/> More

Indexes

Action	Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
<input type="checkbox"/> Edit <input type="checkbox"/> Drop	PRIMARY	BTREE	Yes	No	id	8	A	No	

Create an index on 1 columns Go

- Notice table.

The screenshot shows the phpMyAdmin interface for the 'garbage' database. The left sidebar shows the database structure with 'garbage' selected. The main panel displays the 'notice' table structure. The table has three columns: 'id' (int(11)), 'date' (text), and 'details' (text). The 'id' column is defined as AUTO_INCREMENT. There is one primary key index named 'PRIMARY' on the 'id' column.

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	<input type="checkbox"/> id	int(11)			No	None	AUTO_INCREMENT		<input type="checkbox"/> Change <input type="checkbox"/> Drop <input type="checkbox"/> More
2	<input type="checkbox"/> date	text	latin1_swedish_ci		No	None			<input type="checkbox"/> Change <input type="checkbox"/> Drop <input type="checkbox"/> More
3	<input type="checkbox"/> details	text	latin1_swedish_ci		No	None			<input type="checkbox"/> Change <input type="checkbox"/> Drop <input type="checkbox"/> More

Indexes

Action	Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
<input type="checkbox"/> Edit <input type="checkbox"/> Drop	PRIMARY	BTREE	Yes	No	id	2	A	No	

Create an index on 1 columns Go

4.4 System codes

- Home

```
27 |         |     <!-- end -->
28 |         |     </div>
29 |         |     <p>
30 |         |     <div id="box">
31 |         |     <center>
32 |         |     |     <p><h1>Latest News and Notifications</h1></p>
33 |         |     |     </center>
34 |         |     </p>
35 $conn =mysqli_connect("localhost","root","","gabbage");
36 if ($conn->connect_error) { die("Connection failed: " . $conn->connect_error);}
37 $sql = "SELECT * FROM notice ORDER BY id";
38 $result = $conn->query($sql);
39 echo "
40 <div id='wrapper'>
41 |     <div id='page'>
42 |     <p>
43 |     <p>
44 |         <div id='box2'>" ;
45 |
46 |         if ( isset($result->num_rows) && $result->num_rows >0)
47 {
48 |             while($row = $result->fetch_assoc())
49 {
50 echo "<li>" . ucfirst($row["date"]) . "<br> - " . ucfirst($row["details"]) . "</li>";
51 }
52 }
53 else {}
54 ?>
55 |         |     </div>
56 |     </div>
57 </div>
58 </div>
```

- About us

```
1 <div id="wrapper">
2 | <div id="page">
3 <p>
4 <p>
5 | <div id="box2">
6 | | <p>..</p>
7 |
8 | </div>
9 <div id="box1">
10 <center>
11 <b>About Us</b><p>
12 Electronic waste is the major growing concern of the world. Emergence of newer technologies
13 and exponential growth of electronic usage leads to major accumulation of e-waste. Our objective is to enhance the ease of
14 management in the form of recycle, reuse and refurbish.
15 The focus being on proper collection of e-waste, recover and recycle material by safe methods, sell and buy electronic
16 waste, dispose of e-waste by suitable techniques, and raise awareness of the impact of e-waste.</p>
17 </center>
18 </div>
19 </div>
```

- Contact us

```
1 <div id="wrapper">
2 | <div id="page">
3 <p>
4 <p>
5 | <div id="box2">
6 | | <p>You may reach us through the contacts below.</p>
7 |
8 | </div>
9 <div id="box1">
10 <center>
11 <b>Contact us</b><p>
12 Please call our Contact Centre hotline numbers 97871 or 0702070707 or 0738170170 for service-related enquiries.
13 </center>
14 </div>
15 </div>
16 </div>
```

