VCA4D
VALUE CHAIN ANALYSIS FOR DEVELOPMENT

agrinatura for European Commission

Cotton value chain analysis in Ethiopia

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Agrinatura (http://agrinatura-eu.eu) is the European Alliance of Universities and Research Centers involved in agricultural research and capacity building for development.

The information and knowledge produced through the value chain studies are intended to support the Delegations of the European Union and their partners in improving policy dialogue, investing in value chains and better understanding the changes linked to their actions.

VCA4D uses a systematic methodological framework for analysing value chains in agriculture, livestock, fishery, aquaculture and agroforestry. More information including reports and communication material can be found at: https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-

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The content as well as what has been omitted in this report is of the main responsibility of the research team.

Abbreviations and Acronyms

AARC	Assossa Agricultural Research Centre
AFA	Agri-Food Value Chain Analysis software
AGOA	African Growth and Opportunity Act
AGP	Agricultural Growth Program
AILLA	Agricultural Investment Land Administration Agency
AISE	Agricultural Inputs Supply Enterprise
ATA	Agricultural Transformation Agency
AU	African Union
AwBA	Awash Basin Authority
BCI	Better Cotton Initiative
bn	billion
Bt	Bacillus thuringiensis
CBE	Commercial Bank of Ethiopia
CFT	Crop Field Trial
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement
CmiA	Cotton made in Africa
CMT	Cut-Make-Trim
CONV	Conventional (cotton)
CSA	Central Statistical Agency
CSM	Cotton Seed Meal
CSO	Civil Society Organisation
CSR	Corporate social Responsibility
DBE	Development Bank of Ethiopia
DDT	Dichlorodiphenyltrichloroethane
DFID	Department for International Development (UK)
DEVCO	Directorate-General for International Cooperation and Development (EU)
DP90	Deltapine 90 (cotton variety)
DRC	Domestic Resource Cost Ratio
EBI	Ethiopian Biodiversity Institute
EBITDA	Earnings before interest, taxes, depreciation and amortisation
EC	Ethiopian calendar
ECAE	Ethiopian Conformity Assessment Enterprise
ECDA	Ethiopian Cotton Development Authority
ECI	Ethiopian Cotton Initiative
ECPGEA	Ethiopian Cotton Producers, Ginners and Exporters Association
EDRI	Ethiopian Development Research Institute
EHAIA	Ethiopian Horticulture and Agriculture Investment Authority
EIA	Ethiopian Investment Agency
EIAR	Ethiopian Institute of Agricultural Research
EIC	Ethiopian Investment Commission
EIIDE	Ethiopian Industrial Input Development Enterprise
EiTEX	Ethiopian institute of Textile and Fashion Technology
ELS	Extra long staple (cotton)
ENAO	Ethiopian National Accreditation Office
EOA	Ecological Organic Agriculture
EP	Entreprise Partners
EPA	Ethiopian Protection Agency
EPOSPEA	Ethiopian Pulses, Oilseeds and Spices Processors – Exporters Association
ERCA	Ethiopian Revenues and Customs Authority
ESA	Ethiopian Standards Agency

ESA	Ethiopian Seed Association
ESE	Ethiopian Seed Enterprise
ETB	Ethiopian Birr
ETGAMA	Ethiopian Textile and Garment Manufacturers Association
ETIDI	Ethiopian Textile Industry Development Institute
EU	European Union
EUD	European Union Delegation
FAO	Food and Agriculture Organisation of the United Nations
FDRE	Federal Democratic Republic of Ethiopia
FiBL	Forschungsinstitut für biologischen Landbau (Research Inst. for Organic Agr.)
FLO	Fairtrade Labelling Organizations International
FNS	Food and Nutrition Security
GAIN	Global Agricultural Information Network
GDP	Gross domestic product
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft fűr Internationale Zusammenarbeit
GM	Genetically modified
GOT	Ginning outturn
GOTS	Global Organic Textile Standard
GTP	Growth and Transformation Plan
ha	hectare
HHP	Highly Hazardous Pesticides
HICES	Household Income and Expenditure Survey
HR	Human resources
HS (code)	Harmonised System
IAIPs	Integrated Agro-Industrial Parks
ICAC	international Cotton Advisory Committee
ICT	Information and Communication Technology
IFTLGWU	Industrial Federation of Textile, Leather and Garment Workers Trade Unions
IMF	International Monetary Fund
IO	Input-output
IPM	Integrated pest management
IR	Irrigated
ITC	International Trade Center
kg	kilogramme
kWh	kilowatt-hour
lb	pound
LC	Large commercial (cotton farm)
LCA	Life Cycle Assessment
LS	Long staple (cotton)
m^3	cubic meter
MC	Medium commercial (cotton farm)
mn	million
MoAL	Ministry of Agriculture and Livestock (current)
MoANR	Ministry of Agriculture and Natural Resources (previous)
MoEFCC	Ministry of Environment, Forestry and Climate Change
MoFEC	Ministry of Finance and Economic Cooperation
MoI	Ministry of Industry (current)
MoLSA	Ministry of Labour and Social Affairs
MoT	Ministry of Trade(current)
MoT	Ministry of Transport
MoTI	Ministry of Trade and Industry (previous)
MoWCA	Ministry of Women and Children Affairs

MoWIE	Ministry of Water, Irrigation and Energy
MT	metric tonne
n	number
NBE	National Bank of Ethiopia
NCDS	National Cotton Development Strategy
Ne	English count (yarn)
NIP	National Indicative Program (EU related)
NPC	Nominal Protection Coefficient
NSC	National Steering Committee for Cotton
NVRC	National Variety Release/Registration Committee
OE	Open end
ORG	Organic (cotton)
PA	Peasant Association
PAN	Pesticide Action Network (UK)
PCP	Programme for Country Partnership (UNIDO)
PEPE	Private Enterprise Programme Ethiopia (DFID)
PPESA	Privatisation & Public Enterprises Supervising Agency
PPP	Purchase power parity
RATES	Regional Agricultural Trade Expansion Support Program
RF	Rainfed
RG	Roller gin
SCF	Small Scale Farming (or Farmers)
SCIE	Sustainable Cotton Initiative Ethiopia
SDG	Sustainable Development Goals
SEACF	Southern and Eastern Africa Cotton Forum
SG	Saw gin
SNNPR	Southern Nations and Nationalities Peoples' Region
SSA	Sub-Saharan Africa
SSF	Small scale farmer
SWOT	Strengths, Weaknesses, Opportunities, Threats
t	tonne (metric)
T&A	Textile and Apparel
T&G	Textile and Garment
TIDI	Textile Industry Development Institute
TVET	Technical and vocational education training
TWI	Traditional weaving industry
UNIDO	United Nations Industrial Development Organisation
USD	US dollar ($)
USDA	United States Department of Agriculture
VC	Value Chain
VCA	Value Chain Analyses
VCA4D	Value Chain Analysis for Development
VSS	Voluntary Standards of Sustainability
WARC	Werer Agricultural Research Center
WCS	Whole Cotton Seed (fuzzy seed)
WTO	World Trade Organisation
yd	yard
yr	year

Executive Summary

Context and methodology

Cotton is one of the oldest fibre crops in Ethiopia and its cultivation is seen as part of the Ethiopian tradition. It is an important cash crop and plays a vital role in the agricultural and industrial development of the country's economy, providing livelihood to hundreds and thousands of people engaged in its farming, processing, trade and marketing.

Ethiopia is still a relatively small actor in Africa's cotton production and market though, currently, it is the second largest consumer of cotton in Africa (after Egypt) and a net importer of cotton lint. Over the past 10 years, the demand, especially from international brands, has risen forcing textile factories to import, whereas just less than a decade ago, factories were unable to absorb the cotton lint that was produced in the country.

Recognising the economic relevance of the cotton and textile sector, the government is engaged to address the above-mentioned challenges and it considers the sector as the 2nd most important growth sector for the country. That is why a "National Cotton Development Strategy" (NCDS) and a corresponding roadmap have been developed, for the period 2017-2032 with a special target of making Ethiopia one of the top producers of sustainable quality cotton products in the world by 2032.

The Ethiopia government particularly aims at satisfying the cotton demand of the Ethiopian textile industry by an increasing share of locally produced cotton. Beyond that, the NCDS has also a focus on increasing productivity, value addition and marketing of the cotton sector and to establish, by 2032, a status of worldwide acknowledged cotton brand comparable to that of coffee from Ethiopia that exists already today. To achieve this objective, the NCDS envisages to attain the following strategic cornerstones:

- improvement of the "policy and institutional environment to raise the efficiency and the competitiveness of the cotton value chain",
- promotion of transparency along the cotton value chain",
- promotion of an environmentally and socially sustainable cotton supply chain;
- improvement of the competitiveness and the profitability of cotton production".

Moreover, given the relatively limited use of pesticides and chemical fertilizers by smallholder farmers, Ethiopia has even the potential to become a producer of organic cotton for a niche market. But the absence of any administrative body to monitor and certify organic farm practices – and the lack of separate ginneries and other processing and handling facilities to manufacture organic cotton-based products – is constraining its growth.

Recognising the huge relevance of the cotton industry both at production and at manufacturing level, the EU is thus planning a possible cotton development support program, in line with the EU Commission Staff Working Document 'Sustainable garment value chains through EU development action'.

The VCA4D study is requested in order to analyse the contribution to economic growth, the inclusiveness and the social and environmental sustainability of the value chain (VC); and to better understand what are the bottlenecks that hinder the productivity levels and the challenging factors that block the cotton's competitiveness (such as cotton prices being up to the double of the international market. The VCA4D analysis will describe the current status of the value chain, from production to transformation, and will provide evidence-based information and a baseline for indicators to inform the future EU action in support of this strategic value chain in Ethiopia. It is agreed that the main focus will be limited downstream until the yarn production and that the textile part will only be partially treated, as the time allocated poses limitations and the main interest of the European Union lies on the upper stream of the value chain.

This study shall contribute to an understanding of the cotton and textile sector as it is today and aims to provide evidence for policy makers, supported by a list of indicators measured quantitatively or based on expert assessments that together provide an answer to four framing questions:

1. What is the contribution of the VC to economic growth?
2. Is this economic growth inclusive?

3. Is the VC socially sustainable?
4. Is the VC environmentally sustainable?

The analytical process has four components:

- **Functional analysis**: provides a general mapping and description of the main structures, actors, activities, and operations in the chain, an overview of the products and product flows, the major production systems, a description of the main governance mechanisms in the chain, and a short description of perceived constraints and is based mainly on secondary sources and key informant interviews.
- **Economic analysis**: consists of a financial analysis of each actor type, as well as an assessment of the consolidated value chain. It also assesses the economic performance, and the sustainability/viability for the national economy. Finally, it addresses inclusiveness of growth by examining income distribution and employment creation and distribution. Data is derived from secondary data, key informant interviews, and structured questionnaires.
- **Social analysis**: explores whether the cotton value chain is socially sustainable. It also contributes to discussion on whether potential economic growth in the value chain can be socially inclusive. The social analysis draws on multiple information sources, including secondary data and field data from the actor of the cotton VC at different scales, and other government and nongovernment stakeholders. The social analysis follows six domains of inquiry: working conditions, land and water rights, gender equality, food and nutrition security, social capital and living conditions.
- **Environmental analysis**: evaluates the environmental sustainability of the value chain. The analysis is conducted using Life Cycle Assessment (LCA). The scope of LCA consists of three areas of protection: Human health, Resource depletion and Ecosystem quality, to which a set of environmental impact categories and corresponding indicators are associated. The calculation of relevant environmental impacts in LCA is based on an exhaustive and quantitative inventory of all input and output fluxes over the entire life cycle of the studied system.

Main findings and answers to the framing questions and core indicators

The functional analysis confirms that Ethiopia is suitable for cotton and textile production, with fertile soils with water availability and an appropriate natural climate, humans accustomed since millennia with cotton production and textile fabrics, a culture proud of its traditional cloths made of Ethiopian cotton. Ethiopia currently cultivates 3% or about 55,000 -80,000 ha of the total 2.6 million hectares that is suitable for cotton production according to the official plans and strategies. The Ethiopian cotton sector is the most diversified in Africa, and even in the world, as it combines:

- irrigation and rainfed cultivation;
- smallholder and commercial farms;
- vision of market-led food security and vision of community-based farming and food sovereignty;
- conventional, genetically modified and Cotton made in Africa (CmiA) and organic cotton production;
- saw and roller ginning technology;
- stand-alone (custom ginning) and integrated ginneries.

The cotton-textile and textile and garment (T&G) value chains are very complex and have no equivalent elsewhere in the world. The modern textile industry coexists with the traditional textile sector (manual ginning, spinning and handloom weaving). Ethiopia's textile manufacturing industry embraces both medium and large public and private enterprises. Their activities include spinning (stand-alone and integrated factories), weaving, dyeing, finishing and sewing.

Related to seed cotton production, we find the following structure.

Type	**Small-scale farm (SCF)**		**Commercial farm (MC and LC)**	
	Trad. sector	Modern sector		
Average size (ha)	0.5	0.75	400	
Size range	Modern or traditional 0.1-10 ha		Commercial medium 10-250ha	Commercial large >250ha
Surface used (ha)	19,264		36,317	
Numbers of farms	7,000	19,000	20	70
Water Management Irrigation (IR) or rainfed (RF)	1,046 out of 19,264 ha IR		25,270 out of 36,317 ha IR	
Productivity (kg yield per ha)	1,300	1,600	1,900	
Total production (t seedcotton)	4,550	22,800	68,400	
Ethics of production	Conventional (CONV) or sustainable (EOA[1], sustainable standard) (ORG)			
	CONV and CmiA	Conv and ORG	CONV	CONV and ORG	CONV	CONV

The commercial farms covered in the 2018/19 season 71% of the production. The national production itself covered about 59% of the needs of the textile and apparel demand. About 70,000 t of yarn and carded cotton were imported, partially from neighbouring ginning plants in Sudan in order to satisfy the growing needs of the expanding textile and apparel sector.

To note that we have two distinct figurations within the VC, one based on traditional and simple technologies and the industrial, characterized by the large cotton farms and the foreign-dominated textile sector. The main production areas are in the cotton-sesame belt (Tigray, Amhara, Benjangul-Gumuz, Gambela), SNNPR and Afar. Most commercial farms are based on irrigated production and have a reduced rotation regime as compared to the SCF., which has negative impacts on soil fertility.

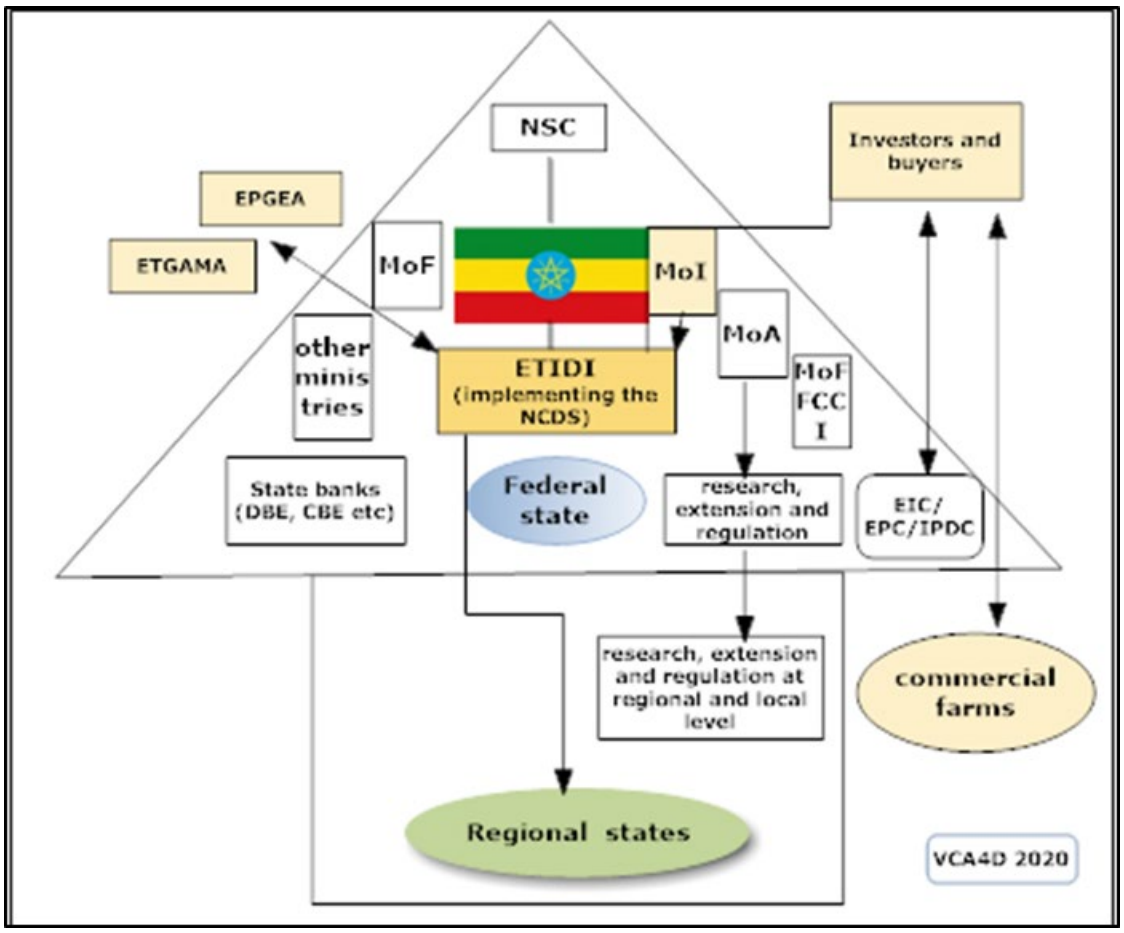
The geographic distribution of ginneries far away from the cotton areas leads to capacity gaps. In the 2018/19 season, seed cotton was processed by 19 operational ginneries with a theoretical total ginning capacity of over 400,000 tonnes of seed cotton per year. However, as most ginneries are poorly maintained, the operational capacity does not exceed 150,000 tonnes.

There are currently 20 installed spinning mills with a theoretical processing capacity exceeding 100,000 tonnes of lint annually. 16 were operational the 2018/19 season. Most mills are located in Oromia and in Addis Ababa.

There are large and medium oil processing mills. The largest one is Addis Modjo Edible Oil Complex. The number and capacity of household oil pressing is not known. As the typical oil content of cotton seed is about 12.5%, current production of cottonseed oil is about 6,000 tonnes per year. Cotton cakes are essentially used for cattle/poultry feeding.

The Ethiopian cotton sector is among the most uncoordinated, which can be explained by the recent dynamics of the textile industry and the complexity to align the heterogeneous cotton production structure with the ambitious targets of both government and the private textile industry. ETIDI is in charge of the whole cotton and textile sector, with a Directorate specifically in charge of the seed-cotton production sub-sector. Yet, the research, extension and regulatory bodies are under the Ministry of Agriculture and Livestock.

The national cotton development strategy (NCDS) serves as guiding document. The involvement of the professional associations ECPGEA (Ethiopian Cotton Producers, Ginners and Exporters Association) and ETGAMA (Ethiopian Textile and Garment Manufacturers Association) is considerable, contrary to the regional states.



The NCSD is not including the cottonseed sub-VC and does not capture the traditional textile context.

What is the contribution of the VC to economic growth?

Viability for the actors

The cotton VC can be defined as financially sustainable, given that its activities create positive incomes for most of the actors who are partially or totally dedicated to it.

The profitability for the actors ranges from negative to very positive according to the stakeholders, the stages of the value chain, and the markets (formal/informal-traditional).

At the production stage, the return on turnover of traditional cotton farmers amounts to 100%. For a small farmer in the 'modern' market, the return on turnover was calculated at 72%, which is higher than 51%-that of commercial farmers.

For the middlemen (traders), the return on turnover is only 4% of the market value of the seedcotton they sell to the ginners. However, their margin is 40% of the differential between the selling price and the price they pay to farmers.
At the processing stage, some ginners do not break even due to the under-utilisation of the ginning capacity and the low productivity (ginning outturn and efficiency). The return on turnover for spinners and oil processors are 14% and 31%, respectively.

Growth Generation

Growth is measured by the gross domestic product. The consolidated direct value added (VA) of the cotton VC (up to yarn and crude oil stages) amounts to 3,2 billion ETB about $110 million. When indirect effects are taken into account, the total VA of the analysed cotton VC is estimated at 3.38 million ETB.

The contribution of the cotton value chain generated in the overall national wealth in Ethiopia is currently quite insignificant. The cotton VC contributes to 0.18% to the national GDP and 0.54% to the agricultural GDP. Small cotton farmers generate a higher direct contribution to the GDP than large commercial farmers, relatively to their production. Traditional farms produce 5% of the total cottonseed production contributing to 6% of the cotton VC's direct VA. Small farms produce 24% of the total production and contribute to a 12%-share, whereas large farms generate only 31% of the VA with their 71%-share of production.

Viability within the global economy and competitiveness

Domestic products of the Ethiopian cotton VC compete with those available on the international markets. Domestic prices of lint are above or close to the international prices. Domestic prices of yarn are much higher, particularly the traditional product. In contrast, prices of cottonseed and cake are lower than world prices. However, the price of domestic crude oil is more than twice the international price. Exports of lint and yarn, estimated to be close to the imports, are boosted by the shortage of foreign currency (by the ginners) in the country. Local market price distortions affect the sustainability and viability of the cotton VC.

The Domestic Resources Cost ratio (DRC) is equal to 0.3, indicating a very good remuneration of domestic factors. Nevertheless, the Nominal Protection Coefficient (NPC) is equal to 1.56, which means a strong positive protection (local production is less competitive compared to imported products). The cotton VC has poor performances in terms of international competitiveness.

The price of seedcotton is by far the most important component in the cost of production of lint. The market price for seedcotton in Ethiopia was the second highest in Sub-Saharan Africa in 2019.

The current ginning outturn (% of lint to seedcotton) in Ethiopia is among the lowest in Africa: 37% compared to an average of 42.5% in the Franc Zone countries. As a result, Ethiopian ginners produce 13% less lint than their counterparts in West Africa for the same quantity of seedcotton. The lower ginning outturn, which is mainly due to the variety (DP90) translates into a commensurate increase in the cost of production of lint. Moreover, the oil content of cottonseeds of the current variety is extremely low, 12.5% compared to 19% in the franc Zone countries. As a result, Ethiopian crushers produce 34% less oil than their counterparts in West Africa for the same quantity of cottonseeds.

This is a critical issue for the Ethiopian cotton sector. Though the price of seedcotton is high by African standards, it is not attractive for the farmers to produce cotton compared to the prices of competing food crops (sesame, bananas, sugar); the resulting rather low level of production further inflates the cost of production of lint, which becomes uncompetitive (all the more so that its quality is poor).

The VC activities seem profitable and economically sustainable. However, the sustainability for ginners will depend on increased production and productivity. In addition, for all producers, long-term economic sustainability will depend on the competition with imports and consumer's recognition for quality. The lack of high-quality planting seed supply is the major bottleneck that hampers the sustainability and the profitability of the Ethiopian cotton VC.

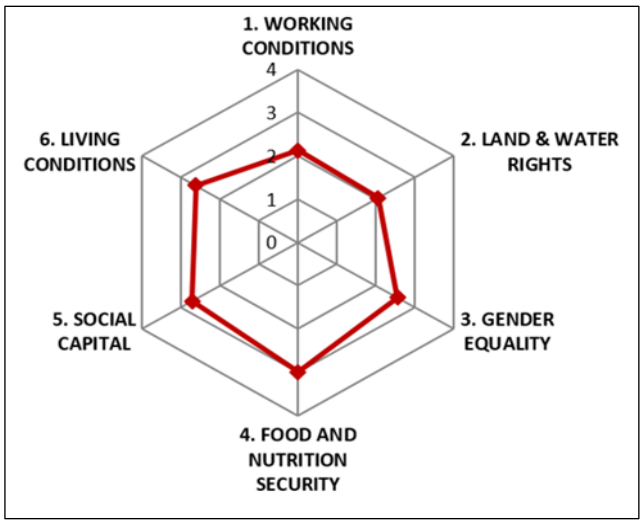
Is this economic growth inclusive?

The cotton VC has a great potential to create jobs in the country as it provides direct waged employment to many people, but mostly unskilled jobs.

Direct wages in the cotton VC are estimated at 463 million ETB, or 14% of the consolidated direct VA. Commercial farms are the largest contributors to job creation, with 58% of the wages. Small farms and spinners account respectively for 16% and 19% of the wages.

Traders (middlemen) benefit from rather comfortable margins but provide few jobs. This results in reduced profitability for small farmers who lack of access to micro-finance, key inputs, extension services and educational training to enhance their productivity, quality and sustainably increase of their incomes.
It should be noted that salaries in the farms are significantly higher than in the spinning mills. Seasonal agricultural workers are usually paid 125 ETB/day, which translates into more than $4 or about $125 on a monthly basis, while unskilled workers are paid less than $50 in the textile industry.

As for most countries in Sub-Saharan Africa, the cotton VC does not escape the country's overall situation characterised by a markedly uneven income distribution. The lack of inclusiveness of the VC could be explained by the strong dualism in the whole system between traditional and commercial systems. The organisation of the cotton VC has an obvious effect on the diversity of prices along the chain and thus on income distribution. The market-oriented component of the chain lacks formal contractual arrangements. Counter intuitively, the Ethiopian traditional market has a promising potential for sustainable development.
The growth is not inclusive. Mainly at two distinct fronts, the large commercial farms producing cotton and the modern textile factories employing cheap labourers (mainly young women) are the weak points to be addressed. The commercial farms, mostly set up in areas dominated by pastoralists or traditional farmers, by leases negotiated without the involvement of the indigenous or newly settled people (coming from the densely populated highlands), exclude these groups from economic growth. At the factory level, the low wages and poor career opportunities, particularly for women, reduce the inclusiveness. But even the traditional weaving sector, employing child labour and reducing their chances for a fair education and better economic prospects, reduce the social impact of the VC induced economic growth.



Is the VC socially sustainable?

The social profile figure sums up the situation of the cotton VC for the six domains. Four out of the six examined dimensions, i.e. working conditions, land and water rights, gender equity and living conditions, have to be improved in order to make the VC socially sustainable. From the food and nutrition security perspective, the cotton VC contributes positively. Not only is cotton enhancing soil fertility and contributing to the diversification of the farms, the income generated by the farmers, labourers and to a lesser degree by the female workers in the various enterprises

within the whole VC contributes to income and food security and the cotton oil benefits the important livestock sector of Ethiopia. This fact is due to the often neglected food (edible oil) and feed (cake) component of the cotton plant.

With respect to working conditions, a major problem appears to be the poor law enforcement, often due to lack of officials and poor communication among the actors and identities. Systematic violations of labour rights are reported. Forced labour is prohibited but it does occur, mainly in areas of immigration of highlanders and affecting indigenous lowlanders. The old tradition in Ethiopia of forced resettlements as well

the ongoing policy of enforcing sedentary lifestyles poses problems to both socio-cultural arenas and natural environment. Child labour is a cross-cutting problem, but also in this VC not an exception. Most of these children live in rural areas but are also employed in the traditional weaving sector, and the problem is due to poverty. Child labour in the weaving sector in Addis Ababa is well known. Most workers employed in the VC are poor, as the salary is insufficient to make a decent living. Some salaries are incredibly low and far below requirements for a decent life (below 20 $/month). Concerning job safety, the exposure to pesticides, also harmful like DDT and Endosulfan, poses the main threat to human health.

With respect to land and water rights, a major problem here are the "closed contracts" between the government (both federal and state) and investors under a 99-year lease contract. The local communities suffer from the consequences of unfulfilled or contested non-compliance of the commercial farms towards the local communities. The crowding-out of indigenous populations leads to feelings of discrimination against the people from Tigray and sometimes Amhara. This is toxic for the process of nation building, social security and peace. The water price for irrigation is very low. This is particularly astonishing in a context of water shortage, climate change and the fact that most new cotton areas should emerge in rather arid regions. At the same time water seems to be scarce and often insufficient to prevent soil salinity (like in Afar). The main groups and identities suffering from deficiencies in this dimension are therefore again the lowland communities, particularly indigenous people. However, also small-scale or family farmers with limited irrigation rights or lack of capital to invest in irrigation have relative disadvantages against large farms. Current and future investors should comply with best practices of corporate social responsibility and refrain from any investment activities in areas where land title is contested, and involuntary resettlement is occurring, until all violations are investigated and remedied.

Concerning gender equality, it may be stated that times are changing for the better for women in Ethiopia. The country has its first female president and half of the cabinet are women. But rural women are still far away to feel this change and the same seems to be true in cotton areas for the cotton female producers (less than 5% of women working in the farms manage cotton fields) and in the processing factories of cotton. Women have limited access to skill trainings, formal education, innovative agricultural inputs, and finance. They also have limited ownership and control over productive assets and technologies. While 46% percent of male-owned businesses used mobile phones for business purposes, only 3% percent of female owned businesses did. Ethiopian women have equal right to own, administer and control property under the existing laws. Particularly, they have a right to access the rural land free of charge and control it equally with men. The revised family codes of the country also uniformly recognize a woman's right to equal share of a common property, including land, upon divorce. Furthermore, women have an equal right to property inheritance". However, the problem is the implementation often due to communities' attitudes towards women rights. The major risks are within the modern textile and garment sector, where women as main employees have limited career opportunities and often unsatisfactory working conditions. This might have as consequence high turnover and difficulties to attract committed women in the industrial sector, mainly in management. Women have, in practice, generally less access to resources and services than men have, and specially related to land rights; they are the most marginalised group in society. The root causes lie in the values of the societies with attitudes impeding equal rights. Even if we can accept that the cotton and textile sector provide new opportunities for women, and that it bears particular opportunities to get heard and organized, big differences remain among the various regions, ethnic groups and religions. The main issue in Gambela: child marriage and low adult literacy; the one in SNNPR and Afar (and the potential cotton area Somali): low adolescent literacy and low incidence on participation in household decision-making.

With respect to food and nutrition security it can be stated that cotton production, at least in diversified and sustainable production modus, contributes in the context of Ethiopia with its rich soils and available amounts of water for irrigation, to both food security and food sovereignty. As a rotation crop, it is perceived to enhance soil fertility, and with the fibre and oilseed as main products used it enriches food, feed and nutrition. But less than 50% of the cotton grown falls under this category of diversified and relatively sustainable production and the prospects are the commercial farms will produce in few years over 90% of all cotton (now 70%). Nevertheless, as per 2018, the contribution of the VC is definitively positive for food and nutrition security. Cotton farmers in Amhara and Tigray produce cotton instead of additional sorghum and sesame. If the year has a favourable price relation between cotton and sesame, they win, if not they might lose income. Important is also the weather: if the rain is good (at least 800 mm and well distributed over the

season) and they have planted cotton, then it is good for the farmers' income (in principle) since the sesame suffers from too much rain and would fail and produce low yields. But a key factor for having more income through cotton is the availability of land. Households with less than 3 ha barely benefit from cotton, as they normally use less than 20% of the land for cotton. To note that even in the cotton-sesame belt, less than 15% of the arable land is used for cotton (and so about 30% for cotton + sesame). Self-sufficiency with cereals remains a key strategy for the small-scale farmers (SCF). Cottonseed oil is a by-product of cotton processing and used to be much more important as a vegetable oil than it is now. The world market replaced this product first by soy oil just after World War II, and since the eighties palm oil became the mass product, mainly as key ingredient for many junk food for the masses. Ethiopia has never tried to better use this key ingredient of the cotton plant and so rarely captures cotton not only as a fibre crop, but as well as an oilseed crop.

Concerning the social capital, a particularly weak point is the ignorance of indigenous rights, which poses current conflicts and harm to pastoralists and other communities neglected in the development process by exclusion of dialogues and contracts. The VC has however a good potential to correct these deficits and contribute to enhanced social and human capital, if the issue is recognized and addressed. Primary cooperatives lack access to finance to lend farmers the money they need to cover weeding and harvest costs or to supply inputs on credit for farmers. They also cannot access credit in order to buy seed cotton from their farmers, although they do get credit from the unions to aggregate sesame (SOFECO, 2016). This reduces the strengths of the cooperatives. According to the NCDS, the situation of the cotton extension system is bleak at the moment: (i) The transfer of the cotton sector from Ministry of Agriculture and Natural resources (MoANR) to Ministry of Industry has led to a withdrawal of the MoANR extension services for cotton production; (ii) The development of private extension services is still very limited; the large commercial cotton farms are usually unable to provide adequate services to the smallholders; (iii) The links with research are very limited and (at least for smallholders) farmers are often not aware of the activities conducted by the researchers. The farmers are therefore recipients of instructions and are hardly supposed to take their own decisions on own plans and aspirations. In most areas, therefore, when eventual instructions by extensionists, based on research knowledge, prevent effective participation, the services are considered a constraint to the farmer's development. Respect of traditional knowledge by state actors is just beginning timidly, and it will take time to create trustworthy relations between (cotton) farmers and the state. The introduction of new extension systems or technologies based on ambitious sectoral plans - like in the massive extension of cotton areas- as part of economic cooperation needs to take into account the traditions and needs of the end users.

With respect to living conditions, a dimension that lies above the average, we like to highlight the main risks for the near future. (i) Health and housing: Land lease contracts are supposed to be linked with provisions of health services by the health officials. It is not clear how these commitments are met. The non-delivery of promised health infrastructure and services could lead to negative attitudes of communities towards investors and the state authorities. (ii) The lowland- and cotton rural areas are generally less served in education than highland and particularly urban areas. Education and training would be required in order to address the economic, social and environmental challenges (poverty, hunger, health, employment, self-confidence, social peace, climate change adaptation). If the ambitious strategy of the VC will have a chance to be realised even partially, such low existing education and training facilities will never be sufficient. (iii) Resettlement and immigration of workers and farmers into newly developed regions and areas always pose problems with indigenous communities. They may lead to social conflicts and human suffering. Mainly Gambela and SNNP are concerned.

Considering the dynamics of the last years, the overall VC analysed (from cotton production to yarn) is socially not sustainable. However, a more differentiated view is required to put this into relations. We consider that the SCF-based VC (from cotton to yarn) is socially sustainable. The commercial or industrial cotton production-based VC is, according to our current state of information, not socially sustainable. A case-by-case analysis might provide a better picture. But various important issues would need to change to make it as a special category sustainable.

Is the VC environmentally sustainable?

In the first instance it should be clarified that an LCA exercise is best considered an indication of ecological efficiency as opposed to an innate indicator of sustainability as it reflects impacts in terms of a defined quantity of product (e.g. per kg). However, the stresses on the local environment manifest at the absolute level and are therefore dependent on both scale and carrying capacity of receiving environment. Therefore, national information and expertise is needed to help interpret how these pressures may manifest in the wider agronomic system. Based on the results it would appear that in terms of ecosystem quality (representing land occupation and ecotoxicity), yarn produced from traditional organic system with the lower yields is less eco-efficient due to land occupation and has a higher human health impact score if large quantities of manure is applied as a fertiliser. For climate change and resource use larger more intensive farms have significantly higher impacts than small holders. Most of the impacts appear concentrated on farm level, which can be attributed to the availability of low carbon electricity.

These points notwithstanding, the question as to whether the VC is sustainable cannot be answered conclusively and will depend on the sub-chain being examined, however it is likely that while most of the elements of the supply chain are unsustainable there are elements that have the capacity to be sustainable within certain context.

There are many aspects which contribute to this value chain being unsustainable. One of the most important elements is unavoidable and this is the occupation of land, in terms of direct cultivation, use of fallow land or land to provide organic fertiliser such as hay. On first evaluation, it would appear that cotton from more intensive farms has a higher integrated single impact score than traditional farming with virtually no processes inputs. Therefore, the score is more reflective of how cotton is produced across different sub chains, rather than inherent unsustainability. Despite demonstrating high yields in comparison with other regions in Sub-Saharan Africa, cotton yields are low in comparison with other big producers. Across all farm types this requirement for direct and indirect land increased the land use intensity of cotton production and will place pressure on other users, particularly if yields do not increase, meaning any increase in demand will require additional land. There remains a lot of uncertainty with regards the actual yields that are experienced on the ground, which can vary depending on local conditions such as weeding effectiveness.

For each farm type used in the analysis the team has encountered anecdotal accounts of higher and lower yields. What is worrying is the likely existence of farms with a higher resource intensity and a lower yield. One of the contributing factors to issue is the release of emissions from the field of N2O which, whilst exacerbated when in organic fertilisers are used will also be released during the cultivation of land for crops or as a source of organic fertiliser. When organic fertiliser has a lower N availability it is (in the absence of other N sources) required in larger quantities which can embody land and direct emissions during cultivation. Therefore, a lack of chemical inputs is compensated for by requiring more land provide nutrient inputs. This manifests directly as traditional farms having the highest single endpoint and ecosystem impact score when the resources embodied in organic fertiliser are retained. **This should not be interpreted as a statement on organic fertilisers being less sustainable than chemical fertilisers**, rather reflecting the processes that contribute to the impact assessment score, which is very sensitive to how much land is required, because both organic fertilisers and/or the soil pool are required if chemical fertilisers are not used. In addition, the low N availability of organic fertilisers means that large quantities are needed when they are a significant source of the nutrients reaching the cotton plants. However, land availability and occupation is a vitally important issue for cotton, as effective rotation and fertilisation is essential to retain soil fertility and structure. The issue of N sourcing is complicated because direct N_2O emissions from the field are difficult to mitigate and a lack of organic fertiliser places additional demand on the soil N sink which itself reflects use of land.

Many farms appear to use chemical fertilisers and pesticides, which are not considered sustainable as they contribute to eco-toxicity, human health impacts etc. without assisting in developing soil organic matter. One of the most important contributors to lack of sustainability is the use of energy on farms, the spreading of fertilisers, ploughing, will consume significant quantities of on farm energy. In particular where ploughing is undertaken by a large tractor (although this is most likely to occur in larger commercial farms), in that regard the value used in this study may be considered conservative. The use of tractors will also have a detrimental effect on soil quality and structure. The use of diesel to pump water in irrigation systems (as opposed to diverted river water) will result in significant energy demand but this is dependent on both the quantity of

water required and the depth it is pumped. In many parts of the country the water table is deeper than assumed in this study and therefore the pumping energy demands are likely to be significantly higher.

The issue of water is central to the sustainability assessment. As the environmental impact assessment method used in this study did not prioritise water use and additional assessment was undertaken using a waterfootprint method which demonstrated the stark difference between irrigated and rainfed systems. However, in reality the importance of this issue is evident without recourse to quantification. Cotton is widely recognised as a "thirsty" crop, within Ethiopia the on farm water demand will depend on both level of rainfall but also the efficiency of water use. In arid climates the loss of water due to evapotranspiration makes efficiency of irrigation more important. This issue is central to Ethiopia as many regions suffer from both water stress (removals vs availability) and high degrees of salinity. Like land use the demand for water has an impact on the wider system whereby the concentration of water demand (such as large commercial farm that irrigates) will reduce water availability for other users in the adjacent region. The consumption of surface and water is particularly relevant within the context of climate change as sub-Saharan Africa is one of the regions that is identified as being particularity at risk from future climate change impacts. This is particularly relevant as a reduction in rainfall (or the concentration of rainfall in a particular time window) may well reduce the available rainfall at the farm level and increase demand for surface water irrigation.

Beyond the farm there are elements that contribute to a lack of sustainability, most notable of which is the energy consumed during the ginning and spinning process as well as fact that processing centres are concentrated in regions such as Addis Ababa (although this does appear to be changing). Long transport distance increases the greenhouse and particulate emissions associated with yarn production.

However, there are elements which are positive within the value chain. In the first instance the prominence of hydroelectric power in the national grid means that electricity is low carbon (that is not to suggest that hydropower is without its own issues) however this does reduce the environmental impact of processes like ginning and spinning that are electricity intensive. This is a significant benefit of manufacturing in Ethiopia.

Returning to the framing question of "is the VC sustainable" allows us to present a very cautious note of optimism. The traditional value chain which, includes rainfed farming without energy or chemical inputs and supplies cotton lint to a traditional hand ginner/spinner has the capacity to be sustainable. This might sound counter intuitive as this farm resulted in the highest end point score. The reason for this is the occupation of land and the large quantity of dedicated organic fertiliser that is supplied to compensate for a lack of chemical inputs. Dedicated organic fertiliser inputs from manure and hay produced outside of the farm embody land occupation in order to grow crops to feed cattle and cultivate hay. (Within the lifecycle assessment software, both low intensity straw and manure have an embodied land use impact). However, the farm boundaries may be "fuzzy" in this context as residues from the field and farm can be used to produce organic fertiliser, risking double counting of land occupation. Therefore, as a sensitivity measure the impact results are presented with and without the embodied impacts of organic fertiliser production.

Under a situation where good organic cultivated practice (including effective weeding and appropriate bio-control mechanisms) can shared, it is not unreasonable to consider it possible to increase yields and reduce land occupation. Furthermore, the cultivation of cotton and the production of yarn provides a large quantity of residues and by-products. The availability and quality of organic amendments remain an issue in Ethiopia, whereby there is an opportunity to transfer good practice in residue utilisation/mulching etc. to improve the efficiency of land. (At this point it should be reaffirmed that the use of land as fallow or as a source of organic fertiliser is not in itself inherently unsustainable, but rather must be viewed within the context of local land availability and risk of depletion of soil fertility).

Enhancing the use of such pathways to nutrient delivery may well reduce the need for fallow land or indeed dedicated organic amendments, which would reduce the dependence on the soil pool. There are undoubtedly examples of good practice in this regard although discussions during the first mission identified challenges in labour demands of such practices, especially if the price of cotton is not seen as attractive. Therefore, there may be need for additional support in developing mechanism for increasing (or at least maintaining) yields through the use of available by-products.

Major bottlenecks and opportunities

We identified nine major bottlenecks (details are in the conclusion):

1) Lack of market and contract transparency: mainly the cotton producers and the ginners lack market information (prices, costs etc) and transparency in order to get the confidence and trust into the VC and take the required measures to respond to the expectations of the market in relation to the quality and quantity demands of cotton lint. Similarly, the communities and regions with large farms under federal lease lack transparency in contracts, which impedes proper integration of these farms in the regional economy and society.
2) Poverty of small-scale cotton producers: The small-scale farmers lack support in increasing technical knowledge and skills in order to access emerging and promising markets (like organic cotton and CmiA) whilst using this knowledge as an opportunity to increase the productivity, sustainability and profitability of cotton to improve income.
3) Unclear roles between the involved ministries (mainly Industry and Agriculture). The sub-optimal relations between Ministry of Industry (closer to the textile sub-chain and investors and commercial farms) and Ministry of Agriculture and Livestock (closer to small-scale farmers, extension, farmer training and research, causes bureaucratic inefficiencies and blocks the promotion of a sustainable growth of cotton, which would be required to satisfy the growing needs of the textile sector.
4) On farm resource requirements and climate change: the ongoing climate change is putting more pressure on the water demand (in both irrigated and rainfed schemes) and the pressure on lands will soon require more proactive measures at farm level to restore the organic matter and humus and keep their levels at the required levels. If not, productivity and income are at risk.
5) Limited quality and quantity of domestic cotton: Mainly due to poor training and skills levels at small-scale farmers level, both the quality (fibre quality and contamination) and quantity produced can be low compared to the potential given by the soil and weather conditions, these bottlenecks causes income losses at farm and ginning level.
6) VC inefficiencies and lack of monitoring system: The current monitoring and management does not allow a systematic or targeted planning of improvement measures to address the challenges mentioned here.
7) Low quality of seeds: The current few varieties are outdated and limiting unnecessarily the yields and which are not suited to the local soil, climate and farming methods. Since 1989, no variety for rainfed cotton has been selected.
8) Low ginning outturn and outdated ginning equipment: This bottleneck increases the costs of cotton lint and reduces the competitiveness of the VC.
9) The further segmentation of the VC along an ecological/traditional/ could position Ethiopian cotton as a multi-functional and biodiversified and rather sustainable agriculture and further decrease the food deficit of Ethiopia. Because of the above bottlenecks, the segmentation will increase and could provoke ecological, social and economic disruptions.

The main causes explaining the stagnation of the cotton area are identified. They cover factors from political, economic, social and natural spheres.

The **recommendations** are proposed based on the opportunities and in the light of SDGs, long-term socio-economic perspectives and the aim of increasing the resilience of the VC in all aspects, including social aspirations and inclusiveness, pandemics, water shortages and expected demands of the world market.

1) Increase in demand for quality lint in emerging markets such as organic cotton as opposed to expansion of output.
2) Using the VC as a vector of sustainable economic growth in which soil quality and biodiversity can be maintained.
3) More research and development into new varieties of seed or appropriate conservation agriculture practices that are suitable for smallholders to implement.
4) Use of the cottonseed oil and seed mash output to enhance food security and income diversification.
5) Better training of stakeholders (and address skill gaps) leading to better availability and use of inputs (reduce restrictions at customs) and share knowledge of niches of good practice where ecological practices and satisfactory yields have been achieved.

6) To use cotton as a strategic cropping system for food and nutrition security.
7) Develop capacity for quality product garments and traditional garment production for the export market, taking advantage of the uniqueness and diversity of traditional Ethiopian garments.
8) Seek to integrate organic and low impact practices with traditional garment production to develop a "brand identity" for an environmentally and culturally valuable product.

Relevant issues requiring further in-depth analysis

We recommend 12 general (or conceptual) measures and consider all as vital for improving the sustainability of the VC. They are to be considered as points of discussions. Each recommendation is more than just a technical action. The challenges are impressive and it will take time, but with an open mind-set, leadership and good partners, they can be managed.

Twelve conceptual recommendations

	Between MoI and MoA	Involving most stakeholders
Technical	• Take better adaptation measures against climate change • **Recognise the strategic role of cotton and textile research** • Take more national ownership at the investment and entrepreneurial side of the textile and edible oil sectors	• Improve skills in dealing with water efficiency and observing soil fertility levels. • **Improve the support for the traditional and modern small-scale farmers** and all stages of the traditional sub-chain. • Integrate the large and medium commercial farms in technical support.
Institutional	• **Improve communication and cooperation amongst official bodies** • Focus on quality seedcotton and textile, reduce the ambitions to expand the cotton area. • Reconsider a more active role for the regional states	• Integrate the interests of pastoralists, communities and workers. • Support organic cotton and textile systematically • **Build a label for quality cotton and textile of Ethiopia**

To make the recommendations more concrete, the study provides an overview with various specific operational measures. The conclusion is that the VC bears various important potentials, which should be addressed and discussed among the main stakeholders from cotton production to the textile sector including the dimensions of food security and the decentralisation of the required services.

Operational recommendations related to Impact domains

	VA and efficiency of VC	Economic impacts	Social impacts	Environmental Impacts
	Cross-cutting recommendations			
Trade-offs between food and fibre sector and improved vertical integration and policy dialogue	Assess the comparative advantages of specific- cotton-cereal production systems, taking into account the food security (edible oil, soil fertility impact, diversity of production systems) and job creation components of cotton. Better harness the potential of the VC for SCF and not just focus on commercial farms. Identify ways to ensure that SCF farmers retain the benefit of cotton production diversification (e.g. growth of oil market).			
			More information, better education, better law enforcement and more care for the health of workers and farmers in the VC should be addressed	Increase uptake and upscaling of domestic composting including use of on-farm residues to help maintain soil fertility and yields.
Governance	Consider the creation of a "consultation framework", bringing together the two main partners (MoI, MoANR), the seed-cotton producers and the textile industry, each of them being organised under their respective Ministries, MoANR and MoI. This should lead to a governance structure and a new focal institution of the VC and for the NCDS which reflects the needs of the sector and integrates accordingly the interests of the relevant Ministries and the other stakeholders. Consider ways to better include the concerned regional states in the governance process. This should address the low level of motivation of SCF for cotton as well as the local economic developments and food security and rights issues. Barriers (cost, information, labour) to penetration of organic cotton should be examined within the context of the other crops in the cycle. Organize a workshop with all stakeholders to jointly analyse the sector based on the outcomes of the VCA4D study and agree on its expectations (food security, incentives to increase seedcotton production, local development). In particular there is a need for a standardised approach for recording the variance in yield across traditional small scale, large scale, commercial, traditional, producers including rainfed and irrigation systems. This will help to identify examples of more sustainable practices. Significant amounts of valuable information are available to existing partners. Devise clearer mechanisms of information sharing between existing partners. This includes governing bodies accepting the experiences of the farmers on effective rotation, appropriate crops etc. Also, this includes negative elements such as effects of			
Agricultural production systems	Better endowment of the research component and specifically for WERER/WARC. To envisage clear obligations towards the investors related to local food security impacts of the commercial farm (independently if cotton or other cash crop like sugar cane or food crop for export is produced on the farm). This measure would require a more active role of the regional states.		Reinforce structure and voices of endogenous people. The public sector should better respond to the existing local initiatives. Better listen to the concerns expressed by women.	Use water more efficiently in RF systems by revising the tax policy and making use of existing technologies. Small scale low impact water saving (and harvesting) measures that are region appropriate need identification.
	Consider wheat-cotton-legumes systems in lowland irrigated areas as means of enhancing soil nutrient poll. Support for better use of on field residues. Institutionalize robust mechanism for social, economic and environmental impact assessments for ongoing and new commercial farms and involved land lease contracts. As few data on nutrition in relation with cotton farming and the VC is available, more research should be done on this important topic. In particular, there needs to be better information on the extent to which the soil nutrient pool is being depleted or enhanced and if the prevalent rotation scheme is adequate for the needs of the whole			
		Commission a feasibility study for organic cotton including environmental, social and economic constraints. Learn from the experiences of the coffee value chain in terms of brand awareness and recognition.		
		Developing socially acceptable solutions to reverse the decline in soil fertility. Review existing rotation and fallow practices on that basis and investigate in other new agroecological practices (agroforestry, soil regeneration, conservation).		

		Monitoring of desirable economic, social and environmental impacts through a research-based support, taking into account changing climate change and socio-	
	Promote skills training, advisory services and mechanization for SCF that is adequate to farms' structures. More decentralized and participatory approaches for extension and advice for the cotton producers. Consider support for farm (field) schools with farmer recognised as important teachers as well as learners.		Utilise available sources of nutrients, including household organic and farm wastes as well as field residues. Provide training in effective composting techniques and making best use of available resources.
	Exploiting genetic variability to combine productivity, fibre quality, climate change adaptation and cotton oil yield by providing new seed varieties	Adapting technical advice to producers according to their typology and socio-cultural context and to the requirements of the agro-ecological zones. (e.g. terraced fields maybe applicable in the Simien Mountains as a means of reducing runoff and soil losses but perhaps not in other areas). Main focus should be on cycles of production systems, where cotton is often competing with economically more interesting crops, like sesame, banana, sugar cane, which tend to reduce cotton's attractiveness if not considered holistically. The unit of the production system should include multi-year rotation systems with cotton as a fixed component. Better integrate with the livestock value chains.	
		Reducing the selling price of inputs for producers if no distortions implied through a better organisation at cooperative	Keeping records of cases of conflict between farmers and herders/pastoralists and indigenous peoples.
		Granting liquidity credits to SCF to enhance attractiveness of balanced cotton systems. Assure more transparency with the land deals.	
Ginning sector	Ginners to be more proactive to encourage in their area quality cotton production and cooperate with the stakeholders on advice and enabling conditions for steady sustainable growth of the sector.		
Cottonseed incl. oil sub-sector	Consider seed with higher oil content. Consider import substitution policy for edible oils by promoting	Modernise and upscale the technology used in the oil sector to improve oil yields and reduce the material intensity. Consider investment in refining as well as extraction, but this needs a cost -benefit analysis approach.	
	Open the dialog with the Association of oil millers and make feasibility study to assess the promotion of the sub value chain on cotton seed.		
Textile sector	Address the issue of child labour in the traditional sector and the issue of working conditions in the modern sector and proactive measures to increase the incentives for SCF cotton producers (better contracts, agree on cotton prices before the season)		
	Recognise the uniqueness and value of the traditional textile sector and also consider the potential role of traditional cotton production for the modern textile sector. Create a new image of high value low impact cotton products, including the marketing of traditional garments	Better enforcement of the laws related to workers' right Better listen to the concerns expressed by women.	

1. Introduction and Context

1.1 Introduction to the project

The VCA4D project is part of the European Union 'Inclusive and Sustainable Value Chains and Food Fortification Programme'. **Thirty-five studies of agricultural Value Chains are being undertaken through this project.**

Value Chain Analysis is used to produce and provide knowledge for enhanced project management, policy dialogue and decision making on value chains operations and accountability. Indeed, it aims at **fostering organizational and technological innovation, identifying or assessing projects and investment opportunities whilst** feeding the policy dialogue with partner governments in the field of Agriculture, Food and Nutrition security. It is a key element of the approach for enhancing the future role of the private sector in inclusive and sustainable agricultural growth. Based on the evidence, the analysis will contribute to increased global knowledge for the potential scale up of interventions whilst ensuring appropriate accountability.

Recognising the huge relevance of the cotton industry both at production and at manufacturing level, the EU is thus planning a possible cotton development support program, in line with the EU Commission Staff Working Document 'Sustainable garment value chains through EU development action'.
The VCA4D study is requested in order to better understand what are the bottlenecks that hinder the productivity levels and the challenging factors that block the cotton's competitiveness (such as cotton prices being up to the double of the international market). The VCA4D analysis will describe the current status of the value chain, from production to transformation, and will provide evidence-based information and a baseline for indicators to inform the future EU action in support of this strategic value chain in Ethiopia.

1.2 Context of this VC Analysis

Cotton is one of the oldest fibre crops in Ethiopia and its cultivation is seen as part of the Ethiopian tradition. It is an important cash crop and plays a vital role in the agricultural and industrial development of the country's economy, providing livelihood to hundreds of thousands of people engaged in its farming, processing, trade and marketing.

Ethiopia is still a relatively small actor in Africa's cotton production and market though, currently, it is the second largest consumer of cotton in Africa (after Egypt) and a net importer of cotton lint. Over the past ten years, the demand, especially from international brands, has risen forcing textile factories to import, whereas just less than a decade ago, factories were unable to absorb the cotton lint that was produced in the country. The Federal Republic of Ethiopia has set the goal to become a middle-income country by 2025 (FDRE 2014). One specific objective is to:

> *Develop the domestic engineering and fabrication capacity and improve productivity, quality, and competitiveness of the domestic productive sectors (agriculture and manufacturing industries) to speed up structural transformation.*

Cotton is considered as one of the key commodities for achieving the goal of getting out of poverty and speeding up the structural transformation. One key aim is to attract more foreign investors in both large cotton farming as well as textile industries.

Agriculture is the main stay and the basis of Ethiopia's economy as about one-third of the Growth Domestic Product (GDP) and 90 % of the total foreign trade come from the agricultural sector. Besides, agriculture accounts for 80 % of the livelihood of the country's total population. It is believed that Ethiopia is one of the centres of origin for several cultivated crops including one of the four cultivated cotton species, Gossypium herbaceum (EIAR 2017).

