



ASSESSMENT OF ECONOMIC VIABILITY OF TAMARIND (*Tamarindus indica* Linn) FRUIT IN KWARE LOCALGOVERNMENT AREA OF SOKOTO STATE, NIGERIA

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Abstract The study examined the economic viability of *Tamarindus indica* in Kware local government area of Sokoto state. The use of interview schedule was adopted and questionnaires were administered. Twelve (12) villages were purposively selected from five (5) districts in the study area. Simple random sample was used to select ten (10) respondents from each village given a total sample size of 120 respondents. The primary data collected were analyzed using descriptive statistics (Tables, frequencies and percentages). The results of the study indicated that average age of the respondents were between 36-45 years with 47.5% and approximately 90.83% are men, majority were farmers (74.17%) while 12.5% are business men. 64.17% obtained Qur'anic education and the results also show that 77.5% of the respondents considered Tamarind fruit as a source of food. It serves as a source of income to the people while about 60.33% of the respondents sell tamarind fruit, 95% of the respondents source Tamarind in the market about 43.33% and received monthly income of ₦5000-10,000. The major problem faced by the respondents in the study area is lack of storage facilities and transportation among others. The study recommended that regeneration of *T. indica* through afforestation, reforestation, and social forestry should be emphasized in order to improve social and economic development.

Keywords: Assessment, *Economic viability*, *Fruit*, *Tamarindus indica*, *Wood*

INTRODUCTION

Global food security and economic growth depend on a declining number of plant species. This has placed the future supply of food and rural incomes at risk. Recently, there has been an increasing interest in underutilized species as they allow improvement in the livelihoods of the rural poor by generating income, supporting food security and improving nutrition (De Caluwe and Van Damme, 2011). Nigeria is characterized by high rates of rural poverty, low basic health services, problematic and unstable food security, and unsustainable use of natural resources. In addition, rural and urban people remain very dependent on the multiple goods and services supplied by indigenous trees and woody plants like *Tamarindus indica*.

Tamarindus indica is a leguminous tree that belongs to the family Fabaceae with Subfamily

Caesalpiniaceae (Steger et al., 2011). It is an economically important tree, found in many countries in Asia, Africa and South America. The tree can grow to a maximum height of 25 m and a crown diameter of 12 m. It is generally free of serious pests and diseases, and has a life span of 80-200 years and can yield 150-500 kg of pods per healthy tree/year at 20 years of age. Tamarind contains 30% pulp, 40% seed and 30% shell by weight (Rao et al., 2015).



A



B

Figure 1: (A) Tamarind shoot with hanging fruit pods and leaves (B) Fruit pulp ball (Chimsah *et al.*, 2020).

In West Africa tamarind (*Tamarindus indica* L.) form part and parcel of traditional farming systems or agroforestry parklands, and the species have been identified by local people as priority species to domesticate. Notwithstanding the great agronomic, ecological, nutritional, cultural and economic importance of tamarind products, very little information is available on the basic market functioning and structures, such as stakeholders involved, trade channels and/or patterns of value adding along the market chain (De Caluwe and Van Damme, 2011). Gatherers of tamarind products are categorized as smallholders. After harvesting, tamarind fruit pods are stripped from their shell and processed into fruit pulp. Tamarind fruits and leaves are harvested using traditional harvesting techniques, which only require manual labour and low-cost tools. Surveyed gatherers in Mali and Benin mentioned dangerous harvesting techniques, seasonality and limited availability of tamarind products, time-consuming processing practices, product quality and a lack of market information as their major problems. Traders of tamarind and other fruits products are mainly women. They fulfill different and varying functions, which points to a lack of functional specialization. Harvesting of tamarind and other fruits are highly seasonal. This is further reflected in the commercialization of tamarind products which is found to occur chiefly during the dry season. However, the uncontrolled destruction of some economic trees such as *T. indica* in the production of charcoal and firewood (Njenga, 2018) calls for an urgent arrest of the situation.

