The Importance of Raw Material in the 21st Century Industrial Locations: A Studyof 9th Mile Area in South-Eastern Nigeria

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Abstract

This study focused on the relationship that exists between raw material and industrial location in order to determine the pulling effect of raw material at the 9th Mile area in the south eastern part of Nigeria within 21st century. In this study, 160 employees of the 32 industrial plants, and the management of the 32 studied industrial plants formed the study population. Data were collected through questionnaire, guided interviews, documentary materials, and field observations. The data were analysed using percentage, graph, Alfred Weber's Material Index (M.I.) method, and Multiple Linear Regression (MLR) analytical technique. The results of the analyses show that in the study area, industrial raw material is sourced locally and from the foreign countries like USA, Brazil, and Republic of Ireland (Europe). Four (4) or 12.5% industrial plants that source for some of their raw materials outside Nigeria are mainly the multinational corporations (including Nigeria Bottling Co. Plc.; 7 Up Bottling Co. Plc.; and Nigerian Breweries Plc.), while a domestic industry includes, Sharon Paints and Chemicals Co. Nig. Ltd. From the results, 15 (46.9%) industrial plants considered raw material weight (15.6%) and availability of raw materials (31.3%) in their location decisions at the 9th Mile area. Another feature is accessibility, and availability of transport facilities which made it easy to obtain raw materials from widely distributed sources across the study area. This contributed in the decision to locate 26 or 81.3% of the studied 32 industrial plants. Therefore, the study recommended that any industrial activity can locate in the area if it is not directly involved in extraction of raw material from the natural environment.

Keywords: Industry, Raw Material, Location, Effect, 21st Century, South Eastern Nigeria.

Introduction

Location or the locality where an industrial plant situates is accepted to be significant in the processes of economic change. In location of industries, assembly, processing, and shipment are vital because input materials are collected to a point where processing takes place, and production and shipment of the outputs to areas of consumption. For instance, the preferred location of each individual producer is that where demand is large or supply of inputs is particularly convenient. An example of such inputs is raw material which is a basic material that is used to produce goods, finished products, energy, or intermediate materials (feedstock that is highly important with regard to producing other products) for future finished products (Singh, 2016). Raw material is also used by non-humans, such as birds using found objects and twigs to create nests. Raw material is very essential for the economy and subsequently for the modern society. It is required for industrial activities as well as for infrastructure and products used in everyday life as revealed by Luidold and Antrekowitsch (2014). The importance of raw material to efficient operation of industrial organization cannot be over emphasized in that the availability of raw material in the right quality and quantity will determine to a reasonable

extent the availability, quality, and quantity of the resultant output. The significance of raw materials in industrial activities is so fundamental that it needs no emphasizing.

Indeed, the location of industrial enterprises is sometimes determined simply by location of the raw materials. Currently, as found by Costa, Monteiro and Rangel (2017), we live in a world where the materials are the protagonists, and raw materials are fundamental to make industrial products, but the increasing demand for these finite natural resources put the more industrialized countries under pressure to find ways to obtain and use needed raw materials. However, modem industry is so complex that a wide range of raw materials is necessary for its growth (Akindipe, 2014). Also, some of the industries, like watch and electronics use very wide range of light raw materials and the attractive influence of each separate material on industrial location diminishes. The result is that such industries are seldom located with reference to raw materials because a wide range of locations is possible. To manage the complex challenge of ensuring the availability of raw materials, therefore, industry has become increasingly more dependent on imports or such wide sources of many raw materials. Thus, there is reduction in the strength of attraction exercised in industrial location by the raw material. This is common in more developed countries as found in China by Crafts and Mulatu, (2006), USA by sloagett and Woods (2003), etc, but the results of studies in sub-saharan African countries like Botswana as submitted by Siphambe (2006), Ghana by Asante (2006), Uganda by Obwona and Egesa (2006) show that input materials contribute greatly on location of industries. This differing opinion called for this study in order to determine the pulling forces of raw material in the 21st century on the location of industry in the new emerging industrial area of 9th Mile, South eastern Nigeria.

Description of Study Area

The 9th Mile area is in Udi L.G. Area of Enugu State (Fig.1), Nigeria. It is found between latitudes $6^0\,24'\,45''$ and $6^0\,26'\,45''$ North of Equator, and longitudes $7^0\,23'15''$ and $7^0\,25'\,00''$ East of Greenwich Meridian (Fig. 1). It is bounded by Ngwo and Enugu in the East, Owa-Imezi in the West, Abor and Eke in the North, and Nsude in the South (Fig. 1). It is a nodal environment, being found at the junctions of many roads (Fig. 2) such as Enugu to Markurdi expressway, and Enugu to Onitsha dual carriageway. Other subsidiary roads are Oji-River-Udi-Ngwo-Enugu road, Nsukka-Okpatu-Abor-Enugu road, and Ezeagu-Eke-9th Mile-Enugu road. It is a gate-way to the northern Nigeria from the eastern and southern parts of the country. The study area comprises Ngwo (Ngwo-Uno and Ameke) and Nsude communities. These two communities have population of 36223 persons (Ngwo, 28836 persons, and Nsude, 7387 persons) (Census 1991). This was projected (based on the National Population Commission (NPC) (2006) recommendation of 2.83% annual increase in population for Nigeria) to 99,003 persons for 2018 because of the non-release of community by community, the 2006 census result by NPC.

The area lies within the false-bedded sandstone of Ajalli formation (Ozonzeadi, 1996), and within step-like scarps made up of the Nsukka-Okigwe cuesta as well as in areas where the land is between 200-500 meters high (Onyeanula, 2007). The sandstone rock available in the area (Obeta, 2003) is a permeable rock stratum (aquifer) that is capable of holding and transmitting groundwater (Remcay, 2004). This is the reason for easy access to groundwater, and why borehole schemes are common in the area (Obeta, 2003). These sandstones form undulating countryside that is common in the area. The area is characterized by sand filled dry valleys due to the influence of lithology, and the occurrence of the highly porous false-bedded sandstone with ground water formation.

The residents undertake a lot of petty jobs like peasant farming, animal rearing, oil palm processing, roadside mechanics, block industry, carpentry, petty trading, and own business

centers (Aneke, 2000; Ehirim, 2001) as well as industrial activities (Fig. 2) including both MNCs and domestic industries.