- Application

```

1  <div id="wrapper">
2   |   <div id="page">
3   |   <p>
4   |   |   <div id="box2">
5   |   |   |   <p></b>Kindly apply using the right credential for easeir retrieval of waste.</b></p>
6   |   |   </div>
7   |   <div id="box1">
8   |   <center>
9   |   <b>Application Form </b> <p>
10  |   <br>
11  <i><font color="red"><?php echo @$mess ; ?></font></i>
12  <i><font color="green"><?php echo @$mes ; ?></font></i>
13  </p>
14  <form action="index.php?page=1" method="post">
15  <table>
16  <tr>
17  <td>National Id </td><td><input type="text" name="nat_id" maxlength="8"><td/>
18  </tr><br>
19  <td>First Name</td><td><input type="text" name="f_name" maxlength="20"><td>
20  </tr><br>
21  <td>Last Name</td><td><input type="text" name="l_name" maxlength="20"><td>
22  </tr><br>
23  <td>Phone Number</td><td><input type="text" name="mobile_no" maxlength="10" placeholder="07xxxxxxxx"><td/>
24  </tr><br>
25  <td>Password</td><td><input type="password" name="password" maxlength="10"><td/>
26  </tr><br>
27  <td>Confirm Password</td><td><input type="password" name="confirm" maxlength="10"><td/>
28  </tr><br>
29  <td>Residential Area</td><td>
30  <select name="location">
31  <option value=""></option>
32  </select>
33  </td>
34 
```

```

33  <?php
34  $conn =mysqli_connect("localhost","root","","gabbage");
35  if ($conn->connect_error) { die("Connection failed: " . $conn->connect_error);}
36  $sql = "SELECT * FROM location ORDER BY id";
37  $result = $conn->query($sql);
38  if ($result->num_rows > 0) { while($row = $result->fetch_assoc()) {echo "<option value='". ucfirst($row["location"]) . "'>" . ucfirst($row["location"]);
39  >>
40  </select>
41  </td>
42  </tr><br>
43  <td>Type of Garbage</td>
44  <td>
45  <select name="garbage_type">
46  <?php
47  $conn =mysqli_connect("localhost","root","","gabbage");
48  if ($conn->connect_error) { die("Connection failed: " . $conn->connect_error);}
49
50  $sql = "SELECT * FROM garbage_type ORDER BY id";
51  $result = $conn->query($sql);
52
53  if ($result->num_rows > 0)
54  { while($row = $result->fetch_assoc())
55  {echo "<option value='". ucfirst($row["name"]) . "'>" . ucfirst($row["name"]) . "</option>" ;}
56
57  } else {
58
59  }
60
61  >>
62
63  </select>
64  </td>
65 
```

```
1 <div id="wrapper">
2 |   <div id="page">
3 |<p>
4 |<p>
5 |   <div id="box2">
6 |     <p>You may reach us through the contacts below.</p>
7 |
8 |   </div>
9 <div id="box1">
10 <center>
11 <b>Contact us</b><p>
12 Please call our Contact Centre hotline numbers 97871 or 0702070707 or 0738170170 for service-related enquiries.
13 </center>
14 </div>
15 </div>
16 </div>
```

