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Towards Optimising Pulp and Paper Production Capacities in Nigeria

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Abstract

In Nigeria, pulp and paper production capacities are low due to dependence on foreign inputs. Two of the three primary pulp and paper mills established in the 1960's to 1970's performed optimally till the 1980's. In 1985 and 1986, capacity utilization in Nigeria paper mill reached 62.3% and 66.17% respectively. Also by 1988, the importation of newsprint had stopped. However, in 1996, the mills stopped production leading to complete dependence on importation of paper and paper products. This resulted in the expenditure of an estimated amount of 500 billion naira annually on importation of paper products. To ensure optimal pulp and paper capacities, government need to deliberately promote investment in small scale pulp and paper mills, agro residues pulping and production of specialized types of handmade paper. Likewise, long fibre pulp production from Sterculia setigera, Sterculia oblonga and Hibiscuss cannabinus has become imperative to save foreign exchange.

Key Words: agricultural residues, integrated, handmade paper, long fibre, pitch deposit, kenaf, and bamboo

Introduction

For many years, the need for the development of pulp and paper capacities in developing countries were of limited interest as a result of the stability experienced in the global pulp and paper market (Picornell, 1984). However, as the global economy began to expand in the late 1950's through the 1970's, and, the market for pulp and paperboard began to increase, developing countries began to establish pulp and paper manufacturing concerns. This development was encouraged by four main factors. These include the need to make use of available raw materials and reduce foreign exchange expenditure; to protect local consumers from the high import prices; to develop local industry and provide employment; and, to promote national industrial development aspirations (Picornell, 1984).

However, the disadvantages of establishing pulp and paper mills in developing countries were observed to be many. Among these are relatively small markets, low range of products output, high dependence on imported inputs resulting in higher costs of operation compared to similar mills in developed countries, dependence on foreign management and technical personnel; high cost of energy and imported chemicals, coupled with low exchange value of domestic currencies. Another major problem that limits the performance of mills in developing countries was involvement of government as there was shortage of capital in the private sector. In Nigeria, the pulp and paper sector of the economy has experienced serious travails brought about by some of the problems highlighted above. This paper examines some of the major problems militating against optimal pulp and paper production in Nigeria and highlights the pathway for promoting optimal pulp and paper capacities locally.

Pulp and paper capacities in Nigeria

The pulp and paper industry in Nigeria was one of the major industries that performed well in the 70-80's before the oil glut era as self sufficiency in paper production was one of the major cardinal objectives of the government. This was evidenced by the establishment of three integrated pulp and paper mills locally between 1969 and 1976. Two of the mills performed, i.e., the Nigeria Paper Mill, Jebba and the Nigeria Newsprint Manufacturing Company, Oku Iboku, performed optimally and paper importation faded out

in the 1980's (CBN,1994). For instance in Nigeria Paper Mill, actual production in 1985 was 40,480mt and in 1986, 42,960 tonnes, representing 62.3% and 66.17% capacity utilization respectively. This pattern of capacity utlisation was also experienced at the Nigeria Newsprint Manufacturing Company, (NNMC), Oku- Iboku about the same period. The volume of production at NNMC rose from 28,927 tonnes in 1989 to 37,581 tonnes in 1990 (CBN; 1990, 1992). Due to establishment of the NNMC, import of newsprint reduced drastically to 17.5% in 1986 and 12.5% in 1987 respectively and faded out in 1988 (CBN, 1994). However, the downturn in the economy in the 1990's revealed the structural weakness of government led industrialization strategy. The mills which were mostly owned by the Federal Government depended extensively on foreign inputs inform of long fibre pulp, management and technical expertise and spare parts. Thus, the integrated mills became convulsed in the 1990's and capacity utilization nose dived. Capacity utilization at the Nigeria Paper Mill became as low as 2.5% in the early 1990's until the mill stopped production in 1996 (RMRDC, 2009). The third pulp and paper mill, the Iwopin Pulp and Paper Company was also established in 1976 to produce fine writing, printing and cultural papers. By 1983, when mill was at about 85% completion (Osadare, 1997), it was abandoned, and up till the time it was shut down in 1998, the mill never produced up to 5% if it's installed capacity (RMRDC, 2009). In line with the privatization agenda of the Federal Government, the primary pulp and paper mills were privatized in 2006. Although, the Nigeria Paper Mill, Jebba, has commenced production of kraft paper on one of its paper machines, the two other mills are yet to commence production. This situation has seriously affected the pulp and paper industry in the country. Table I shows that the supply gap for long fibre pulp, short fibre pulp, kraft paper, newsprint, bank paper etc, were met through import in 2005 (RMRDC,2009).

