Analytic Hierachy Process Model for Ranking the Disposal of Solid Wastes Based on Settlement Pattern

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Abstract- The research applied analytic hierarchy process (AHP) model to determine relative weights for ranking the disposal of solid wastes products in Abuja metropolitan. Three (3) settlement patterns, each having thirteen (13) wastes collection centres were identified. Presently, the disposal of solid wastes at these settlement patterns and their respective collection centres does not have proper schedules. It was found out that this lack of organised plan resulted in some centers, within a settlement pattern, having huge piles of solid wastes unattended to while others were disposed promptly. This unplanned schedule necessitated the application of AHP model to determine the relative weights that ranked the settlement patterns and the collection centres for proper schedule of disposal of the solid wastes. Nine point scales was used to quantify the verbal judgments obtained from the Officers of the Solid Waste Management Agency in respect of the preference of disposal of solid wastes at the centres given the three (3) settlement patterns. Pair-wise comparism matrices were developed and the judgments from the respondents used to develop matrices were determined to be consistent using consistency ratio.

The weights determined ranked the three settlement pattern as, population density first; very important person settlement pattern as second and road network/drainage channel as third. The results of the study also ranked the disposal at the collection centres within each of these all three (3) settlement patterns. These rankings will serve as input for developing planned schedule for the disposal of solid wastes at the collection centres.

Index Terms- Analytic Hierarchy Process, Disposal, Location, Priority, Settlement Pattern, Solid Waste.

I. INTRODUCTION

Solid wastes are wastes which are things that the owners no longer want at a given time and space and which have no current or perceived market value. They are not free flowing and thus have remained one of the man's most challenging environmental problems. Solid wastes are continuously generated and disposed and which have been observed to be a growing problem. The continous generation and disposal of solid wastes have been ascribed to industrial development and population growth. The disposal or disposal of solid wastes, which have been considered as the means of managing them, consumes huge amount of money and other resources such as time. Despite the huge investments government spends on them, their management have still remained one of the most problematic environmental sanitation challenges faced by developing countries of the world (United States Environment Protection Agency, 2003; Martin, 2002; Huang *et al*, 2001).

The disposal or disposal of solid wastes has been an issue of concern for individuals and government officials especially in urban areas, since early modern times (Caruso, Colorni and Paruccini, 1993; Costi *et al*, 2003; Jadea *et al* , 2008) Solid wastes are generally an unavoidable by-product of economic activities. In Nigeria, due to industrialization and rapid population growth, wastes generally are generated faster than they are collected, transported and evacuated (United States Environmental Protection Agency, 20003; Ogwueleka, 2009; Onibokun and Kumuyi, 2003) . It has been observed that management (disposal) of solid wastes in Nigeria is far from being satisfactory. Many of Nigerian cities and towns do not benefit from any organized waste management services and for that reason, wastes are unattended to, buried, burnt or disposed haphazardly (Federal Ministry of Environment, 2005). The sources of solid wastes in Nigeria can be identified as market places, homesteads, factories, workshops, hospitals, seaports, primary, post primary and tertiary institutions (Akoni, 2007). It has been documented that the volume of waste does not actually constitute problem but the ability or inability of governments, individuals and waste disposal firms to keep up with the task of managing waste. Waste management involves collection, keeping, treatment and disposal of waste in such a way as to render them harmless to human and animal life, ecology and the environment generation. In this paper, disposal of wastes as one of the activities of wastes studied involves collection of wastes, transferring the collected wastes to disposal sites and disposal of same from their respective disposal sites. The wastes are usually collected at various collection centres which are located at different places within a given town or city. These locations may be characterized by population density (PD), very important persons'(VP) and Road Network/Drainage Channel (RNDC)settlement patterns. These collection centres are always associated with the volume of wastes growing faster than the volume transferred to disposal sites. This implies that the collection centres always have volumes of wastes accumulated and are rarely evacuated or disposed. The disposal at the collection centres do not seem to be treated equally because their relative locations are described by the population of individuals or firms, thereby giving rise to settlement patterns to be considered during disposal as PD , VP and RNDC. The unequal treatment, with respect to the disposal of these solid wastes, at the collection centres implies that disposal at some collection centres seem to be given more attention than others. In order to justify and measure this relative priority, a model needs to be developed and results derived from the model will provide

numerical measure that describes the preferential treatment of the solid waste disposal at the various collection centres.

