DEMAND FOR DAIRY PRODUCTS IN NIGERIA: EVIDENCE FROM THE NIGERIAN LIVING STANDARDS SURVEY

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Abstract

Based on the data from the recent Nigerian National Living Standard Survey (NLSS), income, demographic and environmental factors as well as exposure to western culture influence the consumption of dairy products in the country. From the results of the descriptive and quantitative analyses, it is safe to infer that demand will grow and therefore government will need to design polices to promote the production and marketing of dairy products to enhance supply in the local market on a sustainable basis.

Keywords: *Demand, Dairy products, Living standard survey, Tobit model.*

1. Introduction

Dairy products in the Nigerian market are sourced locally and internationally. The major local dairy products in the market include ***Nono*** (sour milk), ***Kindrimo*** (sour yogurt), ***Cuku*** (Fulani cheese) and ***Wara*** (Yoruba cheese). The imported varieties as reported in official trade statistics come as sweetened (not concentrated) and unsweetened (concentrated) milk and cream; milk and cream in solid forms; butter, butter milk, cheese and curd. In the market place, however, these imported dairy products come either whole or in processed forms as evaporated milk, powdered milk, baby milk, cream, butter, cheese and yogurt (Jabbar and Domenico, 1990). The traditional dairy products in the Nigerian market are particularly prevalent in the urban and rural market outlets in Northern Nigeria where the tradition and culture of the people favour cattle rearing and where the consumption of fresh and locally-processed milk had long been part of the local diet. The foregoing stem from the fact that the relatively dry climatic condition prevalent in the northern part of Nigeria supports grassland vegetation which provides the basic food for these milk producing animals.

On the other hand, the imported dairy products are available across the country, in virtually all urban and rural market outlets. The consumption of dairy products, particularly the imported varieties had been part of the diet of educated Nigerians for many years. Over the last 60 years or so, and with more people exposed to western education and pattern of life, the consumption of dairy products has increased. This is

particularly true of the southern Nigeria where the people have an earlier exposure to western education and way of life, are more educated and with more working mothers than people in the north. The demand for dairy products is principally based on the perceived health benefits to adults, pregnant mothers, babies and children. With increased urbanisation and education the potential for increased demand exists but local production has been limited. Many supply constraints limit the availability of dairy products in the market despite several interventions in the past (Olaloku, 1976 and Adeneye *et al*, 1984). For example, the Nigerian government had initiated a number of dairy programmes through breeding. These were to mitigate the limited domestic production from the local dairy industry dominated by pastoral herdsmen who husband only local breeds of cattle. In this regard, government established dairy farms in selected areas for the cross-breeding of local and imported cattle. In addition, milk collection centres, including mobile points, were also established. The foregoing notwithstanding, local production had always lagged behind demand. Evidence of increased demand and limitation of local production is reflected in Figure 1 which show that importation of dairy products increased significantly on the average between 1999 and 2004, in quantity and valued terms.

The ensuing excess demand situation makes it imperative to present a better understanding of the structure of demand for dairy products in Nigeria in order to design more effective future production support policy interventions. In addition, the seemingly large national demand for dairy products belies the fact that there are variations in dairy product consumption across the regions. And, in order to design more effective supply policies, it is essential to understand regional differences (from State to State or geo-political zone to another) in the consumption of the products in the country. Furthermore, despite the large market for dairy products in the country only few studies have examined the product demand on a national scale. In fact, available studies have concentrated attention on specific regions only. For example, in Jabbar and Domenico (1990), the researchers examined dairy consumption pattern only in southern Nigeria, while in Jansen (1992) the focus was on consumption in northern Nigeria. In the same fashion, another study focused on the economic and non-economic factors in household demand for dairy products in Ibadan city of Western Nigeria (Odunowo, 2004). These studies showed that increased urbanisation, high educational attainment of household heads and increasing family incomes has positive impact on dairy consumption size. However, the conclusions from these studies are not easy to generalise for the country because the data used were location-specific. This paper helps to fill the gap.

