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GUM OPOPONAX AND MYRRH MARKET STRUCTURE, CONDUCT AND PERFORMANCE FOR WAJIR COUNTY, KENYA

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Abstract: This study focused on gum Opoponax and Myrrh that are harvested from *Commiphora holtziana* (Ehrenb) Engl. and *C. myrrha* (Nees) Engl. in the drylands of Kenya. The aim was to assess and fill information gaps on gum Opoponax and Myrrh market structure, conduct and performance in Wajir County. A total of 104 randomly sampled collectors, processors, commodity dealers and consumers were interviewed. The two commodities exhibit an oligopoly market structure which is characterised by a few big wholesalers with gross profit margins of between 5% and 16%. The quantity of gum resin from Wajir County averaged 450,000 kg per year accounting for about 25% of the national trade volume of 3.3 million kg between 2011 and 2015. The producer price was US$ 1.2 for Hagar and US$ 3.2 for Malmal. These gum resins were mainly exported to China and Vietnam which controls 60% of the international gum resin market. It is recommended that national and county governments ensure accurate and timely trade data capture, guarantee and strengthen local value addition initiatives and institutions.
Keywords: Gum resin, Myrrh, Market, Opoponax
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INTRODUCTION

The Arid and Semi-Arid Lands (ASALs) have enormous resource potential that can be harnessed for local and national economic development. Millions of people across the developing world trade in a diverse range of Non Timber Forest Products (NTFPs) (Scherr *et al.,* 2004). The collection of gum opoponax (Hagar in Somali language) and myrrh (Malmal in Somali language) is carried out for local and international markets. Gum resin collection is a part time or full-time, year round activity, varying across locations and households. Gum resins prices have been known to fluctuate considerably by season reflecting a decline or increase in supply. Gum resins are exploited from inaccessible locations (Neumann and Hirsch, 2000). Other factors that influence NTFPs production are existing property ownership regime, markets, wealth, proximity to the resource base, age, gender, education and accumulated forest knowledge (Cavendish, 2000) and competition (Belicher *et al*., 2005). Hagar and Malmal collection offers potential opportunities to diversify the local communities' income base for many poor households, casual labourers and businessmen in Kenya. The local community in Wajir County perceives a poor person as one who cannot meet their basic needs, such as food and shelter (Lwevo, Onyango and Nyando, 2014). In an effort to understand the dynamics associated with the marketing of gum myrrh and

opoponax in Kenya, it was found necessary to analyze the market structure, conduct and performance among other factors. The ultimate aim is to ensure that the ultimate benefits end up with the collector. Wajir County is sparsely populated with most families living in Manyatas concentrated in/near market centres where bore holes and water reservoirs, food supplies, schools and medical facilities are accessible. Sustainable exploitation of the genus Commiphora is constrained by inadequate information on poor product identification and rampant incidences of adulteration, poor pricing mechanism and imperfect markets (Chikamai and Kagombe, 2002; Girmay, 2000; Mulugeta and Demel, 2003). However; exploitation potential for gum resins is further constrained by remote and isolated areas, limited local buying power, inadequate infrastructure, poor exposure and access to markets, weak political power, high transportation costs, communication problems, inadequate education, and poor organizational structures amongst producers and traders (Muzayen, 2009). Despite effort by government, gum myrrh and opoponax market remain underdeveloped due to imperfect markets, poor harvesting techniques and management of the resources, among other factors. Therefore, this study sought to investigate gum opoponax and myrrh market structure, conduct and performance for improved livelihoods in Wajir County.

EXPERIMENTAL

The study was conducted in Wajir County which is known for gum resins production (Chikamai and Kagombe, 2002). Wajir County covers an area of 56,685.8 Km^2 and lies within the Sahelian climatic region that is classified as Zone VII (100% Arid) and it's characterized by long dry spell and short rain seasons. It is located between latitudes 3^0 20' and 0^0 60' North and longitudes 39^0 and 41^0 East. The County borders Mandera to the North and North East, the Republic of Somalia to the East, Garissa to the South and South West, Isiolo and Marsabit to the West and the Republic of Ethiopia to the North West. Wajir County has five livelihood zones: agro-pastoralist, camel pastoralist, cattle pastoralist and mixed animal species pastoralist (Lwevo *et al*., 2014).

