Assessing the Impact of Solid Waste Management, the Case of Assosa Town, in Benishangul Gumuz Region, Western Ethiopia

Mekonen Hunde Geletu

Department of Geographic Information Science, College of Social Science and Humanities, Assosa University, Assosa, Ethiopia

Email address:
mekonnenhunde@gmail.com

Abstract: Background: The collection, transportation, recycling, resource recovery, and disposal of solid waste produced in urban areas constitute the complex activity known as solid waste management (SWM). The purpose of this investigation is to evaluate how solid waste management has affected the case of Assosa Town in the Benishangul-Gumuz region. Methods: Research designs were used in this study mixed research design, according to Creswell (2005). Both primary and secondary data sources were used. Samples were selected using purposive sampling and simple random techniques. The total number of HH 1489 out of these Using Yamane (1967) formula sample size determination 400 households was selected. The data collected from both primary and secondary sources were analyzed using SPSS software version 20 the result was analyzed via descriptive statistics. Result: Findings of the study revealed that the major sources of waste are produced Garbage from households 120 (30%) Plastic (Highland); 90 (23%), Restaurants/Hotel; 85 (21%) Market places; 53 (14%), and Offices; 45 (12%) respectively. The major types of solid waste in Assosa town are about 305 (76%) Household Hazardous waste, 75 (19%) Commercial Waste, and 20 (5%) Construction and demolition respectively. The major effects of solid waste in Assosa town are about 225 (56%) Infectious diseases (common cold), Environmental Problems 130 (33%) and 45 (11%) Block water drains respectively. Conclusions: Systems for handling solid waste should be established and improved in order to reduce the issues in the study area. The town has poor practices for managing municipal solid waste. Therefore, recommended that the municipal create proper infrastructure and prepare proper disposal sites where municipal solid wastes can be disposed. Organizing youth groups in small and micro businesses for solid waste management activities is also important, as is raising awareness among the local populace.

Keywords: Solid Waste Management, Municipality, Assosa

1. Introduction

The collection, transportation, recycling, resource recovery, and disposal of garbage generated in urban areas are all part of the complex process known as solid waste management [1]. Municipal solid waste is made up of various wastes produced by homes and various establishments, including schools, hospitals, slaughterhouses, houses, and public restrooms [2].

Due to drastically rising solid waste production that exceeds cities' and municipalities' capability, municipal garbage is not efficiently managed in developing countries.

According to reports, less than 70% of waste is collected in low-income nations, and more than 50% of the rubbish that is collected is frequently dumped in unregulated landfills [3]. One of the low-income nations affected by improper solid waste management is Ethiopia. According to reports, between 20 and 30 percent of the waste produced in Addis Abeba, the country's capital goes uncollected.

One of the low-income nations affected by improper solid waste management is Ethiopia. According to estimates, 20 to 30 percent of the waste produced in Addis Abeba, the country's capital, goes uncollected [4].

Both the local municipality's commitment and the

community's participation are necessary for proper solid waste management. In Ethiopia, there are numerous projects being undertaken to enhance environmental health, particularly in the capital city. More than 70% of community residents in Addis Abeba were prepared to pay for door-to-door waste collection service, one of the government's programs, and this indicates that the community's understanding of solid-waste management has increased [5].

The historic town of Assosa is home to numerous public and private hospitals, hospitals, motels, and small businesses, all of which produce a lot of solid waste [6]. Since no private entity is involved in such responsibilities, the municipality of a town is primarily in charge of managing the town's solid waste. A household's solid garbage is collected by the side of the road due to the lack of communal solid waste containers placed at various locations throughout the town. Despite the fact incorrect waste management is one of the most pressing public issues in Assosa, no study has been conducted to systematically determine the scope of the issue and the contributing elements.

The study's findings may be used by local policymakers to create solutions to problems with solid waste management. It might also act as a benchmark study for subsequent research on a regional scale.

