

Raw Materials Development, Machinery and Manufacturing in Nigeria

O.P. Folorunso

Department of Civil Engineering, University of Ado-Ekiti, Nigeria

Abstract: Materials have always been closely associated with human progress. This is because the human species make things like clothing, tools, homes, weapons, vehicles, electronic device, etc and of course, all these products must be made out of the appropriate materials with the required properties in the specified shapes and often with a desired appearance. This study is therefore focusing attention on development, machinery and manufacturing of raw materials to make aforementioned things, this paper also assessed the performance of relevant agencies towards raw materials development and establishing national standard coupled with other activities aimed at reducing the nations over reliance on imported materials. Finally, the study set out primary functions of research centers with sole aim of achieving a development of raw materials to reduce the use of imported materials based on a well articulated material programme on material production and supply.

Key words: Raw materials, machinery, manufacturing, resources, foreign reserve

INTRODUCTION

Raw materials are materials in their natural state which can be used or made to produce something else. Honby (2000). Raw materials may be classified into agricultural raw materials, metallic or non-metallic, solid minerals (Iron ore, tin ore, refractory clays, etc.) and petrol chemical raw materials (crude oil or gas) Folayan (2004). Various developmental processes go into these for them to become intermediate raw materials or required raw materials for desired products, Folayan (2004). The manufacturing of any product from these raw materials requires men with developed science, engineering and technical know-how who would add value to these primary raw materials to become intermediate raw materials to manufacture the require products Folayan (2004).

The Nigerian engineering industry is the largest user of materials, for example, building construction will comprise of thousand elements of varying material specifications and properties Okereke (2000). The performance of any engineering infrastructure is a function of the quantity and quality of each material that constitutes such infrastructure (Lawrence, 1982).

Despite abundant material resources in Nigeria, over 75% of materials presently used in engineering industry are imported (DIFFRI, 1988). The implication is that more will still be spent on these imported materials to develop many engineering infrastructures (DIFFRI, 1988; Okereke, 2000).

With our many resources couple with existence of engineers in Nigeria, there should be hoped of finding

permanent solution to shortage and importation of materials for our infrastructural development (Papazov, 1991; Lawrence, 1982). The situation therefore calls for urgent and concerted efforts for raw materials development, machinery and manufacturing that will compete favourably with imported ones (Degarmo, 1999). Therefore this study shall discuss, Raw materials requirement and specification for the existing industries in each sector, Raw materials available and their sources, Technology requirement for the conversion of the resources into industrial use, Consider the benefits of raw materials development in Nigeria and Problems associated with local sourcing of raw materials.

MATERIALS AND METHODS

Table 1 shows the occurrence and the reserve of some selected raw materials in Nigeria. It has been indicated that most of the raw materials required for our industries are available in the country. Some of these are being exploited on a large scale while others are mined on a small scale.

With improvement generally in every sector of the world, the world population has been increasing tremendously; hence the demand for engineering infrastructures has increase the usage of raw materials to develop these infrastructures. Raw materials must be developed to bring down the cost of materials in the country and must be produced within the country. In pursuance of this, government of Federal Republic of Nigeria established the defunct Directorate of Food,

Table 1: Occurrence development and proven reserves of some selected raw materials in Nigeria

Raw materials	Location	Estimated reserved (MT)	User industries	Exploitation	Quality
Trona	Gashua, Nguru and Zumo	No systematic studies have been carried out	Glass, Chemicals, Caustics soda	Development pilot study of refining trona	62% sodium Carbonate
Kaolin	Kankara, Akure, Ijero, Efon, Bauchi Plateau, Ibech	3400.00 190,000.00	Paints, rubber, paper, cement, cosmetic and ceramic	Six plants exists with a total annual capacity of 150000	Purity as high as 90%
Talc	Kagara, Ilesa, Kwara, Kaduna	40,000.00	Paints, cement, cosmetic, ceramic and insecticide	Plant exists with a 3000 tones for Kagara per annum	72% of Aluminum Silicate
Phosphate	Sokoto, Ilaro, Edo, Ondo and Abia States	Evaluation in progress	Phosphate fertilizer, phosphorus and phosphoric acids	Two plants of 3000 tones per annum in Sokoto	34-35% P ₂ O ₅
Asbestos	Kaduna	Unknown	Asbestos	No exploration	
Bauxite	Gongola, cross river and Ekiti State	Not yet known	High temperature Alumina refractory	Urgent detail exploitation and evaluation	
Limestone	Ewekoro, Sagamu, Ukpilla, Bauchi, Sokoto, Ebonyi	1,200,000	Cement, calcium carbonate, hydrated lime	Seven cement manufacturers curretly producing 2,000,000 P/A	85-95% of Calcium Cabonate
Gypsum	Potiskum, Dambara, Sokoto, Bauchi, Plateu, Benue,				
Feldspar	Imo and Edo States Taraba, Adamawa, Ikene, Boro, Oshogbo	200,000.00 1,200.00	Cement, chalk and plaster of paris Ceramic and Glass production	The cement manufactures consume about 1000,00 Partial exploration Road construction exploited	Deposits are not being
Bitumen	Agbabu Ondo State	Under investigation	company		
Coal	Emugu, Plateau, Kogi, Taraba, Bauchi, Anambra	500,000,000	As fuel and for production of tar, gases and oils.	Annual production is as low as 25,000 tonnes The 3 granite cutting and polishing plants in the country utilize about 80,000 tones per annum	High grade
Granite	Plateau, Ondo, Bauchi, Abuja, Kogi, Cross River, Oyo and Imo	3000,000,000	Decorative stones in homes and offices, also for building construction		High grade
Sand	Glass sand in Ondo, Plateau, Lagos, Enugu, Anambra,			The 5 glass plants in the country utilize 120,000 tones per annum.	
Salt	Rivers and Delta State Salt spring at Awe (Plateau), Abakaliki, Uburu and rock salt in Benue State	150,000,000 Partial investigation	Glass manufacturer Industrial and domestic uses	The salt deposits are not being exploited	High silica SiO ₂ High grade

