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RECICLAR WASTE MANAGEMENT AND RECYCLING SYSTEM

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Abstract

Today's economy in the society is characterized by production of high volume of waste. Disposal of large volume of waste poses the difficulties of disposal sites, location and adoption of methods that will be economical and nuisance free. Health problems may arise since some of the refuse is attractive to insects and rodents. The solid waste generated is a nuisance. In most cities, nearly half of the solid waste remains unattended landfill sites and garbage dumps are overflowing in most cities. The existing solid waste management system has number of problems. The problem of waste management could be mitigated through adoption of improved methods of collection and transportation and active community involvement. Scientific and environment friendly technologies for disposing the waste will reduce quantity of waste to be finally dumped besides generating substantial amount of manure and energy. In order to streamline the system based on preliminary studies, it has been concluded that a proper system which creates awareness and also assists in offering these services, may be the best solution. Often, in some point in life, city dwellers opt to move out of town at one point in their lives to catch a breath in the developing towns. Most times they move out into non-gated community areas and so accessing services like garbage collection becomes a problem. Reciclar is here to ensure that all your waste need are catered for with uttermost satisfaction. Through its web-based system customer are able to place service orders which are then processed and fulfilled according to the customer's satisfaction. Garbage trucks are mostly placed on routes and so, collection services may not be immediate due to the fact that they first operate in a certain region before moving on to another. Services such as dustbin rental are also offered, in that if a customer has an event and probably needs bins to help keep the venue of the environs clean and sort out trash easily, they are delivered within 24 as long as the request is made in advance. This system simplifies the whole process and in return keeps the environments very clean therefore controlling the option of dumping. This waste can be recycled and used in many ways which can bring in capital.

INTRODUCTION

1.0 Introduction

Reciclar is a waste management and recycling system that can be used to dispose of waste in the right way without causing adverse effects to the environment. In this context waste management are the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process. It is meant to assist in waste management in organizations, residences, events and restaurants. This waste may then be recycled if it meets certain conditions. Reciclar is meant to help sort out waste for recycling before it ends up in dumpsites which makes it an uphill task to sort out. Reciclar uses a web-based system to provide its services and create awareness about proper waste disposal so as to lead to an eco-friendly future environment. Reciclar waste management system was developed in order to ensure that things could run easily and processes would be carried out faster and perfectly. The system analyst decided to carry out information gathering from different resources and was able to come up with the possible solution and implement it so that things could run more easily.

Entirely this project deals with the problem of Waste management in cities, where the garbage collection system is not optimized. This project enables the organizations to meet their needs of smart garbage management system. This system allows the user to know the fill level of each garbage bin in a locality or city at all time, to give a cost effective and time saving route to the truck drivers. The system was carefully designed and developed to ensure maximum efficiency and dependence. It was skillfully and carefully coded to seal any possible loop holes in the entire operation of the system.

This system was skillfully developed using HTML. It will help Reciclar and improve its entire structure. It will also assist to manage and control the functionality of the waste management system.

1.1 Background of the study

A primary objective of waste management today is to protect the public and the environment from potentially harmful effects of waste. Some waste materials are normally safe, but can become hazardous if not managed properly. Every individual, business or organization must make decisions and take some responsibility regarding the management of his or her waste. Throughout

history, there have been four basic methods of managing waste: dumping it, burning it, reuse and recycling and waste prevention.

Waste management in developing countries is typically characterized by uncontrolled dumping of waste, often associated with open burning. This burning of waste contributes to greenhouse gases, particularly the burning of organic waste, which can make up more than 50 percent of county solid waste."

Different countries deal with waste management difference and in this I was able to research on three developed countries, two African countries and Kenya.