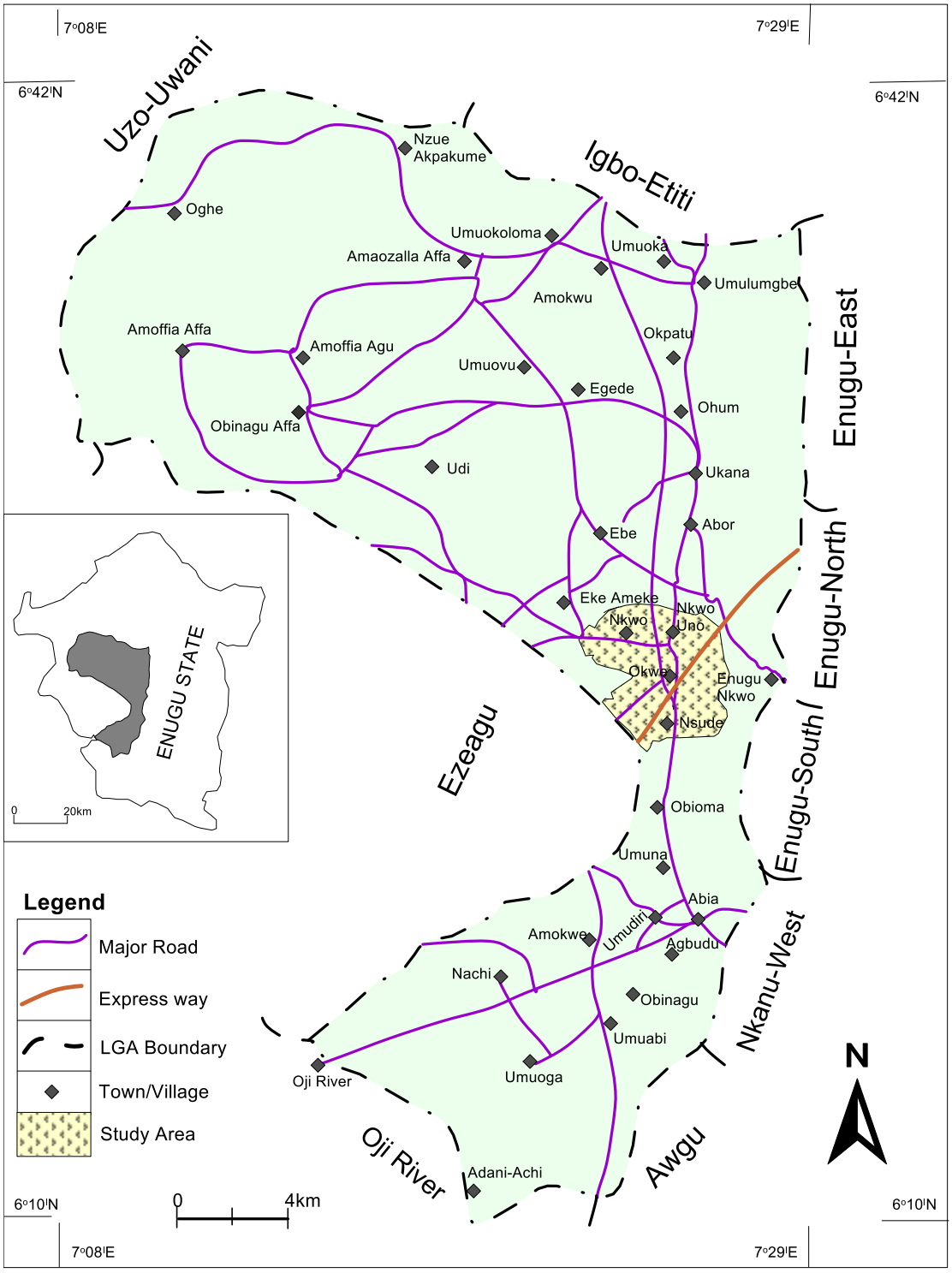

Fig. 1: Udi LGA Showing the Location of the 9th Mile Area.

(Source: Town planning office, Udi LGA, 2010)