(RMRDC, 1996)

Road and Rural Infrastructure (DIFRRI) in 1990s to encourage the development and utilization of local raw materials for the provision of building materials to assist rural people and provide them accommodation at a cheaper price (NBRRRI, 1991).

The development of raw materials in Nigeria is of vital importance as this will remove over dependence on imported materials and its regular depletion of scarce foreign exchange reserve which has very negative consequences on the nation's economy, since a large amount of Nigeria's foreign reserves is spent on importation of materials (NBRRRI, 1991).

Required technology for raw material development:

Table 2 indicates national demand for raw materials and its shortfall due to non availability of relevant technology. To develop raw materials, adequate knowledge of their characteristics and properties are required; this will enable us to design the technology, which includes the machines and components, based on accurate prediction of behaviour of such material to

Table 2: National demand for raw materials and its shortfall

Raw materials	National demand (Quantity)	Supply quantity	Shortfall
Kaolin	150,000	20,000	130,000
Talc	50,000	3000	49,700
Phosphate	200,000	0	200,000
Limestone	3000,000	30,000	270,000
Hydrated lime	5000,000	20,000	480,000
Gypsum	300,000	0	300,000
Feldspar	1000,000	10,000	90,000
Coal	200,000	0	200,00
Salt	500,000	0	500,000
Soda Ash	50,000	300	49,700

(RMRDC 1996)

produce the desire results. A satisfactory design of technology will ensure proper development and functionality of raw material, hence its cost effectiveness.

The designer therefore must have a clear understanding of condition under which intended materials or components will function, the problems in the manufacturing of materials, their behaviours under various conditions and also the initial and long-term costs. The basic things to consider in the development of raw materials are:

- The ability of such material to perform their intended functions effectively and efficiently
- Availability and affordability.

The former referred to as the technology required to develop raw materials that will function without failure, while the latter referred to economic and cost effectiveness.

NECESSITY FOR RAW MATERIAL STANDARDIZATION

The standard of any material is the totality of all necessary requirements which the material must satisfy. Presently, various materials and components are produce in Nigeria; some of these materials are substandard while some have satisfactory quality. The unreliability in the quality of some of these materials is contributory to the preference for imported ones even of inferior quality. In order to enhance acceptability of locally produced materials, there is need for unification in control of qualities of all materials thereby establishing a standard by which the quality of each material produced can be assessed.

The requirement for these materials may be quantitative or qualitative and are usually established from series of tests and experiments and may be documented after having been subjected to statistical analysis. Such documents have the status of law when, they are at the instance of national agencies charged with the responsibility. These documents are known as

national standards and will serve as a guide to designer and developers of the material. Material standardization usually includes:

- General information on the properties and guided requirements for various materials. Such information will include areas of application, methods of testing and quality control.
- Brief description of the material.

Table 3 explain raw materials requirement of existing industries in Nigeria.

Framework for raw materials development standardization, testing and control: The 3 major government agencies involved in raw materials development, research and standardization are;

- The Raw Material Research and Development Council (RMRDC)
- The Standard Organization of Nigeria (SON)
- The Nigerian Building and Road Research Institute (NBRRI)

Raw Materials Research and Development Council (RMRDC) is primarily concerned with discovery and documentation of raw materials in the country, it falls short of developing these materials into usable forms through manufacturing. This is primarily due to absence of manufacturing base and other administrative bottleneck connected with lack of funds. The Nigerian Building

