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COTTON AND ITS BY-PRODUCTS

in Tanzania

ANALYSIS OF COTTON BY-PRODUCTS SURVEY

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in partnership with UNECA and COMESA

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While due care was taken in compiling this report, any errors and omissions remain the author's responsibility.

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Acronyms

CDTF	Cotton Development Trust Fund
COMESA	Common Market for Eastern and Southern Africa
CTT	Cotton Textile Technology
ECGA	Eastern Cotton Growing Area
KG	Kilograms
MoU	Memorandum of Understanding
SPSS	Statistical Package for Social Science
TACOGA	Tanzania Cotton Growers Association
TAREA	Tanzania Renewable Energy Agency
TCA	Tanzania Cotton Association
TCB	Tanzania Cotton Board
TCT	Tanzania Cotton Traders
UNCTAD	United Nations Conference on Trade and Development
VOIL	Vegetable Oil Industries Limited
WCGA	Western Cotton Growing Area

1. Introduction

This document is an analytical report of a cross-section survey of the various actors in the cotton and cotton by-products value chain in Tanzania. It examines the main characteristics of the actors and the key features of the business environment in the industry. The report is presented in nine major sections. The introductory section contains an overview of the state of cotton and cotton by-products in Tanzania, potential opportunities for development, and the objectives and methodology of the survey. Section two covers the main characteristics of respondents in the cotton and cotton by-products value chain. Section three presents the key criteria in each value chain actor's decision to invest or not invest in cotton by-products. Section four presents the cotton production environment in Tanzania. In section five, the report assesses each cotton by-product and its market. The analysis of the price, cost drivers and profit margins is presented in section six. The report analyses the comparative advantage of Tanzania in cotton products in section seven; while section eight discusses the main impediments affecting the development of the cotton industry in Tanzania. Lastly, section nine proposes recommendations for boosting development of cotton by-products in Tanzania.

Unless indicated otherwise, the survey findings presented in this report are the source for the figures and tables included in this study.

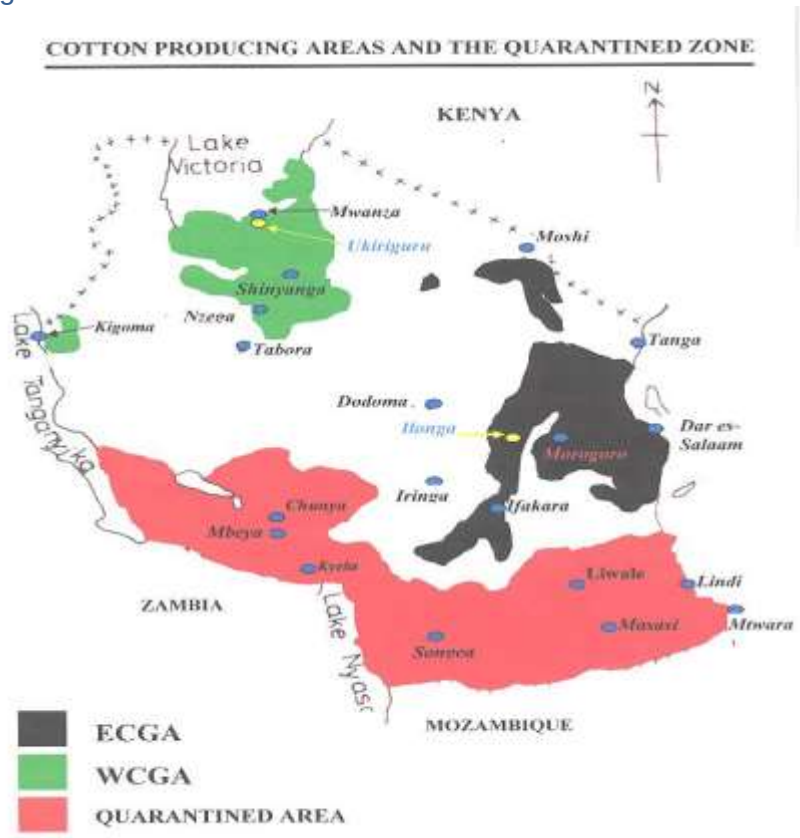
1.1 Cotton Production in Tanzania

Cotton is a cash crop that generates income and welfare for over 250 million farmers across the globe. In Tanzania, cotton is a strategic crop, as it contributes substantially to export revenues and employment in the country, as well as to farmers' incomes in the two cotton-growing zones, namely; the Western Cotton Growing Area (WCGA) and the Eastern Cotton Growing Area (ECGA). Figure 1 shows Tanzanian cotton production by region both the WCGA and ECGA. The WCGA consists of the administrative regions of Shinyanga, Simiyu, Mwanza, Mara, Geita, Tabora, Kigoma and Singida and accounts for 97-99% of the total cotton production in the country. The ECGA includes Manyara, Morogoro, Coast, Kilimanjaro, Tanga and Iringa regions and accounts for the remaining 1-3% of cotton production. Shinyanga and Mwanza are the two largest cotton-growing regions in Tanzania.

Cotton is grown predominantly by smallholder farmers in Tanzania. The size of cotton farms ranges from 0.4 to 40 hectares, and averages 1.5 hectares with a yield of about 750kg of seed cotton per hectare. The smallholder farmers use limited amount of inputs including seeds and pesticides, with the majority of them using hand hoes and animal tracking for tillage. Also, they tend to make their farming decisions on the basis of the previous season's prices and rain patterns, as cotton cultivation is rain-fed in Tanzania. Because of the fluctuations of cotton prices, some farmers tend to move in and out of cotton cultivation by planting competing crops such as green peas and sunflower that sell at higher prices at the end of the previous season. Consequently, the total cotton-sown area fluctuates from 350,000 to 450,000 hectares per season, with corresponding effects on the total harvest. For example, during the 2012/2013 season, 89,619 MT of cotton lint was produced from

420,000 hectares of land; and during the 2015/2016 season, about 44,132 MT of lint was produced, representing around half of the 2012/2013 cotton harvest.

Figure 1. Tanzania Cotton Production Zones



Source: Tanzania Cotton Board

1.2 Cotton By-products: An overview

Although cotton is primarily grown for lint, several cotton by-products can be derived to increase value added in the sector and benefit actors such as farmers, ginners, oil millers and other downstream actors. Cotton by-products include: cottonseed oil used for human consumption and soap manufacturing; cottonseed cake used for animal feed; and waste used for industrial applications, such as polishing clothes and wipers. In addition, cotton stalks can be used in the production of: pellets and briquettes for heating; mushrooms; compost; manure; particle board; pulp, paper and corrugated boxes.

Once the seed cotton is delivered to the ginnery, the ginner separates the seed from the lint (fibre). In general, one ton of seed cotton yields between 350 and 400 kilograms of lint cotton and 600 to 650 kilograms of cottonseed. Cotton lint is sold to local and foreign spinners who process it into yarn and textiles. Apart from clothing, lint is used in the manufacture of industrial products such as ropes, bags, lining for tires, canvas tents and medical bandages. Some seeds are then crushed into cottonseed oil while others are delinked and used as planting seed. Some ginners have only ginning equipment; others have integrated oil milling into their business. These integrated ginner-millers compete with specialized oil milling firms, such as Vegetable Oil Industries Ltd (popularly known as VOIL) and Dehong Oil Mill (Kabissa, 2016). The specialist oil mills source cottonseed from ginners. Crushed cottonseed is processed into crude cottonseed oil which is then refined into edible cooking oil. Often, cottonseed oil is used for deep frying, and for some margarines and salad dressings, as well as for making products such as soap, emulsifiers, cosmetics, pharmaceuticals, rubber, paint, water proofing agents and candles.

In the process of cottonseed oil extraction, several other cotton by-products are generated. One of these is cottonseed cake from oil expression. As it is a protein-rich feedstock, cottonseed cake is often used as a source of protein for livestock, particularly dairy and beef cattle, goats and sheep. The cake is not good for non-ruminants as it contains the enzyme gossypol, which inhibits absorption of nutrients; but technologies for removing the enzyme gossypol from the cake are available. Hulls are another by-product that is a valuable feed source for livestock when blended with the cake to provide roughage. In addition to the use of hulls for stock feeds, they can be used for fertilizer, bran or pulp.

Short, fine or curly fibres, called linters, typically less than 3mm long, remain on the cottonseed after the ginning process. These can be processed into various by-products such as pulp, bandages, ear buds, cotton balls, pads and cushion material. Cotton linters can also be processed into medical grades of absorbent cotton wool. They are also used in the manufacture of paper, such as securities, archival paper and bank notes, as well as a raw material in the manufacture of cellulose plastics.

In volume terms, cotton stalks are the major by-product of the cotton farming process, representing potential source of additional income to farmers after the sale of seed cotton. Apart from chopping and condensing cotton stalks into briquettes for domestic heating, they can also be processed into particle and hard boards used in housing construction. Studies have shown that cotton stalks are comparable to most species of hardwood. Cotton stalks therefore have considerable potential to be used as an alternative raw material for the manufacture of valuable products such as: particle boards, pulp and paper, hard boards, pellets and briquettes for heating, mushrooms, compost, manure, corrugated boards and boxes.

1.3 Potential Income Generation from Cotton By-products

The potential of cotton by-products to contribute to increased income-generating capacity within the cotton sub-sector has been noted by several researchers. For example, Tschirley *et al* 2009 showed that cottonseed by-products such as oil and cake represented up to 30% of the total value of seed cotton in most Sub-Sahara African countries. This suggests that focus on domestic value addition to lint and fuzzy seeds will reduce farmers' exposure to volatile international lint prices. The more the seed cotton price paid to farmers as the result of the value-added activities, the more farmers are uncoupled from international prices.

Furthermore, making full use of cotton by-products will not only bring economic benefits and additional income to small cotton producers, but would also help to reduce the sector's adverse environmental impacts, such as carbon dioxide and insect infections. For example, burning cotton stalks in the field releases large amounts of greenhouse gases; and leaving cotton stalks with unpicked bolls carries over pests from one year to the next. As such, proper use of cotton stalks can significantly contribute to reduction of carbon dioxide and prevention of insect infection and related problems.

While cotton by-products have considerable potential to increase the income of producers in the value chain in Tanzania, several challenges have been identified in the literature, particularly in the paper by Joe Kabissa (2016) – "Cotton and its by-products in the United Republic of Tanzania". One of the challenges identified is the falling volume and quality of seed cotton production in the WCGA. The report showed that almost half of the 79 registered ginners in Tanzania, during the study in 2016, remained inactive due to various reasons; such as shortage of seed cotton, high processing costs due to low ginning capacity utilization and technological obsolescence. The report indicated further that another challenge that constrained the development of cotton by-products, in particular cottonseed oil, was competition from cheaper imported palm oils and other edible oils produced locally (e.g. sunflower). Other challenges to the development of the cotton by-products sector included lack of linkages between sectors and likely disincentives to invest in the sector.

1.4 Unlocking Opportunities in the Cotton Value Chain: On-going Initiative by UNCTAD and COMESA

While there is considerable potential for cotton by-products to generate complementary source of revenue, such a potential is generally overlooked, and these markets are underdeveloped. Numerous reasons have been mentioned to account for this underdevelopment of the cotton by-products. These include lack of adequate input support to smallholder farmers, lack of adequate downstream infrastructure; shortage of enabling policies and institutions to support the development of cotton by-product industries; poor market information on cotton by-products; and lack of data to assess the economic viability of investment opportunities in cotton by-products industries.

Considering the vital economic and environmental benefits that can be generated from adding value to cotton by-products, the secretariat of the Common Market for Eastern and Southern Africa (COMESA) considered the development of cotton by-products as one of its priority activities in its Regional Strategy for Cotton-to-Clothing Value Chain.[1]

The United Nations Conference on Trade and Development (UNCTAD) and its regional partners COMESA and the United Nations Economic Commission for Africa (UNECA) recognize that the existing number of cotton by-product processing units in the Eastern and Southern Region of Africa is small. In order to increase the value addition of cotton by-products, it is important, as a first step, to objectively assess their local and regional value chains. This undertaking implies a need for a detailed analysis of the logistic supply chain as well as primary production and processing of cotton by-products. Moreover, it is crucial to examine the marketing conditions, including current and potential markets for processed cotton by-products. Also, it is important to design appropriate policies and incentives to attract investment and fully explore the potential of cotton by-products. These requirements are the basis of this study, which contributes to bridging the existing statistical gap on cotton by-products in Tanzania. This constitutes the major constraint for assessing the economic viability of cotton by-products and developing effective policies to promote their sustainable commercialization.

1.5 Objectives of the Report

The overarching objective of this report is to present the analysis of the factors affecting the value chain of the cotton and cotton by-products in Tanzania. More specifically, the report seeks to bring out the following:

i. Producers' demographic and income profiles;
ii. The key criteria in each value chain actor's decision to invest or not in cotton by-products;
iii. The main impediments to the development of cotton by-products in Tanzania;
iv. The infrastructure, including technologies, available at each activity step of the value chain;
v. Producers' margins and cost drivers;
vi. The perceptions, mind-sets and views of each value chain actor about the development of cotton by-products.
vii. The incentives that would motivate farmers, ginners, spinners and other actors to develop cotton by-products.

1.6 Approach and Methodology

General Approach

Implementation of the survey on cotton and its by-products involved close collaboration with key cotton-sector stakeholders in Tanzania to get the documents and all secondary literature and information required to inform the study. The cooperation started during the inception stage and continued throughout the implementation of the study. Desk reviews for the study included, among others, the documents on cotton and its by-products in the United Republic of Tanzania, regional

[1] http://unctad.org/en/PublicationsLibrary/suc2017_Regional_COMESA_Strategy.pdf

strategy for cotton to clothing value chain, and the 2016 – 2020 United Republic of Tanzania cotton to clothing strategy. Collection of qualitative and quantitative information involved interviews and discussions with stakeholders in the cotton industry.

Semi-structured questionnaires were used to collect data on the cotton sector's development impediments; perceptions, mind-sets and views of the different stakeholders; key criteria the stakeholders use in deciding to invest or not invest in cotton and cotton by-products; and incentives that would motivate the stakeholders to develop cotton and cotton by-products. Interviews dwelt on self-explanation and narrations from each respondent on the issues patterning to the survey. The study team recorded the interviews; the practice which significantly helped to save time and captured information for a rich analysis report.

Selection of the Respondents and the Interview Secessions

The survey questionnaires, specific for each category of respondents, were administered to selected respondents as follows: Small, medium and large-scale cotton farmers (95 in total) in the proportion of 60%(57), 26%(25), and 13.7%(13), respectively; cotton ginners (some of these have integrated production of cottonseed oil in their operation), producers of cottonseed oil and cotton feed stocks (cotton meal/cake). Other respondents included representative stakeholders from various cotton and cotton by-products value chain associations including the Tanzania Cotton Growers Association (TACOGA), Tanzania Cotton Association (TCA), Cotton Development Trust Fund (CDTF), and Tanzania Cotton Board (TCB). In addition, interviews and discussions were carried out with key and informative persons from the Ministry of Industry of Trade and Investment. The list of the study respondents is attached as Appendix 2.

The selection of cotton farmers involved the size of their farms, categorized as small (with land size less than 5 hectares), medium (with land size from 5 to 10 hectares) and large-scale farmers (with land size above 10 hectares). The selection of these farmers was informed by the key informants from their associations. The distribution of all the interviewed farmers by regions is given in Appendix 3 of this report.

By its design, the survey intended to interview all the main firms (about 44) in the cotton by-products value chain; but during implementation, it was only 24 which were operational and reachable. The full list of the cotton ginning and oil milling companies existing and those surveyed are listed in Appendix 1 of this report.

Preparation of the Survey Report

The survey team travelled and reached the respondents in their locations (working areas) for interviews and physical assessments. Therefore, the farmers were interviewed in their farms while the firms engaged in the cotton value chain were interviewed in their factories/offices. The interviews involved substantial open-ended information in order to capture qualitative information comprehensively and adequately. As such, post coding was carried out after the survey to systematize the data entry and data files. The ultimate data files (for farmers and the processors in cotton by-products) were processed and analysed in SPSS (Statistical Package for Social Scientists).