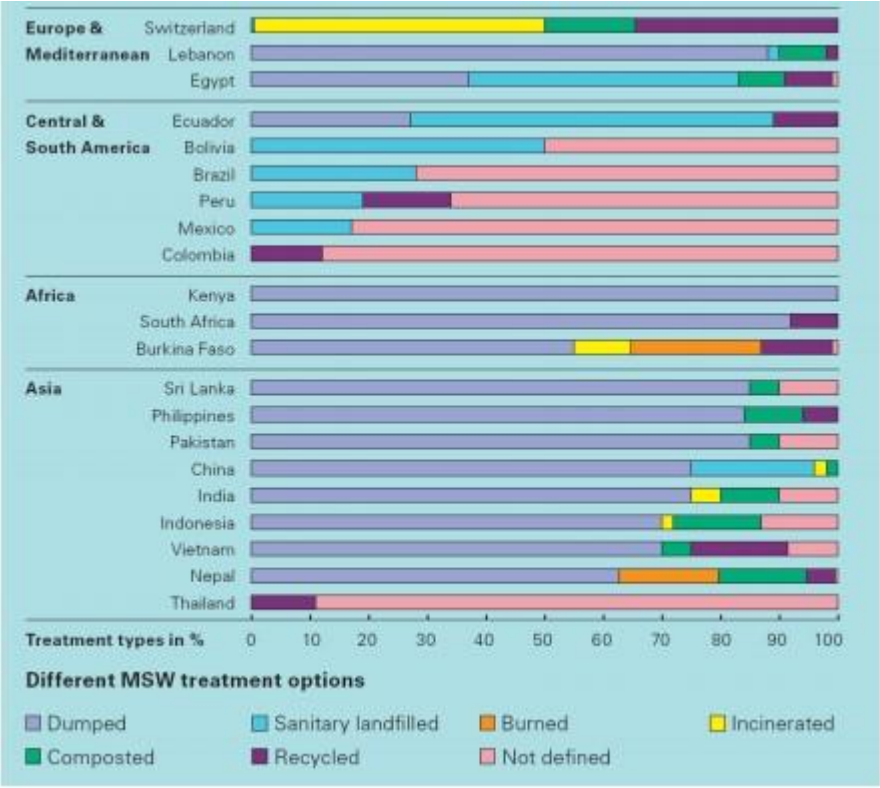


Figure 1.1: Waste Treatment Options Statistics, World Bank

For the developed countries I took a look at Germany, China and Sweden. In Germany the shortage of landfill capacity in the 1980s, coupled with the realization that they need to curb their use of natural resources and energy, prompted the development of a modern waste management system. The “circular economy” is a top priority for environmental policy in Germany, and since the early 1990s, work has been ongoing to transform our waste management into a resource management system. The German public is generally aware of the importance of waste separation and recycling.

Modern sorting, treatment and recycling technologies are now well established, and recycling capacity has been expanded.

In China, Hong Kong generates several different types of waste, and each has its own requirements for handling. The EPD keeps regular statistics on each waste type, such as composition, quantity sent for disposal and quantity recycled. To promote waste reduction and recycling, the Government has been taking the lead in adopting a green procurement policy. For example, bureaux and departments are encouraged to avoid single-use disposable items, and purchase products with improved recyclability, higher recycled contents, less packaging and greater durability.

In Sweden the waste management system has turned it into a global leader, and it recovers more energy from each tonne of waste than any other country, according to Swedish Cleantech.

In fact, the Scandinavian country has become so good at waste management that it imports nearly 800,000 tons of waste from countries like the UK, Norway, Italy, and Ireland to feed its 32 WTE plants. By not wasting its waste and recycling 99% of it, Sweden is on its way to achieving zero waste, and sustainable energy by 2020.

In Africa I took a look at Rwanda and Burkina Faso. In Burkina Faso, the World Bank has supported the solid waste sector with over $67 million in loans since 2005, supporting waste sector planning and construction of two landfills. The capital city, Ouagdougou, now collects an average of 78% of waste generated, which is significantly higher than the 46% average in Sub-Saharan Africa.

In Rwanda Lack of waste separation systems and limited capacity to expand landfills is hampering waste recycling efforts in Rwanda. Despite the government establishing systems for collection and transportation of the increasing waste, which is mainly driven by rising urbanization in Kigali and secondary cities, recycling companies said lack of waste sorting at source is hampering their work.

In Kenya waste generation has been increasing in Kenya in accordance with rapid urbanization. The amount of solid waste generated per year is currently 4 million tonnes, and is predicted to double by 2030. Without proper controls, solid waste is often dumped in abandoned quarries or similar sites. In Nairobi, for example, municipal waste is taken to the Dandora dumping site, a former quarry some 15km east.

