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Competitiveness of Banana production in Blue Nile State, Sudan A Policy Analysis Matrix Approach

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Abstract:
The main objective of this paper is to assess the efficiency of Banana production in Blue Nile State in Sudan for the 2015. The study employed exclusively primary data and applied policy analysis matrix approach as an analytical model. The results highlighted the comparative advantage of Banana in Rosaries and Damazin localities and indicated that, although Banana is profitable and competitive in relative and absolute terms, it is not efficiently produced in the two localities. Internationally the study has shown the international value Added is competitive. The results delineated that government is not protecting Banana farmers. The study concluded that the PAM's measures indicators for Banana in Blue Nile State is much worse than the average measures for Sudan and recommended that the government should revise the adopted existing pricing policies and encourage the adoption of new technological techniques for Banana production in Blue Nile state in Sudan.

Keywords: Policy analysis matrix; Efficiency; Banana production; Comparative advantage.

JEL Classification Codes: B41; C52; D24.

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Introduction:

Bananas are the 4th largest fruit crop of the world, following the grape, citrus fruits and apple. Global production of Bananas grew at a compound annual rate of 3.2 percent, reaching a record of 114 million tones in 2015, up from around 67 million tones in 2000(FAO, 2015). Bananas are predominantly produced in Asia, Latin America and Africa. The biggest producers are India, which produced 29 million tones per year on average between 2010 and 2015, and China at 11 million tones. Production in both countries mostly serves the domestic markets. Other large producers are the Philippines with an annual average of 7.5 million tones between 2010 and 2015, and Ecuador and Brazil both with an average of 7 million tones. The Dwarf Cavendish cultivar,with small fingers is locally grown in the Sudan, and does not compete in international markets (Elkashif. M.E., 2005). Although there is a great potentiality in the Sudan to become one of the leading countries in Banana production and export, But,historically, Sudan was somewhat absent from the World Banana market. However, following a series of economic reforms undertaken by policy makers in the early 1990s, Sudan started to re-emerge as a major player in the world Banana market. This paper employed policy analysis matrix to assess the competitiveness of Banana production produced under a web of policies. Such policies include non-price supports, removal of input and credit subsidies, and impose of various forms of taxes and duties. The results of these policies increased total costs of production and poor competitiveness of the crops in the export markets, where most of the competing crops are not taxed or are subject to little taxation (Elnagarabi E. M., 2009).

- **Problem and Research Question**

The horticultural exports contribution on Sudan's economy is very weak contribute only 0.6% to the total agricultural exports during (1993–2009). There is huge potentiality and opportunities for Banana production and export for the Sudan due to the huge endowments of resources and vicinity to promising foreign markets. Research studies in the field of Banana production efficiency and competitiveness are scant in the Sudan. Few studies had been undertaken by Elnagarabi and others showed the competitiveness and comparative advantage of horticultural exports in Sudan and Gezira State which showed the competitiveness and comparative advantage of Banana in the Sudan. This study was conducted for one of the biggest major Banana producing areas in the Sudan. It aims at assessing the impact of government policies within regions, crops and seasons. Accordingly, The central question of this study is:

Do the government's adopted policies encourage Banana production in Blue Nile State, how and to what extent this policies affects the efficiency of that production?

- **Objectives of the Paper**

The main objective of this paper is to assess the impact of government policy on Banana production in Blue Nile State season 2015 and comparing PAM coefficients results for Banana for Blue Nile State with those obtained by the author for Sudan.

1- Banana production and marketing

1-1- Banana production: Banana produced commercially in small and medium scattered orchards in the Sudan in slightly soils, especially banks of rivers and their branches. The major Banana producing areas are the Gash Delta in Kassala State, along the Blue Nile and in the River Nile State ،There are a lot of factors favor Banana production in Sudan due to availability of fertile soil, suitable climate, experienced farmers, and adequate technologies. The average cultivated areas of Banana in Sudan during (1989–2009) was 43200 feddans (18000) ha. produced 518000 tones(MAF, 2014-2005). As presented in Table 1 the average cultivated area was 57.4 (000) fed, an average yield was 11.4(000) ton. per fed. and output of 660.4 (000) ton. per year on average during 2005 and 2014 was 660.4 ton.

