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Determinants of Gum Arabic Production in Sinnar State From the Producers' Point of View

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ABSTRACT

This study was conducted in 2019, aimed to evaluate the perception of gum arabic producers about the determinant factors influencing the production of gum arabic production in the clay lands of Sinnar State. The study used primary data collected by a structured questionnaire filled by a random sample size of 289 producers, representing 7% of the study population (4000 persons). The study used the five-fold Likert method for data analysis and found that economic, social and natural resources as key determinants of gum arabic production in the State respectively. Among the economic determinants, financing, marketing and monopoly of traders were found to be the major influencing factors of gum arabic production in the State. The study recommended the activation of the role of cooperative societies, review of the marketing system and reform of the market conduct and structure to prevent monopoly to act in gum arabic production and business in Sinnar State.

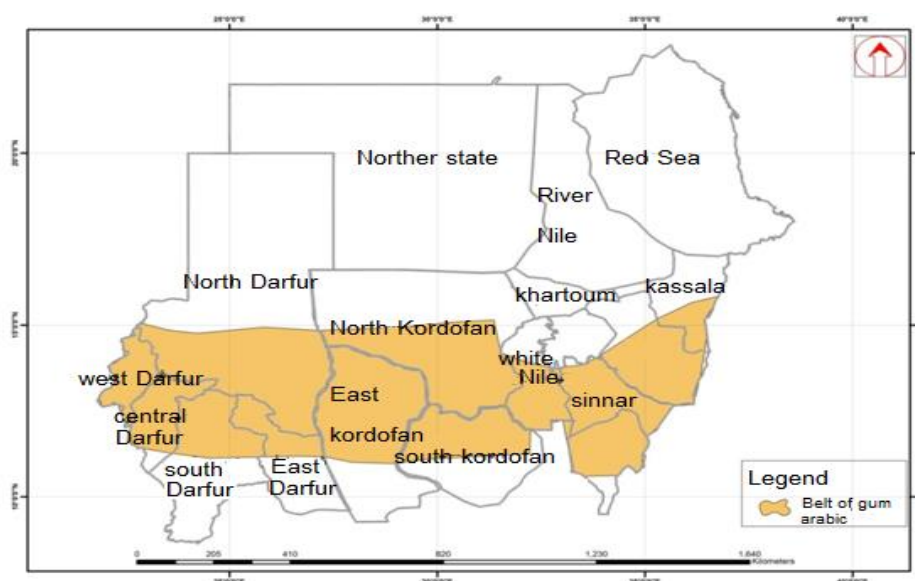
Keywords: *financing; gum arabic; monopoly; prices.*

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1. INTRODUCTION

The gum arabic belt of Sudan constitutes the site of the bulk of the agricultural production and ecological livelihood in the country. It lies in the arid and semi-arid region between latitude 10° and 14° north, and longitude 32° – 37° east in clay, sandy and light clay areas. The Belt accommodates two areas outside its borders; these are the north east area covering Fao in Gedaref State and Wad Al Hilau in Kassala state, and the south east along the Blue Nile/Upper Nile border zone (Abdel Nour, 1997).

The belt is characterized by irregular and low rainfall. The belt extends over traditional rainfed areas crossing 12 states including North, West and South Kordofan States covering 49.3% of the Belt area, parts of North, South, East, Central, and West Darfur States covering 24.4 %, parts of Kassala and Gadaref States covering 23.4%, the White Nile, Sinnar and the Blue Nile States covering 2.9% area of the belt.



Map 1. Gum arabic belt in Sudan

Source: UNDP, 2020

The Belt protects more than 40% of the total area of the country against desert encroachment and accommodates irrigated, mechanized and

traditional rain-fed agriculture, forestry and animal production livelihoods. The producers in the Belt are engaged in growing food and cash crops, gardens of Hashab in the sandy soils and Talha trees in the clay soils and raise a diversity of livestock resources. They give priority to food crop production (usually sorghum and millet) to secure family nutritional needs and produce sesame, groundnuts as cash crops, and melon seeds, hibiscus, and gum arabic to hedge against crop failure. Thus they diversify their sources of income to meet their household's basic needs.

