IMPACTS OF BEVERAGE PLANT ON WETLAND ECOSYSTEM: A CASE STUDY OF NAMANVE COCA-COLA FACTORY-MUKONO DISTRICT, CENTRAL UGANDA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A DEGREE OF BACHELOR OF SCIENCE IN ENVIRONMENTAL MANAGEMENT OF KAMPALA INTERNATIONAL UNIVERSITY

NOVEMBER, 2012

DECLARATION

I **Jovanina Sabah Paul** declare that, this dissertation is my own work and has never been produced by anybody else for any award in any institution or university and that material that are not mine have been fully acknowledged and referenced.

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Date: 24-11-2012

APPROVAL

This is to satisfy that this dissertation has been done under my supervision and submitted to the school of Engineering and applied science for examination with my approval.

MR. MUSINGUZI DANSON
Supervisor

Signature: .....

Date: 24/11/2012

DEDICATION

I dedicate this dissertation to my uncle, mother, friends and the lecturers in the department of Environmental studies.

ACKNOWLEDGMENT

I acknowledge the Lord Almighty GOD for the gift of life.

I also acknowledge my parents, sisters, brothers and friends for all their support throughout my education.

Finally, I acknowledge my supervisor-Mr. Danson Musinguzi for the guidance during this research and all the lecturers in the department of Environmental studies.

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ABSTRACT

The research on "Impacts of beverage Plant on Wetland Ecosystem" was conducted in Namanve Coca-Cola factory-Mukono district, central Uganda. The research was guided by the objectives of the study which included; examining the nature or type of industrial production in Namanve and to determine the possible causes of pollution from industries to their surroundings. The researcher used qualitative and quantitative techniques to collect, analyze and output data.

Results of the study came up with the major issues as: On the nature or type of industrial production in Namanve and the findings revealed that beverage production, production of bottles and production of fertilizers were the answers given by the respondents. On the possible causes of pollution from industries to the environment, findings showed lack of waste treating facilities, absence of filters, disposal of contaminated wastes and lack of pollution control systems were the answers given by the respondents. On the impact of industrial wastes on wetland ecosystem in Namanve and the findings revealed that; death of aquatic life, drought, destruction of plant species, and soil contamination are the answers given by the respondents. The findings revealed that treatment of industrial wastes before disposal, proper installation of filters and precipitators, respect of environmental laws, and disposal of wastes are the answers given by the respondents.

The researcher suggests that pollution control systems need to be used by the industries so as to control industrial pollution in Uganda. This is because lack of effluent treatment plants in a large number of industries is a cause of concern with regard to both surface and ground water/wetland pollution, yet proper operation and maintenance of the effluent treatment plants is critical for ensuring that the effluents are treated in desired levels in Uganda.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Significant progress has been made in many developed nations to reduce direct discharges of pollutants into water bodies, however more than 70 per cent of industrial wastes in developing countries are dumped untreated into waters (Partidario 1996). Since the advent of industrial and technological revolutions, economic indicators have been considered as the principal criteria for measuring the progress of environmental conservation in the world. The industrial and technological progress however, has been accompanied by a growing negative impact on the environment in terms of its pollution and degradation. Industrialization carries with it the seeds of environmental damage, assisted and abetted by both needs and greed of man. Human activities such as manufacturing, processing, transportation and consumption not only deplete the stock of natural resources but also add stress to the environmental systems by accumulating the stock of wastes. The productivity of industries, however, depend on the supply and quality of natural and environmental resources (Ajisegiri, 2002).

Ajisegiri, (2002) further adds that the potential positive impact of an industrialization programme on wetlands, culture, social consciousness, health and education of the people along with its economic benefits on employment and income should be valued against the enormous social cost involved with such programmes, particularly when such programmes are developed in a many area. Apart from cost due to conversion of land from other uses to industrial use, the negative externality of a rural industrialization programme arises due to its impact on environment and quality of resources like agricultural land, forest, grazing land, water

bodies, livestock and human health. Emission of solid, gaseous and liquid effluents cause damage to air, soil, water bodies human health, livestock and bio- diversity. The burning of fossil fuel leads to emission of Carbon dioxide, Carbon Mono Oxide, sulfur, and many other harmful particulates. Dumping of solid and liquid waste results in air and water pollution, which is aggravated by discharge of heavy metals and chemicals into water and drainage of liquid effluents. Moreover use of water for industries leads to lowering of ground water level creating scarcity of water, particularly in dry areas.

Environmental degradation often tends to become irreversible and imposes damaging costs on the economy resulting in output and human losses, loss of labor productivity from ill- health and loss of crop output. While water, soil, air, forest and fishery resources are productive assets, the pollution of water, air, atmosphere and noise are the by-products of economic development, particularly industrialization and urbanization. "Green house effects", "global warming" and "acid precipitation" are cases in point. Pollution is an "external cost" (sometimes called a "spill-over cost" or a "neighborhood cost"). Untreated or improperly treated waste becomes pollution, increasing not only private costs but also social costs (Ajisegiri, 2002).

The ecological and social costs of such unrestrained pollution and degradation have put a big question mark on the perceived notion of industrialization as a way of economic development. Industrialization is on the increase, which of course is necessary for the progress of human civilization but so is the environmental pollution due to emissions and waste generated from these industries. The industrial pollution due to its nature has the potential to cause irreversible reactions in the environment

and hence is posing a major threat to our very existence. Since the carrying capacity of the environment is not unlimited and some areas or ecosystems are more susceptible to adverse environmental impacts than others, unplanned and haphazard industrialization has substantially increased the risk to the environment (Olesen *et al,* 1996).