The commitment of the Ethiopian Institute of Agricultural Research (EIAR) to cotton and its role for the development of Ethiopian economy are stated in the same document:

Cotton (Gossypium spp.) is the world's leading natural textile fibre crop and a significant contributor of oilseed for human consumption. It is one of the best gifts that nature bestowed on mankind. Its fabric is the most skin friendly of all natural fibres available on earth. It's the most important vegetable fibres used by man despite the ever-expanding use of synthetic fibres. Cotton is an important source of cash for the growers, processors, exporters and producing countries. Cotton lint is an important input for the textile factories, garment manufacturing and cottage industries; the cotton seed for oil milling industries and the cotton seedcake for animal fattening sub-sector. Cotton as a sub-sector creates huge job opportunities at different value chains (production, processing and marketing) of the crop. It is a source of hard currency for the country through export of the lint and various products as well as by-products of the sub-sector.

However, there is a big mismatch between plans and intentions on one side and the available resources in order to implement even a minor part of the plan of the researchers. Secondly, the communication challenges already within the research community split into many disciplines are huge. This factor is beyond the context of Ethiopia and concerns most countries in all areas, not just cotton and was described as a structural problem already 80 years ago (Howard, 1943). The lack of research funds has to be kept in mind as an indicator for mismatches between the various segments and actors of this rather complex VC going far beyond the context of Ethiopia.

The geographic implications of the VC can be grasped with Figure 1, mapping the production areas (both smallholder and potential areas for commercial farms) as well as the laces of the industrial parks and textile and apparel industries.

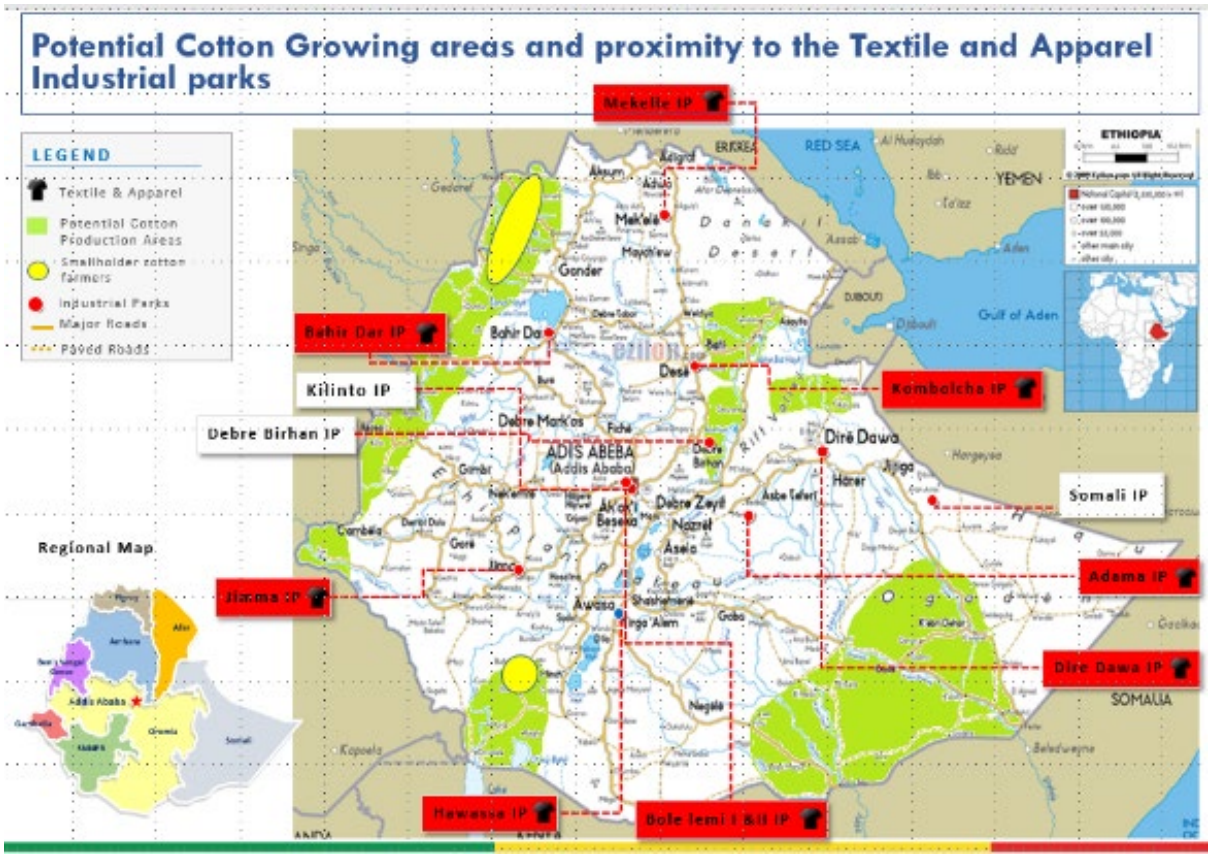


FIGURE 1 : OVERVIEW OF THE COTTON SECTOR, INCL. INDUSTRIAL PARKS
(credit: S.Asefa, ETIDI)

1.3 VCA4D Methodology

The methodology used in this study aims to provide evidence, supported by a list of indicators measured quantitatively or based on expert assessments that together provide an answer to four framing questions:

1. What is the contribution of the VC to economic growth?
2. Is this economic growth inclusive?
3. Is the VC socially sustainable?
4. Is the VC environmentally sustainable?

The analytical process has four components:
Functional analysis: provides a general mapping and description of the main actors, activities, and operations in the chain, an overview of the products and product flows, the major production systems, a description of the main governance mechanisms in the chain, and a short description of (known) constraints. The functional analysis forms the basis for the analyses in the other three components.
The analysis is mainly based on secondary data, and key informant interviews with both value chain actors and key experts.

Economic analysis: firstly consists of a financial analysis of each actor type (financial accounts, return on investment), as well as an assessment of the consolidated value chain (total value of production, global operating accounts). Secondly, it assesses the economic performance (contribution to economic growth in terms of direct and indirect value added generated, and the sustainability/viability for the national economy (domestic cost ratio, Policy analysis matrix). Finally, it addresses inclusiveness of growth by examining income distribution (business income, wages), and employment creation and distribution. In the economic analysis, the key is to strike the right balance between providing sufficient, robust, and reliable quantitative information for decision making, and keeping data collection efforts to a manageable limit. Data is derived from secondary data, key informant interviews, and structured questionnaires. The analysis should have been (partially) conducted with the support of the Agri-Food Value Chain Analysis (AFA) software, developed by CIRAD, however due to issues with operating the software, the entire analysis was conducted in Excel.

The social analysis explores whether the cotton value chain is socially sustainable. It also contributes to discussion on whether potential economic growth in the value chain can be socially inclusive. The social analysis draws on multiple information sources, including secondary data and field data from aquaculture producers at different scales, hatchery owners, processors, input suppliers, traders, exporters etc., and other government and non-government stakeholders. The social analysis follows the six domains of inquiry and their associated questions specified in the methodology and social analysis software; Working Conditions, Land and Water Rights, Gender Equality, Food and Nutrition Security, Social Capital and Living conditions. Few key informant interviews were held with stakeholders in the value chain and in supporting organisations as the intended mission 2 which was mainly planned for these activities had to be cancelled. The six domains and sub questions were scored in a Social Profile excel spreadsheet. Structural features from the social context were included directly into the functional analyses (including on governance).

The environmental analysis evaluates the environmental sustainability of the value chain. The analysis is conducted using Life Cycle Assessment (LCA). The scope of LCA consists of three areas of protection:
Human health, Resources and Ecosystem quality, to which a set of environmental impact categories and corresponding indicators are associated. The calculation of relevant environmental impacts in LCA is based on an exhaustive and quantitative inventory of all input and output fluxes over the entire life cycle of the studied system.

The January 13 meeting with the EUD team (Dominique Devoux, Eshetu Mulatu) at the beginning of mission 1 (January 13 to February 2) helped the team to better understand the context, to take notice from the previous engagement of EUD in the Coffee VC and to arrange a joint meeting within MoA. The following meetings both in Adds Ababa and out in the field (see plan above and Annexe A9) went very well and according plan with no changes. The four experts got along well quickly as a team, making the work a real joint venture, focussing mainly on the function analyses of the cotton VC.

In week 3, a short visit to Mekelle was done in order to assess the concrete conditions for (national) investors to get the land and technical support at regional level (Tigray). For this purpose, a concrete project idea was encouraged, followed over one week and is analysed for Kafta Humera woreda (2,000 ha cotton-sesame-legume-cereal plus land for contract farmers around). This exercise will shed more light on the current

weaknesses and strengths of the governance system as well the execution of the current country strategy for the VC (with focus on fibre). More details in Annexe A2-7b.

1.4 Scope of the Analysis

The objective of the study is to describe and analyse the cotton Value Chain (VC) in Ethiopia using the tools and methods included in the DEVCO/C1 "Methodological Brief. Frame and Tools". The study will therefore produce knowledge about the growth, inclusiveness and sustainability of the cotton value chain in Ethiopia. Sometimes, this CV is also called cotton-textile VC. Our analyses stop basically at the level of yarn production and treats the textile part (the downstream) only partially (including weavers, social aspects of textile workers, etc.). This limitation of scope has to be taken into account when interpreting the economic metrics on value addition, as the value addition increases disproportionally towards downstream.
This methodological framework elaborated by the European Commission includes an evidence-based, largely quantitative, analysis toolkit. It consists of a robust diagnosis system that describes the state of affairs of the functioning of the chain (mapping of the VC system, technical diagnosis and governance) and its sustainability in the three dimensions (economic, social and environmental).
Our VC analyses captures mainly the situation of the 2018/19.

1.5 Notes to the Data Collection

It was agreed with EUD that these VC analyses will concentrate from cotton field up to yarn production (spinning), and to oil and cake production. The further processes beyond yarn (weaving, garment and apparel) will only be treated in general terms.
We met the key players in Addis Ababa, i.e.

1. ETIDI (MoTI)
2. MoAL, Crops Directorate
3. ECPGEA, ETGAMA
4. EP
5. EIAR
6. MoEFCC.

The lead of the T&A sector is clearly allocated within MoT, and specifically ETIDI. On the other hand, the production of cotton is of course supervised by MoAL staff at all 5 levels (Kebele, Woreda, Zone, Region, Federal). ETIDI has no staff at regional level and below, but they compensate this partially with monitoring visits to the commercial farms.

The main information/data types gathered include:

Economic: prices of inputs and outputs, ratios and costs of production, needed for building the financial operating accounts of the identified actors relevant for the economic analysis of the Ethiopian cotton value chain. The draft scoping study on the “National Cotton Development Strategy 2015-2030” (NCDS) done by the consulting firm SOFRECO provides an excellent base and overview of the VC representing the situation around 2015.

Social: organisation and living conditions of seedcotton producers, living conditions traditional textile workers (hand looming), food and nutrition security, social capital, institutions, social systems, historical data, risk factors for specific social categories.

Environmental: variation in yields across farmer types, range of inputs, range in transport distance of seed and yarn, energy use in ginneries etc,

All data collected, checked and received directly from ETIDI or other institutions have been crosschecked and verified as far as possible. We had however insufficient means and time to guarantee accuracy and absence of systematic errors (like over-estimation of yields etc.).

The intended second mission of March 2020 had to be cancelled due to the Covid-19 pandemics. We tried to compensate the missed meetings and field observations with data mainly collected by our national expert.

2. Functional Analysis

2.1 Context of the sector

Ethiopia is considered as a country suitable for cotton and textile production (EIA 2012). Fertile soils with water availability and an appropriate natural climate, humans accustomed since millennia with cotton production and textile fabrics, a culture proud of its traditional cloths made of Ethiopian cotton provide enough indication that Ethiopia provides a context for a flourishing VC. This is exuberated by calculations, that over 2 mn ha land could be additionally used for cotton production (EIA 2014; SOFRECO, 2017). This context variable indicating the cotton area potential is most important and will be analysed in more detail below. Humans and their ideas provide context (Nicolay, 2019), based on the natural and socio-economic conditions. We include them when directly relevant in the VC. From the global markets, with the expected increase in cotton-based textiles and apparel, market currently (2019) signals opportunities for increases in both cotton production and the textile sector, mainly due to the relatively cheap labour force costing less than 60$ per month. Sustainability, corporate social responsibility (CSR) and ethical consumption have become mainstream values. The cotton and textile industries are moving towards sustainability to meet the expectations of their customers for ethically responsible, sustainably produced products. We expect a trend towards figurations, with companies looking at not only environmental and social good practices throughout the supply chain, but also with whom they do business.

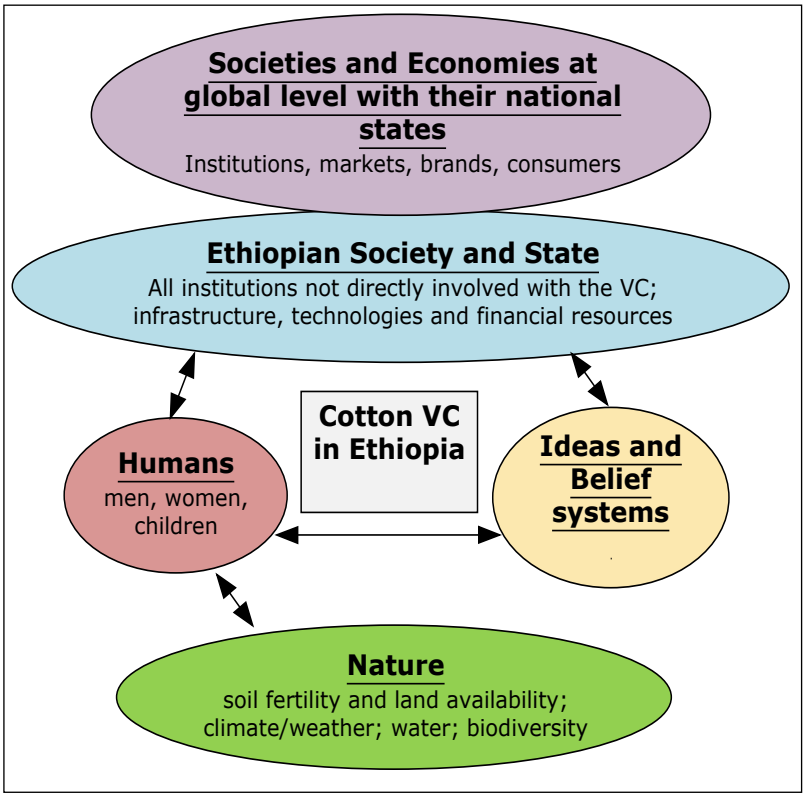


FIGURE 2 : THE CONTEXT OF THE COTTON VC IN ETHIOPIA

High-profile brands and retailers increasingly require information from their suppliers about the production and processing conditions in the cotton textile production chain (NCDS 2018).

Ethiopia currently cultivates 3% or about 55,000 -80,000 ha of the total 2.6 million hectares that is suitable for cotton production according to the official plans and strategies (NCDS).

- The Ethiopian cotton sector is the most diversified in Africa, and even in the world, as it combines: irrigation and rainfed cultivation;
- smallholder (modern and traditional) and commercial (medium and large) farms;
- vision of market-led food security and vision of community-based farming and food sovereignty[2];
- conventional, genetically modified, CmiA and organic cotton production;
- saw and roller ginning technology;
- stand-alone (custom ginning) and integrated ginneries.
-

The cotton-textile and textile and garment value chains are very complex and have no equivalent elsewhere in the world (see more in Annexes 2-6 and 2-8). The modern textile industry coexists with the traditional

[2] See more in Hendrickson, 2017

textile sector (manual ginning, spinning and handloom weaving). Ethiopia's textile manufacturing industry embraces both medium and large public and private enterprises. Their activities include spinning (stand-alone and integrated factories), weaving, dyeing, finishing and sewing.

However, the Ethiopian cotton sector is among the most uncoordinated. ETIDI is in charge of the whole cotton and textile sector, with a Directorate specifically in charge of the seed-cotton production sub-sector. Yet, the research, extension and regulatory bodies are under the Ministry of Agriculture and Livestock.

The map in Figure 1 provides a geographic overview of the places of cotton production (in green), of industrial ginning (red circles) and the industrial parks (blue dots). These three activities/processes- cotton production, ginning, textile fabrication (mostly in industrial parks)- build the core structures of the cotton VC.

The green area from Northwestern Tigray to Gambela, bordering Sudan, is called cotton-sesame belt. It is the largest area with potential cotton land in Ethiopia with ongoing cotton production.
The overall features for the VC and its context may be characterised as follows:

- agriculture accounts for about 33-35[3]% of the GDP, 80% of export value (mainly coffee) and 80% of employment;
- the small-scale cash crop sector is dominant. The average size of a household farm has shrunk due to demographics to around 1 ha only. 55% of the farms are smaller than 1 ha (CSA, 2014);
- key crops are cereals, coffee, pulses, oilseeds, potatoes and vegetable. Cotton is currently not among the most important crops;
- coffee is the largest foreign exchange earner. More generally, access to foreign currency is an issue in securing key inputs, such as fertilizer or ginnery machine parts;
- there is a perception that there is value in diversifying the output of the cotton VC such as using cottonseed to fatten cattle at the ginnery but the viability of this may be dependent on scale.

Over the last years, the cotton area, taken as an indicator for its value to the farmers, varies between 57,000 and 99,000 ha, which is about 0.5% of the total arable land of Ethiopia (150,000 km^2) (Table 1). Its yields are still among the highest in Africa, due to high natural fertility of the soil.

TABLE 1 : AREAS CULTIVATED AND PRODUCTIVITIES OVER THE LAST 10 YEARS

Crop Year	Area Harvested (Ha)	Production		lint (kg/ha)	kg seed-cotton/ha	cotton oil (l/ha)	cake (kg/ha
		Metric Tons	Bales (480 lb.)	(calculated by VC4D team)			
2010/11	99,000	55,000	253,000	555	1321		
2011/12	93,000	62,000	285,200	666	1586		
2012/13	85,000	45,000	207,000	529	1260		
2013/14	57,000	28,000	128,800	491	1169		
2014/15	98,000	40,000	184,000	408	971		
2015/16	65,000	38,000	174,800	585	1393		
2016/17	82,000	45,000	207,000	549	1307		
2017/18	60,000	38,000	175,600	633	1507		
2018/19	77,000	53,000	243,000	688	1638		
2019/20	80,000	57,000	262,000	712	1695		
Source: TIDI and FAS Addis Ababa Forecast Production figures (2014/15-2019/20) are FAS Addis Ababa estimates							
			Average productivity over last 10 years	**581.6**	**1384.8**	**133**	**607**

Source: USDA 2019

As already mentioned, this VC is a double-composed VC, whereby about 60% of the cottonseed material flows into the cotton oil part sub-VC and only 40% into the fibre part of the VC. However, the cotton oil part is not addressed yet by the state authorities dealing with the fibre part, even if clearly stated in the cotton research strategy covering the period 2016 to 2030 (ETIDI, 2017):"Cotton (Gossypium spp.) is the world"s leading natural textile fibre crop and a significant contributor of oilseed for human consumption."

[3] 2017/18 – 35%; 2018/19 – 33% - National Bank of Ethiopia (NBE).

2.2 Structure and main processes

2.2.1 Overview of main arenas of action

We use here the term “arena of action” or “actor arenas” as a "multi-level conceptual map" with which one could zoom in and out of particular hierarchical parts of the governance structures in a social system (Ostrom, 2009). The arena is composed by actors with similar functions and affinities of all categories (economic, social, political, cultural). Each arena her is part of the analysed VC (see more Annexe 2-8) and can be described as a sub-system (Luhmann, 1995). Knowledge and ideas are the foundations of actions and are therefore included in our analyses as much as they are directly linked to the VC.

At the heart of the structure and processes lies policy and regulation (Figure 3). This structure receives inputs from the “ideas generation” part in the form of knowledge, skilled people and advice. Input supply covers all from labour to finance and is most critical in this highly differentiated VC. We distinguish the main economic part into production and processing, by considering only the processing of the fibre, whereby the processing of the oilseed part is kept under production. The import of cottonseed and yarn is important, as so far less than half of the industry needs are covered by domestic production.

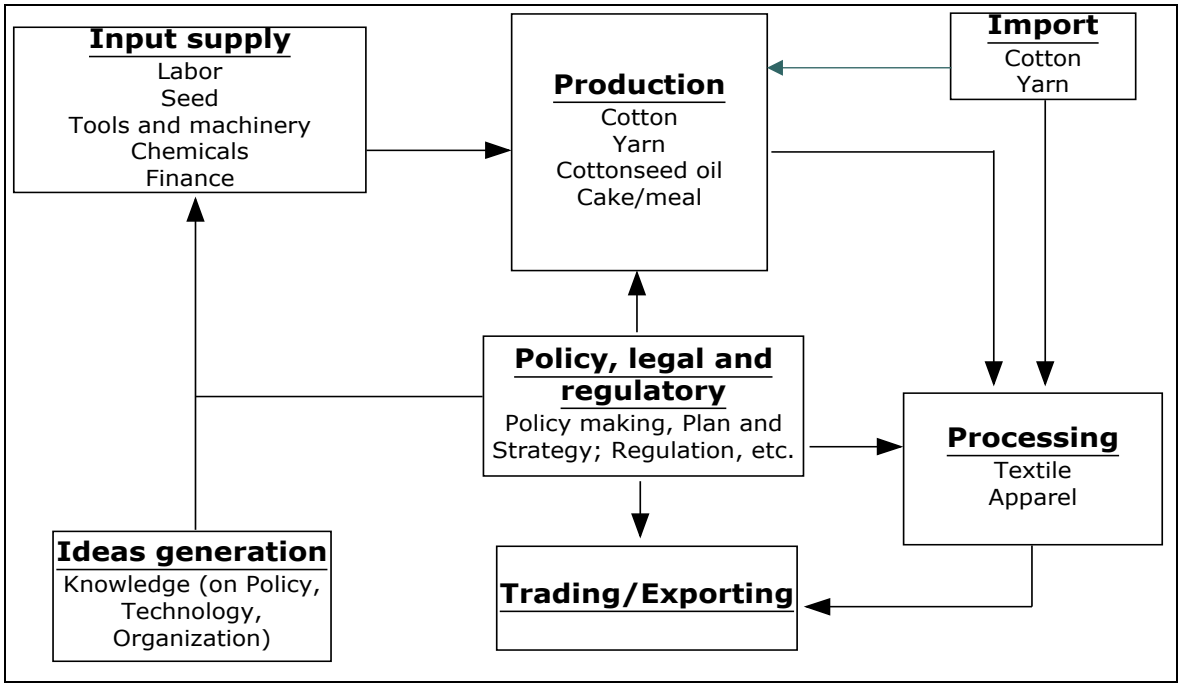


FIGURE 3 : MAIN ACTOR ARENAS IN THE COTTON VC (ADAPTED FROM BAYRAU 2014)

We first define production, processing and input arenas. The other arenas will be detailed in the governance section.

2.2.2 Production arenas

Cotton is produced since over 2000 years in Ethiopia providing the base for the well-established hand looming industry.

The production over the last ten years shows relevant annual fluctuations, influenced by weather and cotton prices mainly but always in the range of 50,000 to 100,000 ha.

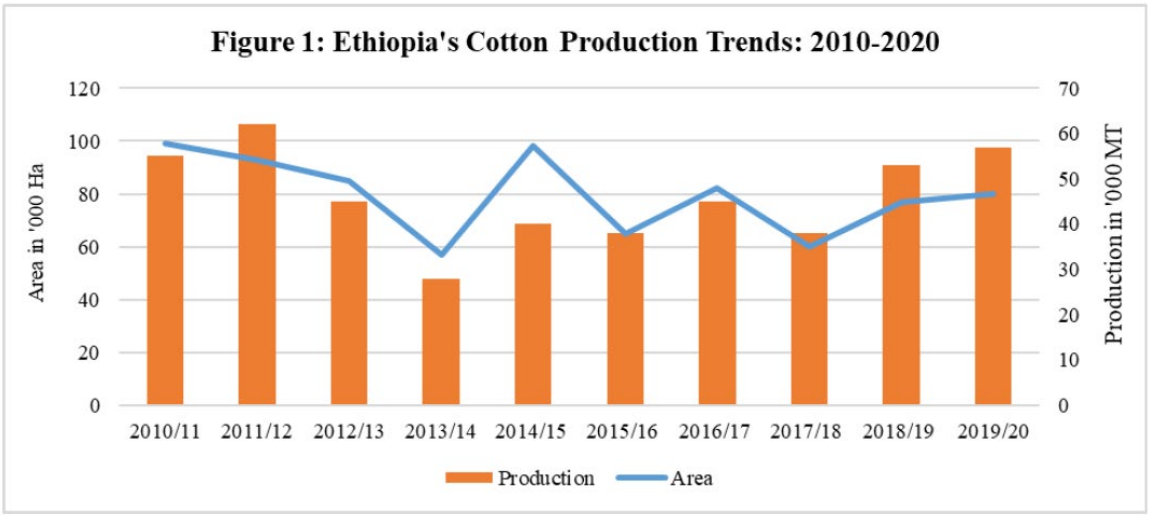


FIGURE 4: COTTON PRODUCTION TRENDS (SOURCE : USDA 2019)

Seedcotton: Cotton production includes five main activities to be managed by the farmers or the responsible workers before shipment to ginners and later textile mills takes place. These are cotton growing processes including plantation, harvesting, storage of raw cotton, ginning (process of seed removal before the marketing process), and warehousing of the ginned cotton. The actors in the process include cotton cooperatives, commercial farms (private and public), and smallholder household farmers. We make a distinction between 3 farm categories: (1) small-scale farms with an average of 1-2 ha and max 10 ha land. (ii) medium commercial farms (MC) with 10 to 250 ha and (iii) large commercial farms (LC) with > 250 ha farmland. The main rotation crops are sesame, sunflower, sorghum, mung-beans and under irrigation banana.

Cooperatives and their unions are important players for the close and active engagement of individual household farmers in the cotton production process.

Both traditional means of transport like donkeys and mules and the modern ones are used to transport raw cotton to storage; this is often handled by the intermediaries or brokers. Trucks are used to transport raw cotton to ginning and the ginned products to textile factories and warehouses. During export, trucks and other logistics institutions and institutions like marine, customs and financial institutions are involved.
Ginneries: More than half of the gins in Ethiopia are located far from cotton growing areas. Raw cotton has to be transported more than 700 km to reach the gins, adding costs to cotton producers and up through the value chain. Upgrading of ginning technologies with cleaning facilities and timely maintenance to reduce contamination and preserve the inherent characteristics of fibre is essential (ICAC 2014).

Yarn: Yarn is generally produced as part of the operation of a textile mill or factory whereby it is an intermediate product. The main process within yarn production is spinning wherein, the strands of cotton lint are twisted together to create a yarn. Whilst different spinning techniques are used globally, ring (spindles) and open-end (rotors) spinning systems are the dominant processes to produce cotton yarns (blended or not with polyester staple fibre) are often seen within the textile industry.

Cottonseed oil: The process encompasses: delinting, hulling (protective hull of the cotton seed is separated from the seed itself), and oil extraction (the kernel is pressed for oil). The product is further chained to the following sectors.

Cake/meal: There is only a loose cooperation with the Association of Oil millers, in which sunflower and sesame are dominating as raw materials.

2.2.3 Processing arena

Textile: Textile manufacturing refers to the transformation of cotton lint to yarn and fabrics and ultimately to clothing. Textile manufacturing includes: yarn spinners, fabric and garment producers. These are supported by packaging, printing and dyeing businesses. These actors are heavily influenced by global retailers and branded markets, if they target export markets. Textile manufacturing machineries are on a continuous change. The ever-turbulent processes in always new design of garment product not only attracts high quality standards in the cotton production but also calls upon the need for state-of-the-art textile machinery, tools and knowledge. In terms of garment production Ethiopia currently is focused on the "cut, make and trim status" and therefore requires technical and skill support in order to transition to a mostly export ready or "freight on board" market (Khurana, 2018).

Apparel: Ownership is diversified across the textile and apparel sector, including state owned enterprises, endowment-owned firms, private locally owned firms, firms owned by members of the diaspora and a variety of foreign-owned firms (Khurana, 2018). Within the past year the number of foreign owned firms within the Ethiopian Textile and apparel sector has increased. In terms of consumer preference, traditional outfit incorporating Ethiopian design and motifs hold an important place in Ethiopian society, with traditional styles changing from region to region.

The market of ready to wear clothing dominated the Chinese imports as they often are price competitive as most consumers are price sensitive. Whilst at present there is little apparent demand for luxury demands, this is considered a place for potential market expansion.

2.2.4 Trading and exporting arena

The Government of Ethiopia hopes to expand the value of textile exports to $30 bn by 2025.
Actors related to the marketing of cotton and cotton products include those who involve in wholesale and retail marketing of the cotton and textile products, textile designers, multinational textile distribution channels, Rapid Logistics Management (Supplier, Production and Distribution Net-work- ICT and integrated supply chain).

Our analyse includes this sub-VC as well as the important traditional handloom sector. This provides us with the following typology of actors (Figure 5). Note that the typology distinguishes fibre and seed as sub-value chains as these are commodities that support different end-users and supply distinct commodities. In that regard the arrows reflect fundamental flows of material between sub-value chains, in this case the flow of the **primary** output, specifically seed-cotton from the farm to the ginners and seed from the ginner to the oil mills.

Farmers sell seed cotton directly to the ginners or to middlemen who buy seed cotton from the farmers and sell it to the ginners. Large commercial farmers sell most of their production directly while small scale farmers sell to middlemen.

The role of such intermediaries is hard to define as they can operate on an informal basis and are often absent from a locality. In addition, some middlemen will offer loans to farmers to cover the initial cultivation costs. Come harvest time, farmers would sell their cotton to them to pay back the loan.

2.2.5 Input supply arena

Labour: Cotton farms are the major employers during harvesting for non-skilled contractual labour forces. Commercial farms employ highlander labour forces mainly males instead of females due to the working conditions though the latter are more productive than the former. Besides, individual household uses self and relatives as workforces. Recently micro and small enterprises facilitate the availability of workforces to the industry when there are requests from the commercial farms. Cotton producers face challenges of contractual temporary labourer supply, wages, sheltering, and food items supply. Though, cotton producers prefer female workforces for cotton picking efficiency, it cannot be feasible to deploy women in such areas due to poor sheltering safety.

Seed: Seeds are supplied mainly by commercial cotton farms, ginning companies and private traders. In Ethiopia, commercial seeds are supplied by commercial farms including, Hiwot Agricultural Mechanization, Lucy Agricultural Development Plc and Amibara Agricultural Development Plc. whereas parent seeds are rarely supplied by the Research Center (Melkawere National Cotton Seed). However, in Ethiopia cotton farms suffer from lack of availability of the parent seeds. There are no firms whose business is specialized in cotton seed supplying. There are also no research institutions that can experiment a variety of seeds varying with geography such as soil and weather conditions.

The Ethiopian Seed Enterprise (ESE) and Regional Seed Enterprises in Amhara and Tigray regions are playing a role in seed production and distribution.

Tools and machinery: Cotton farms use agricultural machinery tools for farm development, planting, pesticide and herbicide spray, and harvesting. Besides, Amibara General Aviation Service provides chemical spray service to different commercial cotton farms.

Chemicals: Agricultural Chemicals include pesticides, herbicides, fungicides, and fertilizers. The major actors in the supply chain are multinational global companies such as DuPont, Cargill, BASF, Bayer etc. In Ethiopia, cotton farms get chemical inputs from Adamitulu Pesticide Processing S. C. and private import trading agents. The Agricultural Input Supply Enterprise (AISE) has the primary responsibility of importing and distributing critical agricultural inputs including fertilisers.

Finance: Financial institutions include commercial banks (the largest is Commercial Bank of Ethiopia - CBE), insurance companies and micro finance institutions. Commercial banks and micro finance institutions provide financial inputs to the commercial farms and individual household farmers respectively. Some commercial farms suffer from shortage of working capital due to the reticence of the commercial banks to finance rain-fed farms. Until recently, commercial farmers were only financing irrigation-fed commercial farms. Recently, however, commercial banks have started revising their policies on the financing of commercial farms.

The Development Bank of Ethiopia (DBE) was the first development finance institution in Ethiopia designed to assist in the development of industrial and agricultural production and to foster the investment of private capital for productive purposes.

The Ethiopian Investment Commission (EIC) and its regional equivalents aims to attract investors to the country, while the Privatisation and Public Enterprises Supervising Agency (PPESA) is responsible for implementing the Government's privatisation plan and supervising public enterprises, including the remaining public T&C enterprises[4].

2.3 VC actors, support structures and levels

Seen from the classical VC perspective and broken down to its 5 geographic levels (from communal to federal), the two main sub-chains fibre and seed are presented with their main actors. Figure 5 visualises the main actor groups of the VC and its support services broken down to the 6 socio-geographic levels (from federal to village).

[4] main source: Bayrau, 2014

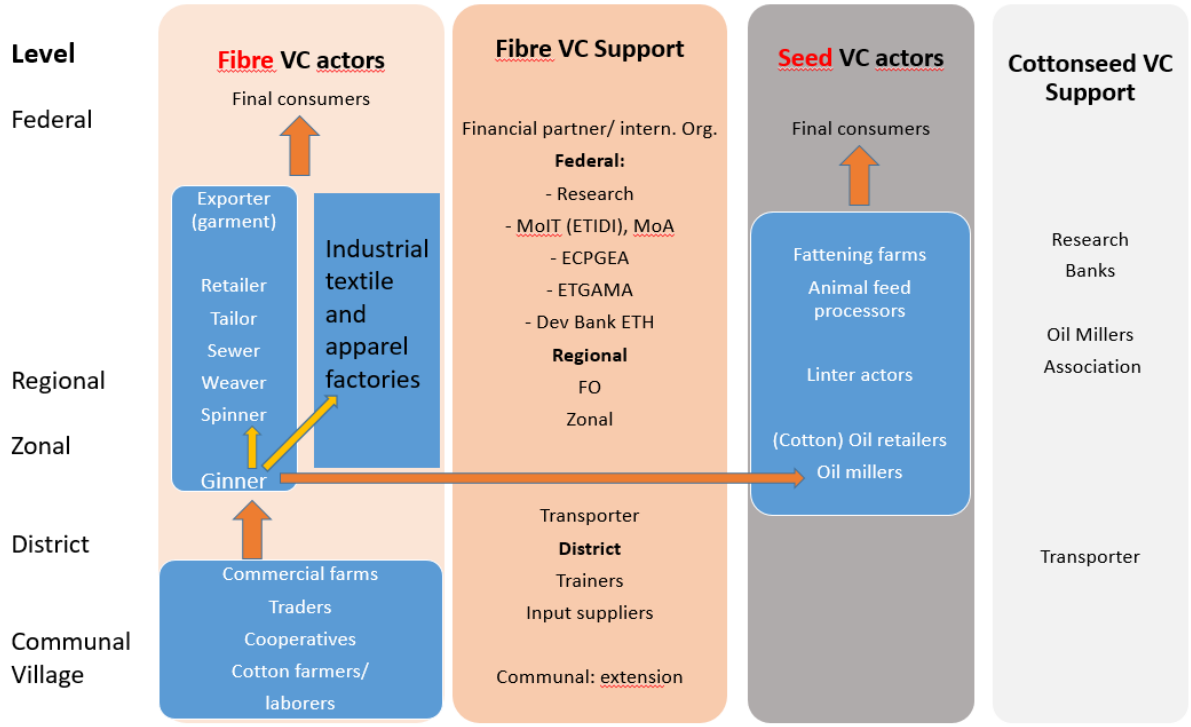


FIGURE 5 : MAIN ACTORS IN THE COTTON VC

Cotton producers, ginners, spinners and weavers reflect a very diverse range of actors, employing different technologies to produce a similar or equivalent output.

We need therefore to distinguish within the fibre sub-VC between traditional and industrial textile and apparel sector. It should be noted that both sub-VCs do not operate in isolation; as a traditional weaver may obtain yarn from an industrial source.

2.3.1 The five main processes

The five main processes, i.e. seedcotton production, seedcotton processing (=ginning to produce lint & cottonseed), lint processing (= spinning into yarn), textile production (weaving, dyeing and sewing) and - cottonseed processing (crushing to produce oil & cake). are embedded by input services and retailing. Three of these processes emanate from the production arena, and each one from Input and Processing arena (

Table 2).

Table 2 : Five main processes

Inputs and services	Seed inputs may be domestically produced or imported. The seed providers are the most important actors in this category. They concern all cotton farms. Fertilisers and pesticides are not used by all farms, but mostly by the medium and large-scale commercial farms. Labourers are always required for harvesting and commercial farms for all operations. The labour market is generally used according to seasonal requirements. Land provision offices (f. ex. land bank) are required for the newly established commercial farms. They are based at regional state level for Ethiopian citizens and at federal level for foreign investors. Credit providers are always required for establishing new commercial farms, to less degree for punctual investments for both commercial or small-scale farms. Research services is currently concentrated on seed development and testing of new varieties.

(1) Seedcotton production	The production can be distinguished and analysed by the criteria (i) farm size (less or over 10 ha; which is also the boundary for a commercial status) and (ii) rainfed or irrigated. As our data does not allow to distinguish medium (10-250 ha) from large scale ((over 250 ha), we just keep 1 category of commercial farms, hence farms with over 10 ha. We will examine in more detail as well the 2 prevailing sustainable cotton standards, CmiA (13,170 ha) and organic (400 ha). But conventional cotton is predominant with about 66,000 ha. By 2018, no Bt-cotton was officially released in the private farms.
(2) Seedcotton processing (ginning)	An overwhelming volume of seedcotton is ginned in factories equipped with either saw or roller ginning technology. Only a very small volume is ginned by hand. The process separates cotton seeds from lint. We will distinguish two main categories of the (industrial) ginning: stand-alone and integrated with farming or spinning. The stand-alone is normally owned by a local entrepreneur, the later by a sort of a cluster, including textile factories.
(3) Lint processing (spinning)	After ginning the lint is spun into yarn. This can be handspun at a domestic scale for own use or local sale. Alternatively, spinning occurs in dedicated business that can be part of the traditional (hand spun) as well as conventional mechanised spinning machines (ring/spindles or open end/rotor).
(4) Textile production (weaving, etc)	The industrial textile and apparel production are dominating (by amount of proceed lint). It is in most cases placed around the capital or around major production areas (Gondar, Bahir Dar, Hawassa, Kombolcha, Adama, Dire Dawa, Mekelle). Handloom weaving is dominating in the old cotton production area of Amhara/Tigray (cotton-sesame belt, see Annex A2)
(5) Cottonseed processing	The process encompasses: delinting, hulling (protective hull of the cotton seed is separated from the seed itself), and oil extraction (the kernel is pressed for oil). Cottonseed cake or meal (animal feed) is the co-product of oil. Addis Modjo is by far the largest oil mill in the country. Cottonseed oil is always blended with other available oils (I-30) and loses so its visibility in the market.

2.3.2 Stakeholders and Sub-chains

Departing from **Error! Reference source not found.**Figure 2 we propose then the following scheme to present the five key processes, the involved VC stages and their involved actors (Figure 6). Included are as well the input providers and the retail marketers on textile. We propose five sub-value chains (numbers in red) as a representation of the system (Figure 6). Please note the systems chosen for analysis may not overlap fully with those distinguished below. The 5 sub-VC are:

1. Commercial-industrial lint-textile
2. Seed oil
3. Cake/meal
4. Handlooming
5. Subsistence cloth production.

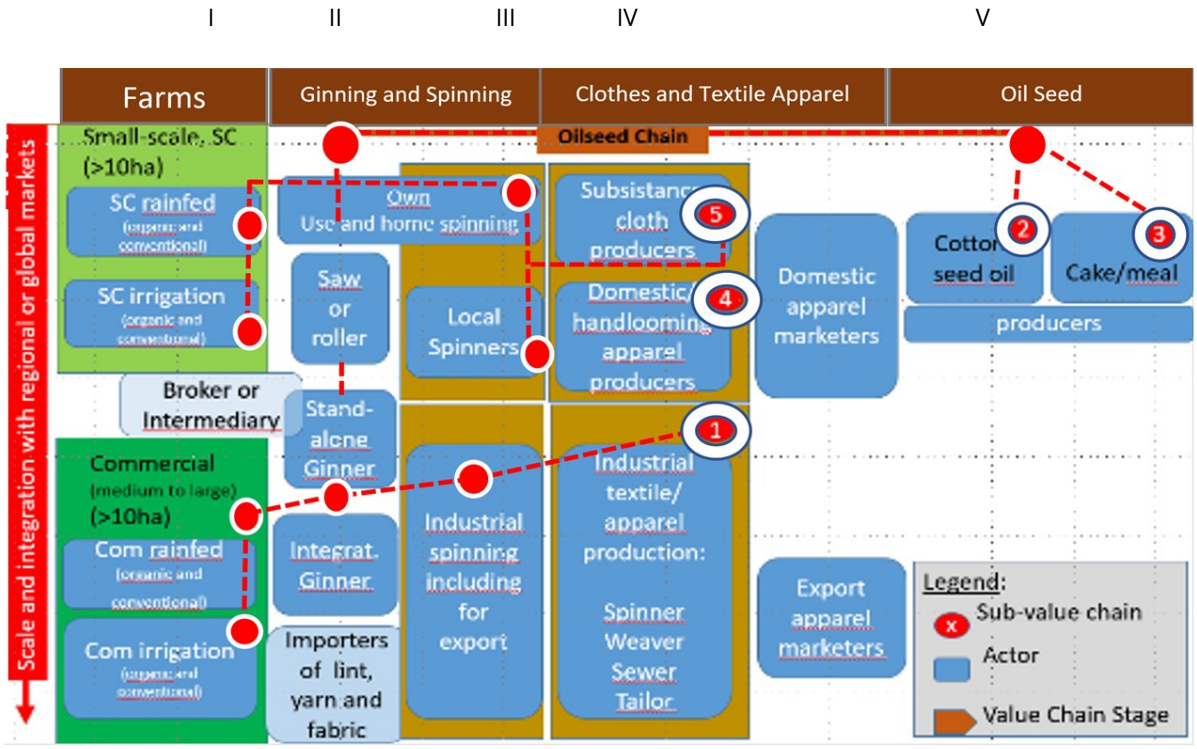


FIGURE 6 : MAIN ACTOR CATEGORIES IN THE SEEDCOTTON AND TEXTILE VC

To note that these actors are spread all over a large area from Western Tigray to the Kenyan boarder in SNNPR, and from Gambela in the West to Afar. Addis is the geographic centre for both regulation and processing and marketing.

2.4 Metrics of the sub-chains

Table 3 shows the metrics of the traditional figuration, determined by the subsistence production and the handloom weaving, which we call here "traditional/SCF" sub-system. This way of production strikes with its estimated 205,000 jobs, outnumbering by two the jobs within the industrial sub-system with estimated 102,000 jobs (in 2018).

The accumulated value created however from cotton to yarn production by the industrial figuration is with the estimated 209 million $ more than 6 times higher than the traditional way. We estimate that the textile industry has to import two times as much of yarn (including carded cotton) as the country is currently producing. Only four regions- Amhara, Tigray, SNNPR and Afar- are involved in this system.

TABLE 3 : METRICS OF THE TRADITIONAL SUB-SYSTEM

	Country	ETB/$ =	29	I (Tig'y)	II (Amh)	V (Afar)	VII (SNNP)	VIII (Addis)
Production								
total SCF production (t seedcotton)	30'577							
% tradtional production	15%			X	X	X	X	
tradtional production (t seedcotton)	4'587	ETB/kg	$/t					
value of seedcotton production (k$) [1)]	4'587	29	1'000					
jobs for cotton sustenance [12]	7'000							
Ginning								
t seedcotton ginned by hand	4'587	% of total =	4.90%	X	XX	X	X	
jobs seasonal (k work-days) [2)]	3'394	0.5						
production of lint (t) [3)]	1'697	37%						
value of lint production (k$) [4)]	3'511	60	2'069					
production of cottonseeds (t) [5)]	2'431							
value of cottonseed production (k$) [6)]	335	4	138					
total value of production (k$)	3'846							
Spinning/ handlooming yarn								
t lint spun by hand	1'697	% of total =	4.90%					
jobs seasonal (k work-days) [7)]	10'097	7		X	XX	X	X	
production of yarn (t) [8)]	1'442	85%						
value of yarn production (k$) [9)]	7'461	150	5'172					
total seasonal jobs (k work-days)[10]	13'491							
No of companies [13)]	7							
Weaving/knitting/apparel incl. tailors [11]								
jobs (conservative estimates)	205'000			X	XX	X	X	XXX
Total jobs	212'000							

various sources.

1) 29 ETB/kg = 1,000 $/t seedcotton.
2) 0.5 kg lint/work-day (interview: 1 week/kg?)
3) ginning outturn = 37%.
4) 60 ETB/kg = 2,069 $/t lint (source: interview).
5) cottonseed outturn = 43 % (10% waste).
6) 4 ETB/kg = 138 $/t cottonseed.
7) 300 m yarn/hour (20 Ne) (interview: 2 days/kg?).
8) Spinning outturn = 85%.
9) 150 ETB/kg = 5,172 $/t yarn.
10) 3 days per kg yarn or 70 kg per year. Mainly concentrated in Addis Ababa, then around Gondar.
11) estim. 140'000 weavers in the 5 regions working full-time (incl. Children) and 65'000 knitters, tailors and shop keepers
12) estimated 7'000 farms in Amhara and Tigray mainly, producing cotton on 0.5 ha and producing cloths and oil. 1 full job for all activities in the household
13) ACTIF Benchmarking reports, 2016

The industrial-driven part of the VC is based on the imported carded cotton and yarn and on the 36,000 ha of the large-scale farms as well as the major part of the 19,000 ha SCF (Table 4).

TABLE 4 : METRICS OF THE INDUSTRIAL SUB-SYSTEM

Region	I (Tig)	II (Amh)	III (B-G)	IV (Gam)	V (Afar)	VI (Oro)	VII (SNNP)	VIII (Addis)	Country		
population (2018; in Mio)	5.7	23.2	1.2	0.5	2.0	39.1	21.1	4.4	109	ETB/$ =	29
area (km2)	85 000	155 709	50 699	29 783	72 053	284 538	105 476	527	1 104 300		
pop. Density (pop/km2)	67	149	24	17	27	137	200	8 387	99		
potential for SCF cotton1) (ha)	14 000	200 000	12 000	0	1 000	0	40 000	0	267 000		
potential for Com. cotton[1] (ha)	30 000	75 000	50 000	200 000	65 000	2 000	70 000	0	492 000		
area used for cotton within 3 years (ha	18 738	59 586	26 904	20 295	18 456	2 547	20 217	0	166 743	(area cot.*3)	
% Current area/Potential	21%	26%	18%	3%	9%	100%	10%	100%	11%		
Seedcotton production											
SCF											
number farms	1 682	12 644	0	0	8 501	0	3 348	0	26 175		
ha	764	14 297	0	0	1 045	0	3 158	0	19 264		
kg/ha (average) [2]	1 500	1 500			1 900		1 900		1 587		
production (t seedcotton)	1 146	21 446	0	0	1 986	0	6 000		30 577	ETB/kg	$/t
value of production (k$) [3]	711	13 311	0	0	1 232	0	3 724	0	18 979	18	621
jobs permanent [4]	255	4 766	0	0	348	0	1 053	0	6 421		
jobs seasonal [5]	764	14 297	0	0	1 045	0	3 158	0	19 264		
Commercial (MC+LC)											
number farms	7	17	25	21	13	1	6	0	90		
ha	5 482	5 565	8 968	6 765	5 107	849	3 581	0	36 317		
kg/ha (average) [2]	1 600	1 600	2 000	2 000	2 000	2 000	2 000		1 878		
production (t seedcotton)	8 771	8 904	17 936	13 530	10 214	1 698	7 162	0	68 215		
value of production (k$) [3]	5 444	5 527	11 133	8 398	6 340	1 054	4 445	0	42 340		
jobs permanent [4]	548	557	897	677	511	85	358	0	3 632		
jobs seasonal [5]	914	928	1 495	1 128	851	142	597	0	6 053		
Total production											
number farms	1 689	12 661	25	21	8 514	1	3 354	0	26 265		
ha (farm land use)	6 246	19 862	8 968	6 765	6 152	849	6 739	0	55 581		
kg/ha (average)	1 588	1 528	2 000	2 000	1 983	2 000	1 953		1 777		
production (t seedcotton)	9 917	30 350	17 936	13 530	12 200	1 698	13 162	0	98 792		
value of production (k$) [3]	6 156	18 838	11 133	8 398	7 572	1 054	8 170	0	61 319		
jobs permanent [4]	803	5 322	897	677	859	85	1 411	0	10 053		
jobs seasonal [5]	1 678	15 225	1 495	1 128	1 896	142	3 755	0	25 317		
Ginning											
number ginneries	1	5	1	1	2	7	1	1	19		
capacity (t seedcotton/day) [24]	75	725	85	85	300	1 275	60	25	2 630		
t seedcotton ginned [6]									94 206		
Lint											
production of lint (t) [7]									34 856	ETB/kg	$/t
Installed capacity (t) [21]									99 589		
value of lint production (k$) [8]									60 097	50	1 724
Cottonseed											
production cottonseed (t) [9]									51 813		
production plantings seeds (t) [10]									1 500	21	724
production oilseeds (t)									50 313	4	138
value of cottonseed production (k$) [11]									8 026		
total value of production (k$)									68 123		
jobs permanent [25]									400		
jobs seasonal [26]									800		
Yarn production: Industrial											
number spinning mills	2	2				10	1	1	16		
capacity (t lint/day) [12]	30	28				149	18	5	230		
t lint spun									34 856		
capacity (t cotton yarn/year) [22]									39 836		
capacity (t total yarn/year) [23]									72 000		
production (t yarn) [13]									27 885	ETB/kg	$/t
value of production (k$) [14]									96 155	100	3 448
jobs permanent [27]									3 650		
jobs seasonal									350		
Cottonseed Processing											
number oil mills								1			
capacity (t cottonseeds/day)								150			
t cottonseeds processed								1 732	50 313	(=100% cs prod)	
oil											
production of oil (t) [15]								221	6 289	ETB/kg	$/t
value of oil production (k$) [16]								381	10 843	50	1 724
cake/meal											
production of cake (t) [17]								1 117	32 452		
value of cake production (k$) [18]								212	6 155	5.5	190
total value of production (k$)											
jobs permanent [27]								120	120		
jobs seasonal											
estim. jobs in weaving/apparel/int.textile									55 000		
Total jobs	1 642	12 934	1 644	1 240	1 807	156	3 288	120	**95 690**		
jobs permanent cootonseed production	803	5 322	897	677	859	85	1 411	120	10 173		
jobs seasonal cotton seed production	1 678	15 225	1 495	1 128	1 896	142	3 755	0	25 317		
estimated livelihoods due to the VC [19]	11 492	90 541	11 509	8 682	12 650	1 090	23 017	840	669 829		
Livelihood from production only	15 300	107 763	14 735	11 977	13 403	1 090	23 017	0	187 285		
Land pot. for cert.sust. cotton prod. [20]	70%	70%	10%	5%	30%	50%	60%	0%	151'000 ha		

Main source: ETIDI

1) NCDS, p.177: high potential option.
2) yields are estimated by the team based on observations.
3) 18 ETB/kg = 621 $/t seedcotton at farmer level.
4) estimation based on ha. 1 full job per 3 ha cotton (SCF) and 1 per 10 MC/LC).
5) 1-2 months employment. 1 employ./1 ha (SCF) and 1 empl. per 6ha (LC).
6) excluding seedcotton ginned by hand.
7) average ginning outturn = 37%.
8) 50 ETB/kg = 1 724 $/t lint.
9) average seed outturn = 55% (8% waste).
10) = 25 kg/ha x 60,000 ha.
11) 21 ETB/kg = 724 $/t planting seeds + 4 ETB/kg = 138 $/t oilseeds.
12) based on averages of 20 g/spindle/hour and 250 g/rotor/hr with 3 x 8-hour shifts.
13) 80% of lint spun.
14) 100 ETB/kg = 3,448 $/t yarn.
15) 12.5% of oilseeds processed.
16) 50 ETB/kg = 1 724 $/t crude oil.
17) 64.5% of oilseeds processed.
18) 5.5 ETB/kg = 190 $/t cake.
19) estimation: 7 livelihoods per average job (seasonal job is counted half)
20) estimation VCA4D team. Potential land in % of current (2018) cotton area
21) based on capacity utilisation of 35% ACTIF Benchmarking reports, 2016
22) 70% utilization rate. ACTIF Benchmarking reports, 2017
23) ACTIF Benchmarking reports, 2018
24) based on NCDS Scoping study with 3 x 8-hour shifts (vs ETIDI: 2,960 t).
25) on average, 20 employees per saw ginnery and 25 per roller ginnery.
26) on average, 30 employees per saw ginnery and 75 per roller ginnery.
27) on average, 10 employees per 1,000 spindles and per 150 rotors.

From the 30,577 t of seedcotton, we have the following commercial and sustenance products (in tonnes) (Figure 7):

- 11,313 t lint and then 9,173 t yarn
- 16, 909 t cottonseed, then 13,362 t cake and 29,354 hl cotton oil
- 458 t planting seed

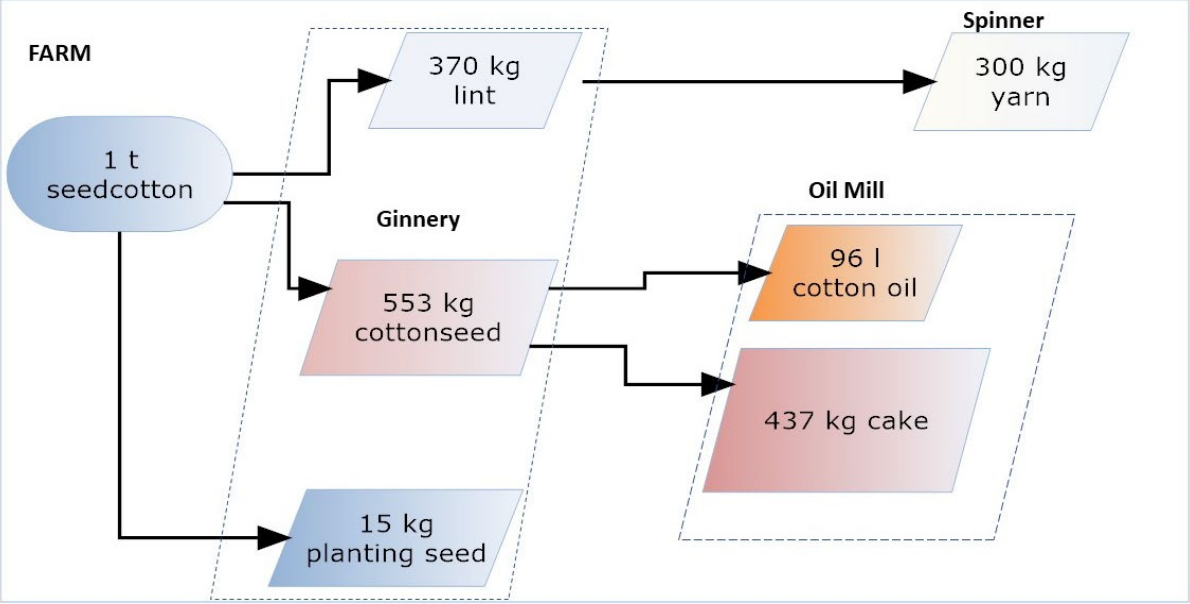


FIGURE 7 : MAIN OUTPUTS IN KG AND LITRES PER TON OF SEEDCOTTON

Cottonseed oil is still used in the cotton areas of Amhara and Tigray for the preparation of Injera (own observations). However, in statistics, literature and awareness of most people outside these areas, the knowledge seems to have vanished. The value of the oil produced by just one central factory is estimated 10.8 million $. To note that the quality of cotton oil is considered to be much higher than the one of the imported palm oil.