Porter's Value Chain Structure Conduct Performance (SCP) framework of value chain analysis was adopted for this study. It focuses on the flow of a commodity through different channels. To assess the market structure, the supply chain was mapped to visualize the stages and the connections between various primary supply chain and support activities by relevant actors (McCormick and Schmitz 2002). The main and supportive actors in the supply chain and the flow of the commodity through different channels were mapped using the market value chain structure analysis. The market conduct was examined by evaluating the behavior of these actors while market performance was analyzed using price margin analysis (Kassa *et al*., 2011). Data was collected using a questionnaire to solicit information from 30 key informants and randomly sampled buying agents (59), duka owners (8) and wholesalers (8). Field observations supplemented the questionnaire method. Quantities delivered along the market chain were monitored using a designated data sheet. The market study assessed and defined the gum myrrh and opoponax market supply and structure; market players and quantities; price formation; estimate profit margins; market barriers such as start-up capital, working capital, experience, education, policy and legal issues, and insecurity to trade in gum myrrh, opoponax and quantities delivered (individuals, groups, households) along the market chain. Data was analyzed using the Statistical Package for Social Scientists (SPSS) and Microsoft Excel computer programmes for descriptive statistics. Market structure of gum oppoponax and myrrh was described using concentration ratios. The classification of gum resin sector is based on the percentage market share of the largest four or eight wholesalers. A 0% concentration ratio indicates an extremely competitive market while 100% concentration ratio means extremely

concentrated oligopoly or even monopoly if the one firm concentration ratio is 100%. The market structure arrangement influences the benefits to the players. The gum resin collectors benefit more if the market is competitive. Concentration is a measure of the proportion of the gum resin sector sales contributed by the *m* largest wholesaler ranked in order of their market share (m = 2, 4, 8 . . .). The Concentration Ratio (CR) was calculated to determine the structure of the gum resin market. The mathematical formulation of the concentration model is as follows:

$$CR_m = \sum_{i=1}^{n} Pi \qquad \text{(i)}$$

Where CR_m = concentration ratio of the largest m firms, *n* =number of traders, *Pi* = the market share of the i^{th} trader (i = 1..., n), *m* =number of the largest firms and range of values is m/n < CR < 1. m < n.

The manner and mechanism by which producers and traders co-ordinate their actions were analyzed for market conduct. Market conduct refers to the behavior of the participants in the physical movement of the gum resin and information from the point of collection to consumption (Kassa *et al.*, 2011). It shows the strategies that participants adopt to gain competitive advantage and examines buying and selling behavior, interactions and relations between actors in the supply chain. One such activity in the marketing of gum resins is adding value through bulking and cleaning. It was interesting to analyse how the various players in the gum resin market, conduct their business. The marketing channels and the barriers to entry were investigated and described.

The hagar and malmal market performance was evaluated by calculating the Gross Profit Margin (GPM) by subtracting cost of gum resins sold from total revenue and dividing by total revenue. The GPM method is easy to use, less time consuming, characterized by high level of verifiability and it's a powerful tool in budgeting.

$$[\text{GPM}] = \frac{\text{Returns} - \text{Investimnents}}{\text{Returns}} \qquad \text{(ii)}$$

Where GPM is the Gross Profit Margin

The top number in the equation, known as gross profit or gross margin, is the total revenue minus the direct costs of producing that good or service. A direct cost does not include operating expenses, interest payments and taxes (Jagelavicius 2013).

RESULTS AND DISCUSSION

Current status of Gum Resins trade in Kenya

According to UN COMTRADE statistics (2000-2015), for Africa, Ethiopia (54%) and Kenya (27%) are the two world-leading producers and exporters of opoponax and myrrh (Figure 1). The other key strategic producers include: Somali (12%), Eritrea (5%) and others (2%). In order to improve the benefits from gum resins trade, this study sought to look into factors affecting the proper functioning of the markets. Trade in Hagar and Malmal from Wajir County averaged 450,000 kg per year between 2011 and 2015. The peak production was realised in 2013 when the county registered a turnover of 572 tons (Figure 2). At the national level during the same period, Kenya exported 3.0 million Kg in 2013. This quantity from Wajir County accounted for about 25% of the national trade volume. The Kenya National Bureau of Statistics (KNBS) records show that trade in gum resins averaged 2.4 million Kg valued at Ksh. 146 million for the period 2005 and 2015 with China and Vietnam being the leading export markets. These statistics may not be accurate since most of the resins have been coded as 29221000 which lumps together gum myrrh, opoponax, frankincense and other myrrh like gums. It will be important to capture Hagar and Malmal under different codes in addition to other products such as frankincense. Therefore, it is necessary for stakeholders to be involved in data capture and dissemination.