2. Main characteristics of respondents in the cotton and cotton by-products value chain

2.1 Farmers

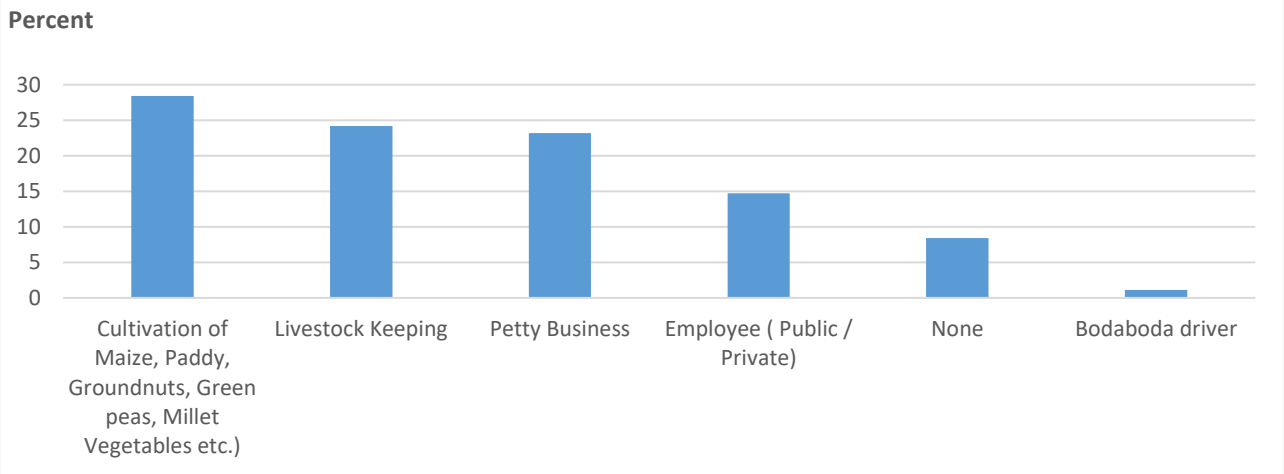
Of the 95 farmers interviewed in the survey, 85 were males while 10 were females. The distribution of the respondents in Table 1 shows that all age cohorts of adults are involved in production of seed cotton: youths represented 28.4%, middle age adults 58%, and those above 60 years were 10% of respondents. All the farmers interviewed in the survey were adults, with majority of them being males.

Table 1. The Survey Respondent Farmers by Age Categories

Age categories	*Counts*	*Percent*	*Cumulative Percent*
Youth 18 - 35 years	27	28.4	28.4
Middle age 36 - 45 years	29	30.5	58.9
Middle age 46 - 60	29	30.5	89.5
Above 60	10	10.5	100.0
All	95	100.0	

In terms of membership in associations, 40% (38) of the interviewed farmers are members in at least one of the 18 associations listed in Appendix 4 of this report. The majority of the respondents (60%) are unaffiliated with any farmers' association. The pattern of the membership does not show any dominant association (i.e. with many members); the range is between 1-7 members.

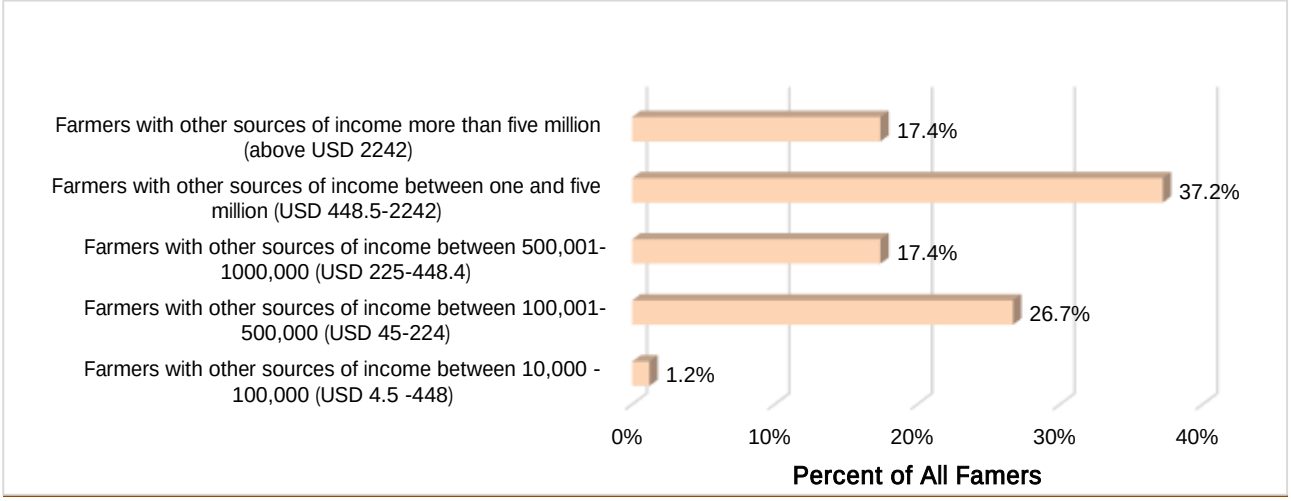
Figure 2. Percent of Farmers Indicating Involvement in Alternative Sources of Income



Cotton farming is not solely carried out as a source of livelihood for households; farmers have other economic activities in which they are engaged in as parallel sources of income. In Figure 2 there are several other activities indicated by farmers as alternative sources of income. As would be expected in the respective regions, cultivation of other crops is the leading (28.4%) side or parallel activity with cotton farming. This is followed by livestock keeping, petty business and hired employment. In fact, more than 90% of the respondents are engaged in more than one economic activity including cotton farming.

Household annual income earned from cotton farming averages TZS 2,007,727 (USD 900) while that from other sources is TZS 2,162,329 (USD 970). As such, generally, about 50% of household income is earned from cotton farming. As indicated further in Figure 3, the majority of households earn between one and five million Tanzanian Shillings (i.e. between USD 449 and 2,242). About 17.4% of the cotton farmers who are included in the survey earn income above TZS five million (USD 2,242) from other sources. The results showed a high dependency on cotton farming as a source of livelihood.

Figure 3. Cotton Farmers' Income from Other Sources



Analysis of the years of engagement in cotton farming by the respondent farmers show that majority of them (76.3%) have been cultivating cotton for more than five years, as shown in Figure 4 and Table 2. They therefore have long time experience with seed cotton production; and more so, are the large and medium scale farmers in the survey.

Figure 4. Farmers' years of experience with cotton farming

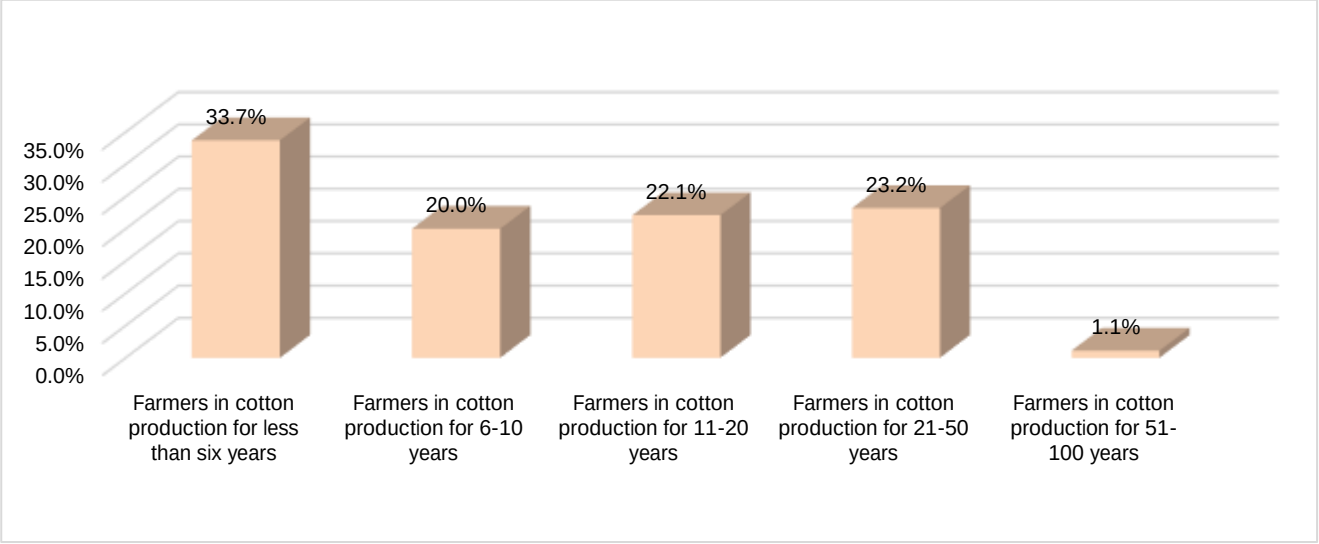


Table 2. Farmers' Total Years of Engagement in Cotton Farming

Category of Farmers	Type of Farmer			All
	Small	Medium	Large	
Farmers in cotton production for less than six years	43.9%	20%	15.4%	33.7%
Farmers in cotton production for 6-10 years	22.8%	16%	15.4%	20%
Farmers in cotton production for 11-20 years	17.5%	32%	23.1%	22.1%
Farmers in cotton production for 21-50 years	15.8%	28%	46.2%	23.2%
Farmers in cotton production for 51-100 years		4%		1.1%

Source: Cotton Farmers' Survey Data 2017

2.2 Producers

The surveyed firms in the cotton industry sector produce eight cotton by-products including the following: cottonseed, cottonseed cake, linters, husks, extra fabric, thread, cottonseed oil for cooking and making soaps. These are categorically the by-products of cotton currently produced in Tanzania.

Figure 5 and Table 3 present the list of the cotton by-products produced in Tanzania, the ranking of each product by the respective producers, and the total number of producers producing each of them. In total there are eight by-products for which the leading by count of the producers involved, are cottonseed (18 or 75% of the surveyed firms) – and its derivatives, cottonseed cake (9 or 37.5%), and cottonseed oil (12.5%). The term "cotton by-products" does not include lint, which is the major product or output of cotton ginners. As such, the by-product ranked first by many of the firms is cottonseed, followed by cottonseed cake and cottonseed oil. Many of the firms, particularly ginners, have more than one by-product; implying that they also produce linters, cottonseed, and even cottonseed oil and husks sometimes. As such, it becomes tedious to separate their by-products from the core business or product of the respective firm.

Figure 5. Firms Producing Cotton By-products (Percent, n=24)

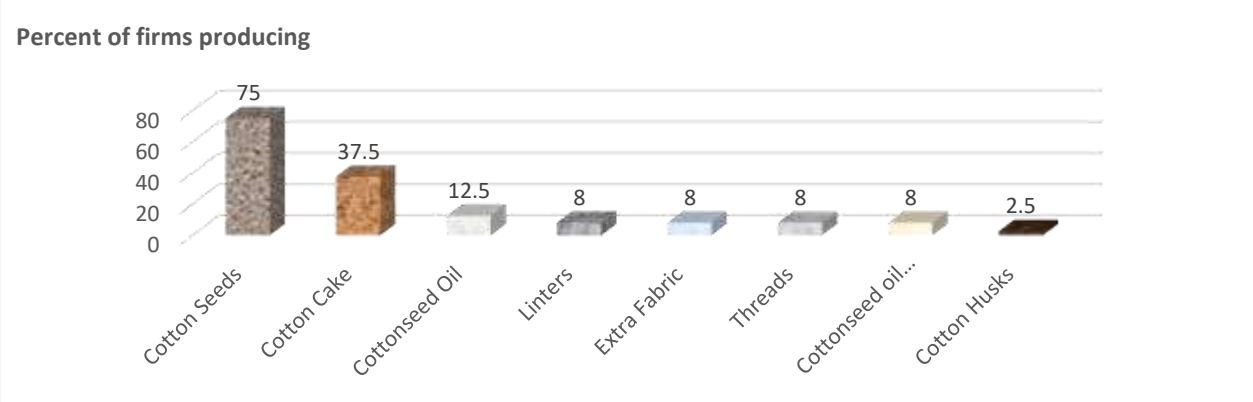
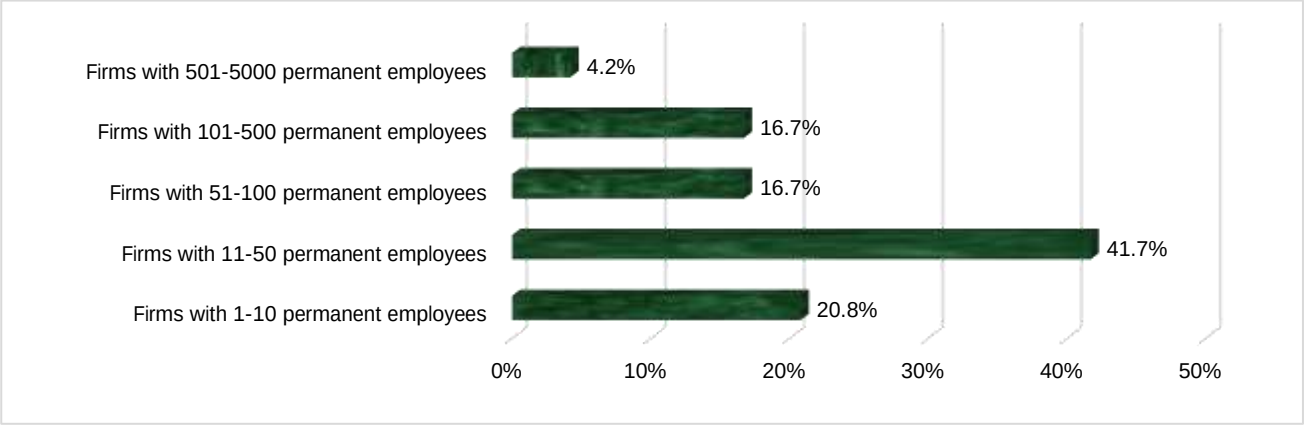


Table 3. Cotton By-products Currently Produced in Tanzania and the Number of Firms Involved

S/N	Product	Firms indicating 1st product		Firms indicating 2nd product		Firms indicating 3rd product		Firms indicating 4th product		**Total for each Product**	
		Counts	Percent	Counts	Percent	Counts	Percent	Counts	Percent	**Counts**	**Percent**
1	Cottonseed	16	66.7	2	8.3					**18**	**75**
2	Cottonseed Cake	3	12.5	6	25	2	8.3	1	4.2	**9**	**37.5**
3	Cottonseed oil			2	8.3	1	4.2			**3**	**12.5**
4	Linters	2	8.3							**2**	**8**
5	Extra Fabric	1	4.2			1	4.2			**2**	**8**
6	Threads			1	4.2					**2**	**8**
7	Cottonseed by-product for making soaps					2	8.3			**2**	**8**
8	Cotton Husks	1	4.2	1	4.2	3	12.5	1	4.2	**6**	**2.5**

Analysis of the size of firms engaged in the cotton value chain in Figure 6 shows that 41.7% of respondents' employ between 11 and 50 permanent employees; about one third of them employ between 51 and 500 permanent employees. The proportion employing more than 500 hundred workers is 4.2%. Many of the firms engaged in the cotton value chain are ginners; they buy seed cotton from farmers as their main activity.

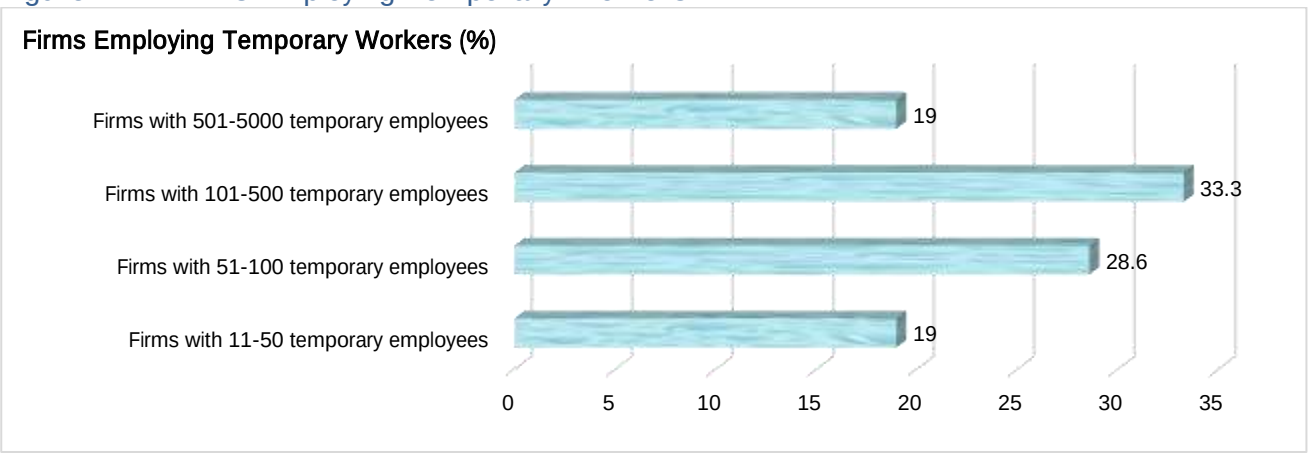
Figure 6. Firms Employing Permanent Workers



Ginners have established several warehouses and therefore employing a good number of people to reach out the farmers in villages. Practically, Ginners have two categories of workers; those working in the field to buy and collect seed cotton and those working in the factories which separate lint and seeds. Therefore, as indicated earlier, of the 24 firms interviewed in the survey, 18 produce cottonseed as one of their by-products.