2. Materials and Methods

2.1. Description of the Study Area

The town of Assosa, which is a part of the Assosa Zone, is one of the towns in the Benishangul Gumuz regional state. The capital of the area is Assosa, which is located 662 kilometers from Addis Abeba, the nation's capital. Resettlement communities around the town on all sides: to the north by Amba 8 and to the west by Amba 3, to the east by Amba 4 and to the south by Amba 38. Geographically, the settlement is situated between latitudes 10°1° and 10°5°N and longitudes 34°29° and 34°36°E. (Figure 1). There are 20,226 people living in the district in total, with 10,929 men and 9,297 women [7].
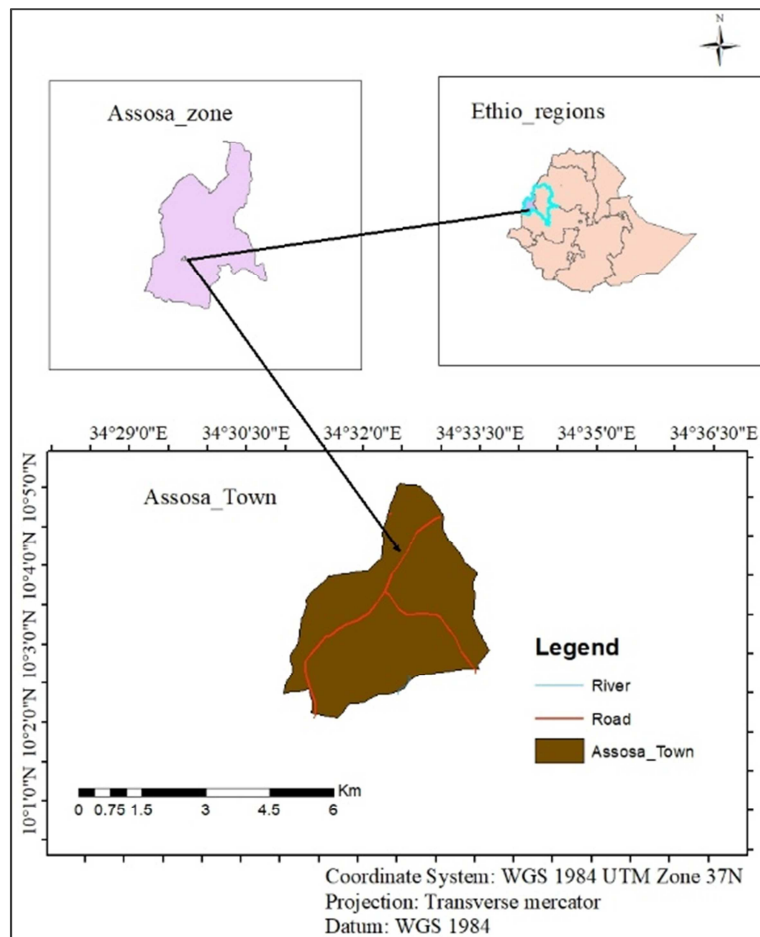

Figure 1. Study area location map.

2.2. Research Design

A mixed method research design that was put into practice was employed for this investigation. Explanatory sequential approaches prioritize numeric data more than exploratory sequential approaches prioritize qualitative data, according to [8]. The main goal of this strategy is to have qualitative data that can be used to further explain the initial quantitative findings. Data related to quality or kind is measured using the

qualitative research approach.

In contrast, the quantitative research approach was used to quantify data by assigning a numerical value in order to identify the most prevalent difficulties in the study area's solid waste management practices.

2.3. Data Sources and Data Types

Both primary and secondary data sources were utilized in the study in order to meet its goal. Through the use of semi-structured questionnaires, the research area's households served as the major data source. The data for the questionnaires which included both closed- and open-ended questions was gathered through interviews with Assosa Town inhabitants and members of the municipality of Assosa Town. The secondary data source was compiled from a suitable data source, which included actions on published and unpublished online services as well as books, journals, nervous papers, and other sources.