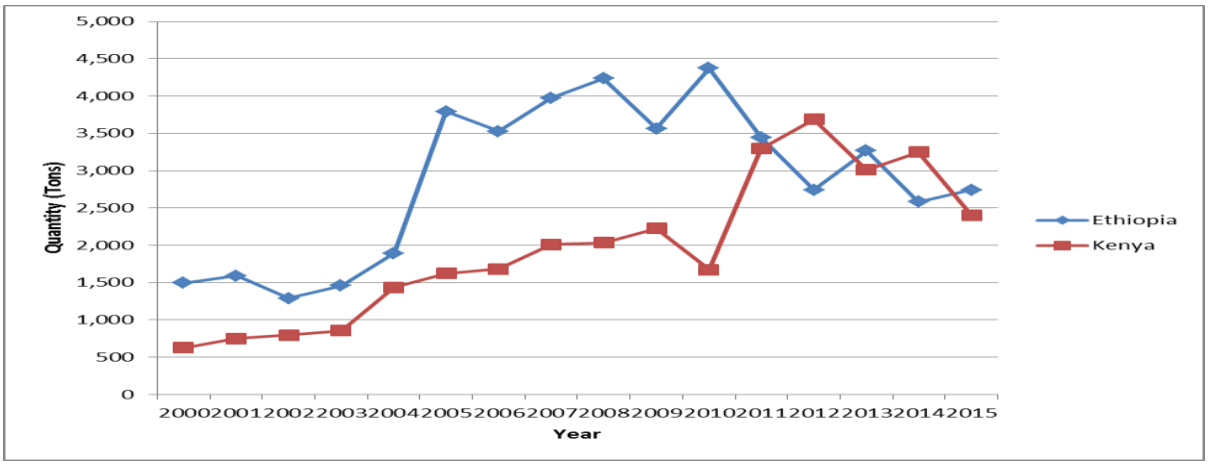

Figure 1. Gum Resin export from Africa
Source: UN COMTRADE /KNBS trade statistics (2000-2015)

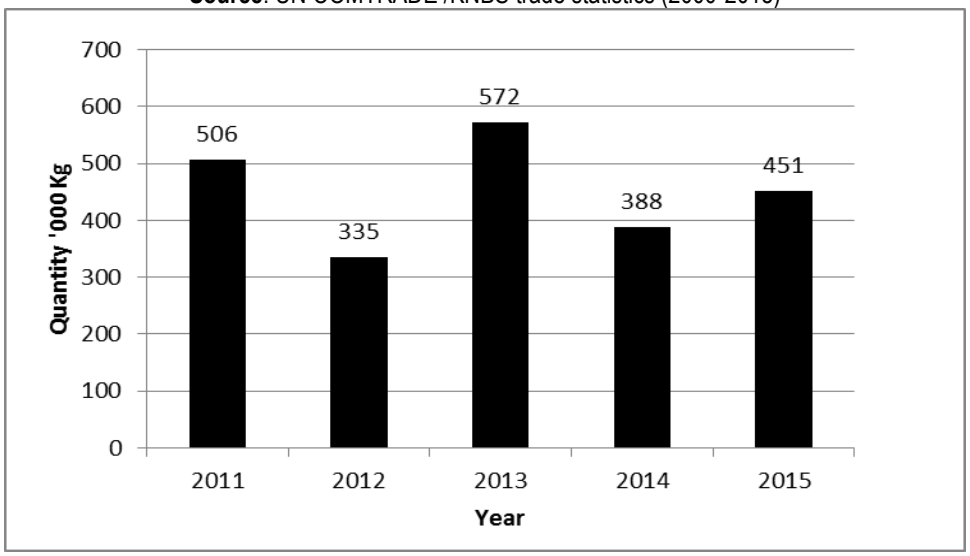

Figure 2. Gum resin trade volume for Wajir County (Tons)
Source: Ecosystem Conservator's Office, Wajir County (2015)

