



## Purview of Public Solid Waste Collection, Disposal and Management Practices in Akwa Ibom State, Nigeria

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### Abstract

*Recent global awareness in environmental monitoring, protection and management raises strings of probes into human practices and influence on the environment. The inquisition into the methods and practice of waste disposal raises much questions among environmental scientist, and analyst, hence the need for this presentation. Analysis of the practice in Akwa Ibom State and its impact was undertaken in a bid to assessing the existing system and proposing enhancement of the system. The collection of spatial data for the waste collection and disposal sites were obtained from field and social survey. Existing solid waste records from the Akwa Ibom State Waste Management Agency was used as ancillary and base data.*

**Keywords:** Solid waste management, Waste collection, Waste disposal, Compactors, Receptacle, Environmental education.

### Introduction

Man developmental strides in the form of urbanization, industrialization, production of packaged and disposable products and containers as well as population growth results in generation of waste. Man in undergoing his daily activities and endeavours generate waste<sup>1</sup>. Natural occurrences and environmental factors such as volcanic activities, severe weather and biological processes also results in one form of waste or the other. These wastes which include garbage, trash, yard waste, wood, metal, stone, and glass scrapes, etc generated on a daily bases are from different sources and of different types including sewage and solid waste. Of these, solid waste constitutes a greater challenge to the well being of mankind and the environment, and is thus the subject of concern in this study. This is because as described by research, solid waste is the most popular and most difficult to manage locally and since it does not flow, evaporate, diffuse, dissolve or absorbed into the surrounding unlike liquid and gaseous wastes<sup>2</sup>.

Defining solid waste, Ebistu and Minale stated that solid waste may be referred to as leaves, food remnants, paper cartons, textile materials, bones, ash/dust/stones, dead animals, human and animal excreta, construction and demolishing debris, biomedical debris, household hardware (electrical appliances, furniture, etc)<sup>3</sup>. Solid waste consists of everyday items which are used and thrown away such as product packaging, furniture, clothing, bottles, newspapers, appliances, household garbage, food wastes and yard wastes, etc. Solid waste which may be classified based in relation to the source include municipal (domestic, industrial, and commercial), agricultural, mining and mineral, radioactive and industrial wastes. However, among the sources, municipal wastes contribute the highest volume

annually. Municipal solid waste (MSW) is “any non-hazardous, solid waste from a combination of domestic, commercial and industrial sources. It includes putrescible waste, garden waste and uncontaminated biosolids”<sup>4</sup>. Solid wastes constitute a menace which has drastically plagued the environment worldwide, hence the concept of waste management.

Solid waste management may be defined as ‘the collection, transport, processing or disposal, managing and monitoring of solid waste materials’<sup>5</sup>. Peter Lang describes solid waste management as the ‘human control on the collection, treatment and disposal of different wastes’<sup>6</sup>. The Encyclopedia Britannica refers to solid-waste management as the development and operation of refuse disposal system which is the ‘technique for the collection, treatment, and disposal of the solid wastes of a community’<sup>7</sup>. This process which involve the collection, transfer, treatment, recycling, resources recovery and disposal of solid wastes, has the aim of promoting quality of the environment, protecting environmental health, generating employment and income as well as supporting the efficiency and productivity of the economy<sup>8</sup>.

Globally, poor management of solid waste poses a lot of problems both to the local environment and human inhabitants. Most times, wastes are often indiscriminately dumped on open plots of land, along/ on streets. This in effect causes pollution, environmental degradation, health hazard and aesthetical descend. Those found on drains obstruct the free flow of water resulting to urban flooding, which destroys lives and property as well as cause displacement of people; those deposited along motorways constitute obstruction to the free flow of traffic while generating offensive odours to the neighbourhood and unpleasant sight to the inhabitants. Solid waste also pollutes soil

and contaminates ground water due to pollutants or leachate. This leads to outbreak of diseases such as cholera and typhoid fever which has cause the loss of lots of human lives<sup>2</sup>. Nonetheless, this scenario arises where there is ineffective management or lack of proper supervision and disposal.