Table n°1: The development of areas yields and outputs of Banana (2005-2014) in Sudan.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
Area(1000)feddans	42.8	43	45	47.4	52	57	62.5	685	75	81	57.4
Yield(1000) tones.	12	12	5.6	12	12	12	12	12	12	12.9	11.4
Output(1000)tones.	512	516	264	562	624	684	750	822	800	980	660.4

Source: Ministry of Agriculture and Animal Wealth and Forestry, Blue Nile State (2010-2015)

Banana ranks on the top of crops grown in the Blue Nile State in terms of area coverage, which constitutes about 80% of the total horticultural crops cultivated areas. The crop posses a considerable economic potential, because it has quick returns on investment, and is suitable for mass production. It is the major source of income for many families and has considerable revenue as taxes and duties for the local government administration unites. It contributes significantly to Sudan export of fruits. As figures in Table 2 illustrates that the Banana cultivated area represents about 85% to 95,%of the total areas of fruit crops and vegetables in the Blue Nile State. The total cultivated area of Banana in Blue Nile State was 15220 feddans produced 135305 tones during (2010-2015), It is estimated that more than one third of the residents on the Blue Nile River banks are engaged in Banana cultivation.

1-2- Banana marketing: Banana requires special tools of packing, transportation, storage and handling. Banana Marketing research had been given little attention in the Sudan,and marketing efficiency is very poor, Production losses, due to inappropriate post-harvest technologies make make investment **in this field more restrictions associated with risk and** uncertainty. Moreover, lack of recorded market prices data , many difficulties arises in monitoring current conditions and establishing marketing research system to assist in guiding and developing a suitable research on the impact the adopted agricultural policies regarding Banana production and marketing.

Table n°2: The total cultivated, productive areas and production of Banana in Blue Nile State (2010-2015).

Seasons	2010	2011	2012	2013	2014	2015	**Average**
horticultural cultivated areas	15000	15250	15410	17116	18325	19130	**16713**
Banana Cultivated areas	14300	14500	14520	15825	16220	16955	**15220**
Banana Production (tones)	13450	13530	13905	14830	15415	16125	**14542**

Source: Ministry of Agriculture and Animal Wealth and Forestry, Blue Nile State (2010-2015)

Sudan has imposed a restrictive tariff schedule, which determined the Sudan's capacity of competitiveness by creating bias against it's exports, raising the cost of tradable inputs for Banana production. Therefore, its more profitable for producers to sell the crop in the local market rather than the international markets. The performance of Banana marketing faces many problems, Most of the producing areas, including Blue Nile, are located in remote areas far away from the consuming centers and the Sudan's main exporting port which rising transportation costs. The key institutions involved in Banana marketing chains in the Sudan are public sector agencies, organized and informal private sectors, civil societies and nongovernmental organizations as well as developmental partners. Marketing margins for Banana in Sudan are extremely very high due to the lack of an adequate market price information system which is8 regarded as a pre-request for efficiency, and equity of the marketing system. Banana marketing charactarizing by perishable foodstuffs, which makes it's distribution very difficult to organize. Being a fruit that is generally eaten fresh, marketing of Banana should be immediate(Ferris, 2003). In Sudan marketing of Banana currently faces several constraints along the marketing chain. These include insufficient handling of the produce from production to consumption sites and poor product conformity. Poor marketing infrastructure such as paved roads, cool storages and cool transport vehicles in Banana production zones, particularly in Blue Nile region lead to reduce the volume traded. Transport is a major constraint to the Banana marketing . It accounts for the largest item of the marketing margins. It also makes traders incur more costs in a bid to reduce on the unit cost through over and poor loading. Besides, lack of credit to traders creates a constraint to increased marketing potentiality. Although Banana is a crop with permanent production, harvesting periods and supplies are influenced by external factors such as mango production, this situation leads to competition and contributes to upward and downward price trends in relation to supply and demand volumes. Due to the non-durability of the product, quick and efficient marketing of Banana is imperative if the commodity is to reach the consumer in a fresh form. Losses especially for highly perishable Bananas emerge when marketing systems are slow and inefficient. High losses due to spoilage in transit occur especially with poor roads and the over loading of vehicles. High per cent losses during transportation and storage are also a constraint for the wholesalers. Quality and size of Banana fruit are not

competing in the international markets. There are some Monopoly features on wholesale trader's side. In-country Banana traders complained of high taxation rates levied by local councils. Cross roads traders mentioned high local taxes as major factors discouraging trade. These levies are no longer decrease marketing margins. Traders see a lack of capital preventing expansion of trade.