- Login

- Admin dashboard

```
1 <?php
```

```
2 session_start() ;
```

```
3 ?>
```

```
4 <?php
```

```
5 if($_GET['do'] == 6){
```

```
6 session_destroy();
```

```
7 header("location:index.php?page=2");
```

```
8 } else { }
```

```
9 ?>
```

```
10 <?php
```

```
11 if(empty($_SESSION['admin_u_name'])){
```

```
12 header("location:index.php?page=2"); else { }
```

```
13 ?>
```

```
14 <?php
```

```
15 if(empty($_GET['garde1'])) { } else
```

```
16 {
```

```
17 $del_gar = $_GET['garde1'];
```

```
18 $conn =mysqli_connect("localhost","root","","gabbage");
```

```
19 // Check connection
```

```
20 if ($conn->connect_error) {
```

```
21 | die("Connection failed: " . $conn->connect_error);
```

```
22 }
```

```
23 mysqli_query ($conn, "DELETE FROM gabbage_type WHERE id=$del_gar");
```

```
24 header("location:admin.php?do=3");
```

```
25 }
```

```
26 ?>
```

```
27 if(empty($_GET['postdel'])) { } else
```

```
28 {
```

```
29 $post_del = $_GET['postdel'];
```

```
30 $conn =mysqli_connect("localhost","root","","gabbage");
```

```
31 // Check connection
```

```
32 if ($conn->connect_error) {
```

```
33 | die("Connection failed: " . $conn->connect_error);
```

```
34 }
```

```
35 mysqli_query ($conn, "DELETE FROM notice WHERE id=$post_del");
```

```
36 }
```

```
37 ?>
```

```
38 <?php
```

```
39 if(empty($_GET['locdel'])) { } else
```

```
40 {
```

```
41 $del_loc = $_GET['locdel'];
```

```
42 $conn =mysqli_connect("localhost","root","","gabbage");
```

```
43 // Check connection
```

```
44 if ($conn->connect_error) {
```

```
45 | die("Connection failed: " . $conn->connect_error);
```

```
46 }
```

```
47 mysqli_query ($conn, "DELETE FROM location WHERE id=$del_loc");
```

```
48 header("location:admin.php?do=2");
```

```
49 }
```

```
50 ?>
```

```
51 <?php
```

```
52 if(empty($_GET['admindel'])) { } else
```

```
53 {
```

```
54 $admindel_id = $_GET['admindel'];
```

```
55 $conn =mysqli_connect("localhost","root","","gabbage");
```

```
56 ?>
```

28

```

64 // Check connection
65 if ($conn->connect_error) {
66 die("Connection failed: " . $conn->connect_error);
67 }
68 mysqli_query ($conn, "DELETE FROM admin WHERE id=$admin_id");
69 header("location:admin.php?do=5");
70 }
71 >
72
73 <?php
74 if(empty($_GET['del'])) { } else
75 {
76 $del_id = $_GET['del'];
77 $conn =mysqli_connect("localhost","root","","gabbage");
78
79 // Check connection
80 if ($conn->connect_error) {
81 die("Connection failed: " . $conn->connect_error);
82 }
83 mysqli_query ($conn, "DELETE FROM clients WHERE id=$del_id");
84 header("location:admin.php?do=1");
85 }
86 >
87 <?php
88 if(empty($_POST['newpassword'])) { } else
89 {
90 $newpassword = $_POST['newpassword'];
91 $connewpassword = $_POST['connewpassword'];
92 $username = $_SESSION['admin_u_name'];
93 if($connewpassword != $newpassword) { $passerror = '<font color="red>Error! Password dont match</font>' ; } else {
94 $conn =mysqli_connect("localhost","root","","gabbage");
95 if ($conn->connect_error) { die("Connection failed: " . $conn->connect_error); }

99 $passerror = "<font color='green'>Password Successfully Changed</font>" ;
100 }
101 else { echo "error" ; }
102 }
103 }
104 >>
105 <?php
106 if(empty($_GET['app'])) { } else
107 {
108 $id_app = $_GET['app'];
109 $conn =mysqli_connect("localhost","root","","gabbage");
110 if ($conn->connect_error) { die("Connection failed: " . $conn->connect_error); }
111
112 $sql = "UPDATE clients SET payment_status = '1' WHERE id=$id_app";
113 if ($conn->query($sql) === TRUE) { header("location:admin.php?do=1");}
114 else { }
115 }
116 >>
117 <?php
118 if(empty($_GET['unsettle'])) { } else
119 {
120 $id_unsettle = $_GET['unsettle'];
121 $conn =mysqli_connect("localhost","root","","gabbage");
122 if ($conn->connect_error) { die("Connection failed: " . $conn->connect_error); }
123
124 $sql = "UPDATE clients SET payment_status = '0' WHERE id=$id_unsettle";
125 if ($conn->query($sql) === TRUE) { header("location:admin.php?do=1");}
126 else { }
127 }
128 >>
129 <?php
130 if(empty($_POST['newadmin'])) { } else {