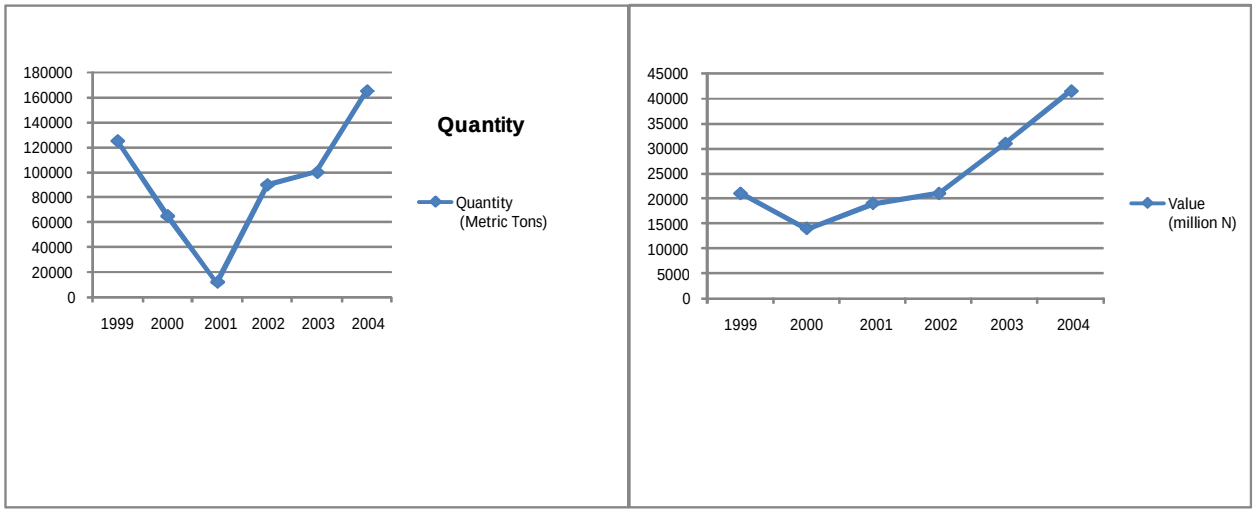

Figure 1: Quantity and Value of imported Dairy Products, Nigeria, 1999-2004

The paper contributes new knowledge on dairy consumption pattern in the country based on the analysis of a national survey data collected from households in all the States of Nigeria. This has enabled an analysis of the pattern of dairy consumption across six geo-political zones (North East, North Central, North West, South East, South- South and South West). In what follows, first, is a discussion on the methodology adopted for the study. This includes a discussion on the source of data as well as the analytical techniques used in generating the information contained in the paper. The next section contains a discussion on the demographic and socio-economic characteristics of households in the different geo-political zones as well as a discussion on the results of the quantitative analysis. The paper ends with a section containing some summary comments and concluding remarks.

2. **Methodology**

2.1. ***Data***

The data were extracted from the household data collected during the recently concluded Nigerian Living Standards Survey (NLSS) conducted by the National Bureau of Statistics (NBS) [formerly Federal Office of Statistics (FOS)], directed at eliciting household consumption behaviours, with particular emphasis amongst other items, on disaggregated dairy products – fresh milk, powered milk and tinned milk as well as other products like ice cream, yogurt, cheese and butter. The data were collected between September 2003 and August 2004. NLSS was an extensive exercise in coverage and scope. The survey was based on the National Integrated Survey of Households (NISH) for running household-based surveys in the NBS, and was designed using the NISH master sample of 2003/2004. The sample design followed a two-staged stratified procedure with the first stage based on a cluster of housing units known as Enumeration Areas (EAs) and the second stage the Housing Units (HUs). One hundred and twenty (120) EAs were selected in 12 replicates in each of the 36 States of Nigeria and 60 EAs in the Federal Capital Territory (FCT). Five (5) HUs were scientifically selected in each EA. On the whole, fifty (50) HUs were covered in each State and 25 HUs in FCT per month. Each State, therefore, had a sample size of 600 HUs, and 300 HUs in FCT. This implied that the survey had an anticipated national sample size of 21900 HUs for the 12-month survey. The sample size was robust enough to provide reasonable estimates. Apart from collecting data on demographics, the survey focused mainly on the household expenditures on food and non-food items like education (school fees, books, uniforms, etc), health (consultations, medication, hospitalisation, etc), utilities, clothing, transportation, communication, recreation, and so on. On food expenditure, since non-economic factors such as differences in cultural and religious belief systems affect preferences of people, the total numbers of households covered in the survey vary from one food item to another.