Howbeit, efficient and effective solid waste management according to research reduces or eliminates adverse impacts on the environment and human health and supports economic development and improved quality of life<sup>5</sup>. In Akwa Ibom State, the issue of environmental protection and sustainability nay solid waste management had been a thing of great concern both to the Local and State government and hence the setting up of Akwa Ibom State Environmental Protection and Waste Management Agency (AKSEPWA). This body is responsible for the monitoring and management of the environment, waste disposal inclusive.

Since the challenge of the 21<sup>st</sup> century environmental monitoring, management and protection is not to be handled with levity in order to forestall hazards and disaster, the existing waste management situation in Akwa Ibom State was undertaken. The aim was to assess the workability of the present system, challenges/problems, evaluate the problems due to short comings of the system and also put forward recommendations for enhancement. The scenario in Uyo, the state capital is considered as a case study.

## Solid Waste Management

Solid waste management involves the collection, transfer, treatment, recycling, resources recovery and disposal of solid wastes<sup>8</sup>.

Solid waste collection is the process of gathering waste from source or point of generation and from collection point/facilities. It usually involves the transportation of collected waste to a transfer station, treatment facility, or final disposal site. Howbeit, the collection process may be tailored to meet the goal of the intended waste management method such as resource recovery or land filling<sup>9</sup>. But irrespective of the waste management method to be employed, the waste must first be collected.

Research has shown that collection systems of solid waste differ remarkably between developed and developing nations; from house-to-house in most developed countries to communal container collection systems in developing countries<sup>9</sup>. In the house-to-house collection systems, domestic waste generated are collected directly from the house in which they are generated using various collection containers (e.g. refuse bags or bins) while in the communal container collection systems waste bins or receptacles are provided at vantage points within communities for households to drop-off waste. Collection trucks then pick up containers, empty them at a final disposal site and return the bins to their locations, or empty the contents of the

bins into vehicles for disposal. The house-to-house approach is most common in developed countries due to enhanced system, organized efforts and funding whereas the utilization of the approach is generally low in developing countries due to economic challenges and financial constraints<sup>9</sup>. However, the communal container collection systems is associated with difficulties leading to uncollected waste as a result of overflow, ground dumping at collection sites, and open/indiscriminate dumping at unauthorized places<sup>9</sup>.

Notwithstanding, in some economies, waste packed from collection points are taken to transfer stations before finally disposed as appropriate. Waste transfer stations are facilities where municipal solid waste is unloaded from collection vehicles and briefly held while it is reloaded onto larger transport vehicles for shipment to landfills, other treatment or disposal facilities. But whether communal, door-to-door or house-to-house, waste collected is disposed by several methods namely, incineration, composting, sanitary land fill and recycling. Composting is biochemical processes in which degradable organic materials such as lawn clippings and kitchen scraps, etc. are decompose by micro-organisms, mainly fungi and bacteria to a rich solid like material. The finished product, which looks like soil, is high in carbon and nitrogen and is an excellent medium for growing plants. Although composting method takes time and a lot of space, it is one of the best methods of waste disposal as unsafe organic products are turned into safe compost for plant use. It does not only benefit the environment and keeps unnecessary refuse out of landfills but also reduces the emission of methane from landfills into the environment and replenishes soil with nutrients. In Nigeria, composting has been practice as a traditional waste management strategy along time now and is used to improve soil fertility and farm yields<sup>10</sup>.

The open dumping method is the most common and widely used in developing countries including Nigeria. This method involves dumping of the waste in a designated spot which is uncovered or at illegal grounds<sup>15</sup>. Open dumps are unsanitary, unsightly and generally smelly, with foul odour as they attract rats, insects, flies, snakes, etc. The drawback with this method is that these open wastes degrades the environment and affect the entire wellbeing of the urban ecosystem. It also pollutes the soil and contaminates the ground water, thereby leading to the outbreak of diseases<sup>2</sup>.

Sanitary landfill method is a waste disposal approach in which waste materials are buried. Sanitary land filling is a modern technological plant where refuse is spread in thin layers, each of which is compacted by bulldozer before the next is spread. When about 3m of refuse has been laid down, it is covered by a thin layer of clean earth which also is compacted. Sanitary land fill is designed, realized and managed to obtain a minimization of negative effects. This may be regarded as the cheapest satisfactory means of waste disposal as pollution of surface and groundwater is minimized by lining and contouring the fill,

compacting and planting the cover crops, selecting proper soil and site, diverting upland drainage and placing wastes in site not subject to flooding or high ground water levels. However, the siting of landfills is critical to any successful solid waste management system but it is best suitable if land is within economic range of the source of the waste because collection and transportation account for 75% of the total cost of solid waste management<sup>11</sup>.