2.4. Sampling Technique and Sample Size

2.4.1. Sampling Technique

Purposive sampling was utilized to choose the study region. There are four kebeles in the research region, and one of them is one that has issues with solid waste management since there are significant sources of garbage disposal there, like a busy bus terminal and a hotel for women. By choosing 01 Kebele, the researcher was taking into mind this issue. As a result, the remaining kebeles were represented by the chosen 01 kebele.

2.4.2. Sample Size Determination

The total household of this kebele is 1489 households, from these total households 400 household was by using [9] formula sample size determination below by considering the level of acceptable margins of error at 5% (or 95% confidence interval):-

$$n = \frac{N}{1+N(e)2}$$

Where: n = is sample size, N= total household in kebele 01, and e= (0.05) stands for margin of errors.

$$\frac{1489}{1+1489(0.05)2} = 400$$

After determining the sample households, the simple random sampling technique was used. Therefore, the sample size for this study was 400 respondents.

2.5. Data Collection Instruments

The researcher employed a variety of data gathering techniques. These include surveys, interviews, and observational studies. Two sections make up the questionnaire. The questionnaire's opening section asked questions about the respondents' profiles. Questions about municipal solid waste management procedures and variables influencing municipal solid waste management procedures were included in the questionnaire's second section. Both open-ended and closed-ended ended questions were included in the questionnaires. Open-ended inquiries are specifically meant to elicit responses and more justifications. Data enumerators used sample respondents from the chosen 01 kebeles to fill out the questionnaires.

2.6. Data Collection Procedures

First, in order to make the questionnaires that had been adopted in the English language understandable to respondents, they were translated into the regional tongue, the so-called Amharic version. Second, a pilot test was done to assess the reliability and validity of the questionnaire by distributing it to 10 respondents who were not involved in the actual data collection. Based on the results of the pilot test, changes were made to the questionnaire. Last but not least, data enumerates were used temporarily to capture the actual data. Also properly trained and bilingual in Amharic are the data enumerators. Households were given a brief explanation of the study's goals and urged to participate. On the other hand, interviews with interviewees were performed based on appointment. Data from secondary sources was obtained by getting permission from concerned officials.

2.7. Data Analysis

In this section, data acquired from households, the Assosa municipality office, and field observations are presented, analyzed, and interpreted. The data were analyzed utilizing both qualitative and quantitative techniques. Closed-ended questions were answered using the quantitative time approach, and open-ended questions and interviews were answered using the qualitative method. Percentages, tabular analysis, and frequency distribution are examples of quantitative approaches. Cause and effect linkages, inductive reasoning, and deduction were all qualitative strategies. Descriptive statistics have been utilized extensively to portray the acquired data in questionnaire studies using quantitative methods, i.e., tables. The data were analyzed using SPSS version 20 software.

3. Results

This section evaluated and analyzed the data gathered from the study households using open-ended and closed-ended questionnaires, structured interviews with the key informants of the Assosa city municipality employees, and data gathered via the researcher's observation.

3.1. Characteristics of the Respondents

In this study, the researcher made an effort to create various sample households with a range of socioeconomic and demographic features.