AHP is a multi criteria decision making approach that has good mathematical properties appropriate for incorporating value judgments of decision makers in modeling for selection of best alternatives. It is equally appropriate for providing numerical measure of ranking of set decision making criteria. In addition to its usefulness for decision making, it is also a tool used for deriving information for planning. Thus, AHP is a decision support tool that can be used to solve complex decision problems. It is modeled in tree- like multi-level hierarchy structure of objective, criteria, sub-criteria and alternatives. Pair wise comparism of the criteria and or sub-criteria is established to model same as a pair wise matrix. The result of the evaluation of the matrix is weights of importance of the decision criteria and the relative performance measures of the alternatives in terms of each individual decision criteria (Alonso and Lamata, 2006; Winston, 1993; Zamali, Mohd and AbuOsman, 2010). In this paper, an Analytic Hierarchy Process (AHP) model is developed for determining ratings for solid waste disposal at collection centers in Abuja Metropolis. The model incorporates the value judgments of the stakeholders of solid wastes management. The choice of AHP for this problem situation is its suitability in determining accurate estimation pertinent to data through its pair wise comparison. Input to the pair wise comparison is the expression of decision maker's opinion about the value of one single pair wise comparison at a time. Doing this requires that a decision maker chooses his answers among 10-17 discrete choices- each choice is expressed as a linguistic phrase(Zamali, Mohd and Abu Osman, 2010; Saaty, 1980). The pair wise comparisons are quantified by using a scale which is one-to-one mapping between the sets discrete linguistic choices available to the decision maker and a discrete set of numbers, which represents the importance, or weights of the previous linguistic choices. Saaty (1980) proposed such scale quantification as contained in Table 1.

Table 1: Scale of Relative Importance.

Intensity of Importance	**Definition**	**Explanation**
1	Equal importance	Two activities contribute equally
3	Weak importance of one over another	Experience and slightly favour one activity over another
5	Essential or strong importance	Experience and judgment strongly favour one activity over another
7	Demonstrated importance	An activity is strongly favoured and its dominance demonstrated in practice
9	Absolute importance	The evidence favouring one activity over another is the highest possible of affirmation
2,4,6,8	Intermediate values between the two adjacent judgments	When compromise is needed
Reciprocals of above nonzero	If activity *i* has one of the non zero nos. assigned to it when compared to activity *j* , then *j* has the reciprocal value when compared to *i*.	

Triantaphyllou and Mann (1994) proposed an evaluation of seventy eight (78) different scales in which all alternative scales depart from some psychological theories and developed numbers which were used based on these psychological theories. According Triantaphyllou and Mann (1995) another attempt at providing scales was proposed by Weber in 1846 by stating a law regarding a stimulus of measurable magnitude. The law asserted that a change in sensation is noticed if the stimulus is increased by a constant percentage of the stimulus itself. This implies that people are unable to make choices from an infinite set. Psychological experiments have also shown that individuals cannot simultaneously compare more than seven objects (plus or minus two). This is the reason why Saaty established nine (9) as the upper limit and one (1) as the lower limit of his scales and a unit difference between successive scales.

The objective of this research is to provide numerical measures that rank the collection centres and settlement patterns relative to each other for preferential disposal of solid wastes at these centres and settlement patterns in Abuja Metropolitan Council. This is to serve as information for solid waste managers in planning for the disposal of solid wastes at these centres.

II. METHODOLOGY

Personal visitation to Abuja, the capital city of Nigeria was made in October, 2011. Face - to – face interview and questionnaire were used as instruments for eliciting responses from the Officers of Solid Waste Management Agency and Federal Ministry of Environment, Abuja. Documented materials on the operations of these organizations were also consulted for relevant data to the research. From the sources, the operations of the existing disposal functional element was identified and assessed. Parameters measured and assessed were:

(i) Number and location of waste collection sites;
(ii) The settlement patterns of the collection sites expressed as population density (PD), Very Important Population (VP) and Road Network/Drainage Channels (RNDC)
(iii) Assessment, in terms of numerical ratings, of the priority of collection sites relative to each other and according to settlement patterns.