In the survey, the numbers of households reporting the consumption of various types of dairy products vary from zone to zone as shown in Table 1. 8432 households reported the purchase of dairy product amongst the 21900 sampled in NLSS. Out of the 8432 households that reported expenditures on dairy products during the NLSS all over the country, 300 were further selected for more detailed study. The 300 households were selected randomly and in proportion to the number of reporting households in each of the 6 Zones. With this sampling procedure 38 households were selected in the North East Zone, 80 in the North Central, 30 in the North West, 63 in South East, 36 in South- South and 53 in South West.

Table 1
Number of Households Reporting Consumption of Dairy Products by Zone

Zone	Fresh Milk	Powdered		Other Products
		Milk	Tinned Milk	
North East	568	232	106	102
North Central	270	326	184	89
North West	1663	265	144	124
South East	211	840	629	168
South South	131	628	517	115
South West	89	465	357	89
Total	2932	2756	1939	687

Source: NLSS Database, NBS, Abuja

2.2. **Method of analysis**

The survey data were subjected to two analytical techniques. First was a descriptive analysis based on convention statistical measures like averages and percentages. The descriptive analysis was used to establish a set of stylised facts on the patterns of dairy products consumption for the six geo-political zones of the country.

Second was a formal quantitative investigation of dairy consumption which focussed on isolating factors important to the Nigerian dairy product market and expenditure behaviour of households. In household surveys, such as the NLSS, not all households purchase all the ranges of products surveyed. In a situation like this, it is not possible to apply standard demand analysis using the flexible functional forms such as the Almost Ideal Demand System (AIDS) or other analytical models (Fuller, Beghin and Rozelle, 2004). In the NLSS, incidences of no purchases were observed for a number of reasons. At times the particular dairy product

may not be available or the transaction cost of incurring expenses may be too high to attract purchases. In addition, sheer differences in consumer characteristics like differences in taste and tradition are factors in preventing purchase as was observed in the survey data. This is particular true for dairy products like ice cream, butter, cheese and yogurt.

When such truncated data are available for analysis the recommended alternative analytical model to conventional regression model is the Tobit model (Tobit, 1958). This analytical model had been widely used to estimate demand equations for survey data with zero consumption observations and is being used for this study as was the case in some others (Blundel and Meghir, 1987; Angulo, Gil and Gracia, 2001; Fuller, Beghin and Rozelle, 2004). The Tobit model is built on the assumption that the observed consumption of a good by household *i*, Y_i is determined by a latent factor measured by Y_i^* that can be represented as linear function of a vector of independent factors X_i, a vector of coefficients β, and an error ε_i, which has a normal distribution N(0, σ^2) which can be described as:

$$Y_i = Y_i^* = X_i'\beta + \varepsilon_i \quad \text{if} \quad = X_i'\beta > -\varepsilon_i$$
$$Y_i = 0 \quad \text{if} \quad = = X_i'\beta \leq -\varepsilon_i$$

For this paper, the Tobit model was applied to the survey data reported for the demand for fresh milk, powdered milk and tinned milk. The demand for ice cream, butter, cheese and yogurt is excluded from the analysis because the expenditure data obtained for these dairy products were lumped together. The model was estimated over the entire selected survey sample using the maximum likelihood estimator (MLE) routine in Eviews (Vogelvang, 2005). Description of the dependent and independent variables included in the regressions are presented on Table 2. The list of explanatory variables does not include prices because price data were not collected and unit values were not derivable for households that did not report purchases. Assigning prices to households that do not purchase items will greatly reduce sample price variations when no purchases were observed. A number of demand studies have also omitted prices in similar circumstances (Gould, 1992, Blisard and Blaylock, 1993, Jensen, 1995, and Yen and Jensen, 1996).

On view of the fact that survey data usually exhibit heteroskedastic behaviour, the conditional moments of the Tobit estimates of all the dairy products were tested (Green, 1993) and the null hypothesis of homoskedasticity was rejected at 5 per cent level for all products. Consequently, the Eicker-White covariance matrix (white, 1980) was used to compute the standard errors and t-statistics of the estimates. In the estimation of Tobit models (and Probit models too), the conventional coefficient of determination R^2 is an inappropriate measure of goodness of fit (Pindyck and Rubinfeld (1998), Vogelvang, 2005). To test the specification of such models, an LR-test is used by obtaining Lu which is the value of the log-likelihood function of the unrestrictedly estimated

model and L_R the value of the log-likelihood function of the restricted estimated equation that the only intercept as regressor. Then the LR-test statistics is LR = -2(In (L_R - In ($L\upsilon$)**)**. LR has an asymptotic X^2 (K-I) distribution under the null hypothesis of zero – slope coefficients. The LR-test statistics is usually printed from Eviews output when Tobit models are estimated with constant terms. The McFadden psendo-R^2 is also an accompanying result from Eviews output and its value indicates the robustness of the Tobit model estimates as it gets closer to unity.