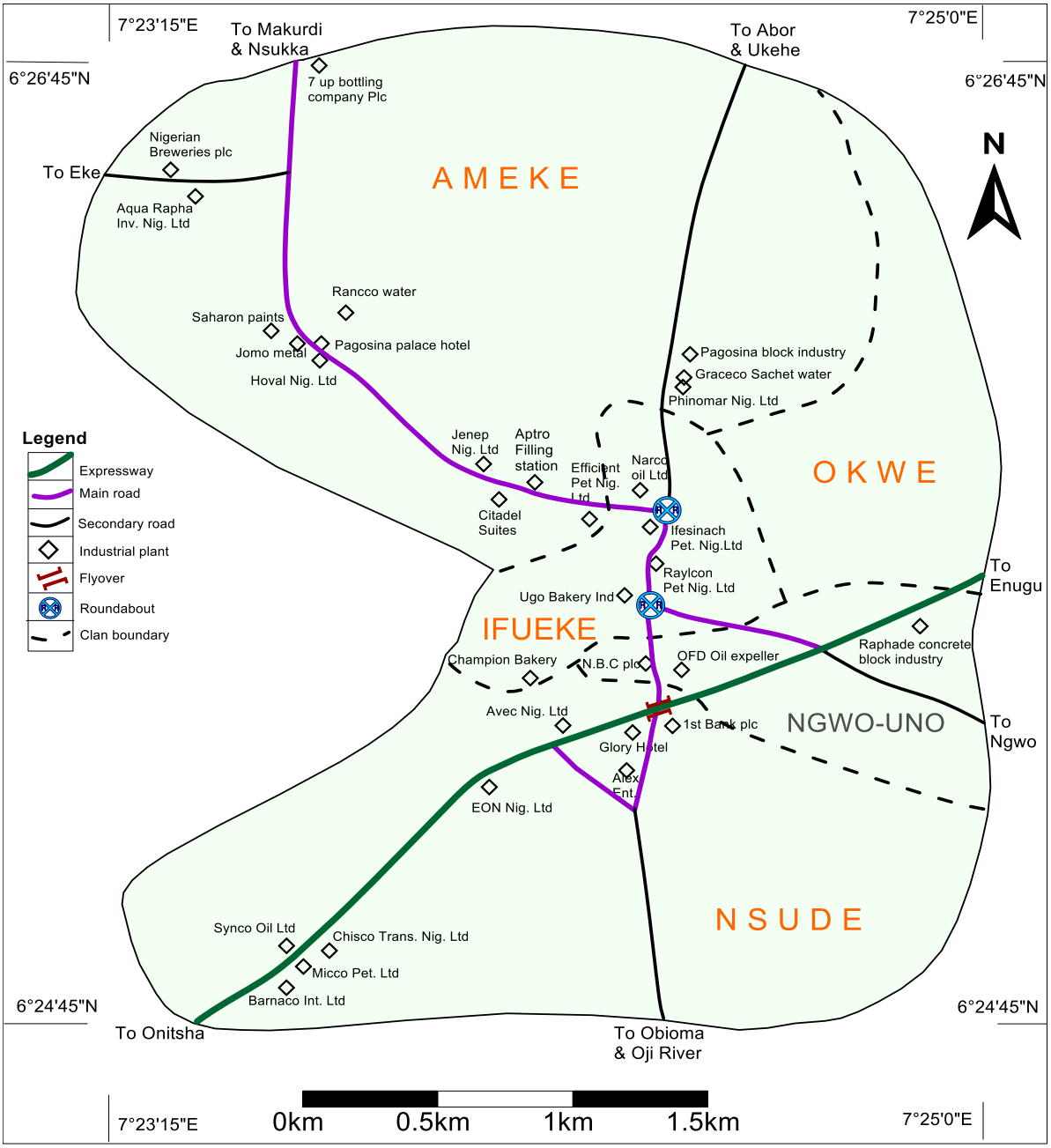

Fig. 2: Location of the Study Area, 9th Mile Area

Source: Adopted from Adinna (1991) and Ehirim (2001)

Literature Review

The variables reviewed in this study were mainly on the conceptual meaning, and the various effects of raw materials on the locations of industrial plants. Raw material is any resource requiring processing before consumption or use, but a resource that exists for immediate consumption is not a raw-material (Bale, 1981). The effects of raw materials vary in bulk, weight, perishability, and availability, and some need special means of transportation as well as handling and storage facilities at the factory. Thus, their distribution is a major determinant of industrial plant location (Sloagett and Woods, 2003; Badri, 2007; Wong, 2007). It also varies spatially. Industries are rarely tied to the location of raw materials because there is greater efficiency in the use of raw materials. Also, transport of raw materials is more efficient and relatively cheaper, and components are relatively small in size and light in weight. This is

found in Europe, Mexico and USA as respectively shown by Waugh (1998), Intel Corporation (2005), Judy (2002), Wong (2007), and Sloagett and Woods (2003). In chemical industry globally, Centre for Industry Education Collaboration (CIEC) (2016) found that access to the sea for transport remains a huge influence. Refineries and chemical companies have been built on the coast of many countries, whether they have their own indigenous oil and gas or whether they import it (CIEC, 2016).

Markusen (1986) obtained similar result in a study of steel locations in U.S.A, and found that generally, the cost of transportation of raw material had diminished in importance, as the pull of steel using markets had increased. In support of this, Bale (1981) explained that as technology improved, former physical constraints became less significant. This is due to improved transport and technology, greater sophistication and complexity in modern industries and the relative increase in importance of other location factors. Others are introduction of techniques of preliminary treatment of primary raw materials (example, beneficiation and fabrication) which reduces the quantity of waste and increase their value, transportability, and efficiencies in their uses.

Hence, with improvements in transport and changing industrial circumstances especially in the more developed countries like USA and China the factor of raw material is of less relevance in the locations of modern industries than it was in the 19th and early 20th centuries (Norton, 1992; Crafts and Mulatu, 2006). However, exceptions are those industries using raw materials that are low in value in relation to their weight or bulk or perishability, lose weight or bulk during the manufacturing process. Also, involved are plants designed to upgrade some mineral ores before export (Waugh, 1998) or those industries that extract their products directly from the physical environment as found by Intel Corporation (2005). Thus, except for some very specialized industries, proximity to raw materials is no longer an important location factor in more developed parts of the world as opined by Strategy for Economic Vitality (SEV) (2002a). Furthermore, Zhuang (2016) even added that the major factors affecting plant location decisions are market and labor.

However, Udo (1982) observed that accessibility to raw materials is still an important location factor in manufacturing especially for the import-substitution factories that are located in the major port-cities in Nigeria. Also, other studies in Nigeria by Ogunkola and Jerome (2006); Subair (2009); Boaduo (2008); Majuk, Erim and Ajor (2010); and Kashim (2011) revealed that sources of input materials play important role in the location of industries. Similar results were obtained in other sub-Saharan African countries like Botswana by Siphambe (2006), Ghana by Asante (2006), Uganda by Obwona and Egesa (2006), and Angola by Organization for Economic Co-operation and Development (OECD) (2002). Therefore, in less developed economy like Nigeria and other parts of Africa where industrial activities are dominated by import-substitution and processing, sources of raw materials greatly influence the location of industries (Onyenechere, 2011; Boaduo, 2008; Subair, 2009; Kashim, 2011; Obwona and Gesa, 2006).

From this review, two different research opinions exist on the importance of raw materials in the locations of industries. In the more developed economy, raw material is no longer important as a pulling factor in the locations of industries, while in the agrarian economy, it has a strong impact in the locations of industrial activities. It is these divergent views that obtain in more developed economy and third world countries that necessitated this study in order to determine if raw material which dominated industrial locations in the 19th and 20th centuries (Norton, 1992; Crafts and Mulatu, 2006) still obtain in 21st century among the African countries using example of an emerging industrial area in the south eastern Nigeria.

Materials and Methods

This study used 32 (64.0%) out of the 52 industrial plants in the study area. The reason is that 18 of them for restrictions on the release of information concerning them refused to fill the questionnaire and attend to the researcher, while 2 plants are inactive. Thus, only 32 functional industrial plants (64.0%) and particularly those that accepted to release necessary information pertaining to their sources of raw materials, and activities were involved in this work.