According to Olesen *et al, (*1996), the processing industries are a part of our environment and are often major generators of wastes. Since the existing environment within which they operate is the only one we have, and shared by both the consumers and operators of other sectors of the economy, there is the need therefore, to ensure the preservation of the environment in as natural and as ecologically balanced a state as possible for the use of all. This must and should be made to be the motivating factor during the design, construction and operation of all industrial enterprises. Industrial waste is a major source of environmental pollution that affects the geology, soil and ecology of an area. The food industries should be aware of the contents of the wastes they generate with the view to making them environment friendly.

1.2 Statement of the problem

The establishments of beverage plants in Uganda have had diverse effects on the environment for long. The public is indeed becoming increasingly aware of the interactions and conflicts between industry and the environment. Industrialization programme instituted primarily in rural settings would be socially and environmentally sustainable only if its long term and short term benefits to the society is at least as great as its total social cost which include cost due to loss of environmental quality.

There are very many environmental challenges that have accrued due to the emergency of Namanve beverage industry. Wastes are being dumped on environment and water channels and this has had diverse effects that even threatens human survival which predominantly depends on the environment for survival.

Even with the existence of environmental laws in Uganda, more wetlands have continued to be degraded and this has had the worst environmental effects in Uganda. It is therefore against this background that the researcher intends to add more on the existing information on impact of beverage plants on wetland ecosystem in Uganda.

1.3 Objectives of the study

General

To find out how the establishments of beverage plants affect the wetland ecosystems in Uganda.

Specific objectives

(i) To examine the nature of industrial production in Namanve
(ii) To find out the possible causes of wetland degradation in Namanve
(iii) To find out the impact of wetland degradation in Namanve
(iv) To find out the possible solutions of wetland degradation in Namanve

1.4 Research questions

(i) What is the nature of industrial production in Namanve?
(ii) What are the possible causes of wetland degradation in Namanve?
(iii) What is the impact of wetland degradation in Namanve?
(iv) What are the possible solutions of wetland degradation in Namanve

1.5 Scope of the study

(a) Contextual Scope

The study was carried on the impact of beverage plants on wetland ecosystem in Namanve Coca-Cola plant-Mukono.

(b) Geographical Scope

This study was carried out in Coca-Cola plant-Namanve. The plant is the biggest beverage drink producer in Uganda and it is located 10 km off Kampala-Jinja road, east of Kampala in Mukono district. The coordinators 00°20′N 32°45′E / 0.333°N 32.75°E at an elevation of 1, 200 m (3,900 ft).

1.5 Significance of the study

The research findings will be helpful to the ministry of Lands, Water and Environment as it will help them evaluate the effects of beverage industries on ecosystem.

The information generated from these research findings will help the policy makers to develop relevant policies and it will also provide a basis for future social, economic researchers.

The information from the study will enable environmentalist, local community members and other stake-holders protect ecosystem around Namanve Coca-Cola plant.

Furthermore, the research will be beneficial to the policy making levels and pollution mitigation agencies since the research will highlight on the cost of industrial pollution on water bodies in Uganda.
The research will help the principle researcher attain a bachelor's degree of Environmental Management of Kampala International University.

Figure 1: Conceptual Framework

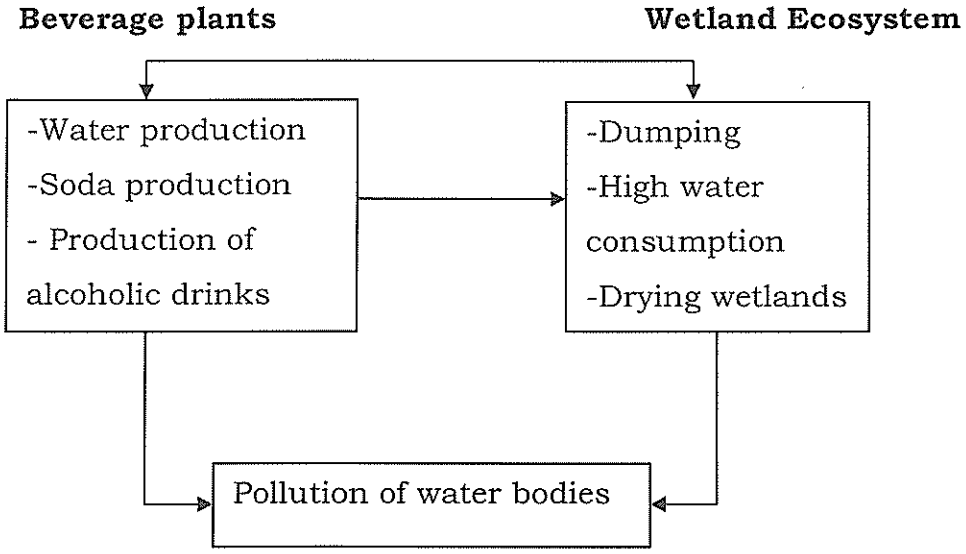

Figure 1 above shows the relationship between beverage plants and wetland ecosystem in Uganda. The figure shows that the production of water, soda, juice and other drinks are the key issues associated with beverage plants in Uganda. The figure further shows that these productions have direct effects on the wetland ecosystems since dumping, high water consumption, drying of wetlands are all the effects associated with pollution of beverage plants.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This chapter looked through the earlier research documents of different researchers; literature with an aim of identifying a problem of concern eventual number of duplication of early research work is done. Apart from going through other related work.

2.1 Beverage industries and Ecosystem

Industrialization is considered the cornerstone of development strategies due to its significant contribution to the economic growth and human welfare. It has become a yardstick for placing countries in the League of Nations and an index of its political stature (FEPA, 1991). Industrialization, like other human activities that impact on the environment, often results in pollution and degradation. It carries inevitable costs and problems in terms of pollution of the air, water resources and general degradation of the natural environment (Suflita et al., 1983; Thomas et al., 1992). Poor water quality has many economic costs associated with it, including degradation of ecosystem services; health-related costs; impacts on economic activities such as agriculture, industrial production, and tourism; increased water treatment costs; the eradication of extreme poverty and hunger (WWAP, 2009). Industrial activities are a significant and growing cause of poor water quality. Industry and energy production use account for nearly 20 per cent of total global water withdrawals, and this water is typically returned to its source in a degraded condition. While industrial production can affect water quality, industrial production can also be negatively impacted by poor water quality.