Incineration, a thermal treatment of solid waste is “a process where combustible wastes are burned at temperature high enough (900-1000`c or 2650-1830`f) to consume all combustible materials, leaving only ash and non-combustibles to be disposed off in a land fill”<sup>12</sup>. Incineration produces heat, gaseous products including carbon-dioxide and water as well as oxides of sulfur and nitrogen and other gaseous pollutant. It also produces non-gaseous products like fly ash and unburned solid residue<sup>10</sup>. Under ideal condition, incineration reduces the volume of waste by 75% to 95%<sup>12</sup>. The use of scrubbers and filters in incinerators prevent the release of acidic ash from burning into the surroundings and the air. Some incinerators also recycle the refuse and the gases and reuse them as fuel for its operation. Recycling is “any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations”<sup>13</sup>.

Generally, solid waste management has the basic objectives of reducing environmental pollution and promoting a clean environment which in turn leads to general aesthetics, promoting recycling and reuse of proposed waste, converting bio waste into energy, protection of human health and improve quality of life for the citizenry. Municipal solid waste management promotes the quality of the urban environment, generate employment and income. It protects environmental health and support the efficiency and productivity of the economy<sup>8</sup>. However, the extent to which any one option is used within a given country varies depending on a number of factors such as topography, population density, and transportation infrastructure, socioeconomic and environmental regulation<sup>14</sup>. Hence, the overview of Akwa Ibom State perspective.

**Background Information on the Study Area:** Uyo metropolis is an urban centre located in Uyo Local Government Area strategically in the south central part Akwa Ibom state. It serves both as the capital of Akwa Ibom State and the headquarters of Uyo Local Government Area. The city lies between longitude 07°54' and 07°58' East of the Greenwich Meridian and between latitude 04°58' and 05°08' North of the equator. The study area covers approximately 47.63km<sup>2</sup>. Uyo is a fast growing city with massive infrastructural development.

Historically, Uyo came into existence in 1905 as an administrative centre during the colonial era, between 1960 and

1967; it served as the headquarters of the defunct Uyo Province which covered Itu, Oron, Eket, Opobo and Uyo divisions. However, in 1976, Uyo became a Local Government Headquarters and when Akwa Ibom State was created in 1987; it became the state capital<sup>15</sup>.

### Existing Waste Management in Uyo Metropolis

Uwadiogwu and Chukwu in a study of strategies for effective urban solid waste management in Nigeria reported that there are two major approaches to waste management in Nigeria; the private and public arrangements<sup>16</sup>. The private system as stated is a contractual arrangement between an individual or group of persons who undertake waste disposal as a business venture and the waste generator and is common among the high and medium income households who can afford the charge. The public system is a conventional approach where government establishes a waste disposal agency whose responsibility it is to collect waste from waste generators and dispose them at disposal depots. Here, it is stated that some cities such as Enugu, Port Harcourt, Aba, Owerri, Ibadan and Kano adopt the combination of the two systems. The authors argued that the hybrid arrangement is usually adopted when the public system is ineffective to cope with the volume of waste generated. That is the private system is brought in to compliment the efforts of the public agency<sup>16</sup>. In Akwa Ibom State nay Uyo Metropolis, solid waste collection is managed by the AKSEPWA established by law to manage and regulate the collection and disposal of waste in the state. The current practice of the Agency in the study area is structured as presented in the following sections.

Solid Waste Records of Study Area: Information of waste related records and management practice of Waste Management Agency of Akwa Ibom was collected through direct and interactive session with management staff of the agency. The information obtained included mode of operation, volume of waste generated, and composition of wastes. Table-1 gives estimation from generated waste as recorded by the Waste Management Agency while Table-2 shows the various Zones (and constituent areas) into which Uyo is segmented into for proper coordination and waste collection.

**Table-1**  
**Waste Generation in Uyo Metropolis (in tonnes)**

Day	Week	Month	Yearly
152.25	1065.75	4560	54720

Source: Akwa Ibom State Environmental Protection and Waste Management Agency.