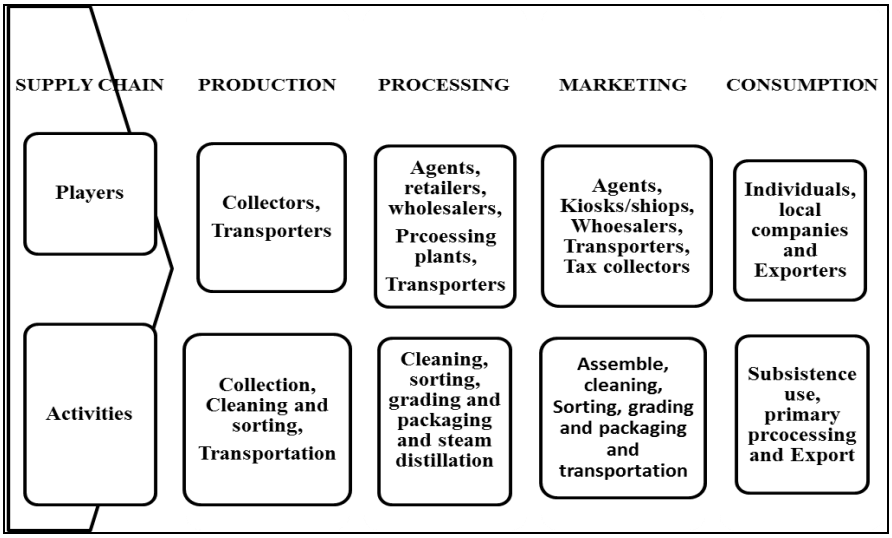

Figure 3. Gum resin supply chain for Wajir County Source: Field data, 2014

Gum Resin Market Structure, Conduct and Performance

Hagar and Malmal market was organised around the wholesalers, retailers, buying agents, transporters and collectors. Collected gum resins was brought from the woodland and sold to duka owners (shops and kiosk) for cash or in exchange with food stuffs. The retailers sort, grade and package the gum resins into 50 kg bags in readiness for transportation and sell to wholesalers in Wajir town. The wholesalers directly fund the harvesting/collection and buying in the local market centres (Figure 3). The suppliers of gum resin to the wholesalers were collectors (74%), duka owners (kiosks and retail shops) (26%) and buying agents (1%). The gum resin business ownership was either by individuals (65%), family (33%) or association (2%). Neumann and Hirsch, (2000) argue that the reason for relatively low income from NTFPs collectors is attributed to lack of access to credit, transportation, lack of information on prices and storage facilities. These conditions create more opportunity to intermediaries to position themselves strategically in the marketing chain. The market players had an experience of 9 years in the marketing of Hagar and Malmal trade since the year 2000. The gum resin buying agents operated either on temporary or permanent basis and purchased Hagar or Malmal during the June – September peak collection period and turning back to their normal businesses during off-peak period. The demand for gum resins is very difficult to quantify since the products are aggregated as "other natural gums, resins and balsams". Consumers of locally marketed woodland products include local people, poor urban residents or immigrants (Shackleton, 2005). Getachew, Sjaastad, and Vedeld, (2007) noted that distance from woodland, household total income; adult labor and household size are among the factors that influence people's dependence on these resources in Ethiopia. Findings from other studies show that poorer households use high quantities of gum resins as compared to richer households within the same communities (Neumann and Hirsch, 2000). However, Cavendish (2000) found that rich households use greater quantities of environmental resources in absolute terms while poor households are more dependent on the resource. The buying agents, duka owners and wholesalers were involved in assembling, cleaning and sorting products. The buying agents received an average of 82 kg per day of Hagar and Malmal supplied by 16 collectors located at an average distance of 15 km away from the buying centres thrice per week. The duka owners received an average of 100 kg per day supplied by five collectors and 251 kg/day supplied by 10 shop and kiosks owners. The wholesalers received an average of 1,159 kg per delivery from 11 shop and kiosks owners who were located at an average distance of 6 km for two trips per week. A wholesaler handles an average of 6,161 kg of Hagar and 4,024 kg of Malmal per month while the buying agents who are located in the market centres handle an average of 420 kg of Hagar and 491 kg of Malmal within the same period. A total of 1,512 kg of Hagar jerer, an adulterant for Hagar, was collected from *C. ogadensis* and stocked by a few gum resin dealers. The wholesalers were involved in the collection and assembling of the products (Table 1). The gum resin wholesalers in Wajir town dominated market decision making for locally purchased gum resins destined for Nairobi. One wholesaler located in Khorof Harar, traded his gum resins through Somali. The wholesalers bought their product from collectors or buying agents (middlemen) positioned in the various market centres. The commodity price varied with product, availability and grade. Hagar and Malmal were classified into three grades whereas Hagar jerer, an adulterant for Hagar, was not graded. Malmal fetched the best price while Hagar jerer fetched the lowest price (Table 2). The prices were regulated by the market forces (50%), the buyer (43.3%) and seasonality and seller (7%) depending on the various grades. Field observations revealed that prices were mainly fixed by the wholesaler who had prior information on the prevailing international prices at the expense of the collection.