Based on the measurements and assessments of the parameters and the preferential scaling of verbal judgments of

the Staff of Solid Wastes Management Agency, Abuja, pair wise comparism matrices of the various collection sites, based on settlement patterns, were developed and from which their relative preferential ratings were determined. Numerical rating of the responses elicited from the respondents were established using nine point scale as contained in Table 2 below.

Table 2: Nine Point Scale for Assessment of Verbal Judgments of the Respondents

S. No.	Verbal judgments of preferences	Numerical Rating
1	Extremely preferred	**9**
2	Very strongly to extremely preferred	**8**
3	Very strongly preferred	**7**
4	Strongly to very strongly preferred	**6**
5	Strongly preferred	**5**
6	Moderately to strongly Preferred	**4**
7	Moderately preferred	**3**
8	Equally to moderately Preferred	**2**
9	Equally preferred	**1**

III. RESULTS

Nine point (9) scales shown in Table 2 was used in rating the verbal judgments of the relative preferences of the collection sites and the settlement patterns. These assessments gave rise to the development of four pair wise comparism matrices (three of which are for the collection centres according to the three settlement patterns and one for the three settlement patterns). Pair wise comparison matrix showing preferences for the collection centers based on three settlement pattern are shown in Tables 3, 5 and 7 while the corresponding syntheses matrixes are shown in Tables 4, 6 and 8 respectively. Tables 9 shows the pair wise comparisons of the three settlement patterns, while Table 10 and 11 is corresponding the pair wise comparison matrix and synthases matrix.

Table3: The Pair wise Comparison Matrix Showing Preferences for the Collection centers based on PD Settlement Pattern

Location	Garki I	Garki II	Wuse I	Wuse II	Cent. A.	Gwarinpa	Maitama	Asokoro	Jabi	Durimi	Lugbe	Kado	Wuye
Garki I	1	2	½	½	4	3	4	4	2	3	3	2	3
Garki II	½	1	½	½	5	2	5	4	3	2	2	3	3
Wuse I	2	2	1	2	5	4	4	5	3	4	3	4	5
Wuse II	2	2	½	1	4	3	4	4	2	3	2	3	3
Cent. A.	¼	1/5	1/5	¼	1	½	6	3	½	½	⅓	½	½
Gwarinpa	⅓	½	¼	⅓	2	1	3	2	½	2	2	3	2
Maitama	¼	1/5	¼	¼	1/6	⅓	1	½	⅓	⅓	⅓	⅓	⅓
Asokoro	¼	¼	1/5	¼	⅓	½	2	1	1/2	⅓	⅓	½	¼
Jabi	½	⅓	⅓	½	2	2	3	2	1	2	½	2	3
Durimi	⅓	½	¼	⅓	2	½	3	3	½	1	2	3	2
Lugbe	⅓	½	⅓	½	3	1/2	3	3	2	½	1	2	2
Kado	½	⅓	¼	⅓	2	⅓	3	2	⅓	½	½	1	½
Wuye	⅓	⅓	1/5	⅓	2	½	3	2	⅓	½	½	2	1

Table 4: The Syntheses Matrix of the table 3.