According to the agency (AKSEPWA), waste generated in Uyo largely consists of paper, plastics, rubbers, glass, bottles, vegetable matter, and metals. At the disposal site, the wastes are first sorted out for materials that could be recycled and further

sold to the recyclers. From the table, Zone 3 is the highest waste generating zone largely due to the presence of Akpan Andem Market. Whereas, Zone 2 which is the section of the city where major government parastatal are located including the Government House has a low waste generation capacity of 600 tonnes<sup>17</sup>.

**Waste Collection Facility:** The procedure adopted within Uyo Metropolis is through a public collection system where waste materials are dumped by citizens and occupant of residential and commercial areas into receptacles/bins strategically placed along street corners and locations of the town. The contents dumped by the citizenry are evacuated by the authorities and subsequently deposited at the deposit site away from their

generating point on daily basis. The content of the bins are finally. The receptacles bins are legal wheeled dump bins of approximate equal sizes (Figure-1).

Beside the collection bins, open dumps exists within the town where some residents choose to dump their waste. Open dumps are illegal dumping locations in the metropolis where people choose to dump their wastes. Waste deposits at these points are sometimes evacuated by the Waste Management Agency or burnt by the local dwellers. For example, Figure-2 is an open dump site along Udoma by Etuk Street created by residents and commercial dwellers within the environs created for dumping of waste.

**Table-2**  
**Zones of Waste Collection and Amount of Generated Waste per Month**

Zone	Composition	Amount of Waste Per Month (tonnes)
1	Ikot Ekpene Road and adjoining streets to the right; Itu Road, Ikpa Road, Uyo Village Road, Itam Market, CCC Road, Science Park Road, Udo Street, Calabar – Itu Highway	901
2	All right hand adjoining Street of Wellington Bassey Way, Nwaniba Road, Udo Obot and Ewet Street	600
3	Right hand adjoining Street of Oron Road, Nyong Esssien Street, Etuk Street, Udoma Street, Nepa Line, Nsiskak Eduok Avenue, Johnson Street, Akpan Andem Market, Udoudoma Avenue, Noah Udo, Ernest Bassey and Obio Imo Streets, Mbiabong Etoi Village and Shelter Afrique	946
4	Udo Eduok, Ukana offot and Mkpong Streets, Jubilee School Road, Aka Road, Aka Idak Eyop, Idongesit Nkanga (State) Secretariat, IBB Avenue and adjoining Streets.	627
5	Right hand adjoining streets of Abak Road; Udi, Udobio, Ibiam, Akpan Essien, Peter Uboh Streets; Atiku Abubakar Avenue, left hand adjoining Streets of Ikot Ekpene Road, and Ibom Connection.	713
6	Ewet Housing Estate, Edet Akpan Avenue, Osongama Estate, Mbiabong Etoi Timber Market and Ifa Atai Village	609

Source: Akwa Ibom State Environmental Protection and Waste Management Agency.



**Figure-1**  
**Solid Waste Receptacle at Street Corners**

**Waste Collection and Disposal:** For proper coordination and ease of collection and evacuation of the receptacle bins, the metropolis is divided into six zones with different vehicles assigned zones of operation. Collection from these bins is done within 9 to 11 am on a daily basis in this trend: compactors are

saddled with emptying the bins, while trucks are saddled with the collection of waste materials deposited on the ground at the waste bins points. Intervention trucks are also used occasionally to collect wastes from open dumps. Figure-3 shows AKSEPWA staff evacuating waste receptacle bins for disposal.



**Figure-2**  
**Open Dump Site at Udoma Street**



**Figure-3**  
**AKSEPWA Staff Evacuating Waste Receptacle Bins for Disposal**



**Figure-4**  
**Collection of Solid Waste by Compactor for Disposal**

With the compactors (Figure-4), collection of waste is carried out mechanically using 1 rear-end loaded compaction trucks of 2 average tonnes capacity. The wheeled receptacle bins are aligned with the hydraulic lifting mechanism of the truck (Figure-1). With the lifting mechanism, the bins are lifted and the content emptied into the truck without segregation of the waste materials. For the trucks, four to five crew members with the use of containers, empty the contents of the receptacle bins into the truck and also pack accumulated ones from and around the bins. Here cans/tins, glass and bottles including metallic waste are segregated for recycling. Intervention trucks which have the responsibility of packing and collecting waste from open dumps also has a large crew size. These personnel also use containers to pack waste and debris into the truck and also employ shovels for directly packing the waste into the trucks. Within the metropolis, the waste collected are later disposed at a disposal site along Old Stadium Road. However, some of the wastes are later burnt while those that are putrescible are allowed to compost with time. At the disposal site, the solid wastes are sorted out for materials that could be recycled and sorted materials sent for recycling.