Table 1. Role of Market Players in the Gum Resin

Activity	% Collectors	% Agent	% Retailer	% Wholesaler
Gum resin collection	60	0	0	32
Gum resin assemble	0	32	42	68
Sorting and cleaning	40	68	58	0
Total	100	100	100	100

Table 2. Price of Gum Resins along the Market Chain

Market player	Buying Price per kg (Ksh)			Selling price per kg (Ksh)		
	Malmal	Hagar	Hagar Jerer	Malmal	Hagar	Hagar Jerer
Agent	274	104	41	320	128	60
Kiosk/Shop	288	127	60	322	144	70
Whole seller	307	131	-	375	168	

Source: Field Data, 2014

The classical approach is that gum resins are graded according to colour, size, impurities, source, and shininess before being exported. Oil content and source tree species are important criteria of classification that have not been explicitly considered in the market (Kassa *et al.*, 2011). Myrrh is usually classified as either cleaned or un-cleaned. Pieces of good quality selected myrrh should be slightly sticky on breaking, rather crystalline, indicating high oil content. Myrrh contains about 3-8% essential oil, 30-60% water soluble gum and 25-40% alcohol. Hagar has four components – germacrene D (23%), furanogermacra 1, ten (15%)-diene-6-one (13.4%) and two unidentified furanosequiturpenes (18% and 11%). Other important components are curzerrenone (10.5%), germacrene B (7.4%), β-selinene (7%), furanosequiterpine (6.2%), unknown (6.0%), β-elemene (5%) and 2 methoxyfuranogerma-crane (3.1%) (Casadei and Chikamai, 2010). The quality of myrrh is judged on aroma as perceived by the prospective buyer.

Gum Resins Market Structure

The results of the concentration ratio showed the proportion of total market sales (share) held by the top 3, 4, 5 …. n wholesalers: A 4th wholesaler concentration ratio of 68% means the top 4 wholesalers account for 68% of all the sales in the industry whereas the 8th wholesaler concentration ratio of 80% means that the top 8 wholesalers account for 80% of all the sales in the gum resin sector (Table 3).

Table 3. Analysis of the Gum Resin Market Share

Wholesaler	Quantity (Tons)/Year				Mkt Share (%)	Cum Mkt Share (%)
	Malmal	Hagar	Total	Cum Total		
1	40	60	100	100	21	21
2	-	80	80	180	17	38
3	4	76	80	260	17	55
4	45	15	60	320	13	68
5	4	30	34	354	07	75
6	3	6	9	363	02	77
7	-	7	7	370	01	79
8	-	5,000	5	375	01	80
Total	96	279	375	-	-	-

% Total	26	74	100	-	-	-
Total County				450	-	-

Source: Field data, (2014)

Market share analysis results indicate that none of the wholesalers was commanding more than 25% of the market share ruling out the existence of monopoly. Firms may be investigated for monopoly power when market share exceeds 25%. There was the existence of an oligopolistic market structure with many wholesaler in the gum resin sector but dominated by a few large wholesalers. In Ethiopia, appropriate governance structures on access to resources and the marketing chain was recommended to create economic incentives for producers to responsibly manage woodlands resources (Kassa *et al.*, 2011).

Gum Resin Market Conduct

The prices for Hagar and Malmal were relatively stable across the industry, there was potential for collusion among the buyers whose behaviour was mainly affected by their rivals business activities. Hagar and Malmal were highly differentiated thus source of competitive advantage and ownership of independent transport system was prevalent. The main challenges facing Hagar and Malmal traders included low and fluctuating prices (27%), adulteration (15%), un-reliable transport system (14%) and high investment cost (11%). The other challenges were sighted as poor markets (8.1%), weak policy and legal framework (6.4%), poor tapping technologies (5.8%), exploitation by Hagar and Malmal buying agents (4.0%), inadequate storage facility (2.9%), insecurity (2.3%), declining vegetation cover (2.3%) and lack of appropriate tapping tools (1.7%).