1-3- Agricultural price policy: Agricultural price policy is a major instrument of government intervention in the operation of agricultural markets in the countries at widely different stages of economic development, in both market-oriented and socialist economies. Agricultural price analysis can help policy makers to evaluate the intended and unintended consequences of specific price changes on agricultural markets. Policies aim to three basic objectives, efficiency, equity and security. Efficiency achieved when the allocation of scarce resources in an economy produces the maximum amount of income and the allocation of goods and services brings highest consumer satisfaction. Equity refers to the distribution of income among groups or regions that are targeted by the policy makers.greater equity is achieved by more even distribution of income, however, the policy refers to the government action. Security is furthered when political and economic stability. The scope for agricultural policies is defined by three basic constrains supply, demand and world prices. National production is limited by the availability of resources (land, labors, and capital), technologies, relative input prices and management capabilities. These parameters are the component of production functions and thus limit the ability of the economy to produce agricultural commodities (Pearson S. R., 2003). The most efficient outcome could be achieved, in principle, if the government were able to enact efficient policies that offset market failure and if the government were decide to override non-efficient objectives and remove distorting policies. Policy-makers are interested in understanding competitiveness and efficiency at farm gate, since they are concerned with farmer's welfare, but comparable world prices are needed to assess efficiency, comparable world prices or processed objectives are available only at the nearby wholesale market. Hence policy analysis matrix (PAM) need to define their studies of commodity system to include four activities, farm production, farm-to-processor transportation, processing, and processor-to-wholesale-market transportation (Tsakok, 1990).

2- Materials and Methods:

2-1- The study area: The study is carried out in the Blue Nile State. It is one of the eighteen states of the Republic of the Sudan. As map 1 shows it is located at the south eastern part of Sudan. The state lies between latitudes 9° 30 to 21° 30´N and longitudes 33° 5´ to 35° 3 E, it is located 650 kilometer South the capital Khartoum. The total area of the state is 38,500 square km, sharing borders with Ethiopia from the East and the Republic of South Sudan from the south, Sinnar State from the North and South West and South East. The annual rainfall ranges between 450–900 mm. The average temperature is between17° C - 32° C. The rainy season starts in April and ends in November.

According tot he estimated population of the Blue Nile State in 2015 was 832,112(SCBS, 2015).The state of Blue Nile is home to the Roseires Dam, the main source of hydroelectric power in Sudan before the completion of the Merowe Dam in 2010.The state is sub-divided into six districts according to hereafter, Damazin (212,712)، AlKormok (110,815), Roseires (215,857), Tadamon(77,668) Bau or Baw (127,251), Qeissan (87,809)(Census , 2006). This study was conducted in two localities of Blue Nile State, namely, Rosaries locality which lies at the eastern bank of Blue Nile River and Damazin locality which lies at the western bank of Blue Nile River. In Rosaries locality urban population accounts only for about 27% of the total population, while rural population represents about 73%. In respect to Damazin locality urban population are the majority represents about 64%, while rural population accounts for about 36%, The majority of population in both localities are farmers Banana is number one in terms of area coverage and economic potential in Blue Nile State, because. Banana is grown easily, has quick return on investment, and is suitable for mass production. Banana is the major source of income for one third residents on the Blue Nile. It is also contributing significantly to Sudan export of fruits.

Figure n°1:location of Blue Nile State

Source: Ministry of Agriculture. Blue Nille State

2-2- Data and Modeling Assumptions: Data required for construction of PAM include detailed production costs, yields, production inputs, marketing costs, inputs and outputs market prices, and farm gate prices. Additional data such as transportation costs, production subsidies, import and export tariffs, and exchange rates and conversion factor are required to calculate social prices. This study employed both primary and secondary data. PAM was compiled for Banana based on quantitative data،.The main source of primary data was a field comprehensive survey to verify Banana cost of production in details . The survey adopted a three-stage stratified random sampling technique used to investigate 52 farmers out of 260 selected according to and distributed over the main

villages in the study areas (Chaudhry, 1997).The questionnaire was developed to collect quantitative and qualitative data. Secondary data were collected from farm records, government units records, reports of federal and Regional Ministries of Agriculture , the Custom Authority, in addition to the yearly statistical books and reports of the Bank of Sudan and the Ministry of Finance and Economic planning. Outputs, inputs, and world prices are used as the reference prices in the study.