1.2 Problem Statement

Waste management in various countries across Africa is becoming quite a challenge and if action is not taken as soon as possible, there will be adverse effects on the environment. The government has come up with environmental boards whose efforts to deal with waste management have proved futile. Every day you talk a walk around the city and find plastic bottles in gutters, household waste on footpaths in residential areas and also there's lots of liquid waste being disposed off in rivers which is harmful to living things most importantly humans and animals if used for domestic use. Reproductive effects associated with landfill sites have been extensively researched and include low birth weight (less than 2500 g), fetal and infant mortality, spontaneous abortion, and the occurrence of birth defects. Several geographical comparison studies have investigated cancer mortality and incidence around waste sites. Increased frequency of cancers in counties containing hazardous waste sites was found in two US studies particularly for gastrointestinal, oesophageal, stomach, colon and rectal cancer. Countries have taken up the challenge to get rid of plastic bags by banning them and still the problem of waste management still exits, just not plastic bags. Plastic bottles are widely used by water and soft drink companies and after they serve their purpose which is holding their drink, they are tossed by their owners and probably end up somewhere downstream, drainage tracts or on road shoulders. Sincerely, there's better ways to get rid of such waste even though it has taken a toll on the government and major companies that produce them to ban these products. Having bins not only in the CBD but also all over the city might help control this situation. From there, this waste management system ensures that proper disposal takes place and companies can be listed as eco-friendly by hiring our services. This not only increases the social corporate responsibility of organizations but leads to a better future environment. I don't believe we have an overpopulation problem. No one can prove that. In fact, I believe that saying we have an overpopulation problem is just a way to ignore the real and scientifically proven problem we have which is overconsumption.

This is our real problem:

- According to the FAO, an estimated 7.3 million hectares of forest are lost each year. Conserve energy future says "One and a half acres of forest is cut down every second."

- The average person generates over 4 pounds of trash every day and about 1.5 tons of solid waste per year. Americans make more than 200 million tons of garbage each year, enough to fill Busch Stadium from top to bottom twice a day.
- We bin around 50m tonnes of electrical waste globally every year.
- Roughly one-third of the food produced in the world for human consumption every year — approximately 1.3 billion tonnes — gets lost or wasted. Food losses and waste amount to roughly US$ 680 billion in industrialized countries and US$ 310 billion in developing countries. (FAO).

What can we do about that? Stop growth, stop the GDP equation as the measure to development. Will replacing all plastic packaging with their biodegradable substitutes solve the problem of rubbish?

1.3 Project Objectives

1.3.1 Overall Goal

To design and develop trash collection and recycling information system avoiding and minimizing the generation of waste by reducing, re-using, recycling and recovering waste.

1.3.2 Systems design and development objectives

1.3.2.1 Using location to track and route waste collection

1.3.2.2 To facilitate online service order creation

1.3.2.3 To offer rating for services offered.

1.3.2.4 The website will have a log in portal to identify users seeking services.

1.3.3 Specific Research Objectives

1.3.3.1 To find out challenges' users face in garbage collection services.

1.3.3.2 To determine the benefits of the system

1.4 Project Questions

What are the challenges?

What are the benefits?

1.5 Scope of the Project

This project will be highly beneficial to a wide range of garbage collectors and recyclers who find it difficult to come up with a reliable timetable for trash collection. With this time and money will be save since the system will come into place to ensure this happens by planning out the entire route map. It will as well assist people living in residential areas and businesses to dispose of their trash in the correct manner.

The system will work in such a way that it will be able to offer multiple features both for business and home use and therefore services will be able to be accessed by visiting our website and filling out a form to request for services. The proposed use of the system is first meant to be implemented in Nairobi County before expanding to other counties and operating in the entire country. The major stakeholders in this waste management system are the county government, who has a main responsibility for urban cleanliness and the citizens, businesses and households who utilize the system. Other stakeholders are government agencies and the investors and owners' group.

1.6 Limitations of the study

Challenges encountered during while working on this project evolved around:

- Time restraints from the beginning to completion
- User-level security
- Shallow knowledge on some of the languages used.

1.7 Significance of the study

Economical - Increase potential of new jobs and new business opportunities within waste recycling and recovery sectors. Recycling will also help in acquiring raw materials by reducing costs spent on purchasing these materials and creating markets for recycling. With proper waste management, the government is able to cut down on road maintenance costs due to free flow of drainage tracts which harbor plastic waste and is a major problem in the city.