Gum Resin Market Performance

The market performance for Hagar and Malmal was analyzed in terms of investment capital and Gross Profit Margin (GPM) among the collectors, buying agents, retailers and wholesalers. The initial start-up capital was raised from own savings (83%), donations from friends and relatives (2%), retained profits (8%) and livestock sales (6%). The capital required was largely dependent on the scale of operation. The wholesaler required the largest amount of an average investment capital of Ksh. 1 million. The buying agent and duka owners required an average of Ksh. 100,000. The buying agents were mostly financed by the wholesalers for an exchange with a commission. The main barriers included high level of secrecy among wholesalers and exporters on information on international markets and prices and insecurity in the region attributed to inter-clan resource use conflict and the Al-Shabab insurgents.

The GPM was assessed at three levels: duka owner, agent, and whole sale level. The GPM was based on handling a kilogram of gum resin. The GPM of Malmal was 5%, 8%, 12% and 15% for collectors, duka owners, agents and wholesalers (Table 4). These results compare well with earlier studies which put the profit margin at 12.1% and 15.9% for duka owners and whole sellers respectively (Chikamai and Odera, 2002). The producer price and gross profit margins varied depending with the type of gum resin. For example, in Ethiopia, the marketing of Tigray type frankincense accounted for more than 90% of the total export volume of gum resins in 2010. A preliminary marketing margin analysis for the shorter marketing channel of Tigray type frankincense indicated that a non-cooperatives producers did not benefit from higher export prices in 2010, as their share of the marketing margin remained low (34.5% in 2007 and 19.1% in 2010) compared to the cooperative exporters' share of the marketing margin at 41.1% and 31.4% in 2007 and 2010, respectively (Kassa *et al.*, 2011). The whole sellers paid cess to the County Government of Wajir to transport their products to Nairobi thus reducing their GPM. Better prices were assured as a result of maintaining high quality gum resin. Hagar was highly adulterated by the duka owners and buying agents. The adulteration and low volume

might have contributed to low GPM duka owners and buying agents as compared with the wholesalers. GPM was 16%, 12%, 5% and -8% for Hagar wholesalers, buying agents duka owners and collectors respectively (Table 5). Earlier studies put the margin at 30.40% and 47.0% for duka owners and wholesalers respectively (Chikamai and Odera, 2002). The low profits margin was attributed to adulteration, underpricing of the commodities by the dealer and the weakening Kenya shilling against the dollar. Kenya Forest Service (KFS) was responsible for the issuance of the commodity movement permit, collection of revenue and participate in monitoring the tapping of Malmal to ensure sustainable exploitation.

Transportation off Gum Resins

Hagar or Malmal was transported using donkey cart (4%), lorry (75%) and bus (21%) from the woodland. One donkey cart could carry an average of five bags (242 kg) on average at a cost of Ksh. 100 per bag. A lorry could carry 56 bags (2805 Kg) while a bus was limited to an average of seven bags (338 Kg) per trip at an average price of Ksh. 200 per bag. The transport cost was high due to the poor state of roads in the study area. A whole seller made two trips by lorry in a month to Nairobi with a minimum load of 20,000 Kg at an average cost of Ksh. 55,000 per trip. It is envisaged that the opening of Lamu port will provide a cheap access to the export market. The results of a linear regression analysis gave a goodness of fit value of 28.9% while an ANOVA analysis was significant at 95% confidence interval. The model shows that the constraint on policy and legal framework was highly significant while adulteration was significant at 90% confidence interval (Table 6). The VIF factor of less than 2.5 and Tolerance factor greater than zero show weak presence of multi-collinearity.

Table 4. Analysis of Malmal Gross Profit Margin (1 kg)

Factor	Item	Collector	Duka owner	Agent	W/saler
Return	**Selling price/kg**	289	322	320	375
Investment	**Opportunity cost/Kg**	200	288	274	307
	Food/water	65	0	0	0
	Equipment	4	0	0	0
	Cleaning/sorting	2	2	2	2
	Packaging	1	1	1	1
	Loading	1	1	1	1
	Movement permit	0	0	0	1
	Cess-fee	0	0	0	1.2
	Transport	2	4	4	3
	Off-loading	1	1	1	1
Total investment	-	276	297	283	317
GPM (%)	-	5	8	12	15

Source: Field data, (2014) GPM = Gross Profit Margin

Table 5. Analysis of Hagar Gross Profit Margin (1kg)

Factor	Item	Producer	Duka owner	Agent	Wholesaler
Return	**Selling price/kg**	98	144	128	168
Investment	**Opportunity Cost/Kg**	30	127	104	131
	Food/water	65	0	0	0