Table 3: Raw materials requirement of existing industries in Nigeria

Sub sector	Raw materials	Source	Quantity at install capacity (Tonnes)	Production level (Tonnes)
Asbestos	Asbestos fibre	Local	134,400	43,150
	Cement	Local	13,6 m	2 m
	Cellulose	Local	666,670	200,000
	Pulp	Local	1 m	2 m
Cement	Gypsum	Local	620,000	300,000
	Limestone	Local	12 m	4 m
	Shalks	Local	393,000	65,000
	Laterite	Local	222,300	40,000
	Clay	Local	411,200	80,000
	Bed Aluminum	Local	28,500	50,000
	Ceramics	Kaolin	Local	356,000
Quartz		Local	220,000	21,000
Fieldspar		Local	192,000	35,500
CaCO ₃		Local	12,800	3,198
Talc		Local	600	3,000
Construction and Building materials	Clay	Local	3,060,000	3,545,000
	Gravel	Local	110,000	35,000
	Sand	Local	30,000	65,000
	Marble	Local	110,000	NA
	Granite	Local	2,500,00	183,000
	Limestone	Local	DING	18,000
Glass	Silica	Local	183,000	9860
Paints	Kaolin	Local	5,240,00	6450
	TiO ₂	Local	256	NA

(RMRDC, 1996)

and Road Research Institute (NBRI) was established in 1978 under the National Science and Technology Development Agency (NSTDA) to develop raw materials for Nigerian houses if it proved more cost effective. (NBRI) was unable to carry out this function due to finance and absence of national programme on indigenization of material production and supply, while Standard Organization of Nigeria (SON) is to standardize methods and products in industries throughout Nigeria and to ensure compliance with government policy on standardization.

For a more pragmatic policy on developing and improving quality of locally produced materials, there is an urgent need to review the instruments establishing these agencies involved in material development, manufacturing, research and quality control. This should be followed with reorganization of these agencies in line with a programme of action towards achieving complete self-reliance in material production and supply.

PROPOSED REORGANIZATION OF RAW MATERIAL DEVELOPMENT AND RESEARCH AGENCIES

Government should establish as a matter of urgency a National Raw Materials Development and Research centre aimed at achieving reliance on locally produced materials and components. The centre should have branches in some selected universities and each branch should be given mandates into research and development of some materials where it has comparative advantage in terms of raw material resources and trained manpower or expertise.

Material sub-sector should allocate public funding for research i.e. material research centers should be financed through public funds. The proposed branches should serve as consultants to the end users in the material sub-sector experts in materials from the academic and other government institutions should be invited to carry out research and manage these centres. These centers should be charged with the responsibility to develop new technologies and to seek optimal solutions to problems related to properties manufacturing and machinery processes.

CONCLUSION

In view of the capital intensive nature of mineral exploration, mining and exploitation, a strong case can be made to justify joint venture activity to promote raw materials development in the country. Those minerals that have been identified as available but inadequately exploited for industrial utilization should be targeted for joint venture financing and development. In this

regard, potentials and manufacturing industries that consume these target minerals should be wooed into joint venture financing of mineral development. Also since most economic activities depends on use of materials, both economics and industrial development of the country depend largely on self reliance in material production using local raw materials and since a large of Nigeria's foreign reserve is spent on importation of materials, concerted efforts to enhance productivity of material sub-sector will reduce over-reliance on imported materials.

Nigeria should tackle the problem of being a dumping ground for foreign materials, by reviewing existing structure of government agencies, involved in material development.

RECOMMENDATIONS

Government should put in place a Raw Material Development Bank similar to the National Agricultural Credit Bank, Educational Bank and Commerce Bank to serve as the financial institution framework for the development of this vital sector. These funds will be used for exploration, mining and upstream developments which are highly capital intensive and less attractive to commercial banks.

REFERENCES

- Degarmo, E. and Co., 1999. Materials and processes in Manufacturing. Macmillian Publishing Co. Inc. New York.
- DIFFRI, 1988. Building Materials Development programme of the Directorate for Foods, Roads and Rural Infrastructure (DIFFRI) Lagos; Nigeria.
- Folayan, C.O., 2004. Raw Material Development, Machinery and Manufacturing. Proceeding of the National Engineering Conference and Annual General Meeting of the Nigerian Society of Engineers. Kano Raw Materials Research and Development Council (RMRDC), 1996. An updated report of the multi-disciplinary task force on some selected minerals for Nigeria industries, 4: 54-61.
- Homy, A.S., 2000. Oxford Advance Learners Dictionary. 6th Edn.
- Lawrence, H.V.V., 1982. Materials for Engineering. Concepts and applications. Addison Wesley Publishing Company. Poland.
- NBRI, 1991. Publication on Raw Materials for Building Industry. Lagos Nigeria Vol. 3.
- Okereke, P.A., 2000. Towards Effective Building Materials Development, Testing and controlling Nigeria. Inter-world J. Sci. Tech., 1: 28-34.
- Papazov, G., 1982. The Work of an Engineer with Standards Technical SOFIA.