Table 2 also shows pulp and paper capacities in Nigeria from 2003-2006. Capacity utilization in the primary pulp and paper sub-sector (fibre source) increased from 4.92% in 2003 to 6.33% in 2005 and to 6.84% in 2006, resulting in average capacity utilization of 6.38% in the sub-sector. The very low capacity utilization in this sub-sector is attributable to status of the three primary pulp and paper mills as the activity in the subsector was only sustained by waste paper recycling (RMRDC, 2009). Local capacity for the production of chemical raw materials remained nil throughout the period. Capacity utilization in the stationary, light/heavy weight packaging subsector varied from 79.62%, 85.06%, 85.57% and 87.39% in 2003, 2004, 2005 and

2006 respectively (Table 2). The overall capacity utilization in the entire sector was 54.18%. The high capacity utilization recorded by the printing, stationary and other subsectors apart from primary paper manufacturers was mainly due to high exchange rate expended on paper imports. This became important in view of the need to satisfy the requirements of the Universal Basic Education as promulgated by government coupled with increase in publicity generated by political activities in the country (RMRDC, 2009). Apart from waste paper which was sourced locally for production of tissue papers, the demands for other raw materials (paper, chemicals, etc) were largely met through import.

Table 1: Demand and Supply statistics on some of the major raw materials required in the pulp and paper sector in 2005

S/N	Raw Materials	Production	National Supply gap	National Demand gap	gap (%)
1.	Long Fibre Pulp(BDMT)	0	85,668.1	85,668.1	100
2.	Short Fibre Pulp(BDMT)	0	280,000.0 2	80,000.0	100
3.	Waste Paper	74,000.0	100,000.0 2	6,000.0	26
4.	Kraft Paper	0	80,000.0	80,000.0	100
5.	Fluiting paper	0	20,000.0	20,000.0	100
6.	Newsprint	0	250,000.0 2	50,000.0	100
7.	Sodium sulphate (tones)	0	2,600	2,600	100
8.	Sodium sulphate(tones)	0	6,000	180,000	100
9.	Soda ash (tones)	0	55	55	100
10.	Sodium Hydroxide	0	144,260	144,260	100

Source: RMRDC (2009)

Challenges of optimal pulp and paper production in Nigeria

A number of problems are militating against optimal pulp and paper production in Nigeria. Some of these are related to the installed capacity of the mills and the type of ownership structure while others stem from the type, quantity and quality of wood raw material resources in the nation's tropical forests. Some of the problems are subsequently discussed.

Table 2: Summary of Capacity Utilisation in the Pulp, Paper, Paper Products, Printing and Publishing Sector (2003 – 2006)

S/N	Sub-Sector	Installed Capacity	Capacity Utilisation (%)				Average Capacity Utilisation (%)
			2003	2004	2005	2006	
1.	Primary Paper (Fibre sources)	1,169,145.00	4.92	5.98	6.33	6.84	6.38
2.	Primary Paper (Chemicals)	105,262,517.00	0.00	0.00	0.00	0.00	0.00
3.	Stationery, Light/Heavy Packaging (Paper)	3,467,400.00	68.44	75.87	84.81	88.07	82.92
4.	Stationery, Light/Heavy Packaging (Boards)	463,410.00	79.62	85.06	85.57	87.61	84.53
5.	Stationery, Light/Heavy Packaging (Chemicals)	571,093.00	76.54	80.24	85.71	87.61	84.53
6.	Stationery, Light/Heavy Packaging (Miscellaneous)	10,203,418.00	63.64	59.67	60.61	62.64	60.97
7.	Printing and Publishing (Paper)	42,903.00	17.64	19.24	20.68	22.222	2.71
8.	Printing and Publishing (Boards)	499,271.10	58.81	61.18	63.16	65.88	63.41
9.	Printing and Publishing (Chemicals)	20,808.00	46.18	46.74	47.49	47.96	47.40
10.	Printing and Publishing (Miscellaneous)	25,573.00	88.98	89.18	89.40	89.83	89.47
Total	**Average Annual Capacity Utilisation (%)**						**54.18**

