

An Assessment of the Impact of Construction Activities on the Environment in Uganda: A Case Study of Iganga Municipality

Lawrence Muhwezi^{*}, Faisal Kiberu¹, Michael Kyakula², and Alex O. Batambuze³

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Abstract: Construction while being an economic activity that provides facilities and infrastructure, it is beneficial to man in some aspects and detrimental in others. There have been environmental concerns related to construction activities globally which mainly focus on atmospheric emissions, depletion of natural resources and energy issues. This study was carried out to assess the impacts of construction activities on the environment in Iganga Municipality and to propose measures for their mitigation. The methodology included: review of relevant literature, observations of the general environmental effects of construction activities, focus groups and a survey conducted among construction industry role players to determine their perceptions and opinions regarding environmental impact of construction activities. The collected data was presented in tabular form and analysed by description of responses to questions. The study revealed that forests were the most greatly degraded due to high demand of timber for construction followed by wetlands degradation. The findings of this study will be useful to architects, designers and builders in order to carefully design buildings and other infrastructure that are environmentally friendly and sustainable. Construction materials and their mode of acquisition are harmful threats to the environment. There is need to reduce the consumption of these materials through recycling and reusing wastes to reduce on waste generation, use of virgin materials and the subsequent waste of energy used in new material production.

Key words: Environment, environmental degradation, construction activities, Iganga

I. INTRODUCTION

Consumption of raw materials by the construction industry is on the increase day by day resulting in the depletion of natural resources, increasing the environmental impacts and carbon emissions all over our surroundings [1]. A number of researches have shown that the impacts on the environment caused by construction activities are serious and need to be controlled [2], [3] and [4].

Iganga Municipal council is one of the young municipalities in Uganda and like many other upcoming urban areas; it is faced with a high rate of population growth. The increasing number of immigrants and investors to Iganga district has led to high demand of space for businesses and accommodation. Consequently a number of structures, residential, industrial and commercial have and continue to spring up. Much as these activities are a sign of social and economic development, they have been carried out with disregard of environmental concerns which mainly focus on atmospheric emissions, environmental deterioration, depletion of natural resources and energy issues.

This study was carried out to assess the impacts of construction and other civil engineering related activities on the environment in Iganga municipality and to propose the best solutions in curbing down these adverse impacts.

II. LITERATURE REVIEW

A Definitions

Environment is defined by [5] as "physical surroundings and conditions, especially as affecting people's lives; conditions or circumstances of living; external conditions affecting the growth of plants and animals". Other terms to describe environment are: surroundings, atmosphere, climate, habitat, territory, biosphere, ecosystem, and nature. The term also may include aspects such as cities, towns and villages (the urban or built environment), culture in all its manifestations, history, lifestyle and quality of life.

B Types of construction projects

Construction is defined as "a process that consists of building or assembling of a structure". On the other hand, a construction project "includes all material and work necessary for the construction of a finished structure for occupancy by end user. This includes site preparation, foundations, mechanical, electrical work, and any other work necessary to complete the project." There are different types of construction projects:

- *Building construction projects*
Building construction projects include: Residential homes; Institutional (e.g. hospitals, schools,

^{*}Lecturer, Kyambogo University, Department of civil and building engineering, P.O Box 7181, Kampala, Uganda. lmuhwezi@hotmail.com (Corresponding Author)

¹Lecturer, Kyambogo University, Department of civil and building engineering, P.O Box 7181, Kampala, Uganda

²Senior Lecturer, Kyambogo University, Department of civil and building engineering, P.O Box 7181, Kampala, Uganda

³Undergraduate Student, Kyambogo University, Department of civil and building engineering, P.O Box 7181, Kampala, Uganda

universities, churches etc); and Commercial (e.g. large shopping centres and retail chain stores, light manufacturing plants and warehouses and skyscrapers for offices and hotels) and industrial buildings. Industrial construction is only a small part of the whole construction industry nevertheless it is a very important part of the industry. Industrial buildings include warehouses and utility and packaging facilities.

- *Heavy and light civil engineering construction projects*

These projects include: water and sewer lines; bridge, highway and street construction; oil and gas pipelines; and power and communication structures. They are valuable projects which heavily affect the quality of life and the living standards of a nation. Typically, heavy and civil engineering construction projects are funded by central or local governments or corporations like power and water companies.