	Equipment	4	0	0	0
	Cleaning/sorting	2	2	2	2
	Loading	1	1	1	1
	Packaging	1	1	1	1
	Transport	2	4	4	3
	Movement permit	0	0	0	1
	Cess-fee	0	0	0	1.2
	Off-loading	1	1	1	1
Total Investment		106	136	113	141
GPM (%)		-8	5	12	16

Source: Author, Field data, (2014); GPM. = Gross Profit Margin

Table 6. Linear Regression Model on Constraints Influencing Marketing

Model	**Un-standardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**Collinearity Statistics**	
	β_0	**SE**	**β_i**			**Tol.**	**VIF**
(Constant)	113.84	108.11		1.05	0.30		
Investment cost	-34.92	120.40	-0.03	-0.29	0.77	0.87	1.15
Transport	-7.41	104.82	-0.01	-0.07	0.94	0.87	1.15
Storage	22.86	230.68	0.01	0.10	0.92	0.69	1.46
Markets	-47.83	130.85	-0.04	-0.37	0.72	0.93	1.07
Over-exploitation	251.89	174.22	0.17	1.45	0.15	0.89	1.13
Tapping technology	-132.39	162.09	-0.10	-0.82	0.42	0.75	1.33
Resource use conflict	-21.12	239.49	-0.01	-0.09	0.93	0.79	1.27
Policy Issues	522.37	155.00	0.41	3.37	0.00***	0.82	1.22
Un-stable prices	-19.32	110.57	-0.02	-0.18	0.86	0.81	1.24
Deforestation	-10.29	235.82	-0.00	-0.04	0.97	0.81	1.24
Adulteration	183.89	109.18	0.19	1.68	0.10*	0.91	1.10
Field gear	-57.89	298.90	-0.03	-0.19	0.85	0.66	1.51

Source: Field data, 2014 Tol. = Tolerance; VIF = Variance inflation factor, *** P<0.01, * P<0.1

Grading and Value Addition Initiatives

Hagar and Malmal grading was carried out among commodity dealers in Wajir (65%). There were no set criteria/standards on the grading of Hagar and Malmal. Grading was based on the following characteristics: method of harvesting (natural vs tapping), colour, size, shelf-life, scent and cleanliness. Three grades of Hagar and Malmal were reported with a large proportion of the commodity being of 2nd grade with Hagar (41.6%) and Malmal (41.3%), 1st grade for Hagar (6.7%) and Malmal (1.3%), 3rd grade were malmal (13.3%) and hagar (6.7%) and rest of the respondents did not respond. The grading systems for Tigray type frankincense and gum myrrh in Ethiopia have 5 grades, with grades 1 and 4 having each two subgrades. It is assumed that there is considerable difference in grades between gum resins for export and those for the domestic market. The three best grades of gum olibanum are exported while grade four products are exported to some countries such as China. The rest is sold in the domestic market (Kassa *et al*., 2011). Best bet practices in the grading of gum resins can be adopted in Kenya. The gum resin harvesting and value addition technologies have remained largely unchanged for decades thus the need to embrace new technology. Value-adding activities are limited to cleaning, sorting and grading. Attributes considered in grading gum resins are size, colour, source area and content of impurities. Kassa *et al* (2011) recommends that there is need to consider other attributes as tree species and oil content. Value-added processing in the country of origin offers modest gains in foreign exchange for the national

economy and employment. The ultimate product from gum myrrh and opoponax is essential oil. Value addition undertaken by the various market players includes cleaning and sorting, packaging and storage. The collectors, duka owners and wholesalers were occupied with cleaning and sorting (100%), packaging (8%) and storage (50%) respectively while it awaits transportation to either Nairobi or Mombasa for export to China (37.0%), Vietnam (20.2%) and the rest of the world (43.8%). The market players would like to see their primary products processed into essential oils for higher returns in the form of foreign exchange earnings and employment opportunities.