Gum arabic is a strategic commodity composed of non-timber forest products. The gum arabic tree generates income for the community, households and the national economy from its exports of gum and from its timber products. gum tree constitutes an important source of income and mainstay for households in the traditional sector in Sudan (Mohammed, 2006 and Yaseen, 2001). The gum product enters the international trade system and furnishes the household and community with ready cash income for their sales in the village and nearby markets. The firewood collected from the tree branches and falling trees provide energy source for household domestic use and cash from sales in markets. The branches and the leaves also offer grazing fodder and shade for animals improving their breeding environment while the roots of the trees are used in rope making and lining of drinking water wells. The trees themselves are cut down and used as poles for building of houses or are burned to produce charcoal (Awouda, 1974, Mahgoub, 2003 and Mohamed, 2005). The gum arabic exports generated USD 116 million in foreign currency in 2019 (Bank of Sudan, 2020).

Gum arabic is primarily produced by small farmers who give priority to the production of food crops (usually sorghum or millet) to secure family food needs. Farmers produce gum arabic to supplement their household income and to hedge against crop failure during droughts and flash floods seasons (WB, 2007). Gum arabic production is part of an integrated crop-animal farming system under traditional subsistence production system. It depends on family labor and traditional technology and tools and seeds. The cost of labour constitutes the highest share in the cost of production of gum product. The labours are used twice in tapping and collecting of gum and require food and water at high cost. Producers

usually pledge future gum production in exchange for current supplies of subsistence needs (Macrae, 2002).

All financial transactions (cash and credit) for gum production are done with local merchants in what is known as *Shail* System (Macrae, 2002). Typically the local traders provide money, tools and basic commodities (water, sugar, tea, etc...) to families during the tapping season and founding periods, while farmers pay the debt in kind at agreed upon fixed prices early in the season. This sort of financing usually includes a high interest rate (Couteaudier, 2007). The supply of credit from agricultural bank of Sudan and other microfinance commercial banks may save households the high cost of the *Shail* system. Thus, the producer shall be in a better economic position and enjoy higher profitability from the sale of their gum product.

This indicates several reasons for the deterioration and fluctuation of gum arabic production in Sudan. The most notably causes are related to the deferred payment of the value of gum in the *Shail* system (Ezeldeen, 1998, and Seif El-Din, 1996). The fluctuation of the gum arabic prices in the local market discourages the producers from tapping large areas under gum trees (Ezeldeen, 1998). Rainfall variability and recurrent droughts are also among the causes of unstable production of gum arabic and migration of gum producers including youth searching for alternative sources of income generation activities (El-Wasila, 1993, Seif El-Din, 1996, Ezeldeen, 1998 and Mohamed, 2003, Couteaudier, 2007). Mismanagement of the forest resources exemplified in severe deforestation by animals, especially camels overgrazing are additional causes for poor performance of gum arabic production in Sudan (Ezeldeen, 1998, Awouda, 1999, El Wasila, 1993, Ezeldeen, 1998, Macrae, 2002, Mohamed, 2003 and Couteaudier, 2007).

Poor infrastructure, lack of basic services especially supply of drinking water and transportation services to nearby and distant markets increase the cost of living and of gum arabic production resulting in low crop returns. The emergence of large number of middlemen in the gum arabic business accruing high returns squeeze the expected income revenues of small farmers to the minimum (Youssif, 2015). Pest and diseases including locusts reduce yields of gum arabic products (El Wasila, 1993 and Seif El-Din, 1996).

The fluctuation and deterioration of gum arabic production negatively affect the income of small producers, who represent 95% of the producers, which leads to an increase in the level of poverty and environmental deterioration in the production areas (Rahim, 2005 and WB, 2007). So any strategic planning for increasing gum arabic production requires supply of adequate knowledge and information that helps in identifying the basic determinants of gum arabic production from the producer's point of view. Most of the existing studies on gum arabic producers in Sudan are concentrated on Hashab gum arabic grown in the sandy plains of Kordofan and Darfur States and ignored the Talha-clay plains gum arabic production areas. The clay area especially of Sinnar State suffers from the limited studies that are related to the determinants of gum arabic production in this State. Accordingly, the paper attempted to answer the question about the main determinants of gum arabic production in the clay plains in general and Sinnar State in particular, that concern the natural, social and economic determinants of gum arabic production in Sinnar State.