A short reminder of the previous importance of cottonseed oil outside Ethiopia. Over the first 30 years of the 20th century cottonseed oil became the pre-eminent oil in the United States. But by the Second World War, cottonseed oil shortages forced the utilization of another direct substitute, soybean oil. By 1944, soybean oil production outranked cottonseed oil production due to cottonseed shortages and soybean oil costs falling below that of cottonseed oil. By 1950, soybean oil replaced cottonseed oil in the use of shortenings like Crisco due to soybeans comparatively low price. Prices for cottonseed were also increased by the replacement of cotton acreage by corn and soybeans, a trend fueled in large part by the boom in demand for corn syrup and ethanol. Cottonseed oil and production continued to decline throughout the mid and late 20th century. Today, cottonseed oil is with about 6 mn t still among the top 12 oil sources (including animals) in the world, doubling olive oil but 6-7 times less important than palm and soy oil. China is main producer and consumer (Gunstone, 2002).

2.5 Typology of producers and main flows

Based on Table 3 and 4 above we can depict the following typology of farmers as well as the visualisation of the examined VC (Table 5). The production of seedcotton is distinguished and analysed by the farm size and the type of irrigation (rainfed or irrigated).

TABLE 5 : FARM TYPOLOGY

Type	**Smallscale farm (SCF)**		**Commercial farm (MC and LC)**			
	Trad. sector	Modern sector				
Average size (ha)	0.5	0.75	400			
Size range	Modern or tradition-nal 0.1-10 ha		Commercial medium 10-250ha		Commercial large >250ha	
Surface used (ha)	19,264		36,317			
Numbers of farms	7,000	19,000	20		70	
Water Management Irrigation (IR) or rainfed (RF)	1,046 out of 19,264 ha IR		25,270 out of 36,317 ha IR			
Productivity (kg yield per ha)	1,300	1,600	1,900			
Total production (t seedcotton)	4,550	22,800	68,400			
Ethics of production	Conventional (CONV) or sustainable (EOA[5], sustainable standard) (ORG)					
	CONV and CmiA	Conv and ORG	CONV	CONV and ORG	CONV	CONV

The labels used should not be considered as absolute as (for example) a farm that is dependent on large volumes of irrigation water would not be considered to be sustainable within the context of future climate change impacts. It should be noted that these categories will include farmers that operate indecently as well as part of a cooperative that operates at kebele (commune) or woreda (district) level or (at larger scales).
For 2018, we estimate the numbers of the farms according the 9 farm types as following (Table 6). (for time being not possible to allocate the data to the 9 types, as we do not have data on differentiated farm size (more or less than 250ha) and on CONV/ORG).

TABLE 6 : ESTIMATED NUMBER OF COTTON FARMS PER FARM TYPE

Small-scale farms (max 10 ha)	**Commercial farms (> 10 ha)**	
SCF: ~26,000	**MC: ~ 20**	**LC: ~70**
(RF/CONV): ~9,000 (RF/ORG*): ~5,000	(RF/CONV): 5? (RF/ORG): 0	(RF/CONV): 30? (RF/ORG): 0
IR/CONV): ~12,000 IR/ORG): ~200	IR/CONV): 25? IR/ORG): 0	IR/CONV): 105? IR/ORG): 1

* in this case CmiA

As we do not have yet the individual farm list, it is not yet possible to allocate land and acreage to MC and/or LC.
The number of farms is as in Table 6. The 90 medium-to-large commercial rainfed farms (MC/LC RF) occupy with over 36,000 ha the largest share of the cotton surface, i.e. 65.3%.

The separation of the SCF in “traditional” and “modern” made here is rather conceptual than empirical. We estimated the number of 7,000 traditional cotton producers and considered as main indicator their integration with the hand looming and traditional textile figuration. This integration link is stronger than the market incentives, explaining that the cotton area at farm level fluctuates around 0.5 ha. The traditional cotton producers are not dependent on advice and only limited to inputs. The study has not enough data to predict if their number will decrease in near future and rather move towards the modern sector.

TABLE 7 : DISTRIBUTION OF THE COTTON FARMS ACCORDING TO TYPE (2017/18)

	Rain Fed		Irrigated		Total	
	n farm	ha	n farm	ha	n farm	ha
SCF	14,000	18,219	12,000	1,046	26,000	19,264
ha/farm		1.3		0.1		0.74
MC/LC	5	11,047	85	25,270	90	36,317
ha/farm		2,209		297		404
All farms	14,005	29,266	12,085	26,316	26,090	55,581
ha/farm		2.1		2.2		2.1

Figure 8 shows a map of the cotton value chain in Ethiopia as outlined in the above sections. 99.3% of the cotton farms are small-scale, but the remaining 0.7 % of farms (90 commercial farms) account for 71% of the seed cotton production in Ethiopia (2017/18).

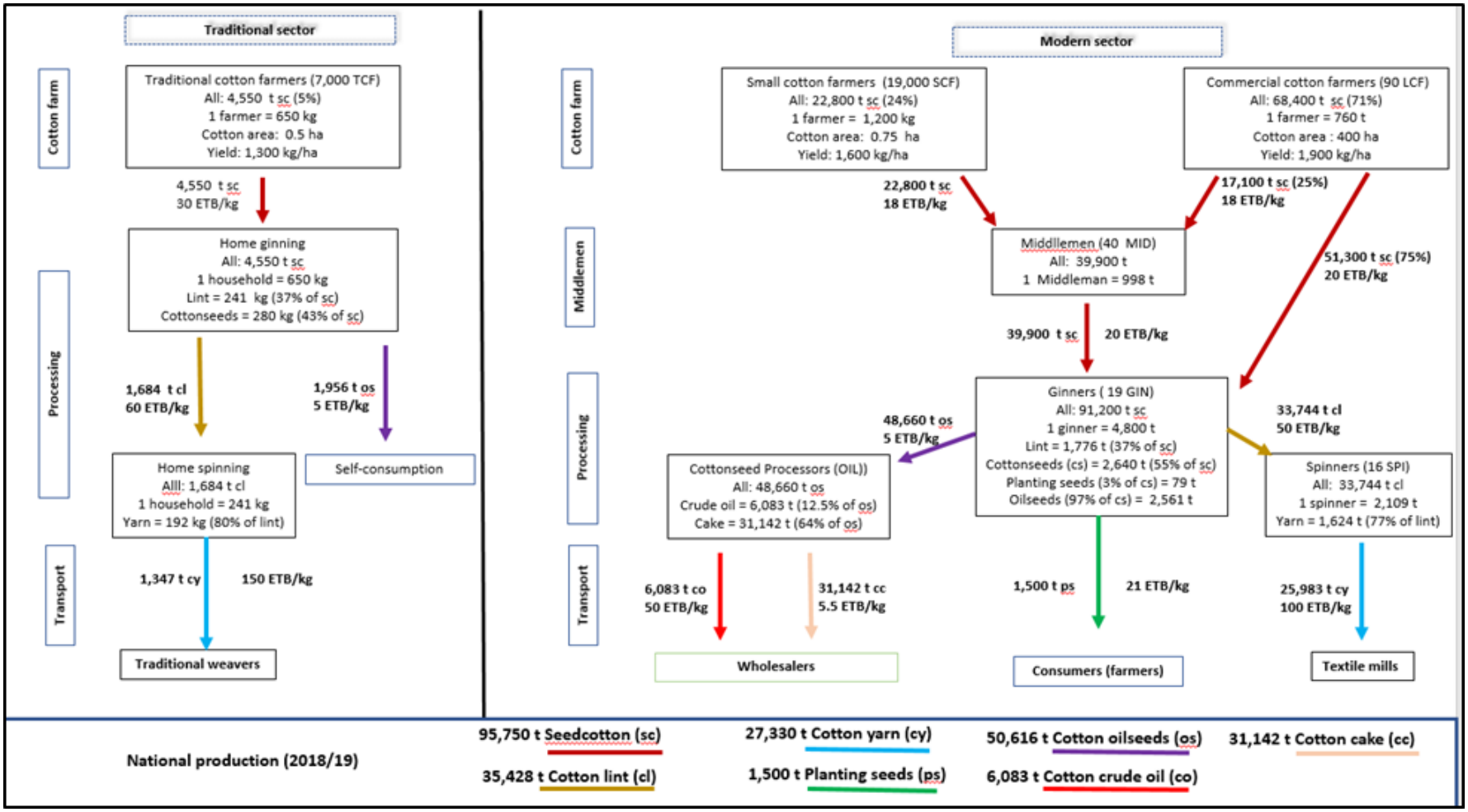


FIGURE 8 : MAPPING OF THE MAIN ACTORS AND FLOWS IN THE VARIOUS SEGMENTS OF THE VC

2.6 Geography of the VC

A large area of the country, including the Omo-Ghibe, Wabi Shebele, Awash, Baro-Akobo, Blue Nile, and Tekezze river basins lie within the optimal altitude range for growing cotton but the majority of the cotton cultivation takes place in the Awash Valley and a few in Gambella, Humera and Metema areas. The western strip, including Humera, Metema, (Tekeze river basin) into the tropical zones, sometimes up to Gambella is also called the cotton-sesame belt.

The relation between cotton production and its use must be close also from the geographic side. These maps do however not include the sub-VC of cotton seed. Generally, in reports and discussions, the cotton VC is mainly limited to the fibre.

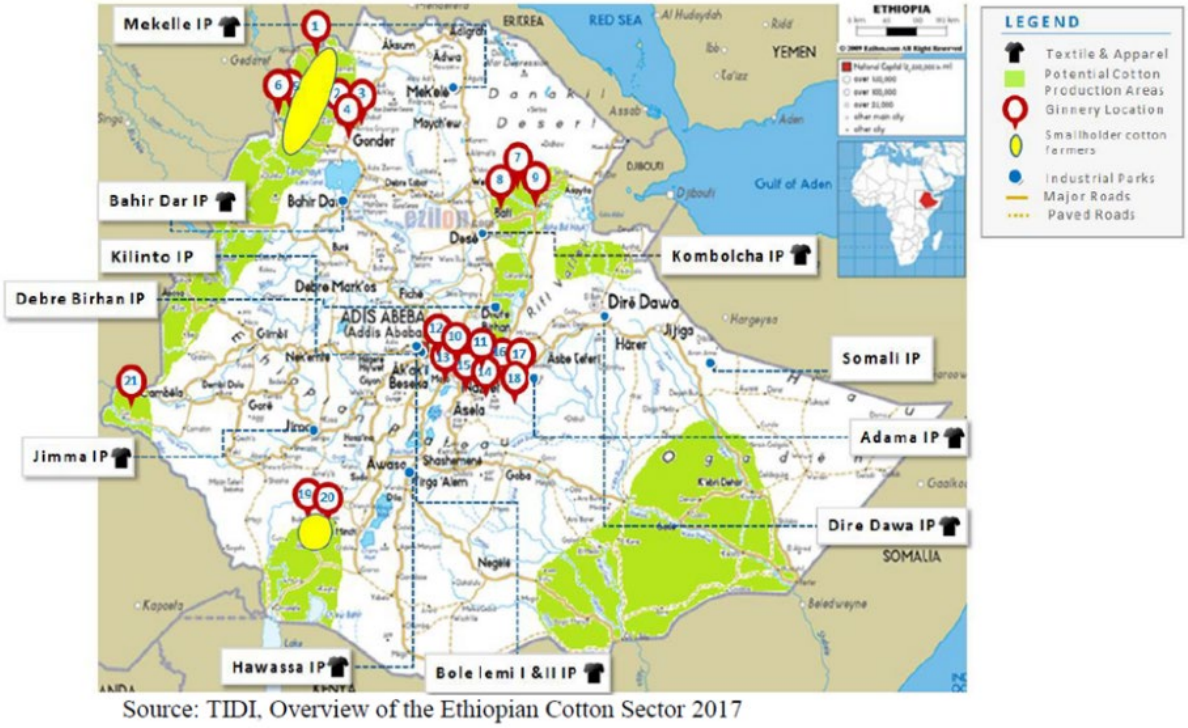


FIGURE 9 : OVERVIEW OF THE COTTON SECTOR INCLUDING GINNING FACTORIES (CREDIT: S.ASEFA, ETIDI)

The main features of the seven regions with cotton and yarn production:

I: Tigray: mainly rainfed, commercial & smallholder farms; ginneries; textile factory
II: Amhara: Mainly rainfed, commercial & smallholder farms; ginneries; textile factory
III: Benishangul-Gumuz: rainfed, commercial farms
IV: Gambela: rainfed, commercial farms; ginneries. Sometimes considered as too humid for cotton production. Only region with Bt cotton. See more on annexe A4-7.
V: Afar: mainly irrigated mostly commercial farms; ginneries; WARC (Werer Agricultural Research Centre); AwBA (Awash Basin Authority)
VI: Oromia: rainfed, commercial farms; ginneries. Mainly in upper Awash valley
VII: SNNPR: mainly irrigated, commercial & smallholder farms; ginneries; textile factory; Organic cotton production; Hand ginning/spinning/weaving associations; South Omo Zone Environmental Protection and Forest Department
VIII: Addis Ababa. Mainly ginning and textile factories.

Note on Gambela as cotton area "reservoir"
Gambela is the only region, in which we have currently only commercial cotton farms and at the same time an impressive theoretical potential for commercial cotton (200,000 ha), by far the highest in the country (see Table 4). No cotton area is however foreseen for SCF. Land and other conflicts with land and water users, pastoralists and peasant farmers are still unsolved and the existence of the largest National Park are at stake. The challenge will be to make the developments in this resource rich region beneficiary as well for the inhabitants and the region as a public space and not just for the foreign investors.
Interesting that the SCF of this region seem to show no interest in cotton production. The Ethiopian state has sought to attract –amongst others- Indian agricultural investors with the promise of extremely cheap and abundant fertile land, along with cheap labor, in the peripheral lowland provinces such as Gambela. In return, the Ethiopian state expects Indian companies to either enhance national food availability or contribute to the state's foreign exchange reserves through commodity exports. See more in Annex A4-7.

2.6.1 Cotton production

The rainfed cotton is produced in the cotton-sesame belt at the west-border towards Sudan (Humera in Tigray, Metema in Amhara up-to Gambela), spread over 4 regions. This makes about 80% of the production. The irrigated cotton is cultivated in the Awash valley (Afar, East Oromia), in Gambela and in SNNPR (Arbaminch lowland west from the lakes, and lower Omo valley south of Jinka), making 20% of the production.

FIGURE 10 : COTTON WORKERS ON THE FIELD IN TIGRAY

Danshu district,West Tigray
Danshu lies south of Metema with land both in the cotton-suited lowlands and in the hills, where the villages are mostly based as well as the land for cereals, other food crops and pasture. The mountains eastwards were the hinterland, where TPLF (Tigray People's Liberation Front) started in February 1975 its fight against feudal structures and the Derg regime- considered by TPLF as "fascist" and too centralistic- and which ended in 1990 with the victory in Addis Ababa. In these 15 years, the beginning of community development and the transformation of the feudal society into a more equal "socialist" system had its origin. Cash for work, irrigation, soil and water conservation, farmer field days and other measures for re-greening of a region depleted from wars and conflicts with its neighbours were undertaken and continue until today. National self-determination was aimed, and socio-economic changes combined with technological innovations leading to an end of hunger and poverty. The own relief organisation "REST" was created in order to organize the development projects which run parallel with the military operations against the Derg army.

After the victory in 1990, many soldiers were allocated land in the plains between the hills in the western part of Tigray until the boarder to Sudan. This land, at that time mostly bushland, was then cultivated and forms since the cotton-sesame belt within the Tigray federal state. The ginning factory, which we visited with Danshu district has been created by TPLF as well textile factories in Adua. Therefore, the cotton system of Tigray is a child of the revolutionary phase under TPLF. A relatively well-organized farmer cooperative structure and the integrated VC is still determining the institutional landscape of Tigray, making it a special feature of the Ethiopian VC.

Arbaminsh Zuria district, SNNPR region

There is long existing tradition of cotton farming, in the study area and once in history Arbaminch Zuria district was called the cotton belt in Ethiopia (Feyso 2018). The area is losing its originality of cotton production due to obstacles faced by substituting other cash crops like banana and food crops like teff and maize. Because cotton harvesting requires a lot of investment and intensive care throughout its cultivation period, there is a trend to shift from cotton to other less time and money consuming and less risky cash crops. Cotton is susceptible to many pest attack like cotton white fly, cotton jassid, African ball worm and cotton aphid are common cotton pests in Arba minch Zuria district. The cost of chemicals become too high and the lack of improved varieties reduce its comparative advantages. Feyso (2018) further reports that weight cheat was a common practice and market power was taken by the traders. In case of cotton producer farmers, some of them adulterate cotton by adding water, mixing stone and course-soil with cotton especially when they supply in large quantity.

Major functions of cotton value chain actors in Arba Minch Zuria district include input supply, raw seed cotton production, trading raw seed cotton and cotton products, processing of raw seed cotton to transform into different products and consumption. See more details mainly on socio-economics in the Annex A4-3.

2.6.2 Ginning and textile

Ginning

There are two main cotton business models in Ethiopia:

- The “seed-cotton business model”, where a company (trader, ginner, cooperative, large commercial farm) supplies inputs to smallholder cotton growers, buys the seed-cotton from them, gins it (commission ginning) and sells the lint and cotton seed;
- The “lint business model”, where a seed-cotton producer (usually a large commercial farm) produces the seed cotton, commissions ginning, and sells the lint and cotton seed after the commission ginning.

A fully integrated model (from farm to garment) has recently emerged as a third model in Ethiopia’s cotton sector.

During the 2018/19 season seed cotton was processed by 19 operational ginneries (out of 21 installed, 17 equipped with saw gins and 5 with roller gins) with a theoretical total ginning capacity of over 400,000 tonnes of seed cotton per season (based on 150 workdays with 3 8-hour shifts), with saw gins accounting for 63% of the capacity. However, as most ginneries are poorly maintained, the operational capacity does not exceed 150,000 tonnes. The geographical distribution of ginneries (Oromia 7, Amhara 5, Afar 2, Addis Ababa, Benishangul-Gumuz, Gambela, SNPPR and Tigray 1 each) leads to capacity gaps.

Yarn spinning

There are currently 20 installed spinning mills with a theoretical processing capacity exceeding 100,000 tonnes of lint annually. 16 were operational the 2018/19 season (5 stand-alone spinning mills and 11 integrated with textile manufacturing). Some 240,000 spindles account for about two-thirds of the total spinning capacity, estimated at 80,000 tons per year (based on 350 workdays with 3 8-hour shifts). There are close to 20,000 open-end frames. 10 mills are located in Oromia, 2 in Amhara, 2 in Tigray, 1 in Addis Ababa and 1 in SNPPR.

Ethiopia's spinning enterprises produce rotor spun carded yarn, ring spun carded yarn, combed yarn and sewing thread from cotton lint purchased from domestic ginneries and abroad.
There is a lack of information on actual cotton mill use and the resulting production of yarn, as cotton is often blended with polyester.

Spinning firms purchase local lint regardless of the quality and additional lint is imported.
Handloom Subsector
Ginning factories produce lint that is spun manually into yarn (used for weft) by women spinners (individual or organised into spinning cooperatives). Some raw cotton is ginned and spun by hand by women to produce yarn used for warp.

Cottonseeds are removed from the boll by tapping the cotton fiber spread out on a flat stone with an iron rod. Drop spindles are still in use today along with spinning wheels. Spinning was learned and practiced by most social classes in Ethiopia and was considered a fashionable and appropriate activity for noblewomen well into the 20th century. Men were typically the weavers, with double treadle looms still in use today.
The weaving sub-sector is impressive. We expect that between 300 000 and 400 000 weavers in the country make their livelihood mainly with this occupation. They provide the main products for the tailors for the famous Ethiopian dresses.

2.6.3 Cottonseed: oil and cake

There are large and medium oil processing mills. The largest one is Addis Modjo Edible Oil Complex. The number and capacity of household oil pressing is not known.
As the typical oil content of cotton seed is about 12.5%, current production of cottonseed oil is about 6,000 tonnes per year. Cotton cakes (about 30,000 tonnes) are essentially used for cattle/poultry feeding.

2.7 Import/export or the role of globalised markets on the VC

The lack of transparency and reliability of cotton statistics in Ethiopia is clearly reflected in the Table 8 below which shows the differences in the estimates of cotton production and mill use of ICAC and USDA. As a result, estimates of imports and export of lint also differ.

TABLE 8 : ETHIOPIAN COTTON SUPPLY AND DEMAND PER SEASON ICAC VS USDA

Thousands	AREA (ha)		PRODUCTION (thousand t lint)		IMPORTS (thousand t lint)		MILL USE (thousand t lint)		EXPORTS (thousand t lint)	
	ICAC	USDA	ICAC	USDA	ICAC	USDA	ICAC	USDA	ICAC	USDA
2015/16	66	65	42	38	13	12	50	50	0	0
2016/17	82	82	52	45	4	11	55	50	0	4
2017/18	60	60	42	38	6	15	41	52	7	3
2018/19	78	77	57	53	6	7	52	60	7	2
2019/20	82	80	60	54	3	7	54	54	7	2

2.7.1 Import flows

Currently, Ethiopia is the largest consumer of cotton lint in sub-Saharan Africa, with an estimated mill use of consuming 52,000 tons in 2018/19 (August 2018 to July 2019) according to ICAC (and 60,000 tons according to the USDA). Since the USDA has lower estimates of cotton production (53,000 tons in 2018/19 vs 57,000 tons according to ICAC), their estimates of imports are higher than ICAC's (7,000 tons vs 6,000 in 2018/19- and 15,000 tons vs the previous season).

Official customs data for cotton imports are much lower (about 200 tons in calendar year 2018 and 300 tons the following year).

See more Annexe A3-2 on imports of the various cotton and textile products. Added are also the figures on palm oil, which is competing with the cottonseed oil. More in the Economy chapter under 3.4.

2.7.2 Export flows

Some cotton lint is exported, in most cases by the ginners in order to get foreign currency required to buy spare parts. According to ICAC, lint exports amount to 7,000 tons per season while the USDA estimates are 2,000 to 3,000 tons.

Official customs data for cotton exports are much lower (about 1,600 tons in calendar year 2017, 1,000 tons in 2018 and 400 tons in 2019).

The main commodities exported are garments and apparels down flow the yarn, which are not part of the scope of this VCA.

2.8 Governance and key drivers

We define governance here as follows:

> *Political processes of governing – whether undertaken by the government of a state, by a market or by a network – over a social system (like formal or informal organization, a territory or a VC) and whether through the laws, norms, power or language of an organized society. It relates to the processes of interaction and decision-making among the actors involved in a collective problem that lead to the creation, reinforcement, or reproduction of social norms and institutions (UNPD).*

This chapter builds on the "Structure and main processes" (2.2) (Figure 3) in which the Policy and Regulation arena with the planning and strategy development will be presented as a part of the governance structure. In this chapter, the governance goes beyond the role of the state. Based on Figure 3, we first examine here other arenas in the cotton VC. Then, we treat this chapter by descripting it from the perspective of the central (federal) state, then from the networks (including regional and global actors) and finally from the international partners perspective.

2.8.1 Policy and regulation arena

Policy making: Policies, legal and regulatory frameworks shape the role of the actors in the value chain. Among others the legal and regulatory frameworks relevant to the value chain include: Growth and Transformation Plan (GTP II), Agriculture led Industrialisation, Land management and certification, the Proclamation to provide for the establishment of cooperative societies, Ethiopian Labour Law, special programs (such as the African Growth and Opportunity Act - AGOA). The Ministry of Industry (MoI) is the sector holder and develops policies and strategies for the industrialisation of the country in general and the textile industry in particular. The Ministry of Agriculture and Livestock (MoAL) is responsible for developing policies and strategies and supervising the performance of the cotton production. Regional Agricultural Bureaus and the ministry provide services including extension services by way of deploying agricultural extension workers. The Ministry of Environment, Forestry and Climate Change (MoEFCC) leads the Protection Agency (EPA) and is responsible for the sustainability and health of the natural environment.

Recognising the economic relevance of the cotton and textile sector, the government is engaged in addressing the challenges and it considers the cotton-textile VC as the 2nd most important growth sector for the country. That is why a "National Cotton Development Strategy" (NCDS) and a corresponding roadmap have been developed, for the period 2017-2032 with a special target of making Ethiopia one of the top producers of sustainable quality cotton products in the world by 2032.

The Ethiopia government particularly aims at satisfying the cotton demand of the Ethiopian textile industry by an increasing share of locally produced cotton. Beyond that, the NCDS has also a focus on increasing productivity, value addition and marketing of the cotton sector. By 2032, the status of worldwide-acknowledged cotton brand, comparable to that of coffee from Ethiopia, which exists already today, shall be achieved. To reach this objective, the NCDS envisages attaining the following strategic cornerstones:

- improvement of the “policy and institutional environment to raise the efficiency and the competitiveness of the cotton value chain”;
- promotion of transparency along the cotton value chain”;
- promotion of an environmentally and socially sustainable cotton supply chain;
- improvement of the competitiveness and the profitability of cotton production”.

The GTP II sets ambitious targets to open other factories in order to create 140,000 new jobs in this sector, with export revenues expected to reach $1 billion by the end of 2020. Beyond the GTP II, the government envisions to make Ethiopia the textile and apparel manufacturing hub of Africa with annual exports of $30 billion by 2025.

Planning and strategy development: for agriculture, the GTP aims to maintain its role as a major source for economic growth and thus to contribute to poverty reduction. In fact, the GTP's objective for Ethiopia to become a food secure and middle-income country can only be achieved, amongst other factors, through increased agricultural productivity, by creating an enabling environment for enhanced private investment and agriculture-led industrialisation. The sector employs more than 80% of the workforce, accounts for about 44% of the GDP, generates almost 75% of exports and will remain a major source of inputs for the emerging industrial sector (NIP 2014).

The Ethiopian Government plans to construct 17 Integrated Agro-Industrial Parks (IAIPs) in which textile and garments will be predominant, that will be built in all states. Construction has already started in four states. Each park is set to generate USD 1 billion and hire 10,000 to 60,000 employees. Large scale cotton farms will be allocated to investors, that will be vertically integrated with textile mills.

The Textile Industry Development Institute (ETIDI) supervises the performance of both the cotton production and textile manufacturing industries. ETIDI is accountable to MoI. ETIDI, established in June 2010 and mandated with coordinating the VC since 2014 (the cotton sector was previously under the supervision of the Ministry of Agriculture), identifies five reasons why cotton has become a top priority for the federal government of Ethiopia:

- become a middle-income country by 2025;
- high expectations towards the manufacturing sector;
- cotton and textile sector expected to create jobs and earn foreign currency;
- the huge investments in textile, garment and apparel value chains result in increased demand for lint cotton;
- therefore, consistent supply of cotton is critical for the sustainability and competitiveness of the textile sector.

Regulation and administration: Administrative organs at regional state level avail land for cotton farms especially for private investors. In some parts of the country until very recently, landlords of the respective vicinities had more power and influence over the availability of land. As a result, investors face shortage of financing as financial institutions could not be at ease to provide bank loan facilities attached to collateral guarantee issues. Government institutions within the regional state administration give some technical and extension supports both to the private farms and individual household farmers. The extension services may include organising farmers for discussion on direction and target defining and awareness creation, on-job (site) training of farmers, land development and input usage, pest control mechanism and many other agricultural activities. Agricultural officers help farmers in sharing knowledge or experience and monitoring performances on a regular base. The administrative levels below the region are the zones, the woreda (district) and finally the kebele (commune; previously called Peasant association or PA under the socialist regime of 1987-1991).

The **Ministry of Industry (MoI)** has a mandate to support the development of agro-processing industries (oil milling) and textile and apparel industries, through providing enabling policy environment and technical support.

The Ethiopian Textile Industry Development Institute (ETIDI) was established by the Council of Ministers in 2010 in order to assist the sector in reaching the goals set by the Government five-year Growth and

Transformation Plan (GTP): increase textile exports to one billion USD by the end of 2015. ETIDI is mandated to provide investment promotion, training and consulting services; engage in research and development; and provide various testing and marketing support services. As such, it has become the focal point for activity in the sector and the main provider of support services.
ETIDI formulates and implements strategies and programmes aimed at stimulating the cotton, textile and apparel industries. The institute focuses on sectoral development, conducts market studies and disseminate trade intelligence, advises potential investors, provides trainings and technical assistance to enterprises (in production, quality and human resources (HR) management), provides testing and quality evaluation services, helps textile companies improve waste water treatment, provides quality and consulting services for inputs and finally, assists in all other areas related to sectoral development and sector-specific investment promotion.

The objectives of the Institute are to facilitate the development of transfer of technologies of cotton and textile and apparel industries and to enable the industries to become competitive and beget rapid development.

The following ministries are also relevant to the cotton and textile value chain:

- Ministry of Environment, Forestry and Climate Change (MoEFCC);
- Ministry of Finance and Economic Cooperation (MoFEC);
- Ministry of Labour and Social Affairs (MoLSA);
- Ministry of Trade (MoT);
- Ministry of Women and Children Affairs (MoWCA);
- Ministry of Water, Irrigation and Energy MoWIE);
- Ethiopan Revenues and Customs Authority (ERCA).

The **Federal Cooperative Agency (FCA)** develops and enforces federal cooperative regulations. It works towards creating enabling environment for various types of cooperatives in the country. It plays a key role in the cotton sector through its influence in providing the enabling environment for the development of effective and competitive cooperatives and unions involved in the cotton sector.

The Ethiopian Agricultural Transformation Agency (ATA) is a strategy and delivery-oriented government agency created to help accelerate the growth and transformation of the country's agriculture sector.
The Ethiopian Horticulture and Agriculture Investment Authority (EHAIA) was established in 2016 to encourage the production and exports of horticulture, commercial farms, livestock and commercial plantation forest.

2.8.2 Ideas generation

Humans create institutions based on clear ideas (Weber, 1922). Ideas are spread in form of knowledge in its various forms through the available ties into society and its networks (White, 2008). We are highlighting here only the institutional sources with confirmed effects on the involved areas of action. However, it is obvious, that innovative ideas and knowledge can emanate from all possible sources and will always start from individual people (Mills, 1958).

The International Cotton Advisory Committee (ICAC), as the international body created already during WWII in order to regulate the global cotton market is still the key knowledge pool related to the cotton VC. It's mission is to "serve the cotton and textile community through promotion, knowledge sharing, innovation, partnerships and providing a forum for discussion of cotton issues of international significance." Its newsletter "The ICAC Recorder" has a high impact on the national decision makers, also when it comes to decisions on technologies: The ICAC, (The Recorder, 2019), states in its newsletter:

> *The average **lint yields in Africa** have been about 350kg/ha for more than three decades, and this must change'. While attributing the low African cotton production to low yields, CIRAD (2018) stated that 'African cotton yields are among the lowest in the world, yet the continent has huge production potential'.*
> *Low yields in Africa are most likely due to the following two factors: (i) • Failure of the cotton sector to develop **appropriate technologies** suitable for facilitating high performances of the cotton crops under the prevailing*

environments, and (ii) • Failure in ensuring formidable adoption and appropriate application of the technologies by the cotton farmers.

For achieving the above objectives toward increasing cotton yields in Africa, there is need for the coordinating bodies in these initiatives, to forge means of having the member governments and the private sectors working in tandem. This is to ensure conformity for amicable legal environments and financial aspects to support the new developments in the respective countries towards sustainable increases in yields of high fibre quality cottons in Africa.

Ethiopia is not a member of the ICAC. The average lint yields are above the African averages: 574 kg/ha for rainfed and 740 kg/ha for irrigated cotton compared to less than 400 kg/ha in Sub-Saharan Africa (mostly rainfed) and about 700 kg/ha Northern Africa (irrigated).

Research: The main role of the Ethiopian Institute of Agricultural Research (EIAR) is to introduce and disseminate productive, environment friendly and pest resistant seeds (see more Annexe A2-9). Research institutions are crucial in the cotton VC process. The other roles of research institutions are testing agro-chemicals, developing tolerant varieties to drought vulnerabilities. The objective of the 2016-2030 strategy is " to increase the production, productivity and improve the quality of cotton lint and cotton by-products (oil and seed cake) produced under irrigated and rain fed conditions through multidisciplinary and participatory research approach from planning to popularization of research outputs there by contributing to the national development agenda of the country" (EIAR 2017). The national cotton research is coordinated from WERER Agricultural Research Centre (WARC) for irrigated conditions and from Assossa Agricultural Research Centre (AARC) for rain-fed conditions both under EIAR.

The Ethiopian Biodiversity Institute (EBI) is a federal government institute with mandates to ensure conservation of biodiversity, sustainable utilisation of resources, and access to and sharing of benefits of biological resources.

WERER Agricultural Research Centre Main Issues

The research center is currently producing four varieties of BPS (best practice seed), namely; DP-90, Claudia, Waiyto and Stam 59A. They have produced a total of 127 QT of BPS in 2018. This is 178 QT short of the amount of forecasted BPS required by seed multipliers in order to produce IPS in 2019.
The research center faces the following challenges:

- Lack of tracing mechanism of the BPS sold. Seed multipliers who not certified are reducing the quality of seed and this is creating shortage of planting seed.
- Lack of coordination with ETIDI regarding distribution of BPS.
- Lack of adequate land and finance to produce more BPS.

Since 1989, no variety has been issued for rainfed cotton (Gudeta, 2019).

EBI maintains a gene bank for the preservation of indigenous land races.
The situation in Ethiopia seems to be quite in line with the one in other African cotton countries as analysed by Seiny (2017):

But beyond these extreme differences, the diagnosis underlines the several significant problems and deficiencies: insufficient human resources (quantitative and qualitative) and funding (amounts and permanence); a less attractive status of researchers as compared to those working in the universities; the absence of incentive measures aimed at cotton research; insufficient collaborative mechanisms between partners, both nationally and internationally; inadequate dissemination of research results; and an approach focused on disciplines rather than themes, in spite of common problematics such as the loss of fertility, climate change, and pest management.

In terms of education: The University of Bahir Dar Institute of technology for Textile, Garment and Fashion design (EiTEX), is Ethiopia's first and primary university for textile engineering established in the early 1960s. The university teaches textile and garment engineering and fashion design at degree level. The ultimate goal for the university is to educate skilled labour to the textile industry at different levels. There is a need for both, so called "low-skilled labour" (for example sewing) and also highly trained engineers and managers at

the factories. Ethiopia wants to educate their own specialized engineers. The institute continues to strive to strengthen research, community service and technology transfer activities in order to contribute to economic development of the country as per Growth and Transformation Plan (GTP). The institute also aims to support and develop Ethiopian textile and garment industries, with the aim towards sustainable progress and keen competitiveness in the World market (source: https://eitex.bdu.edu.et).

Cross-cutting areas

The most relevant institutions covering various action areas are the following:
Cotton stakeholders' associations are established in line with Proclamation No. 341/2003 article no.23 to 28 of the Chamber of commerce and Sectorial Association. Such associations are established by the members of the producers in seeking support by way of training members, promoting products and creating market links on the one hand and advocacy works for a better policy and working environment on the other. The associations generally focus on marketing, information linkage with their respective members, trainings to some extent and advocacy works.

ECPGEA (Ethiopian Cotton Producers, Ginners and Exporters Association)**:** this is the lobby organisation of the organized cotton producers and ginners. Currently 94 institutional members out of six regions. ECPGEA's mission is: "To promote members interest as well as trade and investment in the Cotton and Ginning Industry in the country by providing demand driven service to its members and by advocating for a favourable business environment based on international best practices". There are currently 94 institutional members out of six regions.

ETGAMA (Ethiopian Textile and Garment Manufacturers Association): this is the lobby organisation of the textile and apparel sector. ETGAMA's goal is to foster the development of the T&C sector. Its activities include: updating members on contemporary global business trends; conducting seminars and dialogues with Government regarding policy issues; holding trainings and workshops with development partners; promoting member factories and their products; providing advisory services on technical and operational concerns; building relationships between exporters and international buyers; and helping members meet national and international demand on textile and clothing products. They are also involved in the functioning of the industrial parks.

The **Standards and quality management** in Ethiopia are governed by the following institutions: Ethiopian Standards Agency (ESA) provides a range of services in its role as the national standards body; Ethiopian Conformity Assessment Enterprise (ECAE) provides inspection, laboratory and certification services; Ethiopian National Accreditation Office (ENAO) provides various training, accreditation and monitoring services in its role as the national accreditation body and the National Metrology Institute of Ethiopia (NMI) maintains national measurement standards and provides various calibration, training and consulting services.

2.8.3 The central state

In Ethiopia, the cotton sector, as any other crop, has been traditionally under the supervision of MoAL. However, the production of seed cotton was transferred to the Ministry of Industry (MoI) in 2014. ETIDI is now in charge of the whole cotton and textile sector, and a new Directorate has been created, specifically in charge of the seed cotton production sub-sector (NCDS 2018).

The tensions between actors closer to the cotton production and the ones closer to industry and trade is reflected in the strategy (NCDS):

> *Both MoANR and MoI will play a crucial role in the implementation of the cotton development strategy in Ethiopia. Nonetheless, the role of MoANR is crucial as the priority is to increase cotton production and quality. The role of the Ministry of Finance and Economic Cooperation will also be critical for price support/stabilisation and support to investments, and the Ministry of Environment, Forestry and Climate Change will be closely involved due to the importance of sustainability. The Ministry of Water, Irrigation and Electricity, the Ministry of Trade, the Ministry of Transport, the Ministry of Labour and Social Affairs and the Ministry of Women's and Children's Affairs will also be involved in the implementation of the NCDS The major issue is, therefore, to ensure that institutions with different mandates work effectively together. For this reason, the implementation of the*

NCDS should be led by a dedicated authority, the Ethiopian Cotton Development Authority (ECDA), ideally placed directly under the Prime Minister. ECDA will bring together the main ministries involved in the implementation of the NCDS.

The following narrative of Diriba (2019) puts the governance issue into the larger context:
It was in the early twentieth century that Ethiopia's cotton sector, and consequently the textile and clothing sector, began to grow on a commercial scale. The Italians introduced the first garment factory in 1939, as well as the first modern, integrated textile mill. The sector continued to expand in line with the growing cotton production, and the 1960s saw the establishment of five large, private, integrated textile enterprises. While the socialist Government, which ruled the country 1974 to 1991, nationalized the private textile and apparel companies, it also established additional enterprises to fulfil domestic demand. Nonetheless, the sector eventually suffered from lack of competition, limited investment, and reliance on outdated technology, which hampered the development of textile and clothing sector significantly. Indeed, it was unable to meet international standards and was operating well below capacity. Since the return to a market economy in 1991, the government has identified the textile and clothing sector as one of the priority areas for poverty reduction and economic development. From 2000 onward, the government began to privatize state cotton farms and ginneries and to sell or lease state textile mills. However, it is only in the last few years that the sector has started to grow.

Figure 11 depicts the current governance structure, with in its core the federal state and the NSC strategy and ETIDI as the key coordination and implementing agency.

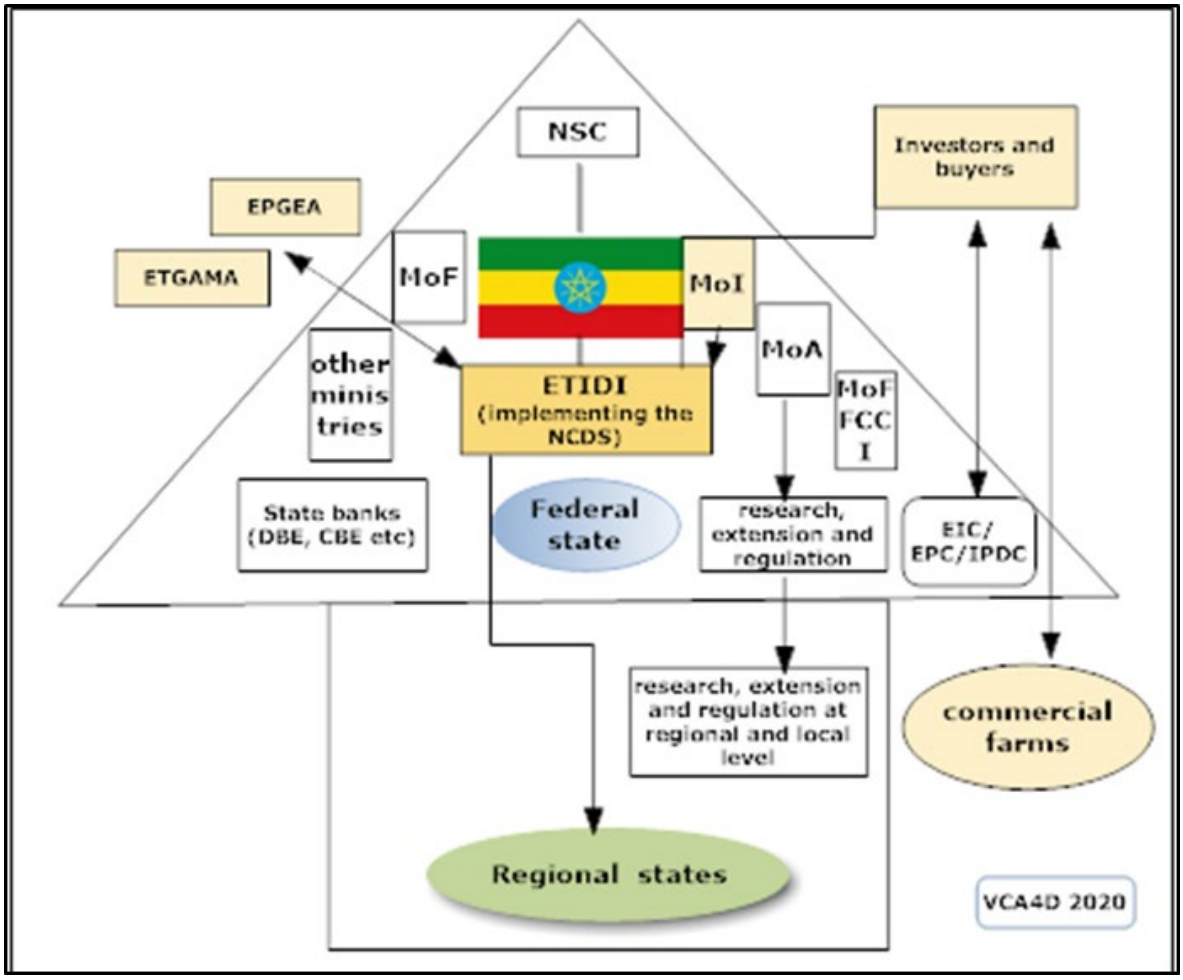


FIGURE 11 : THE GOVERNANCE STRUCTURE OF THE VC

Policy fine-tuning: Some authors report problems with the insufficient supply of cotton and explain it with poor land distribution to small-scale farmers, insufficient access to credit, productivity insufficiencies and generally poor performance of the VC (Bosena et al, 2011). As such situations are very contextual, a challenge

will be for the regional administration and stakeholders from the private sector including the farmers themselves, to find the right mix of policy measures.

To realize the opportunities of the sector authors recommend a set of policy measures, leading to (i) providing technical & supervisory skill development, (ii) regarding employee incentives & retention, (iii) improve quality management skills in line with best global standards, (iv) realize improvement in existing training & education in line with industry's requirement and (v) enhanced design capacity (Diriba et al, 2019).

2.8.4 Key drivers and networks addressing the challenges

There is growing recognition that the world has changed since the 1980s, that the very meaning of 'industry' has morphed from a localized, cluster-based concept to value chain forms that exhibit greater spatial dispersion and more detailed and immediate operational integration (Ponte 2014). From cotton to final products, flows and hierarchies are organised at the global level within a highly differentiated world economy as function system (Luhmann 1995). Complex networks get agency and may reduce the influence of the previously sole governing agent, the state. We will not go more in detail here as this would go beyond our scope, but want just remind that governance does not stop anymore at the national border. We called the actors from outside "Investors and buyers" (Figure 11). The reality may be more complex.

> *At the same time, it is evident that powerful factors and actors external to the chain can shape governance through the impact of regulation, lobbying, civil society campaigns, and third-party standard making. Institutional actors, including states and multi-lateral institutions shape GVCs by providing a mechanism for signatories to enforce, or not enforce, regulations and a platform for negotiating the terms of international trade agreements. Consumers shape GVCs through the purchasing choices they make, as when they turn the products and services they buy to unintended purposes, and even more so, when their wishes are amplified by boycotts, class action litigation, or the programmatic efforts of NGOs. Workers can also influence governance, especially when they are represented by labour unions with the ability to call work stoppages at the level of the enterprise, industry, or broader economy (Ponte 2014).*

The challenges of governance of the VC, distinguished in traditional/modern and the 2 main components (fibre production, textile and garment), and including the perspectives of networks, are visualized in Figure 12.

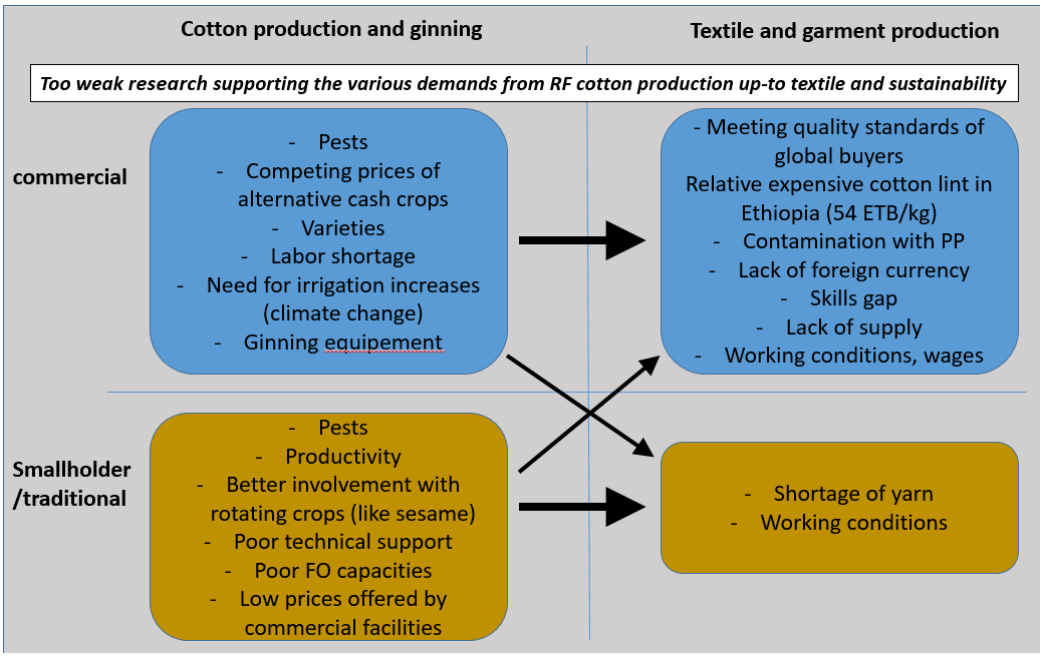


FIGURE 12 : MAIN CHALLENGES RELATED TO GOVERNANCE

We estimate the market for the traditional, handloom-based VC on 7-9,000 t/year (if 15% of the population consumes 0.5kg/yr).

Bottlenecks, constraints and challenges listed by ETIDI (Table 9):

TABLE 9: CONSTRAINTS AND CHALLENGES IDENTIFIED BY ETIDI

Constraints and challenges identified by ETIDI (April 2019)	Comments by VCA4D – M1
The issues of marketing platform and pricing transparency.	Still a major issue. Data are not reliable as there is no proper monitoring system of the cotton sector, from production of seed cotton to the use of lint and cottonseeds.
The availability of inputs is limited (seeds, chemical).	Quality seed availability remain an issue. The use of chemicals is relatively low in Ethiopia and still they have the highest productivity in Sub-Saharan Africa. Water availability is seen as a constraint although access to rivers are available. Some traditional management methods (such as developing supply of organic compost to enhance soil organic matter) are not capitalized upon due to perceptions of labor constraints/feasibility etc.
Ginneries use very outdated equipment, which is also affecting lint quality.	Most ginneries are old and obsolete but new ginneries were built up recently reducing capacity gaps in some production areas.
Cotton quality is affected at both the production, transporting and ginning stages of the value chain. Poor harvesting and post-harvesting techniques	Lack of water and climate conditions was perceived as having a negative impact on cotton fibre quality.
Research is inadequate and underfunded.	Yes, particularly in relation to seed availability, but as well in many other aspects and the overall all aspects like sustainability, including soil fertility.
The ginning outturn is very low, which impacts profitability for both producers and ginners.	The old and ubiquitous DP90 variety has a ginning outturn of 37% only, one of the lowest in Africa and way below the 42%-average in West Africa. Ginning outturn of new varieties coming up has to be checked.
The contractual arrangements between smallholder farmers and ginners as well as textile industry are weak.	Yes. This is due to a lack of transparency on the part of ginners and weak farmers organizations. The relationship is further weakened by middlemen (traders). Actions are being undertaken underway to promote and implement contract farming, notably for organic cotton production.
Minimal coordination between segments or across the subsectors	Yes. Unsurprisingly, being the so-called "owner of the sector", ETIDI does not include the weakness of the current institutional arrangement among the constraints and challenges faced by the cotton value chain.

2.8.5 The perceived role of development partners

United Nations. The concept of global governance is closely linked to debates about the UN. The growing interdependence of countries worldwide through the increasing volume and variety of cross-border transactions of goods and services and of international capital flows, and through the more rapid and widespread diffusion of technology leads since over 30 years to questions of global rules regulating these interactions as they did before within the national systems (Sampson 2001). Labour and environmental issues are governance issues discussed since at global level. Goal-setting is a novel global governance strategy (Biermann, 2017):

Governance through goals' is best exemplified by the Sustainable Development Goals. Unique features of the Sustainable Development Goals set them apart from other existing goals. Operational challenges exist with global governance through goals. Need to identify conditions under which the goals can ensure progress….While the SDGs hold a great potential, their collective success will depend on a number of institutional factors such as the extent to which states formalize their commitments, strengthen related global governance arrangements, translate the global ambitions into national contexts, integrate sectoral policies, and maintain flexibility in governance mechanisms."
Our mission did not allow to enter into deeper layers of this global governance structure. The analyses on how Ethiopia is addressing the SDGs and how the support from outside is facilitating its achievements, would enlighten aspects of global governance related to the cotton and textile VC. The fast changing social, political, economic and ecological environments world require much more attention in order to better understand the VC of cotton and textile as it is manifesting in Ethiopia.

WTO. Cotton has been discussed at the WTO since 2003. The 2015 Nairobi Ministerial Decision on Cotton contains provisions on improving market access for least-developed countries, reforming domestic support and eliminating export subsidies. It also underlines the importance of effective assistance to support the cotton sector in developing countries. Ethiopia is in the processes to resume its membership to the institution (expected to happen in 2022), which is playing – or supposed to play- a key role in global governance. But it is no secret that even WTO is in serious troubles and since years fighting with internal weaknesses and hence not capable in improving governance of the cotton and textile VC of Ethiopia (from Sampson):

- WTO is suffering from an alarming lack of leadership on the part of most of its largest members
- Still unanswered questions: Should the harmonization of standards be a goal of international economic bargaining? Will it occur even without deliberate efforts by governments? Can the global economy achieve its full potential without significant further harmonization of standards across nations, just as successful national economies required the adoption of common standards by constituent political units (e.g. states or provinces)?
- The industrial countries will not be able to dominate trade discussions. But they still do.
- WTO's overburdened staff is unable to respond to all member country requests for information or assistance

Example of development partner activity within the UN/WTO figuration

UNIDO/PCB: An abundance of raw materials, competitive wages and low energy costs give the Ethiopian textiles and apparel sector a comparative advantage over other countries. The textile and apparel sector offer substantial opportunities for access to regional and international markets, especially as foreign direct investment is increasing. However, in order for the sector to achieve its full potential, production and supply chain inefficiencies along the cotton-to-textiles value chain need to be addressed. The PCP Ethiopia is tackling this issue by addressing the skills gap in the industry with a flagship initiative focused on capacity-building and job creation for youth and women in migration-prone areas of Ethiopia. Located in Mekelle in Tigray, the initiative aims to bridge the gap between the Textile & Garment (T&G) industry's

The **EU** is engaged in more efforts in tackling economic, social and environmental challenges (EU 2017). Its three thematic priorities are: Women's economic empowerment; Decent work and living wages; and Transparency and traceability in the value chain.

The three intervention areas are: providing financial support; promoting social and environmental best practices; and reaching out to consumers and awareness-raising.
"The Commission is committed to effectively promote and integrate sustainability in the garment sector – with its economic, social and environmental dimensions – in its development actions. Development cooperation can be an effective tool in encouraging the private sector and in engaging in reforms and dialogue with governments in garment producing countries. Only when all parties commit to sustainable value chains and take appropriate action will economic growth and development go hand in hand with social justice and environmental protection and make it possible to achieve the Sustainable Development Goals in the garment sector." (EU, 2017)

To summarize this sub-chapter, the role of external partners on the governance of the VC, particularly the United Nations and WTO, would need more elaboration in order to assess their contribution.

Example of development partner activity within the EU or European figuration

SOFRECO, a French based consultancy, issued in 2016 the SCOPING STUDY REPORT: NATIONAL COTTON DEVELOPMENT STRATEGY (2015-2030) which is since the main document driving the C&T VC. The study was supported financially by DFID and prepared from information provided by the Ministry of Industry of the Federal Democratic Republic of Ethiopia and a number of other sources.
The following topics were covered:

1. Thematic Area A - Production and Productivity
2. Thematic Area B - Processing and Value Addition
3. Thematic Area C – Competitiveness and Market Access
4. Thematic Area D – Value Chain Organization and Supporting Services and
5. Thematic Area E – Policy and Regulation.
6. Thematic Area F – Social Impact and Environmental Compliance.