Tamarind products are observed to be less seasonal. However, no seasonal storage has been evidenced in most West African countries due to a lack of storage infrastructure, space and financial means. Most surveyed chain actors typically purchase a certain volume of produce, which is stored until it is sold, after which they replenish their stock. As a result, storage

duration is observed to be very variable. According to literatures tamarind products are mainly stored in recycled rice bags which are kept in the house or in a storehouse or granary.

Tamarind (*Tamarindus indica* L.), an indigenous underutilized tree fruit, has many valuable properties and almost every part of the tree is utilized by rural and urban dwellers (Gunasena and Hughes, 2000; Adeola and Aworh, 2010). In Nigeria, tamarind fruit is usually consumed fresh and the seed discarded. Tamarind pulp has a unique sour taste due to the natural occurrence of sugars and plant acids together. The rural dwellers utilize the pulp in beverage production, using ancient processing techniques (Chimsah *et al.*, 2020). The traditional processing methods are cumbersome, slow, non-hygienic and highly subjective, often resulting in non-uniform products whose acceptability is restricted to certain parts of the country. Tamarind is underutilized because inadequate research efforts are directed on it (Adeola and Aworh, 2010). Furthermore, low cost processing techniques are essential for increased exploitation of tamarind (Bhadoriya *et al.*, 2011).

With emphasis on exploring the tree's nutritional potential and uses with already established facts. This study examined the economic viability of *Tamarindus indica* in Kware local government area of Sokoto state with a view to identify different uses and marketing channels of the species.

MATERIALS AND METHODS

Description of the Study Area

This research was conducted at Kware Local Government Area, Sokoto State. Sokoto State lies in the Sudan Savannah vegetation of Nigeria at an altitude of 350meters above sea level (Singh, 2004). The climate is characterized by distinct wet and dry

seasons. Kware is located between latitudes $13^{\circ} 00''$ to $13^{\circ} 20' 0''$ N and longitudes $5^{\circ} 10' 0''$ to $5^{\circ} 30' 0''$ E with an area of 554 km² (Hayatu *et al.*, 2020). The climate of the area is characterized by a Tropical climate with an average rainfall of 565 mm per year and referred to as a local steppe climate. Temperatures are generally extreme, with average daily minimum of 16°C during cool months of December and January and in the hottest month of April to June an average maximum of 38°C and minimum of 24°C (NiMet, 2018).

The vegetation is largely that of the Sudan Savannah zone, which contains woodland on the fertile soils and scattered trees and shrubs on the less fertile ones. The dominant underlying geology of the study area is Cretaceous and Tertiary sediments (Sombroek and Zonneveld, 1971). Basically, soils of Kware local government fall under Kalambaina Formation (Hayatu *et al.*, 2020).