- *Specialized Industrial Constructions*

These types of construction projects usually involve very large scale projects with a high degree of technological complexity such as nuclear power plants, chemical processing plants, steel mills and oil refineries.

III. CONSTRUCTION AND ITS IMPACT ON THE ENVIRONMENT

The construction industry plays an indispensable role in providing physical infrastructure to meet the growing societal needs. On the other hand, it brings about detrimental effects, such as various forms of environmental pollution and resources depletion [6]. The environmental consequences generated from the construction industry relate to many aspects including: (i) consumption of large amounts of energy during the processing of materials, construction processes and in the use of constructed structures; (ii) dust and gas emission released during the production and transportation of materials and in some construction operations; (iii) disruption of people living in the vicinity of construction projects through traffic diversion, noise pollution and others; (iv) production of substantial volumes of waste; (v) waste water discharge; (vi) use of water resources; (vii) pollution from building materials; (viii) land use and (ix) substantial consumption of both renewable and non renewable resources [7], [8] and [9]. Figure I shows some of these effects on the environment.

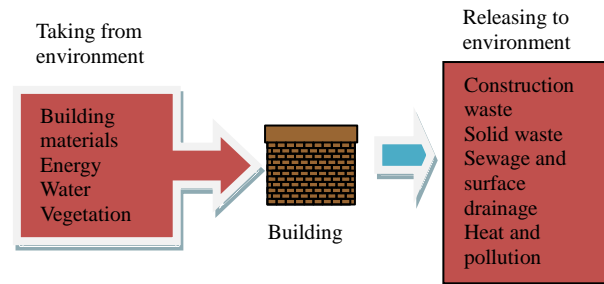


FIGURE I
SOME EFFECTS OF CONSTRUCTION ON ENVIRONMENT

Construction utilizes a wide range of materials, many (e.g. aggregates) occurring in their natural form and requiring only basic processing. Quarrying and the use of timber have direct and lasting environmental effects. Other materials undergo a variety of manufacturing processes, all consuming energy and requiring transportation. These processes contribute to the depletion of natural resources, produce waste requiring disposal and produce atmospheric emissions.

Construction has to support a world of continuing population growth and economic development and at the same time, must pay heed to the widespread social interests in environmental preservation which target has not been achieved yet. It has been reported that very few contractors and private developers spend efforts in considering the environment and developing the concept of recycling building materials [10], because most of them rank completion time as their top priority and pay little attention to the environment [9].

A. Environmental impact of construction wastes

Construction waste is becoming a serious environmental problem in many cities around the world [11]. Construction industry generates serious environmental impacts, compared with other industries and yet it lags far behind in implementing environmental management. The construction industry is responsible for producing a whole variety of different wastes, the amount and type of which depends on factors such as the stage of construction, type of construction work and construction practices on site. International studies have found that the construction industry contributes significantly to resource and environmental abuse. Some of the available statistics indicate that the construction and operation of the built environment accounts for: 12-16% of fresh water consumption; 25% of wood harvested; 30-40% of energy consumption; 40% of virgin materials extracted and 20-30% of green house emissions [12].

While the rapid economic expansion creates the largest construction market in the world and brings about an unprecedented opportunity in the construction industry, pollution resulting from construction activities has become a serious problem. It is estimated that the annual solid waste from construction reaches 30-40% of the total urban solid waste in China [12].

Materials selection for construction can also influence the environmental impact of construction. The main

factors determining the level of impact are the source of materials and the way they are processed. Similar materials can have greatly different environmental impacts depending on these factors. Important factors influencing selection of residential construction materials are their durability compared to intended life span, lifecycle energy consumption, source and environmental impact of all component materials and processes, recycling potential, and distances required for transportation of components.

B. Impacts of road construction on the environment

Road construction is essential for boosting development and economic growth within a society. Roads effectively move goods and people across considerable distances and are fundamental to the transport sector. There are several adverse impacts on the environment, however, which must be considered during the planning, construction and maintenance of roads. Environmental impacts of road construction are categorized as direct, indirect or cumulative.

- *Direct impacts*

Direct impacts involve the effects of the physical presence of the road. Road construction requires direct utilization of land, possibly for environmental practices such as farming. During road construction rivers and streams are diverted and also affected are wildlife habitats.