Essentially, ginning activities and the associated products are seasonal in nature – as they operate during the cotton harvest season. As such, 21 of the 24 firms interviewed employ temporary workers. Figure 7 depicts the percentage distribution of the 21 respondents by the number of temporary workers they employ.

Figure 7. Firms Employing Temporary Workers



The results of the analysis of temporary employment show that firms employ more temporary workers than permanent ones. About 19% employ between 501 and 5000 during cotton season. In general, the cotton industry is one of the sources of employment for both permanent and temporary workers.

3. The key criteria in each value chain actor's decision to invest or not in cotton by-products

3.1 Motives to invest in the cotton sector

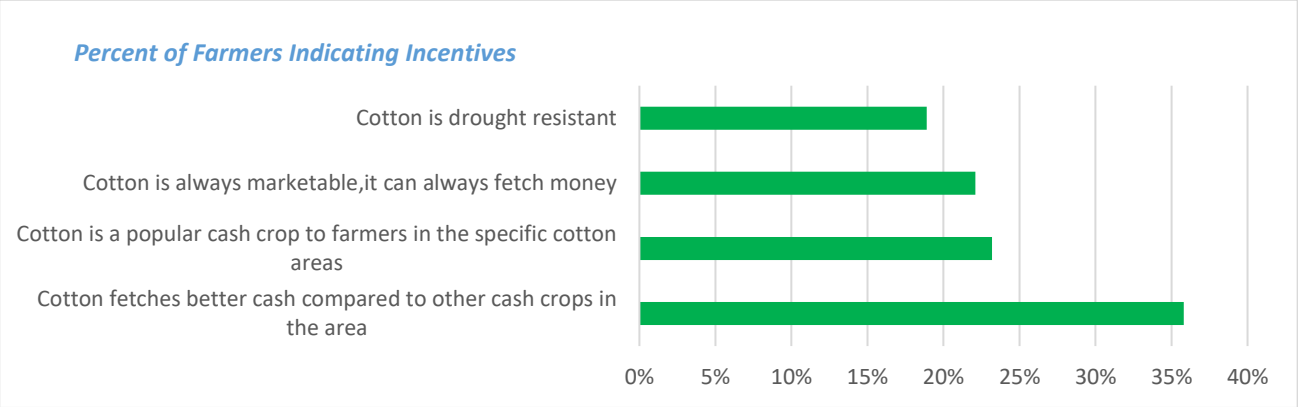
Cotton farming

The survey sought to determine the criteria which influence investment in the cotton sector at each stage of the value chain. Included in the respondents of the survey were cotton farmers who are the primary actors as producers of seed cotton. The main motives for farmers to invest in the sector, as enlist by them during the survey are shown in Figure 8. Unlike other crops, cotton is seen by the

farmers as high value cash crop with reliable market and good earnings. As indicated later in the report in Section 6.3, the price margin for seed cotton farmers was 0.56, labour costs inclusive, for the last season. The estimated average gross profits (labour costs inclusive) was TZS 1,377, 500 (USD 618) per hectare last season. As indicated earlier, on average a farmer earns TZS 2,007,727 (USD 900) annually from cotton growing and TZS 2,162,329 (USD 970) from other sources. Therefore, about half of household income comes from cotton growing. As such, farmers have traditionally continued with production of seed cotton alongside other economic activities as a major source of livelihood.

In comparison with incentives to invest in alternative crops, farmers outlined four main reasons as to why they still prefer growing cotton. As indicated in Figure 8, the main reason is that cotton generates better incomes than other cash crops such as green peas, sunflower and orange-fleshed sweet potatoes. Other reasons include marketability and thus easiness of cotton to fetch cash, popularity of cotton farming in the growing areas, and that cotton is a drought-resistant crop.

Figure 8. Farmers Indicating Incentives to Grow Cotton (%)



The survey also asked farmers to indicate whether their farming activities required working capital; and if so, whether they have access to sources of credit or financing. Of all the 95 respondent farmers, 96.8% responded that their cotton farming activities required working capital; and of those in need of capital, it is 44.6% who have access to credit. By implication, 55.4% of farmers who need credit facilities do not have access to them. Therefore, farmers proposed several policy-related interventions for improving seed cotton production in Tanzania. These include, with the proportion of farmers indicating the support in bracket, delivery of seeds and insecticides before the season starts (11.6%), restructuring of the Farmers' Union (2.1%), arranging for delivery of inputs at the right time (12.6%), introduction of credit schemes for cotton farmers (7.4%), ensuring that the price paid to farmers reflects the market price (27.4%), avoidance of middle men (6.3%), and capacity building of farmers (8.4%).

To a large extent, the interventions proposed by farmers are related to the performance of their Cooperative Unions. These have performed poorly, resulting in inefficiencies that affect farmers' productivity and profitability. Supply of inputs to farmers has been worsening over time while the Unions have not paid relatively good prices to farmers. The existence of middle men seems to worsen the situation – according to the farmers' views.

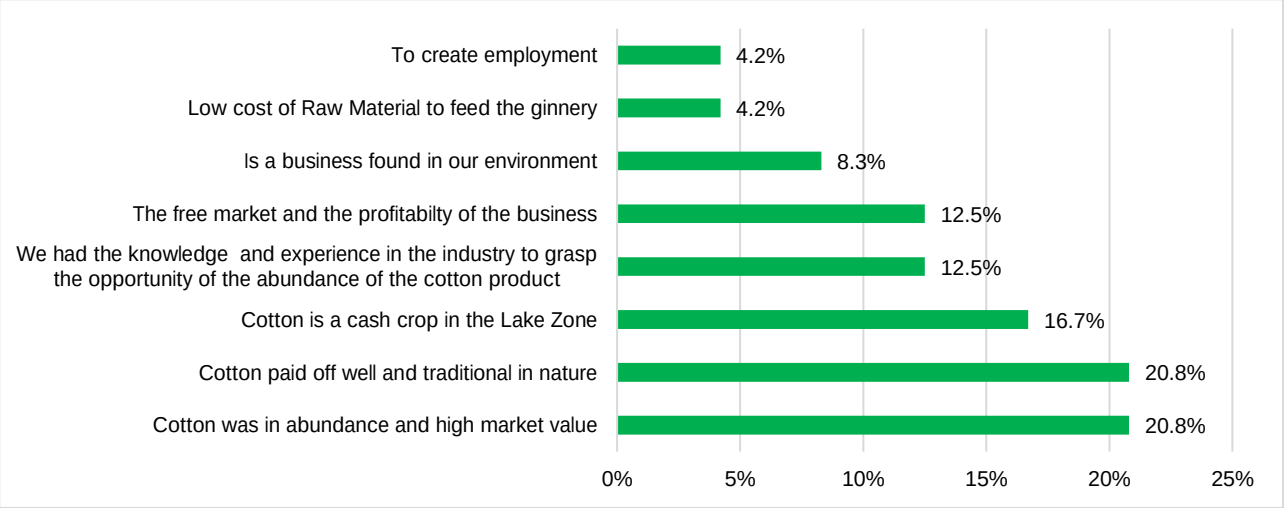
Although farmers have indicated that cotton growing is preferred to other crops, and the fact that it is relatively more marketable and profitable; total output of cotton has declined by about 50% for the past three years, as indicated earlier in this report. The decline is also observed even after the recently announced new price of TZS 1200 (USD 0.54) per kg, which sparked complains from ginners. The cause of the observed decline in seed cotton production, according to the survey respondents, is twofold; one is inputs-related problems and the other is post-harvest management of storage, pricing, marketing, and timely payments to farmers.

As shown later in this report, there is a general problem with availability of timely, adequate, quality, and appropriately priced-inputs during the cotton planting season. The weakening of the cotton farmers' cooperatives and the onset of private buyers led to a deterioration in the utilization of improved inputs in cotton farming. During the harvesting season, farmers earn income from sale of seed cotton; but not all farmers set aside funds for re-investment for the next season particularly for buying improved seeds, fertilizers, pesticides etc. And as indicated earlier, access to credit is only 45%. This reduces productivity and household income overtime – constituting a disincentive to cotton production. Under the first best scenario, a potential solution to inputs supply would be strengthening of a competitive market for private sector suppliers while ensuring that farmers have access to credit also from a competitive market of financial service providers. Unfortunately, markets for both inputs and financial services are either non-existent or very uncompetitive, especially in the rural areas. As such, given that most farmers are smallholders, the government role of strengthening and providing oversight to farmers' groups (cooperatives) in the foreseeable future, while developing competitive markets in the long term, would be the way forward towards improving input-supply for revamping cotton production in Tanzania. Therefore, the role of the public sector as the facilitator of the development of the systems and the regulator thereof needs to be effectively in place.

Producers

Producers of by-products in the cotton value chain in stated eight main incentives that made them to invest in the sector. Of those incentives, as analysed in Figure 9, the leading are two: cotton pays well and is so traditionally, and cotton was abundant and has high market value. Therefore, investors in the sector are motivated by relatively high perceived returns on investment. The investors indicated further that cotton is cash crop in the Lake Zone – making it an attractive investment. Other incentives for investing in the sector include existence of a free market and profitability of the business, investors' accumulated experience and knowledge on the business, the business being operated in the local environment, creation of employment and low cost of raw materials for the factories.

Figure 9. Firms Indicating Incentives for Investing in the Cotton Value Chain (%)



Firms' Incentives for Investing in Seed Cotton Ginning, Seed Production, Oil Milling and Production of Feedstock

Other additional reasons motivating firms to invest in the cotton sector

- *"Cotton is the main cash crop in Tanzania. In the early years the costs of production were very low".*
- *"Cotton is a big business in the Lake Zone"*
- *"We used to have very good contracts with banks. Nowadays we are losing hope as they are no longer offering these loan contracts".*
- *"Experience in the cotton sector"*
- *"Before 2013, profit from cotton was good"*
- *"It is a good business though some stakeholders do not respect it"*

The producers' responses with regard to what motivates them to invest in the cotton sector show that the sector is generally profitable, despite several challenges. The producers have continued to remain in the business because of their long-term experience, the nature of the crop itself- i.e. being well suited to the climate in the Lake Zone, and the profitability of their activities.

However, producers have expressed their concerns that costs of production are relatively high now compared to previous years; and loan contracts for the producers are increasingly becoming difficult to get. As such, profits are no longer as high as they used to be before 2013. Despite of these challenges, producers have remained in the business because of their historical and long term experience rather than profitability per se.

Also, as indicated earlier, many of the firms in the value chain produce more than one product. For example, some ginners produce lint, cottonseed, cottonseed oil, feedstock from cottonseed cake, etc. These activities are in most cases done in the same factory. With multiple products, there is potential cross subsidization in the business; so that the effect of a price change in the inputs like raw materials for the main product or a change in the product mark-up price is spread across several products. This minimizes the impact of negative price variations on the profitability of the respective firm. In addition, during the off season of seed cotton, the firms undertake to continue with processing of the by-products.

Therefore, firms which combine several business activities in the cotton value chain have relatively easy access to raw materials for their by-products than those which don't. For example, oil millers which are also ginners access their raw materials with very minimum cost; and so with feedstock cake producers who are also oil millers in that respect. Thus, promoting engagement in multiple products by the firms in the cotton value chain would increase cotton by-products and at the same time make the chain more efficient and profitable. However, distinctive products like soap making, candle making and those which require complex technologies may require establishment of a different factory.

4. Production environment

The production environment in the cotton industry refers to the conditions in which farmers and firms operate to produce cotton and its by-products in the sector. These include production incentives, availability of inputs and access, technology, infrastructural facilities, value addition processes, storage and the relationship between farmers, ginners and other processors. The survey undertook to interview selected farmers and firms in the cotton value chain to assess the conditions facing their

operations in the cotton value chain. Below, the report gives an account of the production environment for farmers and firms, respectively.

4.1 Cotton Growing

Technology

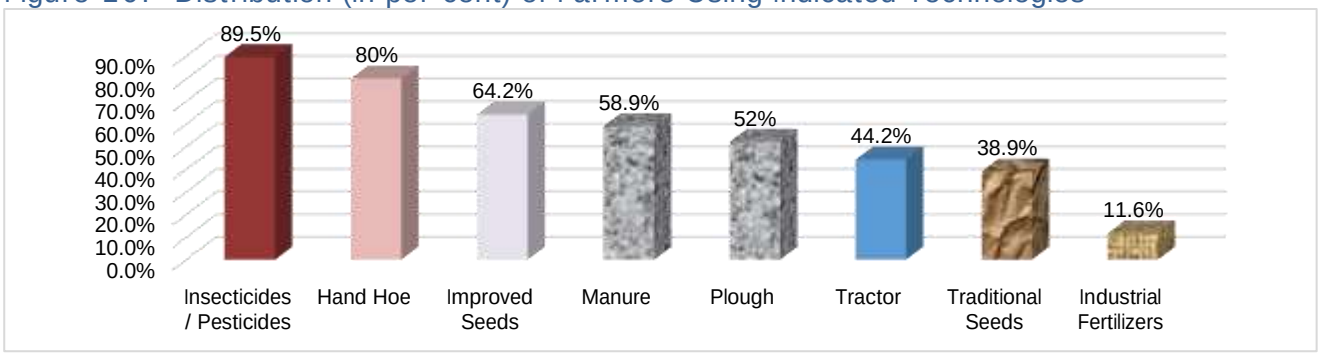
Farmers produce seed cotton in which the resulting by-products are stalks, which are left in the field for other use or cleared cum burnt to prepare for the subsequent season. The common technologies used in land tilling, as depicted in Figure 10, the simple hoe (80%), oxen hoes (52%) and tractors 44.2%). As indicated earlier, the average cotton-cultivated land area is 1.5 hectares of land, which is considered smallholder farming, commonly referred to as peasant farming.

Oxen Plough

A Tilling Tractor in Action

The proportion of farmers applying industrial fertilizers is only 11.6%, compared to relatively higher proportion of the farmers (58.9%) who apply manure. Cotton farmers prefer to use manure rather than industrial fertilizers because the latter are relatively expensive and sometimes not accessible, notwithstanding the perception that soil is potentially vulnerable to industrial fertilizers. Manure is readily available to farmers who are also livestock keepers, though not necessarily adequate to meet demand. A good proportion of the farmers, 89.5%, use pesticides, while it is only 64.2% who use improved seeds. There is a competing demand for cotton seeds as they are needed for replanting and for milling to produce cottonseed oil; the price for the seeds surges as demand exerts on both. As indicated earlier, supply of appropriately priced inputs through well managed farmers' groups (cooperatives) would improve availability of technologies and inputs to smallholder farmers.

Figure 10. Distribution (in per cent) of Farmers Using Indicated Technologies



Value Addition at Farm-Gate Level

Preserving of cotton after harvest is the major activity (46.3% of the respondents) carried out to add value because early selling fetches a relatively low price due to a relatively big supply in the market during the harvest season. Also, farmers indicated that they sort seed cotton (29.5%) to remove foreign matter or contaminants.

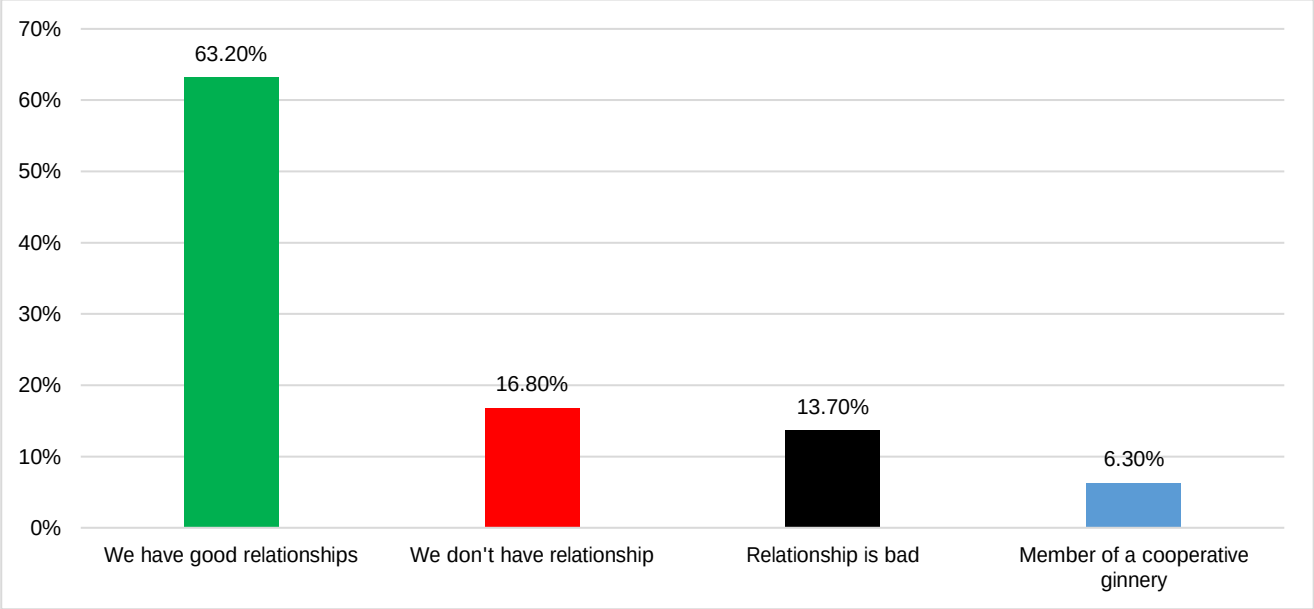
The respondents mentioned two main constraints to value addition; lack of space and equipment for storing harvested seed cotton and farmers' shallow knowledge on value addition opportunities. Therefore, training farmers on how to add value after harvesting cotton in addition to storage techniques and facilities would improve household and other incomes in the cotton value chain

Farmers' Relationship with Ginners

Cotton ginners include privately owned and Farmers' Union-owned ones; although the latter are rented to private operators. Therefore, private ginners are the main buyers of seed cotton from farmers. They also supply inputs on credit and recover these loans from their payments to farmers at

harvest time. The survey sought to establish whether the ginners have good relationship with farmers in terms of supply of inputs and buying of seed cotton.