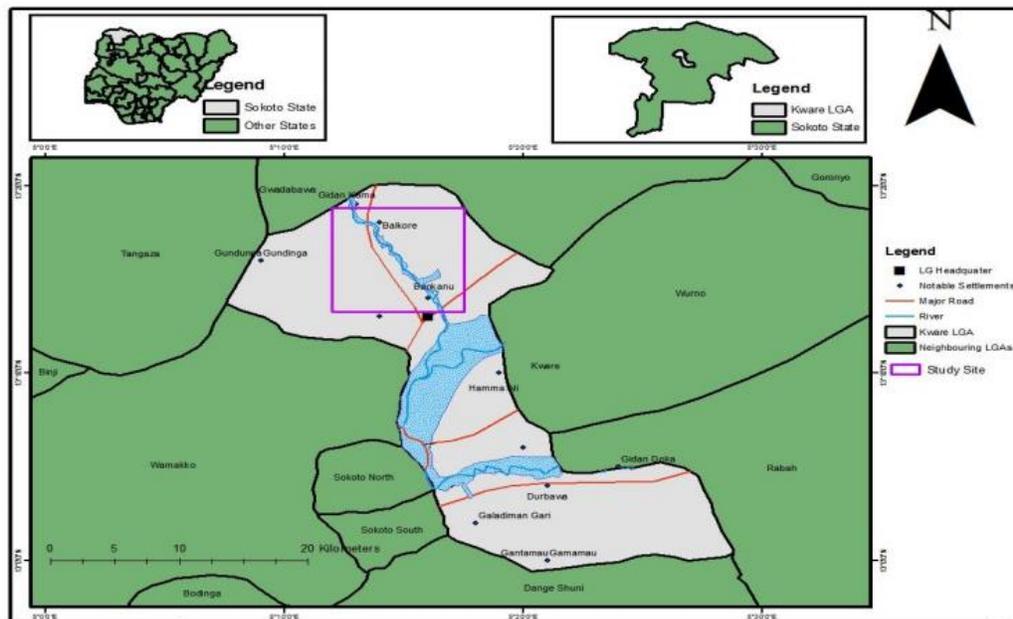


Figure 2: Administrative map showing Kware LGA, study site and neighboring LGAs (Hayatu *et al.*, 2020).

Sampling Procedure

Kware local government area has eleven (11) districts; Bankanu/Rijiyakade, Sabonbirni/Gidan karma, Tsake, Kware, Kabanga, GidanModibbo, Durbawa, Hamma'ali, Moreh, Zamau and GidanAkware. Purposive sampling was used to select four (4) districts; three (3) villages were purposively selected from each district based on the concentration and existence of processors and marketers of *T.indica*. Random selection was made of ten respondents in each village giving a total sample size of one hundred and twenty (120) respondents for the research.

Sources of Data Collection

Structured and open ended questionnaire were administered as an instrument for data collection. The data for this study was collected from two main sources primary and secondary sources, the primary data were collected from field survey by the questionnaires and direct interview to extract information from the respondents. In other to avoid

ambiguity and ensure the validity of the content and adequate balance of questions, Questionnaires were administered by direct contact, such as producers, processors and sellers of *T. indica*. The secondary data was obtained from textbooks, internet, journals, past projects and papers presented at seminars

Data Analysis

Data collected for this study were subjected to descriptive statistics by using tables, frequency distribution and percentages, using statistical package for social sciences. (SPSS version 20). Linear regression model was used to test the relationship between socio-economic characteristics of respondents and the marketing of tamarind fruits.

RESULTS AND DISCUSSIONS

Socio-economic Characteristic of Respondents

Results in figure 3, show gender of the tamarind vendors in the study area, they were predominantly male with the highest percentage of 90.83% while

9.17% was recorded for women. The result of this work is not in agreement with the work of De Caluwe and Van Damme (2011) who reported traders of tamarind products are mainly women. The reason is probably due to location and religion beliefs. The nature of the job, it is extremely physical and delicate

thereby, limiting the involvement of women (Riki *et al.*, 2021). The men fulfill different and varying functions to support their families. The mean willing price of tamarind also varied by gender according to Masette *et al.*, (2015).

Gender Percentage (%)

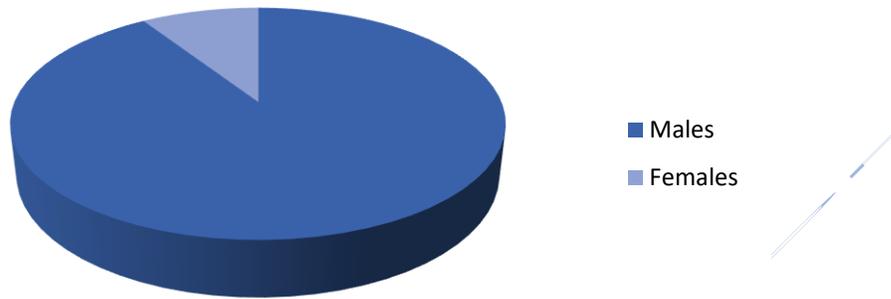


Figure 3: Gender Distribution of the Respondents

Figure 4 shows that age group between 36-45 years had the highest percent of 47.50 and the least was found between age group of 15-25 with 5.00%, meaning the youths are the ones who are actively involved in the business of tamarind in Sokoto State.