Beverage industries have many negative impact of ecosystem but the significant among them, to me, are global warming and the provocation of acid rains it will command upon African soils. Africa already lies at the heart of the over-head sun. Emission of more Carbon dioxide gasses into its atmosphere will spell disaster. Smaller streams that naturally irrigate certain farms lands will dry up as well as rivers and other important water bodies useful for irrigational purposes. The depletion of the Ozone layer will make the situation unbearable for some crops to thrive as well as dehydrate farmers who use their natural energies to farm. Many children suffering from malnutrition, especially diarrhea, will be at greater risk since they will lose too much energy.

Increasing industrialization poses many different challenges to the environment. These are often associated with large-scale energy production and metallurgy but also include the social and economic changes that accompany technological innovation. While there are the obvious concerns about emissions, waste management and land degradation associated with industry, one important aspect to consider, particularly in some African countries, is the increase in population that comes with increasing industrialization. An increasing population places demands on land for housing and recreation, waste disposal and sewage treatment and other resources such as infrastructural improvements (Yasseen and Al-Thani, 2007). Most countries regard industrialization as a positive development capable of generating rapid wealth, revitalizing run-down areas, and conferring influence in world affairs. Most also now recognize the need for a diversified industrial base to safeguard their economies from fluctuations in the market price for their own specialized product.

The negative consequences of beverage industries are sometimes more apparent in developing countries than in countries with established industrial structures, where the social dislocation and environmental problems that often accompany development began long ago. Modern large-scale industrialization schemes commonly require a parallel development of energy sources. In the case of hydroelectric plants, substantial numbers of rural communities may be displaced, since large areas may be flooded to create the necessary water reserves behind the so-called super-dams (Kupchella, 1993).

In all countries, whatever their level of development, there are long-term problems associated with food processing industries. Environmental safeguards may be overlooked, leading to serious problems of air, land, and water pollution. One of the worst incidents occurred in Minamata, Japan, where mercury residues from nearby chemical plants contaminated the water of Minamata Bay, were ingested by fish, and then entered the human food chain to cause death and illness for up to 30 years after the event. Another notorious example was Bhopal, India, where a leak of poisonous gas killed thousands of people and blinded or otherwise injured many others (Kupchella, 1993).

The World Commission on Environment & Development issued a report titled "Our Common Future" and appealed for the application of principles of sustainable development in 1987, the Inter Governmental Panel on Climate Change, (IPPC) was organized jointly by the United Nations Environmental Programme (UNEP) and World Meteorological Organization (WMO) with support from the G-7 nations in 1989. The catastrophic social and economic consequences of global climate change by the end of 21st

century were described in the first report of IPCC in 1990. As a result, the United Nations Conference on Earth & Development (Earth Summit) was held in Rio de Janerio in 1992 where more than 180 nations participated. The Rio Declaration, Agenda 21, Framework Convention on Climate Change, Biodiversity Convention, and Forest Declaration were signed in a historic effort to cope with the global problem of the 21st century (Chaudhary, 2006).

A number of studies have shown that air and water pollution are taking a heavy toll of human life, particularly, in the developing countries through ill-health and premature mortality. Pollution control, thus, assumes greater significance in the context of ensuring sustainable development through planned industrialization. The environmental pollution and ecological degradation because of unplanned industrialization first became issues of international concerns in the 1970s when it was recognized that mass production by industry and mass consumption by society are depleting the resources and are generating huge amounts of solid waste and hazardous substances. The environmental challenges and the natural resources management were first focused in 1972 at the United Nations Human Environment Conference at Stockholm. Since then, a much greater awareness has been created not only amongst the developed countries but also the developing ones with regard to the environmental issues. A number of international committees were formed at different levels to address the environmental issues and cope up with the fast development (Hulme, *et al*, 2000).

Human health is affected by industrial air pollution mainly due to the release of particulate matter and gases such as sulphur dioxide, hydrogen

sulphide, carbon disulphide, etc. The pollutant from the beverage industries in particulate matter that cause diseases (Dalzell, 2000).

2.2 Possible causes of wetland degradation in Uganda

Unregistered small scale units

According to Akpata (1990), it is most likely that most of the unregistered units do have any treating facilities. Discharges from most of the small and tiny scale industries if left into nearby drainages or into other receiving bodies with minimal or no treatment leading to surface and ground water pollution.

Lack of pollution control systems

Akpata (1990) further asserts that the overall status of effluent treatment plants in operation set up by large, medium and small scale industries does not indicate any significant increase during the last years. Lack of effluent treatment plants in a large number of industries is a cause of concern with regard to both surface and ground water/wetland pollution. Proper operation and maintenance of the effluent treatment plants is critical for ensuring that the effluents are treated in desired levels. However, most of the industries do not give due importance to operation and maintenance as it involves significant expenditure.

Lack of common treatment facilities

Anikwe (2002) says that a large number of small scale and tiny industries do not have individual effluent treatment plants as it is not an economic proposition for them. Common treatment facilities that cater to a cluster of homogeneous/heterogeneous industries are the only viable alternatives for such industries. Additional cost in the form of initial investment and recurring operation expenses that would have to be incurred by industrial

units are the cause for non establishment of common effluent treatment plants.

Lack of economically viable treatment technologies

Most of the treatment facilities available are too costly and beyond the capacity of small scale industries. Added to this is the fact that most of the industries have space constraints and treatment facilities need substantial area (Anikwe, 2002).