Table 2

Variable Description for Truncated Dependent Variable Regressions

Variable	Type / Units	Description
D	Binary	1 = Participation in the product market
AGE	Number	Average age of household head
HHSIZE	Number	Number of people in house
CHILD	Number	Number of children under 15 years
MIDDLE	Number	Number of parents 15-59 years
SENIOR	Number	Number of persons over 60 years
NEDUC	Number	Number of persons with no education
PEDUC	Number	Number of persons with pry education
SEOVC	Number	Number of persons with sec. education
TEDVC	Number	Number of persons with tertiary education
INC	N / Person	Per capita household income
UVE	Binary	North East = 1, 0 otherwise
NC	Binary	North Central = 1,0 otherwise
NW	Binary	North West = 1, 0 otherwise
SE	Binary	South East = 1, 0 otherwise
SS	Binary	South South = 1, 0 otherwise
SW	Binary	South West = 1,0 otherwise

3. **Results and discussion**

Demographic characteristics of households vary from zone to zone as indicated by the summary of selected demographic information of the 300 selected households presented in Table 3. The average household size varied from 6.28 in the North East Zone to 3.33 in the South West.

Table 3
Average Household Distribution by Demographic Information and Geo-Political Zones

	North East	North Central	North West	South East	South South	South West	National Average
Household Size	6.28	5.37	5.16	4.52	4.06	3.33	4.70
Children < 15	3.29	2.17	2.39	1.43	1.30	1.06	2.00
Adults 15 – 60	2.84	3.00	.75	2.79	2.51	2.00	2.40
Adults > 60	0.13	0.20	0.05	0.33	0.32	0.33	0.30
Age of Household Head	44.08	44.63	42.78	52.63	48.63	46.22	46.00
Household Head with no Education	27	13	58	17	16	10	-
Household Head with pry Education	4	3	8	28	16	5	-
Household Head with Sec. Education	2	6	9	14	16	12	-
Household Head with Tertiary Education	5	8	5	4	5	9	-

* Age is in years
Source: NBS **NLSS**, 2004; General Household Survey, 2003/2004.

In terms of average household size all the three northern states have more persons per household than the southern zones. In fact while the average size of households in the northern zones are larger than the national average of 4.6 persons the southern zones, particularly, south-south and south west zones, have sizes significantly less than the national average.

Similar differences also exist in the number of young children and older adults among the zones. In the North East Zone, 52.52 per cent of the households had children below the age of 15 years and 2.10 per cent had adults above the age of 60, with 45.38 per cent of persons between the ages of 15 and 60. In North Central, 52.86 per cent of the households had children under the age of 15, 3.13 per cent had adults above 60 years and 44.01 per cent had persons between the ages of 15 and 60. The population distribution in the North West is slightly different from other northern zones. There, 53.01 per cent of households had persons between the ages of 15 and 60, only 0.96 per cent of the total households had adults above 60 years, while 46.01 per cent had children less than 15 years of age. On the other hand, all the southern zones had more adults than the northern zones. In all the three southern zones, on the average, only 31 per cent of households had children less than 15 years, 61 per cent had persons between the ages of 15 and 60 and 8 per cent of persons over 60 years old. These statistics, coupled with the information on household size, on the average, show that the households surveyed in the southern zones have older persons than the households in the northern zones. These results are consistent with national averages as shown in Table 3. In terms of the age of the head of the households, an interesting observation from the survey is the difference of the average age of the head of the household in the northern zones to that of the southern zones. While the average ages of the heads of the households in three northern zones ranges from 42.78 to 44.63 those in the south range from 46.22 to 52.63. And the national average is estimated as 46 years from NBS General Household Survey (GHS) of 2003/2004. Heads of the household in the north are relatively younger than those in the south.