- *Indirect impacts*

Indirect or secondary impacts are more closely related to the construction process and often pose a more serious risk to the environment. They include issues such as land erosion and pollution from construction raw materials, which has knock-on effects on surface water quality. Another indirect impact is deforestation when roads are cut into forest areas to support easy logging transport and settler migration.

- *Cumulative impacts*

Cumulative impacts involve a collective end result of direct and indirect impacts. For example, road construction impacts including river diversion, deforestation, water and noise pollution, cause changes to wildlife habitats, which contribute to animal endangerment and even threaten extinction. Deforestation also causes increased temperatures due to a lack of vegetative cover, as well as a loss of plant species.

- *Unpredictable impacts*

There are a few unpredictable yet possible environmental impacts of road construction. Some of these include roadside pollution by passing commuters, fires and road fatalities due to car accidents. All impacts need to be carefully assessed before a road is constructed in order to minimize their

effects on both the environment and human population.

To reduce the environmental impact of road construction, appropriate preventive measures are available for all three stages of the process, i.e. planning, construction and maintenance. Road design must aim at serving the largest surface with the shortest road development [14] and [15]. Construction techniques and equipment have a strong influence on the type of impact and severity [16]. Construction should be followed by restoration measures [17] and [18].

IV. SUSTAINABLE CONSTRUCTION

The most publicized definition of sustainability is that of the World Commission on Environment and Development [19]. The commission defines sustainable development as: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" Sustainable construction aims at reducing the environmental impact of a building over its entire lifetime, while optimizing its economic viability and the comfort and safety of its occupants. Creating sustainable buildings starts with proper site selection, including consideration of the reuse or rehabilitation of existing buildings. In many parts of the world, fresh water is an increasingly scarce resource. A sustainable building should use water efficiently, and reuse or recycle water for on-site use, when feasible. Sustainable building is constructed of materials that minimize life-cycle environmental impacts such as global warming, resource depletion, and human toxicity. Environmentally preferable materials have a reduced effect on human health and the environment and contribute to improved worker safety and health, reduced liabilities, reduced disposal costs, and achievement of environmental goals.

V. METHODOLOGY

A descriptive survey research design was adopted in this study. The researchers used purposive/judgmental type of sampling to select the respondents basing on their level of education and experience in their interaction with people involved in construction activities. The target population included: technical staff of engineering department, contractors, environmental officers, politicians, private builders and the community members of municipal cells. In total, the study covered forty respondents which the researchers considered adequate to provide reliable data on construction and environment related issues.

A structured questionnaire was developed based on the specified objectives of the study. The area of study was surveyed and the households identified with the help of local leaders that had experience and basic knowledge about the environment and construction processes. Data was obtained through review of relevant documents, structured questionnaire, group focus discussion and physical observations on sites to verify the practices used

in regard to environmental conservation.

Data analysis involved questionnaire editing, coding, summarizing details, tabulation and statistical analysis. Open-ended questions were coded; data was captured using Microsoft Office Excel and then cleaned to remove stray errors that could have occurred during the entry process. Qualitative data was analysed and presented using frequencies, percentages and tables with narrative statements while quantitative data was presented using statistical methods which helped the researcher to find out the problems that under lay environmental degradation.

VI. RESEARCH FINDINGS AND DISCUSSION

A. Types of construction works in Iganga Municipality

From observations and records from the Municipal planning department, the major construction works were: residential buildings, hotels, commercial buildings such as super markets and shopping arcades. The results in Table I indicate that 40% of the respondents are married and this accounts for the high demand of space for accommodation. Also as seen from Table II, 47.5% of the respondents were civil servants, 25% were business men while 25% were peasants and 2.5% others. The majority of these people (civil servants and businessmen) can afford to construct houses and consequently have contributed to the upcoming structures in the municipality.

TABLE I
MARITAL STATUS OF RESPONDENTS

Status	Frequency	Percentage
Married	16	40
Divorced	10	25
Single	8	20
Cohabiting	6	15
Total	40	100

TABLE II
RESPONDENTS' OCCUPATION

Occupation	Frequency	Percentage
Business	10	25
Civil servant	19	47.5
Peasants	10	25
Other (specify)	1	2.5
Total	40	100

B. Types of degradation

The results in Table III revealed that forests were the greatly being affected for building materials followed by wetlands degradation while the focus group discussion revealed that the other impacts of construction on the environment were: poor planning by the authorities, destruction of vegetation for construction place, blockage of drainages from wastes both from construction and the population and construction. It was also reported that theft cases have increased due to the high demand of steel products/scrap by the steel industry.