Figure 11. Farmers Indicating their Relationship with Ginners



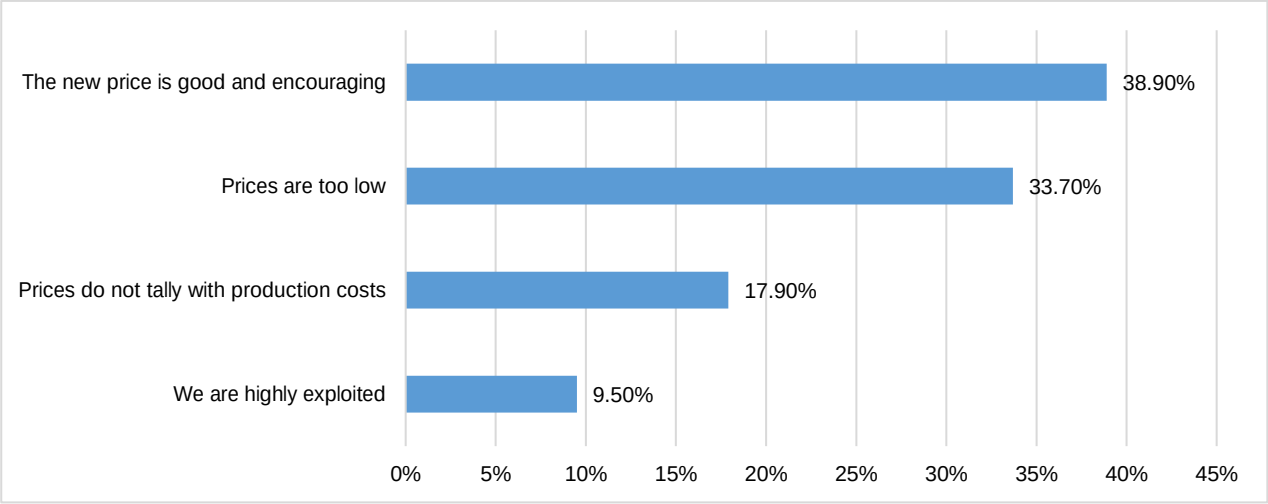
Farmers were asked to state the status of their relationship with their respective ginners. The analysis depicted in Figure 11 shows that 63.2% of the respondent farmers have good relationships with their respective ginners; 13.7% do not have a good relationship while 16.8% do not have any relationship with ginners. Privately owned ginners make arrangement with their member farmers to advance inputs for repayment during the harvest season as they sell their seed cotton to the respective ginner. Cooperative societies, for which some have ginneries, used to supply the same inputs to their members with arrangement to buy seed cotton from them; but the societies are not adequately capitalized to finance its operations. The cooperatives also suffer from persistent financial mismanagement which has compromised their trust to their members. As a result, cooperative unions have rented out their ginneries to private operators.

Nevertheless, smallholder farmers work in isolation in making decision on farm activities; organizing them in small farmer groups of at least 30 members would enhance their reachability in terms of extension services and inputs; and also their access to markets and bargaining power to improve their farm yield from cotton.

The results of the survey on farmers' relationship with ginners show that majority of the farmers are comfortable with the services they get from their respective ginners – who give them inputs on credit, extension services, and in turn buy their produce and settle the loan.

However, minimum price of seed cotton is set by the Tanzania Cotton Board (TCB) in collaboration with the representatives of other actors in the cotton industry. As such, Ginners do not set a minimum price alone; although they are free to pay any price above the minimum set-price. Practically, there are very few ginners who pay a price which is above the minimum set-price per kg of seed cotton. Farmers were asked to give their impression on prices paid to them by ginners as depicted in Figure 12. The results indicate high dissatisfaction with the prices; which are basically determined by the minimum price set by stakeholders. Farmers feel that the prices are low, although 38.9% opined that the new price of TZS 1,200 (USD 0.54) per Kg of seed cotton is encouraging. The results point to a clear indication that although the price paid to farmers has recently increased, there are some farmers who perceive it to be low compared to costs of production. However, detailed analysis of profitability and costs is made in the preceding sections of this report.

Figure 12. Farmers' Impression of Prices Paid to them by Ginners



4.2 Firms/Processors

As indicated earlier, there are several by-products from the cotton value chain including cottonseed oil, cake, husks, etc.; each of these by-products is discussed in detail in Section Five. The survey sought to assess the production environment facing firms engaged in the cotton industry in general, in terms of the technology they use and the infrastructural facilities in which production and transport take place.

Technology / Machinery

With regard to the technology used in ginning activities in the cotton industry, firms made own assessment, as depicted in Table 4. The production process uses different technologies imported from several countries. The majority of ginners are satisfied that the technology they use is of high quality. The rest of the ginners interviewed in the survey describe their technology as being normal, old or labour intensive. Therefore, most ginners are comfortable with the quality of the technology they use.

With regard to the technology used in cottonseed oil milling, firms indicated that they are generally using high quality technology imported from India and Pakistan. The results of the survey show that firms engaged in business in the cotton value chain are generally satisfied with the current technology they use in production.

It has been found earlier that farmers' Cooperative Unions used to buy cotton and carry out processing activities in their own ginneries; but with deterioration in their performance, private ginners were finally welcomed in the industry to boost performance. The cooperatives hired their ginning factories to private firms, which operated for sometimes before shutting down after the hirers bought their machines and established own ginneries. However, seasonality of cotton production makes it hard to run the machines throughout the year; and the decreasing production of cotton has made some of these machines to operate under-capacity or close down. Therefore, the common concern of ginners is how to increase and sustain production of seed cotton rather than the efficiency of the technologies they use; continued investment in technologies used in production in the cotton value chain will depend on the availability of raw materials – which to a large extent, in the context of Tanzania, calls for measures to revamp production of cotton.

Table 4. Firms' Own Assessment of their Technology used in the Cotton Industry

Type of Production Activity	*Type of Technology*	*They are of High Quality*	*Labour Intensive*	*It is good but needs regular maintenance*	*The machines are old*	*Normal*	*Total*
Ginning	SAW GIN	0	0	0	0	1	1
	Al Jamaal, Saw Gin(America), Roller Gin (India)	1	0	0	0	0	1
	Bajaj (Ginning)TOYODA(Japan)	1	0	0	0	0	1
	Double Roller Gin, Bajaj/Jumbo	3	0	1	0	0	4
	Modern Machine (Gin)	4	0	0	0	1	5
	Old Machine (Gin)	0	1	0	1	0	1
	UDP Patel (India)	0	0	0	1	0	1
	GIN Continental	1	0	0	0	0	1
	Saw Gin, Lumas (USA), Double Roller (India)	1	0	0	0	0	1
	Double Roller & Saw Gin	1	0	0	0	0	1
	Roller (Ginning machine)	2	0	0	0	0	2
	Saw Gin,	1	0	0	0	0	1
	All Ginners	**15**	**1**	**1**	**2**	**2**	**20**
Oil Milling	Bajaj & Kumaal (for Oil Milling)	1	0	0	0	0	1
	Kumaal (Milling)	2	0	0	0	0	2
	Al Jamaal (Pakistani) for milling	0	0	0	0	1	1
All	Counts	17	1	1	2	3	24
	Percentage	**74**	**4**	**4**	**8**	**12.5**	**100**

Factory / Business Premises and Roads

Firms' own assessment of the status of the premises of their factories showed that 62.5% of the structures are in good condition; 20.8% are fairly good; and 16.7% are old and in poor condition. With regard to roads, majority of firms (58.3%) indicated that village roads are not good while 41.7% said that roads are fairly good. In the recent years, there has been significant improvement in both major and feeder roads across the country. The road network linking regions and districts in the cotton producing areas is generally very good. The village roads are not yet tarmacked but regularly maintained by district authorities, although they are not easily passable during the rain seasons. Collection of seed cotton from villages to the established warehouses, and from warehouses to ginneries is done through special vehicles. As shown later in the section on analysis of costs of production, transport costs account for about 32% of the total costs. The analysis does not distinguish costs by the various cotton by-products because, as indicated earlier on, many of the firms engaged in business in the cotton value chain produce several by-products.

The on-going road projects to bitumen level to connect the districts in the cotton-growing area will improve transport services. In addition, the on-going upgrading of the current Dar es Salaam to Mwanza railway to standard gauge will transform transport services between and across the involved regions. This will ease export-related transport services for cotton and cotton by-products.

Storage / Warehouses

With regard to storage facilities, the firms assessed that their warehouses were adequate, functioning and fairly good. Indeed, as observed from the picture depicting some of the warehouses, judging from the face value, they appear to be generally good. It is only 29.2% of the respondents who said that their warehouses were old and needed rehabilitation. Also, firms complained that there are no village warehouses – a problem which increases transportation costs.

Seed Cotton Warehouses

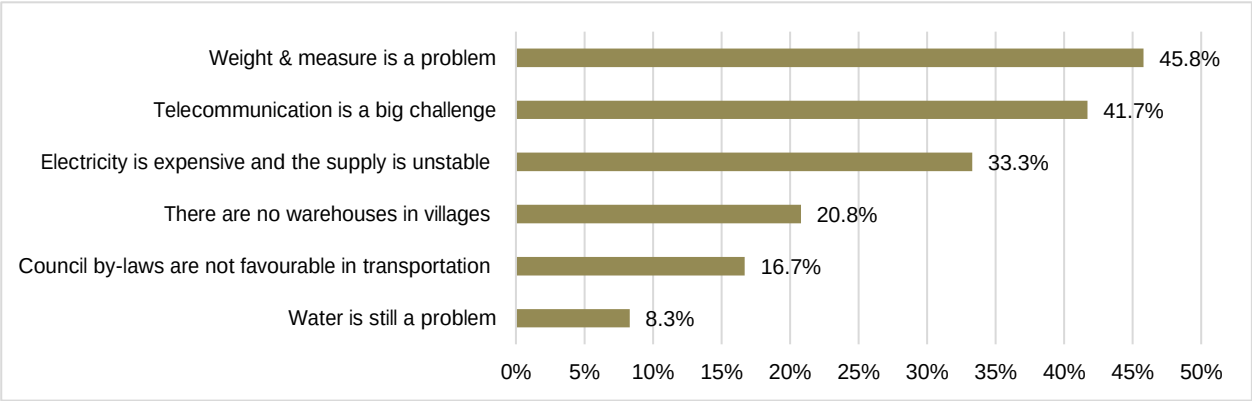
However, as observed earlier, there has been a decrease in cotton production over the last three years; implying that some of the warehouses will be underutilized if not closed. Revamping production of cotton will lead to full capacity utilization and regular maintenance as may be necessary.

Other Infrastructural Facilities

Included in the survey interviews was also assessment of other infrastructural facilities as indicated in Figure 13. Weight and measure for seed cotton was seen by firms (45.8%) to be inappropriate. The firms complained that some of un-trustful farmers add sands or foreign substances with the aim of increasing weigh of their seed cotton for more yield. Also, un-trustful buying agents who cheat by inflating the weight of seed cotton.

Unstable and expensive electricity supply was mentioned by 33.3% 0f the respondents as one of the constraints facing production activities. As indicated in the later section on analysis of cost of production, on average electricity constitute about 14% of the total costs of production. However, under the current arrangement of power tariff between the Tanzania Electricity Supply Company (TANESCO) and ginners, the latter have complained that they have to continue paying for three months after the cotton season regardless of whether they are still operating or not. However, this is a matter of renegotiation with TANESCO for a win-win scenario.

Figure 13. Firms Assessment of Other Infrastructure Facilities



5. Assessment of each cotton by-product and its market

The first product in the cotton value chain is the seed cotton that farmers produce. They sell their seed cotton to ginners, cooperative unions and private buyers in the market. As indicated earlier, cotton is associated with several by-products; and each of these products has its unique market. According to the Tanzania Cotton Board (TCB) in 2015 one ton of crushed cottonseeds yielded, on average, 16% crude oil (12% after cleaning), seed cake 45-55%, husks 25–27%, linters 8–10% and 4% wastes.

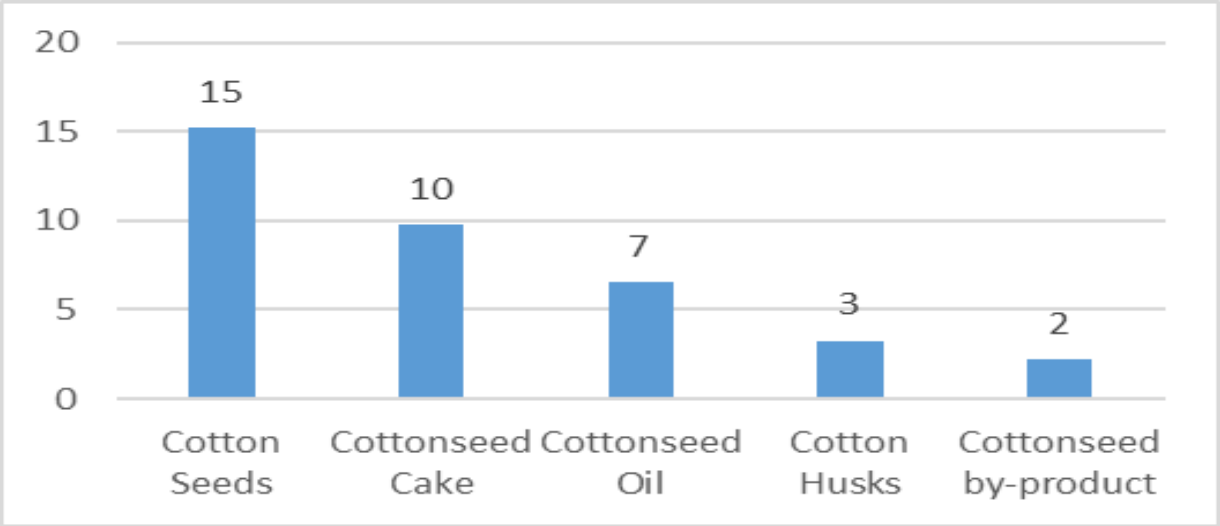
The survey included interviews on general and specific market assessment for each by-product. Table 5 shows firms' assessment of the markets for the various cotton by-products. The table shows that

by-products with a good market are cottonseed, cottonseed oil, cottonseed cake, and cotton husks. Cotton stalks are mainly left in the field for burning because there is no market for them.

Table 5. General Assessment of Markets for Cotton (Number of firms indicating)

How do you assess the Market for	There is a big market	There is a fairly good market	There is no market	Total
Cottonseed	16	6	0	22
Cottonseed Oil	8	14	0	22
Cotton Husks	8	11	2	21
Cottonseed Cake/meal	6	13	2	21
Cotton Stalks	0	10	12	22

Figure 14. Number of Firms Indicating Sale of Cotton By-products



The firms were asked further to indicate whether they sold cotton by-products in 2016. Figure 14 shows that 15 out of the 24 interviewed firms sold cottonseed, representing the main by-product; 10 sold cottonseed cake; 7 sold cottonseed oil; 3 sold husks; and 2 sold cottonseed oil by-products for making soap. Therefore, each of the cotton by-products has a market except for cotton stalks. Export markets consume about 69.6% of production, with the remainder consumed locally. Table 6 shows the general export and domestic markets for cotton products and by-products.