The population of this study comprised the management of the 32 accessible and functional industrial plants, and employees of the 32 industrial plants who agreed to fill the questionnaire. It comprised those adults that can read and write (minimum of SSCE/ NECO certificate holders) so as to effectively attend to the items in the questionnaire. They were purposively sampled, guardedly interviewed and administered with questionnaire. One hundred and sixty (160) of the studied industrial employees were used in this study. On the average, 5 employees from each of the 32 industrial plants were used because Alex Enterprise has only 7 employees and 5 of them were accessible during the period of pilot testing. Again, the difficulties faced by the researcher in convincing them to fill the questionnaire restricted this study to 5 employees from each of the studied industrial plants. Also, similar information was obtained from the management of the 32 sampled industrial plants in the area. Therefore, the researcher used 160 employees of the 32 industrial plants, and the management of the 32 studied industrial plants as respondents in this study.

Relevant data were collected through questionnaire, guided interviews, documentary materials, and field observations. Both structured and unstructured questionnaires were designed for every respondent in this study, and a set of questionnaire was designed for both the managements of the industrial plants, and the sampled industrial employees.

Copies of the questionnaire were given to 3 experts (from Geography (2), and Economics (1)) for validation in terms of their relevancy, clarity, appropriateness of the language, expressions, and instructions to the respondents. In addition, pre-testing of the instrument was conducted on Alex Enterprise. Again, the reliability of the instrument (the degree of consistency with which the instrument measures whatever it is meant to measure) was determined using Cronbach, s Alpha method, and the result obtained which is of 0.85 proved the reliability of the instrument used in this study and showed that the questions in the questionnaire are relevant to the subject they were constructed to investigate. Guarded interview through explanation, clarifications and questioning as well as field observations supplemented the questionnaire. During the processes of questionnaire administration and interview situations more reliable information were obtained from the field especially on the names of raw materials, nature (characteristics), and their sources.

Many statistical techniques were used in the analyses of the field data. Percentage contributions and graph were used to determine the degree of influence of raw material and their source regions. To determine the appropriate orientation of the industrial plants towards the raw material sources, Weber's Material Index (M.I.) method was used. It is comparing the weights of both raw materials and products for each industrial plant. The formular as given by Weber (1929) and Bale (19981) is;

$$M.I. = \frac{WR}{WP} \quad \ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where WR = weight of raw material input per month/year, and WP = weight of the products per month/year.

In addition, Multiple Linear Regression (MLR) analytical technique was used to identify the degree of contributions of the raw material in the locations of the industrial plants in the study area. The general expression as given by Hullman and Boyef (1975) is;

$$Y = a+b_1 \times X_1 + b_2 \times X_2 + b_3 \times X_3 + bn\ Xn + e \ldots\ldots\ldots 2$$

Where Y is the dependent variable; x_1, x_2, x_3, …. xn are the regression coefficients; n is the base constant; b (1, 2, n) are constants of the independent variables, e is the error term or the proportion of the variance not explained by the regression; and a is the interception term.

Results of the Findings

Nature and Sources of input materials, and the location of the industrial plants in the area

As found in this study, raw materials are either natural resources such as sand, water, and wood that are used in a manufacturing process or processed material like wheat-flour, palm kernel oil, and sugar. It includes those finished products like iron pipe, angle iron, and iron rods that are used as input materials for the manufacture of other goods. Such materials are not uniformly distributed over the face of the earth. The degree of attraction exercised by raw materials varies widely according to the materials themselves, and the techniques that are available in their extraction, distribution, and utilization.

Raw materials are sourced within Nigeria, and foreign countries like USA, Brazil, and Republic of Ireland (Appendix 1). The industrial plants that source for some of their raw materials outside Nigeria are mainly the MNCs (Nigeria Bottling Co. Plc, 7 Up Bottling Co. Plc, and Nigerian Breweries Plc), and only one of the domestic industrial plants namely, Sharon Paints and Chemicals Co. Nig. Ltd. These 4 industrial plants form 12.5% of the studied industrial plants. The other 28 industrial plants which account for 87.5 % obtain their raw materials within Nigeria. The raw materials for the bottling industrial plants are similar and non-perishable except sugar if it is not protected from the effects of water and damp environment.

The brewing industrial plant has raw materials that are not perishable if carefully and properly handled in storage for about one to two years. Palm kernel which is the raw material for the palm kernel oil extraction industrial plants is perishable because it decays with time. The nature of the other industrial plants is as contained on Appendix 1. The researcher found out that water obtained from the study area is clean and requires minimum treatment. It also stays useful and consumable for long period of time particularly when it is stored well. Petroleum products are not perishable, but very fragile and inflammable. As such, they are handled with care to avoid fire outbreak. In hotel services, the food items and condiments are perishable and do not last long.

The liquors are fragile and perishable after sometimes especially when their expiration dates elapse. Also, wood decays so easily especially when they are exposed to rainfall and sunlight. Again, in paint industry it is only sand that is not perishable/fragile. However, even at the perishable nature of some of the industrial raw materials, most of them are not obtained in the area of their location, 9th Mile, but from the wide sources outside the study area. Hence, the nature of raw material either as perishable or fragile has no effects in the location decision of industry in the study area. Good examples are petroleum products that are very fragile and highly inflammable but are brought from far distant places such as Lagos, Port-Harcourt, etc into the area for unit distribution to the individual consumers.

The Effect of raw Materials on the Location of Industrial Plants in the Study Area

In this study, the attributes of raw materials obtained from the respondents were weight, perishability (damages easily or after sometimes) or fragility (breaks easily), availability, and transport costs of both raw materials and products. The weights of both raw materials and products for each industrial plant were compared using Material Index (M.I). It is an obvious issue that if M.I. is unity i.e. one (M.I = 1), the industrial plant can locate either at the market or raw material sources. If M.I. is greater than unity (M.I. > 1), the location is at the raw material source because the weight of raw material is greater than the weight of the product, and if M.I. is less than unity (M.I. < 1), sources of market location is more important than any other choice since the product is heavier than the raw material(s). These facts explained the location of 4 industrial plants (12.5 %) of Nigerian Bottling Co. Plc, 7 Up Bottling Co. Plc, Graceco Sachet Water, and Aqua Rapha Investment Nig. Ltd because their computed M.I. shown in Table 1 are respectively more than one, and they are sited where one of the major raw materials (availability of good and large quantity of water) is found. From Table 1, other industrial plants with M.I > 1 in each case are located outside the sources of their raw materials. By doing so, factors other than weight of their raw materials were considered more important in location decisions. Thirteen (13) industrial plants or 40.6% were involved.