Lack of awareness

Ogedengbe (2004) also agrees that most of the industries do not have or cannot afford to have dedicated personnel for treatment facilities. The lack of education and innovation has led to industries not being aware of state of art technologies. Further, there is no centralized database where industries can get information.

2.3 Effects of wetland degradation on wetland ecosystem

Worldwide water bodies are the primary means for disposal of waste, especially the effluents, from industries that are near them. These effluent from industries have a great deal of influence on the pollution of the water body, these effluent can alter the physical, chemical and biological nature of the receiving water body (Sangodoyin, 1991). The initial effect of waste is to degrade the physical quality of the water. Later biological degradation becomes evident in terms of number, variety and organization of the living organisms in the water (Gray, 1989). Often the water bodies readily assimilate waste materials they receive without significant deterioration of some quality criteria; the extent of this is referred to as its assimilative capacity (Fair et al., 1971). The input of waste into water bodies therefore

does not always impact negatively on aquatic environment because of the self purification property of the water bodies.

Industries turn out wastes which are peculiar in terms of type, volume and frequency depending on the type of industry and population that uses the product (Odumosu, 1992). Industrial waste is the most common source of water pollution in the present day (Ogedengbe and Akinbile, 2004) and it increases yearly due to the fact that industries are increasing because most countries are getting industrialized. The extent of discharge of domestic and industrial waste is such that rivers receiving untreated effluent cannot give dilution necessary for their survival as good quality water sources. The transfer of unfavorable releases from industries is detrimental to human and animal health and safety (Sangodoyin, 1991). There is thus a challenge of providing water in adequate quantity and of required quality to minimize hazards to human health and conserve the water bodies and the environment. Olayemi (1994) identified that regular, unregulated indiscriminate dumping of waste into water bodies worsen aquatic pollution.

There are some empirical studies on the impact of environmental degradation on agricultural production but studies on impact of industrial pollution on agricultural production have been few and far between. Pinock (1978) has analysed the effects of different levels of water quality on output and income in irrigated agriculture. The impact of saline water damage in USA Colorado has been analysed by Vincent and Russel (1978); Moore (1978) has also made a similar analysis. Vagirathi Behre and V. Ratna Reddy (2002) have carried out analysis of impact of industrial pollution on agricultural production through deterioration in the quality of irrigation water for a village in Andhra Pradesh in India. Walsh and

Warren have conducted estimation of economic cost of health damage due to water pollution for Africa, Latin America and Asia. Such analysis has also been conducted by a number of researchers for USA (1978).

2.4 Solutions to the effects of beverage industries on ecosystem

Solving the effects of beverage industries require strategies to prevent, treat, and remediate pollution. For example, as a first-order intervention, pollution can be prevented before it enters waterways; second, wastewater can be treated before it is discharged; and third, the biological integrity of polluted watercourses can be physically restored through remediation. Preventing pollution at its source is often the cheapest, easiest, and most effective way to protect water quality. In the industrial setting pollution prevention is most commonly known as cleaner production. Because industrial releases are fixed sources, they are often regulated (Dalzell, 2000).

If efforts to prevent pollution from entering water sources and environment are ineffective or insufficient, mechanisms to treat the water for reuse or before discharge should be undertaken. When industrial wastewater cannot be prevented or recycled on-site, it needs to be treated before disposal. Standards for industrial effluent quality are in place in many parts of the world, but in many places are not adequate or appropriately enforced. In cases where the industrial effluent water quality is severely degraded or toxic, the industrial facility owner should be responsible for safely removing pollutants from the water before discharge and appropriately disposing of the hazardous sludge (Kupchella, 1993).

Recognition of anthropogenic impacts on ecosystems has grown dramatically and there have been increasing numbers of efforts to restore degraded habitats and ecosystems worldwide. The key to effective

restoration efforts is a clear identification of existing conditions and problems in the target resource. Investing in ecosystem maintenance and restoration can yield better water quality results while saving on costs and therefore a significant incentive for industry to invest in watershed management, which is by far more cost-effective. Strategies to implement water quality and general environmental improvements will require awareness building, increased monitoring, and better governance and regulation (Ahiakwo, 1999). Polluter-pays principles need to be implemented so that activities that release pollution into waterways and land internalize the costs of pollution instead of socializing the costs and impacts. This is a particularly effective mechanism that can be applied in dealing with industrial pollution (Sadler, 1996).

CHAPTER THREE
METHODOLOGY

3.1 Research Design

This study employed the descriptive comparative design. Descriptive studies are non-experimental researches that describe the characteristics of a particular individual, or of a group. It deals with the relationship between variables and development of generalizations and use of theories that have universal validity. It also involved events that have already taken place and may be related to present conditions. Furthermore, descriptive surveys are used to discover causal relationships (descriptive correlational), to provide precise quantitative description and to observe behavior.

3.2 Area and Population of study

The research was conducted in one area that is in Namanve Coca-Cola plant Uganda and the company has an approximate number of 300 workers. The respondents consisted of local population especially the company managers, employees, environmentalists and local community members. The area has been basically chosen because the researcher is familiar with the area and is able to speak the most common languages in the area of the study.

3.3 Sample size

Using convenient sampling, 30 company employees, 10 department heads (managers), 20 environmentalists, and 40 local communities, making the sample size to be 100 (hundred respondents).

3.4 Sample framework

The researcher used stratified, random and purposive sampling technique since it ensures that the only predetermined and chosen respondents are approached, hence getting relevant, correct and adequate information.

Researchers also regard a sample of 100 as adequate irrespective of population (Bailey, 1994). Also according to Roscoe 1975), sample sizes of between 30 and 500 are appropriate for most studies. However, through this sampling technique is chosen, it has a weakness that inadequate information can sometimes be given because the selected respondents may be less informed on the topic of research.