Source: RMRDC (2009)

Scale of operation of the integrated pulp and paper mills

Among the three integrated pulp and paper mills, the one with the lowest installed capacity is the Iwopin Pulp and Paper Company with an installed capacity of 68,000 tonnes per annum. This translates to 186 tonnes per day. As any mill with production capacity above 100 tonnes per day is a large scale mill (UNIDO, 1978), all the integrated mills are large scale mills. In

Nigeria where there is inadequate infrastructure, raw materials (long fibre and chemicals), energy and skilled manpower coupled with low capital base, the establishment of only large scale mills can neither be considered optimal nor appropriate. Thus, a mix of scale of operations is required if the industry is to perform to expectation. In India, where per capital consumption is very low compared to developed economies; papermaking holds a considerable share in manufacturing production (Schumacher and Sathaye, 1999). Both small and big mills coexist to produce a variety of paper and paperboard products as well as newsprint. The average size of paper mill in India was 10,400 tonnes per annum compared with 85,000 tonnes per annum in Asia and 300,000 tonnes per annum in Europe and North America (Schumacher and Sathaye, 1999). About two thirds of Indian's paper mills have a capacity less than 18,000 tonnes per annum (Meadows, 1997). Medium sized mills have a capacity between 10,000 tonnes per annum and 20,000 tonnes per annum while small mills are defined as mills with a capacity less than 10,000 tonnes per annum.

Small sized mills became important when due to a severe paper shortage in the early 70's government promoted immediate establishment of small readily available paper mills. Due to this policy, the small and medium sector with about 300 mills accounted for almost 50% of installed capacity in 1992 (Meadows, 1997; Sharma et al, 1998). Also, in China, the capacity of many of the mills was very small until recently when the country started moving towards wood utilization (Hannold, 2009). Small scale mills are likely to be efficient and appropriate in view of the country's extenuating circumstances, more so, as statistics has authenticated that there is a strong link between per capita income of a country and the amount of paper consumed. While in industrialized countries, consumption can be as high as 300kg per capital per year; in some developing countries, the figure can be as low as 1kg and rarely exceeds 15kg per year (WRF, 1997). As per capita income grows and society demand higher rates of literacy, the demand for paper will grow. This can only be reasonably met with indigenous manufacturing capacity and locally sourced raw materials at reasonable costs, avoiding import taxes, higher purchase prices and loss of valuable foreign exchange (WRF, 1997). Smaller mills provide high level of employment, not only in the mill, but amongst associated industries (WRF, 1997). Small mills are also more flexible in their acceptance of raw materials (Onilude and Ogunwusi 2012). A deliberate government policy instituted to encourage establishment of small scale pulp and paper mills in Nigeria will definitely

increase pulp and paper capacities. This type of policy should however be regulated to ensure that old and obsolete equipment that will lead to high production cost are not imported.

Dependence on importation of long fibre and pulping chemicals

The integrated pulp and paper mills in Nigeria depend overwhelmingly on imported long fibre pulp. The forests in Nigeria consist predominantly mixed tropical hardwood species whose fibre lengths vary from 0.8mm to 1.6mm. Dinwoodie (1965) reported fibre length to be an important factor influencing strength development in paper. Casey (1980) also noted that the differences observed in comparing the properties of paper from different types of pulp are mainly due to the influence of fibre characteristics. During beaten, the fibres are shortened to improve sheet formation in order to promote uniformity and smoothness. This causes a substantial reduction in fibre length. Watson and Dadswell (1964) studied the influence of fibre morphology on paper properties and indicated that the prime importance of fibre length is the existence of a critical level of bonding. In short fibre pulp, this critical level is hardly attained necessitating the addition of long fire pulp. As the integrated pulp and paper mills established locally are expected to produce fine writing and printing papers, kraft paper and newsprint, the mills require long fibre pulp to mix with the short fibre pulp to enable development of strength required by each of the products. According to Makinde (2004), among the major factors responsible for the poor outing of the three pulp and paper mills is the high cost of importing approximately 85,000 tonnes of long fibre pulp required in the process. As at 1990, approximately $85 million was required to import 85,000 tonnes of long fibre pulp. In addition, Ogunwusi (1996) reported that approximately 10 billion naira would be required to import different types of chemicals required by the mills if they are to function at full capacity on annual basis while Onwualu (2010) observed that about 500 billion Naira are expended annually to import pulp and paper products locally.