Therefore, out of seventeen (17) industrial plants with M.I. > 1, 4 (23.5%) of them were found to have the attractions of raw material weight in their decisions to locate at the 9th Mile area. Three (3) of the 4 industrial plants are located at Ameke in both the north and northwest (Graceco Sachet Water, 7 Up Bottling Co. Plc, and Aqua Rapha Investment Nig. Ltd), while 1 (Nigerian Bottling Co Plc) is sited at Ngwo-Uno in the eastern part of the area. These 4 industrial plants use a lot of water that forms a greater part of their inputs.

Table 1: Nature and material indices of the industrial plants at the study area

S/N	Plant	Material Index	Nature of Material	
			Raw Materials	Products
1	Nigerian Bottling Co Plc	2.9	Perishable	Fragile
2	O.F.D. Oil Expeller	1.3	Neither perishable nor fragile	Perishable
3	7up Bottling Co. Plc	3.0	Perishable and fragile	Fragile
4	Pagosina Block Industry	0.4	Cement is perishable	Fragile
5	Rancco water	1.0	Perishable	Perishable and fragile
6	Jomo Metal Nig. Ltd.	2.3	None is fragile or perishable	Perishable
7	Aqua Rapha Invest. Nig Ltd	1.2	Neither perishable nor fragile	fragile and perishable
8	Aptro Filling Station	1.0	Fragile	Fragile
9	Ugo Bakery Industry	7.3	Flour, yeast, egg, butter perishable	perishable and fragile
10	Alex Enterprise	1.7	Neither perishable nor fragile	Perishable with time 1½ yrs
11	Synco Oil Ltd.	1.0	Fragile	Fragile
12	Avec Nig. Ltd	1.7	Neither perishable nor fragile	Not perishable & fragile
13	Hoval Nig. Ltd.	2.2	Neither perishable nor fragile	Not perishable & fragile
14	Jenep Nig. Ltd.	1.0	Fragile	Fragile
15	Barnaco International Ltd.	1.0	Fragile	Fragile
16	Champion Bakery	4.7	perishable	perishable and fragile
17	Narco Oil Nig. Ltd	1.0	Fragile	Fragile
18	Efficient Petrol Nig. Ltd.	1.0	Fragile	Fragile
19	Raphade Con.Block Ind.	0.8	Cement is perishable and fragile	Fragile
20	Ifesinachi Petroleum Ltd	1.0	Fragile	Fragile
21	Micco Petroleum Ltd	1.0	Fragile	Fragile
22	Nigerian Breweries Plc	0.7	Perishable	Fragile and perishable
23	Phinomar Nig. Ltd	1.3	Neither perishable nor fragile	Not perishable & fragile
24	Citadel Suites	1.2	Perishable except detergents	some fragile and perishable

25	Pagosina Palace Hotel	1.4	Perishable except detergents	some fragile and perishable
26	Glory Hotel	1.3	Perishable except detergents	some fragile and perishable
27	First Bank of Nig. Plc	1.1	Service provider	Service provider
28	Sharon Paints and Chemicals Co. Nig. Ltd.	1.2	Neither fragile nor perishable	Neither fragile nor perishable
29	Graceco Sachet Water	1.1	Perishable	Fragile and perishable
30	Chisco Transport Nig. Ltd	1.0	Fragile	Fragile
31	E.O.N. Nigeria Ltd	1.0	Fragile	Fragile
32	Raylcon Petrol Nig. Ltd	1.0	Fragile	Fragile

(Source: Fieldwork, 2010-2011)

In addition, the availability of water (good aquifer) was critical in the location of Rancco Water (MI=1) that drills for water in the area. Industries that use much water are pulled to the 9th Mile area that has large quantities of water that is easily accessed. Thus, 5 (27.8%) out of 18 industrial plants with MI ≥1 are located in the area among other factors because their raw materials are heavier than products. This forms 15.6% of the 32 industrial plants studied. Weight of raw material was not a major factor considered in other 27 (84.4%) industrial plants located at the 9th Mile area.

An expression of non-consideration of raw material weights in the location of many industrial plants is found in industrial plants with M.I. = I and M.I > 1. The industrial plants with MI=1 ought to locate at the sources of either the markets or raw materials, but none of them sought raw material sources in their location decisions. Fourteen (14) industrial plants or 43.8% were involved (Table 1). Another striking example is posed by Ugo Bakery Industry, and Champion Bakery because even at M.I. of 7.3, and 4.7 respectively their location was still unfavoured by the attraction of weight of raw materials (whether gross or pure materials). The pull of raw material when the transfer cost of material input is more than that of the output did not obtain in the study area because 5 industrial plants (15.6 %) (Ugo Bakery Industry, Hoval Nig. Ltd, Champion Bakery, Chisco Transport Ltd (Haulage Division), and E.O.N. Nig. Ltd) in which transport costs of raw materials are more than that of the products, were all attracted by other factors than the transfer costs of their raw materials. Three (3) raw materials of water (for bottling, sachet water, and paint productions), food items for hotels, and sand for concrete and block productions are obtained in the area, and they contributed in the location of 10 (31.3%) industrial plants in the area. The 10 industrial plants affected are; 1, 3, 1, 3, and 2 in each of bottling, sachet water, paint, hotel, and block and concrete productions respectively. However, they strongly influenced the locations of 8 (25.0%) of the industrial plants in the area, namely; Nigerian Bottling Co. Plc, Pagosina Block Industry, Rancco Water, Aqua Rapha Investment Nig. Ltd, Raphade Concrete and Block Industry, Pagosina Palace Hotel, Glory Hotel, and Graceco Sachet Water. The other industrial plants that saw availability of raw materials as strongly important factor in their location in the area is in terms of accessibility which describes the easiness with which transport facilities of road and motor vehicles for ease of movements are obtained or used advantageously in the area. This implies that raw materials are easily accessed from wide sources through the available transport facilities obtainable in the study area. This is one of the reasons for raw materials to be either strongly influential or influential in the decision to locate 26 or 81.3% of the studied 32 industrial plants.