The chapter on Thematic Area E is focussed on internal issues, particularly relations between federal and

2.9 Strategic importance of the sector/VC in the context of sustainability

The cotton and textile industry is since many years under pressure to improve its sustainability (FAO 2015, FAO 2019). In the last years, sustainability standards have emerged, as well in Ethiopia. Since 2009, an increased adoption of voluntary sustainable standards (VSS) is observed, mounting from 1% in 2009 to 14% in 2014 (Voora, 2014). CmiA is promoted by SolidarIdad in Western Tigray and Organic standard in Arba Minch Zuria by pesticide networks (both are international NGOs). The potential for Organic cotton in Ethiopia is well known in government (EIA 2012, NGOs and research (Partzsch 2019). To cite Partzsch et al (2019):

> *Ethiopia is witnessing a cotton revival. Voluntary certification programs, such as the Global Organic Textile Standard (GOTS) and Cotton made in Africa (CmiA), promise to ensure the sustainability of this development. When advertising certification, companies call upon consumers to 'join the fashion revolution' and overcome grievances of 'dirty fashion'. We find that GOTS offers consumers the opportunity to alter their position. They have the power to establish an alternative (niche) system of ethical trade. By contrast, CmiA represents power with conventional producers, retailers and consumers. This certification initiative can be considered less radical, but it has a much better market outreach. While we argue that only certification that demands the creation of alternative market structures can be a starting point for a 'revolutionary' transition, we also see a need for the conventional industry to change in countries such as Ethiopia.*

Moreover, given the relatively limited use of pesticides and chemical fertilisers by smallholder farmers, Ethiopia has even the potential to become a producer of organic cotton for a niche market. However, the absence of any administrative body to monitor and certify organic farm practices – and the lack of separate ginneries and other processing and handling facilities to manufacture organic cotton-based products – is constraining its growth.

The Growth and Transformation Plans (GTP II) and Ethiopia's National Cotton Development Strategy (NCDS 2017) urge for a fivefold increase of lint production. The ambitious development plans incorporate global sustainability standards such as the Better Cotton Initiative (BCI) and Cotton made in Africa (CmiA), which are becoming mainstream production systems (BCI 2013 and CmiA 2014/15) due to the strong commitment of international brands and retailers like HandM, PVH, VF, Adidas, CandA, Nike and Timberland, who are committed. The "Sustainable Cotton Initiative Ethiopia (SCIE)" introduced in 2017 pilot interventions of sustainable production principles on large and smallholder farms in the regional states of Afar and Tigray. The first certifications were issued in 2018 (Zerihun, 2019). In Tigray, Solidardad is implementing since 2017 a CmiA project supported by donors and brands.

A special attention should be put on certified organic cotton as a standard not accepting GMO cotton, but bearing the best potential to advance the cause of sustainability (more below).

2.9.1 Cotton certification within more conventional figurations

Four standards of sustainable –also called identity- cotton are possible in the region: organic cotton, CmiA, BCI and Fair trade. Fair trade is often combined with organic. Out of them, CmiA and BCI might be called standards within a more conventional figuration (see Partzsch 2020). These four standards form the so called sustainable cotton.

Currently, the CmIA standard is promoted in Tigray and Amhara on about 7'000 ha and supported by CmIA and EPGGEA and technically executed by Solidardad (oral communication during our mission). H&M is committed as a brand. The start was in 2017. We estimate the 2018/19 CmiA production to have reached 10,500 t of seed cotton (7,000 ha @ 1,500 kg/ha).

It refers to processes of developing shared values, finding common ground, and generating collective strength (Partzsch 2017b). In this sense, actors may overcome the artificial divide between consumers (in the Global North) and producers (in the Global South) and take joint action.

See more on Annexe A2-5, Sustainable cotton production including organic cotton.

2.9.2 Organic and Fairtrade standards

Supported by TRAID, PAN UK has been working in partnership with PAN-Ethiopia since 2013 to introduce sustainable cotton production to farmers near Arba Minch in southern Ethiopia. Over 2000 farmers have now benefited from taking part in Farmer Field Schools. In 2018, about 200 ha were certified organic (in 2019/20 they doubled to about 400 ha). All the cotton is done by SCF and one local commercial farm close to Arba Minch (Lucy farm). Cotton is rotated with banana and maize and mostly irrigated as all other cash crops as well. The unusual way of its promotion is that its focus lies just on production. For the marketing, the project depends currently on the goodwill of ETIDI, which buys the cottonseed and sells it to an integrated company (MNS). Their textile branch produced organic towels which go currently for the Dubai market.
Water shortage around Arba Minch has been reported as a constraint.
Other factories in Ethiopia are buying organic lint or yarn (mostly from India), in order to satisfy their needs.

2.9.3 Difficulties of sustainable cotton and textile in Ethiopia

The main difficulty is the lack of official support, policies and strategies. Secondly, the brands as key players are still reluctant to materially engage in encouraging farmers to convert to sustainable cotton (see more in Annex A2-5). The highly complex institutional landscape of the VC would require a more aggressive positioning of the VC partners, a part of the brands as well the in Ethiopia active textile and apparel partners for organic cotton and textile, sending out clear signals for commitments to participate in covering the investments costs. We could even imagine a future for organic cotton in Gambela, if the cohabitation with GMO cotton could be management without contamination (see Annexe A4-7).

3. Economic Analysis

3.1 Introduction and Methodology

This section of the VCA4D deals with the economic dimension of Ethiopia cotton value chain (CVC) in Ethiopia, up to yarn and crude oil stages.
The economic analysis of the CVC in Ethiopia aims to answer the two framing questions:

1. What is the contribution of the CVC to economic growth?
2. Is the economic growth inclusive?

The analysis follows four main steps:

1. Undertaking the 'financial analysis' of the actors
2. Assessing the overall effects in the national economy
3. Analysing the sustainability and visibility within the international economy
4. Assessing the growth inclusiveness

Core questions and indicators

Framing question 1
CQ 1.1. How profitable and sustainable are the VC activities for the entities involved?
CQ1.2. What is the contribution of the VC to the GDP?
CQ1.3. What is the contribution of the VC to the agriculture sector GDP?
CQ1.4. What is the contribution of the VC to the public finances?
CQ1.5. What is the contribution of the VC to the balance of trade?
CQ1.6. Is the VC viable in the international economy?

Framing question 2
CQ2.1. How is income distributed across actors of the VC?
CQ2.2. What is the impact of the governance systems on income distribution?
CQ2.3. How is employment distributed across the VC?

Information and Data Collected
The level of precision of data was restrained by exceptional circumstances, which led to a relative lack of direct field data. Some of the data gathered are contradictory and sometimes obviously unreliable. Therefore, data are orders of magnitude, and often result from 'educated guesses'.

The economic calculations are based on averages, which are subject to discussion as the cotton value chain is a complex and diversified encompassing several areas, numerous actors with distinct business models. Parameters and ratios used for the calculations are detailed in Annex 3-1.

An average exchange rate of 29 ETB to the US dollar has been used in all calculations. All products in the cotton value chain are valued in dollar terms in the world market: lint, yarn, cottonseeds, oil and cake (with the exception of seedcotton which is not traded internationally).

The AgriFood Chain Analysis (AFA) software developed by CIRAD had been used for the economic calculations and analysis.

3.2 Financial Analysis

How profitable and sustainable are the VC activities for the actors involved in the cotton VC?

Viability for the actors

Operating accounts are elaborated with actual flows and market prices in 2018.

Profitability for each actor is measured by their net operating profit (market value of products minus costs of production: consumables, services (transport), wages, financial charges, taxes and depreciation) (Table 10). (See Annexe A3-1 for the items in the accounts)

TABLE 10 : PROFITABILITY FOR THE INDIVIDUAL ACTORS

('000 ETB)	Tradition. farmer	Smallscale farmer	Commercial farmer	Middleman	Ginner	Spinner	Oilseed processor
Output value	28.9	21.6	14,820	19,950	118,505	186,760	546,708
Consumables		2.1	3,342	17,955	97,137	125,173	288,523
Services			570	998	2,160		
Wages		4.0	2,955		1,388	5,400	4,866
Financial charges			148	200	1,000	1,500	500
Taxes					17,527	28,014	82,008
Depreciation			290		240	1,450	363
Total costs	0.0	6.1	7,305	19,153	119,451	161,537	376,259
Net operating profit	28.9	15.5	7,515	798	- 946	25,223	170,449
Benefit/cost ratio		2.54	1.03	0.04	-<1%	0.15	0.45
Return on turnover	100%	72%	51%	4%	-0.79%	14%	31%

The cotton VC can be defined as economically sustainable, given that its activities create positive incomes for most of the actors who are partially or totally dedicated to it.

At the production stage, the return on turnover of traditional cotton farmers amounts to 100% (Table 10). For a small farmer in the 'modern' market, the return on turnover was calculated at 72%, which is higher than the 51%-rate achieved by large commercial farmers.

For the middlemen (traders), the return on turnover is only 4% of the market value of the seedcotton they sell to the ginners. However, their margin is 40% of the differential between the selling price and the price they pay to farmers.

At the processing stage, the 'average' ginner does not break even (return on turnover: -0.79%) due to the under-utilisation of the ginning capacity and the low productivity (ginning outturn and efficiency). Average accounts are based on industry standard and domestic costs. However, the average maybe flawed and misleading as the distribution of ginneries does not follow a bell-curve and is bimodal.

The return on turnover for spinners and oil processors are 14% and 31%, respectively.

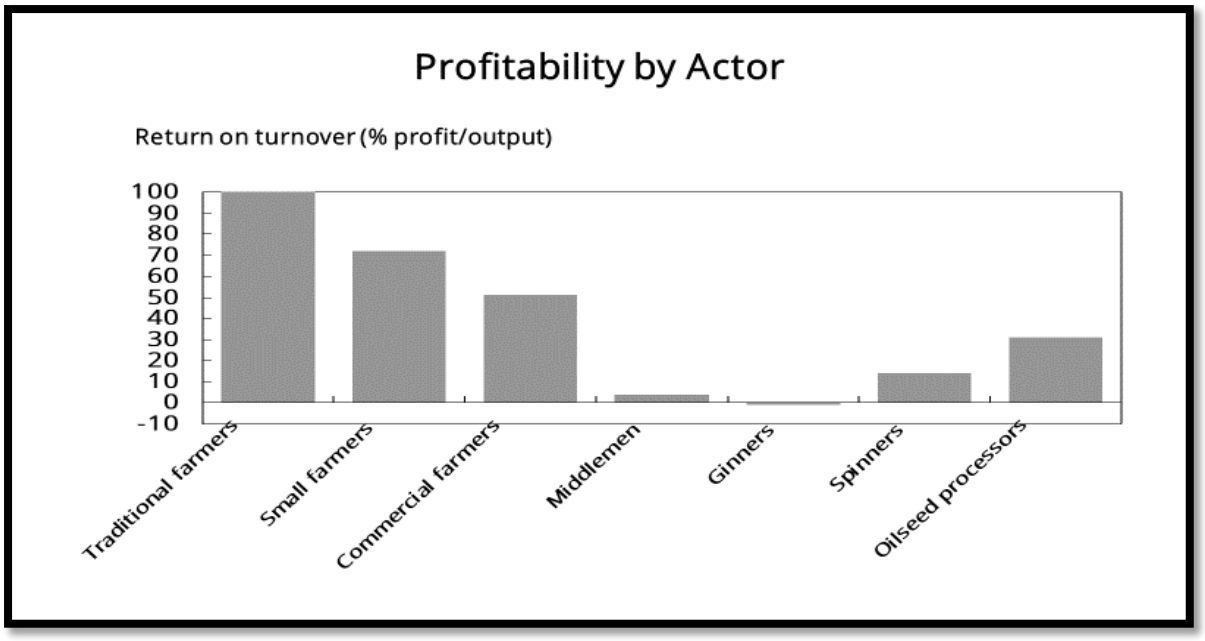


FIGURE 13: RETURN ON TURNOVER BY ACTOR

Average Benefit to cost ratios range from – 1 for ginners to 2.54 for smallscale farmers. This ratio cannot be calculated for traditional farmers as they have no monetary costs (Figure 14).

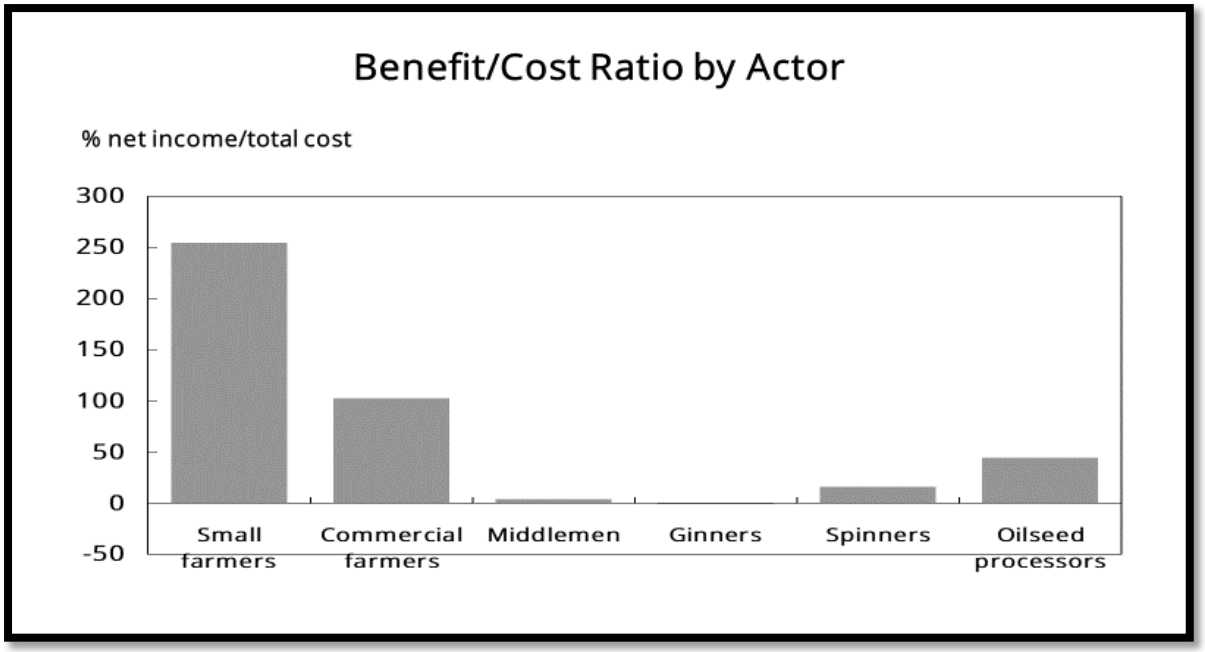


FIGURE 14: BENEFIT/COST RATIO BY ACTOR

3.3 Effects within the National Economy

Consolidation of VC accounts

The individual operating accounts of all the value chain actors are merged into one single account (*Table 11*):

Table 11 : VC Consolidated operating account (in ETB)

Actor	Output	Intermediate Goods and Services	VA	Wage	Tax	Financial Charge	Property Income	Depreciation	Net Operating Profit	Subsidy
Traditional farmer	202,861,754	0	202,861,754	0	0	0	0	0	202,861,754	0
Smallscale farmer	410,400,000	39,757,000	370,642,500	76,237,500	0	0	0	0	294,405,000	0
Commercial farmer	1,333,800,000	352,057,500	981,742,500	265,950,000	0	13,338,000	0	26,100,000	676,354,500	0
Middleman	798,000,000	758,100,000	39,900,000	0	0	8,000,000	0	0	31,900,000	0
Ginner	2,251,590,279	1,886,639.034	364,951,245	26,362,500	333,010,405	19,000,000	0	5,510.000	-18,931,660	0
Spinner	2,988,159,998	2,002,771,583	985,388,415	86,400,000	448,224,010	24,000,000	0	23,200,000	403,564,405	0
Oilseed processor	546,708,189	288,516;749	258,191,440	4,865,900	82,006,230	499,990	0	362,493	170,456,827	0
VALUE CHAIN	**3,769,250,940**	**565,573,022**	**3,203,677,918**	**459,815,900**	**863,240,645**	**64,837,990**	**0**	**55,172,493**	**1,760,610,826**	

Growth Generation

The direct VA of the cotton VC (up to yarn and crude oil stages) amounts to 3,2 bn ETB or about $110 mn (Table 12).

TABLE 12 : DIRECT VALUE ADDED

Actors	Direct VA (mn ETB)	% of output value	% of total direct VA
Traditional farmers	203	100%	6%
Small farmers	371	90%	12%
Commercial farmers	982	74%	31%
Middlemen	40	5%	1%
Ginners	365	16%	11%
Spinners	985	33%	31%
Oilseed processors	258	47%	8%
Total	**3,204**	38%	100%

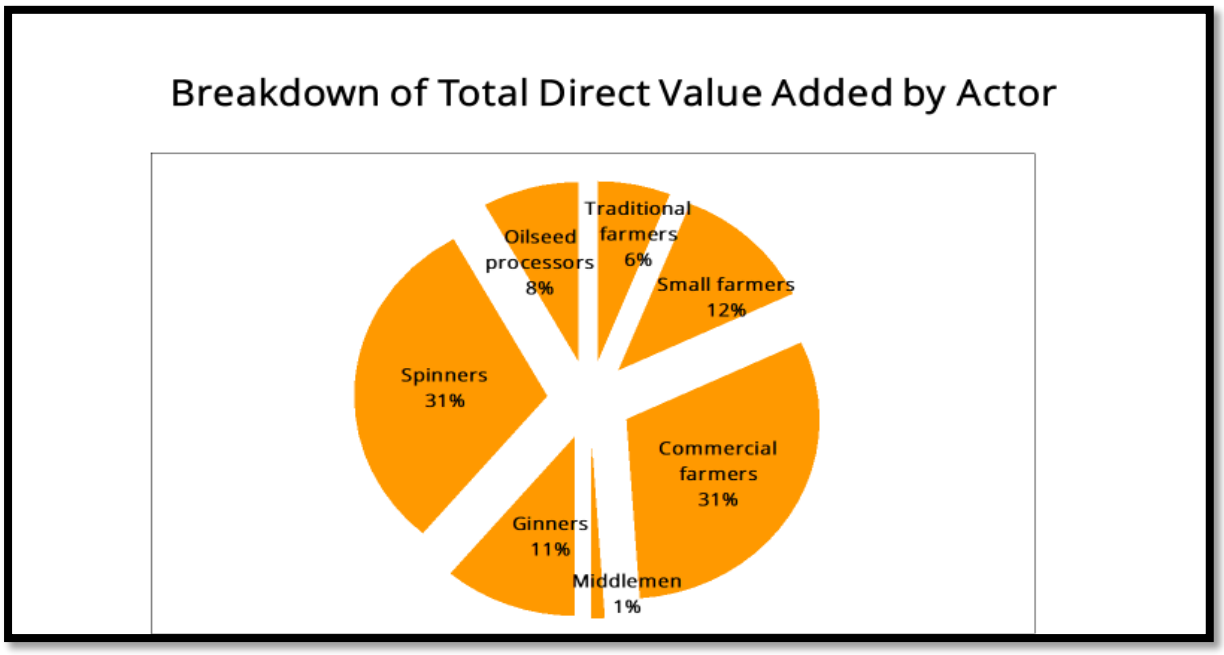


FIGURE 15: BREAKDOWN OF DIRECT VA BY ACTOR

Small cotton farmers generate a higher direct contribution to the VA than large commercial farmers, relatively to their production (Table 12). Traditional farms produce 5% of the total cottonseed production and contribute to 6% of the CVC's direct VA. Small farms produce 24% of the total production and contribute to a 12%-share, whereas large farms generate only 31% of the VA with their 71%-share of production (Figure 15, Table 13).

TABLE 13 : DIRECT VALUE ADDED AT FARM LEVEL

Actors	% of seedcotton production	% of direct VA
Small farmers	24%	12%
Large farmers	71%	31%
Traditional farmers	5%	6%
Total	100%	49%

Total Value Added

In addition to the direct value added generated by the actors operating within the VC, indirect VA results from activities induced by the use of intermediate goods and services supplied by actors outside the VC limits.

Indirect VA is estimated at 176 mn ETB and total value added amounts to 3.38 bn ETB (Table 14), or 0.18% of the GDP (0.54% of the agriculture GDP).

TABLE 14: TOTAL VALUE ADDED

(mn ETB)	Direct	Indirect	Total	% of total VA
Imports		325	325	
IC not disaggregated		64	64	
Value added				
Wages	460	22	482	14%
Taxes	863	26	889	26%
Financial charges	65	39	103	3%
Depreciation	55	53	108	3%
Net Operating Profit	1 761	37	1 798	54%
Total VA	**3 204**	**176**	**3 380**	100%

OPERATING PROFITS ACCOUNT FOR 54% OF THE TOTAL VALUE ADDED, TAXES FOR 26% AND WAGES FOR 14%; FINANCIAL AND DEPRECIATION FOR 3% EACH (

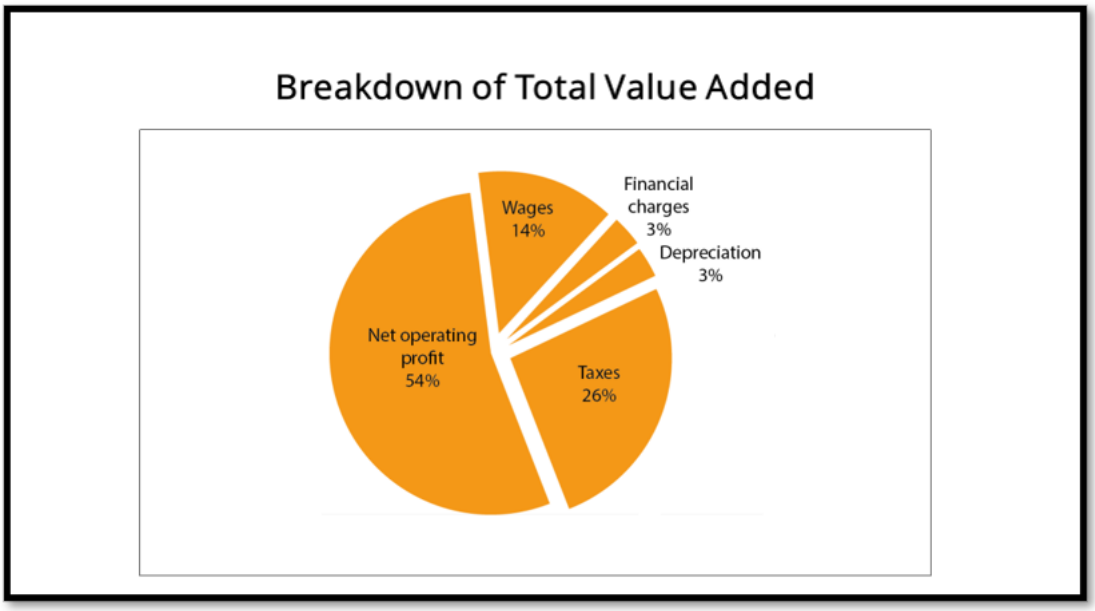


FIGURE 16).

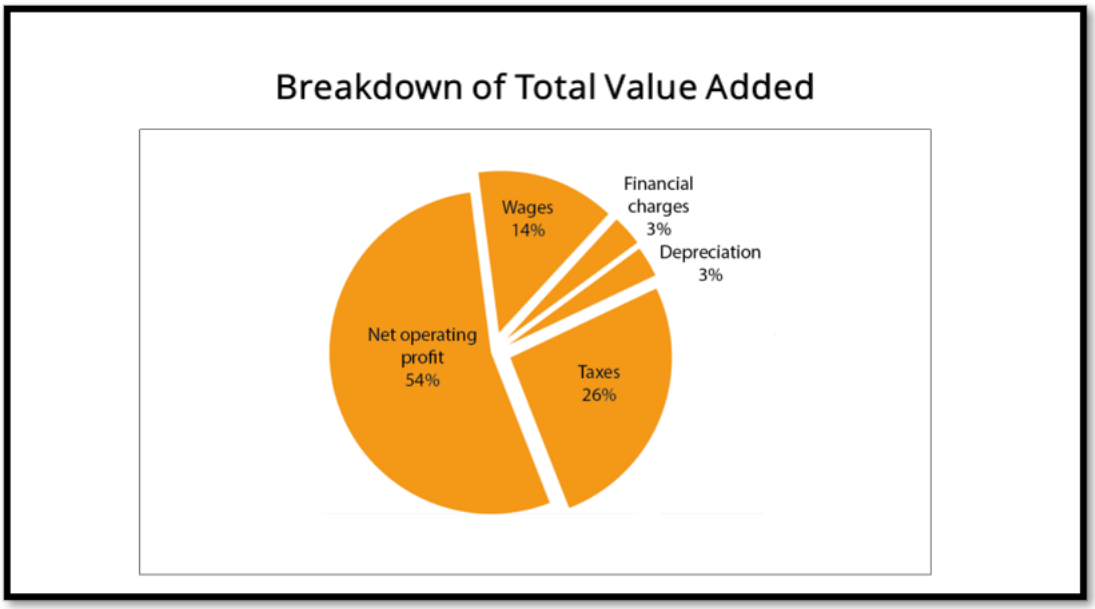


FIGURE 16: COMPONENTS OF TOTAL VALUE ADDED [6]

Contribution of the VC to the GDP?

Growth is measured by the gross domestic product. The contribution of the cotton VC to the national GDP, estimated at 1,875 bn ETB in nominal terms in 2018 (source: National Bank of Ethiopia Annual Report 2018/19), is 0.18%.

The share of agriculture in Ethiopia's gross domestic product in 2018 was 33.3%. The direct value added contributed to 0.52% of the GDP of the Ethiopian agricultural sector (624 bn ETB). The level of integration of the cotton value chain is relatively high, as the total VA (3.38 bn ETB) represents 91.4% of the output of the value chain (3.77 bn ETB).

Contribution of the VC to the public finances

The cotton value chain positively impacts the public finances. The estimated amount of taxes paid to the Ethiopian state by the actors of the VC, about 0.9 bn ETB. The actors don't benefit from any subsidies. The VC contributes to 0.2% of the total revenue collected during 2018/2019 fiscal year (371 bn ETB; NBE Annual Report 2018/19).

Contribution of the VC to the balance of trade

It is assumed that there were no direct imports generated by the actors operating within the limits of the VC. Indirect imports induced by the use of intermediate goods and services supplied by actors outside the VC limits (such as agricultural inputs, spare parts and fuels) are estimated at 325 mn ETB, or 0.065% of national imports (500 bn ETB in 2018; NBE Annual Report 2018/19). The contribution of the VC to the balance of trade is therefore negative.

Total imports represent 8.6% of the total production of the VC.

The economic analysis of the cotton value chain at the upstream level shows a negative effect on the trade balance. Calculations were based on the assumption that all domestic seedcotton production of the 2018/2019 cotton season was processed (ginned, spun and crushed) in the country. In fact, Ethiopia is both an importer and an exporter of cotton lint, but flows offset each other (according to customs data, 294 tonnes were imported, and 414 t exported in calendar year 2019).

Limited quantities of seed cotton were probably imported from Sudan. Cotton yarn flows are also roughly balanced (791 t exported and 890 t imported in 2019).

[6] Net Operating Profit in the breakdown of the total VA refers to the income of the VC actors (52%) and that of suppliers (2%).

The impact on the trade balance would certainly be positive by integrating the downstream level of the value chain as most of the textile and clothing production is exported.

3.4 Sustainability and Viability within the Global Economy

Domestic products of the Ethiopian cotton VC compete with those available on the international markets. As shown in Annex 3-2, Ethiopia exports and imports lint and yarn.

As shown in Table 15 below, domestic prices of lint before taxes (VAT rate 15%) are above or close the international prices. Domestic prices of yarn before taxes are much higher, particularly the traditional product. In contrast, prices of cottonseed and cake are lower than world prices. However, the price of domestic crude oil is more than twice the international price.

TABLE 15: MARKET PRICES VS INTERNATIONAL PRICES

Product	Market price (ETB/kg)	Market price ($/t)	International price ($/t)	%
Lint (industrial)	50	1,724	1,850 [1)]	93%
Lint (traditional)	60	2,069	1,850 [1)]	112%
Cottonseed	5	172	225 [2)]	76%
Yarn (industrial)	100	3,448	2,881 [3)]	120%
Yarn (traditional)	150	5,172	2,881 [3)]	180%
Crude oil	50	1,724	775 [4)]	222%
Cake	5.5	190	465 [5)]	41%

1) season average Cotlook A Index 2918-3019 (CFR).
2) U.S. price.
3) average price of imports in 2018.
4) U.S. price for cottonseed oil (average price of imported palm oil in 2018: 752 $/t).
5) U.S. price.

Competitiveness

The price of seedcotton is by far the most important component in the cost of production of lint.
The market price for seedcotton in Ethiopia are the second highest in Sub-Saharan Africa in 2019. 18 ETB/kg is equivalent to 62 U.S. cents per kg (Figure 17).

The price paid in the traditional market, 30 ETB/kg or more than one dollar per kg is unheard of elsewhere in the world for medium staples cotton (81 cents in the USA).

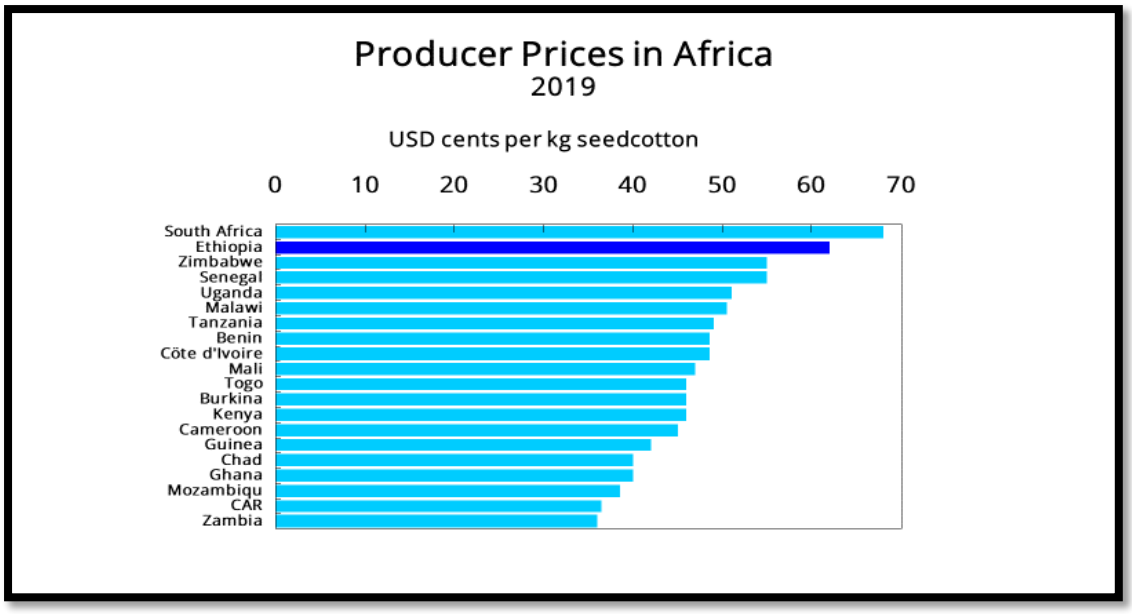


FIGURE 17 : SEEDCOTTON PRICES IN AFRICA

The current ginning outturn (% of lint to seedcotton) in Ethiopia is among the lowest in Africa: 37% compared to an average of 42.5 in the franc Zone countries (Figure 18). As a result, Ethiopian ginners produce 13% less lint than their counterparts in West Africa for the same quantity of seedcotton.

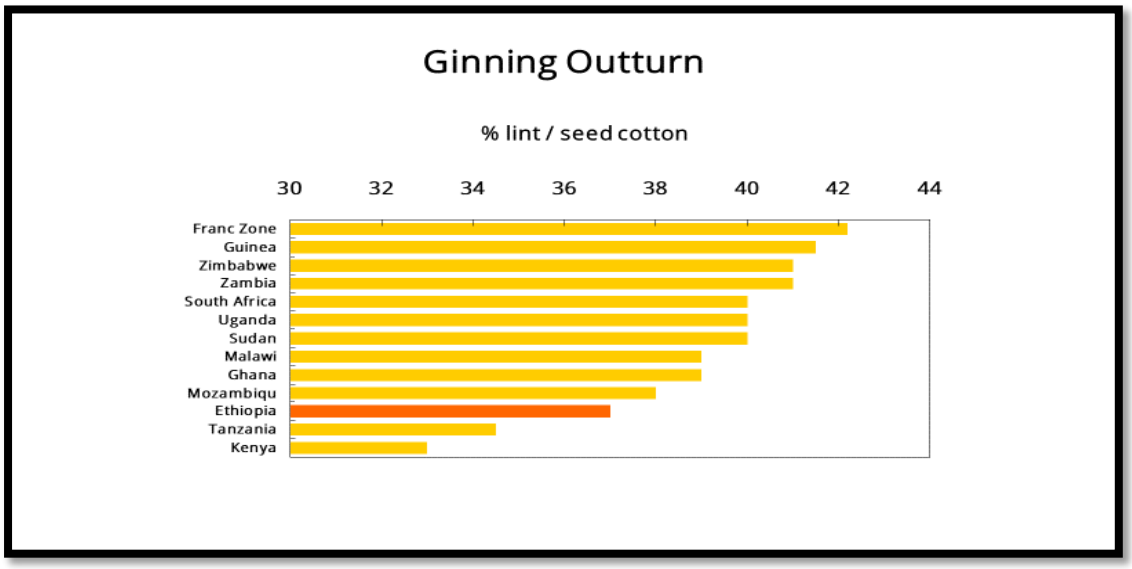


FIGURE 18: GINNING OUTTURNS IN IN AFRICA

The lower ginning outturn, which is mainly due to the variety (DP90) translates into a commensurate increase in the cost of production of lint.

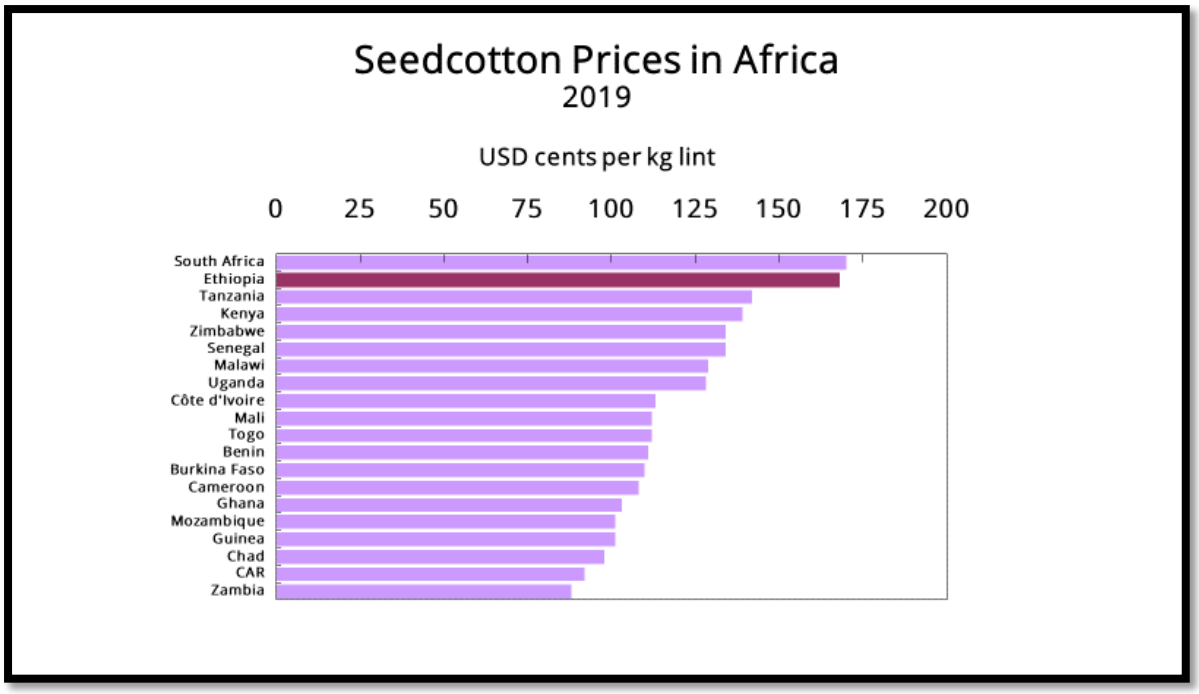


FIGURE 19: SEEDCOTTON LINT-EQUIVALENT PRICES IN AFRICA

This is a critical issue for the Ethiopian cotton sector. Though the price of seedcotton is high by African standards, it is not attractive for the farmers to produce cotton compared to the prices of competing food crops (sesame, bananas, sugar); the resulting rather low level of production further inflates the cost of production of lint, which becomes uncompetitive (all the more so that its quality is poor).

Viability within the global economy

Viability within the global economy is assessed with the Nominal Protection Coefficient (NPC = Production at market price divided by Production at international price) and the Domestic Resource Cost Ratio (DRC = Non-tradable domestic factors at market price divided by Production at international price less Tradable goods and services at international price).

The NPC calculated by AFA software is equal to 1.56, which means a strong positive protection (local production is less competitive compared to imported products), and the DRC is equal to 0.3, indicating a very good remuneration of domestic factors.

The Effective Protection Coefficient (EPC) is equal to 1.69.

3.5 Growth Inclusiveness

As for most countries in Sub-Saharan Africa, the cotton VC does not escape the country's overall situation characterised by a markedly uneven income distribution. The lack of inclusiveness of the VC could be explained by the strong dualism in the whole system between traditional and commercial systems. The organisation of the cotton VC has an obvious effect on the diversity of prices along the chain and thus on income distribution. The market-oriented component of the chain lacks formal contractual arrangements. Counter intuitively, the Ethiopian traditional market has a promising potential for sustainable development. Total farm income (traditional, smallscale and commercial farmers) amounts to 1.17 bn ETB, which accounts for 60% of the final price at farm gate.

The Gini coefficient of the cotton VC calculated by AFA software is equal to 0.75, which means a high level of inequality.

The cotton VC has a great potential to create jobs in the country as it provides direct waged employment to many people, mostly unskilled jobs.

The modern cotton value chain sector provides about 35,500 jobs (including 10,000+ permanent and 25,000+ seasonal) at the primary production stage and an estimated 5,320 jobs (including 4,170 permanent and 1,150 seasonal) at the processing stages (ginning, spinning and crushing). The modern textile sector (from weaving/knitting to apparel) employs an estimated 55,000 people.

The traditional cotton sector provides an estimated 7,000 jobs at the farm level and about 13.5 million work-days equivalent to 54,000 full-time jobs (based on 250 working days per year) for ginning and spinning manually. The traditional weaving and tailoring sector employs an estimated 205,000 people.

Traders (middlemen) benefit from rather comfortable margins but provide few jobs. This results in reduced profitability for small farmers who lack of access to micro-finance, key inputs, extension services and educational training to enhance their productivity, quality and sustainably increase their incomes.

It should be noted that salaries in the farms are significantly higher than in the spinning mills. Seasonal agricultural workers are usually paid 125 ETB/day, which translates into more than $4 or about $125 on a monthly basis, while unskilled workers are paid less than $50 in the textile industry (arguably the lowest salaries in the world). More on salaries in the social chapter under working conditions in Table 20.

Income distribution and employment creation
Direct wages in the cotton VC are estimated at 463 mn ETB, or 14% of the consolidated direct VA.

TABLE 16: DISTRIBUTION OF WAGES IN THE DIRECT VA

Actors	Direct VA (mn ETB)	Wages (mn ETB)	% of direct VA
Traditional farmers	203	0	0%
Small farmers	371	76	21%
Commercial farmers	982	266	27%
Middlemen/Traders	40	0	0%
Ginners	365	26	7%
Spinners	985	86	9%
Oilseed processors	258	5	2%
VC	3,204	460	14%

Commercial farms are the largest contributors to job creation, with 58% of the wages. Small farms and spinners account respectively for 16% and 19% of the wages (6% for ginners) (Figure 20).

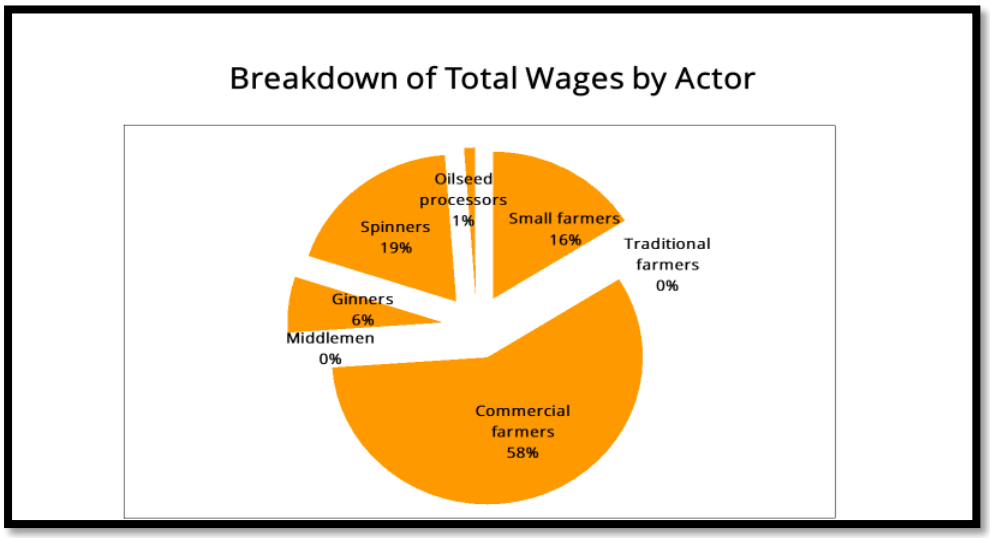


FIGURE 20: BREAKDOWN OF WAGES BY ACTOR

Net operating profits in the cotton VC are estimated at 1,757 mn ETB representing 55% of the direct VA (Table 17).

TABLE 17: DISTRIBUTION OF PROFITS IN THE DIRECT VA

Actors	Direct VA (mn ETB)	**Net operating profits** (mn ETB)	% of direct VA
Traditional farmers	203	203	100
Small farmers	371	294	79%
Commercial farmers	982	676	68%
Middlemen/Traders	40	32	80%
Ginners	365	-18	-5%
Spinners	985	403	41%
Oilseed processors	258	170	66%
VC	3,204	1,760	55%

Commercial farms and spinners are the main beneficiaries of the operating profits created in the VC (43% and 21% respectively). Small-scale farms and traditional farms receive respectively 15% and 11% of the profits (Figure 21).

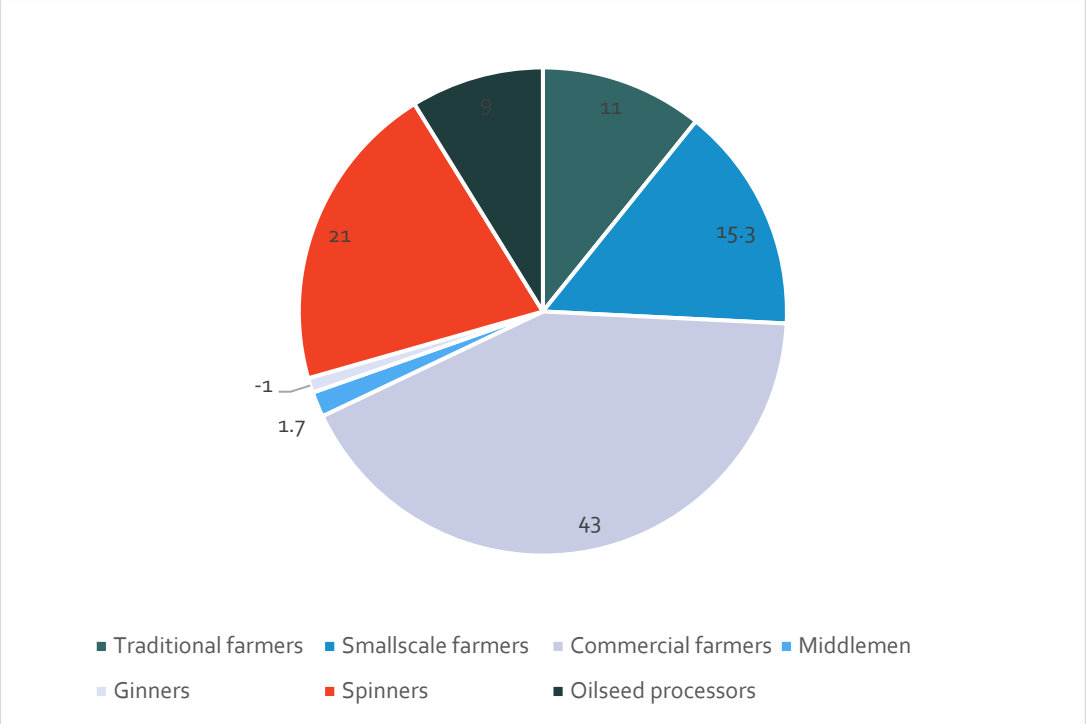


FIGURE 21: DISTRIBUTION OF NET OPERATING PROFITS IN THE VC BY ACTOR

3.6 Main Findings and Recommendations of the Economic Analysis

What is the contribution of the value chain to economic growth?

The profitability for the actors ranges from negative to very positive according to the stakeholders, the stages of the value chain, and the markets (formal/informal-traditional).

The contribution of the cotton value chain generated in the overall national wealth in Ethiopia is currently quite insignificant. The cotton VC contributes to 0.18% to the national GDP and 0.21% to the agricultural GDP. The cotton VC has poor performances in terms of international competitiveness.

The VC activities seem profitable and economically sustainable. However, the sustainability for ginners will depend on increased production and productivity. Also, for all producers, long-term economic sustainability will depend on the competition with imports and consumer's recognition for quality.

Is the economic growth inclusive?

The organisation of the cotton VC has an obvious effect on the diversity of prices along the chain and thus on income distribution. The cotton VC has a great potential to create jobs in the country as it provides direct waged employment to many people, mostly unskilled jobs.

TABLE 18 : SUMMARY TABLE OF ECONOMIC INDICATORS

		INDICATORS	RESULTS IN THE STUDY
Framing Question 1: What is the contribution of the VC to economic growth?			
CQ1.1	How profitable and sustainable are the VC activities for the entities involved?	**Actors and their numbers** Traditional farmer (7,000): Smallscale farmer (19,000): Commercial farmer (90): Middleman (40): Ginner (19): Spinner (16): Oilseed processor (1):	**Net income by type of actor** 28,860 ETB 15,550 7,485,000 798,000 - 946,000 25,223,000 170,449,000
		Benchmark of farmers' net income with minimum wage and/or job opportunities	Ethiopia has no national minimum wage GDP per capita: about 19,000 ETB in 2018
		Return on turnover	Traditional farmers: 100% Small farmer: 72% Commercial farmers: 51% Middlemen (traders): 4% Ginners: -0.79% Spinners: 14% Oil processors: 31%

Framing Question 1: What is the contribution of the VC to economic growth?		INDICATORS	RESULTS IN THE STUDY
CQ1.2	What is the contribution of the VC to the GDP?	Total VA and components	3.4 bn ETB
		VA share of the GDP	0.18%
		Rate of integration into the Economy (total VA/VC production)	91.4%
CQ1.3	What is the contribution of the VC to the agriculture sector GDP?	VA share of the Agriculture sector GDP	0.52%

CQ1.4	What is the contribution of the VC to the public finances?	Public Funds Balance	0.2% of the total revenue for 2018/2019 fiscal year
CQ1.5	What is the contribution of the VC to the balance of trade?	VC Balance of trade	0.07% of national imports
		Total imports / VC production	8.6%

Framing Question 1: What is the contribution of the VC to economic growth?		INDICATORS	RESULTS IN THE STUDY
CQ1.6	Is the VC viable in the international economy?	Nominal Protection Coefficient (NPC)	1.56
		Domestic Resource Cost Ratio (DRC)	0.30

Framing Question 2: Is this economic growth inclusive? ***(To be completed with Social Analysis results)***		INDICATORS	RESULTS IN THE STUDY
CQ2.1	How is income distributed across actors of the VC?	Total farm income	1.17 bn ETB
		% final price at farm gate	60%
		Total wages and salaries	484 mn ETB
CQ2.2	What is the impact of the governance systems on income distribution?	Income distribution	Gini coefficient 0.75
CQ2.3	How is employment distributed across the VC?	Number of jobs and self-employment	About 41,000 jobs in the modern sector and 61,000 self-employed job-equivalent in the traditional sector

TABLE 19: SUMMARY OF EFFECTS AT THE FARM LEVEL

Farm	1	2	3
	Traditional Cotton Farmers	Small Scale Farmers	Commercial Farmers
Number	7,000	19,000	90
Total output value	203 mn ETB	410 mn ETB	1,334 mn ETB
Total direct VA	203 mn ETB	371 mn ETB	982 mn ETB
Total wages paid	0	76 mn ETB	266 mn ETB
% of direct VA	0%	21%	27%
Total net operating profit	203 mn ETB	294 mn ETB	676 mn ETB
% of direct VA	100%	79%	68%
Average net operating profit (per farmer)	28,860 ETB	15,550 ETB	7,485,000 ETB

4. Social Analysis

4.1 Introduction and methodology

This section of the VCA4D deals with the social dimension of the given VC. The social analysis of the cotton and textile value chain in Ethiopia was carried out from a sociological perspective by applying the social profile methodology mainly. Six central questions will help structure the social analysis in this chapter with its key question: "Is the cotton VC in Ethiopia socially sustainable?"

The six structuring questions are:

1. Are **working conditions** in the VC socially acceptable and sustainable?
2. Are **land and water rights** socially acceptable and sustainable?
3. Is **gender equality** throughout the VC recognized, accepted and promoted?
4. Are **food and nutrition** conditions acceptable and secure?
5. Is **social capital** strengthened and equitably distributed throughout the VC?
6. What are the **living conditions** and standards of health, education and training infrastructure and services, and do VC operations contribute to improving them?

In addition, we are going to answer another of the structuring questions of the VCA4D approach, which we have already partially answered from an economic perspective, and here from a social perspective:

7. Is the **economic growth** of the VC inclusive?

This chapter therefore covers the social areas, without abstracting from the economic and certain natural environmental realities that directly impact the psychology and social aspects of the cotton and textile industry, including institutions of a political, ideological and cultural nature. The fluctuation of cotton production over the years and the interactions with other farming cultivations (like cereals) and livestock (pastoralism) are also addressed. In order to understand the complex social relations in this sector and VC and thus the social facts (Weber 1922, Mills 1958) of this sector open to world markets, we also included the analysis of social structures (including networks). Such structures then contributed among others for a better understanding of internal and external governance processes. Aspects that already appear in the functional analysis are sometimes also deepened in the social analysis. The questions on governance and social and institutional dynamics are therefore developed further here, as a complement to the functional analysis (Chapter 2).

The data collection and interviews started on 13th of January 2020 with the field mission 1, which ended in 2nd February 2020. The planned mission 2 had to be cancelled due to Covid-19 (it was intended for March or eventually May 2020). This constellation of only one field mission led to a relative lack of direct field data, which is particularly serious for this complex domain covering large land areas various sub-chains and 85 ethnic groups. At least 7 regional states and very different figurations between farmers, both small-scale and large commercial, entrepreneurs, workers on fields, in traditional workshops and in modern factories of both sexes further contribute to the complex social interactions in this VC. State officials on 5 levels (from Kebele to Federal state), NGOs up to foreign investors were contacted. For details of the conducted interviews (anonymised) and documents consulted, see the annexes. (Annexe A4-5).

Located in Eastern Africa, north of Kenya, Ethiopia is an ecologically diverse country that is home to nine ethnically based states and two self-governing administrations. The economy is largely based on agriculture, with over 80% of the population engaged in the production of crops and livestock. With a still fast growing population of over 110 million people, Ethiopia is also the most populous landlocked country in the world. On average, farm sizes are small, with more than 85% of farming households on less than 2 hectares. Both major producer groups, the commercial farms (often bigger than 250 ha) and the smallholders (mainly 0.5 to 6 ha) produce cotton in alternation with other cash and staple crops. We have therefore always to include these other crops, and often as well livestock (in the smallholder systems) when analysing the cotton VC and its social and socio-economic implications.

Saying that, we have to deal with the following structural and historic facts, in order to understand the social dimension of the VC as it is per 2018/19:

- Cotton production is happening in the lowlands, which is considered by Highlanders as a hardship region. Cotton cultivation in this region is ancient;
- Workers in the textile sector (not just the modern emerging since about 10 years) have a rather low social status since over 100 years;
- Traditional cloths based on (Ethiopian) cotton is a main factor of national identity, going beyond the traditionally dominating groups in Amhara and Tigray;
- **The new VC strategy (2017-2032) intends to enlarge the cotton area from currently less than 100,000 ha to over 2 million ha; this in a context of general land shortages, unemployment and social tensions for land**;
- Ethnic tensions, low educational levels, a very young population and important rural-urban biases become easily factors for exploding social conflicts; (therefore the importance of a dynamic perspective of the social analyses going beyond the "flash" picture);
- Human rights beyond labour rights, democratic aspirations and ideologies are factoring in as crosscutting forces into the VC. We try to consider them following the first set of analyses presented in the functional analysis (Chapter 2);
- Ethiopia is still one of the poorest countries, with low productivity levels, weak institutions and impressive deficits in communication and freedom of unions. In the context of high dependencies towards foreign investments in this VC, social tensions and conflicts need a special sensitivity and should not be silenced (the NCDS sheds light on the conflicts; but how does read it?).

We might call all sociological networks related to resource management and primarily economic issues "interfaces", the ones with socio-cultural value and content generation and social connectivity "arenas" and the figurations or networks dealing with control (regimes) and policymaking "councils". We use this terminology (White, 2008) in order to better differentiate the various aspects of social formation when dealing with governance, power, social conflict and the differences between VC and sector or society; but also to better understand the importance of the various social distances[7] between the various identities, which is a main feature of the cotton and textile VC. This analysis goes therefore sometimes over the boundary of yarn and may elude as well the whole range of the textile and apparel sector, but without going into its details.
These features provide us with a system description based on key identities (Figure 22) which play a role as actors in the VC described as social field covering the Ethiopian nation. Each system has its environment (Luhmann, 1995); here presented as

- Land and water resources
- World markets
- State-nation building in a global and regional context
- Arena of superpower rivalry
- Modernization, liberation and fights for freedom.