Social - By reducing adverse impacts on health by proper waste management practices, the resulting consequences are more appealing to civic communities. Better social advantages can lead to new sources of employment and potentially lifting communities out of poverty especially in some of the developing poorer countries and cities

LITERATURE REVIEW

2.2 Literature review on based on the specific research objectives

2.2.1 Challenges users face in garbage collection services.

Unplanned human settlements caused as a result of lack of urban planning – due to lack of urban planning, everyday 5 out 10 people migrate from rural areas to the capital city. This results in over population and results in poor house planning in that it becomes difficult to share some services such as garbage collection while others resort to skip paying for the services and prefer to dump their trash resulting in landfills.

Inadequate financing – Waste management itself is an investment because one has to invest in trucks used to transport the trash and employee's payroll. Lack of support by the county/city/state government is also a factor.

Lack of adequate technology and infrastructure – There is lack of technology equipment which can be used to recycle waste material for it to be fit to be sold as raw material which in return brings in revenue which can be used to pay employees or expand the service reach. It takes a toll on companies to invent in dumper trucks as well bearing in mind factors such as maintenance costs.

Lack of knowledge on good sanitary practices – People need to be enlightened on practices of keeping the environment clean. At the end of the day, responsibility of proper waste disposal by one individual can really change a lot. Most do not understand the adverse effects and diseases caused by open dumping.

Lack of emphasis on waste to energy - companies need to take up the task to push these practices. Lack of this fails to enlighten people how waste can be converted into useful things and bring in money. But rather waste is undermined as useless yet to people who work in dumpsites it's gold for them.

Legal and Regulatory – To have a fully operational company, legal work is required and for this to be done, it takes a toll on companies leading to discouragement to come up with such companies because the government will be on your case for taxes among other things.

No mainstream acceptance of recycling – companies such as Nakumatt label tried to come up with recycling activities sometime back and it failed just because their expectations were

diminished because their bins were not used effectively and companies such as Coca cola continue to produce more waste rather than recycling thus polluting the earth.

Poor planning – It is so difficult to come up with timetables when trash is meant to be picked up especially in residentials. Without waste bin level monitors a truck may end up spending so much time driving to a certain location just to find there's no trash at all.

2.2.2 Benefits users face in garbage collection services

Keeps the environment clean – having a clean environment increases the value of a place.

Employment creation – there's lots of jobs created from drivers, waste collectors, recyclers and also management and this can be specifically from the youth. This keeps them busy and improves the living standards of the people.

Less pollution therefore fresh air to breathe – fresh air to breathe especially in the capital city is difficult. If waste is treated before being disposed and also disposed off in alternative ways instead of open burning it really preserves the freshness of the environment.

Saves on revenue costs through recycling – through recycling, companies can be able to gain some capital by selling the recycled materials to production companies and for the production companies it saves on costs because they acquire the materials cheaply compared to producing them from scratch.

Less disease outbreaks – if proper waste disposal methods are followed diseases are reduced because there's reduced air and water pollution which are the major causes of disease outbreaks.

Clean streams and rivers – they form a good habitat for fish which can be used as food for most homes and also the same water can be used for domestic purposes such as cleaning, washing and feeding animals.

2.3 Conclusion

In conclusion, waste management is an uphill task but with proper strategies and techniques it can be solved resulting in major benefits which outweigh the problems that are currently being faced in this sector.

RESEARCH DESIGN AND METHODOLOGY

3.1 Locality of the project and Beneficiaries to the project

This system will be implemented in Kenya and specifically the private vehicle owners in Nairobi. Nairobi is the place we have cases of mechanics exaggerating prices of car spare parts and I believe this system will play a major role to provide genuine services. The beneficiaries of this system are home/business owners and garbage collection service providers.

3.2 Research approach

A sample refers to the target population for a survey which is the entire set of units for which the survey data are to be used to make inferences. It must represent the population it is drawn from and must have a good size to authorize statistical analysis. The target population is a group of individuals or objects to which researchers are interested in generalizing their conclusions (Cox, 2006).

The sample I will use will be 15 – 30 home owners and businesses running in Nairobi and owners of waste management companies. The size will represent the characteristics of the whole population and will allow me to get feedback on how many people would be interested in such a system and the kind of features they would expect to be included in the system.

3.2 Population of the study (Target group) and Sampling method

The main objective of a sample is to ensure that it represents the overall population accurately (Rosenblatt, 2011). The research will be carried using random sampling methods and statistical random sampling. Random sampling method will be used so as to make sure that the sample population is not biased and since it might have sampling errors, this is where stratified random sampling comes in handy. It reduces sampling errors by dividing the population into strata of different groups and coming up with the quality size of the desired results as predetermined.