TABLE III
TYPES OF DEGRADATION BY CONSTRUCTION ACTIVITIES AND THEIR RANKING

Type of degradation	Rank
Clearing of forests for building materials	1
Dumping waste in wetlands	2
Brick making	3
Quarrying	4
Pollution by industries	5

C. Qualification of respondents

It was established from the study (Table IV) that at least more than seventy percent of the respondents had qualifications above certificate level. This level of education is good enough to warrant reliable information in regard to environmental degradation caused by construction activities in the municipality.

TABLE IV
QUALIFICATION OF RESPONDENTS

Qualification	Frequency	Percentage
None	11	27.5
Certificate	10	25.0
Diploma	13	32.5
Degree	6	15.0
Total	40	100

D. Construction impacts on the environment

From the study, it was discovered that forests were being degraded (Table III) for building materials and wetlands were also being degraded. As demand for houses increases, people in the building industry have found it to be a virgin area. Land acquisition has increased with almost no more free space in the municipality. Unfortunately, in the wake of this, construction has been done without following sustainable principles. Wetlands are gradually disappearing because of such construction activities as: brick making, dumping of concrete and other forms of debris. People are now constructing everywhere without proper planning and consideration of the impacts to the environment.

From the Focus Group discussion, other impacts of construction on the environment were: poor planning by the authorities, destruction of vegetation for construction purposes, there are no provisions for drainage structures, and high volumes of garbage generated as a result of increased population.

E. Proposed remedies to environmental degradation from construction activities

The results in Figure II indicate that 56% of the respondents proposed the use of alternative materials and 42% proposed sensitization of communities while 2% proposed enforcing environmental laws as measures to mitigate environmental degradation. Using alternative materials with low environmental impact e.g. using metallic sheets and pipes for decking in construction of beams and columns would reduce pressure exerted on forests for timber and proposals for the same purpose. Sensitising communities about reuse of wastes on sites could also greatly minimize environmental damage on wetlands and other un gazetted dampi

ng areas.

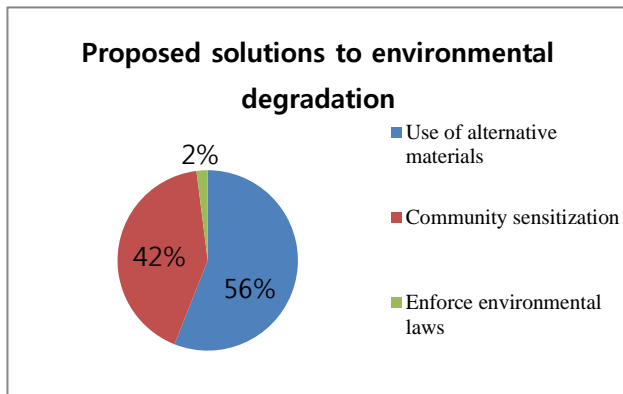


Figure II

PROPOSED SOLUTIONS TO ENVIRONMENTAL DEGRADATION

VII. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

Construction materials and their mode of acquisition are harmful threats to the environment and these threats are increasing with the increase in population and consumption of construction materials. Forests are being degraded at a faster rate as well as wetlands to acquire land for construction because of the pressure exerted by increased population on existing scarce land. The growing trends in extraction of natural construction materials are serious threats to the environment and unless serious actions are taken by designers, engineers and legislators, these natural resources will soon be no more.

B. Recommendations

In order to contribute to the reduction of environmental degradation by construction activities in Iganga municipality the following recommendations should be considered:

- The government of Uganda and National Environmental and Management authority (NEMA) in particular should enforce environmental laws such as mandatory Environmental Impact Assessments (EIAs) and emphasize environmental monitoring and compliance;
- Communities should be sensitized about the dangers of environmental degradation which does not only include the negative effects on human beings but also on the entire eco system;
- Communities within the urban settings should try as much as possible to follow the rules and regulations that govern urban construction and the environment surrounding it. This should be emphasized by the relevant urban authorities

such as the town engineers, environment officers and physical planners; and

- There is need to reduce the consumption of construction materials which can be done through recycling and reuse of wastes and this will reduce on the use of virgin materials and the subsequent waste of energy used in production of new ones.

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