From these results, only 5 (15.6%), and 10 (31.3%) of the 32 industrial plants studied respectively considered weight, and availability as the important raw material variables in their location decisions in the area. Therefore, raw material (weight and availability) contributed in the location of 15 (46.9%) industrial plants in the study area, while 17 or 53.1% of the 32 industrial plants were attracted into the study area by other factors rather than the raw material attractions. This result agrees with the finding of Crafts and Mulatu (2006) that in Britain until the end of the 20th century raw material was very attractive in the location of industries. Again

studies by Judy (2002) showed that in Mexico the features of raw material ranked very low in the location of industries. In more developed economies, studies of countries like USA by Markusen (1986) and Wong (2007), Portland (Australia) by Cortright (2001a) and Europe in general by Intel Corporation (2005), and Japan by Sloagett and Woods (2003) revealed that most of the modern industries are less seriously affected in their location by raw material sources. This is because of the fact that there is greater efficiency in the use of raw materials, and transport is more efficient and relatively cheap, while components are relatively small in size and light in weight. Other reasons given are that individual manufacturers no longer process basic raw materials since most industrial firms purchase partially manufactured commodities from widely distributed sources, improved technology, and relative increase in the importance of other location factors. But a study in East Africa by Sashoo (2012) shows that firms that operate in a weight reducing technique locate at raw material sources. The author gave example that the main advantage of the location of Pan African Paper Mills at Webuye (400 km from Nairobi, centre of printing and publishing in East Africa) is that it is close to the Kenyan forests from which timber is obtained to manufacture paper.

The Relative Position of Raw Material in the Location of the Industrial Plants

A Standardized Matrix which determined the percentage contributions of each of the location factors in each of the 32 studied industrial plants was used to identify in order of importance the effects of raw material in location of the studied industrial plants in the area. This method was employed because it facilitated the weighting of each of the factors that influenced the location of industrial plants. In the matrix, the industrial plants studied formed the column and the location factors (coded A-W) (Table 2) of the industrial plants formed the row. This is for easy identification and assemblage of the effects of raw material in the location of the studied 32 industrial plants.

Table 2: Codes of factors in the locations of the industrial plants.

S/N	Location Factors	Code No.
1	Availability of raw material	A
2	Accessibility to transportation facilities	B
3	Access to market facilities	C
4	Availability of financial capital	D
5	Availability of capital equipment	E
6	Government's industrial location policy	F
7	Government's incentives (loan, subsidy, grants, and free land)	G
8	Availability/presence of an industrial estate	H
9	Benefits from other firms in the area	I
10	Availability of power / energy from national supply source	J
11	Availability of cheap labour	K
12	High cost of labour	L
13	Availability of space for expansion	M
14	Low tax rate on the available land	N
15	Suitable land surface	O
16	Birth place of the entrepreneur	P
17	Family support of the entrepreneur	Q
18	Local authority support of the entrepreneur	R
19	People's recognition of the entrepreneur	S
20	Qualified management is available	T
21	Availability of sales promotion agents	U
22	Free land from the entrepreneur	V
23	Availability of infrastructure like water	W

Source: Author, 2011

In Table 2 and Appendix 2-3, the factor of interest (raw material) is the yellow coloured factor. The location factors were scored by the respondents on a scale of 1 to 5 in ascending order of

importance with 5 being the most important or strongest influencing factors, 4 being influential factors, 3 being undecided factors, 2 being factors that are not influential, and 1 being factors of strongly not influential (Adinna, 1991; Ogbu, 2008). Therefore, scale 1 and 2 are factors that were not considered important in the locations of such industrial plant (s), while scale 3 forms the boundary that separates factors that influenced and factors that did not influence the location of the industrial plants. For each of the accessible and examined industrial plants, the scores of raw material in the matrix were converted to a factor index.

The result of the opinion pull from the respondents reveals that availability and accessibility of raw material in the area contributed in the location of 20 or 62.5% of the industrial plants in the area, and in which the influence of accessibility was important in the location of 12 (37.5%) industrial plants as also found on Appendix 2. Raw material obtained frequency score of 25 (7.9%) to occupy the 3rd position in the scores of the industrial location factors (Appendix 3). The application of regression technique on the scores indicates that availability/accessibility of raw material obtained a significant level of 0.044 in the location of industrial plants in the study area. Raw material accounts for input materials required by industrial plants and implies that these materials are available or easily accessed (easily brought in from other sources) for use by the industrial plants at the 9th Mile area.

Raw materials are important inputs required in industries that produce any types of products. The study area has good aquifer that facilitates the exploitation of water resources that serve as input materials for many of the 32 studied industrial plants. Water is exploited and demanded in large quantities because of its use either as input material or cleaning argent. Thus, it is demanded by every industrial plant (especially as cleaning agent) and it is such demand that gave rise to the importance of water in the area. Eleven (11) industrial plants or approximately 34.4% of the sampled industrial plants were affected. They are in manufacturing activities of brewing, bottling, sachet and bottled water, block and concrete, bakery, and paint productions. On this note, Cook and Pandit (2004); Barton, Jenkins, Bartzokts, Hesselberg, and Lenutsen (2007); Udo (1982); Intel Corporation (2005); and Barcelona Field Study Centre (BFSC) (2007) found that availability of raw materials is still significant in location decisions of industrial plants in North Africa and Middle East, port-cities in Nigeria, U.K., and Barcelona (Spain) respectively. However, the availability and accessibility of inputs in the study area is an indication that the inputs are made available through transport facilities that are easily obtained from the area.

Conclusion

This study has investigated the importance of raw materials in the 21st century industrial location using the case of 9th mile area in Enugu, South Eastern Nigeria. The study findings revealed that many different industrial activities either MNCs or domestic locate in the area as a result of availability of water, sand, food items, and the accessibility of the area which facilitated the inflow of input materials from wide sources. Weight and availability of raw materials are the main raw material attributes that are important in the decisions to locate industrial activities in the area at reduced rates. More transfer cost on the input materials, and perishability as well as fragility of the raw material has little or no effect on the location of economic activities at the 9th Mile. This is for the fact that very few industrial plants even with MI $\geq$1 which ought to be attracted to the sources of inputs are pulled more into the study area by other factors than the raw material features.

Recommendation

Since the study area is accessible, any type of industrial activities can locate in the area and obtain their raw materials easily from widely distributed sources through the available transportation facilities. Again, since many industries use partially processed materials, sources of raw materials are no longer considered important in industrial location decisions. Thus, industry that does not obtain input material direct from natural stock can locate in the study area.