3.2. Demographic Characteristics of the Respondents

The demographic features of the respondents include gender; age structure, level of income, and education level have been presented in below figure.
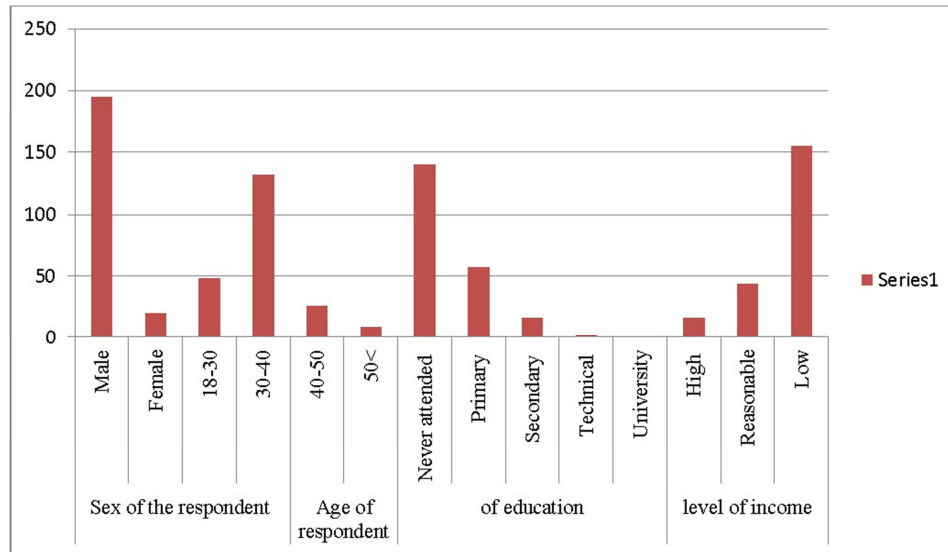
Figure 2. Demographic characteristics of respondents.

As indicated in the figure, of the total respondents, 90.69% of them are male-headed and 9.3% were females. From age categories 22.32%, 61.39%, 12.09% and 4.18% were in age group of 18-30, 30-40, 40-50 and 50< respectively. From this age group, the frequently observed groups were the age group which was categorized as 30-40. The education statuses of respondents were 65.11% never attended, 26.51 primary, 7.44% Secondary, and finally, 0.93% were technical. In terms of income level, our respondents were categorized based on the local income categorization system by discussing with development agents, kebele leaders, and some selected farmers. Farmers also put themselves in the following three income category levels. Accordingly, the respondent income level is 7.44%, 20.46%, and 72.09% that representing high, reasonable, and low respectively.

3.3. Characteristics of Municipael Solid Waste

3.3.1. Type of Municipal Solid Waste Generated in Assosa Town and Source

Regarding the major types of solid waste in the study area, the total number of that household that participated in this study was 400. The description in Table 1, below indicated the major sources of solid wastes regularly generated. Accordingly, the sample households were asked about the types of solid waste mostly produced from their Garbage households 120 (30%) responded Plastic (Highland); 90 (23%) responded Restaurants/Hotel; 85 (21%) responded Market places; 53 (14%) responded and Offices; 45 (12%) responded. In addition to this qualitative data gotten from interviewers and field observation strongly agree with in data to which the selected respondents responded. Likewise, the interviewer said that the dumping of solid waste everywhere, like open areas, river banks, and street roads dumped solid waste in the area was damaging both the environment and public health. As indicated by the interview the community's participation in municipal solid waste management was
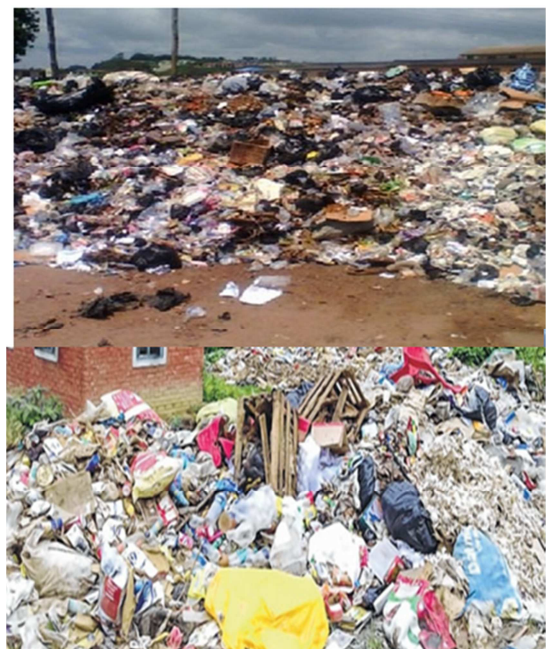
extremely low.