Riki *et al.*, (2021) had age percentage of 46.67% which is similar to 47.50% obtained in this study. The reason may be that youths are agile/active; Non-timber forest products business involves much energy, strength, and endurance.

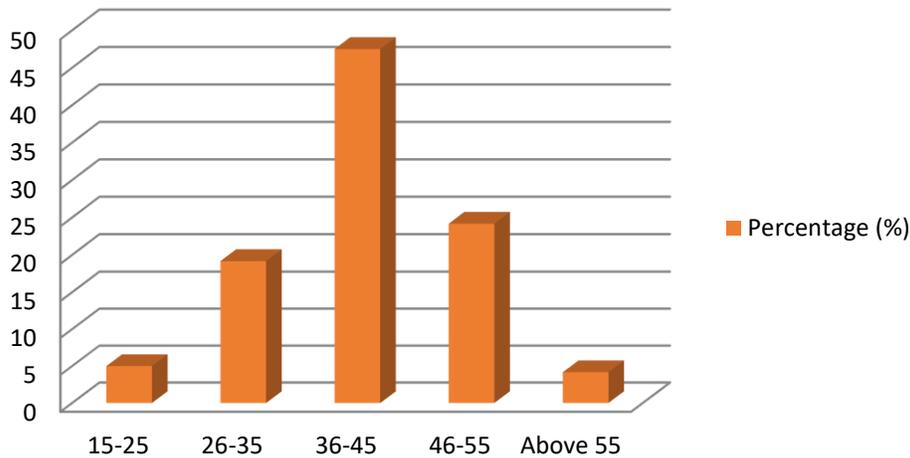


Figure 4: Age Distribution of the Respondents

Marital Status

Another important factor in socio-economic characteristic is marital status of the respondents. The results from figure 5 indicate that 87.5% of the respondents were married while 11.67% represents single and 0.83% represents widower while no value was recorded for divorce. The results show that married individuals have the highest percentages, this

may be because married people are assumed to be more committed to their responsibilities. According to Olarinda *et al.*, (2008) reported that one of the most important factor which determine the efficiency of any business is marital status of individual. It is because married people worked hard in order to meet up the demand of their family members and this will improve their social and economic status.

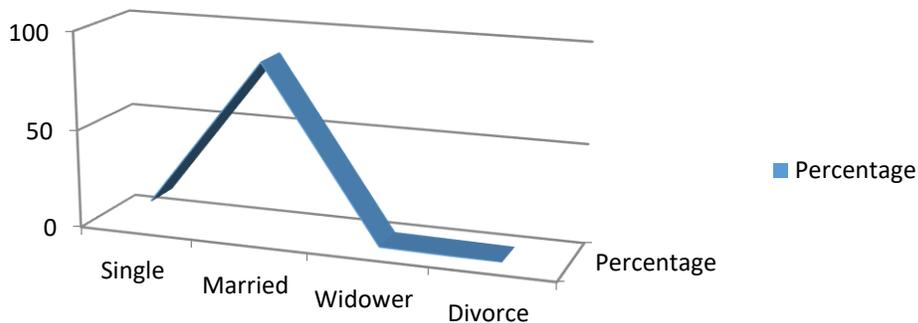


Figure 5: Marital Status of the Respondents

Level of Education of the Respondents

Respondent’s education level in figure 6 indicates that 64.17% of the respondents obtained Qur’anic education been the highest while 0.83% was recorded in Tertiary education been the least. This may be due to fact that majority of the respondents are Muslims and therefore attach greater importance to Qur’anic education and some couldn’t continue school due to financial challenges. Education plays a vital role in

understanding of tree species and marketing of *T. indica* fruits for food and medicinal purposes. Though the activities involved does not require that they acquire higher education, good educational level is important for skill and technology acquisition as well as capacity building which would reduce accident and enhance proper documentation towards profit making. Education has been known to be the gateway to better and efficient output and service delivery (Riki *et al.*, 2021).