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APPENDIX I

Appendix 1: Raw materials, nature and source regions of the industrial plants.

S/N	Plant	Location Comm.	Year Esta-	Raw Material	Source Areas of Raw Mat.	Nature of raw material
1	Nigerian Bottling Co. Plc	Ngwo-Uno	1975	Water Concentrate Beverage Base Sugar	9th Mile U.S.A U.S.A Brazil	Perishable
2	O.F.D. Oil Expeller	Ngwo-Uno	2006	Palm kernel	5 south eastern, and Kogi State.	not fragile & perishable
3	7up Bottling Co Plc	Ameke	2003	Water, Carbon dioxide Co_2) Concentrates Acidulants Sugar	9th Mile 9th Mile Rep. of Ireland Europe Brazil & Nigeria	perishable, fragile perishable perishable
4	Pagosina Block industry	Ameke	2001	Cement Sand Water	Enugu & Anam-bra, 9th Mile area.	Perishable not perish. perishable
5	Rancco water	Ameke	1998	Water	9th Mile area,	Perishable
6	Jomo Metal Nig. Ltd	Ameke	1989	Iron pan- 4, 6, 3, 2, 5, 16 mms, Iron pipe, Rode, Electrode, Angle Iron.	9th Mile, Enugu and Onitsha	Not fragile or perishable
7	Aqua Rapha Investment Nig. Ltd	Ameke	2005	Water Polythene Nylon Rolls Treatment materials	9th Mile Agents supply, Enugu, Onitsha and Lagos.	Neither perishable nor fragile
8	Aptro Filling Station	Ameke	1992	(PMS, AGO, DPK	Enugu and P.H	Fragile
9	Alex Enterprise	Nsude	1997	Palm kernel	Eastern States, Nig.	Perishable
10	Ugo Bakery Industry	Ifueke	2003	Flour, Sugar, yeast, salt, Egg, water, butter, Flavour, and Vitamin C.	Onitsha, and Enugu	Neither perishable nor fragile
11	Synco Oil Ltd	Nsude	1997	Petrol Gasoline Kerosene Engine oil	Enugu, P.H Enugu Enugu	Fragile
12	Avec Nig. Ltd	Nsude	2004	Petrochemical Psoprophyol Butanol A.K. Blue (ink)	Lagos, P.H (Eleme) Lagos	Neither perishable nor fragile
13	Hoval Nig. Ltd	Ameke	2005	Wood (Agba) Maize	Middle Belt & Northern states	Not friable & perishable
14	Jenep Nig. Ltd	Ameke	1997	D.P.K, PMS AGO, & oil	Lagos, and P.H	Fragile
15	Barnaco Int' Ltd	Nsude	1988	Petrol, Gas, Kerosene	Enugu, Lag. PH	Fragile
16	Champion Bakery	Ifueke	2003	Flour, Sugar, Salt Butter Groundnut oil Yeast Egg Flavour (brown), Water	Warri, P.H, Lagos , Enugu	perishable
17	Narco Oil Nig. Ltd	Ifueke	1980	PMS, AGO, D.P.K	P.H, Lagos, open market, Enugu	Fragile
18	Efficient Pet.Nig.ltd	Ameke	1991	P.M.S, AGO, D.P.K	Enugu, PH, Lag.	Fragile
19	Raphade Concrete Block Industry	Ngwo-Uno	1977	Cement, River sand (washed)	Benue, PH Enugu rivers	perishable and fragile
20	Ifesinachi Pet. Ltd.	Ifueke	1990	P.M.S, AGO, D.P.K, oil	Enugu, PH, Lag.	Fragile
21	Micco Petroleum Nig, Ltd	Nsude	2003	Petrol Diesel, Kerosine, and Engine oil.	Enugu, Lagos, PH. Onitsha.	Fragile
22	Nigerian Breweries Plc.	Ameke	2002	Sorghum, Maize Water, Barley and malt.	Nigeria 9th Mile Europe	Perishable

23	Phinomar Nig. Ltd	Ameke	1999	Metal, Rubber, Chemical.	Enugu, Anambra Abia	Not fragile & perishable
24	Citadel Suites	Ameke	2006	Different food items, condiments, Liquors.	9th Mile and Enugu.	Perishable except detergents
25	Pagosina Palace Hotel	Ameke	1998	Different food items condiments, Liquors.	9th Mile, and Enugu.	Perishable except detergents
26	Glory Hotel	Nsude	2004	Different food items, condiments, Liquors.	9th Mile, and Enugu.	Perishable except detergents
27	First Bank of Nig. Plc	Nsude	2003	Financial exchange services.	Financial Exchange Institutions	service
28	Sharon Paints and Chem.Co. Nig. Ltd.	Ameke	2003	Resin, Pigments, Diluents, Solvent, Additives, Extenders	Imported, Nigeria	Not fragile & perishable
29	Graceco Water	Ameke	2004	Water , Polyethylene	9th Mile area, Enugu, Lagos.	Perishable
30	Chisco Trans.Nig Ltd (Haulage Div)	Nsude	2003	Truck, spare parts, Lubricants, AGO/Fuel	NNPC, and Enugu state	Fragile
31	E.O.N Nig. Ltd.	Nsude	2003	Truck, spare parts, AGO/Fuel, Lubricants	Producers, all over Nigeria	Fragile
32	Raylcon Pet.Nig. Ltd.	Ifueke	1996	PMS, AGO, DPK, & oil	NIPC, NIPCO Oil	Fragile

(Source: Fieldwork, 2010- 2011)

Appendix 2: Important factors in the locations of the studied industrial plants.