Table 1. Sources of solid waste in Assosa town.

№	Sources of waste	Frequency	(%)
1	Plastic (Highland)	90	23
2	Garbage from households	120	30
3	Offices	45	12
4	Market places	53	14
5	Restaurants/Hotel	85	21
	Total	400	100

Sources: Field Survey, 2022

3.3.2. Composition of Municipal Solid Waste in Assosa Town

Source: Researcher field observation

Figure 3. Composition of MSW in Assosa.

As is indicated in the review of the o literature parts of this research municipal solid waste is a term usually applied to various mixtures of solid waste produced in urban areas. But commonly urban waste can be subdivided into two major components called biodegradable and non-biodegradable [10].

The biodegradable component of urban solid waste constitutes organic waste such as food waste, garden waste, and agricultural waste which undergoes biological degradation under controlled conditions and can be turned into compost or organic fertilizer. While non-biodegradable wastes include inorganic materials which can't be decomposed and degraded [11]. Likewise, from the researcher's observation of the disposal site. Illegally dumping areas and in residential areas, Assosa city's physical composition of municipal solid waste is also composed from both biodegradable and non-degradable components.

3.4. Type of Municipal Solid Waste Generated in Assosa Town

A crucial element in the creation of effective and affordable solid waste management plans is a comprehensive understanding of the types and quantities of garbage that are being produced. A systematic survey of waste arising's given little priority elsewhere, and the amounts, characteristics, seasonal variations, and long-term etrends of waste generation are poorly understood. This is true even though among some of the more developed and developing countries within the region, quantification and characterization of waste form the basis for management and intervention. At the country level, some broad trends and common features are apparent despite the lack of full or consistent information.

Table 2. Types of solid waste in Assosa town.

№	Types of waste	Frequency	(%)
1	Household Hazardous Wastes	305	76
3	Construction and demolition	20	5
4	Commercial Waste.	75	19
	Total	400	100

According to the above table, results revealed that the majority of respondents responded about 305 (76%) Household Hazardous Wastes, 75 (19%) Commercial Waste, and 20 (5%) Construction and demolition respectively which means the types of waste found in Assosa town.

According to interviews which is from different government employers, especially from Assosa town municipality and the researcher, field observation was the same result as the result which was from the respondent above table.

3.5. Effect of Solid Waste Management

Ineffective solid waste management and disposal practices are one of the main environmental issues that developing nations must deal with. Solid waste has been a significant environmental problem ever since the industrial revolution. In addition to the waste, we produce at home, in the market, and in other public areas. There are furthermore those from

business, agriculture, healthcare, pharmaceuticals, and other sectors. While some wastewaters such as paper products, food scraps, as well as plants like grass and twigs are biodegradable, others such as metals, aluminum cans, plastics, damaged computers and auto parts are not. Due to their slow decomposition rate, they accumulate in landfills and garbage dumps, where they cause significant harm to the surrounding water, land, and population.

Table 3. Sources of solid waste management in Assosa town.

№	Effects of waste	Frequency	(%)
1	Infectious diseases, (common cold)	225	56
2	Block water drains	45	11
3	Environmental Problems.	130	33
	Total	400	

According to above table result revealed that the majority of respondents in the study area the effects of solid waste are 225 (56%) Infectious diseases (common cold), Environmental Problems 130 (33%) and 45 (11%) Block water drains respectively.

The interviewers say that the common cold is a viral infection of our nose and throat (upper respiratory tract). It's usually harmless, although it might not feel that way. Many types of viruses can cause a common cold. Healthy adults can expect to have two or three colds each year which highly face the Assosa town people and the major effects of solid waste.

4. Discussion

The major types of solid waste in Assosa town are about 305 (76%) Household Hazardous waste, 75 (19%) Commercial Waste, and 20 (5%) construction and demolition respectively.