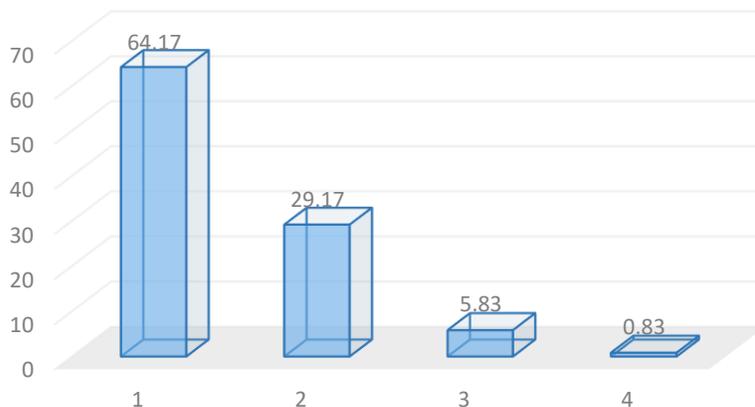


Figure 6: Distribution of the Respondents according to Educational Level

Occupation of Respondents

The results in figure 7 indicate that 74.17% of the respondents stated their occupation as farming/fishing which is the highest in terms of occupation while the

lowest was obtained in petty traders with 5.83%. Occupation simple means job, by which an individual earn a living. This agreed with the work of Abdullahi

(1999), which said majority of the occupation of the rural people was farming activities.

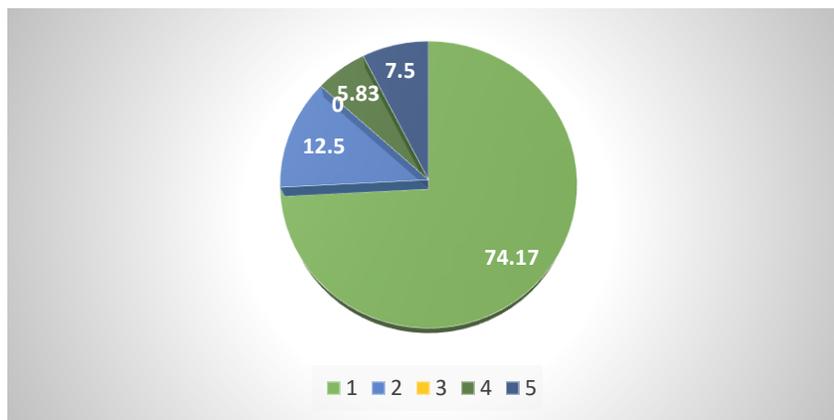


Figure 7: Distribution of the respondents according to their Occupation

Uses of *Tamarindus indica* to the Livelihood of the Respondents

The result in figure 8 reveals that 77.5% of the respondents considered Tamarind fruit as food for consumption while 22.5% considered it for medicinal purposes. Conventionally, tamarind pulp is used for preparing different food products and medicated products. Tamarind seed and shell occupies 70% of the pod weight. Tamarind pod shell can be used as fuel, absorbent for the removal of methylene blue and amaranth dyes from aqueous solutions. Tamarind seed

can be used after processing, i.e. after removing outer layer of the seed in food industries, textile industries, craft industries, furniture industries (Rao *et al.*, 2015). It is clear that several authors have reported the use of this fruit tree for both local and industrial purposes. It can also be a very important remedy in parts of the world where malnutrition is a prevalent problem. From its use in local food, drinks and medicinal purposes (Jimoh and Onabanjo, 2012; Chimsah *et al.*, 2020).

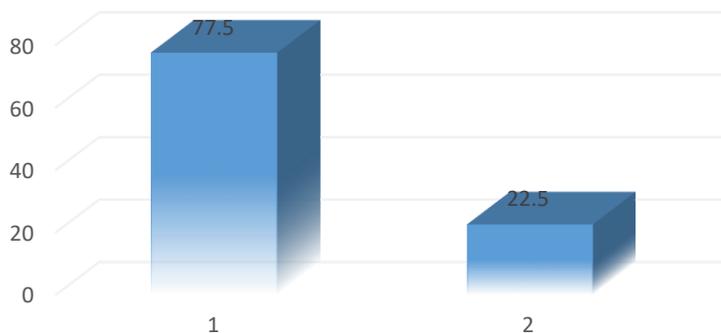


Figure 8: Uses of *T. indica* Fruits

Mostly utilized Plant Part

The results in Table 9 reveals that 45% of the respondents choose tamarind fruit as mostly utilized part, the mostly uses fruit as their sources of food while 1.67% was obtained in the plant roots as the least. This study agrees with the work of several