### **Significance of Existing System**

Based on observations and social surveys, the system has the merit that the waste dumped in the receptacle bins by the

citizens are evacuated on a daily basis such that the receptacles are kept ready for newer waste materials the subsequent days. Since the Metropolis is divided into zones, the collection of the waste is done orderly and default by any group could easily be checked. Usually, the transportation and routing of the waste is usually carried out during regular or down time period when the amount of traffic is less and the trucks usually covered to prevent spilling of the waste along streets as the trucks navigates their way to the disposal site.

### **Drawback of the System**

In spite of the plus of the waste management system in the study area, some issues were observed which served as weaknesses to the method. Within the case study area, there is only one disposal site where all the waste generated in the city is disposed. In effect, waste has to be transported from all the segments of the town to this location, hence, bringing about inherent routing issues. Besides, there is only one type of waste receptacle bin in the city which is meant to collect all categories of waste. Due to this there is direct disposal of waste to the collection receptacles without segregation. Besides, the size of the bin are the same irrespective of the spatial extent or area which the bins are meant to service thus leading to over flow of bins and dumping of waste round the waste receptacles. The receptacles are also not covered making people to continue to

dump until the waste spills leading to accumulation of waste around the bins.

Furthermore, arising from the size of the receptacles with respect to the service areas, waste bins are filled soon after they are evacuated and this in turn cause bad odour to be created around the waste bins area which makes environment unpleasant. Since the collection bins are placed randomly, the non placement of waste receptacles at some localities and at convenient distances within some service areas lead to the emergence and existence of open dumps at many locations within the study area. Beside the accumulation of waste around receptacles, there is also the issue of lack of base platform for bins. This accumulated and spilled garbage become breeding ground for insects, flies, different bacteria, and micro-organisms. When rain falls, some of the waste matter is transported through the soil profile into the soil while some are washed by runoff to roads and public places. The decaying matter provides suitable material for harmful insects (mosquitoes and flies) to thrive and rapidly causing diseases.

There is also a lack of waste handling awareness amongst the citizens and this account for situation were waste are being thrown on the ground even when waste bins are present. Most importantly, the waste management agency (AKSEPWA) lagged behind in adopting technologies in the management of solid waste even though it has a systematic approach to handling of wastes. This in essence account for the major drawback in the operation of their waste management system.

**Findings:** From the foregoing, it was observed that the entire workings of the management agency were based on old traditional methods which in effect cannot cater well in the 21st century scheme of waste management.

From assessment, a total of 106 waste collection points and 1 disposal site were identified within the study area. It was also observed that some areas were in complete neglect of waste bins and this in a way impacted negatively on the environment. One of such negative effect is the degrading of the environment

aesthetically and burning of wastes by some people which in turn contributes to global warming.

Regarding the location of the disposable site, analysis on the proximity of the disposal site to the settlement (built up area) around it was considered in terms of proximity to the built up area and the consequence on the residents<sup>15</sup>. According to the author, the least criteria (200m and 700m) proposed by Rahman & Hoque for situating a disposal site away from settlement area were adopted and a buffer of 200m created around the disposal site showed that the settlement fall within the buffer zone indicating unsuitable location of the disposal site taking into cognizance the wellbeing of the residents<sup>15</sup>. Another observation made was the unpatriotic attitude of on the part of some citizenry. Some people intentional refuse to dump their wastes on the provided bins but rather prefer dumping them on the ground. This therefore calls for enlightenment and campaigns against such attitude.

### Discussion and Recommendation

For effective planning of waste management, the opinion of the masses as the users of the waste points is most necessary. To this effect, the convenient distance of waste bins to users were sought through questionnaires. A total of 70 questionnaires were sampled and 66 respondents were received. 30 questionnaires were sampled in Ewet Housing, a moderate residential hub of the city and 40 were sampled in other part of the study area classified as others. The analysis of the received questionnaire is as presented in Table-3.