Table 6. Markets for Cotton Products and By-Products from Tanzania as Indicated by Respondents

Cotton Product/by-product	*Local Market*	*Foreign Market*
Cotton lint	*Local market*[2]	*China, Viet Nam, German, South Africa, Indonesia, India, Thailand, Bangladesh and Singapore*
Cottonseed oil	*Local market*[3]	*Switzerland and India*
Cottonseed	*Local market*[4]	*German and China*
Linters		*German, and China*
Feedstock/cottonseed cake	*Livestock keepers*	*Kenya, Uganda and Rwanda*

The interviewed firms offered a number of proposals to improve the markets for cotton by-products. With regard to easing market entry, the suggestions include sensitization of consumers on local products, reducing costs of production, as well as taxes, and improving in the business environment.

[2] Lint: local companies include MWATEX, 21st Century Company, Sunflug, OLAM Tanzania Ltd, NAFCOM, SAURSHRA, AWATAC and URAFIKI Textiles
[3] Cottonseed Oil: Local market include local shops (wholesale and retails) and fish frying businesses in the Lake Zone
[4] Cotton seeds: local market include farmers, and companies such as Jie-Long (Chinese Company), Mount Meru Group in Bunda, Singida and Arusha, and Walji & Birchard Company

Respondents also proposed imposing of strict regulations on the cotton value chain, building awareness among cotton stakeholders on contractual obligations and minimum standards required in the market. Also, the respondents proposed improving the feeder roads in the cotton zone.

The analysis of the survey data also expounded the specific market for each cotton by-product as presented in the following subsections.

5.1 Cottonseed

Commercially, cottonseed is vital for its oil and other by-products. The seeds are also sold for planting by farmers. Often, cottonseed belongs to the ginners. Some ginners reserve some seed to sell to farmers for planting; for those with milling facilities, they process cottonseed for oil; those without mills sell their cottonseed to oil millers.

Cotton Planting Seeds

Fuzzy cottonseed

The main buyers of cottonseed include farmers, Jielong, Oil Millers (Kahama Oil & Mwatex) Mount Meru Group (Bunda & Singida), Walj, Birchind, J-Long, other international companies such as Prexas, CDI, Raha Oil Mill, etc. Therefore, the market for cottonseed is big, and includes both domestic and international markets.

During the last season in 2016, the total amount of cottonseed sold by the survey respondents was 19,878 tonnes. however, according to the survey respondents, demand for cottonseed is high compared to the amount produced annually. As indicated earlier, declining cotton production is the major reason for decreasing supply of cottonseed. Also, increasing investment in cotton by-products increases demand for the cottonseed. For example, as indicated earlier, the 2015/2016 total cotton output was just about half of the 2012/2013.

The strength of cottonseed as a by-product in Tanzania is that it has a ready market and the stock can be stored for extended periods without spoiling. Moreover, products derived from cottonseed have good markets.

However, when the quality of cottonseed is compromised, its price and durability decline. In addition, poor quality seeds yield less oil; and when planted, do not grow well. Therefore, the quality of cottonseed is a crucial issue with regard to its market and the consequent by-products from oil production. Some farmers add water to increase the weight of the seeds. This compromises quality and the resulting products from the seeds.

The survey respondents proposed that cottonseed be promoted along with measures to improve quality. They opined that cottonseed lead to several by-products which have a good market; promoting its production and quality would boost production of its oil and related by-products. Production of more and quality cottonseed is contingent to production of more and quality seed cotton; as such, promoting production of more and quality seed cotton, as indicated earlier in this report, will boost production of cotton by-products in Tanzania. Therefore, cotton farmers are the epicentre for initiating improvement in the cotton industry in Tanzania.

In the year 2016, farmers were supplied with UK91 cotton seeds for planting. These included some delinted and some fuzzy seeds. During the 2017 season, farmers have been supplied with a more advanced variety - UKM08 which include delinted and fuzzy seeds. Delinting cottonseed gives two products – seeds and linters; and improves the quality of the seeds. Improved seeds have a big

market in Tanzania – for replanting and for production of cottonseed oil. Delinted seeds produce more oil during milling than fuzzy seeds; also, the quality of the remaining cake improves because when seeds are crushed with linters, some oil remains in the cake with the linters – which compromise the quality of the cake – usually used to make livestock feed. Therefore, the use of improved cotton seeds for planting, and delinting fuzzy seeds after ginning, will increase the quality of cottonseed in Tanzania including the quality of by-products such as linters, cottonseed oil and cottonseed cake. The market for the seeds would increase, and so with yields from the related by-products.

5.2 Cotton Linters

Linters are the short fibres that remain on the cottonseed after the ginning process. These are recovered from the fuzzy seeds with de-linting machine at the cottonseed oil mill and/or at the ginnery before processing the cottonseed for oil or black seeds for planting. Various types of linters would be produced, depending on the number of times the cottonseed passes the de-linting machines. Linters have a number of uses, including the manufacture of cellulose products like cellulose acetate, viscose rayon, carboxymethyl cellulose, microcrystalline cellulose, cellulose nitrate and the preparation of specialty-grade paper.

In Tanzania, production of cotton linters is minimal due to methods used in oil extraction. Many ginner-cum-oil-millers have older expeller pressing machines, rather than the newer solvent extraction technology. Currently, the production of linters is confined to the few oil millers using the solvent method. Data on the production trends of linters are limited because TCB does not monitor production of some cotton products, such as cottonseed oil, hulls and linters. Thus, deliberate efforts to delint cottonseeds and promote the commercial uses for linters within the local and regional markets is prerequisite to attract new investment in value added linter products.

5.3 Cottonseed oil

Cottonseed oil is produced from the kernel of the cottonseed –the inside meat of the seed that remains after removing the surrounding hard outer hull/shell. The cottonseed processing segment only uses local seeds to produce oil for both edible and industrial uses, such as soap and margarine. They also produce linters in negligible quantities, hulls for animal feed, and cottonseed cake.

Expeller seed pressing machine

Source: https://en.wikipedia.org/wiki/Ex 1

Many of the oil millers (expellers) press the seeds physically without removing the husks, while a few millers do remove them; and one firm in Shinyanga region uses modern solvent extraction technology. The expeller technology presses seeds with the husks; and, in addition, the technology leaves some oil in the cake - which not only reduces oil yield, but also makes the remaining cottonseed cake a bit oily. Cake from expeller technology often contains linters as well, as many firms press the seeds without delinting. This reduces the quality of the cottonseed cake, making it less competitive on the domestic market, as compared to other feedstocks, such as sunflower cake.

Some mills produce semi-refined cottonseed oil, while others produce refined cooking oil. Semi-refined oils yield lower quality oils, unfit for human consumption. As indicated earlier, some of the millers do not have a technology for extracting all the oil from seeds – leaving the resulting cottonseed cake with oil. There is potential for increasing cottonseed oil production if solvent extraction technology is used to fully extract oil from seeds.

The main local market for cottonseed oil is in the Lake Zone, where the oil is used for roasting fish. Export markets for cottonseed oil are mainly Switzerland, China and India. In the last season, the total

amount of cottonseed oil produced by the respondents of the survey was 214,520 litres, yielding total revenue of TZS 359,429,663 (USD 161,179).

The demand for cottonseed oil is generally high in the market; and its supply depends solely on the availability of cottonseed. Cottonseed oil is healthful and keeps for a long time. Also, cottonseed oil retains most of its natural colours, flavours and nutritional qualities. The taste and health benefits of cottonseed oil are high; as such, cottonseed oil is a product with a ready market and little market risk.

Cottonseed oil in a coke bottle

Oil Milling in Progress

Cottonseed Oil in Cans of 20 Liters

Despite of all the market potential and health benefits of cottonseed oil, the survey respondents said the market prefer substitutes, such as sunflower oil. Also, some of the produced cottonseed oil does not meet international standards, restricting its access to export markets.

The survey respondents said further that there is lack of appropriate technology for extracting all available oil from the cottonseed. As a result, cottonseed cake remains with some oil as indicated earlier. The cost of installing and operating improved technologies for extracting cottonseed oil is high. As a result of low production of cotton, costs of extracting cottonseed oil are too high. Also, the quality of produced cottonseed oil is inadequate, as some impurities remain in the oil because of the use of fuzzy seeds in extraction. In most cases, produced cottonseed oil requires additional processing or refining to remove unwanted impurities. This is partially a result of insufficient research on cotton production and on the processing of its by-products.

The main threats of the cottonseed oil production sub sector, as illustrated by the survey respondents, include decreasing quantity of cotton production; competition from other sources of edible oil such as sunflower. palm. coconut, sesame and groundnuts; lack of skilled personnel to operate factories; high competition from imports of cheap and subsidized edible oils, mostly palm oil from countries such as Indonesia, Bangladesh and Malaysia; the need for any oil miller to deal with multiple statutory regulatory bodies on matters relating to taxation, fire safety, food safety and food standards; corruption and bureaucracy on paying fees and accessing licenses; and the high costs and unreliability of electricity to run expellers.

Oil expressers also opined that their products should be promoted in the market because they are domestically produced; but also to increase their production in the country. Proposed additional measures include removing VAT on local cottonseed oil, controlling imports of edible oil, and improving the production chain.

In curbing competition from imported edible oils, the proposed solutions included introduction of an appropriate tax on imported edible oil, producing cottonseed with high quality, and installing modern technology in the industry. Also, the respondents were of the opinion that applying a regional market approach for edible oils would be better for the industry than imposing an import ban to support domestic producers.

Cotton oil millers have come up with a long list of proposed measures to improve production and marketing of cottonseed oil in Tanzania. The most pressing challenges with regard to production relate to volume and quality of available cottonseed. This has to do with the cotton production process, where, as indicated earlier, farmers will have to be motivated and supported to grow more cotton and at the same time be able to keep it clean and dry before selling it to ginners. The role of the government of strengthening and providing oversight to farmers' groups has already been emphasized.

Market for cottonseed oil will not improve unless the issues of quality of the oil and efficiency in production are addressed. Delinting fuzzy seeds and separating the husks from the kernel of the cottonseed, coupled with adequate refining would give cleaner oil for domestic consumption and, potentially, export markets. This will improve the quality of cottonseed cake, as well as yielding linters and husks, which are potential raw materials for production of several other cotton by-products. Therefore, this is an issue of technology that may require access to finance and appropriate skills. Improved efficiency and quality will reduce production costs per unit – and thus make cottonseed oil from Tanzania more competitive in the market. By-products from cotton linters and husks, as explained later in this report, will also constitute an additional source of income for oil millers and other investors.

Most of the oil millers interviewed complained about competition from cheap imported edible oils. In 2012, SNV estimated that the total demand for edible oil in Tanzania was 350,000 MT, of which the domestic market was able to supply 90,000 MT, or 26% only. The rest of the demand was filled by imported oils, especially palm oil, which sells at competitive prices in Tanzania.

There have been suggestions to impose a protective tax on imported oils. Nevertheless, Tanzania is a member of the East African Common Market, in which complete tariff elimination among the member countries took place more than five years ago. Therefore, imposing a tax on oils from the member countries will not be feasible without retaliation by the other countries in the community. However, if any of the imported oil is subsidized by the exporting country, appropriate measures should apply to level competition.

Along with from imported edible oils, competition has intensified from domestic oils derived from other oilseeds. For example, production of sunflower has increased by more than five times in the last ten years. Cottonseed oil millers should focus on quality and production efficiency to increase their competitiveness in the market and, where feasible, target special markets.

5.4 Cottonseed cake or meal

Cottonseed cake is a solid mass residual product obtained after oil is extracted from cottonseed. Rich in protein, it is a sough-after ingredient in feed for ruminants, such as dairy and beef cattle, goats and sheep. The local market for cottonseed cake is relatively small compared to available markets in neighbouring countries such as Kenya, Uganda and Rwanda. The main buyers of cottonseed cake include livestock keepers, private shops, and producers of animal food.


Cottonseed cake

The total production of cottonseed cake, by the respondents of the survey, in the 2016/17 season, was 14,410 tonnes, worth TZS 4,468,894,489 (USD 2,003,988) in total revenue. This was 0.004% of GDP in 2016.

However, cottonseed cake is not available all over the country and its price is high compared to other livestock feeds. The local market is small compared to the export market, leading to relatively low domestic prices. Despite growing demand for cottonseed cake, both in Tanzania and neighbouring countries, such as Kenya South Africa and Rwanda, Tanzanian production has been insufficient to meet demand.

The main threats facing the cottonseed cake subsector include: its dependency on seed cotton production; a narrow domestic market; competition from sunflower cake; poor quality; and high perishability if stored for a long time.

As indicated earlier, decreasing production of cotton affects the volume of cotton by-products. The volume and quality of seed cotton produced determine the volume and quality of cottonseed, and thus, cottonseed oil, cake and husks. The earlier proposed measures to raise production of seed cotton will have an impact which cuts across all the by-products in the value chain, including cottonseed cake.

Poor quality in cottonseed cake is associated with the quality of the seeds, production and storage conditions. These are issues that can be resolved through appropriate training and production and storage technologies. Delinting fuzzy seeds before pressing them for oil will remove linter substances in the resulting cottonseed cake; also, as indicated earlier on, applying appropriate technologies to extract all the oil from the seeds during pressing would ensure that cottonseed cake is dry enough and suitable for livestock feeding.

Cottonseed cake is a good animal feed for ruminants, but not so for non-ruminants, because the cake contains the enzyme gossypol, which inhibits absorption of nutrients. The presence of this enzyme in the cake reduces its market because non-ruminants like poultry, fish and piggery cannot feed on the cake. Non-ruminants are on increase in Tanzania as the country continues to promote fish farming, modern poultry and piggery – this is a growing potential market for cottonseed cake, provided it is free from the enzyme gossypol. Technologies for removing the enzyme gossypol from the cake are available.

Competition with sunflower cake in the domestic market will only increase, as sunflower production and processing continues to grow. Promotion of cottonseed cake, for example, encouraging livestock keepers to use mixed animal feed, may be required to expand the domestic market. This however will depend on whether cottonseed cake will sell at competitive prices. Otherwise, the export market is growing; producers can strategize to increase export of the cake, while also taking measures to improve quality.

5.5 Cotton Husks

Husks, also known as hulls, are the tough outer shell of the cottonseed. They are removed from the cotton kernels before they are taken for oil extraction. These are sold for livestock feed, charcoal making and for burning bricks – in Mwanza (Tanzania) and Kenya. With advanced technology, the hulls can be incorporated in the mud used in oil well drilling and can also be used in the production of synthetic rubber and in petroleum refining.


Ground husks


Fresh Husks

In Tanzania, most of the oil millers press whole cottonseed without removing the husks. The resulting cake after milling is a mixture of pounded or pressed husks and the remains of the inner soft part of the seeds. This technology does not leave options for separating linters and husks prior to oil extraction. However, a few mills have the technology of separating the inner soft part of the seeds from husks; leaving options for production of other cotton by-products.

Cotton husks are suitable for processing into charcoal, for setting fire in tunnels, and for producing manure or fertilizer. Most of these products are not yet in production in Tanzania, except in a few places, like Mwanza, where husks are used to burn earth blocks and making charcoal briquettes.

The respondents of the survey said that cotton husks are not available all over in the country and they do not have standards for external markets. Besides, the current volume of husks produced is insufficient because the technology to separate husks from the inner part of seeds is not yet common;

and at the same time availability and adequacy of the expertise related to the use of cotton husks is lacking in the country. Also, the price of husks is low. Therefore, the market in Tanzania is small for processing husks into other products.

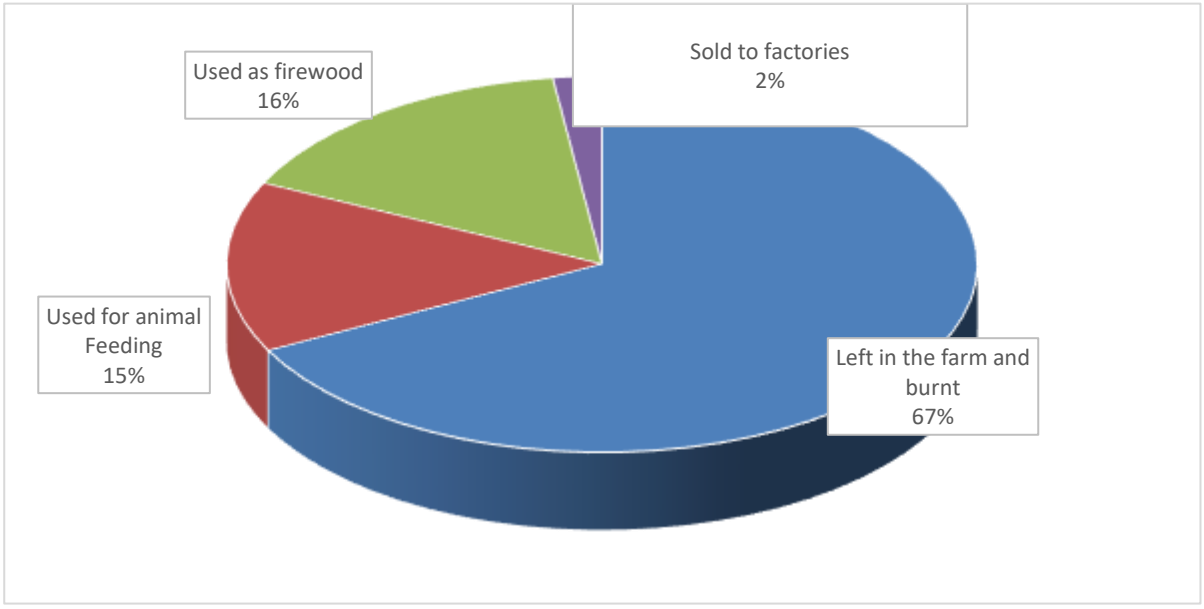
Although the market for husks is small, there is potential for them to be used in charcoal briquettes, production of fertilizer, etc. Husks could also be a source of cheaper alternative feed for ruminant livestock, e.g. cattle and goat. This feed is useful during the dry season, when grass and crop residues are in short supply.