2-3- Policy Analysis Matrix: PAM is a computational framework, developed by (Pearson S. a., 1989) and augmented by (Masters, 1995), for calculation of input efficiency, comparative advantage, and the degree of government interventions. PAM is a set of profit and loss identities in fam business(Nelson, 1991), The basic structure of PAM as shown in Table 3 is a matrix of two-way accounting identities .The data in the first row provide a measure of private profitability (N),defined as the difference between observed revenue (A) and costs (B+C). Private profitability reflects the competitiveness of the commodity system, Under the current technologies, prices for inputs and outputs, reflecting actual market prices received or paid by farmers, merchants, or processors in the agricultural system (Pearson S. a., 1989). Revenue (A) and non-tradable inputs (C) are priced by the actual market prices paid, while tradable inputs (B) are converted into local currency using the weighted average official exchange rate. The private profitability, from producer's point of view, is the farm gate price less the production costs, while the private profitability, from the government's point of view is the border value of the product minus production and marketing costs, all taxes and subsidies are excluded in computing public profitability, as they are merely transfer payments. The second row of the matrix calculates the social profit O = D - (E+F) which reflects social opportunity costs. Social profits measure efficiency and comparative advantage. A positive value of social profit indicates the efficient use of scarce resources and a static comparative advantage in producing that commodity at the margin. Similarly,a negative value of social profit indicates wasting of resources that could have been utilized more efficiently in another sectors,and costs of domestically produced commodities exceeds costs of imported commodities,so that the sector cannot continue producing that commodity without government subsidies at the margin.

Table n°3:: Policy Analysis Matrix Structure

	Value of Input			
	Value of Output	**Tradable**	**Domestic Factor**	**Profit**
Private prices	A	B	C	N
Social prices	D	E	F	O

Source: Pearson, S.R. and Monke, E.A 1989. The policy analysis matrix for agricultural development. Journal Development Southern Africa. Cornell University Press,. pp 133-140.

The third row of the matrix estimates the difference between private and social values of revenues, costs, and profits that can be explained by policy interventions. PAM

can be used to calculate some useful indicators for policy analysis such as nominal protection coefficient to output (NPCO) and nominal protection coefficient to input (NPCI) , effective protection coefficient (EPC), and domestic resource cost(DRC). Domestic price used could be either the procurement price or the farm gate price, while the world reference price is the international price adjusted for transportation, marketing, and processing costs.

2-4- Effect of Divergences (Policy Effects): The difference between the observed private (actual market) price and the estimated social price (efficiency) price explains the effects of the policy or existence of market failures. Distorting policies leads to an inefficient use of resources that enhance the divergence .The efficient policies offsetting the effects of market failures generate greater income. Divergence can be corrected by reducing difference between private and social value, PAM format is flexible and can be divided further to more conventional measures of comparative advantage and indicators of policy effects, which are independent of measurement units and scale of operation, for more comparisons among different commodities , which can be illustrated by the expansion of the PAM to include six rows as shown Table 4 below.

Table n°4: Expanded PAM

Item	Revenue	Cost		Profits
		Tradable	**Domestic Facto**	
Private Price	A	B	C	D
Social price	E	F	G	H
Diverge and efficient policy	I	J	K	L
Effect of market failure	M	N	O	P
Effect of distorting policy	Q	R	S	T
Effect of efficient policy	U	V	W	X

Source: Pearson, S.R. and Monke, E.A 1989. The policy analysis matrix for agricultural development. Journal Development Southern Africa. Cornell University Press,. pp 133-140**.**

2-5- Social prices of non-tradable: The private prices for non-tradable (such as land, labor and capital) obtain from the private budget at the farm-gate level. Social prices of non-tradable outputs are estimated by correcting their private prices for divergences (distorting policies and market failures). Sometimes it is very difficult to estimate the social prices for non-tradable commodities. The first step is to adjust d the private prices of non-tradable outputs for identifiable divergences. Researchers adjust the observed private prices (A and B) for the effects of divergences (I and J) and then s, are nearly impossible to measure. If the effects of divergences cannot be estimated, the next step is search for the prices of a close substitute commodity to use as a proxy for the social prices of the non-tradable commodity. If researcher fails, the last step is to seek the price of the same commodity. The most common non-tradable goods and services include electricity, transportation, construction, labor and land. The most difficult tasks for construction a PAM are the estimation of social prices for outputs and inputs and decomposing inputs into their tradable and non-tradable components (Yao, 1997).