Location	Garki I	Garki II	Wuse I	Wuse II	Cent. A.	Gwarinpa	Maitama	Asokoro	Jabi	Durimi	Lugbe	Kado	Wuye	**Priority**
Garki I	0.1165	0.1970	0.1049	0.0706	0.1231	0.1679	0.0909	0.1127	0.1274	0.1525	0.1744	0.0759	0.1161	**0.1254**
Garki II	0.0583	0.0985	0.1049	0.0706	0.1538	0.1119	0.1136	0.1127	0.1911	0.1017	0.1163	0.1139	0.1161	**0.1126**
Wuse I	0.2330	0.1970	0.2098	0.2824	0.1538	0.2239	0.0909	0.1408	0.1911	0.2034	0.1744	0.1519	0.1935	**0.1882**
Wuse II	0.2330	0.1970	0.1049	0.1412	0.1231	0.1679	0.0909	0.1127	0.1274	0.1525	0.1163	0.1139	0.1161	**0.1382**
Cent. A.	0.0291	0.0197	0.0420	0.0353	0.0308	0.0280	0.1364	0.0845	0.0318	0.0254	0.0194	0.0190	0.0194	**0.0401**
Gwarinpa	0.0388	0.0493	0.0524	0.0471	0.0615	0.0560	0.0682	0.0563	0.0318	0.1017	0.1163	0.1139	0.0774	**0.0670**
Maitama	0.0156	0.0125	0.0156	0.0156	0.0104	0.0208	0.0625	0.0313	0.0208	0.0208	0.0208	0.0208	0.0208	**0.0222**
Asokoro	0.0291	0.0246	0.0420	0.0353	0.0103	0.0280	0.0455	0.0282	0.0127	0.0169	0.0194	0.0190	0.0194	**0.0254**
Jabi	0.0583	0.0328	0.0699	0.0706	0.0615	0.1119	0.0682	0.0563	0.0637	0.1017	0.0291	0.0759	0.1161	**0.0705**
Durimi	0.0388	0.0493	0.0524	0.0471	0.0615	0.0280	0.0682	0.0845	0.0318	0.0508	0.1163	0.1139	0.0774	**0.0631**
Lugbe	0.0388	0.0493	0.0699	0.0706	0.0923	0.0112	0.0682	0.0845	0.1274	0.0254	0.0581	0.0759	0.0774	**0.0653**
Kado	0.0583	0.0328	0.0524	0.0471	0.0615	0.0187	0.0682	0.0563	0.0212	0.0254	0.0291	0.0380	0.0194	**0.0406**
Wuye	0.0388	0.0328	0.0420	0.0471	0.0615	0.0280	0.0682	0.0563	0.0212	0.0254	0.0116	0.0759	0.0387	**0.0421**

From tables 3 and 4:

$$\lambda_{max} = 13.9500,\ CI = 0.0792,\quad RI = 1.5551\quad and\quad CR = \frac{CI}{RI} = 0.0509 < 0.1,\ is\ \ OK$$

Table5: The Pair wise Comparison Matrix Showing Preferences for the Collection centers based on **VP** Settlement Pattern

Location	Garki I	Garki II	Wuse I	Wuse II	Cent. A.	Gwarinpa	Maitama	Asokoro	Jabi	Durimi	Lugbe	Kado	Wuye
Garki I	1	2	2	2	½	3	⅓	⅓	2	3	3	3	3
Garki II	½	1	½	½	⅓	2	⅓	¼	2	3	½	½	3
Wuse I	½	2	1	½	½	2	⅓	¼	½	2	½	2	3
Wuse II	½	2	2	1	½	2	¼	⅓	2	2	2	3	3
Cent. A.	2	3	2	2	1	3	⅓	½	3	3	3	3	4
Gwarinpa	⅓	½	½	½	⅓	1	½	¼	½	2	½	2	2
Maitama	3	3	3	4	3	2	1	4	3	3	4	4	4
Asokoro	3	4	4	3	2	4	¼	1	4	4	3	4	5
Jabi	½	½	2	½	⅓	2	⅓	¼	1	2	2	2	2
Durimi	⅓	⅓	½	½	⅓	½	⅓	¼	½	1	½	½	2
Lugbe	⅓	2	2	½	⅓	2	¼	⅓	½	2	1	2	2
Kado	⅓	2	½	⅓	⅓	½	¼	¼	½	2	½	1	2
Wuye	⅓	⅓	⅓	⅓	¼	½	¼	1/5	½	½	½	½	1