2. METHODOLOGY

The study used secondary and primary data. The secondary data were obtained from governmental and non-governmental sources, periodicals, Academic theses and the internet sites. The primary data were collected from a field survey by using a questionnaire. The questionnaire covered three categories of gum arabic determinants namely:

1. **Natural Determinants:** these consist of desertification, infestation of locusts and other pests, variability in rainfall and temperature.
2. **Social Determinants:** these included the horizontal expansion of agriculture, excessive cutting of forest trees, migration of producers from the countryside to the cities, overgrazing, exploitation of trees in construction, firewood use and charcoal making.
3. **Economic Determinants:** these are composed of alternative sources of income generation available to communities, low income, shortage of finance for gum arabic production, marketing and trade; the emerging monopoly phenomena in the gum arabic value chain system.

The Study Area

Sinnar State is located in the gum arabic clay belt in the rich savannah region. It falls in south-east Sudan, and borders the States of Gezira on the north, Gadaref on the north east, White Nile on the west, the Blue Nile on the south, and Ethiopia on the south-east, and the Republic of South Sudan on the south. The population of Sinnar is projected at 1.4 million people by 2020, mostly concentrated on both banks of the River Blue Nile. Agriculture, especially horticultural and forestry production, is the most important economic activity in the State (Sinnar State, 2019). The total area of rainfed agriculture is estimated at 23 thousand square kilometers (or 57% of total state land area). The state is vulnerable to rainfall variability and an intensifying cycle of floods and drought which lead to a low crop yields and quality as well as the deterioration of rangeland and vegetation cover.

Study Population

The total number of gum arabic producers in Sinnar State was about 4000 producers (Forest Commission, 2019).

The Method of Data Collection and the Sample of the Study

The study used primary data collected from a field survey filling a structured questionnaire from a stratified random sample. The sample size was obtained by using the Cochran's equation (1977) which estimated a stratified proportional random sample size from the study population in all localities producing gum arabic in the State. The equation estimated a sample size of 289 respondents, about 7% of the population study with a margin of error of 0.06. The surveyed localities covered Karakouj, Dinder, Al-Dali, Al-Mazmoum, Okalma, Wad Al-Nil and Al-Qarneeb.

Method of Analysis

Likert Scale

The study used the Likert Scale method, most widely adopted scales for measuring tendencies, desires and ideas. The Scale was originated by Rensis Likert in 1935 in the field of psychology and from then widely applied in medical, business and career behaviour research and in many other fields. The Scale aims to measure the degree of approval or

disapproval of individual statements, and is easy to design, apply, manipulate, and test its reliability and validity.

The Scale provides five options:

- (1) Strongly disagree option which indicates extreme opposition to the effect of the factor on the production of gum arabic in the state.
- (2) Disagree option which indicates an opposition to the effect of the factor on the production of gum arabic in the state.
- (3) Neutral option which indicates inability to agree or reject the effect of the factor on the production of gum arabic in the state, or the lack of knowledge of the effect.
- (4) Agree option which indicates approval of the effect of the factor on the production of gum arabic in the state.
- (5) Strongly agree option which indicates extreme approval of the effect of the factor on the production of gum arabic in the state (Table 1).

Table 1. Scale scores for the determinants of gum arabic production

Response	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Score	1	2	3	4	5

Stability of the Questionnaire

To calculate the stability of the questionnaire, Cronbach's alpha value was estimated separately for each determinant, and for the whole questionnaire. The alpha value for the natural determinant was $\alpha = 0.936$ (4 statements), for the social determinant was $\alpha = 0.842$ (6 statements), for the economic determinant was $\alpha = 0.938$ (7 statements) and for the whole questionnaire was $\alpha = 0.783$ (17 statements). Alpha values indicate the stability of the questionnaire. For indicator analysis, the study used the weighted average and standard deviation estimates for defining the scale of responses. The interpretation of the estimated values is shown in the following five- point Likert Scale:

1. The range: subtract 1 from 5 gives 4 ($5 - 1 = 4$),
2. The category length: divide the range by the number of categories (options) (4 is divided by 5 gives 0.8 ($4/5 = 0.80$),
3. Formation of categories is based on category 1, category $1 + 0.80 = 1.8$, category $1.9 + 0.80$ and so on,

Table 2 gives the interpretation of values of weighted averages and determining of the degree of trend of the sample.