From Table-1, 53.6% of respondents in Ewet Housing prefer a receptacle to be placed at about 150m from their residence for effective waste management while only 10.7% prefer a greater distance of 200m. The remaining 35.7% wants waste receptacles to be placed at an average distance of 100 from their residence. Comparing this preference to that of the resident on the other part of the study area, a greater percentage (65.8%) prefer a less distance of 100m to the waste bins for effective waste management. From the analysis, it is recommended that waste receptacles must be allocated by finding proximity distance convenient to the people at a distance between 100 to 150m.

**Table-3**  
**Analysis of Questionnaire**

Location	No. of Sampled Questionnaire	No. of Respondents	Percentage (%)	Responses		
				100m	150m	200m
Ewet Housing	30	28	93.3	10 (35.7%)	15 (53.6%)	3 (10.7%)
Others	40	38	95	25 (65.8%)	10 (26.3%)	3 (7.9%)

To check transportation and routing issues and littering the street in the course of collecting the waste, a number of disposable facilities should be provided within the fringes of the Metropolis. Waste receptacle size should be decided in consideration with the volume of waste generated within a service area and collection frequency checked to avoid overflow of bins, dumping of waste indiscriminately and on open grounds. Receptacle bins should be placed to collect different waste.

Although sensitization/awareness campaigns are being carried out in the state, enlightenment programs should be intensified and brought down to the grass root. However, the publicity through electronic media is not sufficient as most citizens may not have access to these gadgets, thus, supplementary and proper education on the hazards of the indiscriminate disposal of refuse should be made available at all levels of learning and social interaction to the citizenry. As observed, urban waste management requires the concern of government, businessmen, politicians, religious organizations, civil servants, men, women, literate and illiterate, the rich and the poor; and a host of other tangible and intangible groups<sup>16</sup>. Thus the entire citizenry must be brought together by government policy and legislation to work together in order to check urban waste problems and enhance sustainable waste management. Hence, citizen mobilization and environmental education is strongly advocated.

Again, the waste management strategies proposed by research which include waste management policy and implementation of waste management legislation, monitoring and surveillance, infrastructural and management improvement, government support and strengthening of waste management agency is recommended<sup>16</sup>. Presently, the waste management process largely involves simply moving waste from one place to another and not really managing it. Application of science and technology in waste composting, recycling and resource recovery should be adopted. Landfill sites should be upgraded and properly designed in accordance with environmental standards.

Howbeit, researches have shown that Geographic Information System (GIS) play a significant role in solid waste management system. It provides solutions to waste collection and routing issues such that optimization of vehicle routing in terms of distance and travel time is enhanced which in effect leads to reduced collection cost. In waste facility location and allocation, it's spatial analysis tools helps in the integration of various data and for selection of best site giving information on the exact areas where there is need of bins rather than been placed haphazardly. With GIS, an improved tool to alternative conventional method of minimizing operational costs for contractors and efficiency of waste collection and transportation in the municipality will be obtainable through data update and monitoring. Based on research, GIS has proved successful in assisting planners to give suitable location for transfer stations

for solid waste storage, designing short routes for waste collection, creating databases for households that pay and those who have not paid for the services, arranging time tables for trucks to collect waste, etc. and is thus recommend for use in Akwa Ibom State nay Nigeria.

## Conclusion

The management of solid waste in study area as employed by the Akwa Ibom State Environmental Protection and Waste Management Agency is that the Metropolis is divided into six zones to ease the process of collection and disposal. The evacuation of waste contents from the receptacle bins is done routinely on a daily basis. Vehicle used are compactors which carries nine (9) tonnes of waste at a time and tippers capable of carrying two (2) tonnes a time. While the Compactors are used for evacuating waste contents from the waste bins, tippers are used to evacuate wastes deposited on the ground at waste bin points and from open dump sites.

Though it was observed that the working of the system is systematic, proper and effective management in terms of monitoring, routing of vehicles, siting of waste collection and disposable facilities could be efficiently executed with the application of GIS. Therefore this study strongly recommended among other things the use of GIS in solid waste management in order to curb the drawbacks in the existing traditional method.

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