Table 6: The Syntheses Matrix of table 5

Location	Garki I	Garki II	Wuse I	Wuse II	Cent. A.	Gwarinpa	Maitama	Asokoro	Jabi	Durimi	Lugbe	Kado	Wuye	**Priority**
Garki I	0.0789	0.0882	0.0984	0.1277	0.0513	0.1224	0.0702	0.0406	0.1000	0.1017	0.1429	0.1091	0.0833	**0.0934**
Garki II	0.0395	0.0441	0.0246	0.0319	0.0342	0.0816	0.0702	0.0305	0.1000	0.1017	0.0238	0.0182	0.0833	**0.0526**
Wuse I	0.0395	0.0882	0.0492	0.0319	0.0513	0.0816	0.0702	0.0305	0.0250	0.0678	0.0238	0.0727	0.0833	**0.0550**
Wuse II	0.0395	0.0882	0.0984	0.0638	0.0513	0.0816	0.0526	0.0406	0.1000	0.0678	0.0952	0.1091	0.0833	**0.0747**
Cent. A.	0.1579	0.1324	0.0984	0.1277	0.1026	0.1224	0.0702	0.0610	0.1500	0.1017	0.1429	0.1091	0.1111	**0.1144**
Gwarinpa	0.0263	0.0221	0.0246	0.0319	0.0342	0.0408	0.1053	0.0305	0.0250	0.0678	0.0238	0.0727	0.0556	**0.0431**
Maitama	0.1875	0.1875	0.1875	0.2500	0.1875	0.1250	0.0625	0.2500	0.1875	0.1875	0.2500	0.2500	0.2500	**0.1971**
Asokoro	0.2368	0.1765	0.1967	0.1915	0.2051	0.1633	0.0526	0.1220	0.2000	0.1356	0.1429	0.1455	0.1389	**0.1621**
Jabi	0.0395	0.0221	0.0984	0.0319	0.0342	0.0816	0.0702	0.0305	0.0500	0.0678	0.0952	0.0727	0.0556	**0.0577**
Durimi	0.0263	0.0147	0.0246	0.0319	0.0342	0.0204	0.0702	0.0305	0.0250	0.0339	0.0238	0.0182	0.0556	**0.0315**
Lugbe	0.0263	0.0882	0.0984	0.0319	0.0342	0.0816	0.0526	0.0406	0.0250	0.0678	0.0476	0.0727	0.0556	**0.0556**
Kado	0.0263	0.0882	0.0246	0.0213	0.0342	0.0204	0.0526	0.0305	0.0250	0.0678	0.0238	0.0364	0.0556	**0.0390**
Wuye	0.0263	0.0147	0.0164	0.0213	0.0256	0.0204	0.0526	0.0244	0.0250	0.0169	0.0238	0.0182	0.0278	**0.0241**

From tables 5 and 6: $\lambda_{max} = 14.1111,\quad CI = 0.0926,\quad RI = 1.5551 \quad and \quad CR = \frac{CI}{RI} = 0.0595 < 0.1 \; is \; ok$

Table7: The Pair wise Comparison Matrix Showing Preferences for the Collection centers based on **RNDC** Settlement Pattern

Location	Garki I	Garki II	Wuse I	Wuse II	Cent. A.	Gwarinpa	Maitama	Asokoro	Jabi	Durimi	Lugbe	Kado	Wuye
Garki I	1	2	3	2	2	2	2	4	4	2	3	3	4
Garki II	½	1	½	½	¼	⅓	3	2	3	3	3	2	3
Wuse I	⅓	2	1	2	½	½	2	3	3	2	2	2	3
Wuse II	½	2	½	1	½	½	2	2	3	2	3	3	4
Cent. A.	½	4	2	2	1	2	2	3	3	3	2	4	3
Gwarinpa	½	3	2	2	½	1	2	2	2	3	2	2	4
Maitama	½	⅓	½	½	½	½	1	½	½	⅓	⅓	½	2
Asokoro	¼	⅓	⅓	½	⅓	½	2	1	½	⅓	½	3	4
Jabi	¼	⅓	⅓	⅓	⅓	½	2	2	1	½	½	½	2
Durimi	½	⅓	½	½	⅓	⅓	3	3	2	1	2	2	2
Lugbe	⅓	⅓	½	⅓	½	½	3	2	2	½	1	½	2
Kado	⅓	½	½	⅓	¼	½	2	⅓	2	½	2	1	2
Wuye	¼	⅓	⅓	¼	⅓	¼	½	¼	½	½	½	½	1