authors who have reported the uses of this fruit tree for both local and industrial purposes (Chimsah *et al.*, 2020). This spice condiment is also used as emulsifying agent in syrups, decoctions, etc., in different pharmaceutical products (Rao *et al.*, 2015). The species has a lot of medicinal purposes. The bark

is mainly sold and used for wound healing purposes and boiled to make tea for treatment of diarrhea (Chimsah *et al.*, 2020).

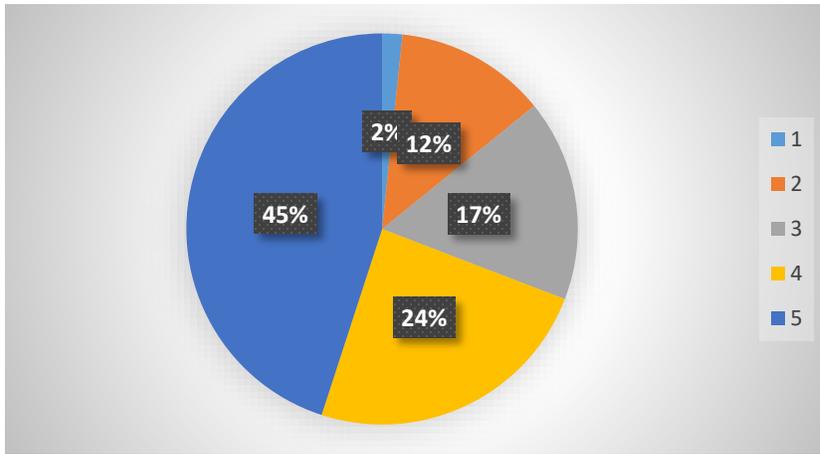


Figure 9: Distribution of Respondent according to the mostly Utilized part of Tamarind Tree

Contribution of *Tamarindus indica* to the Livelihood

Results in figure 10 reveal that that 65.83% of the respondents use *T. indica* as food for consumption while 29.17% of the respondents used it as sources of income and 5% for medicinal purposes. Almost every part of the tree is used in one way or the other from food including beverage drinks, jams, and curries, to

pharmaceutical, textile, timber, fodder, and as a fuel source. It is rich in vitamins, minerals and other proximate elements (Chimsah *et al.*, 2020). The Tamarind plant has undoubtedly great potential based on its benefits, and uses. In Uganda, the *T. indica* pulp is mixed into the local millet porridge or bread and eaten as a delicacy (Katande *et al.*, 1999).

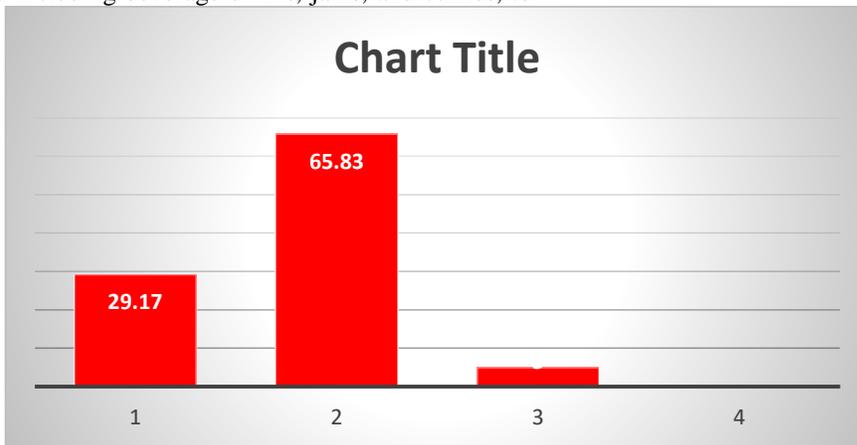


Figure 10: Distribution of the respondents according to the contribution of *Tamarindus indica* to the livelihood of the respondents

Business of respondents in Relation to *Tamarindus indica* Tree

This provides information on business of respondents in relation to tamarind tree which have been

categorized according to producing fruits, processing fruits and selling fruits. The results in figure 11 shows selling fruits had the highest with 60.83% and the least was obtained in producing fruits with 8.33%.