Educational attainment of heads of household also varies across the zones. Those without formal education are generally higher in the north. 71.05 per cent of household heads in North East zone had no formal education and 13.16 per cent of them had tertiary education, with the rest having either primary or secondary education. In the North Central, 43.33 per cent of household heads had no formal education and 6.25 had tertiary education. In the North West, 72.5 per cent had no formal education, while 6.25 per cent had tertiary education, and 21.25 per cent either primary or secondary education. In the southern zones, percentage of household heads without formal education ranges from 26.98 in South East to 30.19 in South-South and 27.78 in South- West. From the survey data, 66.6 per cent of the household heads have either or secondary education in the South East, 60.36 per cent in the South- South and 47.22 per cent in the South West. The percentage of the household heads with secondary education or less is smaller in the south west than the other

southern zones and the South West also has the highest percentage of household heads with tertiary education. While 25 per cent of household heads had tertiary education in the south west, the south east had 6.36 per cent and south- south 9.43 per cent.

Overall, the household heads in the southern zones are more educated than those in the northern zones. This is in agreement with statistics from other surveys and from official statistics on education. These demographic characteristics have some bearing on the consumption of dairy products; that is, the observed regional variation in the expenditure of households on different dairy products is in line with the regional variations in age distribution of the population and levels of exposure to western education of the heads of the households across the zones

A further interesting finding from the survey data was the breath of the consumption of dairy products in Nigeria. All the dairy products (fresh milk, powdered milk, tinned milk and the others like ice cream, butter, cheese and yogurt) are consumed across the country. Table 4 presents the average household expenditure for all the zones on all the different dairy products. However, average households in the northern zones consistently out-spend their southern counterparts on fresh milk with the reverse the case for processed (imported) dairy products like powdered milk, tinned milk, ice cream, butter, cheese and yogurt.

Table 4
Average Annual Household Expenditure on Dairy Products by Zone

Zone	Fresh Milk	Powder Milk	Tinned Milk	Other Products
North East	150.17	121.67	20.42	17.22
North Central	388.24	293.4	65.25	49.76
North West	778.00	118.11	20.77	70.00
South East	112.98	522.45	276.16	46.77
South South	117.88	160.76	169.65	112.34
South West	31.76	185.18	186.74	126.35

Source: NBS **NLSS**, 2004

In terms of details, households in North Western Zone, on the average, expend ₦778 annually on fresh milk as against the households in the North Central, ₦308 and North East, ₦150. The South West Zone had households that spent the least on fresh milk, ₦31 as against ₦112 in the South East and ₦117 in the South- South. For powdered milk, the South East Zone led the pack with average household expenditure of ₦522 per annum, followed by ₦293 in the North Central, ₦185 in the South West, ₦160 in the South- South, ₦121 in North East and ₦118 in North West. The expenditure on tinned milk is less significant in the northern zones than in the south. While the consumption of tinned milk is close to

powdered milk in the south, except for the South East, the expenditure on powered milk over tinned milk is more significant in the northern zones. South East dominates the consumption of tinned milk as was the case with powdered milk. South West Zone leads others in the consumption of other dairy products like ice cream, butter, cheese and yogurt. The North East Zone consumes the least with average household expenditure standing at ₦17 as against ₦169 in the South West. The South- South Zone was next with ₦112, North West, ₦70, North Central, ₦50 and South East, ₦47.

On the national scale, some of revealing information washes out of the survey data. Extrapolating from the survey data to the national scale, the per capita annual expenditure on powdered milk was highest at ₦211, followed by fresh milk at ₦203 and tinned milk at ₦108. The collective per capita expenditure on dairy products like ice cream, butter, cheese and yogurt was smallest at ₦47. In terms of age, middle age household heads, that is, those in the thirties and forties, consume more fresh milk and dairy products like ice cream, butter, cheese and yogurt than the older household heads. On the other hand, older household heads consume more powdered and tinned milk than younger ones. Furthermore, household heads with primary or no education consume more fresh milk and dairy products like ice cream, butter, cheese and yogurt. The more educated household heads with secondary and tertiary education consume more powdered and tinned milk. The implication of the foregoing is that the dairy products market is a multi-million Naira market when judged by the relatively high per capita expenditure. This is a piece of information that will be of interest to private sector operators willing to invest in the market. The fact that households headed by younger persons tend to consume fresh milk, ice cream, butter and yogurt as against powdered and tinned milk by households headed by older persons means that dairy products producers and suppliers have excellent piece of information for their production and marketing plans. In addition, the pattern of consumption which varies between highly-educated household heads and less-educated household heads will also be an important piece of information for producers and suppliers. The market is well segmented and this can allow for the design of better marketing advocacy programmes. To add more credence to the descriptive analysis so far presented the result of the empirical analysis is hereby reported and discussed in what follows.