Table 8: The Syntheses Matrix of table 7

Location	Garki I	Garki II	Wuse I	Wuse II	Cent. A.	Gwarinpa	Maitama	Asokoro	Jabi	Durimi	Lugbe	Kado	Wuye	**Priority**
Garki I	0.1739	0.1200	0.2500	0.1633	0.2727	0.2124	0.0755	0.1595	0.1509	0.1071	0.1374	0.1250	0.1111	**0.1584**
Garki II	0.0870	0.0600	0.0417	0.0408	0.0341	0.0354	0.1132	0.0797	0.1132	0.1607	0.1374	0.0833	0.0833	**0.0823**
Wuse I	0.0580	0.1200	0.0833	0.1633	0.0682	0.0531	0.0755	0.1196	0.1132	0.1071	0.0916	0.0833	0.0833	**0.0938**
Wuse II	0.0870	0.1200	0.0417	0.0816	0.0682	0.0531	0.0755	0.0797	0.1132	0.1071	0.1374	0.1250	0.1111	**0.0924**
Cent. A.	0.0870	0.2400	0.1667	0.1633	0.1364	0.2124	0.0755	0.1196	0.1132	0.1607	0.0916	0.1667	0.0833	**0.1397**
Gwarinpa	0.0870	0.1800	0.1667	0.1633	0.0682	0.1062	0.0755	0.0797	0.0755	0.1607	0.0916	0.0833	0.1111	**0.1114**
Maitama	0.0313	0.0208	0.0313	0.0313	0.0313	0.0313	0.0625	0.0313	0.0313	0.0208	0.0208	0.0313	0.1250	**0.0385**
Asokoro	0.0435	0.0300	0.0278	0.0408	0.0455	0.0531	0.0755	0.0399	0.0189	0.0179	0.0229	0.1250	0.1111	**0.0501**
Jabi	0.0435	0.0200	0.0278	0.0272	0.0455	0.0531	0.0755	0.0797	0.0377	0.0268	0.0229	0.0208	0.0556	**0.0412**
Durimi	0.0870	0.0200	0.0417	0.0408	0.0455	0.0354	0.1132	0.1196	0.0755	0.0536	0.0916	0.0833	0.0556	**0.0664**
Lugbe	0.0580	0.0200	0.0417	0.0272	0.0682	0.0531	0.1132	0.0797	0.0755	0.0268	0.0458	0.0208	0.0556	**0.0527**
Kado	0.0580	0.0300	0.0417	0.0272	0.0341	0.0531	0.0755	0.0133	0.0755	0.0268	0.0916	0.0417	0.0556	**0.0480**
Wuye	0.0435	0.0200	0.0278	0.0204	0.0455	0.0265	0.0189	0.0100	0.0189	0.0268	0.0229	0.0208	0.0278	**0.0254**

From table 7 and 8: $\lambda_{max} = 14.3104,\ CI = 0.1092,\ RI = 1.5551$ *and* $CR = \frac{CI}{RI} = 0.0702 < 0.1$ *is ok.*

Table 9: The Pair wise Comparisons of the three Settlement Patterns

S/No.	Pair wise Comparison	More Important Criterion	How Much More Important	Numerical Rating
1	PD-VP	PD	Strongly to very strongly more important	**6**
2	PD-RNDC	PD	Moderately to strongly more important	**4**
3	VP-RNDC	VP	Moderately more important	**3**