2-6- Estimation of the shadow exchange rate factor and standard conversion factor:
The shadow exchange rate (SER) is the economic price of foreign currency. In free floating exchange shadow exchange rate (SER) does not equal to the market exchange rate. That would be the case only if there is no taxes and subsidies on the demand and supply of tradable goods, if all commodities and factors were priced at their economic value and if the current account was sustainable. In all cases, the (SER) will diverge from the market or official exchange rate (OER). Exchange rates are one of the key macro-prices affecting project performance. If the (OER) is taken as the (SER), a hind the (OER) is overvalued, then projects producing non-tradable with tradable inputs are favored relative to projects producing tradable with non-tradable inputs. On the other hand, if the (OER) is undervalued, projects producing tradable with non-tradable inputs are favored relative to projects producing non-tradable with tradable inputs. If OER is depreciated to attain external competitiveness, or the OER is appreciated to attain internal competitiveness, project performance suffers. In general, the greater the divergence between the OER and the SER, the more likely will depreciation or appreciation occurs and affects project performance. Market prices are adjusted to economic prices. Shadow prices are introduced to reflect the true economic cost of project inputs and output to the society in order to give emphasis to those projects which contribute to governments efforts to achieve national development objectives. Shadow prices of goods or services also known as National Economic Parameters, is a measure of the real worth to the economy of a specific project. This method of shadow pricing is tedious and time consuming and consequently rarely followed. Instead, non-traded goods are generally valued at economic prices by the use of conversion factor. A conversion factor is a short-cut method for converting prices of non-tradable goods and services into border prices. At the aggregated level a single conversion factor is used. The standard conversion factor (SCF) is derived by taking the ratio of all exports and imports at the international market prices to their value at domestic prices. Shadow prices of non-traded items are then obtained by multiplying the (SCF) the market prices. This reduces market prices to their real economic value. The formula for the SCF is:

$$\mathbf{SCF} = \frac{\mathbf{M} + \mathbf{X}}{(\mathbf{M} + \mathbf{D}) + (\mathbf{X} - \mathbf{1})}$$

Where,

M: Value of imports at the international market prices; X: Total import duties;
D: Value of exports at the international market prices; T: Total export taxes.
SCF: the standard conversion

This formula of conversion is the weakest link in the logical chain of establishing shadow prices. Many applied research estimates non-traded goods and services shadow prices approximately. Standard conversion factor (SCF) can be defined as the ratio of the economic price value of all goods in an economy at their border price equivalent values to their domestic market price value. It represents the extent to which border price

equivalent values, in general, are lower than domestic market price values. The SCF will generally be less than one. For economic analysis using the world price numeracy, it is applied to all project's items valued at their domestic market price values to convert them to a border price equivalent value. While items valued at their border price equivalent value are left unadjusted. The conversion factor used in this paper was 0.8 (Sudan, 2015).

3- Results and discussions

Costs involved in Banana production for all average farms in the two localities are illustrated in the budget table 5 Labor wages and management constitutes the highest percentage of Banana production total costs in the two localities, followed by Land preparation, weeding and mast cutting and transportation. Fertilizer and seedling constitute relatively lower percentage of Banana production costs.

Table n°5:Total costs of banana production in the two Localities season 2015 in SDG per feddan

	Item	Rosaries locality	%	Damazin locality	%
1	Seedlings (Plantation)	89.50	3.50	112.60	4.33
2	Land Preparation	390.28	16.90	403.49	15.52
3	Ploughing leveling	170.54	6.60	133.50	5.14
4	Transportation	261.03	10.06	250.75	9.65
5	Irrigation	207.09	7.98	175.05	6.73
6	Weeding & mast cutting	325.58	12.61	254.25	9.78
7	Fertilizer	13.07	0.50	16.33	0.63
8	Labor wages &Management	507.20	19.63	621.73	23.92
9	Land Rent & buildings	92.30	3.57	102.58	3.94
10	Water pipes & Tools	236..33	9.14	221.98	8.54
11	Machines & pumps	170.50	6.56	180.90	6.96
12	Spare parts	120.21	4.65	125.07	4.81
13	Total costs	2592.63	100	2598.48	100
Total Revenue		3600.00	100	3240.00	100

Source: Field Survey, 2015.

Ploughing and leveling operations are carried out by tractors in the study areas rented from other farmers, human labors were used for other minor work. All respondents in Rosaries and Damazine localities reported that water is free of charge, all the farm holders confirmed that the source of water is the river, directly or indirectly from water basin wells dug on the river bank. The only cost incurred on irrigation was labor cost and fuel consumption of generator pump. As presented in Table 5 the per feddan costs of irrigation for average farm are estimated at 7.98% and 7.87% of the total costs per acre in Rosaries and Damazine localities, respectively. Herbicides and Pesticides per feddan costs for average farm in both localities amounted to 3.6% of the total cost per feddan. The estimated productivity was 4.0 tons per acre in Rosaries, and 3.6 tones per feddan in Damazin season 2015. The estimated Farm-Gate prices was 900 SDG per ton in 2015.