S/N	Industrial Plant	1st Order (strongly influential)	2nd order (influential)	No of influential	3rd order (neutral)	4th order (not influential)	5th order (strongly not influential)
1	Nigerian Bottling Co. Plc	A,B,C,H,I,K ,N,P,U,W	-	10	D,L,M, O,Q,R,S,U	E,G,J,	F,T
2	O.F.D Oil Expeller	C,I,J	A,B,E,H,K,L, M,P,Q,	12	W,	D,G,O, R,T,U,	F,N,S,V.
3	7up Bottling Co. Plc	W.	B,C,F,H,J,	6	A,O,R,	T,	D,E,G,I,K,L M N,P,Q,S,U,V.
4	Pagosina Block Industry	A,B,D,K,M, N,T,W.	C,E,F,O,	12	P,J,Q,S, U ,V,H	G,I,L,R	-
5	Rancco Water.	A,J,L,W.	Q,R,U,B,C, K,M,N,O.	13	D,P,U	E,F,I	G,H,T,S.
6	Jomo Metal Nig. Ltd.	A,U,J,W.	B,C,E,H,I,L, Q,S,T,V.	14	D,O,P,R	F,G,K,N,	M
7	Aqua Rapha Investment Nig. Ltd.	A,O,W.	B,C,D,L,M, S,U,V,	11	E,H,I,JK, N,Q.	F,P,R,T.	G.
8	Aptro Filling Station	B,C,I.	J,M,V,H.	7	G,N,T.	D,E,K,O, P,U,W.	F,L,Q,R, S,A.
9	Ugo Bakery Industry.	A,C,J,Q,S, U,W.	B,K,N.	10	D,E,F,G, I,L,M,V.	R,T.	H,O,P.
10	Alex Enterprise	C,D,P.	A,B,E,J,K,N.	9	H,I,O.	M,R,S, T,U,W.	F,G,L, Q,V.
11	Synco Oil Ltd.	F,J,	D,V.	5	A,G,I,K,V.	B,C,H,E,M ,N,O,P,Q, R,S,U,W	T.
12	Avec Nig. Ltd.	A,B,J,M,U	C,L,O,V,W	10	K,N,S,R	G,H,P	T,D,E,F,I,Q

13	Hoval Nig. Ltd.	C.	A,B,M,Q,U.	6	E,H,N,O,S, V,W.	D,I,J,K, L,P,R,T.	F,G
14	Jenep Nig. Ltd.	J,K,B,C,M.	D,E,H,I,N, O,U,V,W.	14	-	F,G,L,P,Q, S	A,R,T.
15	Barnaco International Ltd.	D,J,O.	A,B,C,F H,K,W	10	I,L,M, N,P.	E,Q,R, S,T,U,V.	G.
16	Champion Bakery	A,M,W,	B,H.	5	I,N,O,P.	C,D,E,F,G, J,K,L,Q,S, U	V,R,T.
17	Narco Oil Nig. Ltd.	C	A,D,J,K M,N,O.	8	1,L.	B,F,G,P,Q, R,S,U,W,T	E,H,V.
18	Efficient Petroleum Nig. Ltd.	B,C,D,E,H, J,K,M,O,W.	N,U.	12	R.	F,G,I,P,Q,S .	A,L,T,V.
19	Raphade Con.Block Ind.	A,C,K,N,P, D.	B,J,M,S,U,W	12	1,O.	E,H,Q,R.	F,G,L.
20	Ifesinachi Petrol. Ltd.	A,B,C,J.	D,I,K,P,Q,W.	10	W,F,G,H,L .	M,O,U.	N,R,T,U.
21	Micco Petroleum Ltd	A,B,C,J.	K,D,I,P,Q,W.	10	E,F,G,H,L.	M,O,R,T,U	N,S,V.
22	Nigerian Breweries Plc.	C,W	A,B,E,I,J	7	D,FL,K,M O	H,N	G,P,Q,R.
23	Phinomar Nig. Ltd.	B	A,C,I,J,M,O, W.	8	K	D,E,F,G, H,L,P,R,S.	U,V.
24	Citadel Suites	D,J;R,V,W.	B ,C, E, I,O, Q, S, U	13	K,M,R	A,H	G,F,L
25	Pagosina Palace Hotel	A,C,D,E,N,	B,J,M,RT,V, W	12	H,P,Q,S,U.	F,I,L,O,	G,K
26	Glory Hotel	A,I,J,S,W.	B,O,H,M	9	C,K,L,O,U.	E,N,Q,R,V.	F,G, P,T.
27	First Bank of Nig. Plc.	L,J,	B,E,I,N,V.	7	G,O,U	D,F,K,M, O,T,W.	A,H,L,P, R,S,
28	Sharon Paints & Chem. Co. Nig. Ltd.	B,C,K,M, N,O,P.	A,J,U.	10	F,H,I,L,V.	D,E.	G,Q,R, S,T,W.
29	Graceco Sachet Water	A,T,W	P,C,E,I,J, K,N,P,Q,S.	13	D,O.	F,L,M, R,U.	G,H,V.
30	Chisco Transport Nig. Ltd. (Haulage Division).	A,B,H, L,S.	E,I,K,M, N,U.	11	C,D,F,J, O ,W.	G,P, Q,V.	R, T.
31	E.O.N Nig. Ltd.	A,B,H,I.	C,D,E,F, M,N,O.	11	K,L.	J,P,Q,R,S,T , U,V,M	G.
32	Raylcon Petroleum Nig. Ltd.	C,D,K.	A,B,E,F, H,I,J,O,U.	12	L,Q,S,W.	M,P,R,V.	G,N,T.

Source: fieldwork, 2010-2011)

Appendix 3: Frequency of occurrence and ranks of the location factors.

S/N	Factors (code Number)	Frequency		Total	%	Rank
		1st order	2nd order			
1	B	12	18	30	9.4	1st
2	C	17	11	28	8.8	2nd
3	A	16	9	25	7.9	3rd
4	J	14	1	25	7.9	3rd
5	W	13	8	21	6.6	5th
6	M	7	11	18	5.7	6th
7	K	7	10	17	5.3	7th
8	D	8	8	16	5.0	8th
9	I	5	11	16	5.0	8th
10	N	5	10	15	4.7	10th
11	E	2	12	14	4.4	11th
12	U	4	10	14	4.4	11th
13	H	4	9	13	4.1	13th
14	O	4	9	13	4.1	13th
15	P	5	4	9	2.8	15th
16	Q	2	7	9	2.8	15th
17	V	1	8	9	2.8	15th
18	S	3	5	8	2.5	18th
19	F	1	5	6	1.9	19th
20	L	2	4	6	1.9	19th
21	T	2	2	4	1.3	21st
22	R	0	2	2	0.7	22nd
23	G	0	0	0	0.0	23rd
	Total			318	100.0	

(Source: Appendix 2)