The types of waste generated include; waste (34.8%), food residual (31.4%), paper (30.3), metal waste (1%), and other waste (2.5%). This result is in line with the study done on the high level of improper solid waste management practice. It was consistent with study findings from Nigeria 83.3% [12, 13], and Gonder, Ethiopia 69.7% [14].

Garbage from homes accounts for 120 (30 percent) of the waste produced, followed by plastic (Highland); 90 (23 percent), restaurants/hotels; 85 (21 percent), markets; 53 (14 percent), and offices; 45 (12 percent). This outcome is consistent with the assessment of the solid waste management situation in Ethiopia's Asella town provided in [15]. About 225 (56%) infectious infections (such as the common cold), 130 (33%) environmental problems, and 45 (11%) blocked water drains are the main effects of solid waste in Assosa town, respectively. This outcome is consistent with a study conducted by Birhanu, Y., and Berisa, G. [16] entitled Assessment of Solid Waste Management Practices and the Role of Public Participation in Jigjiga Town, Somali Regional State, Ethiopia.

About half of the respondents in our study's sample lived in underdeveloped nations where inappropriate solid waste disposal is frequent (dumping it in the yard, burning it in

their compound, throwing it in the ditch and in the river). According to a study conducted in Keko Machungwa, Tanzania, 62 percent of homes dispose of waste illegally. This high rate of improper solid waste disposal was caused by the area's inaccessibility due to informal settlements and congested roads [17]. Similar studies were conducted in Wolkite Town, Ethiopia, by Weldeyohanis, Y. H., Aneseyee, A. B., & Sodango, T. H. [18].

5. Conclusion

These inferences are made in light of the findings: Waste handling in particular and solid waste management in general are both lacking. The study's findings showed that MSEs were still in their infancy (they did not have sufficient waste collection facilities to do their assignment). Other techniques employed by the respondents for disposing of waste include digging a hole around the house and burning it, dumping it in a sewer, ditch, or roadway, and disposing of it in the backyards of their homes.

Most households who disposed of their waste at unapproved (illegal) locations preferred to do so between the hours of early morning and early evening. In addition, the sample respondent added that the municipality occasionally gathers rubbish that homeowners discard in open spaces and remove by open burning.

Thus, it is clear from the foregoing comments that solid waste management in the city is in dire need of improvement. The strategy for reducing solid waste has a flaw (segregation, reuse, recycling, and resource recovery). Two communal solid waste transfer stations were created by soil waste, but they are marked by an uneven distribution of beneficiaries and Kebele-specific disposal sites, and their management was also deemed insufficient.

This is due to the fact that the site is far away and surrounded by mountain ridges, despite the fact that there are nearby settlements, a church, and agricultural fields (used for crops, livestock grazing, and children's playgrounds) where natural waste is being carelessly dumped without further treatment. Household awareness and involvement in the SWM are quite low. The results of the assessment showed that very few households are aware of solid waste and its management. The amount of households participating in SWM activities is negligible.

The effectiveness of the municipal MSWM is hampered by a number of institutional reasons, including very lax enforcement of laws and regulations. In summary, this study looked into three key variables that exacerbate the city's current subpar municipal solid waste management practices. These include institutional, technical, and sociocultural aspects.

Abbreviations

CSA: Central Statistical Agency
NGO: -Non-Governmental Organization.
SWM: solid waste management

MSWM: municipality solid waste management

Authors' Contributions

Mekonnen Hunde data collection and analyzed socioeconomic data collected from the study area. Finally, the author read and approved the final manuscript.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the researcher on reasonable request.

Ethics Approval and Consent to Participate

The research was carried out with an ethical approach in mind. Before beginning the interviews, talks, and picture sessions, the participants' permission was requested and a letter of approval for the research location was received from the relevant institutions.

Consent for Publication

The work was accepted by the authors and given their blessing before being published in the International Journal of Environmental Monitoring and Analysis.

Competing Interests

The authors declare that they have no competing interests.

References

[1]   Lema, Gorfnesh, Million Getachew Mesfun, Amade Eshete, and Gizachew Abdeta. "Assessment of status of solid waste management in Asella town, Ethiopia." BMC public health 19, no. 1 (2019): 1-7.