Average farm budget for Banana allocated into Tradable and Non- Tradable Inputs is presented in Table 6.

Table n°6:Average farm Budget for Banana allocated into Tradable and Non-Tradable Inputs, Damazin & Rosaries localities in SDG / Feddan

Localities	Rosaries locality			Damazine locality		
Item & Operations	Total costs in SDG per feddan	Tradable cost Ratio	Non- tradable cost Ratio	Total cost	Tradable cost Ratio	Non-tradable cost Ratio
Seedlings	98.50	100%	000	112.60	100%	000
Land preparation	390.28	000	100%	403.49	000	100%
Transportation	261.03	10.61	89.39	250.75	10.61	89.39
Ploughing & Leveling	170.54	25%b	75%	133.5	25%	75%
Irrigation	207.09	40%	60%	175.05	40%	60%
Weeding & Mats cut.	325.58	000	100%	254.25	000	100%
Fertilizer	13.07	90%	10%	16.33	90%	10%
Labor Wages	507.20	000	100%	621.73	000	100%
Land rent	92.30	000	100%	102.58	000	100%
Water pipes & tools	236.33	95%	5%	221.98	95%	5%
Machines & pumps	170.50	97%	3%	180.90	97%	3%
Spare parts	120.21	100%	000	125.07	100%	000
Total cost	2592.63	764.97	1827.16	2598.48	774.12	1824.3
Total income	3600.0			3240.0		

Source: Field Survey, 2015.

Policy Analysis Matrix Results: The PAM results point out the competitiveness and efficiency of Banana production in the two localities, Rosaries and Damazin in Blue Nile States. The Interpretations of the results are shown below in terms of absolute measures, measures of incentives, the overall production incentives and measures of relative competitiveness.

3-1- Absolute measures

- **Private and social profitability:** As shown in Tables 7 and 8 the values of private profitability are positive indicating profit earning which could lead to future increases of investment in Banana production. Social profitability are also of positive values, indicating that scarce resources are efficiently used and there is static comparative advantage in producing Banana at the margin, and expansion of Banana production will lead to an increase in national income. Revenues at private prices is less than revenues at social prices. This reflects that Banana does not received price subsidies in both Rosaries and Damazin localities, and the producers receive less prices than the international prices. The private tradable inputs costs are less than the social tradable input costs in both localities, implies that the government subsidized tradable inputs, imports lees tradable inputs than the private sector, and Banana producers pay less prices for tradable inputs than the world prices. Private costs for domestic resources are greater than the social costs indicates that the government does not subsidies domestic resources.

Table n°7: Private and social profits for Banana for Damazine Season 2015

	Value of Output	Tradable	Domestic Factor	Profit
Private prices	3255.24	599.767	1773.834	881.639
Social prices	3385.74	609.312	1396.877	1379.551
Policy transfer	-130.5	-9.545	376.956	-497.912

Source: PAM calculation from field survey (2015)

Table n°8: Private and social profits for Banana for Rosaries season 2015

	Value of Output	Tradable	Domestic Factor	Profit
Private prices	2929.716	619.128	2099.047	211.541
Social prices	3047.171	628.974	1643.25	774. 947
Policy transfer	-117.455	-9.846	456.022	-563.406

Source: PAM calculation from field survey (2015)

The private profitability is less than social profitability, implies that the adopted price policy encourages and favors the use of resources in Banana production with productive efficiency in Blue Nile state under the prevailing technologies, and there is no motivation for introducing a new technologies. The negative values of the net transfers implies that the net impact of the adopted policy is not favor Banana productive system in Blue Nile state in the short run.

- **International Value Added:** Absolute competitiveness is measured by the international value added per fadden reflects the foreign exchange saving. An absolute competitiveness is calculated as crop revenue minus the imported tradable inputs (A-B), expressed in foreign currency. A crop with positive (IVA) indicates positive foreign exchange earnings or saving. It neglects the domestic factors. Results presented in Tables 6, 7and 8 show that Banana is competitive since IVA values are positive with regard to the absolute competitiveness at the national level. This means that it is sufficient to compensate for the continuous increases in domestic use. It is obvious that Banana at the national and international level is competitive during the study period. Based on the above results trade liberalization in the Sudan will have serious implications on agriculture.