```

5 APPENDIX

5.1 QUESTIONNAIRE

Introduction and Consent:

Hallo, my name is..... I am conducting a research on e-waste management on behalf of Nairobi county council. The research aims at reducing the levels of e-waste generation with emphasis on proper disposal mechanism, strategies and system. This is realized by carrying out research, raising awareness and doing advocacy at all levels. I would like to ask you some questions related to how you manage your waste and its impact on the environment. Your answers to our questions will assist in assess the current situation and help in designing a system to manage emerging issues. Whatever you tell me is confidential and shall only be used for purposes of this study. If there are some questions that you do not wish to answer, just tell me and we will skip them. Do you have any questions? If yes, kindly clear the issues before proceeding with the interview. Do you agree to participate? Yes/No.[.....] If No end interview and thank the interviewee.

A. General

1. Date:..... Interviewer:.....
2. Interviewee: Position:.....
3. Name of institution: 4. Type of institution:

- Government.
- Private co.
- NGO.
- International.
- Informal business

Other (Specify).....

5. Type of stakeholder:

- Corporate consumer Individual consumer.
- Assembler Distributor
- Importer Supplier
- Final disposer

Other (Specify).....

6. Is your institution ISO 140013 certified?

- Yes.
- No.

ISO 14001 is an internationally accepted standard that sets out how you can go about putting in place an effective Environmental Management System (EMS).

7. What brand of computers (desktop) do you deal with?

- IBM
- Dell
- HP
- Lenovo

Others (Specify).....

8. Are you aware that some hazardous fractions in e-waste need a special treatment in order to be safely disposed of?

- Yes.
- No.

B. Customer

9. . Where did you acquire your equipment from?

- Retail outlet or shop
- General distributor

Formal 2nd hand market

Informal 2nd hand market

Others, specify.....

10. What do you do with the equipment when it is no longer useful?

Sell as 2nd hand equipment

Give them to a recycler

Donate to family, schools, employees, friends, etc.

Others, specify.....

11.. For how long did you possess the equipment before you discarded (became obsolete)?

1 month-1 year

1-2 years

4-5year

Over 5 years

12. In what condition was the equipment when you discarded it?

Broken – unfixable

Broken – fixable

Working condition

Other, specify.....

13. Would you be ready to pay for your discarded equipment to be collected and recycled?

Yes.

No.

C. E-waste collectors.

14. How do you identify the e-waste to be collected?.....

15.How do you do the actual e-waste collection?

Pick-up e-waste door to door?

Have a common collection point

Send municipal collection lorries

Pick from garbage disposal gardens

Others, specify.....

16. Is the way e-waste is currently collected convenient to you?

Yes.

No.

17. If no, what can be improved?

18. After collecting the e-waste, what do you do with it?

Repair and sell as 2nd hand

Dismantle and sell as parts

Deposit to a refurbishing firm

Others, specify.....

5.2

INTERVIEW

Interview with Ministry of Health.

- 1.How do you view e-waste management in kenya?
- 2.What effects does e-waste have in your ministry?
- 3.What kind of health risks does e-waste pose to the community?
- 4.What opportunities are available for you as a ministry in e-waste ?
- 5.Is there a need for e-waste policies and why?
- 6.Who should be incharge of formulating e-waste policies?
- 7.If and when the policy is formulated, what key factors should the policy cover?

Interview with Ministry of Environment and Natural Resources.

- 1.How do you view e-waste management in kenya?
- 2.What effects does e-waste have in your ministry?
- 3.What kind of health risks does e-waste pose to the community?
- 4.What opportunities are available for you as a ministry in e-waste ?
- 5.Is there a need for e-waste policies and why?
- 6.Who should be incharge of formulating e-waste policies?
- 7.If and when the policy is formulated, what key factors should the policy cover?

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