[2]   Chanhthamixay, B., Vassanadumrongdee, S., & Kittipongvises, S. (2017). Assessing the sustainability level of municipal solid waste management in Bangkok, Thailand by wasteaware benchmarking indicators. Applied Environmental Research, 39 (3), 49-61.

[3]   Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). What a waste 2.0: a global snapshot of solid waste management to 2050. World Bank Publications.

[4]   Gelan, E. (2021). Municipal Solid waste management practices for achieving green architecture concepts in Addis Ababa, Ethiopia. Technologies, 9 (3), 48.

[5]   Weghmann, V., & Van Niekerk, S. (2018). Municipal solid waste management services in Africa and Arab countries.

[6]   Kebede, Y. S., Alene, M. M., & Endalemaw, N. T. (2021). Urban landfill investigation for managing the negative impact of solid waste on the environment using the geospatial technique. A case study of Assosa town, Ethiopia. *Environmental Challenges*, *4*, 100103.

[7]   Central Statistical Authority of Ethiopia, "Population Stabilization Report Ethiopia," Addis Ababa, Ethiopia, 2013.

[8]   Creswell, J. W., & Creswell, J. D. (2005). Mixed methods research: Developments, debates, and dilemmas. *Research in organizations: Foundations and methods of inquiry*, *2*, 315-326.

[9]   Yemane, M. (1967). Elemantary Sampling Theory, Printice-Hall Inc. Englewood Cliffs, New Jersey, USA.

[10]   Prajapati, P., Varjani, S., Singhania, R. R., Patel, A. K., Awasthi, M. K., Sindhu, R.,... & Chaturvedi, P. (2021). Critical review on technological advancements for effective waste management of municipal solid waste—Updates and way forward. *Environmental Technology & Innovation*, *23*, 101749.

[11]   Rastogi, M., Nandal, M., & Khosla, B. (2020). Microbes as vital additives for solid waste composting. *Heliyon*, *6* (2), e03343.

[12]   Adogu, P. O. U., Uwakwe, K. A., Egenti, N. B., Okwuoha, A. P., & Nkwocha, I. B. (2015). Assessment of waste management practices among residents of Owerri Municipal Imo State Nigeria. *Journal of environmental protection*, *6* (05), 446.

[13]   Yoada, R. M., Chirawurah, D., & Adongo, P. B. (2014). Domestic waste disposal practice and perceptions of private sector waste management in urban Accra. *BMC public health*, *14* (1), 1-10.

[14]   Gedefaw, L., Ayele, A., Asres, Y., & Mossie, A. (2015). Anaemia and associated factors among pregnant women attending antenatal care clinic in Walayita Sodo town, Southern Ethiopia. *Ethiopian journal of health sciences*, *25* (2), 155-164.

[15]   Fereja, W. M., & Chemeda, D. D. (2022). Status, characterization, and quantification of municipal solid waste as a measure towards effective solid waste management: The case of Dilla Town, Southern Ethiopia. *Journal of the Air & Waste Management Association*, *72* (2), 187-201.

[16]   Birhanu, Y., & Berisa, G. (2015). Assessment of solid waste management practices and the role of public participation in Jigjiga Town, Somali Regional State, Ethiopia. *International Journal of Environmental Protection and Policy*, *3* (5), 153-168.

[17]   Bodduluru, L. N., Kasala, E. R., Thota, N., Barua, C. C., & Sistla, R. (2014). Chemopreventive and therapeutic effects of nimbolide in cancer: the underlying mechanisms. *Toxicology in Vitro*, *28* (5), 1026-1035.

[18]   Weldeyohanis, Y. H., Aneseyee, A. B., & Sodango, T. H. (2020). Evaluation of current solid waste disposal site based on socio-economic and geospatial data: a case study of Wolkite town, Ethiopia. *GeoJournal*, 1-17.