3.3 Data collection methods and Primary Data collection methods

Data collection is the process of preparing and collecting data. The data is specifically collected to provide information on a particular subject. It can be classified as primary and secondary data collection methods. According to Blum and Foor (1986), there are eight different types of data collection methods. This includes observation, experiment field research, archives, case history, group discussion, survey, and simulation. Blum and Foor further explain that despite their differences, all these methods are equally good. Primary data collection methods include

Interviews, experiments, surveys and observation and secondary data collection methods include library sources, internet sources, journals, reports etc.

3.4 Data analysis methods

Data collected from the various sources will be analyzed with simple, descriptive, statistical and analytical tools such as frequencies, percentages, graphs and charts (control, pareto, monitoring, bar, pie etc.).

RESEARCH FINDINGS AND ANALYSIS

5.1 Response rate

Response rate refers to the number of people who answered the questionnaire divided by the number of study sample. (Holtom,2008).

I was able to administer 50 questionnaires online and out of this all the 50 people were able to full respond to the questionnaires. This turn up rate gives a response rate of 100%

5.2 Demographics results

5.2.1 Distribution by Gender

The study was to establish gender distribution of those who partook in responding to the questionnaire. As shown in the study,

The study sought to establish the distribution by gender of the respondents in selection of the sample. From the study 56% represented the male while 44% female. The table below shows the distribution by gender.

Respondent Gender

The information can be represented by use of a pie chart shown below



Figure 5 1: Pie chart representing Gender Results

Source: Author Data 2019

5.2.2 Distribution by Age Group

The study covered five groups in terms of age. The groups were as follows: GROUP1: 18-23, GROUP2: 24-30, GROUP3: 31-38, GROUP4: 39-49 and GROUP5 whose members were more than 50 years. The pie chart below shows the participation in terms of the age group.