The results of the tobit regression model is presented in Table 5. The results shows that for all three dairy products, fresh milk, powered milk and tinned milk, many of the coefficients are of the expected signs and these are consistent with the results of the descriptive statistics. The consumption of the three types of dairy products are positively related to household income. And, as expected from the descriptive statistics, educational attainment and exposure to western culture of the household heads should be positively related to the consumption of dairy products. This relationship was established in the estimated Tobit model where attainment of education at the primary, secondary and tertiary levels was

positively related to the consumption of dairy products, particularly powdered and tinned milk. It is only in north east zone that consumption of fresh milk is not positively related to exposure to western education.

Table 5
Regression Results for Fresh, Powered and Tinned Milk from Tobit Models

Variable	Fresh Milk	Powered Milk	Tinned Milk
INC	0.162**	0.334**	0.281**
	(2.91)	(2.71)	(2.18)
HHSIZE	1.788*	2.08*	2.06*
	(1.88)	(1.98)	(2,02)
Age	-0.469*	-0.647**	-0.834**
	(-1.98)	(-2.12)	(-2.14)
CHILD	5.327*	4.44**	0.889*
	(1.93)	(2.01)	(1.89)
MIDDLE	3.441**	2.48**	3.24**
	(2.44)	(2.24)	(2.23)
SENIOR	4.562**	3.11**	2.78**
	(2.23)	(2.34)	(2.18)
NEDUC	2.28*	-1.87	-1.18
	(1.64)	(1.54)	(1.18)
PEDUC	1.11	2.18*	2.14*
	(1.08)	(2.11)	(2.08)
SEDUC	1.86	(2.31)**	2.31**
	(1.33)	(2.21)	(2.18)
TEDUC	1.16	2.88**	1.87**
	(1.51)	(1.98)	(2.12)
NE	-2.33**	--	--
	(2.08)	--	--
NC	-2.68**	-0.443	-0.668
	(-1.97)	(-0.93)	(-1.02)
SE	-0.044	-2.201**	-3.198**
	(-0.78)	(-2.19)	(-2.24)
SS	-0.113	-3.108**	-2.766**
	(-0.113)	(-2.06)	(-2.18)
SW	--	-4.142**	-3.688**
	--	(-2.31)	(-2.28)
CONSTANT	13.711	8.822	9.766
	(2.99)	(2.46)	(2.87)
LR	77.13	76.44	75.68
Mc Fadden R^2	0.68	0.71	0.74

Note: t- statistics are given in parenthesis, ** denotes significance at 5% level; ** denotes significance at 10% level; LR-test Statistics given a measure of the goodness of fit. Figures in parenthesis represent the t-statistics.

4. Conclusion

Drawing from the latest Nigerian Living Standards Survey data in Nigeria, this paper analysed demographic and cultural factors influencing dairy consumption in the country.

Using information about fresh, powdered and tinned milk as well a set of other products like ice cream, butter, cheese and yogurt, the data showed the influence of age, educational attainment and income of heads of households, as well as the structure of the age distribution within the household, household size and regional location on consumption. In an indirect way, the data also showed the influence of western culture through education on the consumption of dairy products. These variables were used as regressors in the estimated Tobit models of dairy consumption. The results were quite consistent with *a priori* expectations.

In addition to income being a significant driver of dairy consumption, western culture is now being observed as influencing the consumption of dairy products in view of the substantial expenditures on ice-cream, butter, cheese and yogurt. And this trend may continue with increasing number of fast-food outlets opening in most Nigerian urban centres. The fact that the coefficient for CHILD variable in this regression was significantly positive also show that the potential for increased consumption of dairy product in high.

When considering Nigeria's future dairy industry, it reasonable to conclude that demand is going to continue to grow. Policies that will promote production and marketing of both domestic and imported dairy products need to be strengthened to enhance supply. This is particularly true of the production of fresh milk which is in currently being undertaken by nomadic Fulani herdsmen using traditional manual technology which constraint supply. It is now time to promote a more sedentary form of cattle rearing and fresh milk diary production in Nigeria to meet the potential large market in the country. In the face of growing population, increasing number of educated Nigerians, increase personal income and influence of western culture, the country needs an efficient dairy industry that will produce sufficient quantity and high-quality and safe dairy products for the her people.

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