Table n°9: Relative measures indicators for Banana for Blue Mile State Damazine & Rosaries Localities season 2015

Indicators	NPCI	NPCO	EPC	DRC	CIC	PCR	IVA
Damazine	0.99	0.54	0.95	0.88	1.62	0.90	0.95
Rosaries	0.98	0.45	0.90	0.62	1.72	0.70	0.77

Source: PAM calculation from field survey (2015)

3-2- Measures of incentives

- **Input price incentives:** Input price incentives are measured by the nominal protection coefficient on inputs (NPI). It is calculated by dividing the value of tradable inputs at private prices B by the value of tradable inputs at social price F. Alow value of (NPI) implies a positive protection to farmers through government subsidy , A high ratio implies that inputs are taxed by the government The details of PAM results shown in Table 8

implies that NPCI for Banana are 0.99 and 0.98 indicate that the adopted price policy encouraged Banana production through subsidization of tradable inputs used during the period under analysis. Suggest that the government policies are reducing tradable input costs for Banana production. Elnagarabi found that the average NPI for Banana for Sudan (2003-‹2009) was 0.71and (2009-2014) was 0.19 indicating that Banana producers in Blue Nile State gains less price incentives than the other producing States .

- **Output price incentives (Nominal Protection Coefficient on Output (NPCO):** NPC is used to measure the output price incentives provided by the adopted policy. this ratio is estimated by dividing the revenue at private prices (A) by revenue at social prices (E). It measures the extent of policy intervention on output market. If this ratio is less than one, it shows the presence of taxes on outputs, if the NPC is greater than one it indicates the presence of subsidies. When the NPC is equal to or close to one in the absence of market failure it reveals the absence of government intervention in the output market.

As figures in Table 9 show the NPCO values are 0.54 and 0.45 for Damazin and Rosaries localities, respectively, the private prices in the two localities have remained less than their corresponding international reference prices, suggesting that domestic price is highly below the international price, and much lower than one .that implies a government pricing policy is not protecting Banana farmers in both localities. as they receive only 54% and 45% of the world prices and the existence of 46% and 55% implicit taxes Elnagarabi found that the average NPCO for Banana for Sudan (2003-‹2009) was 0.50 and (2009-2014)was 1.36, indicating that Banana produces in Blue Nile State less much output prices incentives than the other producing State's producers.

3-3- The overall production incentives (Effective Protection Coefficient (EPC): EPC is a more reliable indicator of the effective incentives than the NPC, as the former recognizes that the full impact of a set of policies includes both output and input prices, enhancing effects import tariffs‹ cost reducing effects and input subsidies. The EPC nets out the impact of protection on inputs and outputs and reveals the degree of protection accorded to the value-added process in the production activity of the relevant commodity. In calculating the (NPC), no account is taken of the subsidies or levies on inputs. To correct for this defect allowance for distortions on both input and output prices is made by calculating the (EPC). The (EPC) measures the protection according to the value added rather than final product. It is calculated as the ratio of the value added measured at market prices (A-B) to the value added measured at social prices (E-F). If EPC >1this indicates that the protective policy provides positive incentives to producers. An EPC <1 implies net disincentives and taxation's in the system‹The EPC value given in both localities Rosaries and Damazin are 0.90 and 0.95 are less than unity. The results show that, the government is giving too little incentives to the farmers to grow Banana, and still it is a big challenge for the government to increase price protection and positive incentives in inputs, output and marketing to the domestic producers of Banana. The EPC values in Table 9 show that farmers face a net tax of around 10 and 5 percent on their value added.

Elnagarabi (2015) found that the average EPC for Banana for Sudan during the period (2003- 2009) was 0.87, increased to 1.49 during (2009-2014) indicating that banana production in Blue Nile State faces much taxes than in other producing States in Sudan. The overall production incentives are improving by time.

3-4- Measures of relative competitiveness

- **Measures of Domestic Resource Cost Ratio:** DRC determines the efficient use of domestic resources. DRC is calculated by dividing the factor costs (G) by the value added in social prices (E-F), DRC=G/ (E-F). DRC <1 implies efficiency. DRC = 1 implies absence of government intervention. As DRC was 0.88 and 0.62 for Damazin and Rosaries localities respectively, there is a comparative advantage of Banana in the two localities,but, the effectiveness of the production system in Rosaries is better than in Damazin. Elnagarabi (2015) found that the average DRC for Banana in Sudan during the period (2003-2009) was o.63 and during(2009-2014) was 0.10 indicating that Blue Nile State is much lesser efficiency and comparative advantage in producing Banana than the other producing states in the Sudan.