3.4.1 Sample technique

Random sampling technique in which the size of the respondents is predetermined before the research is conducted without bias. A sample size of 100 was arrived at and was randomly selected from the sheets of paper spread. This is when using stratified random sampling. After that systematic random sampling is used this later gives the actual sample size. Quantitative data collection was then used which involved editing, encoding, and later tabulation of the collected material.

3.4.2 Sample procedure

The selection of the respondents sample size was based on the simple random sampling which is a type of sampling technique that allows researchers to collect data in which each element in the population has a known and equal probability of selection. This technique was convenient to achieve the research objectives because the respondents had the same chance to be in sample.

3.5 Data collection instruments

The following data collection instruments were used:

(i) Questionnaire

This was designed in line with the topic and objectives. They included both open and closed-ended questions. This instrument has been selected because it is efficient and convenient in a way that the respondent is given time to consult the documents before answering the questions. It is also because the respondent can give unbiased answers since she/he is given to write whatever she/he would like to write which would otherwise be hard for the respondent to write if the researcher is present.

(ii) Documentary Review

This included detailed review of already existing literature. The tool is selected because it gives accurate, correct and historical data, which may be used for future aspects. The sources of the information here were the libraries, data banks, news papers and any other published information that can readily be available for use as regards the topic of research.

3.6 Source of data collection

The researcher collected data from both primary and secondary sources.

i. Primary Data

This was sourced by physical and visiting of the files and collecting data through variable tools. The respondents were got by first determining the number of the respondents and then taking a physical visit to seek for the consent of the respondents to have them answer the set questions in the questionnaire and this was through following stratified random sampling techniques in the respondents are first selected and then approached.

ii. Secondary data

This was sourced by reviewing of documented resources as newspapers, journals, reports, presentations, magazines and online publications. This is done in order to fist identify the existing information on the topic of research and to understand how much the respondent knows about the research topic in order to avoid lies.

3.7 Data analysis

Data processing started by editing the schedules and coding the responses. Editing, Coding and Tabulation techniques are used in data processing exercise. This involved preparing data collected into some useful, clear and understandable data. The whole exercise involved editing, tabulation and analyzing the data to enable the researcher draw conclusions in relation to the research variables. Data once edited and coded are put together in some kind of tables and may undergo some other forms of statistical analysis. Data is put into some kind of statistical table showing the number of occurrences of responses to particular questions with percentage to express data in ratio form.

3.8 Ethical procedure

Before going to the field, the researcher began with getting authorization letter from the Dean of school of Engineering and applied then take it to the respondents and this enabled the researcher attain adequate information from the respondents. During the process of data collection, confirmation was given to the respondents in that the researcher assured the respondents that the reason for the research was for academic purpose only.

3.9 Limitations of the study

Unwillingness of the respondents to effectively respond to the questions was one of the most notable problems that the researcher may face while conducting the research.

Financial constraints were also problems that occurred during the process of conducting the research. Transport costs were so high to be met by the researcher and this fully contributed to the delay of the research because it may become so hard for the researcher to continue with the less funds.

Hostility among some respondents was also another limitation of the study in the sense that the researcher found that there are hostile respondents who in the long-run turned down the request of the researcher to answer the questions. Some of such respondents did not fill their questionnaires.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND DISCUSSION OF THE FINDINGS

4.0 Introduction

4.1 Socio-demographic Characteristics

4.1.1 Age of the respondents

Respondents were asked questions related to their age and the results are shown in the table below:

Table 1 Age distribution of respondent

Age group	Frequency	Percentage
Below 25	10	10
25 - 29	20	20
30 – 39	18	18
40 – 49	30	30
50 – above	22	22
TOTAL	**100**	**100**

Source: Primary data

Table 1 above show that 10% of the respondents were below 25 years, 20% were between 25-29 years of age, 18% were between 30-39 years of age, 30% were between 40-49 years and 22% were above 50 years of age. This means that majority of the respondents are between 40-49 years of age followed by those above the age of 50.

4.1.2 Marital Status of the respondents

Another variable which was important in respect to the situation of the people in the area was marital status. Information regarding marital

status of the respondents was obtained by asking them whether they were married, single, widowed or widowers.

Table 2 Marital status of the respondents

Marital Status	Frequency	Percentage
Married	40	40
Single	27	27
Widow	22	22
Widower	11	11
TOTAL	**100**	**100**

Source: Primary data

Table 2 above shows that 40% of the respondents were married, 27% were single, 22 were widows and 11% were widowers. This means that majority of the respondents were married people followed by a handful of widowers.

4.1.3 Sex of the respondents

Sex was also another factor which was considered during the study. This is because the researcher was interested in finding out the number of females and males in the whole of the population, and compares the percentage composition of the two.

Table 3 Sex of the respondents

Sex	Frequency	Percentage
Female	40	40
Male	60	60
Total	**100**	**100**

Source: primary data

Table 3 shows the sex of the respondents and it was found that 40% of the respondents were females and 60% were males. This therefore means that the majority of the respondents are male and the male dominate the enterprises with over 60%.

4.1.4 Educational status of the respondents

Respondents were asked questions related to their educational status and their responses are shown in the table below;

Table 4: Educational level of the respondents

Education levels	Frequency	Percentage
Uneducated	20	20
Secondary	15	15
University	25	25
Tertiary	30	30
Total	**100**	**100**

Source: primary data

Table 4 above shows educational levels of the respondents and it revealed that 20% had no education, 15% of the respondents had secondary education, 25% received university education, and 30% had tertiary education. This means that the majority of the respondents had tertiary level of education as compared to university and secondary education.

4.2 Nature of industrial production in Namanve

Table 5: Nature of industrial production in Namanve

Responses	Frequency	Percentage
Beverage production	63	63
Production of bottles	26	26
Production of fertilizers	11	11
Total	**100**	**100**

Source: Primary data

Research objective one sought to find out the nature of industrial production in Namanve and the findings revealed that; beverage production, production of bottles and production of fertilizers were the answers given by the respondents.