Sub-optimal performance of *Pinus species* in plantations

One of the strategic plans of the Nigerian government for the development of the paper industry was to promote plantation establishment of *Pinus species* for long fibre pulp production. In view of this, seeds were imported and established in plantations in various locations within the savanna and forest ecologies in Nigeria (Ojo, 1971). While some successes were recorded at the

early stage of the project, the exercise later turned out to be a failure (Momoh, 1970). One of the major causes of the failure was the inability of the micorrhiza imported to become established in the field (Momoh, 1971). The micorrhiza functions as an absorbing organ for the plant and failure of pine plantations and nurseries were attributed to the lack of development of the micorrhiza association (Jackson, 1971). The failure of the micorrhiza to become established was associated high temperature (Momoh, 1970). According to Jackson (1971), in the savanna region of Nigeria, pines have to be initially inoculated with micorrhiza if satisfactory results were to be obtained. Despite this and several other methods that were tried, the project did not record adequate success. Thus, Madu (1971) summarized that the failure of the project was due to lack of suitable micorrhiza in Nigerian soils. As a result, despite the efforts of pioneer foresters in Nigeria, *Pinus species* can only be found on experimental pilots in locations such as Afaka in Kaduna State and Miango in Jos, Ijaye forest reserve in Oyo State and in a number of other isolated areas (RMRDC, 1991).

Inadequate funding of R&D projects on pulp and paper

While the development of pulp and paper sector in the United States is fuelled by adequate funding of Research and Development (R&D) projects as it is mandatory that 1% of the sales of the paper and allied sectors are annually directed towards R&D (AF&PA, 2004), in Nigeria, funding of forestry projects, most especially those in the pulp and paper sector is nonexistent. According to Famuyide and Adebayo (1993), about 0.02% of the budget of the Ministry of Agriculture is expended on forestry activities and most of the funds released are devoted to payment of salaries. Thus, the mandated organizations such as the Federal Institute of Industrial Research, Oshodi, Forestry Research Institute of Nigeria and relevant departments in tertiary institutions groan under inadequate funding (FAO, 2001).

Strategies for optimising pulp and paper production

While the need for production of optimal quantity and quality of pulp and paper products has been recognized locally, little or no efforts have been pulp in place to actualize this except the sale of the three integrated pulp and paper mills. In view of the importance of paper to national development and achievement of industrial, social and educational development aspirations of Nigeria as encapsulated in its vision 20:2020, there is need for a deliberate strategic plan by national planners to develop the sector locally. Some of the

approaches that may be instituted sequel to the privatization of the three integrated pulp and paper mills are subsequently discussed.

Promotion of Kenaf utilization for long fibre pulp production

Kenaf is currently being explored in most developed and developing countries as a viable raw material for pulp and paper production. In Malaysia; due to the potential commercial value of kenaf, the government allocated RM 12 million for research and development of kenaf based industry under the 9th Malaysian development plan (2006 – 2010) (Mohd Edecrrozey *et al*, 2007). Under this plan, government also emphasized diversification and commercialization of the downstream kenaf based industries including the pulp and paper industry in cooperation with the private sector. In Nigeria, efforts have also been made to promote kenaf utilization in the pulp and paper industry. Udohitinah and Oluwadare (2011) reported the mean fibre length of locally grown kenaf to be 2.90 mm while the fibre diameter was reported as 28.16um; lumen width, 6.08 um; and cell wall thickness; 11.04 um respectively. The average fibre length, diameter, lumen width and cell wall thickness of the kenaf sample compared with the fibre dimensions of kenaf varieties reported by Ververis et. *a*l. (2009) and Nkaa *et al* (2004). It was also observed to be comparable to the range of 2.7mm to 4.6mm for softwood tracheids (Ates *et al*, 2008). Consequently, Uddohitinah and Osadare (2011) submitted that kenaf bast fibre could go a long way in alleviating the problems posed by a shortage of long fibre pulp to Nigeria pulp and paper mills. Likewise, the Raw Materials Research and Development Council constituted a task force that determined the optimal parameters for commercial scale pulping of bast kenaf fibres in 1991. The report of the task force showed that bast fibre pulp of kenaf can replace imported long fibre pulp and elucidated the optimal pulping parameters for commercial scale pulping of bast kenaf fibres. However since the completion of the study, little or no progress had been made in securing private sector investment in kenaf long fibre pulp production as a result of the high cost of erecting a new pulp mill to use kenaf as its major raw material, the unwillingness of the paper mills in the country to change from the use of wood to non-wood raw materials coupled with the collapse of the pulp and paper mills in the country in the mid 1990's.