Currently, oil millers press cottonseed without removing hulls, which as a result increases production of cottonseed cake feedstock. To this extent, cotton hulls form part of the cottonseed cake used for animal feed. Separating the hulls from the inner part of the cottonseed depends on the between selling hulls as feedstock and pressing seeds with hulls to get cake for animal feed. In the current situation, pressing the seeds without de-husking add more value or yield than de-husking – simply because the technologies, capital investment and markets for enabling production of by-products from cotton hulls are not yet widely accessible. As a result, the husks are not available in commercial volumes and, where available, are often used to make charcoal briquettes – a relatively new product in the market in Tanzania.

5.6 Cotton Stalks

Cotton stalks are by-products of seed cotton harvest. They are the leftovers after picking the raw seed cotton from the cotton plants on the farm. Figure 15 shows that, of the 95 farmers interviewed in the survey, 67% of them said that they leave cotton stalks in the field and burn them during clearing for the next season. About 16% of the respondents use the stalks as fire wood; 15% use them as animal feed; and it is only 2% who sell cotton stalks to factories that make charcoal briquettes or burn earth bricks. These include on-going projects on renewable energy, such as Empowerment of Marginalized Communities (E-MAC) by Green Microfinance in Mwanza, TAREA and SNV Tanzania project, also in the Lake Zone.

Figure 15. Cotton Stalks and their Usage



During preparation of farms for the coming season, farmers burn stalks to prevent cotton pests and diseases from passing to the next cotton-growing season. The potential supply volume of cotton stalks is therefore considered, as the other uses listed – as animal feed or as fuel - are relatively uncommon. People do not have the appropriate skills and technology needed to add value to cotton stalks.


Cotton stalks in the field

Respondents were aware of some of the products that can be made from cotton stalks, including charcoal briquettes, particle boards, paper and pulp. By using stalks to manufacture these products, deforestation could be reduced, and natural forests protected.

As indicated earlier, the total land area used for cotton production annually in Tanzania ranges from 350,000 to 450,000 hectares. The estimated quantity of stalks produced annually ranges between 455,000 and 585,000 MT of cotton stalks biomass.[5] This gives a huge potential for developing various by-products and additional income for cotton farmers. The World Bank estimates[6] of 2009 show that about half of the charcoal (about 500,000 MT per year) used in Tanzania is consumed in Dar es Salaam. Were the 500,000 MT of cotton stalks produced every year used to produce briquettes, they would replace approximately 50% of the wood charcoal consumed in Tanzania. This would represent an enormous contribution to environmental conservation and reducing waste and climate change.

In India, one hectare under cotton yields approximately 3 MT of stalks, which a farmer can sell for about TZS 100,000 (UDS 45) as an additional source of income. Therefore, with an average of about 400,000 hectares of cotton-cultivated land in Tanzania, and applying the Indian price in Tanzania, there would be an estimated additional income of TZS 40 billion (USD 17,937,219) per year. With an average of 1.5 hectares devoted to cotton, each farming household would earn an estimated TZS 150,000 (USD 67.30) per year in additional income from selling cotton stalks. In addition, the use of compressed briquettes saves about 20% of cost of the traditional charcoal (un-pressed); this would be income saving to households in cities, replacing charcoal as a source of heating energy.

The Environmental Activity and Sector Registry for Tanzania in 2016 show that 90% of middle income households use wood-based charcoal as a heating fuel, while only 1% of households use gas. The Ministry of Natural Resources and Tourism has been discouraging wood charcoal consumption due to deforestation. Switching to sustainable sources of energy like biomass-based briquettes is particularly encouraged and supported. This creates room for instituting appropriate policies for the development of the briquetting technology and businesses.

Therefore, promoting the use of cotton stalks to produce briquettes will yield additional income to farmers and reduce consumption of charcoal n urban areas. In addition, production of charcoal briquettes is done by small and medium size machines, which are available in Tanzania and relatively affordable. This is a source of employment and incomes for youth and other low-income groups, because production of briquettes does not require big investments, as do technologies for producing other cotton by-products.

[5] Kabisa 2015 Background Paper on the Cotton Industry in Tanzania
[6] http://siteresources.worldbank.org/EXTAFRREGTOPENERGY/Resources/717305-1355261747480/World_Bank_Transforming_the_Charcoal_Sector_in_Tanzania.pdf

6. Price, cost drivers and profit margins

6.1 Price Setting

The price of seed cotton is set by the Tanzania Cotton Board (TCB), with input from representatives of the farmer and producer associations. As said by the respondents of the survey: "normally we hold stakeholders' meeting that includes farmers, ginners governing bodies (TCB) and agree on the price that is fair to all stakeholders." However, farmers argue that the price is not attractive relative to their costs.

The prices of cotton by-products are set by producers by looking at several factors including the following (with proportion of responding firms in brackets): production costs (33.6%), world market (33%), negotiations (20.1%) and demand and supply in the market (12.5%).

Therefore, to a large extent, prices of cotton by-products in Tanzania are determined by two major factors: costs of production and the world market conditions. The two factors influence production by more than 66%. These are obvious deterministic factors, which any firm producing for export will encounter. As shown earlier, demand for cottonseed is strong because the seeds are sold for replanting or to mills for cottonseed oil. Since production of seed cotton has decreased in the last three years, demand for the seeds is increasing. But the market for the by-products made from cottonseed face competition in both the domestic and export markets as indicated earlier. The presence of close and sometimes competing or better substitutes, as indicated earlier, is a big factor in setting price margins.

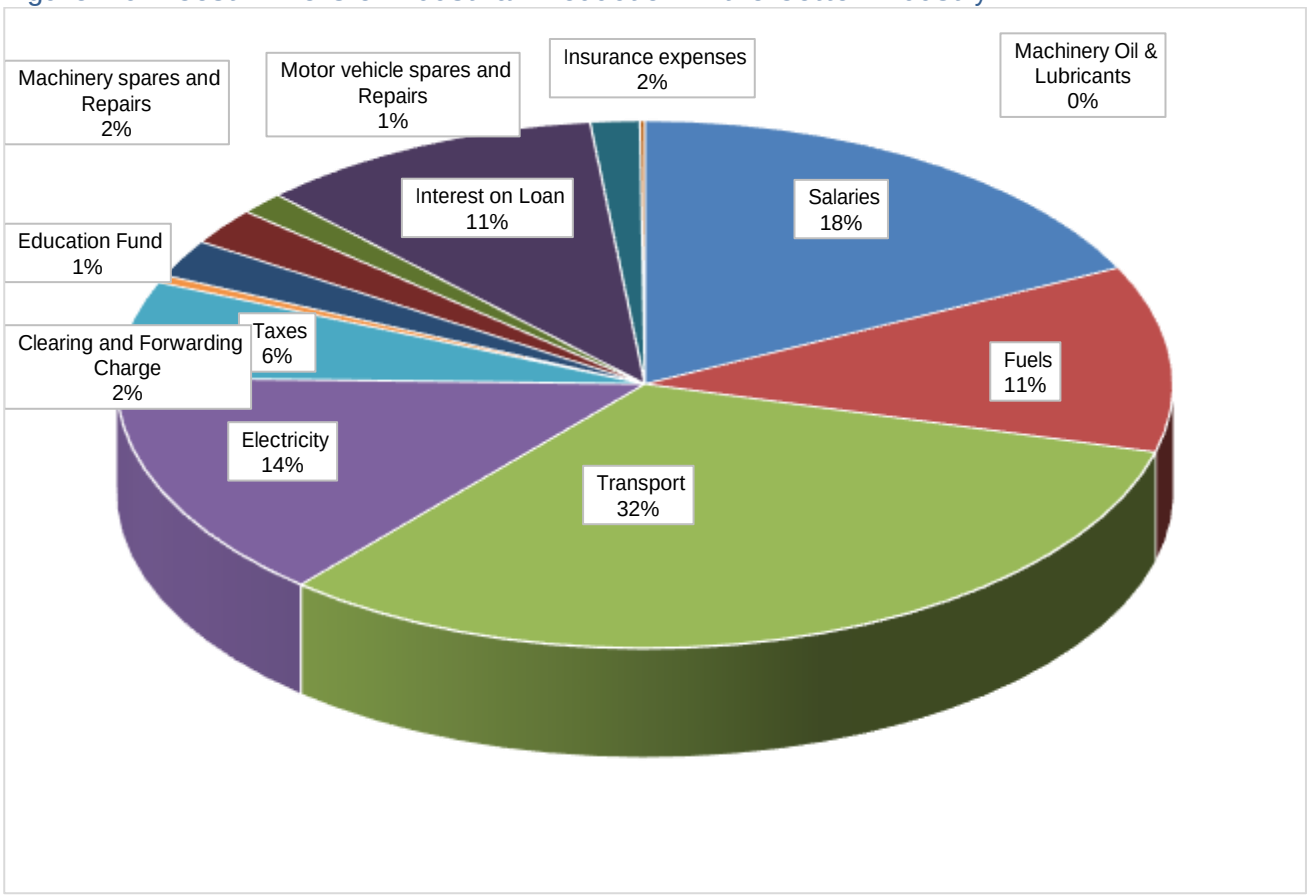
Currently, the cotton by-products produced in Tanzania are simple and very few; not so many to give them access to several other potential markets – these could include production of charcoal briquettes, particle board, pulp, paper corrugated boxes, etc. Also, cottonseed oil could be used to make other products such as soap, emulsifiers, cosmetics, pharmaceuticals, rubber, paint, water proofing agents and candles in order to increase product diversification and reduce competition and risks emanating from the edible oils markets.

6.2 Cost Drivers

The drivers of the cost of production of seed cotton or cotton farming, according to the interviewed farmers, are farm inputs which include the quality of planting seed, sowed pesticides and farm labour, especially for weeding. For example, the costs of hiring a casual labourer during the weeding season ranges from TZS 25,000 to TZS 30,000 (USD 11.2-13.5) per hectare; and weeding is done three times per one season of cotton farming. This is estimated to be about 27% of the cost of seed cotton production. Details on costs and profitability are discussed in Section 6.3 on Turnover and Profitability.

Analysis of secondary data on costs of operations of firms engaged in the cotton value chain shows that the costs of industrial production in the cotton industry are mainly driven by transport costs (32%), salaries (18%), electricity 14%, interest on loans (11%) and fuel (11%) – see Figure 16. Taxes constitute 6% of the costs, while the remaining costs are relatively small. Transporting raw materials to factories and products to the market involves substantial costs to investors. Also, electricity is one of the major drivers of the costs of industrial production in the cotton industry in Tanzania.

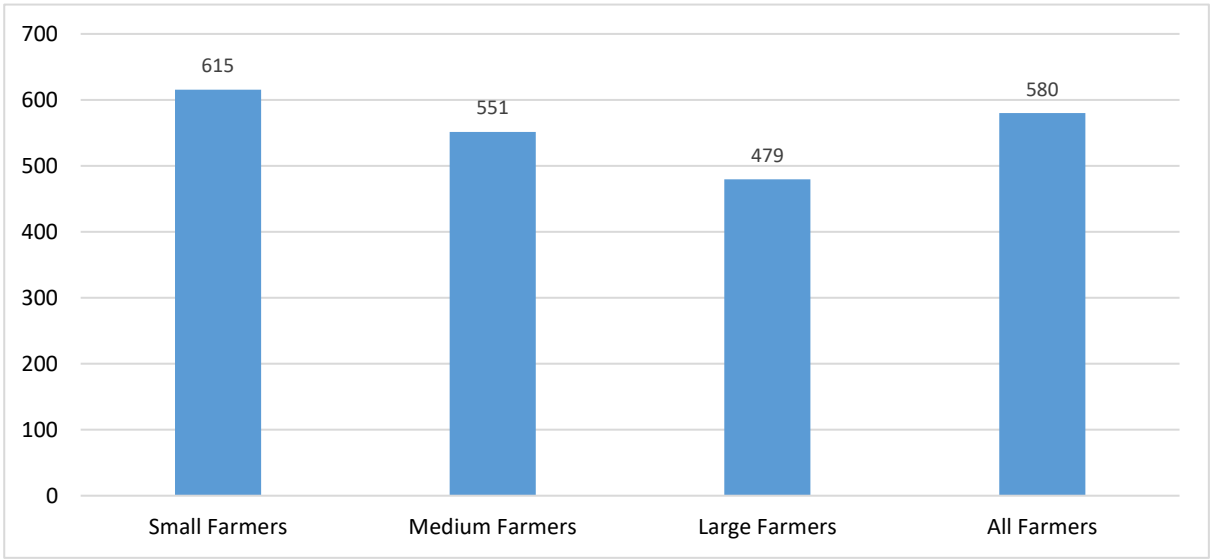
Figure 16. Cost Drivers of Industrial Production in the Cotton Industry



6.3 Turnover and Profitability

The average farm yield of seed cotton production per hectare for all farmers in the last season was 580kg, as shown in Figure 17. This was only 25.5% of Australian cotton production (the top in productivity during the year) per hectare during the year, 74.2% of cotton production in South Africa; and more than one and half times of cotton production per hectare in Uganda and Zambia during the year.

Figure 17. Seed Cotton Yield in Kg per Hectare



Analysis of costs and gross profits from cotton farming, presented in Table 7 shows the average gross profit margin (excluding labour costs) for farmers to be 56%. Gross profit increases with the size of farms, indicating that although smallholder farming achieves a higher yield; it is labour-intensive compared to big farms. The results of the survey data show further that if we include cost of farm labour on production, as indicated earlier, the estimated cost of producing 1kg is TZS 534.3 (USD 0.24) which less than the estimated cost of USD 0.32 in Africa (excluding West Africa)[7].

Table 7. Costs and Profit Margins of Cotton Farming

Type of Farmer	Cost of Production per Kg in TZS	Last season selling price per Kg in TZS	Gross profit margin per Kg
Small	430.38	953.51	55%
Medium	428.36	976.80	56%
Large	370.54	1007.69	63%
All	420.71	967.05	56%

The estimated average household earning from cotton farming was TZS 2,973,196 (USD 1,333) last year. This ranged from TZS 1,598,498 (USD 717) for smallholders to 9,063,076 (USD 4,064) for the relatively larger farms.

Profit margin for firms engaged in cotton by-products has been estimated from data collected from ten out of the 24 firms involved in the survey. This is because other firms did not provide data on revenue. The gross profit (i.e. before interest expense and tax) is 33%. This estimate does not distinguish profit margin between the various by-products of cotton because many of the firms produce more than one product and their financial data provided to the study team do not indicate such a distinction.

The net profit margin (i.e. excluding all costs) for the firms engaged in cotton by-products is estimated to be 28.3%. It is generally observed that irrespective of all the challenges facing the industry, there are still clear incentives for investing in the cotton sector, which appears to be generally profitable. Basing on the data from the 95 interviewed farmers, gross return on farmers' investment in cotton farming is about 50%; and considering labour costs of about 27% of total costs, average net return on seed cotton farming in Tanzania is estimated to be 45%. This is significantly high to motivate farmers as long as reliable markets and input supply and extension services are in place. Tanzania has a comparative advantage in cost of production than many other countries in the region in which the average cost is USD 0.32 compared to the average cost of USD 0.24 in Tanzania.

Many of the firms engaged in the cotton value chain produce more than one product, which makes it tedious to separate costs of production for each by-product. However, despite of all the challenges mentioned earlier, the general estimated after-tax profitability rate is 28.3 for cotton by-products using data from the few firms which provided data on costs and revenue. The road net in the cotton producing zone has significantly improved in the last ten years; and more improvement in the road network is expected when the on-going projects on road construction to bitumen level will be completed. Also, the renovation and upgrading to Standard Gauge of the current Dar es Salaam-Mwanza Railway line is not only expected to revolutionize transport system between the two cities, but also to easy business in the cotton value chain particularly export and import trade.