Majority (63%) of the respondents said that beverage production is the major industrial production done at Namanve. The respondents stressed that Coca-Cola plant at Namanve was established to handle the production of mainly beverages in terms of sodas, water and other related beverages like juice among others. They stated that this is the prime reason behind the establishment of Coca-Cola plant at Namanve.

Furthermore, 25% of the respondents noted that bottle production is yet another nature/type of industrial production at Namanve Coca-Cola plant. The respondents here noted that Coca-Cola does the production of bottles which in different types, some are class in nature and others are plastic. These bottles are used for packaging of their industrial products which are mainly sodas, juices and water.

Over 11% of the respondents also noted that fertilizers are also produced at Namanve Coca-Cola plant. The respondents stressed that fertilizers have for long been produced at Namanve by Coca-Cola plant. The fertilizers according to the respondents-have been produced from the remains of the raw materials used by the plant since the plant uses fruits as the prime raw material for the production of its products.

4.3 Possible causes of wetland degradation in Uganda

Table 6: Possible causes of wetland degradation in Uganda

Responses	Frequency	Percentage
Lack of waste treating facilities	28	28
Absence of filters	26	26
Disposal of contaminated wastes	22	22
Lack of pollution control systems	24	24
Total	**100**	**100**

Source: Primary data

In the second research objective, the researcher sought to establish the possible causes of wetland degradation in Uganda and the findings revealed that; lack of waste treating facilities, absence of filters, disposal of contaminated wastes and lack of pollution control systems were the answers given by the respondents.

The majority (28%) of the respondents noted that lack of waste treating facilities was the major cause of wetland degradation in Uganda and mainly in Namanve Coca-Cola plant. The respondents stressed that

industries do not have waste treating facilities, hence discharges from most of the industries if left into nearby drainages or into other receiving bodies with minimal or no treatment leading to surface and wetland pollution. This finding is in agreement with Akpata (1990) who asserted the overall status of effluent treatment plants in operation set up by large, medium and small scale industries does not indicate any significant increase during the last years. Lack of effluent treatment plants in a large number of industries is a cause of concern with regard to both surface and ground water/wetland pollution.

In addition to the above, 26% of the respondents noted that absence of filters in many industries has equally contributed to wetland degradation by the industries in Uganda. The respondents note that many industries do not install filters that absorb dust and other particles emitted by the industries and this makes it possible for these particles to directly spill into the land, hence destroying the wetland ecosystem in Uganda.

Over 22% of the respondents noted that the disposal of contaminated wastes is also another cause of wetland degradation in Uganda. The respondents noted that many industries usually dump contaminated wastes into the environment and this has caused severe harm especially to the ecosystem as the wetlands have ceased to perform their functions of water absorption, supporting plant growth and regulating weather changes.

Finally, 24% of the respondents noted that lack of pollution control systems was also another cause of wetland degradation in Uganda. The respondents stressed that lack of effluent treatment plants in a large number of industries is a cause of concern with regard to both surface

and ground water/wetland pollution, yet proper operation and maintenance of the effluent treatment plants is critical for ensuring that the effluents are treated in desired levels. However, most of the industries do not give due importance to operation and maintenance as it involves significant expenditure.

4.4 Impact of industrial wastes on wetland ecosystem in Namanve

Table 7: Impact of industrial wastes on wetland ecosystem in Namanve

Responses	Frequency	Percentage
Death of aquatic life	26	26
Drought	25	25
Destruction of plant species	25	25
Soil contamination	24	24
Total	**100**	**100**

Source: Primary data

The third research objective in this study sought to find out the impact of industrial wastes on wetland ecosystem in Namanve and the findings revealed that; death of aquatic life, drought, destruction of plant species, and soil contamination are the answers given by the respondents.

Majority (26%) of the respondents said that death of aquatic life like fish and snakes among others were one of the major impacts of industrial wastes on wetland ecosystem in Namanve. The respondents noted that industrial wastes dumped on wetland have been diverse and it has led to the death of many aquatic lives in the wetlands. They stressed that these industrial wastes are in many times not treated at all and yet they are

poisonous. Ajisegiri, (2002) also stated that apart from cost due to conversion of land from other uses to industrial use, the negative externality of a rural industrialization programme arises due to its impact on environment and quality of resources like agricultural land, forest, grazing land, water bodies, livestock and human health.

Over 25% of the respondents have noted that drought have been a result of dumping industrial wastes into the environment. The respondents here stated that the poisonous wastes not only affect the survival of aquatic life, but it also causes drought as many of the living things-including grass and trees are destroyed in the long-run, hence leading to drought. This finding is in support with Hulme (2000) who stated that A number of studies have shown that air and water pollution are taking a heavy toll of human life, particularly, in the developing countries through ill-health and premature mortality. Pollution control, thus, assumes greater significance in the context of ensuring sustainable development through planned industrialization.

Furthermore, another 25% of the respondents noted that destruction of plant species such as papyrus which retain sediments and absorb harmful substances in water. Other species include, such as cattails (*Typha spp.*), bulrushes (*Scirpus spp.*), sedges (*Carex spp.*), Arrowhead (*Sagittaria latifolia*), Water Lilies (Yellow - *Nuphar variegata* and White - *Nymphaea odorata*), Blue Flag (*Iris versicolor*), and 'floaters' like Common Duckweed (*Lemna minor*). The respondents noted that the toxic wastes do not support the growth of anything but it rather destroys virtually every living thing on the ground surface where they are dumped.