Table 10: The Pair wise Comparison Matrix

Settlement Pattern	**PD**	**VP**	**RNDC**
PD	1	5	2
VP	1/5	1	3
RNDC	½	1/3	1

Table 11: The Syntheses Matrix of table 10

Settlement Pattern	PD	VP	RNDC	Priority
PD	0.5882	0.7895	0.3333	**0.5703**
VP	0.1176	0.1579	0.5000	**0.2585**
RNDC	0.2941	0.0526	0.1667	**0.1711**

$$\lambda_{\max} = 3.0523, \quad CI = 0.0262, \quad RI = 0.5245, \quad CR = \frac{CI}{RI} = 0.0499 < 0.1$$

The judgment is consistent

Table 12: Summary of Relative Weights for each Collection Centres according to Settlement Pattern

	Settlement Patterns		
Waste Collection Centers	**PD**	**VP**	**RNDC**
Garki I	0.1254	0.0934	0.1584
Garki II	0.1126	0.0526	0.0823
Wuse I	0.1882	0.0550	0.0938
Wuse II	0.1382	0.0747	0.0924
Cent. A.	0.0401	0.1144	0.1397
Gwarinpa	0.0670	0.0431	0.1114
Maitama	0.0222	0.1971	0.0385
Asokoro	0.0254	0.1621	0.0501
Jabi	0.0705	0.0577	0.0412
Durimi	0.0631	0.0315	0.0664
Lugbe	0.0653	0.0556	0.0527
Kado	0.0406	0.0390	0.0480
Wuye	0.0421	0.0241	0.0254

Table 13: Rankings of the Collection Centres for Disposal of Population Density Settlement Pattern

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Location/Collection Sites	Weight	Ranking
Wuse I	0.1882	1st
Wuse II	0.1382	2nd
Garki I	0.1254	3rd
Garki II	0.1126	4th
Jabi	0.0705	5th
Gwarinpa	0.0670	6th
Lugbe	0.0653	7th
Durimi	0.0631	8th
Wuye	0.0421	9th
Kado	0.0406	10th
Cent. A	0.0401	11th
Asokoro	0.0254	12th
Maitama	0.0222	13th

Table 14: Ranked Ratings of the Collection sites for Disposal at Very Important Persons Settlement Pattern

Location/Collection Sites	Weight	Ranking
Maitama	0.1971	1st
Asokoro	0.1621	2nd
Cent. A	0.1144	3rd
Garki I	0.0934	4th
Wuse II	0.0747	5th
Jabi	0.0577	6th
Lugbe	0.0556	7th
Wuse I	0.0550	8th
Garki II	0.0526	9th
Gwarinpa	0.0431	10th
Kado	0.0390	11th
Durimi	0.0315	12th
Wuye	0.0241	13th

Table 15: Ranked Ratings of the Collection sites for Disposal of Road Network /Drainage Channel Settlement Pattern

Location/Collection Sites	Weight	Ranking
Wuse I	0.1882	1st
Wuse II	0.1382	2nd
Garki I	0.1254	3rd
Garki II	0.1126	4th
Jabi	0.0705	5th
Gwarinpa	0.0670	6th
Lugbe	0.0653	7th
Durimi	0.0631	8th
Wuye	0.0421	9th
Kado	0.0406	10th
Cent. A	0.0401	11th
Asokoro	0.0254	12th
Maitama	0.0222	13th

IV. DISCUSSION OF RESULTS AND CONCLUSION

The computations and the results from Table 11 ranked the settlement patterns as follows: population density settlement should be given top most priority followed by Very Important Persons settlement and Road Network and Drainage Channel given least priority as indicated by their respect weights 0.5703, 0.2585 and 0.1711.

Table 12 contains the summary of the relative weights determined from the pair-wise comparism matrices for the thirteen collection centres within the respective settlement patterns. Based on the results of this table, the rankings of the collection centres within each settlement pattern were derived as contained on tables 13 to 14.

The results obtained in this study demonstrated that AHP can be applied to determine relative weights. In this study it has been applied to determine weights of the settlement patterns within respective collection centres, relative weights of the collection centres and the relative weights of the settlement patterns. These weights are the numerical measures that ranked the disposal of solid wastes at each settlement pattern within a collection area. This serves as information for proper planning towards solid waste disposal in Abuja Metropolitan Council and is therefore recommended for implementation by the Solid Waste Management Agency, Abuja.

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