7. Comparative advantage of Tanzanian cotton products and by-products

Producers of cotton products and by-products were asked to indicate their views on the advantages of Tanzanian companies over foreign companies. In general, some of the respondents considered

[7] https://www.icac.org/cotton_info/speeches/Chaudhry/2008/bremen_april_2008.pdf: Update on Costs of Producing Cotton in the World

Tanzanian companies to have market advantage over foreign competitors (33%), while others felt foreign companies had the advantage (58%). Those who said that Tanzanian companies are disadvantaged in the markets cited the factors to be low production of seed cotton (48%) and importation of competing cotton products, such as bails of second hand clothes and edible oils (10%). Respondents who considered Tanzanian companies as having a market advantage argued that local companies produce high quality cotton products because of interventions by TCB (14%) and the potential to produce more cotton given the country's availability of arable land (14%).

However, it has been indicated earlier that Tanzania gets relatively less seed cotton production per hectare compared to several other major cotton producing countries. For example, during the last season, cotton productivity per hectare was just around a quarter of the best cotton producing countries like Australia. However, compared to other cotton producing countries in the region, Tanzania produces more seed cotton per hectare than Uganda and Zambia; and less per hectare than South Africa as indicated earlier. Therefore, Tanzania has a comparative advantage in output of cotton per hectare. The price margin for seed cotton is also sufficiently big to motivate investment in cotton farming. But reliability of markets, timely payments to farmers and input supply are the major setbacks which compromises productivity.

The cost of production per kg, as indicated earlier, is comparatively favourable to Tanzania relative to other countries in the region. The regional average production cost per kg is USD 0.32, while for Tanzania is USD 0.24 – which is less by 25%. The combined advantage in productivity and cost of production gives Tanzania a comparative advantaged in cotton production over many other producing countries in the region.

The cotton by-products produced in Tanzania have domestic markets which appear to be competitive as indicated earlier. Production of cottonseed is somehow automatic from ginning of seed cotton, but the quantity and quality of the seeds depends entirely on cotton farming, storage and handling of the seed cotton. Productivity of cottonseed is induced by-production of seed cotton; as such, when a country has a comparative advantage in cotton production per hectare, it will also be so in seed cotton production. In this regard, Tanzania has a comparative advantage in producing more cottonseed compared to the neighbouring countries in the region.

Cottonseed oil is produced for both domestic and export markets in Tanzania. Given the comparative advantage in cost and productivity that Tanzania has over the other countries in the region, production of cottonseed and thereby-production of cottonseed oil would also give Tanzania a comparative advantage. However, the technology used in Tanzania does not give high quality cottonseed oil; and pressing of the seeds without removing the husks compromises the quality of the oil when the appropriate technology for refining is even not there. Therefore, the quality of the cottonseed oil is compromised due to lack of appropriate technology for milling and refining the seeds; the price of the oil is not as competitive as would be if the technology is improved. The domestic market faces competition from imported cheap oils and other domestic edible oils; the low quality of the inadequately refined cottonseed oil gives the other oils a comparative advantage in the market. Cottonseed oil is mainly used for frying fish around Lake Victoria. It is also used as a lubricant for machines in Tanzania.

Production of cottonseed cake benefits from the comparative advantage that Tanzania enjoys in production of cotton; but sunflower cake, as indicated earlier, is generally cheaper and widely available than cottonseed cake. Also, cottonseed cake is perishable if stored for long time. The technology used in milling does not extract all the oil from the inner part of the seeds – leaving some of the oil in the cake.

Cotton husks are pressed together with the inner part of the seeds, as indicated earlier; except a few firms which have the technology that separates the husks from the inner part. By implication, husks are not produced as raw materials for several other products that could be produced as a result.

Cotton stalks are left in the field for burning during preparation for the next season. There are very few people who use them as sources of firewood for domestic use and burning of earth bricks. Since stalks are not yet in high demand, its price would be very low and give investors a comparative

advantage in the input market. The products produced from the stalks would sell at relatively competitive prices compared to countries where stalks are already in high demand.

8. Main impediments affecting the development of the cotton industry in Tanzania

The survey respondents mentioned several impediments which hamper development of cotton and cotton by-product in Tanzania. These constraints are presented in two categories: those that are specific to farmers and those that are specific to processors.

8.1 Specific Impediments Facing Cotton Farmers

The impediments facing cotton farmers as mentioned by them include low price of seed cotton, inadequate government oversight on the various buyers in the sector and thereof appropriate interventions for improvement, inadequate supply of inputs, unfavourable weather conditions, lack of credits to finance inputs and too many taxes.

Low price of seed cotton

About 24.4% of the interviewed farmers expressed their concern that the current producer prices for seed cotton are low. They opined for an increased role of the government in favour of famers who considered themselves to earn relatively low compared to the effort they exert. They opined further that the structure of the cotton sector is functioning poorly. According to their views, when the structure was functioning properly, Tanzania used to receive premium as a result of the quality of its cotton. Over the last couple of decades since the liberalization of the cotton sector, Tanzanian cotton has increasingly traded at a discount due to its poor quality. TCB is trying to educate both farmers and ginners on the importance of producing high quality cotton, although this alone without proper training on the same will not be effective.

Farmers feel that incentive to grow cotton among them is low because of low producer prices, the lack a price stabilization system and inadequate government local support in mitigating the impact of price volatility on producer prices.

About 21% of the respondents opined that government support in the cotton sector is inadequate. They argued that the government has left the responsibilities of developing seed cotton farming to ginners. Consequently, ginners are taking advantage of the gap by planning and buying cotton from farmers at a relatively lower price than would exist with appropriate government support. On the other hand, ginners supply inputs such as fertilizers, insecticides, and planting seed at prices considered expensive by some of the respondent farmers.

As indicated earlier, the minimum price of seed cotton in Tanzania is set by the Tanzania Cotton Board (TCB) in collaboration with the representatives of other actors in the cotton industry. As such, ginners do not set a minimum price alone; although they are free to pay any price above the minimum set-price. Practically, there are very few ginners who pay a price which is above the minimum set-price per kg of seed cotton. For the 2016/17 season, TCB announced a price of TZS 1,200 (USD 0.54) per kg of seed cotton, or about 95% of the international price.

The average gross profit margin (excluding labour costs) for farmers, as shown earlier, is 56%. Gross profit increases with the size of farms, indicating that although smallholder farming achieves a higher yield; it is labour-intensive compared to big farms. The results of the survey data show further that if we include cost of farm labour on production, as indicated earlier, the estimated net profit margin is 45%; and the cost of producing 1kg is TZS 534.3 (USD 0.24) which less than the estimated cost of USD 0.32 in Africa (excluding West Africa). Therefore, cotton farming is profitable in Tanzania, and relatively more so than the continental average.

Nevertheless, farmers think that the government sets prices; and more so, they think that price setting is an outcome of negotiation between their representatives and government bodies. This perception

and historical politicization of the cotton sector have led farmers to always demand a higher price for their cotton, arguing that cost of production is higher than what they receive.

In reality, the international price is determinant, as more than 65% of Tanzanian lint is exported. Since farmers receive more than 90% of the international price, and earn net profit margins of around 45%; then the argument of low price is more of a political or negotiating tactic than the result of commercial cost-benefit analysis. The issue of productivity, as indicated earlier, is the driving factor for low earnings per hectare; increasing productivity would increase farmers' income, even when prices are low.

Constrained supply of inputs

Inadequate supply of inputs was mentioned by 20.8% of interviewed farmers as one of constraint affecting cotton production in Tanzania. Several issues were identified with regard to inputs including high price of planting seed, which has caused farmers to plant recycled and uncertified seeds from past harvests. On average, the price of cottonseed is 35,000 TZS (USD 15.70) per a bag of 50 kg. One hectare requires 50kg of seeds for planting – which cost 35,000 TZS (USD (15.70).

Farmers complained that seeds are supplied late, after the appropriate planting period. In addition, farmers consider the limited supply of improved and quality planting seed as a constraint to productivity of seed cotton. They consider this to be the result of weak system of multiplication of improved planting seed. Farmers have continued to rely largely on seeds of UK91, an unregistered cotton variety first released nearly 25 years ago – despite its deteriorating fibre strength and length.

In addition, farmers were concerned about inadequate and poor quality infrastructure, such as roads, storage facilities and irrigation facilities. On storage, the common facility used by farmers is their private houses which often provide insufficient area for seed cotton storage. Nevertheless, keeping seed cotton in a private house is risk given the possibility of cotton to catch fire and attract theft. Many farmers are unable to afford appropriate cotton storage and harvesting equipment.

For many farmers, production capacity is constrained by the high costs of using tractors. Only a few rich farmers can afford to buy tractors for cultivation and planting. Many use oxen hoes and hand hoes for these tasks.

High costs of production

Farmers considered costs of producing seed cotton to be high; the resaons being low soil fertility, compounded by limited use of fertilizers and mechanized equipment, such as tractors and irrigation. Another reason for high costs of production is the use of low quality inputs, such as insecticides and fertilizers (sprays or buster). Sometimes, insectisides do not kill insects and purchased seeds do not grow.

The inputs supply system for cotton farmers has frequently faced criticism due to delays in delivery, low quality and inflated prices. Of late, there have been some farmers who were supplied with seeds that did not gow; and others were supplied with ineffective insecticides. Farmers complained and called for government intervention. The presence on the market of substandard inputs increases costs and constrains yields. However, the government is working closely with the TCB and farmers associations to address the concerns.

Unfavourable weather conditions

Unfavourable weather was mentioned by 12.5% of the respondents. This is considered a problem because of rain-dependent nature of the cotton farming in Tanzania. Irrigation systems are not yet well developed in the cotton-growing areas.

Lack of access to finance

Lack of adequate financial resources to finance inputs such as seeds, herbicides and insecticides was an impediment identified by 8.3% of the respondents. As such, many of those who lack financial

resources rely on input credits supplied by ginners and recovered against harvests. Some of the farmers do not trust ginners; as such, they consider these loans to be expensive. It was also revealed that many farmers are not literate on financial matters - knowledge that could help them to properly manage their earnings from seed cotton. Savings in these communities is limited as many farmers spend their income on day-to-day needs. Consequently, many farmers do not have enough working capital to prepare their fields and plant cotton appropriately for the new season.

Multiple Taxes and Financial Contributions to Farmers' Associations

About 8.3% of the interviewed farmers explained that their cotton farming is constrained by many taxes and financial contributions to cotton farmers' association. For example, they explained that associations such as TACOGA, TCT, and CDTF depend on the financial contributions from farmers' incomes for their operations. Nevertheless, they have not been able to address the challenges facing farmers for a long time now. Also, many of the farmers' associations have their offices in towns, while cotton farming activities that require their support operate in rural areas.

8.2 Impediments Specific to Firms in the Cotton Value Chain

Inadequate supply of raw materials

Firms complained that the quantity of seed cotton produced in Tanzania does not satisfy the demand in the market –given the currently installed ginning capacity of factories in the country.

As a result of inadequate supply of raw materials (i.e. seed cotton and cottonseed), many processors operate below their installed capacity. Of the 24 interviewed firms, only 12.5% (3) considered themselves to operate at their full installed capacity, while 87.5% (21) were not operating at their full installed capacity; the main reason being low supply of raw materials. As such, any measures to revamp the cotton value chain in Tanzania must in the first place lead to an increase in the volume and quality of seed cotton and cottonseed.

Multiple taxes and contributions

Existence of many taxes and contributions were mentioned by 16.6% of the respondents as constraints affecting development of the cotton and cotton by-products sector. These taxes include the district levies, for which 5% is collected from each kilogram of cotton bought by a seed cotton buyer, as well as village levies, and revenue tax. Firms are asked to pay the district levy of 5% upfront; when they end up buying more than the estimates, they pay the difference, when they buy less, they lose the difference. However, the Finance Bill of 2017 has reduced crop cess from 5% to 3%. Despite of the collection of these taxes, producers think that there are no significant indications that the benefits of the spending from the taxes have been trickling down to support, for example, extension services in the rural cotton-growing areas. According to the respondents, many taxes are detrimental to the development of the cotton and cotton by-products sector. Multiple taxes lower farmers' earnings and make production process tedious. In addition to taxes, there are contributions that producers are asked to contribute including requests by government officials to cover various costs, such as visits by high government officials, the education fund, the Uhuru Torch, AIDS Day and Independence Day.

Weights and measures and cheating problems with farmers

Seed cotton weighing in progress

Some of the firms explained that cotton buyers, usually agents, tend to cheat farmers by using different tactics, such as underweighting the cotton, manipulation of price, delays in payments and half payments –which discourage cotton farmers and ultimately reduce seed cotton production.

Competition from Imports

Competition from imports, such as lint and edible oils, especially palm oil, was an issue for some of the firms in the survey. Even though, those who consider competition as an issue were of the opinion that local cotton products are not adequately promoted in the local market and that local costs of production are somehow high.

Business structural issues

Several structural issues were also identified as constraints to the development of the cotton sector. One of these is intense competition between ginners, which has precluded them from coordinating their efforts on issues such as quality control, inputs supply, credit availability, and research and extension services.

High cost of electricity

On average, electricity costs to firms engaged in the cotton value chain constitute about 14% of total costs, as shown earlier. Firms have special rates for which they pay in three–month instalments, regardless of whether they produce or not. This is seen as expensive by some of the firms in the value chain. The firms said further that power cuts are common – affecting production and productivity. Renegotiation with TANESCO is hereby encouraged to ensure win-win for both sides in order to boost development of the cotton sector.

Decreasing access to loans for the sector and too high interest rates

Of late, commercial banks' appetite to lend the agricultural sector has declined; the portfolio of loans for agriculture is decreasing because banks consider the risk in the sector has increased. Interest rate are also high, ranging from 15% to 24%.

Volatile international lint price

Firms indicated that volatility in the international price of lint makes it risky to invest in the sector because it becomes difficult to predict earnings and plan credit and investment requirements accordingly. Investment in the sector is thus constrained by business uncertainty.

9. Recommendations for boosting development of cotton by-products in Tanzania

9.1 Increase productivity and quality of seed cotton production

The findings of this report have shown that production of cotton has been declining over time, to the extent that the total installed cotton-ginning capacity in the country is much bigger than the total output of seed cotton production; and some of the ginneries have been closed temporarily. Consequently, supply of cottonseed for making cotton by-products has also decreased. The quality of seed cotton and cottonseed has also deteriorated due to various reasons as indicated earlier by respondents of the survey. With a view of reversing the observed deterioration and thereby revamp development of the cotton sector value chain, several measures have been proposed to increase productivity and quality of seed cotton.

Improve input supply and access

The first set of proposed measures relate to inputs supply and access by cotton farmers. These include delivery of improved planting seed before the cotton planting season starts and high-quality insecticides and fertilizers to farmers at the right time and quantity. Availability and usage of tractors by more farmers is also been proposed to encourage relatively large-scale cotton farming. This may include introduction and strengthening of credit schemes and financial services for cotton farmers.

The current system of linking farmers to ginners for input supply and extension services is good; but needs improvement and effective oversight by the central or local governments. Farmers have to be organized into registered, recognized and strengthened groups, in line with the Cotton Industry Act of 2011 Part VI; such that they can enter into effective and binding formal agreement with ginners. The terms of the agreements will spell out the conditions and obligations of each of the two parties involved. Mutual respect and implementation of the agreements will then be binding under the oversight of the local government. The government can also arrange for loan guarantee schemes for cotton farmers to be implemented through the farmers' groups.

Carry out capacity building to farmers

The second set of measures is on capacity-building programs to improve cotton farming techniques, harvesting and storage. This would aim to address not only the issues of productivity, but also quality of the post-harvest seed cotton, so as to increase its value and thus more income to the farmers. The training should include good agricultural practices, integrated pest management, etc. with an objective to improve productivity to at least fifty percent of the best performing country in the world.

Cotton farming is a business which must generate livelihood to the farmers. As such, simple and relevant business skills must be imparted to farmers, so as to carry out cotton growing on business terms. The leaders of the farmers' groups have to be trained on management and leadership skills to enhance governance and management of the groups.

Improve weighing and measure for seed cotton

Cotton ginners complained that some untrustworthy farmers add sand or foreign substances to seed cotton in order to increase weight and get more money. Also, some untrustworthy buying agents cheat by inflating the weight of seed cotton. The cheating compromises the quality of seed cotton, in addition to cheating buyers. Appropriate measures are needed to rectify this malpractice. This may include sensitization and education to farmers and buying agents, enforced by appropriate punishments. Also, distribution of scales to farmers' groups and training them in their use, as well as establishing standards and procedures to resolve weights-and-measures disputes, would alleviate problems related to weighing and measures.