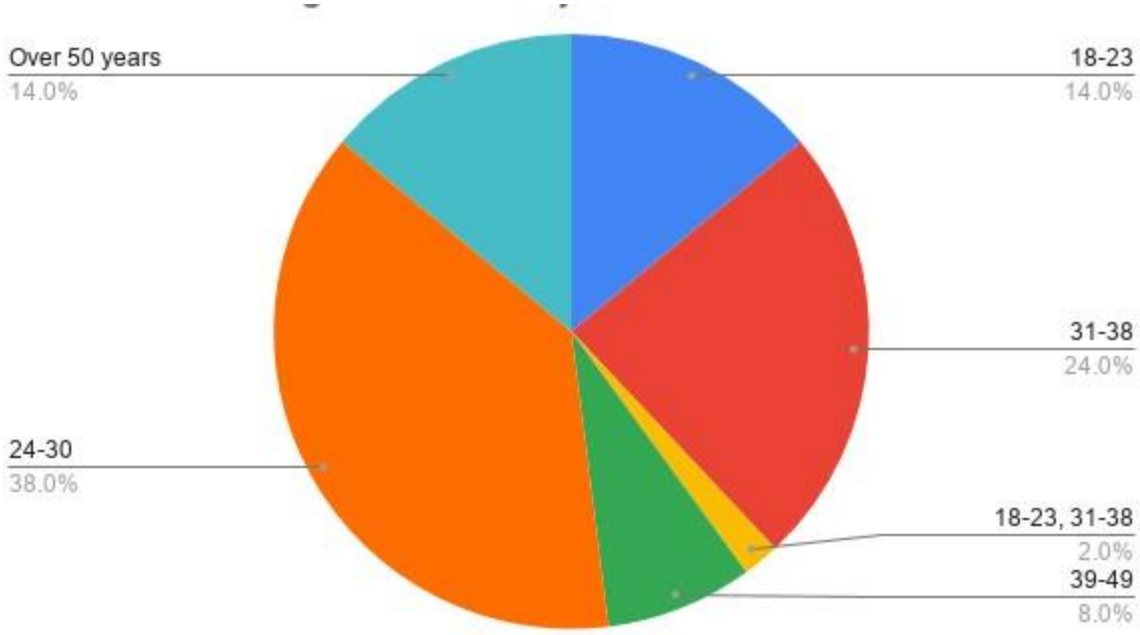


Figure 5 2: Pie Chart representing Age Group Results

Source: Author Data 2019

5.3 Findings on challenges faced in garbage collection services.

The following were considered as the main challenges faced in garbage collection services, unplanned human settlements caused as a result of poor urban planning, lack of adequate technology and infrastructure, inadequate financing and lack of emphasis on waste to energy. The respondent was to indicate the whether the challenges provided are faced online waste management system. According to the graph below 78% which represents 39 respondents go with unplanned human settlements caused as a result of poor urban planning and 42% which represents 21 respondents agree with lack of adequate technology and infrastructure and 32% which represent 16 respondents concur with inadequate financing and lack of emphasis on waste to energy as challenges faced by the system. The above information is displayed by the bar graph below.

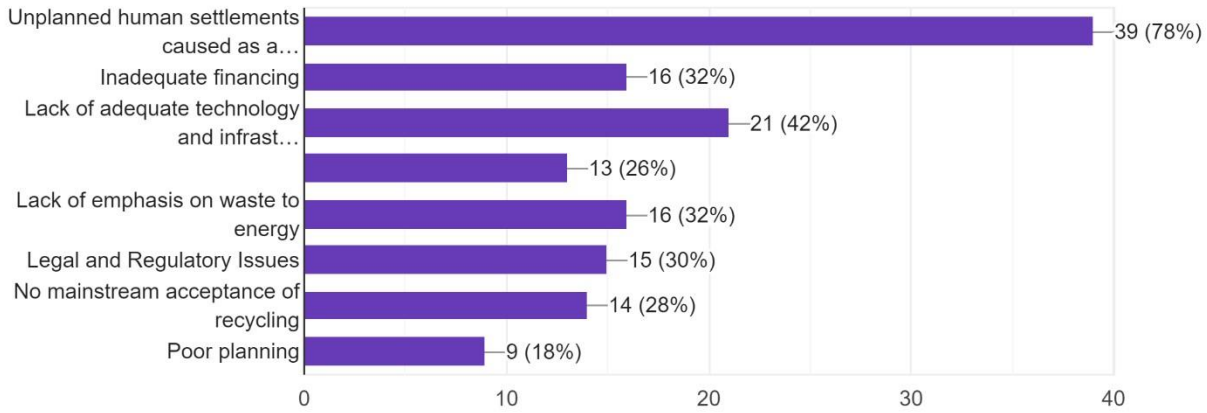


Figure 5 3: Bar Chart representing Challenge results

Source: Author Data 2019

5.4 Findings on benefits users face in garbage collection services.

The following were considered as the main benefits faced in garbage collection services, employment creation, saves on revenue cost through recycling and keeping the environment clean. The respondent was to indicate the whether the benefits provided are faced online waste management system. According to the graph below 52% which represents 26 respondents go with employment creation and 50% which represents 25 respondents agree with saves on revenue cost through recycling and infrastructure and 40% which represent 20 respondents concur with keeping the environment clean as benefits faced by the system. The above information is displayed by the bar graph below.

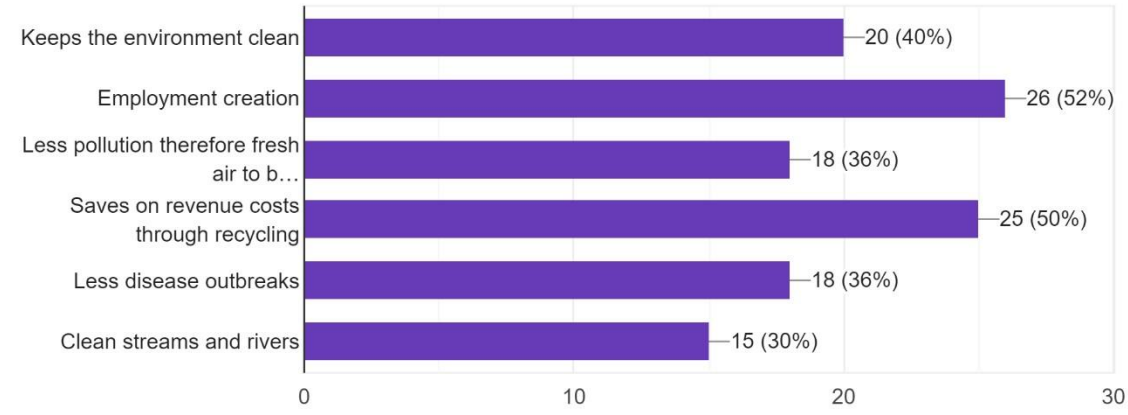


Figure 5 4: Bar Chart representing Challenge results

Source: Author Data 2019

5.5 Findings on recommendations of the system by respondents

According to the results, all the 50 respondents recommended the use of this system in waste management as displayed below.