Development of long fibre pulp from S*terculia Setigera*

One of the major indigenous raw materials reported locally to have long fibre characteristics is *Sterculia setigera*. Ogunwusi (2002) reported the fibre length to be 2.41mm. As a result of its mean fibre length value, *S. setigera* can be regarded as a long fibre wood species in accordance with the classification of Bublitz (1980). Consequently, *S. setigera* may produce pulp with properties reminiscent to those of imported long fibre pulp. The mean wood density is 249kg/m^3 (Ogunwusi, 2002) . Although, this density value is within the acceptable range for pulp and paper production, it is considered low and may lead to low pulp yield. The low density may place the wood species at a disadvantage as pulpwood raw material when the economy of optimal digester packing is considered (Casey, 1980).

Utlisation of S*terculia oblonga* for long fibre pulp production

Sterculia oblonga is also one of the indigenous wood species that has been reported to have long fibre length. Osadare (1996) in a preliminary work carried out on *Sterculia oblonga* from Nigeria showed the fibre characteristics of the plant species to be as presented in Table 3. The average fibre length of the wood species is 2.07mm which is higher than in most hardwood species. The alcohol benzene solubility is 3.6% and the wood density was 260kg/m^3 (Table 3). The strength properties of unbleached kraft paper at K-NO 10 were also reported by Osadare (1996) to be within acceptable range when compared with commercial kraft paper at Nigeria Paper Mill. In the light of the above, the development of the Nigeria Pulp and Paper industry may be premised on long fibre raw material sourcing from plantation grown Sterculia *oblonga*.

Table 3: Fibre Dimensions and Morphological Indices of *Sterculia oblonga*

Property	Wood	Bark
Fibre Length (mm) 2.07	3.27	
Diameter (u)	32.98	28.53
Lumen width (u)	20.47	11.54
Cell wall thickness (u)	6.25	8.49
Wall fraction (%)	62	177
Slenderness	63.1	115.1
Suppleness (%)	62	49
Wall rigidity	0.19	0.30
Cross sectional Area (u2)	854	739
Basic Density (kg/m3)	260	

Source: Osadare (1997)

Bamboo utilization for pulp and paper production

Despite bamboo's ubiquity in the some parts of Nigeria, little or no attention has been directed towards its development while bamboo is a popular raw material for pulp and paper making in countries such China, India and Malaysia. In a recent study, Ogunwusi and Onwualu (2011) indicated that bamboo is widely distributed in the south and middle belt regions of the country. Despite this, bamboo utilization for pulp and paper production locally was inconsistent as it was dropped by the Nigeria Paper Mill, Jebba in 1980's as a result of silica deposition problems experienced by the mill. Ogunsile and Uwajeh (2009) reported a study carried out on the pulping potentials of *Bambusa vulgaris* growing in Nigeria. The average specific gravity was observed to be within a range of 0.58-0.69 and the fibre length to vary from 2.37-2.92mm, indicating the possibility of producing strong paper with good tearing resistance from the plant.

The major problem of bamboo pulping is silica deposition (Andtbacha, 2005). However according to Andtbacha (2005), when a bamboo mill is designed, the high silica content must be taken into consideration as the silica content gives scaling problems in the cooking plant and in black liquor evaporator leading to difficulty in lime pre-burning.

Promotion of investment in small scale pulp and paper mills

While there are many options whereby paper demand can be met, the large scale option based on government participation has failed in the country (Ogunwusi, 1996a, 1996b; Makinde, 2004). Consequently, the recourse will be for establishment of smaller mills. A major advantage of small scale paper mills is the low initial capital requirement which makes it more attractive to small scale investors (Kryklund, 1983). To encourage development of small scale pulp and paper making industries in Nigeria, government may have to earmark certain products exclusively in the domain of the small scale paper industries to protect them from competition from the large industries that have been privatized, improve their access to credit, technology, skill and market information (business development services), promote formation of associations, clusters or industrial ecology, and cooperatives to help small enterprises benefit from scale of economies in procurement inputs, transportation and promotion of products and research and development (McQueen *et al* 2006) and to increase their bargaining power and prevent their exploitation by intermediaries and value chains;

creation of enabling environment for business, in particular to remove many of the obstacles that make high transaction costs in small enterprise , increase in tariff on products of small scale pulp and paper mills and to eliminate double taxation for raw materials and products. However, small scale pulp and paper mills have difficulty in coping with environmental legislation as small scale black liquor recovery is not yet fully perfected (Honnold, 2009). Nevertheless, biological treatment plants such as anaerobic digester can be used to treat the effluent.