9.2 Promote and support locally produced cotton by-products

Promote firms' engagement in multiple cotton by-products

Firms processing one or two products in the cotton value chain have relatively easy access to the raw materials to process other by-products. For example, ginners typically own the fuzzy seed that remains after the ginning process, so could add delinting and oil extraction units to the end of their production line, yielding them linters, cottonseed oil and cake at minimal extra operating costs. Thus, creating incentives for firms to integrate several by-products into their operations would increase the firm's efficiency and profitability, as well as diversifying the sector's output of cotton by-products.

Such a vertical integration strategy should also incorporate incentives for technological upgrading. For example, modern solvent extraction technology should be promoted for new oil extraction business lines, accompanied by delinting machines.

Policies can support vertical integration of by-products in the cotton sector in three ways. One is for the public sector to extend subsidized credit to selected investors, particularly ginners, who are willing and have viable business plans for installing and operating an appropriate solvent-based oil extraction technology and delinting machines. The second is to assure and promote domestic production of medical products from linters – given the recent appointment of Tanzania as the SADC sole procurer of certain medical products including those originating from linters. Thirdly, is to design a tax-related incentive package for motivating potential investors – this can include free importation of the technology plus a few years tax holiday, as appropriate.

Nevertheless, there are limits to this vertical integration strategy, as activities such as soap and candle making require complex technologies that may require the construction of a separate factory. cottonseed cake

Continue to improve road and rail transportation infrastructure

The on-going and planned road projects to bitumen level to connect the districts in the cotton-growing area will improve transport services. In addition, the on-going upgrading of the current Dar es Salaam to Mwanza railway line to standard gauge will transform transport services between the cotton-growing zone and Dar es Salaam – the exit Port. This will ease export-related transport services for cotton and cotton by-products to reduce the current average transport costs of 32% in the cotton industry. This will make the cotton products more competitive in the domestic and export markets.

Increase supply of electricity at a reduced tariff rate

Unstable and expensive electricity supply was mentioned by one third of the respondent firms as one of the constraints facing production activities. The estimates of costs of production of cotton by-products in this report have shown that on average electricity constitute about 14% of the total costs of production. However, under the current arrangement of power tariff between the Tanzania Electricity Supply Company (TANESCO) and ginners, the latter have complained that they have to continue paying for three months after the cotton season regardless of whether they are still operating or not. Electricity is the cheapest source of energy for firms engaged in production of cotton and cotton by-products. Tanzania is undertaking several major projects in electricity to double power supply in the coming few years. This will eliminate power cuts and potentially reduce power costs due to increased supply and the switching to more production of hydroelectric power from the prospective Stigler's Gorge station.

Improve extraction and refining of cottonseed oil

Many of the oil millers (expellers) press cottonseed physically without removing the husks while a few millers do remove them; and one firm in Shinyanga region uses modern solvent extraction technologies. The expeller technology presses seeds with the husks; and in addition, the technology leaves some oil in the cake - which not only reduces oil yield, but also makes the remaining

cottonseed cake a bit oily – and with cotton linters because many of the dealers press the seeds without delinting. Some mills produce semi-refined cottonseed oil while others produce refined cooking oil. Semi refined oils do not produce good quality oil useful for human consumption.

There is potential for increasing cottonseed oil production if an appropriate technology is used to fully extract oil from seeds. Also, marketability of cottonseed oil can increase if the oil is properly refined before it goes to the market. As such, the concern here is acquisition of appropriate technologies for improved oil extraction and refining. This can be attained by encouraging importation and installation of such technologies. Duty exemptions on capital goods can be extended to such technologies and, where appropriate, tax holidays can be conferred. The Tanzania Investment Bank can also consider giving loans to finance acquisition of special technologies such as those destined to improve by-products in the cotton value chain.

Improve quality of cottonseed cake and promote it in the domestic market

Cottonseed cake is a good animal feed for ruminants, but not so for non-ruminants because the cake contains the enzyme gossypol, which inhibits the absorption of nutrients in non–ruminants, such as poultry, fish and pigs. Non-ruminants are on increase in Tanzania as the country continues to promote fish farming, modern poultry and piggery – this is a growing potential market for gossypol-free oilseed cakes cottonseed cake. The technologies for removing the enzyme gossypol from cottonseed cake are now available in the market. However, investors in Tanzania have not yet implemented the technology. The Tanzania Cotton Board needs to sensitize potential investors on the availability and commercial benefits of de-gossypol technology in the country. Also, as proposed earlier, duty exemptions on capital goods and appropriate tax holidays can be applied to such technologies. The Tanzania Investment Bank can also consider giving loans to finance their acquisition.

Sensitize and motivate firms and individuals to produce by-products from cotton stalks

Cotton stalks are currently left in the field for burning during preparation for the next season. There are a few people who use them as sources of firewood for domestic use and burning of earth bricks. Since stalks are not yet in high demand, its price would be very low and give investors a comparative advantage to use cotton stalks as a raw material. There is a need to sensitize and motivate firms to invest in the production of cotton by-products that use cotton stalks as raw material.

It is recommended that the government scale up the on-going training on briquette making; and at the same time waive all taxes on purchase of these technologies. Once the production volume of briquettes is sufficient, it is proposed that the government bans the sale and use of wood charcoal in urban areas.

Harmonize and reduce taxes imposed by local authorities

Many respondent firms cited the many taxes and contributions levied on cotton and its by-products as constraints on the development of the sector. These taxes include the district levies, for which 5% is collected from each kilogram of cotton bought by a seed cotton buyer, as well as village levies, and revenue tax. Firms are asked to pay the district levy of 5% up front. However, the Finance Bill of 2017 has reduced crop cess from 5% to 3%. Meanwhile, respondents claim that the funds collected via these taxes are not spent on programs or investments in the cotton sector. In addition to taxes, producers are asked by government officials to contribute to various costs, such as visits by high government officials, the education fund, the Uhuru Torch, AIDS Day and Independence Day.

However, the current government is taking effective measures to eliminate all unnecessary levies on crop yields, as well as contributions introduced by local authorities. It is recommended that the implementation of the exercise should be fast-tracked to ensure that nuisance taxes and contributions in the cotton value chain are eliminated.

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Appendix 1: Cotton ginning/ seed oil companies in Tanzania

	GINNER	LOCATION	CONTACT
1	Afrisian Ginning Company	**Dar Es Salaam**	Tel: 022 2138781 Fax: 022 2130650 Email: afrisian@bol.co.tz
2	Roshan Meghjee Co. Ltd	**Dar Es Salaam**	Tel: 022 2112371/ 022 2117198 Fax: 022 2110766/ 022 2138845 Email: roshan@bol.co.tz, roshan@cats-net.com
3	BioSustain (T) Ltd	**Dar Es Salaam**	Tel: 022 2112868 Fax: 022 2122779 Email: haider@biosustain.de
		Shinyanga	Tel: 028 2763751/028 2763749 Fax: 028 2763740
4	Shirecu Co-operative Union	**Shinyanga**	Tel: 028 2762525. Fax: 028 2762525 Email: shireculimited@yahoo.com
5	Jambo Oil Mill	**Shinyanga**	Tel: 028 2762628 Fax: 028 2762629 Email: jambooil@yahoo.co.uk
6	Gaki Investment Co. Ltd	**Shinyanga**	Tel: 028 2762732 Fax: 028 2763016 Mob: 0756376679/ 0784 750806/ 0754 284203 Email: gakiginnery@yahoo.com
7	Roko Investment Co. Ltd	**Shinyanga**	Tel: 028 2763130 Fax: 028 2763130 Mob: 0784 666163/0785 130000 Email: rokoinvestment@yahoo.com
8	Busangwa Organic Farming (BOFA)	**Shinyanga**	Tel: 028 2763637/ 028 2762079 Mob: 0754 568395/ 0785 955813 Email: busangwainfo@yahoo.com
9	New Ubora Ngwessa Edward	**Shinyanga**	Tel: 0786 360160/ 0767 100120 Email: newbora@yahoo.com
10	Kisumwa Machinery Co. Ltd	**Shinyanga**	Tel: 028 2762298, Mob: 0754 361175/ 0756 005804 Fax: 028 2762298
11	Fresho Investments Co. Ltd	**Shinyanga**	Tel: 028 2762061 Fax: 028 2762080 Email: freddy@freshotz.com ginnery@freshotz.com
12	S & C Ginning Co. Ltd	**Shinyanga**	Tel: 028 2621230/028 2621137 Fax: 028 2621229 Email: scgl@africaonline.co.tz cmg@nbcl.biz
13	BioRe (T) Ltd (Organic Cotton)	**Meatu District, Simiyu**	Tel: 0784860854/ 028 2795090/ 028 2795025 Fax: 028 2795027 Email: info@biore-tanzania.com
14	Aham Investments Co. Ltd	**Shinyanga**	Tel: 0767100009/ 0754 399838 / 028 2763012 Email: ameir@myself.com
15	Chesano Cotton Ginnery	**Shinyanga**	Mob: 0784 494493/ 0756 562705 Email: limitedchesano@yahoo.com
16	NGS Investment Co. Ltd	**Shinyanga**	Tel: 028 2700153 Mob: 0784 484838 Fax: 028 2700460 Email: ngs_investment@yahoo.com
17	Nsagali Co. Ltd	**Shinyanga**	Fax: 028 2500212/ 028 2700460 Mob: 0784 761720/0754 761720 Email: nsagali1974@yahoo.com
18	Nida Textile & Oil Mill (T) Ltd	**Shinyanga**	Tel: 028 2710718 Fax: 028 2710719 Email: dgom786@yahoo.com
19	Kahama Cotton Co. Ltd	**Shinyanga**	Tel: 028 2710085 Fax: 028 2710573 Mob: 0784 243586/0759505534
20	Kahama Oil Mills	**Shinyanga**	Tel: 028 2710658 Fax: 2710616 Email: kahamaoilmill@iwayafrica.com
21	Nyanza Co-operative Union	**Mwanza**	Tel: 028 241615/240082 Fax: 028 2500218

	GINNER	LOCATION	CONTACT
			Mob: 0784 652760
22	Birchand Oil Mill	**Mwanza**	Tel: 028 2500607/2570259 Fax: 028 2500463 Mob: 0784 203557 Email: laxmi@mwanza-online.com
23	Alliance Ginneries Ltd	**Bariadi, Simiyu**	Mob: 0784 461986 Email: ogola@alliance.co.tz
24	Nyanza Cottonseed oil P.O. Box 11614	**Mwanza**	Tel: 028 2542206, Fax: 2550220 Mob: 0756 476437/0786 994596 Email: nyanzaoil@mwanzaonline.com
25	S.M. Holdings Ltd	**Mwanza**	Email: smholdings@cats-net.com
26	Integrated Cotton Field Ltd	**Mwanza**	Tel: 028 2541263, Fax: 028 2762878 Mob: 0754 272428/0784 272428 Email: exkwayu@yahoo.com
28	Tanzania Cotton Growers Association	**Mwanza**	Fax: 028 2500680 Email: ginnery20@yahoo.com tacogatz@yahoo.com
29	Olam (T) Ltd	**BUNDA, MARA**	Tel: 028 2502902/0783791121 Fax: 2501466 Email: aranyak.sanyal@olamnet.com
30	Nyanza Commercial Farming Ltd	**Mwanza**	Tel: 028 2540500/ 028 2562409 Email: nyanza@africaonline.co.tz
31	MSK Solutions Ltd	**Mwanza**	Tel: 028 2542260/ 028 2542261 Fax: 028 2500676 Email: mskltd@gmail.com
31	Vitrecs Oil Mill	**Mwanza**	Tel: 028 2700219 Mob: 0784 501114
32	ICK Cottonseed oil Co. Ltd	**Mwanza**	Mahandu, Tel: 028 2500161
33	KBL Enterprises Ltd	**Magu - Mwanza**	Mob: 0754 464442 Email: kblltd@yahoo.co.uk
		Dar Es Salaam	Mob: 0713 660979 Email: abdulhilal39@yahoo.com
34	Hassanal Walji	**Mwanza**	Tel: 2503309 Fax: 028 2500310. Mob: 0713 318883
		Maswa	Tel: 028 2750508 Fax: 028 2750278 Email: hrwalji@hotmail.com
		Morogoro	Tel: 023 2604080, Fax: 022 2182844
35	Copcot Cotton Trading (T) Ltd	**Geita**	Tel: 028 2520127 Fax: 028 2520335 Email: mail@copcot.co.tz
		Mwanza	Tel: 2501064 Fax: 028 2500905
36	Vearrian (T) Ltd	**Bunda – Mara**	Tel: 028 2621226 Fax: 028 2621228 Email: pamba@virianbunda.com
37	Badugu Ginning Co. Ltd	**Musoma**	Tel + Fax: 028 2620657 Mob: 0784 455873 Email: baduguginning@yahoo.com
38	Lisha Investment (T) Co. Ltd	**Nzega – Tabora**	Tel: 026 2692424 Fax: 026 2692408 Mob: 0767 389798/ 0784 389798 Email: lishainvestmentcompanyltd@yahoo.com
39	Kahama Coopérative Union	**Shinyanga**	Operations Manger Tel: 0767425217
40	New Tabora Textile (T) Limited	**Tabora**	**Managing Director** **Tel 0785275820**
41	Mount Meru Miller LTD	**Igunga, Tabora**	Production Managers Tel: 0752545000
42	**Biharamulo Coopérative Union**	**Chato, Geita**	Managing Director Tel: 0753623706
43	BIBITI GINNERIES LTD	**MEATU, SIMIYU**	DIRECTOR IN CHARGE TEL: 0768111666
44	SIMIYU COMMODITIES	**BARIADI, SIMIYU**	PRODUCTION MANAGER, TEL: 0754749499

Appendix 2: Institutions and associations dealing with cotton in Tanzania

No	ORGANIZATION	LOCATION	CONTACTS
1	Tanzania Cotton Board (TCB)	3rd Floor, Pamba House, DAR ES SALAAM	022-2122564 022-2128347 Fax: (+255) 022-2112894 E-mail: info@cotton.co.tz Website: www.tancotton.co.tz
2	Tanzania Export Processing Zone Authority (EPZA) Benjamin William Mkapa, Mabibo External, Nelson Mandela Road,	DAR ES SALAAM	Tel: +255 (0)22 245 1827-9 & 1 Fax: +255 (0)22 245 1830 Website: www.epza.co.tz
4	Tanzania Bureau of Standards	DAR ES SALAAM	Phone: +255 22 2450206 Cell : +255 754 279 552 Fax : +255 2450959 Email : info@tbstz.org
6	Tanzania Investment Centre, (TIC)	Shabaan Robert Street DAR ES SALAAM	Tel: +255 (22) 2116328 –32 Fax: +255(22) 2118253 E-mail: information@tic.co.tz Website: www.tic.co.tz
8	Agricultural Research Institute Ilonga	Kilosa, Morogoro	Tel: (255-23) 2623284 (Director) (255-23)2623201 (General) (255-23)2623358 (Zonal Research Coordinator) (255-23)2623282 (EZCORE) Fax: (255-023) 623284 e-mail: ilonga@africaonline.co.tz
9	Tanzania Cotton Association, (TCA)	Pamba House, 2nd Floor, Room 18, 1672 MWANZA	Telephone: +255 28 2500203 E- mail: tca@tca.co.tr
10	Cotton Development Trust Fund, (CDTF)	CDTF, MWANZA	The Manager CDTF, P.O. Box 935 MWANZA Tel: 0787287494/+255 (28) 2542535 E- mail: cdtf@thenet.co.tz
11	Lake Zone Agriculture Research Institute (LZARDI)	LZARDI, Ukiliguru, MWANZA	LZARDI Ukiruguru, S.L.P. 1433 MWANZA Tel: 0629516067/0732-980 768 E-mail: lzardi@iwayafrica.com

Appendix 3: Distribution of the responded farmers by region

Name of Region	Counts	Percentage
Shinyanga	19	20
Simiyu	62	65.3
Mara	10	10.5
Tabora	1	1.1
Geita	3	3.2
Total	95	100

Appendix 4: **Farmers' membership in associations**

Name of Association	Counts	Percent
SHIRECU	7	7.4
MIBAFU	1	1.1
Muungano Group	1	1.1
KACU (Kahama Cooperative Union)	1	1.1
Chama cha Msingi lgunga	1	1.1
Bungetuse Union	1	1.1
Kikundi cha Vijana	3	3.2
Jipe Raha	1	1.1
Kilimo Bora	3	3.2
Uhai Group	2	2.1
Iponya Buguli	2	2.1
Umoja ni Nguvu	3	3.2
Mwabusalu Amkrosi	2	2.1
Mkombozi Cooperative Union	1	1.1
NGS Company Ltd	2	2.1
BioRe (T) Ltd	5	5.3
MUTEX	1	1.1
None	57	60.0
DASIP Group	1	1.1
Total	95	100.0

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