The four main sub-systems are defined as social, economic, political and cultural (fields), visualized in Figure 22 as quadrants. They are all characterized with the proposed identities (i.e. acors), key institutions and social categories seen as relevant in the VC.

The relative lack of interviews and field visits has been tried to be compensated with literature and over 90 references (see Annexe A4-6). Interdisciplinary work was done as much as possible during the months March unto June 2020 with weekly Skype meetings with the full team.

[7] not to confound with the misleading term (unfortunately) used in the context of Covid-19

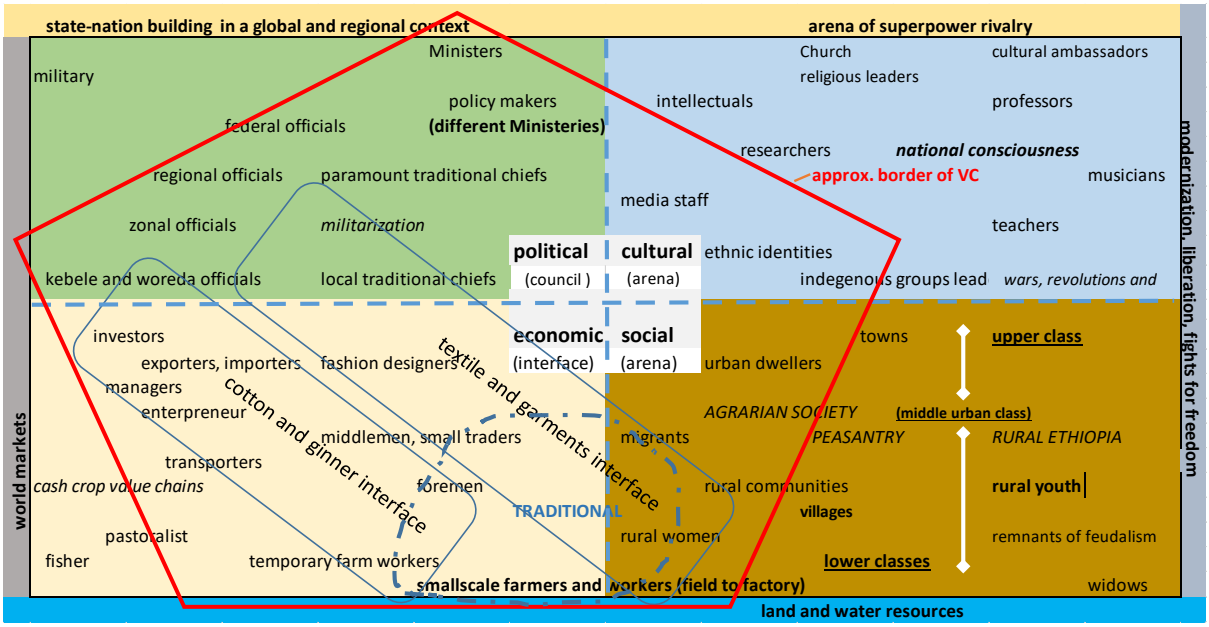


FIGURE 22 : SOCIAL SYSTEM BOUNDARIES AND KEY IDENTITIES OF THE VC

We continue this analysis with a summary of features from the recent history and covering structural features and figurations, which co-determine the current social reality around cotton.

4.2 Historical, institutional and social structure of the VC

> *Happier the nation that uses the recurring tension between social forces of repression and resistance to expand the boundaries of freedom and justice.*
> *Happier still that which utilizes historical memory of collective resistance to mould a more egalitarian and coherent political community.*
>
> G. Tareke (2009)

To better understand the dynamics of the current VC, from the social and politico-military perspective, the recent double revolutions from 1975 to 1991 (Tareke 2009) as well the main lines of policies related to development and agricultural development need to be reminded. Ethiopia was in the yearly 1970ties, just fifty years from now or hardly two generations ago, a deeply feudal state, with 80% of industry and lucrative trade – including cotton- controlled by foreigners. Peasants were making over 90% of the population suffering from the jugs of unfair land tenure systems and suffering increasing disasters of famine (1958, 1973/74; then again in 1983/84). Hardly any of the rights proclaimed after World War II by the United Nations was a public issue. Rural society had no voice and food production was falling behind demographic development. The two parallel revolutions, the one nationalist and centrist (Derg), the other regionalist and ethno-nationalist, brought at the end no winner, but a huge militarization of society. Women however got more rights through these revolutions and start since rising to more equal citizen. But certain structural features remain unsolved: democratization, national unity, justice, elimination of misery and rural poverty, overcome the archaic agrarian organization, intense competition for scarce natural resources due to demographic developments, freedom and security. These features are related to the impressive land and water resources of Ethiopia and to the structure of the national and global economy (see Figure 22). Nevertheless, one major achievement was reached over the last 50 years: dialogue has replaced as the means of struggle violence and militarization. It is still a weak "plant", but with care and nurture, dialogue might grow to a new central institution.

Moving directly from this contextual narrative to the overall societal characteristics of the VC, we are not astonished to note its complexity. Before addressing the core topic of the social profile, we like to depict some additional structural and historic features. The current perspective on the cotton VC on its importance to society is well described with Gudeta et al., (2019):

"Cotton is one of the main cash crops in Ethiopia and is widely grown in the lowlands on large-scale and small-scale farms under both irrigation schemes and rain-fed agriculture. There are about more than 3 million hectares of potential land suitable for cotton production in the country. However, out of the country's total potential areas for cotton production, less than three percent is being utilized yet. So the current domestic cotton production is much lower than the potential. But, cotton consumption in Ethiopia outstrips domestic cotton production due to the demands of the rapidly expanding textile industry in the country. Thus, Ethiopia has been importing raw cotton from abroad. Cotton production and productivity is highly constrained by a lot of biotic, abiotic, social and economic factors. For the last five decades the Ethiopian Institute of Agricultural Research/ EIAR/ and Werer Agricultural Research Center/WARC/ has made the utmost effort and several improved cotton technologies were released; such as improved varieties along with proper crop management and crop protection practices. Since, transgenic cotton has been proved in controlling the major insect pests in global cotton production, Ethiopia recently started Bt cotton adaptation trial after getting approval for CFTs by the regulatory authority in the country to overcome the constraints of bollworms in the cotton production and two genetically modified cotton hybrids were recommended for commercial production. Despite the huge research efforts made, the production and productivity of the crop has not attained its maximum potential as a result of low utilization of the research recommended technologies by cotton producer farmers and low utilization of resource potential lands. There are several factors contributed for the low acceptance, underutilization and/or adaptation of the improved cotton technologies. Therefore, there is a huge gap ahead to fill in technology development, research capacity building and creating effective research, extension and stakeholders linkage. (In this paper), potential areas, production trends, gaps, research status and future directions for cotton improvements were assessed in order to plan well-organized research strategies for the future".

The first fact is that cotton is only grown in the lowlands, a geographic area often avoided by the historically dominating highlanders of the past due to the harsh climatic and the prevalence of diseases (mainly malaria and tsetse). An exception are the old cotton areas bordering the lowlands in the western parts of Amhara and Tigray, in which cotton is produced eventually since over thousand years. According to Bosena (2011):

In Ethiopia, spinning and weaving to make cloths from cotton is perhaps as old as the history of the country. Though written records are scarce, it is widely believed that Ethiopians wore clothes woven from cotton fibres centuries ago. Still about 85% of the total population living in rural areas of the country, produces a significant part of its textile needs from the traditional non-industrial sector. Clothes that are woven from cotton are popular also in urban areas of the country. However, the amount of cotton exported and the amount of revenue generated from the export is low.

Cotton production has long been underway in Ethiopia. Cotton was cultivated and marketed all over the territory of modern Ethiopia (after Menelik's conquest in the late 19th c. (see Annexe A4-1). Before the revolution, large-scale commercial cotton plantations were developed in the Awash Valley and the Humera areas by the Italians. The Tendaho Cotton Plantation in the lower Awash Valley was one of Ethiopia's largest cotton plantations. In 1867 it was reported that there were plans to construct a 362-kilometre (225-mile) road from the Ethiopian cotton fields to the Red Sea to trade with Egypt and Turkey. Since the revolution, most commercial cotton has been grown on irrigated state farms, mostly in the Awash Valley area. Production jumped from 43,500 tons in 1974/75 to 74,900 tons in 1984/85. Similarly, the area of cultivation increased from 22,600 hectares in 1974/75 to 33,900 hectares in 1984/85 and then fluctuation in the last years between 60 and 90,000 ha (see Table 1).

We have now two very distinct social networks or interest groups involved in the cotton and textile industry: on one side **the commercial industry** including foreign investors and factory workers and supported mainly by the federal government under the leadership of ETIDI (see also Fig.16). On the other side, we find **the traditional sector** with the peasants and poor workers in the classical cotton areas producing cotton and traditional cloths by the handicrafts sector and for self-sufficiency. These two interface-networks or figurations are interlinked through a web of complex interactions and ties.

The cotton was always produced on a very rich land characterized by fertile soils and many crops. Wylde[8] (1901) was impressed by Ethiopian farming. Of a village in Yeju in Wag (Amhara, close Gondar) he exclaimed, that

> *It produced everything that man wants in this world: tobacco of excellent quality, bananas, oranges, cotton, sugarcane, potatoes, vegetables of all sorts, red peppers, onions, garlic, wheat, barley, Indian corn, dhurra, tef and other grains, beans, peas, shipti, plant for soap, plenty of milk and butter, oxen, sheep, chickens and everything in abundance, and at absurdly cheap prices, also the most delicious white honey for which the district is famed*.

Nicholson (1960, p.84) suggested, based on the available botanical and historical evidence, that Gossypium herbaeceum var. acerifolium is indigenous to Ethiopia.

On the side of the textile and garment industry (T&G), the recent evolutions related to employment is also significate. The MVO report (2019) states:

> *"It is also interesting to examine the number of employees in the T&G sectors as the industry is labour intensive. The number of employees in the sector declined from 30,000 employees in 1991 to 22,000 in 2006 and then 10,000 in 2007. It increased after 2007 to reach c. 20,000 workers in 2010. In 2013, the total number of employees doubled and amounted to c. 42,000 workers. (Central Statistical Agency Of Ethiopia, n.d.) The current number of workers in the T&G sector is difficult to assess and may reach between 50,000 and 70,000 employees in 2017 (Clasmann, 2017). Based on workforce, it may be argued that the T&G sector growth is steady since 2008, which demonstrates a dynamic development and confirms the 2007 turning point... Workers are relatively untrained and unskilled and efficiency is very low. As of 2019 this still translates in a product with a low quality and a long lead-time. In addition, there is worry among stakeholders and (potential) buyers about issues such as living wage and the freedom of association in Ethiopia."*

Overall, the government does not effectively enforce wage laws. Incomes in the informal economy are generally below subsistence levels, and the official estimate for the poverty income level was 315 birr (US$11) per month. The MoLSA carried out regular labour inspections to monitor compliance in the formal sector. In practice, a majority of the total employment is active in informal activities and labour regulations are not applied due to a lack of awareness or incentives. The government employed 516 labour inspectors in 2018, which reached close to one inspector per 100,000 workers (or one per 13,300 employees, representing just 14% of the total employment). The ILO recommends one per 40,000 workers in less developed countries (FAO 2019).

Two million new people are entering the labour market every year. Many young urban people are frustrated by the lack of access to formal jobs. They often lack incentives to job hunt due to the absence of a minimum wage. Many of those who do work are frequently not being paid according to the amount of work they do. This is fostering a negative attitude towards work within the labour market (FAO 2019). The government expects a reduction of employed people in the primary sector between 2015 and 2020 from 69 to 65%. And 3-4% of mainly young people are expected to move into the industrial sector. The textile and apparel industry is one of the promising sectors.

The migration flows consist as well, mainly due to the rural-urban flow, but also due to internal displacement, out-migration (emigration) and refugees. The migration from rural to urban areas is reflected in a rapidly rising urbanisation rate driven by workers seeking better job opportunities and higher income possibilities (FAO 2019).

The Ethiopian **development vision** underlying its Growth and Transformation Plan (GTP) is

> To *become a country where democratic rule, good governance and social justice reigns, upon the involvement and free will of its people and once extricating itself from poverty to reach the level of a middle-income economy as of 2020-2023.* Related to economic and social development the vision includes "*building an economy*

[8] Wylde was a correspondent for the Manchester-Guardian newspaper, and entered Ethiopia from the north in 1896, shortly after the battle of Adowa, in order to gain information about the battle and its aftermath.

which has a modern and productive agricultural sector with enhanced technology and an industrial sector that plays a leading role in the economy sustaining economic development and securing social justice and increasing per capita income of the citizens.

This vision expressed by the national state (council or control regime) is very ambitious from the social analysis perspective. It involves new areas supposed to be planted under cotton in regions with minor or no cotton tradition (see map on Figure 9). Only major reforms and structural changes within very short time could allow its realization. But let's continue to the next dimension of the plan:

Food security: another important dimension of the Plan in the development of the agriculture sector concerns improving the food security situation in the country. To this effect, efforts have been made to ensure food security through enabling chronically food insecure households participate in productive safety net program and household asset building to prepare the ground for a smooth transition to speed up their graduation. It has been planned to benefit 7.7 million households through the productive safety net program during the plan period. By the end of the plan period, 778,572 households who are believed to have ensured their food security graduated from the program. Below we will discuss in more detail the social reality of food security. But it should be noted that large areas of leased farm land is managed by foreign companies who intend to export the commodities, and that for time being the salaries paid to the workers (both on farm and in factories) hardly allow them to make savings in order to be prepared against food shortages.

GTP2: During the GTP period, it is planned to diversify and deepen the production and export baskets in the economy. In this regard, the manufacturing products will play a significant role in the export sector.

Special focus will be given to labour-intensive industrial products that take advantage of the country's relative abundance of labour and low wages during the plan period. These include leather, footwear, and other leather products, textile and garment, agro-processing, and sugar and related products, etc. ***In agriculture****, the focus is on expansion of cut flower, fruits and vegetables, improving both volume and quality of coffee, cereals and oilseeds through more effectively implementing the agricultural strategies with the aim of expanding and diversifying exports to increase the global market share and foreign exchange earnings. In addition, it is also planned to broaden export base through expanding the mining sector; increasing the volume of gold being supplied by small and large companies; expanding newly emerging manufacturing, agricultural and mining (potash and other) products, alongside increasing the traditional export commodities. In the* ***Textile and Garment Industry:*** *By improving production capacity, productivity, quality and competitiveness of the textile and garment sub-sector, attracting more quality investments, ensuring sustainable and reliable input supply, forging strong input and market linkages, increasing the export performance significantly, strengthening its role in job creation and structural changes, it is planned to manufacture USD 2.18 billion worth of production and earn USD 779 million in export revenue by the end of plan period. Average production capacity utilization of this subsector will reach 80% by 2019/20. In terms of employment, 174,000 job opportunities will be created in this subsector and it is set to reduce the carbon emission of the sector by 25% by the end of the plan period.*

The regions play an important role, as extension, development priorities and most stakeholders are linked with this level and too far away from the capital. However, some of them are rather weak and not always capable to transform federal plans into action, which favour their proper region. It is therefore clear, that the challenges to reconcile the current governmental plans and the existing structural parameters with society are impressive.

4.3 Social profile

The social profile is constructed on its 6 dimensions mentioned above and 53 specific questions. These basic questions and answers are all documented in a separate Excel document (Social profile VC cotton 2020; on 11 pages). The profile, measuring each dimension on a scale from 0 to 4, shows below-average performances on the following two dimensions:

- Working condition
- Land and water rights

Three dimensions are in a middle range:

- Gender equality

- Living conditions
- Social capital

Only one dimension reaches a good score: food and nutrition security (see Figure 23).

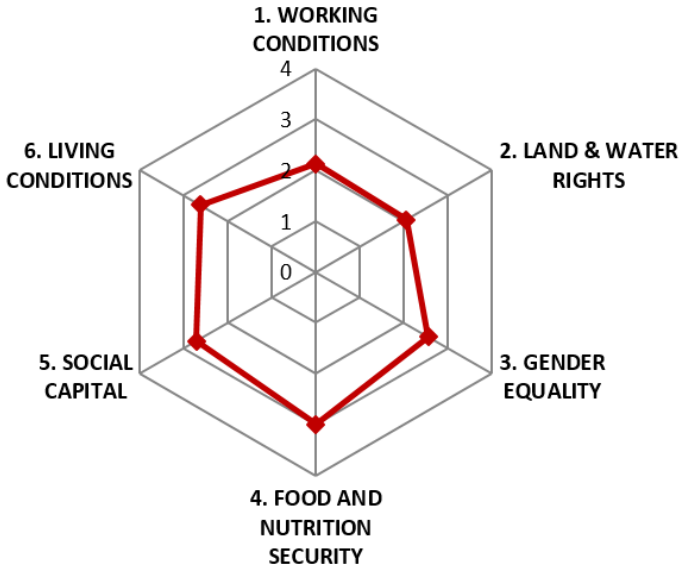


FIGURE 23 : SOCIAL PROFILE

4.3.1 Working conditions

Indications show that employers of the garment factories and the government neglect workers right. The employers are notably accused to violate the following four of the 8 fundamental ILO rights: low wages, violation of the right of dignity, difficulties for unions to work and workers to join unions. ILO in 2019: "However, Ethiopia's garment industry faces multiple challenges, in particular with regard to productivity, working conditions, industrial relations and social compliance. The ILO has initiated a comprehensive and coordinated intervention to advance decent work and inclusive industrialization in the country. The government on its side is committed to adhere to the conventions and to improve the situation.

This freedom of association is allowed, but not effective. Ethiopia scores a 4 on the ITUC Global Rights Index (scale 1-5) for freedom of association and workers' rights, which stands for systematic violations of labour rights. The government and/or companies are engaged in serious efforts to crush the collective voice of workers putting fundamental rights under continuous threat. Only 60% of factories have some form of workers' representation. The government is pushing for this. For some factories this takes the shape of a union, some have worker representatives' meetings, some have suggestion boxes. The national union of the sector, IFTLGWU, states in a report:

> *Minimum and living wages are central to a campaign by the 55,000-strong syndicate. With the current wages most workers struggle to make ends meet and can be described as working poor. A low wage economy means jobs that will neither change living standards of the workers, nor end poverty.*

One of the best indicators of working conditions to compare the conditions within and outside the VC are the salary payments. Table 20 shows huge salary differences between a seasonal work and a managerial position (factor 1: 100). The salaries of the women textile workers achieve according our data 60-70% of permanent farm workers after 1 year of employment.

TABLE 20 : PAYMENTS IN THE VC

Payment for workers and managers in the VC	**Birr** (in bracket the calculation for day or month; 22 WD/m)		USD/month
cases observed	**daily**	**monthly**	
simple field work on commercial cotton farm (seasonal)	17	374	12.9
work on irrigation in commercial farm	25	550	19.0
picking on commercial farm (1st)	100	2200	75.9
picking on commercial farm (2nd)	150	3300	113.8
picking 1 kg of cottonseed on commercial farm (1st)	1.3 Birr/kg		
picking 1 kg of cottonseed on family farm (1st)	1.0 Birr/kg		
picking on family farm	150-200	3300-4400	
average worker salary permanent staff commercial farm x		3600	124.1
average worker salary permanent staff commercial farm y		2000-5000	
salary management commercial farm	> 1600	> 40000	over 1'200
salary ginning factory x		average, fair	
salary weaver (handlooming)		2000-2500	77.6
salary textile worker x (1000 ETB as starting salary)	(45-68)	1000-1500	43.1
salary textile worker y (after 1 year)		1800-2500	72.4

29 ETB (Birr) = 1USD ; all data from VCA4D team

A major problem appears to be the poor law enforcement, often due to lack of officials and poor communication among the actors and identities. Systematic violations of labour rights are reported. Forced labour is prohibited but it does occur, mainly in areas of immigration of highlanders and affecting indigenous lowlanders. The old tradition in Ethiopia of forced resettlements – particularly under the Derg in the 1980 ties- as well the ongoing policy of enforcing sedentary lifestyles poses problems to both socio-cultural arenas and natural environment. Child labour is a cross-cutting problem, but also in this VC no exception. Most of these children live in rural areas but are also employed in the traditional weaving sector, and the problem is due to poverty. Child labour in the weaving sector in Addis Ababa is well known. Most workers employed in the VC are working poor. As we see from Table 20, some jobs are incredibly low and far below requirements for a decent life (below 20 USD/month).

Concerning job safety, the exposure to pesticides, also harmful like DDT and Endosulfan, poses the main threat to human health. To note that often the workers are not equipped with the protection measures and often not informed on the risks. The number of governmental labour inspectors is insufficient. Cases of incidences with pesticides on the cotton fields as well on horticulture using Endosulfan designed for cotton are reported. Factory workers face sexual and reproductive health risks. Low levels of knowledge and confidence around these topics, combined with the abrupt transition from living in traditional home settings to living alone in areas with more men, creates a higher potential for risks such as sexually transmitted infections, HIV, and unwanted pregnancy.Looking at the major risks, consequences and possible mitigation measures, we identify 4 categories below (Table 21).

TABLE 21 :LABOR ISSUES

	Major risks and Consequences	Mitigation measures
Respect of labour rights	The major risk groups here are the textile workers and the indigenous people affected by expropriation of farmland. They concern low wages, poor rights of workers unions and generally no or poor law enforcement for freedom of association. The consequences are high job fluctuations, difficulties to get the required workers in the factories and social tensions between affected indigenous people and state officials.	To continue to implement joint projects between the state and development partners under the ILO-led initiative for coordinated interventions to advance decent work and inclusive industrialization. The state to get more staff in the respective institutions to better assure law enforcement, including to better inform the workers and farmers on their rights. The policy of promoting sedentary lifestyles is questioned. More participatory planning, including social impact assessments are recommended.
Child Labour	Over 40% of the total population are children of 5-17 years and Ethiopia has one of the highest rates of child labour in the world. This is mainly due to poverty, as many parents require their children to work or cannot afford school enrolment or both. The most affected places are the garment sector (both traditional and modern)- particularly Addis Ababa- and the family farms. The consequences are posing on the future of the country, as every child missing education and support is becoming a burden to society and economy in his/her adult life; apart that basic human rights are taken away for ever.	More joint efforts by state, NGOs and local governments to address this serious issue should be taken. The state should have more (human) resources to enforce its at least the existing laws and promised rights.
Job safety	The major risk groups are in the cotton fields and the larger textile factories. On the farm fields, the exposure to pesticides (particularly Endosulfan and DDT) cause harm to the workers and farmers not informed or equipped with the normal measures. To note that Endosulfan designed for cotton is also used on other crops and horticulture. In the textile and apparel factories, risks related to sexual and reproductive health are reported. The consequences are avoidable damage to people and society, including additional burden to the health sector. But the whole VC could lose attractiveness (see next).	More information, better education, better law enforcement and more care for the health of workers and farmers in the VC should be addressed.
Attractiveness	The sensitive sub-sectors related to attractiveness are the commercial farms and the garment factories. On the farms, the labourers often work without	Better listen to the complaints of the workers and take measures to enhance attractiveness of the sector. This should be done by all

	contracts. The garment workers often complain about serious violations and unfair practices like excessive wage deductions, verbal abuses, pregnancy discrimination, and forced and unpaid overtime. Consequences are reduced attractiveness and reduced resilience on the job markets. Whenever better job opportunities in other VC and sectors should appear, the workers will move out. The ambitious targets of the sector will hardly become attainable in such a scenario.	stakeholders, who have a vested interest in making this sector and the VC grow and benefitting from synergies between agriculture and industrialisation. With the growing freedoms, transparencies, information and also competition within the job markets for reliable and qualified workers and managers, more focus on human and social capital should be aimed, instead of short-term success with attracting investors and increasing production targets.

To note that ILO is leading a group of development partners in order to support the government to improve the situation on the working rights and address the multiple challenges. The aim is to advance decent work and inclusive industrialization.

4.3.2 Land & Water Rights

Land and water rights are closely linked to working conditions. The poor human resource base of the government and the huge social and geographic distances make any law enforcement very difficult. Furthermore, the laws assessed on property rights including VGGT, which is weakly adhered, do not require the government to provide affected landholders with the reasons for expropriation nor to conduct a social impact assessment prior to expropriating land. The laws assessed do not recognize the indigenous right to Free Prior and Informed Consent (FPIC).Considering that the State is not effectively implementing the VGGT (see more below), it is not probable that the foreign companies will do so, as it is not in their short-term interest. The contracts between investors and the government are closed to the public and often even to ministers (OI, 2011). It seems that the foreign investors consider the land leases “as near ownership”.

A major problem here are the “closed contracts” between the government (both federal and state) with investors active in so-called “under-populated” area under a 99-year lease contract. Here major problems are related with land tenure disputes and unfulfilled or contested non-compliance of the commercial farms towards the local communities. The crowding-out of indigenous populations leads to feelings of discrimination against the people from Tigray and sometimes Amhara. This is toxic for the process of nation building, social security and peace.

The water price for irrigation is practically for free. We have knowledge of farms paying just 10 US cents for 1’000 m3 water! This is particularly astonishing in a context of water shortage, climate change and the fact that most new cotton areas should emerge in rather arid regions. At the same time water seems to be scarce and often insufficient to prevent soil salinity (like in Afar).

The main groups and identities suffering from deficiencies in this dimension are therefore again the lowland communities, particularly indigenous people. However, also small-scale or family farmers with limited irrigation rights or lack of capital to invest in irrigation have relative disadvantages against large farms. Current and future investors should comply with best practices of corporate social responsibility and refrain from any investment activities in areas where land title is contested, and involuntary resettlement is occurring, until all violations are investigated and remedied.

Looking at the major risks, consequences and possible mitigation measures, we identify 4 categories below (Table 22).

TABLE 22 :LAND AND WATER ISSUES

	Major risks and Consequences	Mitigation measures
Adherence to VGGT (Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security)	The adherence to the VGGT is weak. This poses major risks to communities affected by expropriation and land leases given to investors (mainly foreign companies) and particularly to indigenous people, which are not recognized as right-holders. The non-transparency of contracts between investors and the state risk to open doors for corruption, mismanagement of public goods (land, finances, rights) and social discontent.	More transparency of the contracts in order to assure that Ethiopian citizen have at least the same rights as the investors.
Transparency, participation and consultation	The risk is here with land deals of over 5,000 ha, as they are handled by the federal state. This increases the risk of mismanagement and social conflicts in the farm areas and among communities and even ethnic groups. The perception is strong that the ethnic factor is involved in such land deals.	More transparency with the land deals.
Equity, compensation and justice	The most serious risks prevail for indigenous peoples, as they dominate in the cotton-suited lowlands, often previously mainly used as pastoral land. This concerns Gambela and SNNP mainly. A major consequence can be increased ethnic tensions wherever commercial land but also cotton areas promoted by competing regions is in place.	More sensitivity at all levels, but particularly at federal level for possible injustices related with land allocation, land and water rights by the state officials, particularly at federal level.

4.3.3 Gender Equality and the role of the Youth

It may be stated that times are changing for the better for women in Ethiopia. The country has its first female president and half of the cabinet are women. But rural women are still far away to feel this change and the same seems to be true in cotton areas for the cotton female producers.

According to the media, masculine, patriarchal, and archaic traditions are intertwined in the Ethiopian society. These traditional characteristics often place women in a subordinate position that create a power imbalance in relations between men and women within the labour market. For example, women earn, on average, only about 63% of what men do. The wage gap is largest in agriculture and smallest in the public sector. Over half of all women engaged in the agricultural sector receive no payment. Similar trends exist in other industries like small-scale manufacturing, where 58% of women workers are unpaid family workers, relative to 40% of men workers. Another factor is that women still are getting married at an early age: 40% of girls in Ethiopia are married before the age of 18. It is in contrast to the Revised Family Code No. 21 from 2000 that sets 18 years as the minimum legal age of marriage. Women often bear a disproportionate burden of unpaid household activities, including child-and elder-care as well as the provisioning of food, fuel, and water. This creates trade-offs on women's income-related activities. The Gender Inequality Index–measuring health, empowerment and economic status –ranked Ethiopia 121 out

of 189 countries (1 is highest). What keeps this relatively low ranking is related to the high maternal mortality ratio and adolescent birth rate; and to low education. (FAO, 2019)

Women are less likely than men to be paid for their work: over half of all women engaged in the agricultural sector, for example, receive no payment. Similar trends exist in other industries like small-scale manufacturing, where 58 percent of female workers are unpaid family workers, relative to 40 percent of male workers (D55). Unions said they will continue fighting outsourcing which in most instances replaces permanent jobs with precarious ones.

A study illustrates that Special Economic ZONE/Industrial Park workers, most of them young women from poor farming families, cannot afford decent housing, food, and transportation since their salaries remains low. Even though some factory owners contribute modest additional payments for regular attendance and meals, it is common for young women to share a small room with up to four others. Moreover, SEZ/IP workers receive little training, and dissatisfied have protested by stopping work or quitting altogether (FAO, 2019).
Tura (2014) states:

Women are the most marginalized group of the society in relation to accessing and controlling rural land in Ethiopia. The main challenge for an effective implementation of women's right to rural land in the country is largely attributable to the negative attitudes and harmful practices, which deny a woman's right to own, administer property and control the rural land. Moreover, women do not have a customary right to inherit land from their family. The control of land during marriage falls chiefly under the control of their husband…Moreover, women face challenges in enforcing their rights through the lengthy trial procedure from Kebele (the lowest administrative unit) to the Federal Court of Cassation due to resource limitation and lack of an effective legal aid system to women. Thus, there should be organized state funded legal aid scheme which exclusively aims at the women's empowerment and enforcement of their rights to property including rural land….Women residing in rural Ethiopia are the most disadvantaged groups who are both illiterate and poor who face inconceivable challenges because of the society's stereotypes and discrimination against them. When they are evicted from their landholding illegally and thrown out to the field, it is really the most life-threatening act that must be interfered by the concerned governmental bodies such as the women and children affairs bureau.

The gender gap analysis presents clear evidence that the differences in access and returns to resources result in poorer economic outcomes for women in Ethiopia: lower agricultural productivity (36%), business sales (79%), and wage income (44%) compared to men. In agriculture, lower access to and usage of agricultural extension services, agricultural inputs, and formal credit, as well as lower crop diversity appear to drive the gender productivity gap. Meanwhile, in self-employment, differential business revenues between men and women stem from differences in time spent on business activities, access to hired labour and credit, and business licensing, whereas in wage employment, demographic factors and education help explain some (but not all) of the gender gap in income (WB 2019).

The situation of the female workers in the apparel is not better (Yost, 2017):

Many female workers cited stable revenue as a benefit of factory employment and a reason they initially joined the workforce. Yet stakeholders and female workers said alternatives to factory jobs, such as working in construction, running a small business like a coffee stand, or taking up domestic work as a migrant in the Gulf States, offer better pay for women. In some cases, these alternatives are considered more desirable, particularly once women have entered wage work. Several women workers we spoke to were ultimately disappointed by the quality of opportunity available to them in a factory setting and anticipated looking outside the factory for longer-term opportunities…Female workers described wages as below what they had expected when they began working at the factory. The perception that workers have not received the wage opportunities promised to them makes low wages a persistent challenge and demotivating factor. Furthermore, many expected to receive a raise after finishing the trial period but were never bumped up.

Though women contribute a significant amount to the agricultural labour force, yet they are not updated regularly about new farming practices and have few opportunities to develop their skills base (FAO 2012). Instead they have to rely on information being passed on to them from men, or ideas gleaned through their informal networks. In turn, this will affect their productivity and their ability to innovate and fulfil their productive potential. Women generally are likely to be more responsive to activities that: (i) can take place on a small area of land; (ii) can be undertaken close to the home (especially if they are caring for other

household members, such as children, the elderly or the sick); (iii) do not require many resources, including labour; and do not expose them to too much risk if the venture fails. Hence, cotton fields far away from homes will be managed by men only.

Women have limited access to skill trainings, formal education, innovative agricultural inputs, and finance. They also have limited ownership and control over productive assets and technologies. While 46% of male-owned businesses used mobile phones for business purposes, only 3% of female owned businesses did. Ethiopian women have equal right to own, administer and control property under the existing laws. Particularly, they have a right to access the rural land free of charge and control it equally with men. The revised family codes of the country also uniformly recognize a woman's right to equal share of a common property, including land, upon divorce. Furthermore, women have an equal right to property inheritance" (Tura, 2016). However, the problem is the implementation often due to communities' attitudes towards women rights.

Some recent studies argue that women are significantly less likely to own a business, and when they do, they face significant operating constraints. Only 17% of all businesses registered with the Ministry of Trade in 2014 were owned by women. The median start-up capital of male-owned enterprises is five times higher than that of female-owned enterprises. Women-owned firms appear to have less access to finance, fewer land use rights in some areas, and smaller (FAO, 2019).

Youth:
The youth merit also a special mention as a particular social group. Ethiopia comprises one of the world's youngest populations. At least seven out of ten (70%) of the population are below the age of 30. This population composition has been called a youth bulge; i.e. younger generations are larger than the previous generation. It is a result of, among other factors, an impact of improvements in nutrition and health services as well as decreases in child mortality. The youth (15-24 years) employment-to-population ratio was estimated at seven out of ten (70%) in 2019, which is 12% points higher than the Eastern Africa average (VGGT 2017).

But the youth, not long ago, made history in Ethiopia. To cite Tareke (2009, p.340):

> *In Ethiopia, revolution and war were blended. Stirred by the events of 1960 and driven by utopian dreams, young men and women made a revolution whose ambitions were grandiose as its failures. They dismantled an absolutist dynasty and the feudal structures on which it had firmly rested for centuries and by which they blamed the country's abysmal stagnation, appalling poverty, and illiteracy rate of 95 percent. They vowed to create a new and more just society based on scientific socialism…*

Today however, the new youth does not dream of revolution, but rather tries to find the best ways to find answers to individual needs of best survival. And how many still have the memory of their grandfathers' and grandmothers' youth and collective fights for change?

Looking at the major risks, consequences and possible mitigation measures, we identify 4 categories below).

TABLE 23 : YOUTH AND GENDER ISSUES

	Major risks and Consequences	Mitigation measures
Economic activities	The major risks are within the modern textile and garment sector, where women as main employees have limited career opportunities and often unsatisfactory working conditions. This might have as consequence high turnover and difficulties to attract committed women in the industrial sector, mainly in management.	Better listen to the concerns expressed by women.
Access to resources and services	Women have generally less access to resources and services than men have, and specially related to land rights; they are the most marginalized group in society. The root causes lie in the values of the societies with attitudes impeding equal rights. The consequences are many, amongst other the closed access to formal jobs for women, lack of access to credit, reduced economic activity, reduced impact of the women and mother on the enhancement of the children's education. The consequences are therefore on all aspects of the VC. The situation for the youth as a social group is similar, but less discriminatory than for women. To note that in rural areas most women switch rather fast from child to married women without enjoying the phase as a youth.	It will take time to change this. But persistent programs, projects, communication and steady improvements of laws and opportunities on all levels and providing women to take leadership positions, particularly also in rural areas, where the situation is much worse than in bigger towns.
Decision making	The generally lower social status of women, particularly in the lower social classes, exclude them from the full rights of taking decisions concerning household and community as well as organisations. This is crosscutting through all aspects of the VC. The consequences are reduced household food security and income, reduced success in launching businesses and less involvement of women in management decisions in factories owned by men.	See above.
Leadership and empowerment	Even if we can accept that the cotton and textile sector provide new opportunities for women, and that it bears particular opportunities to get heard and organized, big differences remain among the various regions, ethnic groups and religions. Gambela: child marriage and low adult literacy; SNNP, Afar (and the potential cotton area Somali): low adolescent literacy	The measures should be addressed at regional level mainly, in order to be more efficient with progress. The different levels and institutions need to become active: Community leaders Cooperative leaders Each formal organisation and enterprise Educational institutions

	and low incidence on participation in household decision-making.	
Hardship and division of labour	No major risk specific for this VC	

4.3.4 Food and Nutrition Security

Cotton production, at least in diversified and sustainable production modus, contributes in the context of Ethiopia with its rich soils and available amounts of water for irrigation (without considering the demands of its neighbours, particularly Egypt), to both food security and food sovereignty. As a rotation crop, it is perceived to enhance soil fertility, and with the fibre and oilseed as main products used it enriches food, feed and nutrition. But less than 50% of the cotton grown falls under this category of diversified and relatively sustainable production and the prospects are the commercial farms will produce over 90% of all cotton. But as per 2018, the contribution of the VC is definitively positive for food and nutrition security.

Increase in food production requires, in the context of SCF (small scale farming), support from extension and input availability. In Ethiopia's cotton areas, these services will have to come from the DA (development agents). Here again we observe, that "technology transfer is also fashioned and adopted as the only good approach to extension. Despite the persistence of technology transfer as an alternative extension approach, end users have limited access to technologies or inputs they need, such as improved seeds. Similarly, the farmers' growing need for product markets and customer satisfaction has still not been met (by extension)". However, only 33% of the cotton land is produced by the SCF; and according to the strategy it will be even much less in 10 years' time (< 10%).

Cotton farmers in Amhara and Tigray produce cotton instead of additional sorghum and sesame. If the year has a favourable price relation between cotton and sesame, they win, if not they might lose income. Important is also the weather: if the rain is good and they have planted cotton, then it is good for the farmers income (in principle), as the sesame suffers from too much rain. But a key factor for having more income through cotton is the availability of land. Households with less than 3 ha barely benefit from cotton, as they normally use less than 20% of the land for cotton. To note that even in the cotton-sesame belt, less than 15% of the arable land is used for cotton (and so about 30% for cotton + sesame). Self-sufficiency with cereals remains a key strategy for the SCF.

The cottonseed Oil issue

Cottonseed oil is a by-product of cotton processing and used to be much more important as a vegetable oil than it is now. The world market replaced this product first by soy oil just after World War II, and since the 80ties palm oil became the mass product, mainly as key ingredient for many junk foods for the masses. Ethiopia has never tried to better use this key ingredient of the cotton plant and so rarely captures cotton not only as a fibre crop, but as well as an oilseed crop, as it is since 200 hundred years for example in the United States of America. The socio-economic consequences may be read in the following statement of a minister:

> *As the living standard of people improves, the consumption of edible oil and choice of preference increases including in the rural areas. She [Minister of Trade and Industry] further stressed that the government has given priority for the investors who invest in the manufacturing sector. She urged the company officials not to worry about the market of edible oil in Ethiopia because the country spends a lot of its currency for importing oil. The statement indicated that the Minister has mentioned Ethiopia's strong tariff protection for investors who invest in the import substitute products. Reports show that even though Ethiopia has the potential to grow oilseeds, the country imports 350 million metric tons of subsidised palm oil per annum mainly due to challenges in the oil value chain. Ethiopia has annual potential of producing more than 784,809 tonnes of oilseeds, according to the Central Statistics Agency of Ethiopia 2016. Source: website*[9]

We see here again a missed opportunity based on traditional policies based on world markets and poor influences of agriculture research and farmer-entrepreneurial networks with policy makers. Today, Ethiopia

9

imports 80% of the edible oil, exporting at the same time sesame oil for devices. A better culture of dialogue could definitively uplift the potential of cotton oil and replace imported edible oil and create valuable jobs at the same time- and of course further improve the contribution of cotton to national and local food security. Table 24 and Figure 24 indicates the relation between the current cottonseed oil with cottonseed production and with (mainly imported) oil crops.

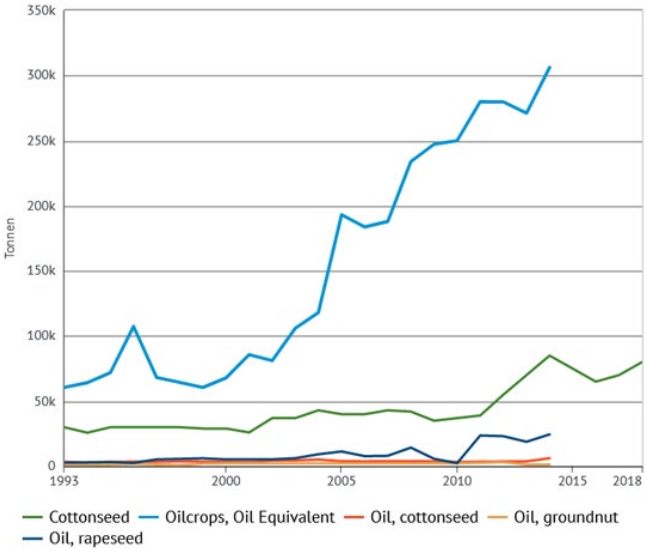


FIGURE 24 : THE RELATIVE IMPORTANCE OF COTTON OIL IN THE EDIBLE OIL MARKET OF ETHIOPIA SOURCE[10]

Traditionally, cotton oil was used for *injera*, the staple dish of (northern) Ethiopia. Its nutritional quality is superior to the now imported palm oil. The Association of Oil Millers provides a network to better link with the VC, in order to promote the 20%[11]-oil content of the cottonseed and transform it into a socio-economic and nutritional asset for the country. The current potential is approximately 13,000 t/year.
Looking at the major risks, consequences and possible mitigation measures, we identify four categories below.

TABLE 24 :COTTON BY-PRODUCT ISSUES

	Major risks and Consequences	Mitigation measures
Availability of food	Major risks are "only" concerning the areas with commercial cotton farming, particularly large farms which produce for the world market (or specific markets outside Ethiopia). As these areas make over 70% (by 2018) of all cotton produced, the availability of food might be reduced in these areas, so mainly in Gambela, Amhara, Afar and SNNP. Consequences are already observed: social unrest and discontent and lack of food security for all households having lost access to land due to the new landowners. (To note that in cotton areas dominated by smallholders, the effect of cotton on availability is rather positive)	To envisage clear obligations towards the investors related to local food security impacts of the commercial farm (independently if cotton or other cash crop like sugar cane or food crop for export is produced on the farm). This measure would require more transparency as well as a more active role of the regional states in assuring their function in governance.

[10] https://newbusinessethiopia.com/manufacturing/malaysian-company-to-produce-edible-oil-in-ethiopia/
[11] Reaching 20% is the objective by the end of NCDS. Modjo gets only 13% of crude oil; and even less for refined oil.

Accessibility of food	Cotton systems and so the VC is too often disconnected from the food system, even if a) it is produced by farmers and farms who are in majority involved in food production and agriculture and b) cotton is not only a fibre, but with its oilseed also a feed and oilseed crop for human consumption. The consequence of this disconnection between the cotton VC and the food and agriculture system are not only missed opportunities and lowered inefficiencies of the input and advisory, but also institutional "clashes" and inefficiencies amongst the various ministries of all levels (federal, state, zone, Woreda).	The EU and Africa must join efforts to reach the Sustainable Development Goal of zero hunger and address the challenges of nutrition and food security by boosting safe and sustainable agri-food systems. A partnership on agriculture would support the development of environment-friendly agricultural practices, promote local production and integrate biodiversity concerns. This includes setting sanitary and phytosanitary standards and the protection of natural resources. Trade between the EU and Africa plays an instrumental role supporting opportunities for sustainable food systems.
Utilisation and nutritional adequacy	Ethiopia imports quite amounts on edible oil, mainly palm oil, which is of lower nutritional quality then cotton oil. The consequence of this neglect of key feature of the cotton plant and element of the VC has consequences as well for the national nutritional system.	The government should include cotton as well as a oilseed plant in the various statistics, and then better link up the concerned stakeholders, mainly from farmers, processing and the various ministries. As few data on nutrition in relation with cotton farming and the VC is available, more research should be done on this important topic.
Stability	The risks are only in areas with large commercial farms producing for world or foreign markets (with higher purchase power), and where indigenous peasants and farmers had to be evicted from traditional and accessible land. If already over the last years, farms with about 50'000 ha producing cotton, have caused many unsolved conflicts in a context of land scarcity, ethnic tensions and food insecurity, it is not clear to see what the consequences will be, if a land mass of 500'000 or even 1 million ha should be converted from indigenous or small-holders to commercial farms.	Institutionalize robust mechanism for social impact assessments for ongoing and new commercial farms and involved land lease contracts.

Food and nutrition security is a complex issue, and in the context of Ethiopia, support from development partners and the "international community" is required to address them. Adaptation to climate change, reduction of pesticides and overuse of fertilizers, restoring of soil fertility and the stop of biodiversity as well as more attention on combining agriculture with job creation are just the most prominent challenges.

The EU (2020) formulates this in its recent "From farm-to-Fork Strategy" in these words:

> *There is an urgent need to reduce dependency on pesticides and antimicrobials, reduce excess fertilisation, increase organic farming, improve animal welfare, and reverse biodiversity loss. The sustainability of food systems is a global issue and food systems will have to adapt to face diverse challenges. The EU can play a key role in setting global standards with this [from Forks to Farm] strategy. The EU will focus its international cooperation on food research and innovation, with particular reference to climate change adaptation and*

mitigation; agro-ecology; sustainable landscape management and land governance; conservation and sustainable use of biodiversity; inclusive and fair value chains; nutrition and healthy diets; prevention of and response to food crises, particularly in fragile contexts; resilience and risk preparedness; integrated pest management; plant and animal health and welfare, and food safety standards, antimicrobial resistance as well as sustainability of its coordinated humanitarian and development interventions. The EU will build on ongoing initiatives and integrate policy coherence for sustainable development in all its policies. These actions will reduce the pressure on biodiversity worldwide. As such, better protection of natural ecosystems, coupled with efforts to reduce wildlife trade and consumption, will help to prevent and build up resilience to possible future diseases and pandemics.

The interconnectedness of food production, agriculture and rural development, fairness in value chains, healthy diets and nutrition with policy coherence and sustainable development (SDG) at both national and global level are clearly expressed.

The potential of sustainable cotton and textile must be seen in this context. For time being, only a fraction of Ethiopia's VC – both cotton and textile- is produced under a certified standard. A major increase would definitively increase food and nutrition security, as negative impacts on health, the environment and income could be mitigated.

4.3.5 Social Capital

The various networks and figurations at the farm and- to a less degree- on the factory levels have made important improvements over the last 50 years. Communes, still called "peasant associations" as introduced in the late 1970ties by the Derg have institutionalised collective procedures of dialogue, planning, joint action and reporting. The same is with the district level, where the Woredas often implement dozens of projects from various financial partners including the own government. But top-down plans still dominate, weakening the drive and potential dynamics of this local networks and social assets.

A particularly weak point is the ignorance of indigenous rights, which poses current conflicts and harm to pastoralists and other communities neglected in the development process by exclusion of dialogues and contracts. The VC has however a good potential to correct these deficits and contribute to enhanced social and human capital.

Primary cooperatives lack access to finance to lend farmers the money they need to cover weeding and harvest costs or to supply inputs on credit for farmers. They also cannot access credit in order to buy seed cotton from their farmers, although they do get credit from the unions to aggregate sesame (SOFRECO, 2016). This reduces the strengths of the cooperatives. According to the NCDS, the situation of the cotton extension system is bleak at the moment: (i) The transfer of the cotton sector from MoANR to MoI has led to a withdrawal of the MoANR extension services for cotton production; (ii) The development of private extension services is still very limited; the large commercial cotton farms are usually unable to provide adequate services to the smallholders; (iii) The links with research are very limited and farmers are often not aware of the activities conducted by the researchers. The problem is a structural one (SOFRECO, 2016):

> *The demand side of agricultural extension—the input plans and delivery system—is not only based on farmers' demands but also on the previous year's achievement records and a combination of actual farmer needs and the quota plans transmitted by the regional authorities to the Woredas and Kebeles. Therefore, the Woredas are less decentralized in the development of their own implementation plans and cannot make decisions, which is a critical structural problem in the Agricultural Extension System. The Woreda, therefore, remains dependent on top-down quota plans. Farmer participation and decision-making in agricultural extension is extremely low in practice. Thus, the decentralization of the extension system has not been well nurtured and promoted such that it can support bottom-up planning and ensure real farmer participation.*

The farmers are therefore recipients of instructions and are hardly supposed to take their own decisions on own plans and aspirations. In most areas, therefore, forced participation is considered a constraint to rural development. Respect of traditional knowledge by state actors is just beginning timidly, and it will take time to create trustworthy relations between (cotton) farmers and the state. The introduction of new extension

systems or technologies based on ambitious sectoral plans - like in the massive extension of cotton areas- as part of economic cooperation needs to take into account the traditions and felt needs of the end users.
Looking at the major risks, consequences and possible mitigation measures, we identify four categories below (Table 25).

TABLE 25 : ISSUES OF SOCIAL CAPITAL

	Major risks and Consequences	Mitigation measures
Strength of producer organisations	At farmer level no major risks are seen. The weak point is however at the workers level within commercial farms and the textile factories, producing seedcotton, lint and yarn. The consequences will be sub-optimal human resource situations in these organisations impacting the limited growth of the sector.	Better enforcement of the laws related to workers' rights.
Information and confidence	The risks are on three levels: (1) Extension and advice for cotton producers is still top-down and suffering from inconsistencies between the main involved Ministries (MoT, MoA); (2) Research is much too weak and too narrowly focussed on creating new cotton varieties, hence limiting requested information to advance the sector; and finally (3) The information between the various sub-chains is poor.	More decentralized and participatory approaches for extension and advice for the cotton producers. Getting clarity on responsibilities on this issue amongst the lead ministries. Better endowment of the research component and specifically for WERER/WARC. Agree on better information supply, mainly at regional level. This would also increase transparency and trust levels.
Social involvement	Indigenous knowledge is as weak as the recognition of the ethnic-based livelihoods. This has implication on the cotton production level for both family and commercial farms. The consequences are in a decrease of sustainability of farming and social systems (households, communities, larger social figurations) and social conflicts.	Better recognition of indigenous rights.

4.3.6 Living Conditions

The scoping study (SOFRECO 2017) made the following observations related to the impact of the VC on living conditions.

> *Farmers in North Gondar (Amhara Region) recently adopted the CmiA sustainable production system while farmers in the Arba Minch area (SNNPR) try to start organic cotton production…Social impact: commercial farms provide a series of benefits on top of wages, usually including housing, food, drinking water and medical treatment. It positively impacts households' livelihood as well as the access of farms' surrounding neighbours to new resources (ex: tracks rehabilitation facilitating contacts with remote social services). Workers exposure to pesticides is generally high, due to frequent lack of personnel protective equipment but varies with the region and the practices. Despite the freedom of association, no workers association operates in the cotton farming industry.*

The positive expected impact of sustainable cotton, just emerging since 2015-17 is mentioned, on which we fully agree (see above on food and nutrition security). The benefits to be provided by commercial farms seem to remain theoretical, as many complains are raised on not committing to the promises. But a case by case assessment would be required on that. Our mission had no opportunity to do that. The lack of freedom to organize as well at farm-workers level is still unchanged. However, small-scale farmers producing cotton when prices are good will be better off than others, workers employed on cotton farms and textile factories better off then unemployed. Loosing are indigenous people having lost their land to cotton plantations.
Primary education does not seem to be dependent directly on cotton areas. However, indirectly may cotton contribute to sustainable intensification and so to more social dynamics and stimulation of investments by the state into education. Although it may be difficult to change the level of education of current mothers and fathers, by educating today's children, the next generation will benefit from more educated parents.
Looking at the major risks, consequences and possible mitigation measures, we identify 4 categories below (Table 26).

TABLE 26 : ISSUES OF LIVING CONDITIONS

	Major risks and Consequences	Mitigation measures
Health services	Land lease contracts are supposed to be linked with provisions of health services. It is not clear how these commitments are met. The non-delivery of promised health infrastructure and services could lead to negative attitudes of communities towards investors and the state authorities.	Better transparency on commitments of lease contracts and follow-up by regional state authorities.
Housing	Similar situation as described above on health services.	
Education and training	The lowland- and cotton rural areas are generally less served as highland and particularly urban areas. Education and training would be required in order to address the economic, social and environmental challenges (poverty, hunger, health, employment, self-confidence, social peace, climate change adaptation). If the ambitious strategy of the VC will have a chance to be realised even partially, such hardly existing education and training facilities will never be sufficient.	Better planning with related services, ministries, communities and NGO in order to enhance education and training in cotton and textile.
Mobility (social, geographic)	Resettlement and immigration of workers and farmers into newly developed regions and areas poses always problems with indigenous communities. They may lead to social conflicts and human suffering. Mainly Gambela and SNNP are concerned. Other consequences are unsustainable farming practices leading to environmental damages and loss of biodiversity and other public goods.	Reinforce structure and voices of endogenous people. The public sector should better respond to the existing local initiatives.

4.4 Conclusions on the social dimension

Institutional bottlenecks and diverging interests

If you cannot find the thorn in your foot,
You will always walk with a limp.

(African proverb)

One problem or challenge with social analysis is the fact that it depends on the perspective taken. A thorn for one reader may turn rather to an incentive or sweetener for somebody else, or a third reader may take it as an offense towards a projected noble aim. From the social profiling exercise and before in the functional analysis we have identified six major social groups which face distinct risks or problems. These risks are presented in Table 27, distinguishing if they emanate directly from the VC- and so could be solved within the VC- or rather from the rather larger context (economy and society).

TABLE 27 : THE KEY SOCIAL RISKS FOR THE SIX MAJOR CONSTITUENCIES OF THE VC

Social category or identity	Risk from VC	Risk from society
Women	- Limited career opportunities - Working conditions in factories	- No equal rights; low social status - Gender discrimination (often embedded in tradition)
Small-scale farming	- Cotton often disconnected from the food crops; few synergies and support from technical services - Poor technical support reduces productivity, profitability, income and effective forms of social coherence.	- Farmer associations (including cooperatives) are weak
Large scale commercial farming	- No transparency of contracts - Expropriation practices - Exposure of workers to pesticides - Production for global markets vs land scarcity - Indigenous communities get land use problems; this may cause social conflicts	- Tensions between indigenous and state officials - Often no contracts for labourers
Traditional weaving	- Child labour (with its consequences on human capital)	
Industrial garment and textile industry	- Violations and unfair practices (including low salaries) - High job fluctuations	
Regional and local stakeholders (officials)	- No real involvement in planning - Unclear roles between MoANR and MoTI - Unequal means to deal with the VC and its potential and problems	- No saying in larger land deals (handled by federal level) - Partially huge differences amongst regions

	- Missed opportunities with cotton oil for food - No role for researchers at this level; limited one for advisers/extensionists	

We will address the recommendations addressing the risks in the last chapter (including the economic and environmental dimensions). Figure 25 provides as with a picture on the winners and losers of the current situation of the VC. The majority of the involved people, the labourers, workers and SCF seem to have a rather neutral effect by the VC. The main beneficiaries are the middlemen, foremen, managers, exporters/importers, investors and eventually the officials at federal level, enjoying more freedom to decide, as well as the urban dwellers benefitting from the infrastructure and the new jobs. The pastoralists, fisher folk, in most cases villagers suffering from social conflicts where social conflicts could not be solved and indigenous peoples having lost land are bearing most of the negative impacts from the VC.