In Kenya, processing of gum resin is carried out by three organizations namely the Kenya Industrial Research and Development Institute (KIRDI), Luban Chem based in Nairobi and Arbor Oils of Africa in Naru Moru, Nanyuki. The common method of oil extraction is by steam distillation (Chikamai and Kagombe, 2002). Steam distillation (Figure 4) is the most efficient and cost-effective way of extracting essential oil, an ingredient in the manufacture of perfumes. The gum resin production plant in Wajir town is still under construction. The plant targets the international market where essential oil from C. myrrha fetches an average of US$1900 per kg. Therefore, the price of raw Malmal in Kenya is valued at US$ 95 per kg assuming a recovery of 5% (Caiger, 2014). Myrrh is highly valued for its aromatic fragrances which are common ingredients in incense, perfume, soaps, detergents, creams and lotions and often included in meditation blends (FAO, 1995). Frankincense and myrrh are still widely used therapeutically in regions ranging from North Africa to China (Krieglstein, Anthoni, Rijcken, Laukötter, Spiegel and Boden, 2001) and especially in the traditional Ayurvedic medicines of India, Arabia and China as well as in Ethiopia and Somalia (Farah, 1994; Mulugeta *et al*., 2003). The Gum Arabic and Resin Association (GARA) coordinate and spur development of the gum resin sector in the country. GARA is a useful body for advising: the government goals on formulating enabling policies; producers on sound production and quality control practices; and traders on good business practice for the benefit of the domestic and export markets. Value addition has been constrained by capacity in acquisition of value addition technology. Steam distillation unit and purchase of raw materials require huge financial investment beyond the reach of many local communities.

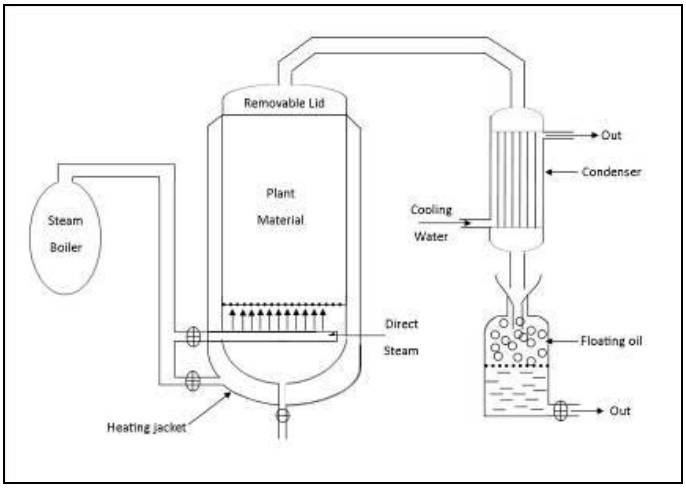

Figure 4. An illustration of an essential oil extraction unit (KIRDI, 2015)

Employment Opportunities

The informal sector has the potential to create employment opportunities in livestock production, gums resins collection and business. Hagar and Malmal supply chain directly or indirectly employ a number of local people: collectors, transporters, buying agents, wholesalers and retail traders. There are plans to start processing gum resins

locally through steam distillation. Currently, a small percentage of the local people find employment in the formal sector due to low literacy levels and traditional way of life dependent on pastoralism. A few youth find employment in the gum resin stores especially in Wajir town and among commodity duka owners in the market centres. The wholesaler employs double the persons employed by either the buying agent or retailers. Each Hagar or Malmal buying agent, duka owner and wholesaler employs an average of 13, 15 and 28 people respectively. The range of employees varies between 11 and 150 people along the supply chain per market centre. The Wajir gum resin plant is expected to create 1,000 direct and 15,000 indirect job opportunities (ENNDA, 2011). The finding of this study show that the current direct employment opportunities in the gum resin sub sector in Wajir County stands at 120,000 job opportunities. In Ethiopia, women clean, sort and retail gum resin after buying from large retailers, indicating the importance of this activity for the disadvantaged in society (Kassa *et al*., 2011).

CONCLUSION

The gum opoponax and myrrh market exhibit an oligopoly market structure which is characterised by market information distortions. Adulteration and producer price of Hagar influenced the quantity traded on the international market. Wajir County contributes about 25% of the national gum resin export volume. Hagar contributes about 70% of the gum resin volume from Wajir County. It is therefore recommended that: we adopt value chain marketing approach; strengthen local and international market information system on gum myrrh and opoponax supply, demand and prices; link commodity dealers to credit facility, ensure participation of local commodity dealers and other stakeholders in coding, quality control and standardisation of gum resins; and assess the cross border trade in gum resins and assess. There is need to improve the profits of producers as an incentive to woodland resource management, which have vital environmental and ecological benefits. Encourage producers and exporters to form cooperatives and associations for increased supply of high quality products while ensuring value addition and improved bargaining power.

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