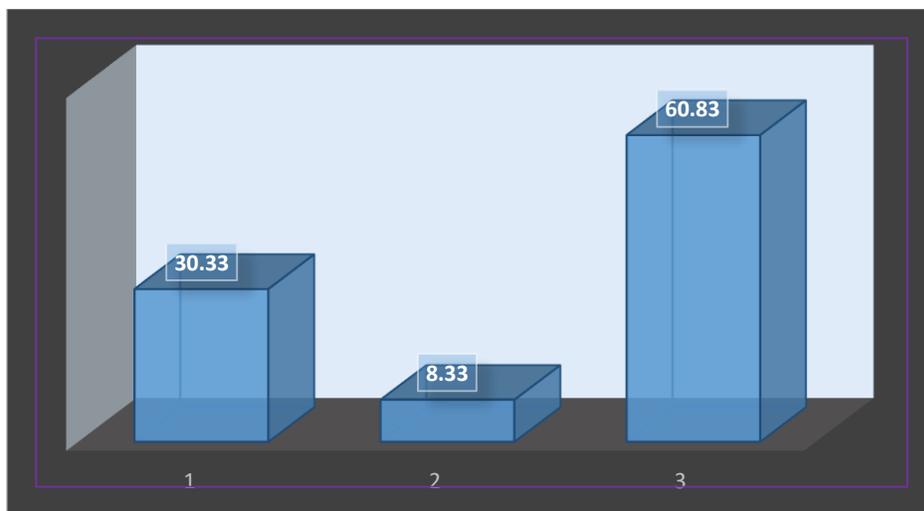


Figure 11: Distribution of respondents according to the Producing fruit, processing fruit, and selling fruits

Impacts of *Tamarindus indica* to the Environment.

Table 1 reveals the results of the impact of *T. indica* on the environment where 55.83% was obtained for shade and cover while the lowest was recorded in

control erosion with 10.00%. *T. indica* have profound influence on our environment by providing shade and covers, and wind break.

Table 1: Impact of *Tamarindus indica* in our Environment

Impact	Frequency	Percentage
Provide shade and cover	67	55.83
Forage for livestock	27	22.5
Control erosion	12	10.0
Wind break	14	11.67
Total	120	100

Source: (Field survey, 2016).

How and where to sell *Tamarindus indica* Products

Results in Table 2 reveal that 63.33% of the respondents sell their products (Tamarind fruits) fresh followed by 24.17% mixed (fresh and dry fruit) and the least was obtained dried with 9.19%. Similarly, 80% of the respondents sells Tamarind fruit in central

market been the highest while 2.50% was obtained in farm gate. This result agrees with the finding of El-saddiq (2006), who says Africa on the whole does not produce Tamarind on commercial scales though it is widely consumed by the local people.

Table 2: Distribution of Respondents on how to sell (Tamarinds fruit) products and where to sell them

How to sell	Frequency	Percentage (%)
Fresh	76	63.33
Dried	11	9.19
Mixed (Fresh and Dried)	29	24.17

Other	4	3.33
Total	120	100

Where to sell them Taramind

Farm gate	3	2.50
Local market	14	11.67
Central market	96	80
Others	7	5.83
Total	120	100

Source: (Field survey, 2016).

Monthly Income of *Tamarindus indica*

The result in Table 3 shows that 43.33% of the respondent's received an income between ₦5000-10,000 was the biggest followed by 37.17% obtained an income between ₦10,000-15,000 and the smallest was found in an income between ₦1000-500 with 5.83%. Income is the amount of money or equivalent

received during a period of time in exchange for labor or service from the sales of goods or property. However for household or individual, income is the sum of all wages salaries, profits, rents, or other form of earning, received in a given period of time (Maznaya, 2006).