The remaining 24% of the respondents stressed that soil contamination has also been a result of disposal of industrial wastes into wetlands. The respondents noted that these toxic wastes dumped into the environment have had diverse effects into the wetland ecosystem and it has contaminated the soil to the extent that it cannot even support plant growth in many areas. This is in agreement with Ajisegiri, (2002) who stated that the potential positive impact of an industrialization programme on wetlands, culture, social consciousness, health and education of the people along with its economic benefits on employment and income should be valued against the enormous social cost involved with such programmes, particularly when such programmes are developed in a many area.

4.5 The possible solutions of wetland degradation

Table 8: The possible solutions of wetland degradation

Responses	Frequency	Percentage
Treatment of industrial wastes	30	30
Installation of filters	27	27
Respect environmental laws	22	22
Proper waste disposal	20	20
Total	**100**	**100**

Source: Primary data

The fourth and last research objective in this study sought to find out the possible solutions of wetland degradation and the findings revealed that treatment of industrial wastes before disposal, proper, installation of

filters, respect of environmental laws, and disposal of wastes are the answers given by the respondents.

Majority (30%) of the respondents noted that treatment of industrial wastes before disposal is one of the possible solutions to wetland degradation in Namanve. The respondents stressed that industrial wastes need to be treated to reduce the level of toxicities so that it can be environmental friendly. This finding is in agreement with (Dalzell, 2000) who stated that solving the effects of beverage industries require strategies to prevent, treat, and remediate pollution. For example, as a first-order intervention, pollution can be prevented before it enters waterways; second, wastewater can be treated before it is discharged; and third, the biological integrity of polluted watercourses can be physically restored through remediation. Preventing pollution at its source is often the cheapest, easiest, and most effective way to protect water quality. In the industrial setting pollution prevention is most commonly known as cleaner production. Because industrial releases are fixed sources, they are often regulated.

Furthermore, 27% of the respondents noted that installation of filters is yet another way of solving wetland degradation in Namanve. The respondents noted that industries need to install filters that will help filter dust and other related toxic particles emitted in the wetlands. The respondents said that once the filters are installed, this will help reduce on the amount of risks posed by industries on the environment. Kupchella (1993), also stated that when industrial wastewater cannot be prevented or recycled on-site, it needs to be treated before disposal. Standards for industrial effluent quality are in place in many parts of the world, but in

many places are not adequate or appropriately enforced. In cases where the industrial effluent water quality is severely degraded or toxic, the industrial facility owner should be responsible for safely removing pollutants from the water before discharge and appropriately disposing of the hazardous sludge.

Over 22% of the respondents noted that respect to environmental laws would also help solve the problem of wetland degradation in Namanve. The respondents noted that industries should always respect environmental laws that prohibit them from dumping into the environment and the other related laws that guide industrial productions in Uganda.

Finally, 20% of the respondents noted that proper waste disposal is another possible solution to wetland degradation in Namanve. The respondents noted that industries ought to properly dispose their wastes in that they ought to dispose their industrial wastes in particular areas and properly burn them to avoid pollution of the wetland.

CHAPTER FIVE

EXECUTIVE SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter was concerned with the summary of the study, conclusion and recommendations.

5.1 Summary of the study

The research was conducted in Namanve Coca-Cola factory-Mukono district, central Uganda on "Impacts of beverage Plant on Wetland Ecosystem." The research was guided by the objectives of the study which included; examining the nature/type of industrial production in Namanve; finding out the possible causes of pollution in the industries in Uganda; finding out the impact do these industrial wastes have on wetland ecosystem in Namanve; and finding out the possible solutions of industrial pollution on wetlands.

The research found out the socio-demographic characteristics. On the age of the respondents, findings revealed that; 10% of the respondents were below 25 years, 20% were between 25-29 years of age, 18% were between 30-39 years of age, 30% were between 40-49 years and 22% were above 50 years of age. On the marital status of the respondents, the study found that; 40% of the respondents were married, 27% were single, 22 were widows and 11% were widowers. Furthermore, the study also found that on the gender of the respondents, 40% of the respondents were females and 60% were males; and finally on the education of the respondents, the study revealed that-5 above shows educational levels of the respondents and it revealed that 20% had no education, 15% of the respondents had secondary education, 25% received university education, and 30% had tertiary education.

On the nature/type of industrial production in Namanve and the findings revealed that; beverage production, production of bottles and production of fertilizers were the answers given by the respondents. On the possible causes of pollution in the industries in Uganda and the findings revealed that; lack of waste treating facilities, absence of filters, disposal of contaminated wastes and lack of pollution control systems were the answers given by the respondents. On the impact of industrial wastes on wetland ecosystem in Namanve and the findings revealed that; death of aquatic life, drought, destruction of plant species, and soil contamination are the answers given by the respondents. On the possible solutions of industrial pollution on wetlands and the findings revealed that treatment of industrial wastes before disposal, proper, installation of filters, respect of environmental laws, and disposal of wastes are the answers given by the respondents.

Conclusions and recommendations were later made after interpreting and analyzing data.

5.2 Conclusion

From the data that the researcher collected, the researcher made conclusions basing on the findings from the four research objectives. On the nature/type of industrial production in Namanve, the researcher concluded that; beverage production, production of bottles and production of fertilizers were the major types/nature of industrial production in Namanve Coca-Cola plant. Furthermore, the researcher concluded that; lack of waste treating facilities, absence of filters, disposal of contaminated wastes and lack of pollution control systems are the possible causes of pollution in the industries in Uganda. On the impact of industrial wastes

on wetland ecosystem in Namanve, the researcher concluded that; death of aquatic life, drought, destruction of plant species, and soil contamination are the major impact of industrial wastes on wetland ecosystem. Finally, the researcher concluded that; treatment of industrial wastes before disposal, proper, installation of filters, respect of environmental laws, and disposal of wastes are the possible solutions of industrial pollution on wetlands in Namanve Coca-Cola plant. Generally, the researcher concluded that industrial production in Namanve and Uganda in general need to be properly controlled and managed by the industries for the safety of the ecosystem.