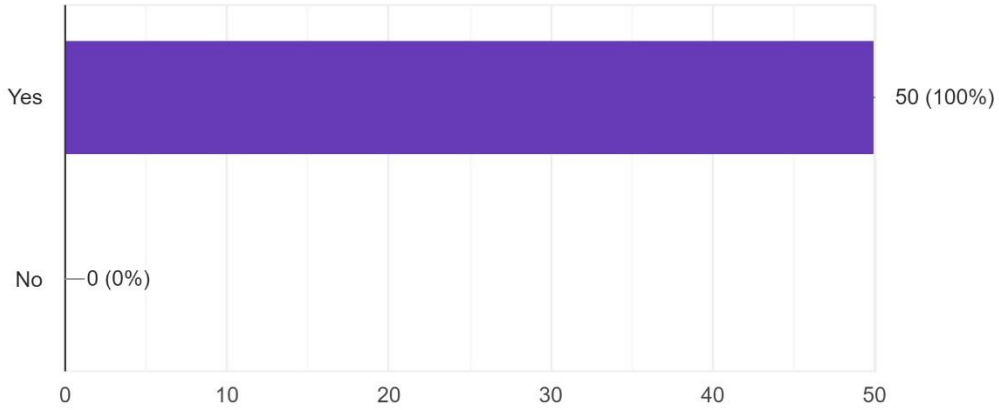


Figure 5 5: Bar Chart representing Recommendation results

Source: Author Data 2019

DISCUSSION CONCULSION AND RECOMMENDATIONS

6.1 Discussion

From the study above, it was noted that a majority percentage of my respondents were males who represented a solid 56% of the population as compared to females who only represented 44%. The implication that may arise from this is that males are more exposed to waste management because in most households, it's their responsibility to take out the trash and a times take care of bills. From the above information concerning age group, majority of the respondents are those between the ages of 24-30 and 31-38 with a respective percentage representation of 38% and 24% respectively. The implication that may arise from this is that most people between this age can relate to the current waste management in this century and are aware about how it may have adverse effects in future years to come. This also represents a large population of the middle class who have just started households and live in areas where waste management is an issue.

Further information gathered from the results on the benefits of waste management system show that the system will play a vital role in ensuring employment creation, saves on cost are revenue through recycling and keeping the environment clean. These three benefits contributed to 52%, 50% and 40% respectively.

Findings on challenges gathered from the results of waste management system show that the challenges faced are unplanned human settlements caused as a result of poor urban planning, lack of adequate technology and infrastructure, inadequate financing and lack of emphasis on waste to energy. These three challenges contributed to 78%, 48% and 32% respectively.

6.2 Conclusion

Based on the results, this study concluded that online waste management system is by far better as compared to the manual system which is used in most of the residentials. The findings show that most of the respondents prefer the use of online waste management system because it offers many advantages and benefits that lead to its effectiveness and efficiency. Due to the increased confidence on users on the system, I can conclude that waste management system should be fully implemented in our city in order to ease the whole process of collecting and recycling trash hence minimizing much of the resources used in the process.

6.3 Recommendations

According to the above findings, majority of the people need the system to be fully implemented in most of the urban cities in Kenya. This is because the system will eventually assist in uplifting the environmental sector by providing quick and easily accessible waste management services. This is cost saving because rates are fixed and the trucks are readily available. The system will also assist ensuring cleanliness in the environment through proper waste disposal

The system still needs some more features that will integrate it so that it may lead to development of one large system which will coordinate the use of waste bin sensors which will keep track of bin level and control over-filling bins which look untidy.

6.4 Future work

With proper funding, the project will later be advanced in that it will feature the use of ultrasonic distance sensors to track waste been levels and also GPS tagged bins to help map routes which will eliminate wastage of time spent on locating bins manually.

The project will also feature a live notification alert whereby request received will be displayed in real-time.

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