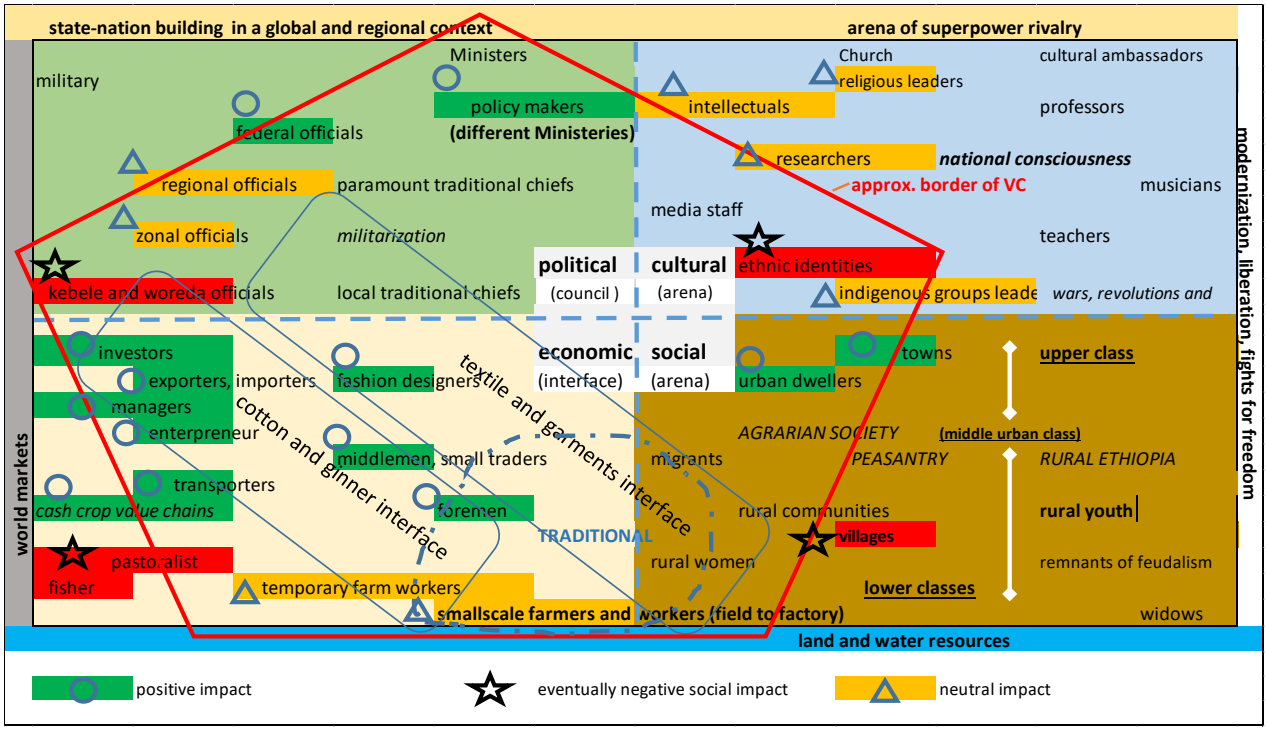


FIGURE 25 : WINNERS AND LOSERS OF THE VC FROM THE SOCIAL PERSPECTIVE

An overall feature of the VC is the exploitation of cheap resources (land, water, labour) in order to maximize the throughput (mainly cottonseed and garment) in the interest of the investors (both Ethiopian and foreigner). This goes at costs for the labourers and lower hierarchy officials and communities, and so at the end to important segments of the Ethiopian society. Particularly the indigenous peoples in the newly established commercial agriculture perimeters under irrigation practicing traditionally pastoralism and fishing are the main losers. The regional state and their sub-offices (Zone, Woreda, Kebele), particularly if working under the MoANR, are somehow side-lined within the VC and so not integrating cotton in their daily business as it should be.

On the other side, the VC still integrates two often separate figurations: industrial agriculture and garment & textile production and community-based, diversified and sustainable forms of cotton production and traditional weaving, garment Ethiopian fashion confection. This integration has grown organically over the last 20 years without any central steering. Sustainable forms of cotton production (CmiA, organic, Fairtrade) are still very marginal, but they seem to find more and more recognition within the VC and society. The limits to growth (Meadows, 2004), considering demography, deforestation levels, pollution with intensive and unsustainable farming, but also the emerging trends at global level of sustainable consumption- particularly in the fashion sector (Textile Exchange, 2019), are not (yet) a factor in the social landscape of the VC. The

weakest point is the insufficient targeting of the poor. Mainly the small-scale farmers still lack fair access to land, knowledge and inputs. This is the reverse of the medal favouring large operators and pushing through very ambitious centrally-planned strategies without the required time for participation at local level; and without trying to reconcile the various interests and right claims.

Responses to the posed framing questions

Is this economic growth inclusive?

The growth is not inclusive. Mainly at two distinct fronts, the large commercial farms producing cotton and the modern textile factories employing cheap labourers (mainly young women) are the weak points to be addressed.

Is the Value Chain socially sustainable?

Four out of the six examined dimensions, i.e. working conditions, land and water rights, gender and living conditions, have to be improved in order to make the CV socially sustainable.

Related to working conditions, the situation of the factory workers as well as the conditions of the labourers involved in areas of commercial farming are the most critical.

Indigenous communities in relation with newly leased commercial farms, lowland communities not being involved in the VC and children having to work instead of going to school are the critical elements related land and water rights.

The often-precarious conditions of women in the textile factories as well the overall discriminatory practices against women rights (not directly due to the VC) make the gender dimension rather critical.

Cotton areas are by nature in a harsher condition (climate, diseases) and therefore rather neglected by the state. For time being, the private companies managing the commercial cotton farms have not proven to offer better services leading to satisfactory living conditions.

From the food and nutrition security perspective, the cotton VC is positive, more than often conceived from the perspective of the food sector. Not only is cotton enhancing soil fertility and contributing to diversification of the farms, the income generated by the farmers, labourers and workers in the various enterprises contributes to income and food security and the cotton oil benefits the important livestock sector of Ethiopia. However, the potential of the VC for FNS is heavily under-exploited.

The social capital is quite strong at the community level (producer villages, Kebeles, local networks including farmers, middlemen, ginners, weavers, traders) and urban settings hosting the factory workers. The weak point are critical relations between various hierarchically structured identities, like indigenous/state or regional/federal institutions as well as the poor presence of unions (except in Tigray).

Considering the dynamics of the last years, the overall VC analysed (from cotton production to yarn) is socially not sustainable. However, a more differentiated view is required to put this into relations. We consider that the SCF-based rather traditional VC (from cotton to yarn) is socially sustainable. The commercial or industrial cotton production-based VC, driven by external investments, according to our current state of information, is not socially sustainable. A case-by case analysis might provide a better picture. However various important issues would need to change to make it as a special category sustainable.

We assume that a full analysis of the value chain, covering alsomore cases from the textile sector, would not substantially change the social analyses' results.

5. Environmental Analysis

5.1 Goal and Scope Definition

This section of VCA4D report encompasses the lifecycle assessment exercise used to determine the environmental impact of activities within the Ethiopian cotton value chain leading up to provision of a defined product. In this case the functional unit of the study is 1 kilogram (or tonne) of cotton yarn (or refined oil) delivered to a consumer within Ethiopia, or ready for the export market. This will contain adjacent processes that are not themselves related to provision of the final product but reflect adjacent processes which utilise important co-products from a particular stage within the value chain; specifically, the use of seed by products. The main purpose of this exercise is to answer the question of whether the value chain is environmentally sustainable.

The main boundary of the study is summarised in Figure 26 below with the main flows delineated.

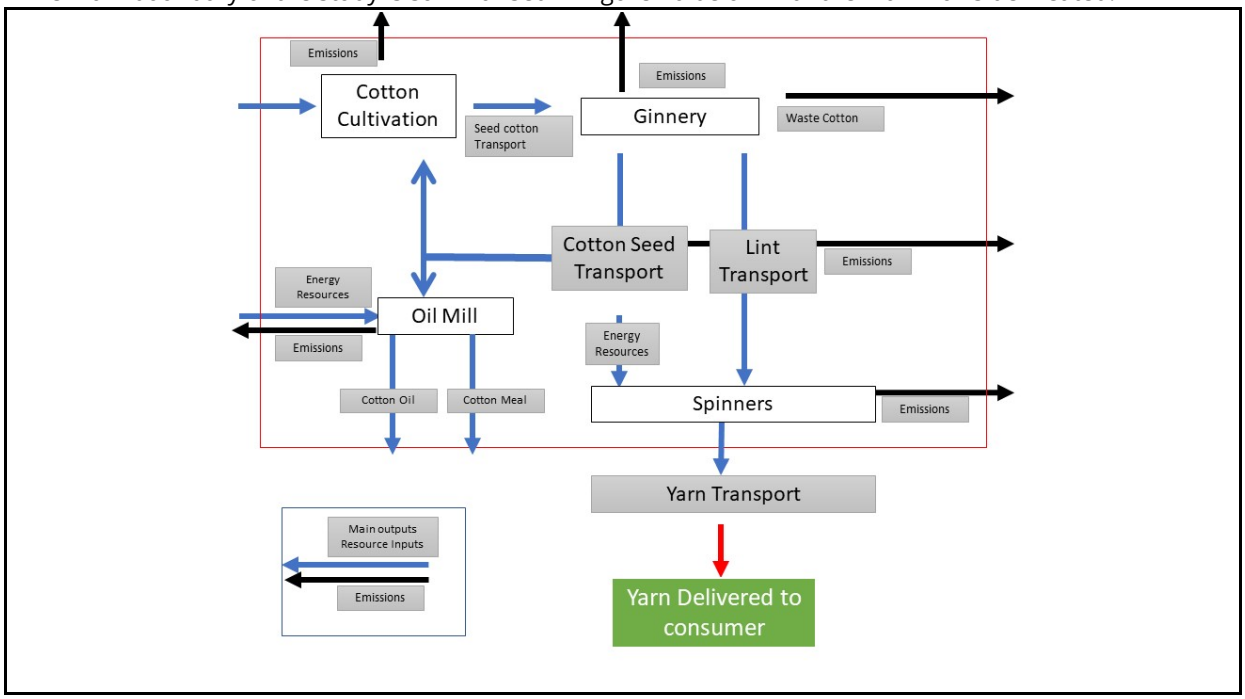


FIGURE 26: LCA STUDY BOUNDARY

The following sections will summarise the main assumptions within each product stage, followed by results and discussion.

5.2 LCA System Description

The main assumptions underlying the inventory flows and the inventory flows at farm levels are described in the following sections by value chain stage; cotton cultivation, ginning and spinning, and oil mill. The inventory flows for the farm stage is summarised in Table 28.

5.2.1 Cotton Farm Types

Within this study 3 different farm systems are depicted with an additional 4th farm system included for illustrative purposes in the appendix. This reflected a farm of the same type 3 but reflected the first cultivation after conversion from sugar cane, with a lower yield of cotton.

The data used to populate the inventory are based on integrating mission notes, questionnaire data, and data from literature sources. At this point it will be necessary to present a caveat as information from different contexts and regions will be needed to provide a full account of activities within a farm. Therefore, whilst

information from a particular farm in a specific woreda or region may be utilised in order to provide data for a defined activity that does not suggest that it is indicative of all farms in the region or all farms within that category. Therefore, the case studies here are intendent to reflect a broad categorisation of actor by intensity of activity, as opposed to reflecting a specific region. (In other words, in order to be regionally consistent representative regional specific information on yields and rainfall etc. would be necessary). The main farm characteristics are summarised in Table 28 below. Irrigation reflects whether a farm relies solely on rainwater whilst level of intensity refers to use of externally sourced chemical fertilizers. Ownership relates to the extent to which the farm is owned by a farmer or by commercial company. It should be mentioned that due to data uncertainty the boundary between categories remain fuzzy, therefore quantified ranges of inputs is difficult to quantify. Equally the approximate area is taken from the functional analysis, based on discussion across the whole team and reflects a very uncertain approximation, especially between farm types 1 and 2.

TABLE 28 : MAIN DISTINGUISHING FEATURES OF FARM TYPES USED IN THIS STUDY.

Farm	1	2	3
Size Category	Traditional Cotton Farmers (1-2 ha, 10 Max)	Small Scale Farmers (10-250 ha)	Commercial Farmers (> 250 ha)
Yield Range	1-1.5 tonnes /hectare (anecdotally higher)	1.5-2 tonnes /hectare	≥2 tonnes/hectare (anecdotally higher)
National area	19,264 ha	11,047 ha	25,270 ha
Irrigated	No	No	Yes
Ownership	Private Small holder	Private Small holder	Commercial
Level of input intensity	Low	Medium	Medium/High
Mechanisation	No	No	Yes
Main Market	Mostly Traditional or home.	Traditional/Mass	Traditional/Mass

The main distinguishing features of the farms is the yield and the level of intensity and water source. The first farm type is based in part on mission notes and focus group responses amongst small holders in the Tigray region and represents a small holder with limited inputs except organic fertiliser, the use of legumes and dedicated fallow periods, along with the use of manual weeding is assumed to result in (comparatively) higher yields. Fertiliser application is based on the use of organic fertiliser, this farm is assumed to have a yield of 1.3 tonnes seed cotton per hectare based on the response from the crop development directorate agricultural ministry (giving a range of 1-1.5 tonnes per hectare). This farmer is assumed to supply mostly the traditional or home use market. It should be noted that responses from focus groups suggest that such small holders can achieve higher yields of 2 tonnes per hectare under favourable conditions (e.g. frequent and effective weeding, minimal pest incursion, and irrigation).

The second farm type is based partly in response to discussions with the members of Dansha Kabela co-operative and reflects small holders (and some medium sized farmers) that have a greater degree of input use, possibly as part of a cooperative. Pesticides and chemical fertilisers are used within its operation but it is not mechanised. This farmer type serves both the traditional and mass market and is assumed to have an average yield of 1.6 tonnes seed cotton per hectare based on mission responses. The NCDS scoping study (NCDS 2016) suggest a value of 1.2 – 1.7 tonnes /ha in rainfed farms, therefore these farms reflect this productivity range.

The third farm is a commercial irrigated farm based on notes from a commercial farm in Metema and questionnaire responses from a commercial farm in Amibara. This farm had a higher level of inputs in terms of fertiliser and pesticide use and was irrigated. In contrast to the previous examples, this category includes mechanisation in its operations. Both representatives from the Ethiopian Cotton Producers Exporters and Ginners Association (ECPGEA) and the Cotton development plan suggest that larger commercial irrigated farms can achieve up to 2.5 tonnes of seed cotton per hectare. Similarly, the NCDS scoping study (NCDS 2016) suggests a value for yields ranging from 2-3 t/ha cottonseed in irrigated areas. However, in discussions with farms with Metema it become apparent that many such farms perform poorly (the irrigated commercial farm at Metema suggested a lower yield of 1.5 tonnes per hectare). Following up with enquires made by the

National expert, a compromise value of **2 tonnes per hectare** was used. This was chosen as it provides a benefit for irrigation but it is a conservative value. The view that commercial farms might not be as productive as initially conceived was a theme that anecdotally was repeated throughout the mission.

5.2.2 Farm inputs

In the first instant the amount of atmospheric carbon embodied in harvested seed cotton is calculated based on a cotton carbon content of 40% (Casuarano et al. 2006). (However, this should not be confused with carbon sequestered, due to the lifespan of the material, although this is debated.). The amount of land required to produce a defined quantity of seed cotton is based on the reciprocal of yield defined above. In addition, for farms 1-2 the amount of fallow land necessary is calculated based on the ratio between occupied and fallow land described in Bosena et al. (2010), who estimate that cotton small holder cotton production has 4 ha fallow for 2 ha allocated to cotton, under optimal conditions the same amount of land is fallow as used for cotton, these ratios are used for farms 1 and 2 respectively. In farms 3 the ratio between occupied and fallow land was taken directly from questionnaire returns from a commercial farm which gives a much lower fallow land requirement, however it was unclear if this was sufficient to suppy N to the soil pool more generally so a midpoint ratio (0.6) was chosen between farms 2 and 3.

The theoretical amount of water required for Cotton in sub Saharan Africa is taken from Chapagain et al. (2005) and is assumed to be equivalent to 993 mm of precipitation at the field level per year. This is converted into an amount per tonnage by converting into the equivalent amount of water per hectare and dividing by yield. Assuming an average yield of 2 tonnes cottonseed per hectare and a lint yield of 38%, this equates to water demand of 14,000 M^3/t lint. Alternatively, in Australia (NSW), irrigated cotton consumes 7.8 megaliters per ha, and higher lint yield of 2.2. tonnes per hectare (taken from the most recent Australian Crop report) this results in a value of 3,545 M^3 irrigated water per tonne. Given the differences in climate and yield these systems are not immediately comparable and are presented depicting the range of water demand in areas that area climatically distinct despite both being within an arid zone.

The theoretical irrigation demand can be calculated based on the discrepancy between rain supply and crop water demand, however it should be noted that it is questionable whether farms will abstract and apply the theoretical amount of water required. As mentioned above it is assumed that farms 1-2 receive sufficient rainfall, but this is a simplification. For example, the Woina dega (Subtropical zone) which includes the highlands areas of 1,830 – 2,440 meters demonstrates an annual precipitation between 510 and 1,530 mm. For farm 3 an annual precipitation rate of 700 mm (as estimated from Climate-data.org) is assumed. However, it is unlikely that a sprinkler irrigation system will supply just what the plant needs. Therefore, the theoretical value was trebled to take into account leakage, evaporation from soil etc. (Levidow. 2014). This may well be a conservative estimate.

In terms of nutrient inputs it is assumed that farm 1 (which does not have any chemical inputs) applies organic fertilizer (based on focus groups responses). The amount of organic fertiliser applied was based on the lower range of organic N applied (8 kg organic N per hectare of Ethiopian crop land, taken from Van Beek et al., 2016). However, this is insufficient to meet plant needs of approximately 83 kg N per tonne of seedcotton-based on an estimate of 200 kg of N necessary to produce 2.42 tonne of seedcotton under arid conditions (Wajid et al., 2017). In this instance any N not sourced from organic sources needs to be supplied by the soil pool which is replenished during the fallow period. For that reason the higher occupied to fallow land ratio was assumed in the first farm.

This poses a challenge as N containing fertiliser may come from local sources or be produced on the farm with limited impact (it may be cattle manure) or in some cases purchased outright (such as commercial compost). Equally some farms may have access to large quantities of residues and the available manpower to process and utilize them. For that reason it is assumed that half of the available N flows come from organic inputs and half from the soil pool, or 41.4 kg N/tonne seed cotton respectively.

In the first instance the N content was divided evenly between farmyard cattle manure with a total available N content of 1.4% and hay (or organic residue) with a N content of 1% based on East African conditions, it was assumed that 25% of the N was available for plant uptake (Snijders et al. 2014).

In this case the hay is assumed to come from an extensive farming system and dried in the fields as that would be more compatible with Ethiopian conditions before being incorporated into the soil. The existing extensive Hay module within was augmented to reflect Ethiopian conditions, namely a lack of mechanization, and an approximate yield of 5 tonnes/ha (FAO 2000). Hay crops are traditionally mown by sickle or scythe (locally called falch). The mown ha by sickle or scythe, is subsequently spread or left on the ground for 2-3 days to sun dry, an economical method and efficient method. Most hay is produced from natural pasture and crop residues and can include sown forage like oats and vetch. In the highlands there is bottom-land unsuited to cropping, and uphill land which includes natural pasture that could be used for hay.

Many households (more common in the North) hold continuously cropped maize fields (locally referred to as aradas), which benefit from input of organic fertilisers, such as compost (locally, kosi) or household wastes. Kosi is comprised from a variety of locally sourced organic materials, such as various types of animal dung, kitchen ash, crop residues, and feed refusals (Mukai and Oyanagi, 2019).

Due to the low available N content a large amount of organic fertilizer and manure needed is large due to the lack of chemical fertilizer and the inability to rely on the soil pool. Indeed the quantity of N assumed to be applied via organic sources in this study appears within high range (> 16 kg N/ha) within a wider Ethiopian context.

The service of the soil pool will depend on the level of fertility achieved, which will be location specific. Because of the uncertainty associated with organic fertiliser input, for each farm two impact assessments are undertaken one in which the **embodied** impact from organic fertilizer production are included and excluded, but direct N_2O NH3 field emissions from manure and other organic fertilisers application are left unchanged. This was due to the risk of over-estimating the embodied impact of organic fertilizer, which could potentially be sourced from the farm (e.g. kosi) with limited energy and resource input. In the case of the other farms a similar alternative is included for organic inputs.

For the second farm and third farm lesser amount of organic N inputs were assumed for farm 2, with the assumption that 25% of N inputs are satisfied by organic residues or hay incorporated into the soil. Based on the responses of Dansha co-op management and the commercial farm in Metema (which are intended to be representative of the farm types) both farm types 2 and 3 are assumed to apply 100 kg NPS and 50 kg urea per hectare annually with the exception that farm type 3 uses NPK (20-20-20) instead of NPS (NCDS 2016). It should be mentioned that in the case of the small holder farm this is based on a situation in which farm inputs are subsidised and therefore may not be replicated in all cases for similar farms. Again, the remaining N is assumed to be supplied by the Soil pool.

Farm type 1 was assumed not to use any pesticides with the exception of molasses trap which is in itself a bio-control mechanism. Based on the responses of Dansha co-op management farm 2 is assumed to apply 0.4, 1 and 2 liters of Karate 5 EC, Dimethoate 40, and Malathion 50% EC. No specific information on specific pesticide application was available for farm type 3 other than an approximate estimate of 3 rounds of 3 liter applications. Therefore, the same assumption as farm 2 (in terms of application per hectare) was assumed with the addition of 7 liters of “Ethiosulphan” (also commonly known as endosulfan) and 1.5 L of “Marshal” applied per hectare in Amibara against African bollworms. The pesticide application for farm 4 was taken from the questionnaire response from a commercial farm directly. Farm types 2 and 3 were assumed to be pre-treated with glyphosate herbicide at 2 liters per hectare. The active ingredient input per tonne of seedcotton output is summarized in

Table 29 below, based on pesticide labels grouped in terms of chemical family. (E.g. The active ingredient of 'Dimethoate 40 Neat' is 'O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] dithiophosphate' which is an organophosphate.

TABLE 29 : ACTIVE INGREDIENT INPUT PER TONNE SEEDCOTTON.

Active Ingredient Input (g per tonne)			
AI by group	**Farm 1**	**Farm 2**	**Farm 3**
pyrethroid	0	13	8
organophosphates	0	1,359	870
organochloride	0	0	450
1-benzofurans	0	0	120

Farm tractor energy for farm type 3 and 4 are taken from the approximate duration of each activity. For farm 3 as estimated by farm management at Metema. This includes 3 applications of pesticide and 1 application of herbicide at 6 hectares per hour motorised spray, 2 applications of NPS and 1 application of urea both of which are applied at a rate of 12 hectares per hour motorised spray, ploughing and planting at 3 and 0.6 hours per hectare respectively. It was assumed that the tractor size was modest at 125 hp. This was converted into fuel consumption per hour based on the relationship published in Grisso et al. (2010). This resulted in estimate of 75 L diesel/tonne seed cotton based on a yield range of 1.5 tonnes/hectare based on the farm yield responses. Direct emission combustion estimates were taken from the "Diesel combustion, in tractor/FR U" module in Ecoinvent. By way of comparison a similar exercise was applied to the approximate activity data supplied by an organic commercial farm in Goma zone of Arba Minch which resulted in an approximate estimate of 89 L diesel/tonne seed cotton.

Finally, the tractor activity for farm type 4 was supplied directly by the questionnaire response. As this farm was transitioning from sugar to cotton in its first year it included a large number of activities that would not be considered part of the conventional cultivation cycle as it had transitioned from sugar cane. The range of tractor sizes were supplied, and it was assumed that the largest tractor (300 hp) was deployed in ploughing, the activity which required most time per hectare. For that reason, and the low yield of the first year under cotton, the estimated energy demand in L/tonnes of seedcotton was multiple times that of the previous farm. The results of which are included in the appendices.

For farm 3 pumping energy is assumed to derived via a diesel pump, taking water from a nearby surface water source. Based on the gravity constant, 9.81 Joules of energy is required to lift one liter of water up a height of one meter, or 9.8 MJ per ML of water. The pumping energy demand is calculated based on irrigation demand calculated above and an assumed average pumping depth of approximately 15 m(Walraevens et al., 2009) and a pump, drive and motor efficiencies estimated by Foley (2015). This was chosen as a cautionary estimate, as to the large quantity of water involved, pumping water from deeper acquirers in this instance would result significantly larger quantities of diesel, higher than estimated in other studies for Ethiopia (NCDS, 2016). For the pump, the emission per unit of fuel consumption was estimated from Li et al (2016). However it is not unforeseen that larger commercial farms will be able to capitalize on significantly deeper acquirers with a resultant increase in on-farm energy.

5.2.3 Farm outputs

The main emissions from cotton cultivation are a result of inputs to the system. Carbon dioxide emissions (and other species) are taken directly from the quantity of diesel consumed during farm operations. The emission of carbon from soil is not reflected in the impact assessment as it is treated as biogenic Carbon. This is not to denigrate a clearly serious and growing problem, with implications for soil health, yield and climate adaptation capacity. Kihara et al. (2020) report on long running studies in Kenya that demonstrate annual soil organic carbon loss rates of between 0.5 and 0.7% for tillage systems, fertilizer application regimes and conventional cropping systems. Activities such as residue use, manure etc. have the capacity to mitigate soil losses. Fallow periods have the capacity to reduce soil losses but only at a duration of > 4 years. Gelaw et al. (2013) estimate that in Tigray land under rainfed crop production and irrigated fruit production contains 16 and 36 tonnes of organic carbon (OC) (the 0–30 cm layer) per hectare respectively. Due to the level of

uncertainty associated with this issue it is assumed that farms 1 and 2 have OC stock of 16 tonnes per hectare of which 0.7% is lost annually. The remaining farms are assumed to exhibit the same carbon stock but with a higher annual loss rate of 2% (Kihara et al., 2020). The loss of carbon is assumed to result through oxidation resulting in the release of biogenic CO_2 into the atmosphere. (Biogenic carbon is treated as having no net climate impact. This is very debatable if the carbon has been stored in the soil for an extended period.) The loss of soil carbon is included here as reaffirmation of the importance to conserve soil stocks.

The other major greenhouse gas is nitrous oxide, whose emissions are based on the amount of nitrogen applied. For inorganic fertilisers the IPCC default N-N2O EF of 1% of Nitrogen inputs is assumed with 0.8% for manure (Shcherbak et al 2014), whereas for organic non-manure fertilisers a lower N based emission factor of 0.1% N is applied to the organic (readily available) N inputs (Rahman et al., 2019).

The Nitrogen content of the fertilisers is taken from Alemayehu and Jemberie (2018). For farm residues, the same emission factor was used based on a N content of 1% and an average residue yield of 3.5 tonnes per hectare, being mostly recovered stalks (Sharma et al. 2018). Because it is also bio-chemically active the soil inputs from the soil pool are also assumed to result in N2O emissions, although this may be an overestimate due to the N to be more available to soil bacteria. For that reason half the 2006 IPCC default N-N2O EF of 1% is halved.

In addition, indirect N2O emissions are reflected in 3 ways, due to atmosphere deposition of N, conversion of volatilized NH3 (the volatilised fractions are then assumed to redeposit and are assigned an emission factor of 1%) and leached Nitrates. Atmosphere deposition of N on Ethiopian soils is taken from van Beek (2016) directly and estimated at an average of 4 kg N/ha/yr.

Similarly, an emission factor of 0.43% of N is applied for and NO emissions respectively, taken from Van Cleemput (1998) as used in the CmiA (2014). Gaseous NH3 emissions are calculated based on an average emission factor of 14% of the synthetic N applied (Pan et al., 2016) although urea is often considered to have a higher ammonia volatilisation loss estimate. Compound fertilizers such as a NPK are considered to have a lower value of 2% which is applied here (EEA, 2006). Farmyard manure uses the default estimate of 20% of total N excretion volatilises as NH_3 although estimates as high as 60% have been recognised. Emissions to soil are based on leachate. The main losses of nitrogen are assumed to occur as losses as nitrate (Kihara et al. 2020). Van Bleek et al. (2016) estimate nitrogen inputs and outflows for tillage activities within designated areas of Ethiopia. By comparing N nitrogen inputs and leachate losses a median loss rate of approximately 60% was estimated (including regions where the loss rate exceeded 100%), this was in comparison to an estimate of 17% for cotton in Asian conditions (Liu et al., 2014). For that reason compromise leachate loss (as nitrates) of 40% was chosen with a lower range estimate of 10% organic inputs. The same approach was taken for nitrates emissions to water, in this case based on erosion of surface soil that makes its way into water bodies. In this case a high loss rate of 30% of applied N was estimated. However, unlike leachate it was assumed that only 10% of losses due to erosion infiltrate a water body (CmiA, 2014). (Although it should be noted that this is a source of uncertainty as different environmental impact assessment mechanisms will make assumptions on the faction that reaches water.)

Phosphates are more stable in soil than nitrates but will be lost due to erosion. This process is difficult to generalise as it is sensitive to regional conditions such as climate, typography, soil type, crop cultivated and crop type (CmiA 2014). (Nitrate loses are of similarly sensitive in this regard). The loss rate is also dependent on whether recommended agricultural practices are followed. By way of example applying superphosphate in winter resulting in the loss of 2.3- 6.7% of superphosphate application from US pasture, whereas less than 2% of applied P are lost from African oil palm plantations (Bah et al. 2014). Due to these uncertainties and the uncertainty associated with the portion of eroded soil that reaches water, it was assumed that 1% of P inputs are lost due to Phosphate erosion.

For pesticides and herbicides used in farms 2-4 the volume of pesticides was converted into the mass of active ingredient based on the pesticide label information from the List of Registered Pesticides and herbicides published in Amera and Abate (2008). The input of active ingredients was grouped into main chemical families namely: Pyrethroids, organophosphates, organochlorides and benzofurans. As with

phosphates the propensity for loss is difficult to generalise, depending on the interplay between the soil affinity of each distinct chemical, soil properties, application rates and timing.

Sub surfaces pesticide losses are thought to range from 0.1%–1%, becoming 4% of the quantity applied in worst case conditions. Surface losses are thought to account for 7%–93% of total pesticide losses or 0.005-5.43% of applied quantity (Siimes and Kämäri, 2003). As country specific pesticide loss rates were unavailable a loss rate of 1% of input quantity was applied for both emission to water due to erosion losses and emissions to soil to leachate losses.

All farms are assumed to transport cotton in jute or PPE bags of approximately 20 kg capacity for farms 1 and 2 and 90 kg for farms 3 and 4. Farm 1 is assumed to mostly serve the artisanal and traditional market with cotton transported a short distance via donkey to a local traditional operation that combines ginning and spinning. Farm 1 is assumed to transport the cotton 10 km on donkey, farm 2 is assumed to transport cotton 20 km in a small light commercial vehicle whereas farms 3 is assumed to transport seed cotton a longer distance of 50 kms on a larger vehicle. This was chosen to reflect the fact that many farms will be located at greater distances from ginneries and that it is arguably more feasibly for larger farms to benefit from economies of scale in terms of transport cost. It should be noted that in some instances commercial farms may operate as part of an integrated ginning structure, whereby ginneries may be located closer to the farm. As farm 4 is based primarily on the questionnaire response the seed cotton transport distance of 10km is used from directly from the questionnaire.

Due to uncertainty and data availability (existing soil concentrations, risk of erosion etc.) heavy metal emissions are taken directly from the Ecoinvent Cotton seed ROW for farms 2 and 3 with organic cottonseed inventory estimates used for farm 1.

TABLE 30 : MAIN FARM INVENTORY FLOWS

Main Product Output.					
Output type	**Description**	**Farm 1**	**Farm 2**	**Farm 3**	**Unit**
Seed Cotton	Seed Cotton Harvested for Sale	1	1	1	Tonnes
Yield	Tonnes per hectare	1.3	1.6	2	Tonnes/ha
Effective yield	Tonnes per hectare	0.5	0.8	1.25	Tonnes/ha
Farm Type		Ecological Low Intensity Small Holder	Moderate Intensity Small Holder	Commercial Farm	

Inputs from Ecosphere					
Input type	**Description**	**Farm 1**	**Farm 2**	**Farm 3**	**Unit**
Carbon	Carbon from the atmosphere	0.52	0.64	.8	Tonnes C /tonne
Agricultural Land	Area needed on an annual basis	0.77	0.63	0.5	ha/tonne on an annual basis
Fallow Land	Area of fallow land	1.30	0.63	0.1	ha/tonne on an annual basis
Crop Water Requirement	Total Water needed	7638	6206	4965	m3/tonne
Rainfall	mm per year	2000	2000	700	
	Rainfall	**high**	**high**	**low**	
Crop Water Requirement	Irrigation Water Input	0.00	0.00	4389	m3/tonne
Crop Water Requirement	Rain Water Input	7638	6206	585	m3/tonne
Multiplier applied to rainfall deficit				3.00	

Inputs from Technosphere					
Input type	**Description**	**Farm 1**	**Farm 2**	**Farm 3**	**Unit**
Seed	Seed	11.53	12.5	10	kg/tonne
Fertiliser 1	NPK Application	0.00		**50.00**	kg/tonne
Fertiliser 2	NPS Application	0.00	62		kg/tonne
Fertiliser 3	Urea Application	0.00	31	**25**	kg/tonne
Fertiliser 4	Organic Residue Manure	5952		**0.00**	kg/tonne
Fertiliser 5	Organic Residue Hay	8333	8333	8333	kg/tonne
	N from organic fertilisers	41.67	20.83	20.83	kg/tonne
	N from inorganic fertilisers		26.25	11.50	kg/tonne
	N from Soil Pool	41.67	36.25	51.00	kg/tonne
					kg/tonne
	Available P2O5	39.31	34.44	29.69	kg/tonne
	Petrol for tractor			50	Litre /tonne
	Petrol for irrigation pump			62	Litre /tonne

Input type	**Description**	**Farm 1**	**Farm 2**	**Farm 3**	**Unit**
Pesticide 1	Karate 5 EC Neat application	0.00	0.25	0.20	Litre /tonne
Pesticide 2	Dimethoate 40 Neat	0.00	0.63	0.50	Litre /tonne
Pesticide 3	Malathion 50% EC Neat	0.00	1.25	1	Litre /tonne
Pesticide 4	Ethiosulphan			2.25	Litre /tonne
Pesticide 5	Marshal			0.74	Litre /tonne
Herbicide 1	glyphosate		1.25	1	Litre /tonne
pyrethroid	Active ingredients inputs	0	13	10	g/tonne

organophosphates	Active ingredients inputs	0	1,359	1,087	g/tonne
organochloride	Active ingredients inputs	0	0	563	g/tonne
1-benzofurans	Active ingredients inputs	0	0	150	g/tonne
					g/tonne

Emissions to Ecosphere

Emissions to Atmosphere

Output type	Description	Farm 1	Farm 2	Farm 3	Unit
N2O Emissions	Emissions due to N fertiliser	0.13	0.45	**0.40**	kg N2O /tonne
N2O Emissions	Emissions due to N soil inputs	0.33	0.28	0.40	kg N2O /tonne
N2O Emissions	Emissions due to N deposition	0.04	0.03	0.02	kg N2O /tonne
N2O Emissions	Due to residues	0.04	0.03	0.03	kg N2O /tonne
Indirect N2O emissions	Due N deposition and NH3 conversion toN2O	0.26	0.06	0.05	kg N2O /tonne
NO Emissions	Emissions due to N fertiliser	0.06	0.28	0.20	kg NO /tonne
NH3 Emissions	Emissions due to N fertiliser	14	4.64	3.66	kg NH3 /tonne
NH3 Emissions	Emissions due to N deposition	0.39	0.32	0.26	
CO2 Emissions	Emissions due to tractor			138.84	kg CO2/tonne
CO2 Emissions	Emissions due to Pump			174.89	kg CO2/tonne
CO2 (biogenic)	Emissions due to loss of soil	315.90	256.67	733.67	kg CO2/tonne

CO				0.50	kg CO/tonne
NOx				4.02	kg NOx/tonne
N2O				0.01	kg N2O /tonne
PM <25 um				0.43	Kg PM <25 um /tonne
Sox	Emissions due to diesel consumption			0.1	Kg SO2 /tonne

Emissions to Soil

Output type	Description	Farm 1	Farm 2	Farm 3	Unit
NO3 Emissions	Emissions due to leaching of Nitrates into soils	15.79	83.43	74.13	kg NO3 /tonne
pyrethroid Emissions	pyrethroid Emissions	0.00	0.13	0.1	g/tonne
organophosphates Emissions	organophosphates Emissions	0.00	13.59	10.87	g/tonne
organochloride Emissions	organochloride Emissions	0.00	0.00	5.65	g/tonne
1-benzofurans Emissons	1-benzofurans Emissons	0.00	0.00	1.50	g/tonne
Cadmium		1.03E-04	2.06E-04	2.06E-04	kg/tonne
Chromium		2.84E-04	5.67E-04	5.67E-04	kg/tonne

Emissions to Water

Output type	Description	Farm 1	Farm 2	Farm 3	Unit
NO3 Emissions	Emissions due to soil erosion	2.64	4.65	**2.04**	kg NO3 /tonne
PO4 Emissions	Emissions due to erosion of Phosphates into soils	0.53	0.47	0.40	kg PO4 /tonne
pyrethroid Emissions	pyrethroid Emissions	0.00	0.13	0.10	g/tonne

organophosphates Emissions	organophosphates Emissions	0.00	13.59	10.87	g/tonne
organochloride Emissions	organochloride Emissions	0.00	0.00	5.63	g/tonne
1-benzofurans Emissons	1-benzofurans Emissons	0.00	0.00	1.50	g/tonne
Cadmium		1.70164E-05	3.4E-05	3.4E-05	kg/tonne
Chromium		0.000283606	0.000567	0.000567	kg/tonne
Copper		0.00011344	0.000227	0.000227	kg/tonne
Lead		1.13E-03	2.26E-03	2.26E-03	kg/tonne
Zinc		1.13E-03	2.26E-03	2.26E-03	kg/tonne

5.2.4 Ginning

The ginning process reflected in this study includes 3 main different ginning configurations. The first configuration reflects a traditional artisanal setting that involves both hand ginning and spinning. This is assumed to be powered manually with the main resource requirement being the use of an electric light. It should be noted that unlike the following steps none of the embodied impact is allocated to seeds as it is assumed they have no economic value beyond use at the homestead level. (It could be argued that if they are used as animal feed they have an value associated with an avoided cost).

The other two configurations reflect conventional mechanised ginning. These are based on data derived from i) mission notes referring to a ginnery visited in Metema and ii) from a ginnery in Amibara. Both ginneries are equipped with saw gins.

One of the main issues associated with this calculation stage is the need to apportion a fraction of the total environmental burden to each product out of the ginning process, namely lint and cotton seed. In this study the environmental impact of outputs of the ginning process are allocated based on both their proportional mass and value. In that regard whilst cotton lint output may be allocated 36-40% of the environmental impact of processing 1 tonne of seed cotton based on a mass flow, this fraction of the impact of processing 1 tonne of seed cotton becomes higher when value is included given the price differential between seed and lint. The proportional output of each ginnery (based on conversation with gin management and questionnaire response respectively) is utilised in allocating the environmental burden between co-products. The price of lint is taken as 50 ETB per kg in order to remain consistent with the economic analysis. The price of seed is seen to fluctuate significantly depending on context with an observed range of 8.5 (middle Awash) and 4.1 ETB/kg (in Amibara). Therefore, a median value of 5 ETB was used following advice of the economic expert. In this case a conversion rate of 29 ETB/$ was used. It should be noted that in contrast with the CmiA study cotton seed appears to have a higher comparative price than in other African markets (CmiA 2014). It should be noted that for home spinning 100% of the impact is allocated to lint as seeds are assumed to have minimal market value at the homestead level.

TABLE 31 : ALLOCATION FOR GINNERY BY PRODUCTS

	Ginnery 1	Ginnery 2
Price Seed [$/kg]	0.17	0.17
Price Lint [$/kg]	1.72	1.72
Price Waste [$/kg]	0	0
Mass of Seed	57%	52%
Mass of Lint	38%	36%
Mass of Waste	5%	11%
Allocation of environmental burden to lint	87%	87%
Allocation of environmental burden to Seed	13%	13%

Apart from material inputs, the main process input is energy. This is an area where there is some deviation between mission notes and literature. The ginnery visited near Gondar (equipped with saw gins) reported a 70,000 ETB annual electricity bill and a daily lint output of 1,000 quintals. Assuming an annual operational schedule of 300 days and an approximate electricity price of 0.6 ETB/kWh, this results in an approximate estimate of 4 kWh/tonne lint. This is significantly lower than what is claimed in the literature and was not considered representative Funk and Hardin (2017) suggest a value of 35 kWh per bale lint or 154 kWh per tonne of lint. The same authors suggest a value of 156 kWh and 256 kWh per tonne for saw and roller gins respectively. Based on consultation with the economic expert on the team an estimate of 125 and 200 kWh/tonne lint was assumed for saw and roller gins respectively with an assumption that a supplementary back up diesel generator was used, a ratio of 0.3 L per kWh. In order to apply the allocation rate estimated in the tables above, the energy consumption estimates in terms of lint were expressed in terms of seed cotton input with an assumed lint yield of 37%. (i.e. The energy required to produce 1 tonne of lint also produces approximately 1.7 tonnes of seed and waste, requiring the input of approximately 2.7 tonnes of seedcotton).

This impact of processing 1 tonne of seedcotton is allocated to the resultant 0.36/0.38 tonnes of lint based on the allocation rate in the table above (Table 31).

It should be clarified that the emissions due to electricity for Ethiopia was calculated within simapro based on the proportional grid mix of contributing technologies. This is important as hydropower contributes to over 90% of the grid energy mix (EIA, 2019). The occupation of land and environmental impact embodied in the rollers are also an input into the process, for the first ginnery these were estimated on an approximate land area estimate and machinery weight (approximately 20 tonnes per roller). Whilst these are uncertain, the level output and functional life of the facility means these are miniscule when allocated per unit of input. For both ginneries the lint is assumed to be loaded onto a truck via a LPG forklift, with approximate fuel consumption of 6 lbs (2.7 kg) per hour (Toyota, 2020). An average lift time of 3 minutes per pallet (one 185 kg bale per pallet) is assumed as a conservative estimate. The emissions per diesel and LPG use are estimated as standard based on the emission factor published by the UK and are generally representative of diesel (HMGOV, 2019).

It should also be noted that following the ginnery site visit the first ginnery uses sulphuric acid to de-lint seed, with a consumption of 12 L per 100 kg seed. As this process occurs post ginning it is additional step which occurs subsequent to any allocation step. In other words this is not attributed to lint but to the products of seed consumption.

5.2.5 Spinning

After ginning the lint from both ginneries is assumed to be transported 300 km comparable to the distance from the outskirts of Arba Minch to more industrialised setting in outskirts of Addis Abba as it is assumed the spinning is more likely to be undertaken there. Based on existing datasets within Ecoinvent and discussions with the team, 1.3 kg of lint is assumed to be necessary to produce 1 kg of yarn. This study terminates at the yard production stage and therefore does not include additional processes such as weaving, wet processing, dyeing of fabrics. Therefore, the main inputs include energy and lint. The production of yarn itself whilst broadly referred to a spinning encompasses a number of processes including blowing, carding, breaking, draw frame, fringe framing etc. as well as the ancillary use of lighting and a HVAC. This process will be affected by whether the yarn is the finished (potentially requiring specific sizing and winding) product ready for transport/sale or is merely the input to the warping/weaving process. Within the Ethiopian context yarn may be an output or is more likely to be part of the textile process, being an input to the warping and weaving processes (Kurshid et al. 2012). Therefore, the energy required to produce yarn will depend on specific production variables (delivery speed, twist level, spindle speeds and machines efficiencies) a different linear densities (count), with finer yarn generally requiring more energy (per kg) than coarsely spun yarn. Additionally, even with the same yarn count, the energy consumption is high for a high level of twisted yarn (Warp Yarn) and low for low level of twisted Yarn (Hosiery Yarn) for the same yarn count. Hasanbeigi and Price (2012) give an approximate range of 134-672 kWh/100 kg depending on cotton yarn count and whether the yarn goes for knitting or weaving.

With that in mind, two differing spinning processes are reflected. A lower energy consumption is taken from Palamutcu (2010) reflecting a Turkish textile factory whereby cotton spinning includes opening-blending line, a carding machine, drawing lines, a roving machine a, ring spinning machine and winding machine. Taking both lighting and HVAC into account this study estimated an energy consumption of 3.2 kWh per kg yarn. This is comparable to Kurshid et al. (2012) who (in relation to an industrial processing established in Pakistan that involved blowing, carding, breaking, finishing, lap forming, combing and a ringing machine) estimated electricity consumption to range from 3-4.6 kWh/kg for carded and combed yarn respectively. In contrast Dhayaneswaran and Ashokkumar (2013) report on a configuration used in India consisting of a blow room, draw frame and comber machines, speed frame and ring frame machine. The yarn produced in this factory is thinner yarn, with the speed frame and ring frame machine converting the thicker thread into yarn. As mentioned, the production of thinner yarn comes with an associated higher energy consumption estimate of approximately 8 kWh/kg. Following on from these two spinning specific energy consumptions estimates are used, 3 and 8 kWh/kg for Spinner 1 and 2 based on the production of mid and thin-weave yarn. In both cases the energy is assumed to be provided by electricity.

5.2.6 Oil production

In addition to the production of yarn this analysis includes the production of crude cotton oil through the operation of an oil mill. This analysis is undertaken based on survey information obtained from Addis-Modjo Edible Oil Complex S.C. It is assumed that the seed is sourced form the first mill and is transported 50 km.
In this case the data on energy consumption (electricity and petrol) is provided in terms of oil output. However, in order to be allocated into the other co-products these results had to be expressed in terms of cotton input. Therefore, the estimate of 723 kWh per tonne of crude oil output (based on the provided oil yield of 13%) was taken to refer to 7.8 tonnes of seed input, yielding 0.13 tonnes of oilseed and 0.64 tonnes of cake. (The implied total annual energy demand based on mill survey returns is compared with an approximate estimate derived from electricity bill in order to check accuracy before estimating energy in terms of process inputs). A similar approach was utilised for process diesel consumption. As with ginning outputs the upstream embodied and direct process emissions are allocated amongst co-products based on their relative volumes and value (61,968.57/ton of edible oil and Birr 5,522/ton cake in 2018/19). Using this data, the main material input and output and exergy flows of the existing SimaPro crude oil mill operation were replaced to reflect Ethiopian context, whereas the water consumption and additional material requirements (such as small quantities of chemicals and lubrication oil etc) were retained. Diesel emission factors (kg per kg diesel consumed) were taken from Li et al. (2018) referring to combustion in an agricultural furnace/boiler. The crude oil is assumed to be transported 200 km to a refinery where it is refined into edible oil. This utilises the existing refined cotton production system within Ecoinvent, with the electricity substituted by electricity from the Ethiopian Grid.

5.3 Results

The inventory flows into and out of each main component of the cotton value chain were quantified as in the previous tables. The resulting inventory results were expressed as impact category scores using the IMPACT2002+ assessment method whereby results are converted into values equivalent to a defined environmental indicator by impact category (Climate Change, Resource Depletion, Human Health, Ecosystem Quality) and a single indicator score. The single indicator score is entitled the milipoint and is an aggregated score derived from each impact category whereby each “point” is one thousandth of the environmental burden experienced by an average European. The results are summarised in the figure and tables below. SHRF1 and 2 refer to the first farm and second farms (small holder with organic and chemical inputs respectively) whilst LCIR refers to the large sale irrigated farm.

As mentioned, because of nutrient requirements, and the level of inorganic inputs and the uncertainty on what can be reasonable be expected to be delivered from the soil pool (i.e. how fertile the soils are and the benefits gained during the fallow period), all farms are assumed to benefit from organic amendments, especially the first farm for whom 50% of N is assumed to be delivered via this mechanism. Due to the low N content (including N availability) this results in a large quantity being required which increases the uncertainly associated with embodied impacts as the form of organic inputs may vary. Residues and compost on the farm will likely have a lower embodied impact than dedicated hay or manure for example. **For that reason, each farm impact is recalculated without the embodied impact of fertiliser and is distinguished by ‘*’**.

The distinction between sub-chains is arguably clearer when expressed in individual damage categories (Jolliet et al., 2003). Climate change impact is measured in CO2 equivalents. The “human health” damage category is the sum of the midpoint categories “human toxicity”, “respiratory effects”, “ionizing radiation”, “ozone layer depletion” and “photochemical oxidation”. Human health impact is expressed in “DALYs” which is the disability adjusted life year which is a measure of active years of a person’s life which is lost due to ill-health, disability or early death. This category is influenced by respiratory effects caused by inorganic substances emitted into air. The “ecosystem quality” damage category is the sum of the midpoint categories “aquatic ecotoxicity”, “terrestrial ecotoxicity”, “terrestrial acid/nutr”, “land occupation”, “aquatic acidification”, “aquatic eutrophication” and “Water turbined”. Ecosystem impacts are measured in the % of potentially disappeared (PDF) species per area. The damage category “Resources” is the sum of the midpoint categories “non-renewable energy consumption” and “mineral extraction” and is influenced by non-renewable energy consumption.

It should be noted that any impact assessment method is dependent on the translation of individual inventory flows into defined equivalents (e.g. individual flows are translated into Vinyl Chloride and Triethylene-glycol equivalents which are translated into % PDF). This means that specific flows will have a greater impact than others, for example land use appears to have a greater impact on ecosystem quality than nutrient loading.

TABLE 32 : IMPACT ASSESSMENT CATEGORIES

Damage category	Impact category	Factor	Unit
Human Health	Carcinogens	2.80E-06	DALY/kg C2H3CL eq
Human Health	Non-carcinogens	2.80E-06	DALY/kg C2H3CL eq
Human Health	Respiratory inorganics	7.00E-04	DALY/kg PM2.5 eq
Human Health	Ionizing radiation	2.10E-10	DALY/Bq C-14 eq
Human Health	Oxone layer depletion	1.05E-03	DALY/kg CFC-11 eq
Human Health	Respiratory organics	2.13E-06	DALY/kg C2H4 eq
Ecosystem quality	Aquatic ecotoxicity	5.02E-05	PDF*m2*yr/kg TEG water
Ecosystem quality	Terrestrial ecotoxicity	7.90E-03	PDF*m2*yr/kg TEG soil
Ecosystem quality	Terrestrial acid nutrification	1.04	PDF*m2*yr/kg SO2 eq
Ecosystem quality	Land occupation	1.09	PDF*m2*yr/m2org.arable
Climate change	Global Warming	1	kg CO2 eq/kg CO2 eq
Resources	Non-renewable energy	1	MJ primary/MJ primary
Resources	Mineral extraction	1	MJ primary/MJ surplus

5.3.1 Results at the farm

In the first instant results for seed cotton are compared up to farm gate. As can been seen from the results when expressed in millipoints (mPT) the small holder with inorganic inputs exhibiting a higher estimate. The results dominated by the Ecosystem quality category which is significantly reduced then the embodied impact of supplying inorganic fertilizer is omitted. This is reflective of land area required to provide hay (and manure) as well as the difference between Ethiopian yields and the European crop yields which inform the impact assessment. The comparison of different farming systems is not straightforward. A significant issue is land use. Farms 1, 2 and 3 have a yield of 1.3, 1.6, and 2 ha respectively on an annual basis. However, the maintenance of fallow is included as an additional input with the assumption that double the areas of cultivated land is needed for the first farm, with the rest needing an equivalent area as cultivated land. Furthermore, the comparison is complicated as, regardless of source of the inputs the basic nutrient requirements of the plant are the same. Therefore, given the differences in input type nutrient content and nutrient availability, a small portion of inorganic fertilizer is equivalent to a larger quantity of organic inputs. How different impact methods deal with the impact embodied in such elements as land (fallow and cultivated) and nutrient carriers will affect the extent to which different cultivation systems are represented.

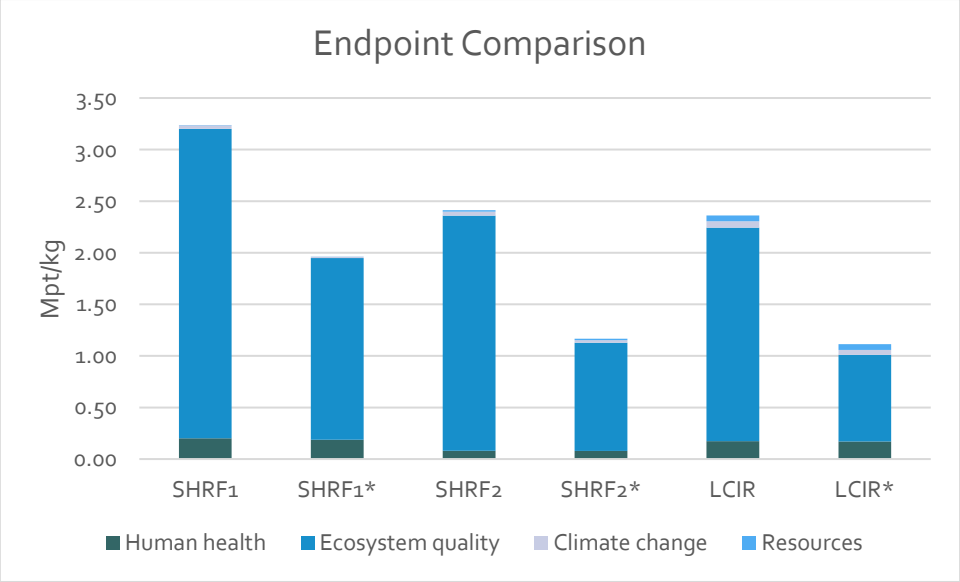


FIGURE 27 : ENDPOINT IMPACT ASSESSMENT FOR 1 KG OF SEEDCOTTON.

This complexity is seen when comparisons are made across individual impact categories. For the small scale (more) organic farm demonstrates the health impact, a significant portion of (15%) of the health impacts occur embodied in hay and manure provision, the remained are associated with on-farm activities. Assuming an input of manure in sufficient quantities to provide a quarter of the N inputs, this results in a larger amount of N supplied to the farm and a larger ammonia release associated with manure application. If both embodied impact due to organic provision and direct NH3 emission were to be eliminated (i.e. minimal additional land requirements and no manure use), the human health score associated with the cotton from the first farm would reduce by approximately 90%.

At this point it should be reinforced that lifecycle impact scores in themselves are reflective of the intensity of impact per unit of output but not scale and does not reflect sustainability as the absolute impact at local is a much more meaningful impact.