Production of Pulp and paper from agricultural residues

King (1977) and Patel *et al,* (2011), have recommended that developing tropical countries re-strategize and promote paper production processes that depend more on local raw materials to ensure the sustainability of the industry. One of the major options available to countries with substantial agricultural produce is the production of paper from agricultural wastes. In India, three categories of pulp and paper mills are recognized. These are forest based mills; agro residues based mills and recycle fibre based mills (Schumacher and Sathaye, 1999). In 1992, forest based mills accounted for 49% of total raw materials input for paper, paperboard and newsprint production while agricultural residues and wastes paper accounted for 29% and 22% respectively (Sharma et al, 1988) . In India, the consumption share of forest based materials has been declining overtime. The share of agricultural residues shows a steadily increasing trend since 1980 and it is expected to rise further in the future (Schumacher and Sathaye, 1999). The small paper mills set up in the early 1970's almost exclusively use agro raw materials/residues such as rice straws, wheat straw, and baggase which are relatively short cycle regenerative and abundant (Schumacher and Sathaye, 1998). Bublitz (1980) estimated that agricultural crops generally produce an annual crop with straw tonnages varying from a low 2.2 MT/ha to 4.4 MT/ha to a maximum of 18 to 22 MT/ha. Apart from improved yield, agricultural residues are mostly products of annual plants compared 10 to 20 years needed for trees to become large enough for commercial harvesting.

Promotion of investment in handmade paper production

Handmade paper is a paper produced manually. Handmade paper will gain widespread acceptance if it can be produced and delivered with a high level of consistency of quality and reproducibility between different lots. The quality control procedures evolved by Banjara (2001) on specifications for

the purchase of raw materials, inspection procedures and control of pulping parameters should provide adequate guide for operators. The Japanese method of sheet formation and the European method of stock recirculation in the vat are methods that can be adopted for production of finer varieties of handmade paper (Winners *et al*, 2011). A major advantage of handmade paper is that large-scale units consume an average of 2.5 tonnes of forest based raw materials per tonne of paper while small-scale units consume an average of 3.5 tonnes of raw materials per tonne of paper. In contrast a handmade paper unit uses only 1.1 tonnes of raw material per tonne of paper produced. One important reason for this is that the waste generated in the manufacturing process is internally recycled without loss of quality (Banjara, 2001). Handmade paper production is not capital intensive capital intensive (Ogunwusi;1996a, Ogunwusi, 1996b). Economically this is one of its biggest advantages. Capital intensity increases dramatically as the scale of production increases (Banjara, 2001). For large-scale integrated units, it can cost up to US$ 1000 to add each extra tonne of capacity. Adding capacity in handmade paper units costs only half as much. Handmade paper enjoys a similar advantage in employment generation potential. Employment creation in a handmade paper unit requires only one tenth the capital required in a large-scale integrated unit (Banjara, 2001). In India handmade paper contribute about 0.1% of total pulp and paper capacities.

Conclusion

For the privatization of the integrated pulp and paper mills to be meaningful, it is imperative that efforts should be made to promote production of long fibre pulp locally. Any of the indigenous long fibre wood species discussed in this write up offers great potentials. As the total output from the integrated mills cannot satisfy local demand even if they are to function at maximum capacity, there is need to increase pulp and paper capacities locally by encouraging small scale paper mills to come on board. Small scale pulp and paper mills will offer provide opportunities for training managerial and technical personnel on several areas of pulp and paper production. It also has the capacity and capability of utilizing local raw materials including agricultural wastes in the production processes. There is also need for introduction of handmade paper culture locally. This will assist in production of specialty papers. With these strategies, Nigeria may turn out to be a major paper exporter to other ECOWAS countries.

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