Table 2. Degrees for determining the direction of the sample

Direction	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Value	1-1.8	-2.61.9	-3.4 2.7	3.5-4.2	4.3-5

3. RESULTS AND DISCUSSION

(1) Natural determinants of Gum Arabic production

The opinion of the respondents to the assumption that natural factors have influence over gum arabic production in Sinnar State is rejected. The average Scale was 1.13 with a standard deviation of 0.54 which indicates that the general tendency of the sample strongly reject the assumption that the natural factors have determinant influence on the production of gum arabic in the State. The effects of temperature on production 23% and of rainfall 23%, had the highest rejection rate followed by the effect of locusts and other pests was 22%, and the effect of sand encroachment was 22% (Table 3). From the value of the standard deviation, it follows that there is no deviation of opinion among the respondents on strongly disagreeing with the proposed statement. On comparing the calculated t value with the tabular t, it is indicated that all the responses were statistically significant. These results differ with the results of the studies of El-Wasila (1993), Seif El-Din (1996), Ezeldeen (1998) and Mohamed (2003) who confirmed the effect of rainfall, temperature, locusts and other pests sand encroachment on the production of gum arabic in other areas of Sudan. This could be attributed to the location of Sinnar State in the rich savannah area where the rains are abundant and the forests are widespread and there is no desert encroachment.

(2) Social determinants of Gum Arabic Production in Sinnar State

The opinion of the respondents to the assumption that social factors have influence over gum arabic production in Sinnar State is neutral with an average Scale of 3.47 with a standard deviation above 90% (Table 4). The effect of fires on production had the highest approval rate 73% followed by overgrazing 72% and excessive cutting of trees 69%. The

respondents' opinions were neutral about the effect of labor migration from the countryside to the cities and the effect of tree exploitation for fuel and construction 67% and 66% respectively, and strongly disagreeing 30% with proposition that horizontal agricultural expansion is influencing gum arabic production in the State. The standard deviation values indicate that opinions do not deviate from the agreed public opinion for all statements. On comparing the t calculated value with the t tabuled, it is found that all the responses were statistically significant. These results agree with the findings of Ezeldeen (1998) and Awouda (1999) on the effect of overgrazing, over-cutting of forest for firewood purposes. This study finding, on the other hand, differ with the findings of El Wasila (1993), Ezeldeen (1998), Macrae (2002), Mohamed (2003) and Couteaudier (2007) on the effect of migration of gum Arabic producers. This could be attributed to the fact that Sinnar State does not suffer from drought, which is the main reason for the migration of producers.

Table 3. Natural determinants of gum arabic production in Sinnar State.

Factor	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average	standard deviation	%	T	Sample Direction	Question Rank
Influence of desertification on production	273	7	2	2	2	1.10	0.48	22	-67.95	SD	3
Influence of locusts and other pests on production	268	14	2	2	3	1.12	0.54	22	-59.21	SD	4
Influence of Rainfall on production	264	16	5	1	3	1.14	0.55	23	-57.41	SD	1
Influence of Temperature on production	258	21	4	3	3	1.17	0.60	23	-51.85	SD	2
Natural Determinants						1.13	0.54	22.7	-	SD	'

t tabuled = 2.592. At the level of significance 0.01. SD= Strongly Disagree.

Table 4. Social determinants of gum arabic production in Sinnar State.

Factor	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average	standard deviation	%	t	Sample Direction	Question Rank
Influence of the horizontal expansion of agriculture at the expense of forests and the loss of acacia on production	216	18	45	8	2	1.48	0.90	30	-28.57	SD	6
Influence of the use of trees in construction and fuel on production	8	64	52	163	2	3.30	0.91	66	5.60	N	5
Influence of labor migration from the countryside to the cities on production	8	59	47	171	4	3.36	0.91	67	6.69	N	4
Influence of excessive cutting on production	7	54	43	177	8	3.43	0.91	69	8.11	A	3
Influence of overgrazing on production	5	44	38	178	24	3.60	0.90	72	11.19	A	2
Influence of fire on production	5	43	36	168	37	3.65	0.94	73	11.81	A	1
Social Determinants						3.47	0.92	69	-	N	1

t tabular = 2.592. At the level of significance 0.01. SD= Strongly Disagree. N=Neutral A=Agree

(3) Economic determinants of Gum Arabic production in Sinnar State

The respondents strongly agreed with the statement that economic factors have influence on gum arabic production in Sinnar state. The average Scale was 4.7 with a standard deviation above 65% (table 5). The effect of weak returns and the presence of other sources of income had the highest approval rate 96% followed by lack of financing, weak marketing and monopoly of traders 95%, high cost of production 94% and the effect of low and fluctuating prices was 89%.