TABLE 33 : LIFECYLE IMPACT SCORES OF 1 KG OF SEED COTTON

Damage category	Unit	SHRF1	SHRF1*	SHRF2	SHRF2*	LCIR	LCIR*
Human health	DALY	**1.43E-06**	**1.33E-06**	**5.72E-07**	5.55E-07	**1.22E-07**	1.21E-06
Ecosystem quality	PDF*m^2*yr	**41**	24	**31**	14	**28**	12
Climate change	kg CO_2 eq	**0.34**	0.13	**0.51**	0.24	**0.61**	0.47
Resources	MJ primary	**0.4**	0.013	**2**	2	**9**	9

* denotes exclusion of embodied Organic fertiliser impacts

Regardless of whether embodied impacts due to organic fertiliser are included the second farm exhibits a significantly lower health impact due to lower impacts at the field level (no particulate emission, lower ammonia output as manure is not applied). When the impacts embodied in organic fertiliser are retained, approximately 60% of the health impacts occur at the field. Approximately 10% of embodied heath impacts are due to the production of nitrogen containing chemical fertiliser. In the third farm, the majority of health impacts occur on the farm, reflective of emission from the field, especially particulates due to fuel combustion.

In all cases the large quantity of hay requires to provide approximately 25% of the input contributes significantly to the score as it is estimated to require 8 tonnes of hay (due to the low N availability) requiring more than 1 hectare. When this is omitted the differences in ecosystem quality are equivalent to land requirements based on yields and the assumption of fallow requirement.

Comparisons of resource and GHG emissions is arguably more simplistic, as impact scores increase from farm 1 to 3 as farms move from using only organic inputs to requiring significant energy for tractors and irrigation pumps. However the occupation of land to provide the large quantities of hay (reflective of the low N availability) necessary, is also a source of on-field N_2O emissions, approximately 0.2 kg CO_2e/kg cotton. It should be noted that when the emissions embodied in organic fertilizer provision (hay and manure production) are removed from the first farm GHG emissions remain associated N_2O from N inputs including the conversion of a portion of NH3 emissions due to manure. However, it should also be stated that the climate change impact value includes the negative flows of carbon embodied in cotton seeds. Due to the intensity of the other activities removing the emissions embodied in hay has a proportionally lower impact on GHG impact of cotton produced from the third farm.

This comparison is more dramatic if the third farm score (including hay provision) is compared with the first farm in which the resources embodied in hay and manure is removed. This is unsurprising when in the absence of processing of organic fertilizer and the first farm has minimal nonrenewable resources whereas the third farm has significant energy demands for both tractor and pumping demands. As can be seen the removal of embodied impacts due to hay (in the case of third and second farm) has a negligible effect on the resources impact score as it was assumed that hay was manually harvested. The differential in the first farm is due to assumed impact of manure storage infrastructure which might not be applicable in the Ethiopian context.

5.3.2 Results per yarn

The cotton seed leaving the farm is integrated into 3 value subchains, the first involves seedcotton from a small holder farm with externally sourced organic fertiliser and subsequent hand ginning and spinning with limited additional transport. The second cotton sub chain assumed seedcotton leaves the small sized farm with higher inputs and is assumed to be transported 20 km (via a small truck) to a **ginnery** with saw ginsand subsequently transported 300 km to a textile mill that produces coarser yarn. The final sub chain reflects cotton leaving a large irrigated farm, being transported on a truck 50 km to a ginnery which has a roller gin and subsequently transported 300 km to a textile mill that produces finer yarn. It should also be noted that due to the seed to lint ratio, differences between the impact of cotton leaving the farm are magnified along the value chain to the final product.

Health Impact

In terms of health impact traditional yarn demonstrates the highest value with the majority (>80%) of the impact associated with activities on farm and as mentioned is very sensitive to NH3 emissions due to the use of manure. For the second sub-chain which demonstrates the lowest impact per yarn, 55% of embodied impacts occur on the field, with 12% of the impacts associated with organic and inorganic fertilizer inputs at the farm. For the final yarn sub-chain the total value is comparable to traditional yarn, 70% of the heath impact occur at farm associated with particulate and ammonia emissions on farm, 10% of the total impact is associated the provision of on-farm products (fertilizer hay diesel) as well as diesel use during the ginning.
Ecosystem Quality

As mentioned before this score is due to the land area requirement, including hay, fallow and direct occupation. The land required to provide hay is estimated to 41%, 54% and 60% of the impact score for yarn respectively. **Removing the embodied land in organic fertilizer provision** results in a score differential that is proportional to land occupation. (i.e. Including fallow, the first farm occupies 2.3 times the land as the second farm with an equivalently higher Ecosystem Quality score for yarn produced via this route).

Climate Change and resource use
In terms of climate change there is a clear distinction between sub chains. The traditional value chain demonstrates a lower emission factor **overall (per kg yard)**. However in comparison with other sub-chains with other over 50% of the impact score is attributed to N_2O associated with on field emissions, due to N inputs from organic fertilizer, soil N input, emissions embodied in hay conversion of ammonia etc. In the

second value chain N_2O emission due to hay and cotton cultivation contribute to 47% of emissions, with inorganic fertilizer production and transport/diesel use contributing to approximately 10% respectively. The final value chain demonstrates the lowest relative contribution of N_2O to emissions (33%), with 56% of emissions due to hay provision or on-field due to N inputs and energy use. Emission embodied in inorganic fertilizer and diesel production account for 4% and 5% respectively. The ginning process is estimated to contribute 7% of emissions. Given the diverse routes by which energy can be embodied there is no clear element which contributes to the majority of resource use but the distinction between the first second and third in terms of energy required on the farm as well as processing ginning, spinning and transportation. (The small estimate for the first value chain is based some use of on farm energy used to prepare the pasture land). Comparing the GHG and resource scores for second and third value chain demonstrates the impact of a low carbon energy source. Due to increased on-farm and process energy, yarn produced via the third sub-chain is estimated to result in emission estimate that 1.7 times greater than the second case study despite demonstrating a resource intensity that is over 3 times greater.

TABLE 34 : COMPARISON OF MIDPOINT ASSESSMENT SCORES PER KG YARN ACROSS MAIN SUB-CHAINS

Damage category	Unit	Sub Chain 1 (from traditional rainfed farms)	Sub Chain 2 (from high input small farms-rainfed)	Sub Chain 3 (from commercial farms-irrigated)
Human health	DALY	5.07E-06	1.91E-06	4.21E-06
Ecosystem quality	PDF*m^2*yr	144	94.9	90.9
Climate change	kg CO_2 eq	1.25	1.43	2.41
Resources	MJ primary	1.84	10.9	34.6

By way of a sensitivity assessment the results of yarn were recalculated using seed cotton in which the embodied impacts of organic fertilizer are removed. This resulted in a significant reduction in ecosystem quality and climate change, particularly in the first value chain. However at this point it should be reiterated that the nutrient demands of cotton remain fixed and would have to be met by whether by organic, inorganic fertilizer or the soil pool.

TABLE 35 : IMPACT REDUCTION WHEN EXCLUDING IMPACTS EMBODIED IN ORGANIC FERTILISER

Damage category	Unit	Sub Chain 1 (from traditional rainfed farms)	Sub Chain 2 (from high input small farms-rainfed)	Sub Chain 3 (from commercial farms-irrigated)
Human health	DALY	7%	3%	1%
Ecosystem quality	PDF*m^2*yr	41%	54%	59%
Climate change	kg CO_2 eq	61%	31%	19%
Resources	MJ primary	75%	0%	0%

5.4 Water Use

At this point the issue of water requires special mention. Within the method described above the impact of resource use is assessed based on the quantity of non-renewable resource use. However, that is arguably not the most effective indicator of water use. In addition to the results presented above, the production of yarn in both the second and third sub chain (reflecting a rainfed and irrigated farm) were re-assessed using a water footprint methodology published in Boulay et al. (2018).

Available Water Remaining per area in a watershed after the demand of humans and aquatic ecosystems has been met. It assesses the potential of water deprivation, to either humans or ecosystems, building on the assumption that the less water remaining available per area, the more likely another user will be deprived. Within this study it is assumed (as a simplifying factor) that three times the water deficit due to lack of sufficient rainfall is applied to crop area. When results are estimated using the above method the resulting

water footprint value is estimated at **2.92 and 190 m3/kg cotton** for the second and third farm respectively, demonstrating the impact of irrigation. It needs to be clarified that the results presented above include the use a **weighting factor** based on a specific definition of regionalised water scarcity and therefore should not be considered as reflecting the actual quantity of water consumed. Equally, alternative methods will result in different results. Therefore, the absolute results are in this context less important than the relative difference between an irrigated and rainfed system.

In addition, as not all the irrigated water will be lost as some of the water applied to the field will return to the acquirer. However, given the nature of the soil on which cotton is grown (black and often cracked) and the climate it is likely that most of the water applied will be lost through evaporation. However, this issue is complex the availability of irrigation water arguably is one of the aspects which enhances the seed-cotton yield in the irrigated farm which ultimately will reduce the impact per unit of seed cotton output. Therefore, it could be argued that a trade off for higher yield (and reduced impact in some categories) is a greater water resource demand. Regardless of the specific tools being applied to develop appropriate indicators of water use, the issue of cotton's water demand is well known. Cotton has been identified as having one of the highest water footprint per quantity of agricultural output (Chapagain et al. 2006).

As mentioned earlier in this section cotton requires approximately 1000 mm of rain to be viable. This is important within an Ethiopian context, as in drier regions (such as in the highlands) the loss of water from the field by evapotranspiration is high during the cotton growing season. Therefore, irrigation is essential during the growing season in drier regions to maintain and enhance crop strength, fiber quality and yield (Dağdelen et al. 2006). Berhanu et al. (2014) demonstrate the regions that are more likely to require a greater irrigation load when cotton is grown (Figure 28).

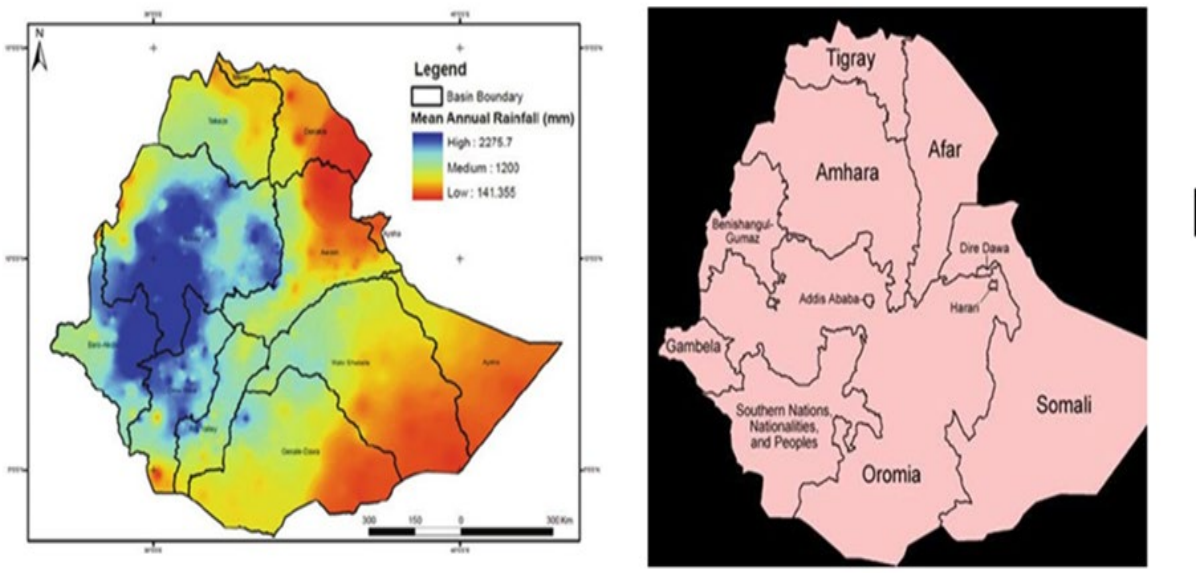


FIGURE 28: SPATIAL VARIABILITY IN MEAN ANNUAL RAINFALL TAKEN FROM BERHANU ET AL. (2014).

Within this study it is assumed that the irrigation demand is based on the shortfall between rainfall (in this case 700 mm per annuum) and cotton demand and the level of irrigation efficiency. Therefore, the actual level of on farm irrigation will vary significantly across Ethiopia based on climatic conditions and farm management. A more arid region would require significantly more irrigation water to sustain viable yields. In this study it was assumed that more irrigation water than is theoretically required by the plant was applied. In the absence of quantified measurements of on farm water use it is difficult to assess the range of current water demand estimates in the Ethiopian context and the snapshot presented here is likely to be exceeded in more arid regions.

In water deficient areas, the availability of irrigation water becomes a limiting factor for yields, whereby the limited availability of irrigation may require improvement in irrigation management or implementation of

water saving techniques. The presentation of water use per unit of output can be misleading as the absolute quantity of water consumed in a locality has significant impact on availability for other users. This is particularly the case where irrigation is intended to maximize yield, but the practice is not sustainable in basins where water is being withdrawn faster than it is being replenished (Farahani et al. 2009). This will exacerbate the local water stress as more users compete for locally limited resource.

Areas such as the Awash basin for example experience both seasonal water stress (with drought conditions occurring every 5-10 years) as well as periodic flooding (Adeba et al. 2015). This would suggest that practices such as water harvesting could potentially play an important role in water management, but this may require collective measures as well as investment at farm scale. Expansion of cotton production is likely to coincide with an increase in irrigation demand in water deficient areas, increasing the risks of soil salinity, with Ethiopia being ranked 7th globally in 2015 in terms of percentage of land area suffering from soil salinity (Adhanom, 2019). The issue of soil salinity arises when farmer use of poor quality water coupled and more intensive farm practices (excessive fertilisation, mechanisation, limited fallow) which damage soil structure and is exacerbated by a lack of on-farm water management practices and adequate (or absent) drainage facilities (Gebremeskel et al., 2018). Increasing salinity and intensification will ultimately result in a reduction in yields and risks a situation where farmers become trapped in a cycle of increased water demand, increased climate vulnerability and decreasing cotton yields.

5.5 Comparison of GHG emissions

Due to the assumptions involved within any complex value chain assessment, comparisons against alternative studies are difficult. This particularly the case for impact categories where many different inventory flows are expressed in terms of a single unit. However, comparisons can be made. For climate change the conversion to CO_2 eq is relatively straightforward. With that in mind the impact of lint from the second chain and third chain is recalculated and compared against the value for cotton lint estimated in CmiA (2014). In order the make the comparison more consistent the same transport distance (250 km) is assumed and the source of electricity is changed from Ethiopian to Gas as Cote d'IVoire derives most of their electricity through gas combustion. Upon these changes 1 tonne of lint is estimated to embody 691 and 1390 kg CO_2 eq depending on whether the emissions embodied in organic fertilizer is included which are comparable to the value of 1037 kg CO_2 eq estimated in CmiA (2014). A higher range of 1,360-1,960 kg CO_2 eq is observed for the third value chain. The difference is due to a number of factors but primarily the differences in the electricity intensity of ginning as well as the resource intensity of the farm activities, which are themselves dependent on yield at the field level.

5.6 Cotton Oil

As an aside the result from the cotton mill incorporating seeds from the second and third sub chains (seedcotton from a high input small holder sent to a spinning gin and seed from a commercial farm sent to a roller gin) are compared against an alternative refined cotton oil based on a generalised account. Because of the very different system (including different oil yields) this is presented on an indicative as the comparison is against a product which is treated as a by-product.

TABLE 36 : IMPACT PER KG OF REFINED COTTON OIL, COMPARED WITH: "COTTONSEED OIL, REFINED {ROW} | COTTONSEED OIL REFINERY OPERATION"

Damage category	Unit	Global	Sub Chain 2	Sub Chain 2*	Sub Chain 3	Sub Chain 3*
Human health	DALY	2.95E-06	1.85E-06	1.853-06	2.92E-06	2.92E-06
Ecosystem quality	PDF*m^2*yr	7.16	41	19.1	41	16.8
Climate change	kg CO_2 eq	1.94	1.31	1.12	1.75	1.54
Resources	MJ primary	25.8	16.4	16.4	26.9	26.9

* Denotes removal of impacts embodied in organic fertiliser.

The first Ethiopian examples demonstrate a lower value for human health whilst all alternatives reflect a lower climate change score which may be due to a less intensive cultivation practice and less combustion of fossil fuels in electricity generation. The most dramatic difference is in ecosystem quality, mentioned previously the land (with its 1:1 ratio for occupation and fallow land) and nutrient intensity of the medium sized farm contributes to a higher ecosystem quality than the existing global estimate. Removing fallow land occupation and the (land use and ghg) impacts embodied in organic fertilizer for the third sub chain would result in a value roughly equivalent to existing global estimate presented above.

It should be clarified that any such calculation is sensitive to the assumptions of seed price used to allocate impact at the ginnery level. Mission notes and discussions amongst the team have demonstrated how the price of seed can fluctuate significantly locally. A higher price of cottonseed which means that a potentially larger portion (than in (CmiA, 2014) for example 2014) of both the impact of ginning as well as cottonseed production is allocated to cottonseed. As most of the impact of growing seedcotton is allocated to lint, the low oil yield (12.5% for the Ethiopian) exacerbates the differences in impact at the farm level.

5.7 Conclusions: Is the cotton value chain environmentally sustainable?

This is not a straightforward question to answer given the range of environmental impacts and how they are measured and the production context. This answer would appear to be yes and no.

Taken at face value, the end point results, as expressed in a single unit, suggest that traditional farms without chemical fertiliser are less sustainable than those which utilize large amount of energy and fertilisers, contributing to higher yields. A lack of chemical inputs translates into a higher demand on land (direct and embodied) resulting in the highest overall score based on the impact assessment method applied. This is not the same as stating that a system based on, organic fertiliser is less sustainable than alternatives but rather it places the burden on the locally available nutrient pools.

Therefore, in the first instance there exists an option for low impact yarn production that has significantly lower impacts if supported by small scale rainfed cultivation and traditional hand ginning and spinning. In this context the main contributor to lack of sustainability is the higher land intensity associated with a lower yield. Given the issues of scale, it is unlikely that the traditional sub-chain can replace the scale of the mass market, but there are opportunities for expansion. In order to capitalise on this and reduce the land use impact there is a need to increase yields without relying on excessive chemical inputs. In addition, large quantities of organic inputs can increase the impacts on ecosystem quality and human health impacts. An ideal situation would result in the supply of practices which increase yield through low impact locally sourced organic fertiliser and without recourse to irrigation. Utilising available resources such as organic residues could assist in that aspect. In that regard perhaps it is more appropriate to suggest that traditional cotton with adequate fallow period and measures to prevent soil erosion could be **sustainable where there is land** availability. The low quality of organic fertilizers has already been identified as a challenge, and the results of this study suggest that where large quantities of organic fertiliser are required they will embody ecosystem quality, GHG and human health (if depend on manure) impacts.

Comparing endpoint and midpoint results for seedcotton demonstrates an initially contradictory assessment. Due to the prominence of ecosystem quality score, the most intensive farm appears to have a lower score than the organic farm when expressed in mPts. As this unit is expressed based on relative to a European baseline this may be attributed to regional differences in both yields and the distribution of crops. When expressed in individual impact categories increasing intensity does appear to result in an increased impact, with exceptions such as the aforementioned ecosystem quality, and human health in the case of higher input small holders. In these cases, the relative results are sensitive to assumptions on yield, and fertilizer use. (As mentioned previously removing the impact of hay production and ammonia emissions due to fertilizer resulted in an equivalent human health score for both higher input small holders). In the regard LCA impact score are more reflective of eco-efficiency as opposes to the actual impact on the receiving environment.

The impact of increasing intensification is much more apparent for resource use and climate change associated with on farm energy for pumping and tractor use. Given the need to limit greenhouse gases and reduce soil erosion, improve infiltration and enhance organic matter, it can be argued that despite demonstrating a lower single score (in mPts) than the small holder, the more intensive farm embodied less sustainable practices. One of the important aspects of this analysis is that following farm responses during the mission, both high input small scale and large scale commercial farms have similar levels of input (per hectare) for fertilisers and key pesticides, resulting in greater impact per kg associated with these activities. The activity which contributes to yield differentials, namely irrigation, may result in a lower environmental impact in the short term, but reflect lack of sustainability in the longer term.

Therefore, the results are very sensitive to assumptions on yield and land use and should be viewed in that context.

The distinction between intensity becomes more apparent when results are compared per unit of yarn. With the exception of the aforementioned ecosystem quality, yarn produced from a traditional sub-chain has a significantly smaller impact. Equally the comparison of more energy intensive processes sub-chains demonstrates a doubling of resource and climate change impacts. It should be noted that as most ginneries in Ethiopia are saw gins and that the yarn produced from the second sub-chain (from high input small farms-rainfed) (with its lower resource and climate change score) is more typical. The higher ecosystem quality score is attributed to the land intensity associated with a lower yield and a higher fallow ratio. If yields could be increased without additional input requirement (and reducing the fallow ratio) then ecosystem impact score of the yarn produced by the second sub chain could be significantly reduced. In that regard there may be an opportunity for application of conservation agricultural practices to enhance yields and develop low impact routes for nutrient supply which assist in making cotton supply more sustainable.

One of the benefits of the Ethiopian value chain is the dominance of hydro-electricity in the electricity grid. This manifests in a lower GHG impact for Ethiopian cotton from the second sub-chain (which is more comparable as it assumed a Saw Gin) than the alternative presented in CmiA (2014). One of the main drivers of GHG emissions in that case is transport distance. In particular, the concentration of ginneries in Oromia and Amhara means that it is likely that seedcotton can be transported significant distances if local production cannot mean ginning demands.

One of the weaknesses of the impact assessment method applied is the inability to fully quantify the impact of water consumption. With changing climate and shifting rainfall patterns it likely that expanding cotton supply will increase irrigation demand and vulnerability to climate change impacts. Equally increased irrigation will increase the impact of soil salinity on yields and soil health. The extent to which irrigation is unsustainable will depend on several factors; including rate of withdrawal, rate of water recharge, efficiency of irrigation systems, competing water demands etc. However, it is difficult to consider irrigated cotton to be sustainable in the absence of dedicated water management systems including water saving irrigation practices and (where possible) rainwater harvesting.

Finally, it should be reiterated that expressing and comparing environmental impact scores in relative units is essential for comparisons against different product routes, the actual impact of resource consumption will depend on the absolute impact. Large scale farms will concentrate impacts locally. So whilst a large scale farm may (due to its higher yield) demonstrate a lower impact per kg of cotton than a small scale farm with the similar inputs but a lower yield, the local impacts (such nutrient loading or irrigation demand) will be concentrated, placing additional pressure on local carrying capacity.

6. Conclusions and recommendations

6.1 Summary of main features of the VC

Our SWOT analyses comes to the following main characterizations according the field of Strength (S), Weakness (W) (as they are now), as well as the projected Opportunities (O) and Threats (T):

TABLE 37:SWOT OF THE FUNCTIONALITY OF THE VC

S	**O**
Comparative advantages related to land availability, water for irrigation, labour, electricity rates and availability, complete VC including Industrial parks. Well established value chain and practices with relatively autonomous sub-value chains Examples of low input requirement on farms. Increasing cases of good practice and knowledge transfer amongst farmers in relation to sustainable production. A viable structure of governance exists on paper (design, strategy, plans etc.). Relatively good cotton yields by SCF (highest in Africa with about 600 kg lint /ha in (RF) (second highest in SA on with 740kg/ha in IR (irrigated)) Government incentives Lower carbon intensity of the national grid reduced the impact of electricity intensive manufacturing processes. Existing domestic practice, tradition and skills covering the whole VC from cotton up- to fashion. Good integration with commercial livestock farms.	Increase in demand for quality lint. Using the VC as a vector of sustainable economic growth. More research and development (WERC). Use of the cottonseed products (oil, cake) for food security and economic development. Better training of stakeholders across the VC (address skill gaps) leading to higher availability and use of inputs and higher efficiency. Organisation of farmers (to enhance profit for farmers and increase attractivity for cotton). To use cotton as a strategic cropping system for FNS and enhance share of sustainable cotton (particularly organic). Develop capacity for quality product garments (for export market). More selling of traditional garments for global market including to diaspora.

W	T
Lack of market transparency. Poverty of small-scale cotton producers. Unclear roles between the involved ministries (mainly Industry and Agriculture). Sub-optimal cooperation. Limited quality and quantity of domestic cotton. VC research inefficiencies and lack of monitoring (system). Cotton is considered by MoAL as a non-strategic crop (= neglected crop) Oil seed potential overlooked. Low quality of seeds (only one new successful cottonseed variety developed) and underfunded research. Low ginning outturn and outdated ginning equipment. High requirements for irrigation in rain-deficient areas.	The (land use) competition with food crops will not allow the expected expansion of the cotton area (> 1 million ha). Communication breakdowns of the various stakeholders leads to partial paralyses and delays. Imbalances between the natural environment (biodiversity, water) and modern agriculture destabilizes the ecosystems irreversibly. Violent social conflicts for scarce land. Further discriminations against pastoralists. Declining soil fertility and risk of erosion on large mono-cropped surfaces. Climate impact on cotton fibre quality.

6.2 How sustainable and inclusive is the CV and its sub-chains?

Is the cotton value chain sustainable as a whole?

Yes and No. The operation of the cotton value chain requires acceptance of trade-offs across the social, economic and environmental spheres. The VC activities seem profitable and economically sustainable. However, the sustainability for ginners will depend on sufficient and therefore increased production (cotton availability) and productivity at both ginning and farm levels. Related to the issue of cotton availability, for all producers, long-term economic sustainability will depend on the competition with imports and consumer's recognition and demand for quality. The full potential of the producers to more sustainably expand output is not well exploited. For example, better training and advice, better access to inputs and smarter farming design through combination with rotation crops and soil fertility management measures could improve both income and sustainability of most farms. Examples of good practice exist (such as coordinated organic cultivation and certification schemes) but these often require both collective agreement and sufficient external support. A better cooperation among the involved service providers, mainly from the public, as well as the other stakeholders, has the potential to significantly improve the sustainability of the VC.

Therefore also, from the social perspective, the answer is both yes and no, depending on what perspective and what segment of the VC is considered. The conditions around the large commercial farms, including the working conditions are not socially sustainable. Neither is the current configuration of land and water rights and how this manifests in the relations between the interconnected (and potentially competitive) hierarchical levels of the VC actors, sustainable. Most workers are only staying employed in both farm and factory, because of lack of locally available alternatives. As the VC does not offer incentives to the employees and is not contributing to valuable skills, the situation from the employment side is rather unsustainable. In addition, pastoralists and indigenous people, with a reduced bargaining posture and leverage, are often victims of cotton projects where foreign investors are involved. There are no or poorly executed mechanisms in place to mitigate the impacts of social conflicts (e.g. reduced access to resources). As a special case, it is recognised that Women employed in the textile factories have unsatisfactory working conditions. The high turnover and the difficulties to hire sufficient staff in these facilities indicate socially unsustainable conditions. Therefore, the VC can hardly be considered to enhance the low social status of women in these areas. As ever, the situation is complex, from a socio-economic perspective there are positives through income opportunities, the contribution of cotton to more diversified farming (at least on SCF areas) and even potentially to enhanced soil fertility (reported in Amhara and Tigray) and to the industrialization and job

creation in various urban areas all over the country. The traditional part of the VC with the booming textile and apparel sector contributes with the Ethiopian cloths significantly to the nation building and national identity. Larger segments of society- urban dwellers, foremen, middlemen, entrepreneurs- and investors benefit from the VC.

In terms of environmental performance despite demonstrating a higher single unit environmental impact score than the most intensive production options, the traditional low input rainfed cotton production is more likely to be considered sustainable if land occupation can be managed or mitigated, in other words if yields can be increased with the **surplus** resources available locally or on the farm. (The impact of land occupation will depend on local context, and land availability. In many regions, a lack of suitable land at a local level is a significant concern) For lower input farms, the main contributor to the impact is due to land occupation and demand for fallow (associated with lower yields) which dominates the single score. The cotton cultivation in sesame dominated areas contributes through the rotation effects to positive impacts on soil fertility and hence income. Use of organic manure fertiliser also contribute to human health impacts through ammonia volatization. The issue of land utilisation/occupation and is complex as increasing yields is challenging since Ethiopia already performs well in comparison against other African countries in terms of yield. Not sustainable is the insufficient technical and institutional support for the farms, particularly the still low level of engagement for sustainable cotton and textile products. More mature routes for organic fertilisation may reduce fertiliser cost and reduce the demands placed on the soil poll, which is in itself not sustainable. In addition, there is a need for new seed varieties to be made available to the producers in order to better achieve increased yields, to improve the profitability of producers and ginners, but also to respond to the risks of the ongoing and future climate change, such as increased temperatures and water availability.

In relation to organic cotton production there is a weakness across the VC whereby whilst the market and demand is increasing over the past 10 years, but the response from Ethiopian stakeholders (and growth in organic output) is still hesitant. This lack of leadership to exploit the potential for a promising trend and emerging segment of the market is regrettable. But this indicates as well the difficulty in managing trade-offs in a complex socio-ecological context, characterized by hierarchical institutional conditions and fragile socio-political processes.

Comparisons across individual environmental, economic and social impact categories demonstrates that with exceptions (such as the ecosystem quality issue mentioned above), large-scale farmers have a higher impact than small-scale farmers. This issue is exacerbated where small-scale farmers have the same inputs (e.g. kg N per hectare) as larger scale farmer, with bigger yields. This manifests as the higher impact for small holders in some impact categories. The most unambiguous differentiation between farms types is in relation to energy use and greenhouse gases, which demonstrates a clear distinction between small scale and large-scale farms, the latter of which demonstrates significantly high resource and GHG impacts. This is a significant environmental impact and it is difficult to consider this as being sustainable given the need for all sectors to decarbonise.

The comparison of farm types and the impact of yield is closely related to the issue of water use. Where rainfall is not sufficient to cultivate cotton (like in Afar and SNNP), irrigation is required. Where there are additional local water demands by other farmers or industry, or water reservoirs are depleted at a higher rate than it is replenished is fundamentally unsustainable. The demand for irrigation is also related to the risks of soil salination if not properly managed. The challenge for Ethiopia will be to expand output without recourse to additional inputs for material and energy. Despite its effect on the environmental impact score described in the environmental analysis, the occupation of land itself may not necessarily be unsustainable, i.e. a lower yield produced by an organic system that enhances soil fertility and builds soil organic matter is arguably to be more sustainable than a more intensive system that requires less land. The existence of apparently viable organic and low impact practise (e.g. successful implementation of molasses traps against some pests) means that there is evidence of effective and sustainable skills than can be transferred amongst different farmer groups. The higher employment rate and food production efficiency per surface by the SCF as compared with the mechanized large farms is a clear social trade-off to the advantage of the family farms and against the mechanized commercial large-scale farms. If it comes to new land occupation for cotton, the indigenous peoples and herders need more recognition as partners in the planning process and trade-offs will be required.

Moving beyond the farm stage the economic sustainability for ginners will depend on increased seed cotton production and productivity (i.e. better access to high quality seed and decreased lint losses).Within the processing of seed cotton into the lint and yarn the allocation of impacts in this instance is sensitive to assumptions on the prices of various commodities, for example local cottonseed and seed prices are higher than in other African market which has an impact on the sustainability and viability within the global market. The main drivers for impacts post farm are energy use, trade-offs and competition between other crops (like sesame, banana, wheat), low salaries for factory workers, governance at both federal/national and local level and low efficiencies at ginning and spinning level. The latter is important as waste, (e.g. plastic contamination) and losses at the spinning and ginning level compound the impact of a lack of sustainability in the earlier stages of the supply chain.

Regarding inclusiveness, the cotton VC has a great potential to create jobs in the country as it provides direct waged employment to many people, but mostly unskilled jobs. Also, as for most countries in Sub-Saharan Africa, the cotton VC does not escape the country's overall situation characterised by a markedly uneven income distribution. The lack of inclusiveness of the VC could be explained by the strong dualism in the whole system between traditional and commercial systems. The organisation of the cotton VC has an obvious effect on the diversity of prices along the chain and thus on income distribution.
The growth is not inclusive. Mainly at two distinct fronts, the large commercial farms producing cotton and the modern textile factories employing cheap labourers (mainly young women) are the weak points to be addressed. The commercial farms, mostly set up in areas dominated by pastoralists or traditional farmers, by leases negotiated without the involvement of the indigenous or newly settled people, exclude these groups from economic growth. At the factory level, the low wages and poor career opportunities, particularly for women, reduce the inclusiveness. But even the traditional weaving sector, employing child labour and reducing their chances for a fair education and better economic prospects, reduce the social impact of the VC induced economic growth.

Is the Ethiopian cotton VC worth supporting?

The conclusions of the economic, social and environmental analyses on the profitability, competitiveness and sustainability of the Ethiopian cotton value chain for the 2018/2019 season under review are mixed. However, the cotton VC deserves to be supported in light of its production potential, which is largely under-exploited.

Indeed, the margins of progress are considerable both in terms of productivity and quality of lint as well as of cottonseeds. Varietal improvement is crucial to replace the current ubiquitous obsolete variety with high-yielding (in terms of ginning outturn and oil content) varieties, better adapted to the various regional irrigated or rainfed conditions in a climate change context as well as to the requirements of low and no-mineral fertilizer production systems and better suited to the requirements of the textile industry.

Tapping the full potential would require to improve the policy and institutional environment and to increase transparency along the value chain, to better coordinate the actions of the numerous stakeholders and to better integrate the cotton value chain with the upstream supply chain and with the oilseed and livestock value chains. Support is needed to raise the efficiency and competitiveness of the cotton VC and to promote an environmentally and socially sustainable cotton supply chain.

The manufacturing sector is expected to play a key role to achieve Ethiopia's target to reach the middle-income country status by 2025 or 2030, and the cotton and textile sector has been identified among the top priorities through export-led growth of the cotton-to-clothing value chain. As demand for cotton increased, the consistent supply of lint at the right quantity, quality and price is critical for the sustainability and competitiveness of the textile sector. Ethiopia has an undeniable comparative advantage arising from very competitive labour and energy costs.

Supporting the upstream cotton value chain to help to address its constraints and leverage its opportunities will contribute to the socioeconomic growth through export-led growth of the downstream cotton-to-clothing value chain. The development of the cotton VC will increase incomes and reduce poverty in rural areas, create

jobs in urban areas, improve the trade balance generating much-needed foreign currency, with positive effects on the national budget.

The traditional cotton sub-chain appears to be profitable, sustainable and resilient and, as such, deserves appropriate support for improving its performance and the social conditions of its workers to fully enhance the potential of its market, which is less subject to external competition than the modern sector and so contribute to food and nutrition security for humans and livestock.

6.3 Major issues: Risks

The risks or bottlenecks, ordered according to the five guiding questions, can be stated in an overview as follows (Figure 29):

Main bottlenecks (risks)

Related to:	Ramifications for Cotton Value Chain
Contribution to economic growth 	• Lack of market and contract transparency • Limited quality and quantity of domestic cotton and Low quality of seeds • Low ginning outturn and outdated ginning equipment
Inclusive growth 	• The further segmentation of the VC could increase the food deficit of Ethiopia
Social Sustainability 	• Poverty of small-scale cotton producers
Environmental sustainability 	• The ongoing climate change is putting more pressure on the water. • Demands placed on land and soil fertility.
Governance and functional features 	• Unclear roles between the involved ministries (mainly Industry and Agriculture) • VC inefficiencies and lack of monitoring system

FIGURE 29: MAIN BOTTLENECKS (RISKS)

1) Lack of market transparency

There is a dangerous lack of market transparency, affecting all stakeholders, and poor infrastructure and labour shortages in some places. It could be argued that there are some elements of "market failure" within the Ethiopian cotton sector. The contractual arrangements between smallholder farmers and ginners are weak, mainly due to a lack of transparency on the part of ginners and weak farmer organisations. The relationship is further fragilised by middlemen (traders). The contracts between investors and the government are not transparent as well and the complaints related to custom and import/export conditions (for spare parts, rights to export/import) indicating risks to reduce the attractiveness of the VC. This lack of transparency contributes to a stagnating cotton production.

2) Poverty of small-scale cotton producers

Increasing productivity and improving quality stands out as a top priority for enhancing the competitiveness and profitability of cotton production in Ethiopia. Poverty of small-scale farmers exacerbates the pressure on farmers to always produce where the market price is attractive and neglecting sustainability practices (sub-optimal rotation, insufficient soil fertility management measures). This makes extension and advisory, already limited by the relative disconnect of the advisors from the VC, more demanding. The risk is that the public sector further neglects this mayor pillar of the VC.

3) Unclear roles between the involved ministries (mainly Industry and Agriculture). Sub-optimal cooperation

The sector is characterised by a general lack of coordination and communication between market segments, which leads to inefficiencies and a reduction in quality. In addition, there is a general lack of/insufficient transparency along the entire value chain, in terms of price and volume of production.

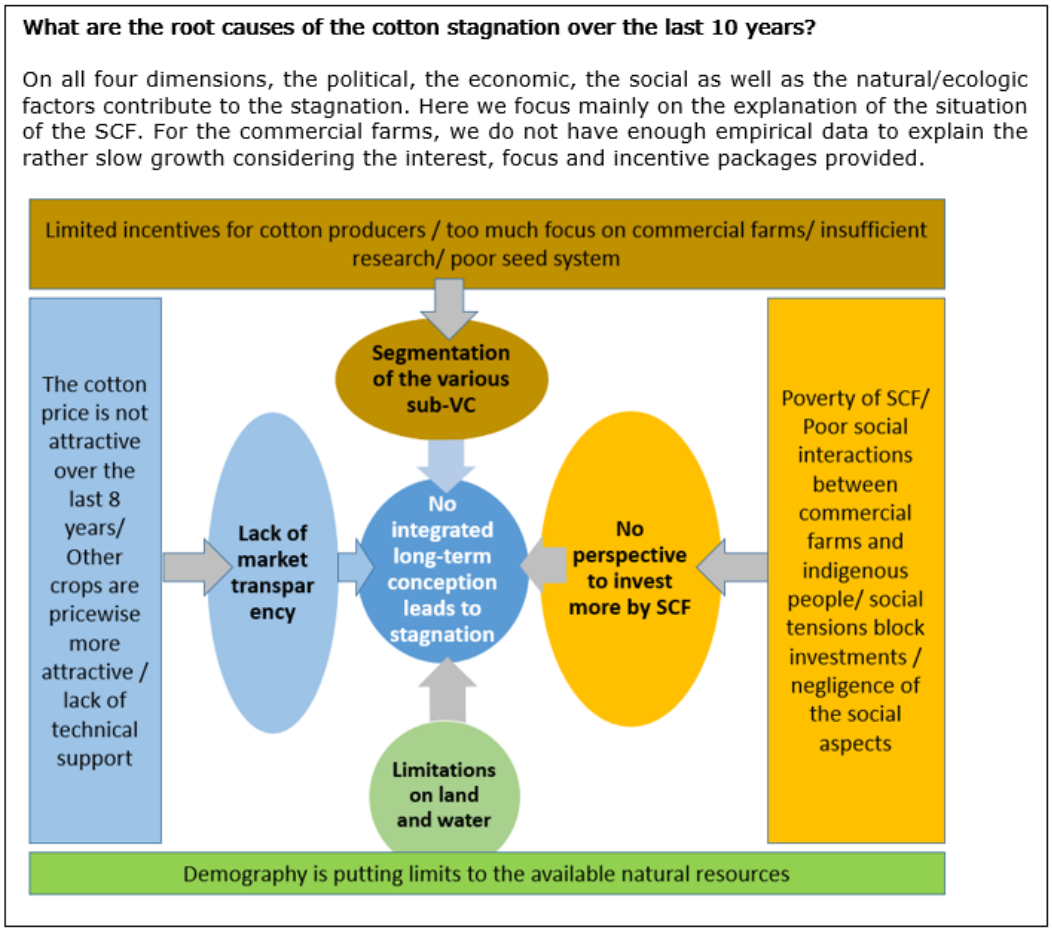


FIGURE 30: CAUSES OF THE COTTON STAGNATION

The main challenge of the cotton sector is the lack of coordination not only between the different institutions and stakeholders but also between the Federal Government and the National Regional States, compounded by a lack of dedication and/or inability to execute given mandates and responsibilities.

Enterprises in Ethiopia cover the entire T&A value chain, from input production to textile manufacturing and clothing assembly. The garment segment is the most advanced part of the value chain, but limited investment upstream has led to capacity imbalances and relatively weak performance in the cotton production and ginning segments. The surface of cotton over the last 2 years is regressing instead of progressing (against the plan).

Other specific constraints of the Ethiopian cotton sector are the relative weakness of farmers' organisations and their lack of experience in the co-management of the sector with the ginning companies. The Ethiopian cotton sector is the most diversified in the world but is also one of the most uncoordinated. Stronger farmer cooperatives and unions could redress this situation.

A major challenge to Ethiopia's cotton sector stakeholders is to ensure that growth is well-linked to other segments, translating into an evolution of the cotton value chain as a whole. This again will only be possible with a clear strategy for the potentially over hundred thousand farmers in cotton areas, considering cotton as a normal multi-functional crop (fibre, oil, animal feed, soil fertility) and fully integrated into the agriculture

and livestock strategies. As cotton is considered by MoAL as a non-strategic crop (= neglected crop), this position should be overcome.

4) On farm resource requirements and climate change

Cotton is an input-intensive crop, and the key challenge for the Ethiopian cotton sector is how to respond simultaneously to the issues of pricing, input (and knowledge/information) supply and extension provision. In particular, expansion of cotton is likely to increase local water stress unless it occurs in regions that allow rainfed cotton to be grown. This is related to issues of climate vulnerability as changing rainfall patterns are likely to change in response to climatic changes. Whether rainfall is reduced or more concentrated seasonally, the end result is likely to disrupt established patterns of cultivation and increase irrigation demand. Other adaptation measures to climate change, like enhancing organic soil matter, are not taken in sufficient consequence by both small and large scale farms. Increased mechanisation in both cotton and organic fertiliser production will increase the impacts of the value chain.

5) Limited quality and quantity of domestic cotton

Cotton quality is affected at both the production and ginning stages of the value chain, and by sub-optimal production, harvest and post-harvest techniques. The fragmented farming system and the low level of education and training facilities at all stages of the VC makes it difficult for farmers and managers to access knowledge and extension services and translate it into skills through participative and experiential learning that would improve these techniques.

The limited quantity and quality of domestic cotton reduces competitiveness and profitability throughout the value chain.

6) VC inefficiencies and lack of monitoring (system)

Production data (areas sown, yields and production) are often unpredictable and unreliable. There is no proper monitoring system for the cotton sector from the production of seed cotton to the use of lint. The MoAL is not involved in the monitoring and important products like cottonseed oil and cake are not even captured. Neither rotation crops nor soil fertility are monitored, both critical for the long-term performance and sustainability of the VC. Therefore, improvements cannot be done in a systematic way.

Productivity improvements would also raise the incomes of both farmers and ginners and increase their incentive to enlarge investments. The full potential of Ethiopian cotton remains largely untapped both in volume and quality.

7) Low quality of seeds and difficulties to find inputs

There is only one new successful cottonseed variety developed over the last years (some have been imported, for example from Israel). A main reason is the underfunded research and isolated research.

The quality of seeds is quite low, and research is inadequate and underfunded. The availability of inputs is also limited as there is no specific institution responsible for cotton inputs. Furthermore, farmers and their organizations (cooperatives, unions) also lack access to finance that would allow them to ensure quality through the use of appropriate inputs and better contacts to seed researchers. In addition, low quality organic fertiliser grown separately and is required to be applied in volume, can increase the embodied land and emission impacts of organic farming.

In a related point to the one below, there is a need to increase the oil yield of cottonseed. This requires both better seed variety as well as modern oil mill equipment to maximise oil output and minimise waste.

8) Low ginning outturn and outdated ginning equipment

The ginning outturn is very low by African standards (37% as compared with 42% in West Africa), which impacts profitability for both producers and ginners. Thus, this weakness with the risk of further reduce the outturn is linked with the seven risks and factors mentioned above. Ginneries use very outdated equipment, which affects lint quality. Producers and ginners have little motivation to invest in quality due to the marketing, grading and pricing system. Moreover, the oil content of the cottonseeds is also very low, about 12.5% compared to 19% in West Africa.

9) The further segmentation of the VC could lead away Ethiopian multi-functional and biodiversified and rather sustainable agriculture and further increase the food deficit of Ethiopia.

The current situation of the VC (stagnating if not regressing lint production, more dependency on imported lint and yarn, low overall productivity and profitability), the fragmentation of the support system (engaging trade, agriculture, livestock, the 5 levels of the government structures and the private sector) and the increasing food imports over the last years , bears the risk of continuing rather on a vicious cycle than on a path of real inclusive and sustainable development. The strong market driven approach and the neglect of viable governance structures and processes bears the risks to increase social distances between winners (like the middlemen) and losers (like indigenous peoples affected, ginners, low-paid workers) and so augmenting social conflict potential. The relatively low attractivity of cotton in a "free market" with growing attractivity for food crops requires a new strategy focussing more on farm sustainability and rural development then on monocrops and single and closed VC. The stability of the food security poses risks in areas with large commercial farms producing for world or foreign markets (with higher purchase power), and where indigenous peasants and farmers had to be evicted from traditional and accessible land.

6.4 Major issues: Opportunities

1) Increase in demand for quality lint
As the apparel sector continues to grow and Ethiopia seeks to expand its presence in the export sector whilst foreign investment (and ginning capacity) in the sector increases, the demand for lint (produced in Ethiopia) is likely to increase.

2) Using the VC as a vector of sustainable economic growth
The cotton and textile VC bear many untapped potentials going beyond the interest of the VC stakeholders. A stronger research, open and transparent attitudes and programs by the public sector and the focus on sustainable and green growth (considering the natural limits of the resources) could turn the current VC into an asset for the future for both food and agriculture and industrial and tourist development.

3) More research and development (WARC)
At present the cotton sector is dominated by a single variety. Additional research is needed to support the development of new varieties that may reduce climate vulnerability or enhance pest resistance. This will take both time and resources as well as clearer understanding of the needs of farmers. In addition, more research is needed on the impact of emerging issues such as soil erosion and salinity which are likely to become more apparent in the future.

4) Use of the cottonseed oil outcomes (food security, development)
Cotton provides a range of co-products including lint, seed cake and oil and therefore has relevance beyond the textile industry. There are growing examples of diversification within the cotton sector whereby cottonseed cake is fed to cattle. This is an example for achieving co-benefits by creating new sub-chains (e.g. ginneries sell oilseed back to farmers at a low cost). Another opportunity may be to consider by-products of the cotton VC as inputs into organic fertiliser production systems.

5) Better training of stakeholders (and address skill gaps) leading to better availability and use of inputs (reduce restrictions at customs)
The is already examples of significant organisation of the farmers to solve common challenges, there are opportunities for farmers to cooperate to further enhance profit by taking on the role of middlemen. There are examples of farmers achieving viable yields through implementation of organic and lower input fertilisation and pesticide management, including organic certification. However, this is often localised in niche pockets. There is an opportunity for farmers to share best practice in how such practices to increase eco-efficiency can be implemented in way that is consistent with current farming practices in Ethiopia. An important aspect to ensure farming remains as sustainable as possible is the availability of low intensity locally sourced organic fertilisers. Farmers should be supporting in developing mechanisms to utilise available (fallow) land and resources (or those of their neighbours) to produce fertiliser. This is currently seen by many farmers to be labour intensive. Farmer cooperatives can play a role in this respect.

6) To use cotton as a strategic cropping system for FNS (food and nutrition security)

The systems perspective of the VC, considering all three dimensions of sustainability, will open new insights, synergies and better efficiency and profitability. Cotton should not be seen anymore as a pure fibre crop. When the various mentioned functions of this old-grown and well established plant would be recognized by all relevant stakeholders, cotton can become through its high integration with the downstream industry and world markets demanding increasingly sustainable commodities and services, become a strategic cropping system also for MoAL.

7) Develop capacity for quality product garments for export market
There are two aspects to this issue. In the first instance there is an issue to increase the average technical skill level of garment production and finishing to increase the penetration of garments that can enter the finished garment market and compete within the end market segment. Secondly, there already exists a niche segment of the market where quality is very important: the traditional garment segment. There is a small but growing number of garment producers who are beginning to market internationally produced garments in a semiformal way (e.g. supported by social media), including to the diaspora.

8) Improve the working conditions for all workers.
With such a measure, the vicious cycle of low productivity, low performance, stagnation and high turnover at the factory side could be broken. However, this measure would require collective actions and strong leadership. Only investors with a long-term commitment would be supportive, which would on the other side increase the sustainability of the VC shifting its focus from quantity towards quality.

6.5 Recommendations

The recommendations presented are conceptual first and then operational.

We recommend 12 conceptual measures (Figure 31) and consider all as vital for improving the sustainability of the VC. They are to be considered as points of discussions. Each recommendation is more than just a technical action. The challenges are impressive and it will take time, but with the required openness, leadership and good partners, they can be managed.

Twelve conceptual recommendations

	Between MoI and MoA	Involving most stakeholders
Technical	• Take better adaptation measures against climate change • **Recognise the strategic role of cotton and textile research** • Take more national ownership at the investment and entrepreneurial side of the textile and edible oil sectors	• Improve skills in dealing with water efficiency and observing soil fertility levels. • **Improve the support for the traditional and modern small-scale farmers** and all stages of the traditional sub-chain. • Integrate the large and medium commercial farms in technical support.
Institutional	• **Improve communication and cooperation amongst official bodies** • Focus on quality seedcotton and textile, reduce the ambitions to expand the cotton area. • Reconsider a more active role for the regional states	• Integrate the interests of pastoralists, communities and workers. • Support organic cotton and textile systematically • **Build a label for quality cotton and textile of Ethiopia**

FIGURE 31: TWELVE CONCEPTUAL RECOMMENDATIONS

The twelve conceptual or general recommendations in more detail:

1) Improve communication and cooperation amongst official bodies
There is a need to formalise and support communication and cooperation between departments/Ministries/regional states/private sector/farmers and increase transparency among them. This can take many forms, including common understanding of which aspects of the VC are the most relevant to

which body. This includes communication on good cultivation practices, availability of supporting schemes or standards etc.
An important aspect is clarification and common understanding of the roles and competencies of each actor in the value chain and its links with related VC and services. Only improved communication channels (which clearly defined and mutually agreed hierarchies) between the various hierarchies, sectors and sub-chain will assure measurable improvements of the governance, the efficiency and performance of a sustainable VC of the future. The cotton research centres should play a more active role in order to implement the main parts of the current research strategy (2016-2030).

2) Improve skills in dealing with water efficiency and observing soil fertility levels
Provide training and support for low impact/low cost water harvesting and or water efficient irrigation systems. For small scale farmers, low impact water saving/harvesting mechanism (e.g. using locally available material) are particularly relevant. Particularly for large-scale farmers and their managers, there needs to be policy incentives to limit unsustainable abstraction of water (particularly ground water use). Apart from water efficiency, the pressure on the demand side for cotton lint increases the risk for soil depleting practices. More investments in farmer education, training courses and technical assistance in order to save this most precious asset, the fertile soil, from impoverishment and destruction, will remain a noble task by the public sector. Practices such as effective household composting (including use of farm residues) or integrated pest management can be supported by showcasing examples of good practice relevant to the Ethiopian context.

3) Focus on quality seedcotton and textile, reduce the ambitions to expand the cotton area
Focus on quality by focussing on the workers and their rights and conditions, as only committed workers will be able to produce qualitative products. Implement the existing cotton development strategy but reduce the land use objective to less than 1 million ha and refocus on quality and lower impact production (sustainable cotton and textile, fair fashion).
The Post-Corona time will most probably reshape the global VC and it is well possible that the demand for low-quality, cheap, disposable, textile products will decrease and the need for quality products increase. Considering the expected water shortages (and floods in some cases), the growing needs of land for food and the completely unsustainable consumption patterns of the past at the global level should clearly be taken as signs for a paradigm change towards quality, sustainable intensification and new targets on land areas to be foreseen for cotton. This strategic shift would be a win-win for most actors and particularly for the SDG of Ethiopia.

4) Integrate the interests of pastoralists, communities and workers
Due to issues of land scarcity and suitability, reassess cotton production targets taking into account the local limits of land use and competing demand for cotton and other food crops (that might be more profitable) and better protect the interests of pastoralists who are sensitive to price fluctuations. Workers at farm and factory level, and here particularly women, need better social protection. Working relations in general need more attention. If succeeding with this point, the VC could be called inclusive.

5) Improve the support for the traditional and modern small-scale farmers and all stages of the traditional sub-chain
Improve cotton production conditions for SCF (technical- and pricewise). Each cotton farmer is also a sorghum, sesame, or banana, or cereal farmer. The annual income of the farmer household, as a key criterion, should improve with cotton. If this is not the case, the expansion will be impossible from the side of the SCF. The good integration with the downstream clients of the cottonseed within the country, on both traditional and industrial level, allows innovative ways to better motivate the farmers for more cotton production. This is important as seedcotton ultimately has many potentials for consumers, including within the fabric, oil and animal feed and livestock sectors of the economy.

6) Integrate the large and medium commercial farms in technical support
Improve cotton production commercial farms, in particular support farmers in recognizing vulnerability to soil loss, increased salinity due to continued irrigation etc. Such services could be done on a commercial level and linked with requirements on ecological and social standards. Examples of good practice (i.e. farms or cooperatives that are both profitable but also adhering to organic standards) should be used to benchmark more widespread practices. Commercial farms (particularly the once who got the lease under the condition

or promise to produce cotton) should be run under effective legal control by the government and the produce exported should be made transparent (to note that Ethiopia is increasing its food imports since many years). The support should at the same time monitor the level of soil fertility. Bad practices like overuse of mineral fertilizer and lack of organic inputs enhancing mycorrhiza growth risk depleting the soil fertility levels and destroying its current asset base.

7) Take better adaptation measures against climate change

Incorporate climate impact maps (temperature and rainfall patterns) into cotton development strategies and plans to identify regions and districts that are most of risk from future climate change. Review current irrigation practices and their impact on soil quality. The best way to adapt to climate change are investments into soil organic matter. They should at least keep the levels of natural soil fertility and so assure a relatively high water use efficiency.

8) Support organic cotton and textile systematically

Sustainable cotton and particularly organic cotton and textile are on the increase at the demand side. This is a unique opportunity for Ethiopia to tap into a market which will not only increase profitability at all levels, but at the same time address ecological, touristic and human health issues. A move towards higher quality offers an opportunity to expand the contribution of cotton without necessarily expanding production. Special measures will have to be taken to prevent contamination with GMO cotton, to prevent economic losses at the farm and ginning level. The regions and woredas could become active and use organic cotton farms as starting points for the promotion of organic and healthy food.