5.3 Recommendations

The following recommendations are thus advanced by the researcher in a bid to limit the effects of industrial production on wetland ecosystem in Namanve and Uganda at large.

The researcher suggest that tougher laws be enacted by the government that prohibits dumping of toxic wastes into the environment and these laws need to be properly implemented by the concerned authorities and its breach should carry a heavy penalty.

Furthermore, the researcher suggests that industries need to be confined in a particular place and not to be scattered the way they are now. The researcher states that industries need a particular place of operation and they ought to be in areas that are far way from residential areas and wetland areas.

The researcher also suggests that pollution control systems need to be used by the industries so as to control industrial pollution in Uganda.

This is because lack of effluent treatment plants in a large number of industries is a cause of concern with regard to both surface and ground water/wetland pollution, yet proper operation and maintenance of the effluent treatment plants is critical for ensuring that the effluents are treated in desired levels in Uganda.

5.4 Areas Research

Given the time and scope of the study, this research could not digest all the necessary information to cover the researcher gap. So, further research needs to be done on the impact of dumping of wastes on the wetland ecosystems in Uganda.

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APPENDIX A: QUESTIONNAIRE FOR COMMUNITY MEMBERS

I am Jovaninah Sabah P, a student of Kampala International University pursuing a Bachelor of Science in environmental management. The topic of my research is "the **impacts of beverage plant on wetland ecosystem: A case study of Namanve coca-cola Factory-Mukono district, central Uganda".**

I kindly ask you to fill this questionnaire that would help me finish my academic research as a requirement for this award. The information provided to me in this questionnaire will be used only for academic purposes and will be treated with high confidentiality. You are therefore not expected to indicate your name.

I thank you for your co-operation.

Instructions: Tick in the box or write in the spaces provided appropriately

Date of interview.....

Site/zone.....

Respondent's number.....

PART ONE: DEMOGRAPHIC PROFILE OF RESPONDENTS

1. Sex of respondent

Male ☐ female ☐

2. Age of respondent in years

15-25 ☐ 26-35 ☐ 36-45 ☐

46 and above

3. Education of respondent

Primary ☐ Secondary ☐ Tertiary ☐

University ☐

Others,

specify.....

.....

4. Occupation of respondent

Peasant farmer ☐ Commercial farmer ☐ Business person ☐

Others,

specify.....

.....

None ☐

5. Length of habitation in the place (months or years of living in the same place)

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6. Marital status of respondent

Single ☐ Married ☐ Divorced ☐

Others, specify.....

7. The tribe of the respondent.....

8. How many people do you live or stay with as relatives or dependants?

Below 5 persons ☐ 5-10 persons ☐

More than 10 persons ☐

9. What is your religious affiliation?

Protestant ☐ Catholic ☐ Islamic ☐

Others, specify.....

PART TWO

11. Describe the types of industrial production in Namanve wetland.

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12. In your own understanding, do you think that the coca-cola plant in Namanve is environmental friendly?

Yes ☐ No ☐

If Yes or No, state your answer

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13. Was it right for the government to allocate Namanve wetland for industrial production?

Yes No ☐

If Yes or No, why?

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14. Beside the dangers imposed on ecosystem, what other effects does industrial production have in the area?

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15. What do you thinks needs to be done to regulate the industrial production in Namanve wetland ecosystem?

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SECTION C (industrial wastes released by industrial production)

16. What is the quality of products and wastes from industries reaching Namanve wetland?

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17. What wastes are being released by industrial production in Namanve?

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18. What impact do these industrial wastes have on wetland ecosystem in Namanve?

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19. What effects are these industrial wastes on the Namanve wetland ecosystem?

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20. How has soda and food processing industries in Namanve impacted on the surrounding wetland Ecosystems?

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SECTION D: (effects of industrial production on ecosystem)

21. What species that are threatened by industrial processing at Namanve Coca cola plant?

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22. What are the causes of wetland degradation in Namanve coca cola plant?

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23. What has the industrial effects on wetland ecosystem impacted on climatic change in Namanve?

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24. Describe how wetland ecosystem has been affected by industrial production in Namanve?

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25. What other environmental effects have been caused by industrial production in Namanve wetland ecosystem?

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SECTION E: (possible solutions to overcome problems of industrial wastes)

26. What are the possible solutions to overcome the industrial production threat on the wetland Ecosystems?

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27. Who do you think is best suited to handle the problems caused by industrial production in Namanve?

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28. Given the state of the wetland ecosystem in Namanve, do you think the lost value can still be regained?

Yes No ☐

If Yes

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.....

THANK YOU

END

APPENDIX II: INTERVIEW INFORMANT GUIDE (FOR NAMANVE STAFF/WORKERS, NGOS, CBOS, etc.)

I am **Jovaninah Sabah P**, a student of Kampala International University pursuing a Bachelor of Science in environmental management. The topic of my research is "the **impacts of beverage plant on wetland ecosystem: A case study of Namanve coca-cola Factory-Mukono district, central Uganda".**

I kindly ask you to fill this questionnaire that would help me finish my academic research as a requirement for this award. The information provided to me in this questionnaire will be used only for academic purposes and will be treated with high confidentiality. You are therefore not expected to indicate your name.

I thank you for your co-operation.

Instructions: Tick in the box or write in the spaces provided appropriately

Date of interview.....

Site/zone.....

Respondent's number.....

Title/office name.....

Responsibility held by respondent.....

QUESTIONS (TICK OR WRITE IN THE SPACES PROVIDED)

(1) What are the different resources existing in and around the Namanve industrial area that can be affected by industrial discharges and wastes

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(11) By what value does your company invest in preventive or cleaner technologies geared toward protecting or reducing damages caused to the environment resources of this production?

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Thank you for your cooperation