From the value of the standard deviation, there is no deviation of opinion among the respondents in general on all statements. All the respondents'

ideas were statistically significant. The study findings agree with the findings of Ezeldeen (1998), Seif El-Din (1996) and Youssif (2015) on financing problems, existence of middlemen and monopoly, low returns and low prices for gum arabic.

Table 5. Economic determinants of gum arabic production in Sinnar State.

Factor	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average	standard deviation	%	t	Sample Direction	Question Rank
Influence of low and fluctuating prices on production	1	8	25	83	172	4.44	0.79	89	30.92	SA	7
Influence of low return on production	2	4	11	22	250	4.78	0.65	96	46.87	SA	1
Influence of the presence of other sources of income on production	4	5	6	21	253	4.78	0.70	96	43.39	SA	2
Influence of the lack of financing for the production process on production	4	8	8	16	253	4.75	0.76	95	39.20	SA	4
Influence of poor marketing on production	9	5	5	15	255	4.74	0.84	95	35.08	SA	5
Influence of higher production costs on production	11	9	5	12	252	4.68	0.95	94	30.08	SA	6
Influence of monopoly by traders on production	6	7	5	14	257	4.76	0.78	95	38.24	SA	3
Economic Determinants						4.70	0.78	94	-	S A	1

t tabular = 2.592. At the level of significance 0.01. SD= Strongly Disagree. N=Neutral A=Agree

4. CONCLUSION

The economic determinants represent the main determinant of gum arabic production in Sinnar State, where all its items were highly approved. The order of the economic determinants was as follows: weak returns, presence of other sources of income, lack of financing, poor marketing, monopoly by local traders, high production costs low and fluctuating prices. The social determinants come second to the economic determinants, with some of its items were approved in the order of

cutting trees for firewood, overgrazing and over-cutting. The opinions were neutral about the effect of labor migration, cutting trees for firewood, construction while strongly posing the statement of horizontal expansion of agriculture had influence over the production of gum arabic in the State. As with respect to the natural factors, the results showed that they have minimum determinant effect on the production of gum arabic in Sinnar State.

The study recommends the activation of the role of cooperative societies to provide production, financial and marketing services; review of the marketing system of gum arabic and reform of the market conduct and structure to prevent monopoly; adoption of price incentives that reflect the real value of export prices to gum arabic producers; strengthening producers' unions, cooperative societies and mass media broadcasting spreading information on export and market prices of gum arabic reaching the producers in remote areas at the beginning of the season; provision of non-price support to producers in form of improved infrastructure and feeder roads in production areas and availing microfinance institutions in the gum arabic production areas.

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Determinants of Gum Arabic Production in Sinnar State From the Producers' Point of View

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المستخلص

أعدت هذه الدراسة في العام 2019م وهي تهدف إلى تقييم آراء المنتجين حول أهم العوامل التي تؤثر على إنتاج الصمغ العربي (صمغ الطلح) القطاع الطيني في ولاية سنار. اعتمدت الدراسة على بيانات أولية جمعت باستخدام استبانة مصممة لهذا الغرض، حيث كان حجم العينة 289 مُنتج تمثل 7% من مجتمع الدراسة البالغ 4000 مُنتج. استخدمت الدراسة تحليل ليكرت الخماسي. توصلت الدراسة إلى أن المحدد الاقتصادي هو أهم مؤثر على إنتاج الصمغ العربي يليه المحدد الاجتماعي ثم المحدد الطبيعي. أيضاً توصلت الدراسة إلى أن التمويل، التسويق واحتكار التجار يمثلون أهم المحددات الاقتصادية لإنتاج الصمغ العربي بولاية سنار. أوصت الدراسة بتفعيل دور الجمعيات التعاونية، مراجعة النظام التسويقي للصمغ العربي وإجراء إصلاحات هيكلية منعاً للاحتكار.

الكلمات المفتاحية: الاحتكار؛ الاسعار؛ التمويل؛ الصمغ العربي.

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