- Coefficient of International Competitiveness (CIC): CIC is the ratio of domestic resource cost, expressed in domestic currency at economic prices, to international value-added, expressed in foreign currency, CIC = G / (E-F). If the value of the CIC is less than the prevailing exchange rate, the product is economically profitable. CIC values for Damazin and Rosaries localities was 1.62 and1.72, respectively, showed competitiveness of Banana. The merit of DRC and CIC is that they take into account domestic factor costs as well as tradable inputs and outputs (Jansen, 1986).Table 8 showed that Banana appears to be highly competitive because its producers would produce more than enough international value added to compensate for the domestic resource used.

- **Private Cost Ratio (PCR):** PCR is a measure of the ratio of domestic factor costs to value added in private prices. PCR < 1 means that value added in domestic prices is greater than the costs of domestic resources used to produce that income, and farmers have gained privately or socially profit from cultivating the crop. On the contrary, PCR >1 indicates non-profitability. PC for Banana in Damazin and Rosaries was 0.90 and 0.70, respectively, which implies high competitiveness in both localities. Rosaries is of highly competitive than Damazin. Compared to an average PCR of 0.681 found by Elnagarabi (2015) for Sudan during the period (2003-2009), the competitiveness of Banana production in the two states at actual market prices seems to be less than for other producing States.

Conclusions

The use of PAM enabled the estimation of the comparative advantages and competitiveness of Banana production in the Blue Nile State in the Sudan. In spite of the comparative advantages and competitiveness of Banana production in the Blue Nile State, the PAM's indicators pointed out that Banana is not efficiently produced, Such results are consistent with the similar results obtained by (Elnagarabi E. A., 2015). However, the

comparative advantage results can be altered by more changes in the input and output prices. The general conclusion from this analysis is that trade liberalization and domestic policy reforms that alter the current levels of effective protection could significantly affect the constellation of Banana production.

Bibliography:

1. FAO .(2015) .year statistical book of Food and agriculture organization .UN.
2. Bank of Sudan .(2015) .statistical report .Bank of Sudan.
3. C.G., and Panggabean. M Nelson.August, 1991 .(The Costs of Indonesian sugarcane policy: A Policy an analysis matrix approaching .The American Journal of Agricultural Economics ، pp 703-12
4. Census .(2006) . Populations andHousing. Sudan.
5. E. M. Alhag .M.S. and Alamin .A.E Elnagarabi .(2009) .Analysis Impact of government policies on the production of cotton and wheat on the Gezira Scheme 2004-2007 .Gezira Journal of Agricultural Sciences) volume 1
6. E.A., and Pearson ،S.R Monke .(1989) .The Policy analysis matrix for agricultural development .Ithaca and London: Cornell University Press.
7. E.E.M. Ahmmad A.S.and Eldaw.A.M Elnagarabi) .March, 2015 .(Impact analysis of the government policies on fruit and vegetable sector in Sudan 2003 .2009 - Journal of Agricultural Sciences ، pp 167-77.
8. Elamin, O.M. And Ali. S.A Elkashif. M.E .(2005) .Effect of packaging method and storage temperature on quality and stabilities of four introduced banana clones .Gezira Journal of Agricultural Science ، pp195-185
9. H& .Matute, M. M Ferris .(2003) .Structural and functional succession in nematode fauna of a soil food web .Applied Soil Ecology ، pp 93-110
10. J., and Beghin, C Fang) .August, 2002 .(Protection trade liberalization under incomplete market integration)84 ".August): 228-33 .American Journal of Agricultural Economics ، pp-228 33
11. MAF .(2005-2014) .statistical reports .Khartoum - Sudan: Ministry of Agriculture and Forestry.
12. S Yao .(1997) .Comparative advantages and crop diversification: A Policy Analysis Matrix for Thai Agriculture .Journal of Agricultural Economics ، pp211-22
13. S. M Chaudhry .(1997) .Introduction to Statistical Theory .Lahore 5400 ،Pakistan: llmi Kitab Khana.
14. S. R., Gotsch, C. and Bahri, S Pearson .(2003) .Application of policy analysis matrix in Indonesian Agriculture .
15. S.R. and Monke, E.A Pearson .(1989) .The policy analysis matrix for agricultural development .Journal Development Southern Africa ، pp133-40
16. SCBS .(2015) .Sudan Annual reports .Khatoum, Sudan: Sudan Central Bureau of Statistics.
17. Tsakok .(1990) .Agricultural price policy: A practitioner's guide to partial-equilibrium analysis .Cornell University Press.
18. W.A., and Winter-Nelson Masters .(1995) .measuring the comparative advantage of agricultural activities: domestic resource costs and the social cost -benefit ratio .American Journal of Agricultural Economics ، pp 214-50