Table 3: Distribution of Monthly Income of *Tamarindus indica*

Mostly income	Frequency	Percentage (%)
₦1000-500	7	5.83
₦5000-10000	52	43.33
₦10000-15,000	47	37.17
₦15,000-20,000	7	5.83
Total	120	100

Source: (Field survey, 2016).

Problems faced by the respondents in the marketing of Tamarinds fruits

Table 4, reveals that among the problems faced by responding in *T. indica* business, transportation had the highest with 33.33% followed by financial

problems (20.83%) and the least 12.51% was recorded in infestation. The result of this study has clearly shows that transportation has always been the major of most agricultural produce in Nigeria.

Table 4: Distribution of respondents according to the problems face by respondents

Problems	Frequency	Percentage
Lack of storage facility	24	20.00

Transportation	40	33.33
Lack of customers	16	13.33
Financial problems	25	20.83
Infestation	15	12.51
Total	120	100

Source: (Field survey, 2016).

Marketing Channels for *Tamarindus indica* Fruits

Marketing channel refers to the path through which a commodity passes from a point of production to the final consumers (Olukosi *et al.*, 2005). Marketing channels are important in evaluating the marketing

system because they indicate how the various participants in the marketing system are organized to accomplish the movement of products or commodities from the producer to the final consumer.

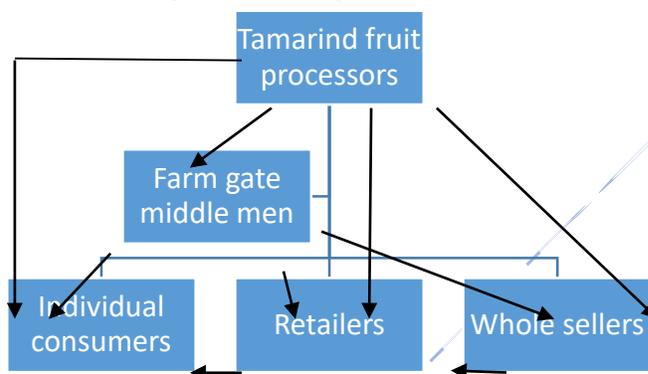


Figure 13: Marketing channel for Tamarind fruits

Figure 13 shows a typical marketing channel for *T. indica* fruits. The channel showed that, once the processors of tamarind fruits processed the product and it's ready for sale, individual consumers, farm gate middlemen, retailers, and wholesalers get to them to purchase this product. Farm gate middlemen also sell to individual consumers, retailers and wholesalers. Wholesalers sell the product to retailers and individual consumers.

Regression analysis between Socio-economic characteristics and the Marketing of *Tamarindus indica* fruits

Table 5 presents information on the regression analysis socio-economic characteristics among *T. indica* marketers. The results show that the coefficient of multiple determination (R^2) of 0.059 is very low. It also shows that age, sex, occupation and house held size with the regression coefficient of -0.129, -0.205, -0.110, -0.184 respectively are negative and are not significant.

Table 5: Regression analysis showing the relationship between Socio-economic characteristics and the Marketing of *Tamarindus indica* fruits

Variables	Coefficient	Std error	P>t	Remark
Age	-0.13	0.12	-1.05	NS
Sex	-0.26	0.33	-0.80	NS
Marital status	0.03	0.28	10.10	NS
House size	-0.18	0.19	-0.97	NS

Education	-0.18	0.19	0.97	NS
Occupation	-0.11	0.09	-1.12	NS
Constant	2.57	0.065	3.91	NS

CONCLUSION

The findings of this research reveals that *T. indica* contribute immensely to the socio-economic development of the people in Kware local government area of Sokoto State. Virtually every part of *T. indica* (wood, root, leaves, bark and fruit) has either nutritional or medicinal value and also serves as sources of income to many respondents which are an indicator of economic development. In spite of wide

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