9) Recognize the strategic role of cotton and textile research

Provide better support for cotton and textile research, in particular there is a need for greater seed variety, for better support with ICT tools on farmer education and advice and on cross-cutting issues related to quality from field to the T&A segment. Good seeds with higher yield, higher oil content and fulfilling the requirements of the textile industry are required. The positive impact will benefit all actor's income. Finally, the seed should be fit for the changing climate and respond to the expected higher temperatures and water losses through evapotranspiration.

10) Take more national ownership at the investment and entrepreneurial side of the textile and edible oil sectors

Use the VC for domestic development and enhance ownership in the textile sector, in particular provide incentives for greater Ethiopian ownership of factories (and other elements of the value chain that add significant value) will enhance the retention of the value of cotton in the Ethiopian economy. Tariff protection against cheap imported palm oil is a concrete measure to be envisaged in order to promote the edible cotton oil domestic market. The actors from the private sector of both main sub-VC, the fibre/textile and the cottonseed should work hand in hand.

11) Reconsider a more active role for the regional states

Apart from Tigray, most regions are rather passive participants of the current VC. The federal level should try to better involve them, to decentralise certain measures and to empower the regions to better exploit the mentioned potentials. The regions are closer to the actors and with an integrated approach considering cotton VC as relevant for agricultural and industrial, fibre and oil/cake and being responsible to steer through the coming difficult times caused by climate change, this VC is a great opportunity to act on its opportunities.

12) Build a label for quality cotton and textile of Ethiopia

Make Ethiopia famous for sustainable cotton and textile as it is now for premium coffee. In particular, consider marketing both the ancient legacy of cotton in Ethiopia and the vibrant and important **traditional garment sector**. It is something unique and precious that can be shared with the world while retaining its distinctiveness. At the same time, the focus on quality will increase the resilience of the VC for the ongoing and future pandemics, with the expected breakdowns of the globalized VC based on mass products.

The operational recommendations, covering the priority measures only, are as follows (Figure 32):

FIGURE 32: OPERATIONAL RECOMMENDATIONS RELATED TO IMPACT DOMAINS

<table>
<tr><th colspan="5">Operational recommendations related to Impact domains</th></tr>
<tr><td></td><td>VA and efficiency of VC</td><td>Economic impacts</td><td>Social impacts</td><td>Environmental Impacts</td></tr>
<tr><td></td><td colspan="4">Cross-cutting recommendations</td></tr>
<tr><td>Trade-offs between food and fibre sector and improved vertical integration and policy dialogue</td><td colspan="4">Assess the comparative advantages of specific- cotton-cereal production systems, taking into account the food security (edible oil, soil fertility impact, diversity of production systems) and job creation components of cotton. Better harness the potential of the VC for SCF and not just focus on commercial farms. Identify ways to ensure that SCF farmers retain the benefit of cotton production diversification (e.g. growth of oil market).</td></tr>
<tr><td></td><td></td><td></td><td>More information, better education, better law enforcement and more care for the health of workers and farmers in the VC should be addressed</td><td>Increase uptake and upscaling of domestic composting including use of on-farm residues to help maintain soil fertility and yields.</td></tr>
<tr><td>Governance</td><td colspan="4">Consider the creation of a “consultation framework”, bringing together the two main partners (MoI, MoANR), the seed-cotton producers and the textile industry, each of them being organised under their respective Ministries, MoANR and MoI. This should lead to a governance structure and a new focal institution of the VC and for the NCDS which reflects the needs of the sector and integrates accordingly the interests of the relevant Ministries and the other stakeholders.
Consider ways to better include the concerned regional states in the governance process. This should address the low level of motivation of SCF for cotton as well as the local economic developments and food security and rights issues. Barriers (cost, information, labour) to penetration of organic cotton should be examined within the context of the other crops in the cycle.
Organize a workshop with all stakeholders to jointly analyse the sector based on the outcomes of the VCA4D study and agree on its expectations (food security, incentives to increase seedcotton production, local development).
In particular there is a need for a standardised approach for recording the variance in yield across traditional small scale, large scale, commercial, traditional, producers including rainfed and irrigation systems. This will help to identify examples of more sustainable practices.
Significant amounts of valuable information are available to existing partners. Devise clearer mechanisms of information sharing between existing partners. This includes governing bodies accepting the experiences of the farmers on effective rotation, appropriate crops etc. Also, this includes negative elements such as effects of</td></tr>
<tr><td>Agricultural production systems</td><td colspan="2">Better endowment of the research component and specifically for WERER/WARC.
To envisage clear obligations towards the investors related to local food security impacts of the commercial farm (independently if cotton or other cash crop like sugar cane or food crop for export is produced on the farm). This measure would require a more active role of the regional states.</td><td>Reinforce structure and voices of endogenous people. The public sector should better respond to the existing local initiatives. Better listen to the concerns expressed by women.</td><td>Use water more efficiently in RF systems by revising the tax policy and making use of existing technologies. Small scale low impact water saving (and harvesting) measures that are region appropriate need identification.</td></tr>
<tr><td></td><td colspan="4">Consider wheat-cotton-legumes systems in lowland irrigated areas as means of enhancing soil nutrient poll. Support for better use of on field residues.
Institutionalize robust mechanism for social, economic and environmental impact assessments for ongoing and new commercial farms and involved land lease contracts.
As few data on nutrition in relation with cotton farming and the VC is available, more research should be done on this important topic. In particular, there needs to be better information on the extent to which the soil nutrient pool is being depleted or enhanced and if the prevalent rotation scheme is adequate for the needs of the whole</td></tr>
<tr><td></td><td colspan="4">Commission a feasibility study for organic cotton including environmental, social and economic constraints. Learn from the experiences of the coffee value chain in terms of brand awareness and recognition.</td></tr>
<tr><td></td><td colspan="4">Developing socially acceptable solutions to reverse the decline in soil fertility. Review existing rotation and fallow practices on that basis and investigate in other new agroecological practices (agroforestry, soil regeneration, conservation).</td></tr>
</table>

		Monitoring of desirable economic, social and environmental impacts through a research-based support, taking into account changing climate change and socio-	
	Promote skills training, advisory services and mechanization for SCF that is adequate to farms' structures. More decentralized and participatory approaches for extension and advice for the cotton producers. Consider support for farm (field) schools with farmer recognised as important teachers as well as learners.		Utilise available sources of nutrients, including household organic and farm wastes as well as field residues. Provide training in effective composting techniques and making best use of available resources.
	Exploiting genetic variability to combine productivity, fibre quality, climate change adaptation and cotton oil yield by providing new seed varieties	Adapting technical advice to producers according to their typology and socio-cultural context and to the requirements of the agro-ecological zones. (e.g. terraced fields maybe applicable in the Simien Mountains as a means of reducing runoff and soil losses but perhaps not in other areas). Main focus should be on cycles of production systems, where cotton is often competing with economically more interesting crops, like sesame, banana, sugar cane, which tend to reduce cotton's attractiveness if not considered holistically. The unit of the production system should include multi-year rotation systems with cotton as a fixed component. Better integrate with the livestock value chains.	
		Reducing the selling price of inputs for producers if no distortions implied through a better organisation at cooperative	Keeping records of cases of conflict between farmers and herders/pastoralists and indigenous peoples.
		Granting liquidity credits to SCF to enhance attractiveness of balanced cotton systems. Assure more transparency with the land deals.	
Ginning sector	Ginners to be more proactive to encourage in their area quality cotton production and cooperate with the stakeholders on advice and enabling conditions for steady sustainable growth of the sector.		
Cottonseed incl. oil sub-sector	Consider seed with higher oil content. Consider import substitution policy for edible oils by promoting	Modernise and upscale the technology used in the oil sector to improve oil yields and reduce the material intensity. Consider investment in refining as well as extraction, but this needs a cost -benefit analysis approach.	
	Open the dialog with the Association of oil millers and make feasibility study to assess the promotion of the sub value chain on cotton seed.		
Textile sector	Address the issue of child labour in the traditional sector and the issue of working conditions in the modern sector and proactive measures to increase the incentives for SCF cotton producers (better contracts, agree on cotton prices before the season)		
	Recognise the uniqueness and value of the traditional textile sector and also consider the potential role of traditional cotton production for the modern textile sector. Create a new image of high value low impact cotton products, including the marketing of traditional garments	Better enforcement of the laws related to workers' right Better listen to the concerns expressed by women.	

Annexes

General

A1 References
A2 Thematic maps

Functional analysis

A2-1 Cotton production, surface and yields from 2014 to 2018
A2-2 Land suitability map- Potential Cotton Development Area in Ethiopia
A2-3 Farms per region IN 2018/19 SEASON
A2-4 Cotton varieties and seed supply
A2-5 Sustainable cotton production including organic cotton
A2-6 Parameters of the ginning and textile sector
A2-7 Procedure for investors in Tigray (since December 2019) and Ethiopia
A2-8 "Value chain" and "VC analyses for development" definition
A2-9 Cotton Research Strategy 2016-2030 (EIAR)

Economic analysis

A3-1 Parameters for the economic analysis
A3-2 Import and export data

Social analysis

A4-1 Elements of sociological and historic facts of Agriculture related to cotton VC
A4-2 Historic cotton production: peoples and markets (Westphal 1975).
A4-3 The socio-economics of cotton and textile around Arba Minch
A4-4 Varia on labour conditions and productivity related with the socio-economic context
A4-5 List of interviews conducted (anonymized)
A4-6 List of consulted literature (mainly for the social/sociological part)
A4-7 The ambiguity of Gambela as a future place for cotton

Environmental analysis

A5-1 Snapshot LCA results from a commercial farm following conversion from Sugar cane.

Conclusion

A6-1 The situation with GM cotton in Ethiopia
A6-2 Recommendations related to Covid-19 for the cotton sector

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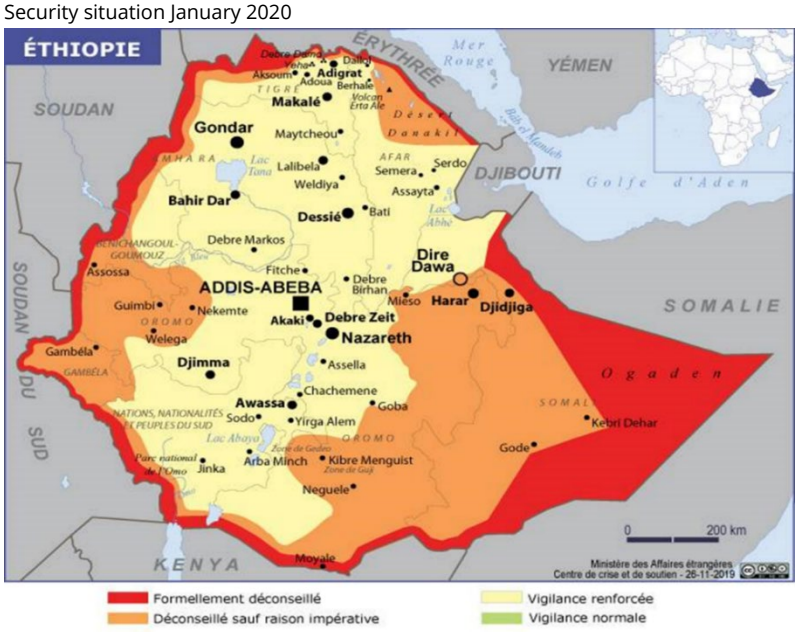
A2 Thematic maps of Ethiopia

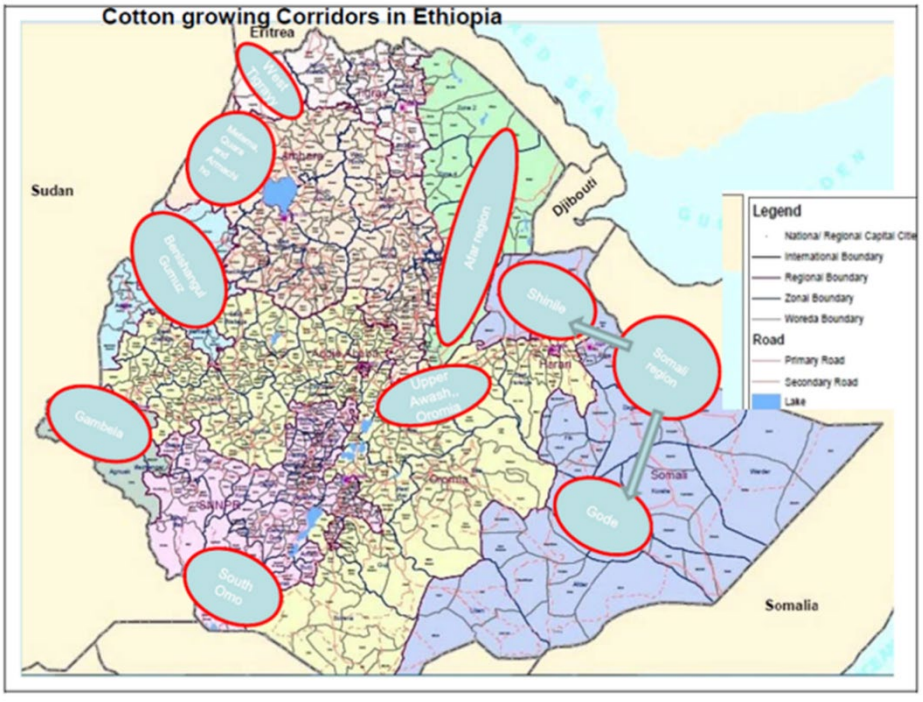
Order of maps:
Security situation January 2020
Main cropping areas for coffee, cotton, maize, teff etc
Current and potential cotton areas according to NCDS 2018
Topography
Cotton production 2011-2015
Geography of the coffee areas
Regional organisation of the State in the early 1970 (above) and in 2018 (below)
Economic activity min 1970
Geography of Religions in 2007
Main ethnic groups
Evolution food aid 1958-2015
World Governance Index of Ethiopia compared

Security situation January 2020



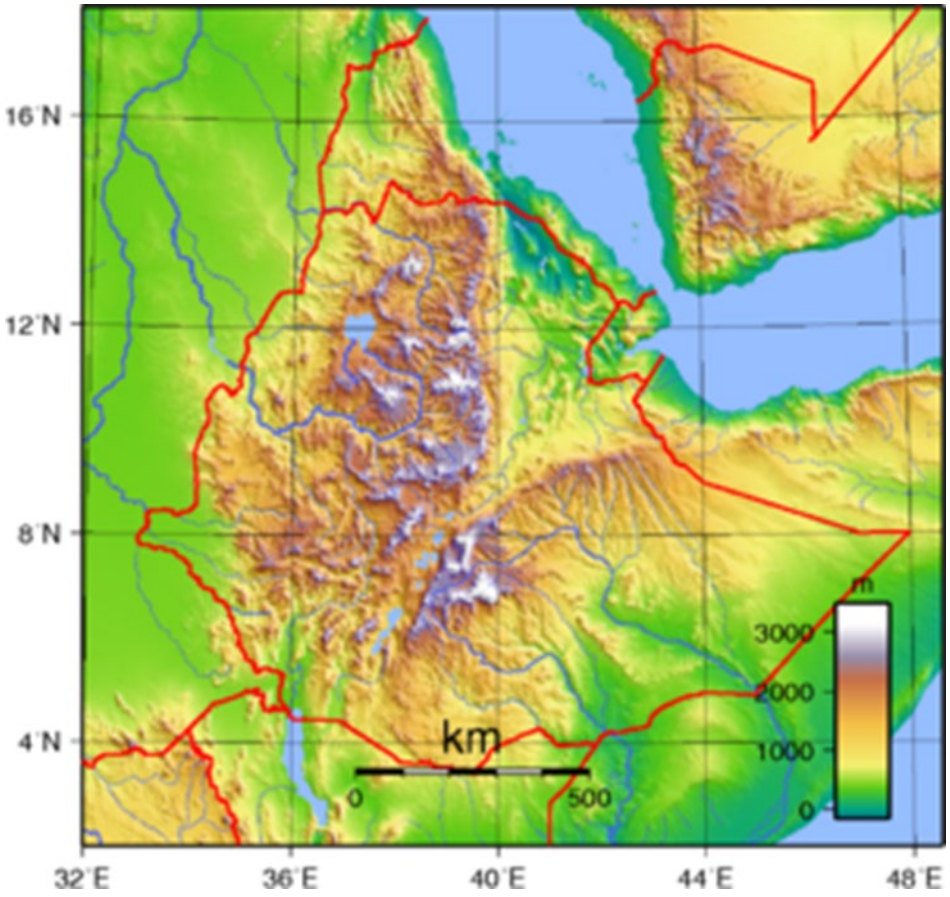
Main cropping areas for coffee, cotton, maize, teff etc.

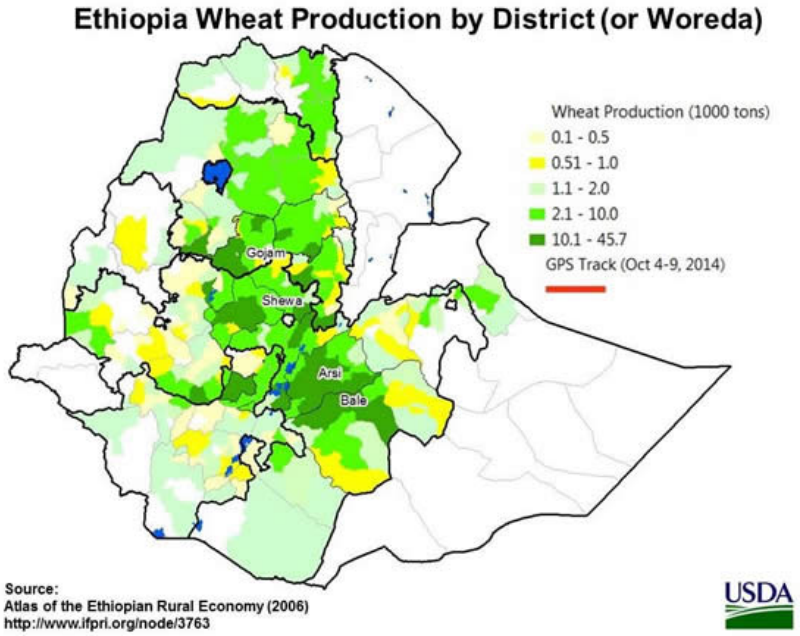
Current and potential cotton areas according to NCDS 2018



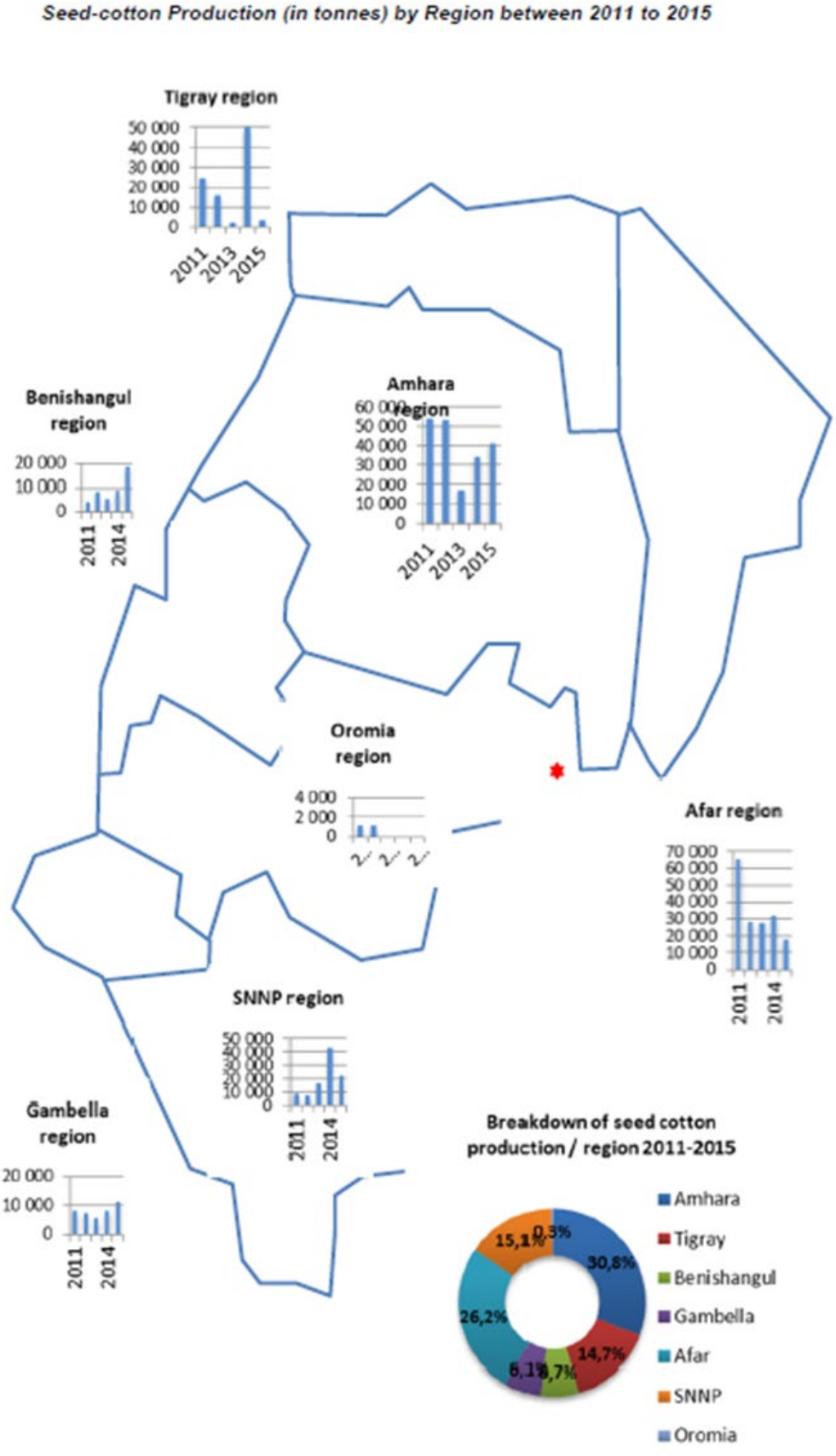
Source: NCDS 2018

Topography:

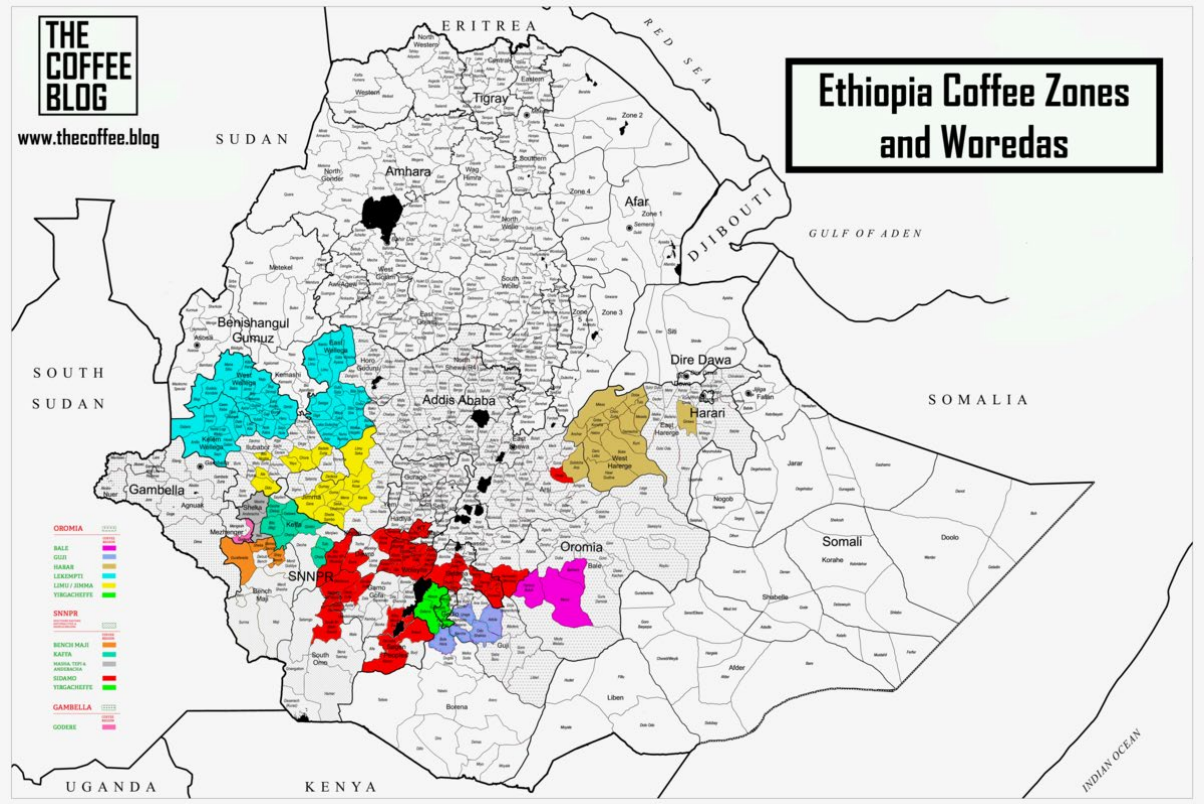

16°N
12°N
8°N
4°N
32°E
36°E
40°E
44°E
48°E
km
0
500
m
3000
2000
1000
0


Ethiopia Wheat Production by District (or Woreda)
Wheat Production (1000 tons)
0.1 - 0.5
0.51 - 1.0
1.1 - 2.0
2.1 - 10.0
10.1 - 45.7
GPS Track (Oct 4-9, 2014)
Gojam
Shewa
Arsi
Bale
Source:
Atlas of the Ethiopian Rural Economy (2006)
http://www.ifpri.org/node/3763
USDA

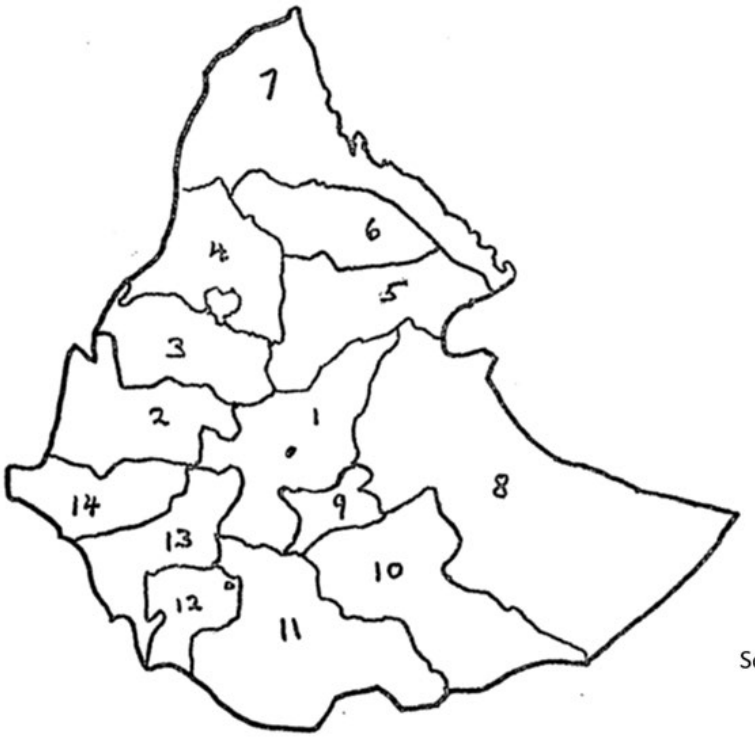
Cotton production 2011-2015



Geography of the coffee areas (produced on 550'000 to 600'000 ha)

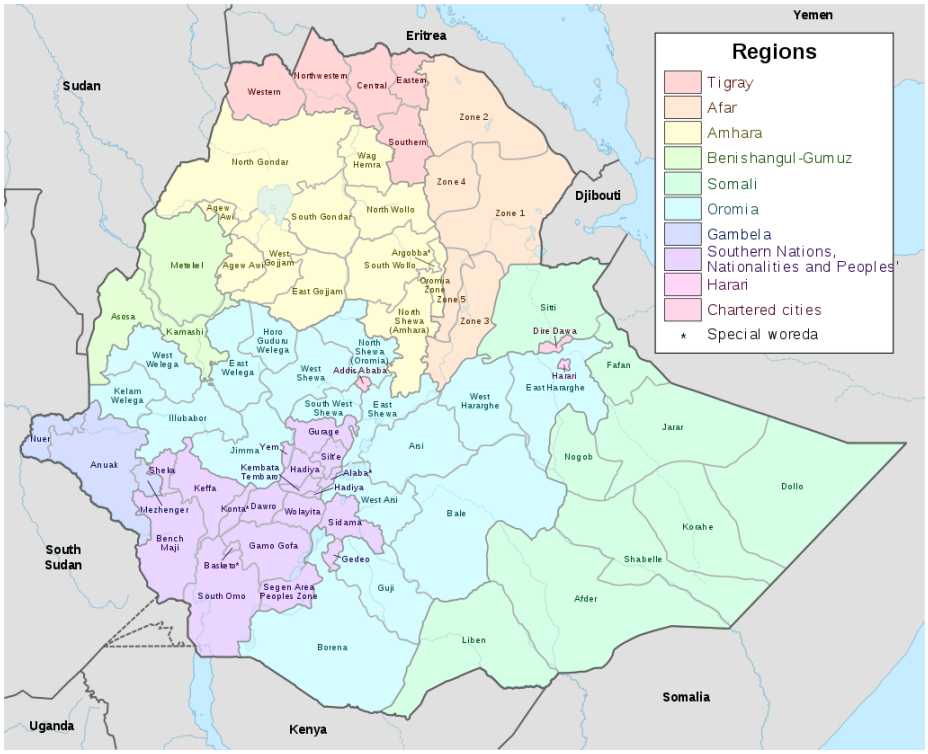


Regional organisation of the State in the early 1970 (above) and in 2018 (below)

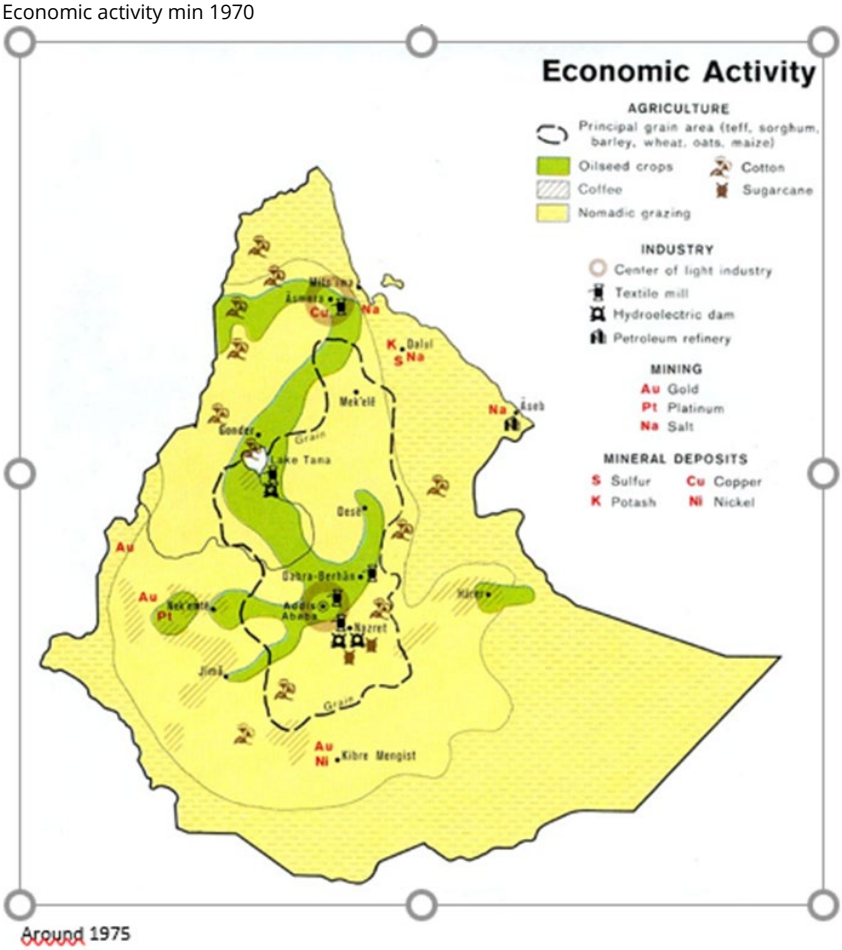


1. Shoa
2. Welega
3. Gojam
4. Begemdir
5. Welo
6. Tigre
7. Eritrea
8. Harrar
9. Arussi
10. Bale
11. Sidamo
12. Gama Gofa
13. Kafa
14. Illubabor

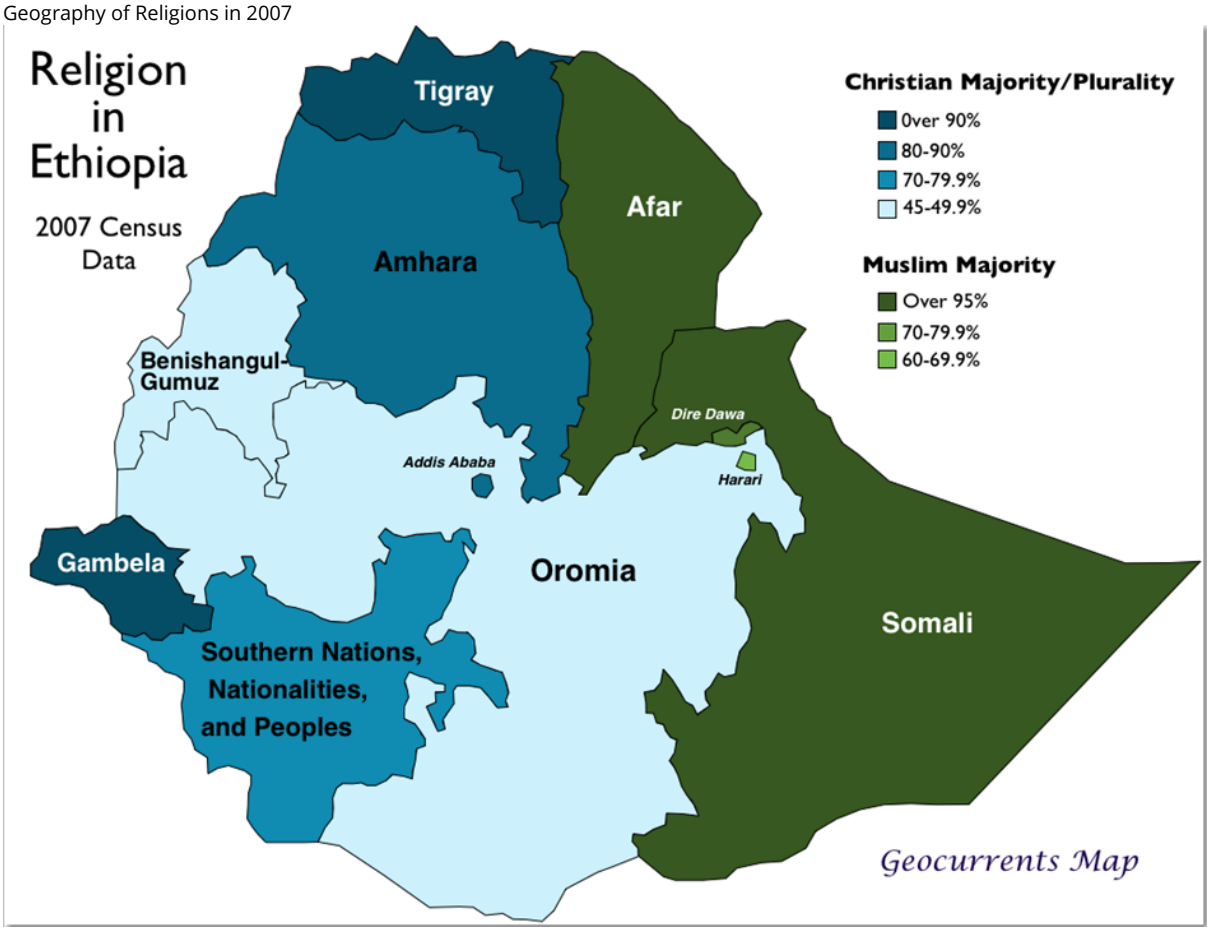
Source: Burley 1976



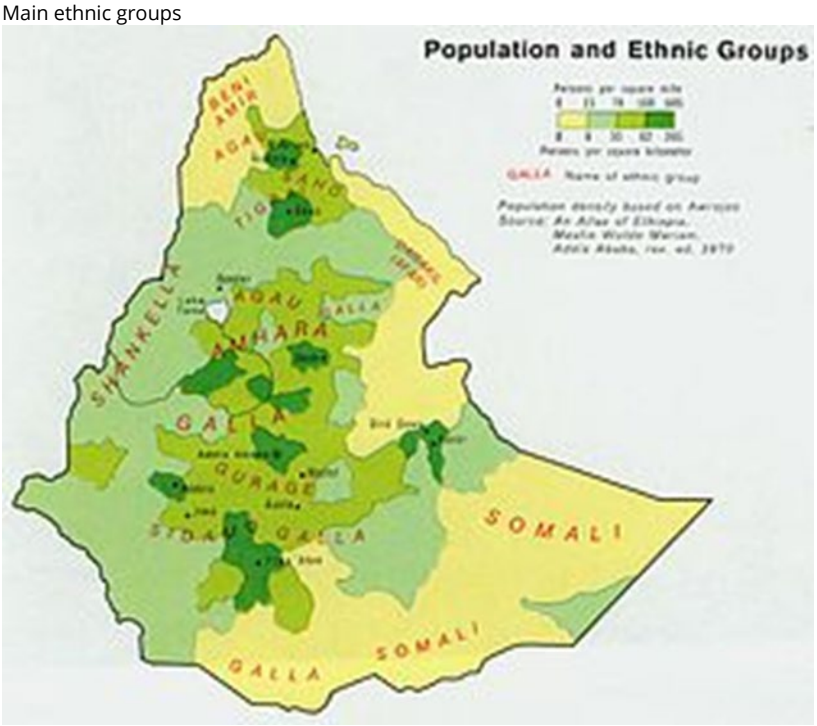
Economic activity min 1970



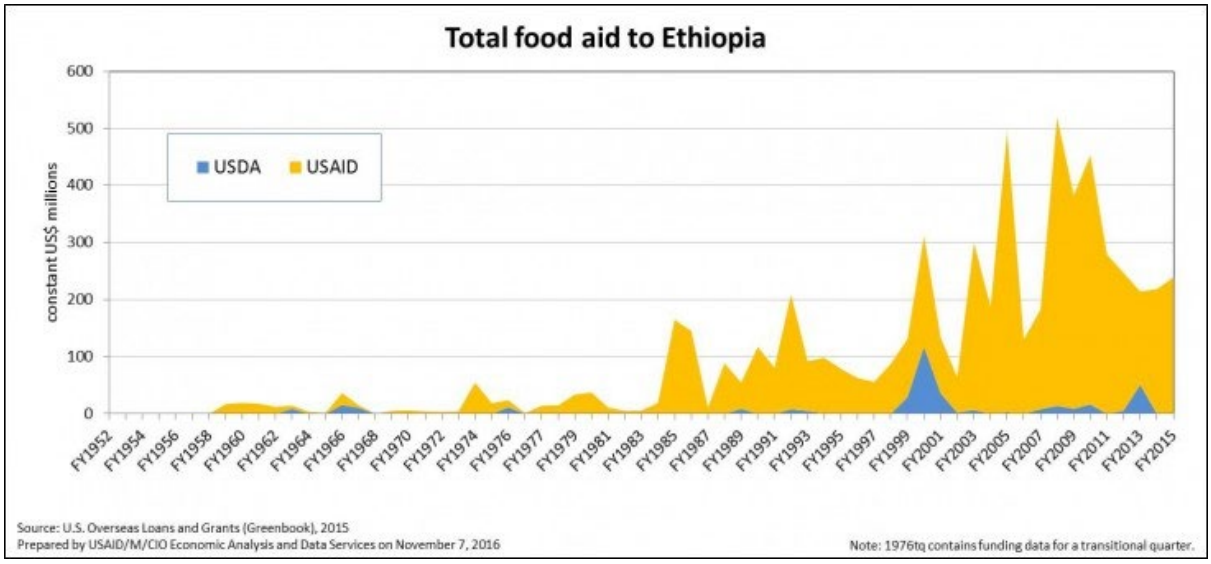
Geography of Religions in 2007



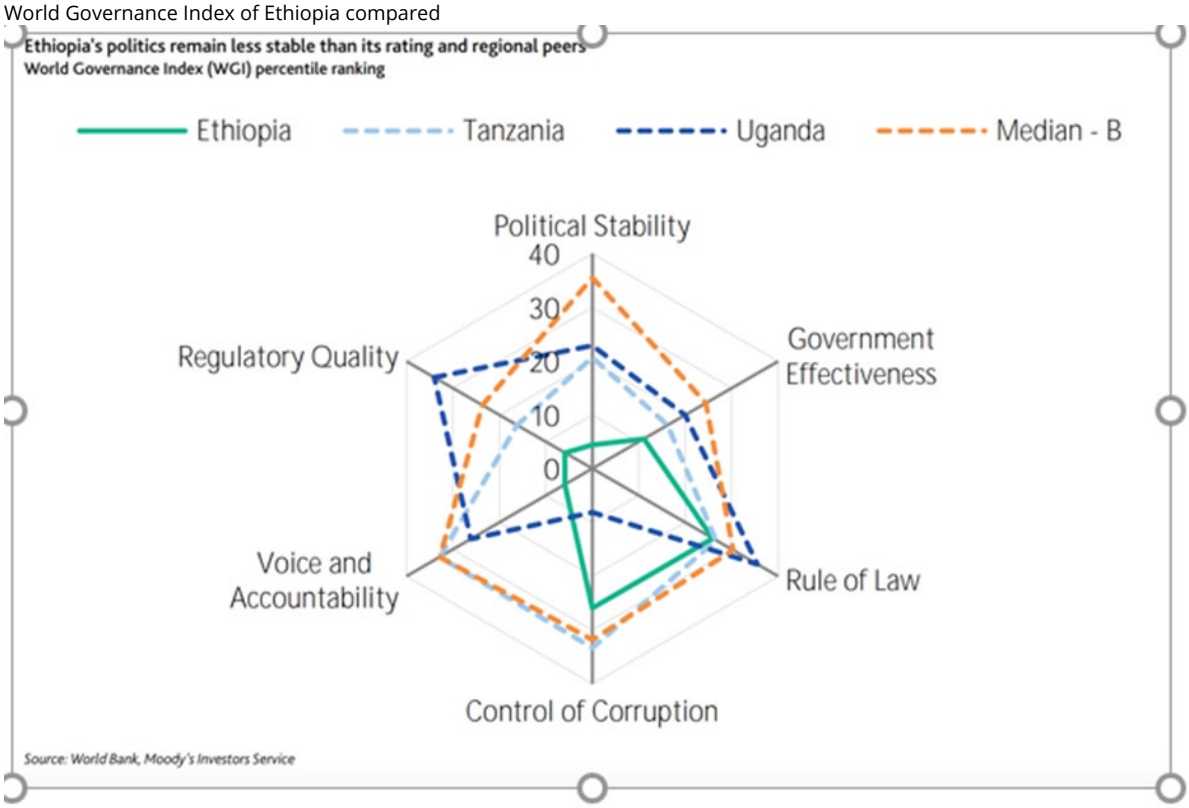
Main ethnic groups



Evolution food aid 1958-2015



World Governance Index of Ethiopia compared



WGI 2018

A2-1 Cotton Production, surface and yields from 2014 to 2018

Cotton production over 4 years:

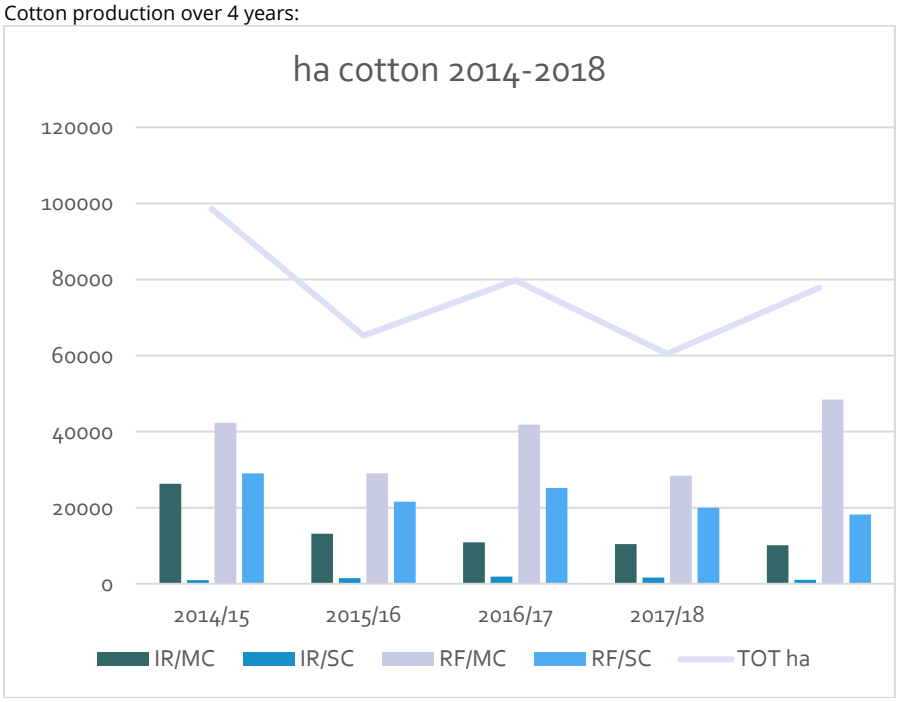


Figure 3A: cotton area since 2014

75% of the cotton surface 2017/18 was produced by mid-and large scale commercial farms.
The average 80,000 ha cotton cultivated make just 0.5 % out of the 14 to 15 mn ha arable land- or, about 1 out of 200 ha arable land is cultivated with cotton.

The production (in tonnes) is as follows:

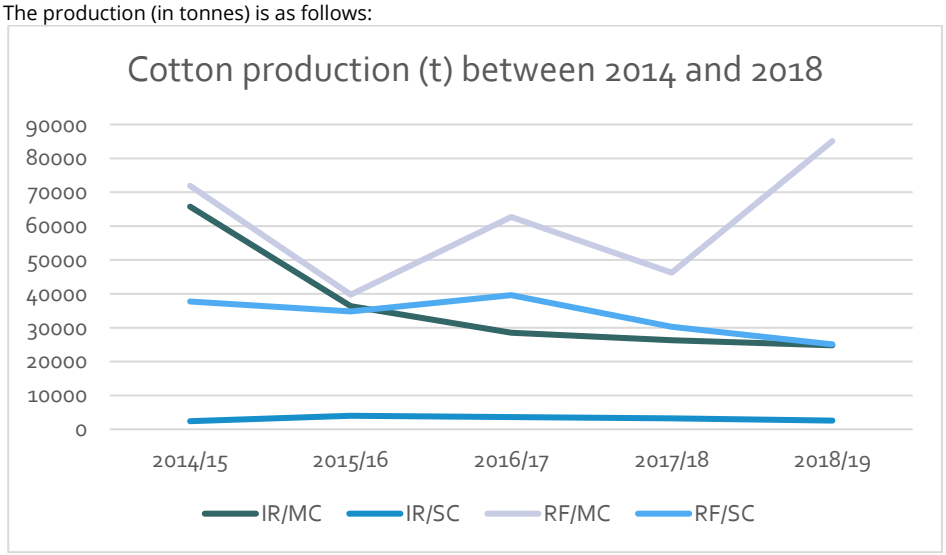


Figure 3B: cottonseed productiona since 2014

The total production in 2018/19 was 137,531 t, whereby 79% came from mid- to large scale commercial farms, and only 21% from small-scale farms.

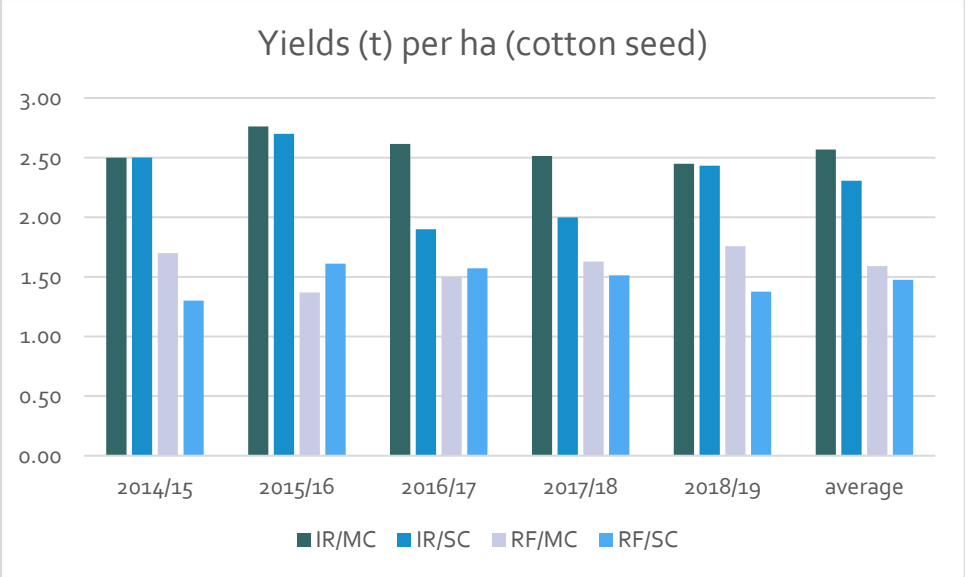
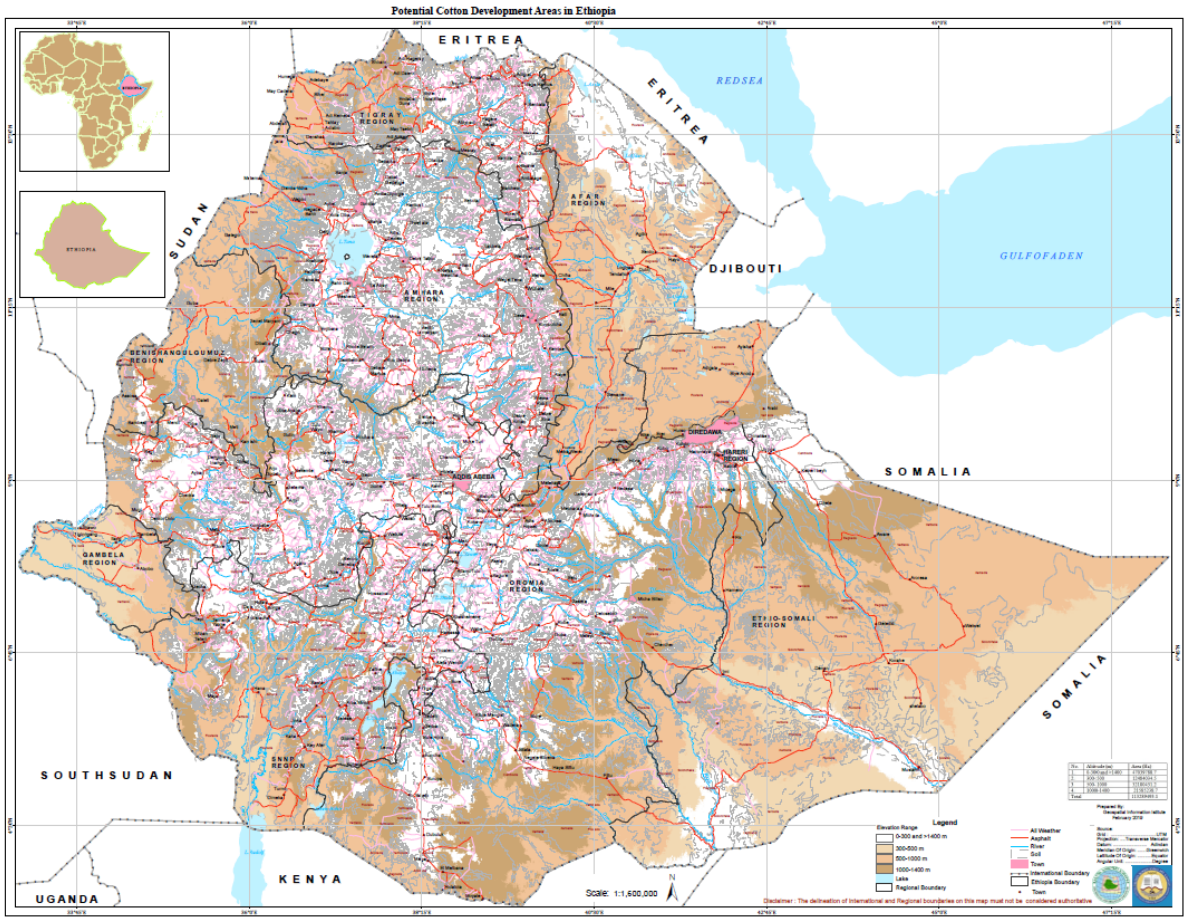


FIGURE 3C: COTTONSEED YIELDS SINCE 2014

The average land productivity of the irrigated cotton of the last known 5 years is 2.57t/ha for commercial and 2.31 t/ha for SC farms. The rainfed cotton is for both farming systems (commercial, small-scale [12]) about 800 kg/ha smaller but with 1.5-1.6 t/ha still in the top league for Africa, thanks to the good soils.

A2-2- Potential Cotton Development Area in Ethiopia



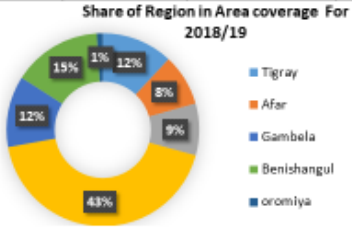
Source: ETIDI

[12] From our interviews we got the impression that it is common for small holder to have higher yields than commercial farms. It doesn't come across very strongly above and with the official data.

A2-3 Farms per region in 2018/19 season

Land coverage, participants across regions and farming system of the 2018/19 cropping season

S/N	Regions	Investor		Small holder		Total Land covered	Share in (%)
		Number of Participants	Land covered	Number of Participants	Land covered		
1	Afar	17	5,694	1,342	1045.5	6,739.5	8.7
2	South/SNNPR	5+1	3,581	8,553	3,157.8	6,738.8	8.7
3	Amhara	609	18,985	18,586	14,297	33,282	43
4	Tigray	17	8,449.3	1,683	764	9,213.3	12
5	Gambela	29	9,333	-	-	9,333	12
6	Benishangul	35	11,482	-	-	11,482	15
8	Oromiya	1	849	-	-	849	1
	Grand total	714	58,373.3	30,164	19,264.3	77,637.6	100



21

SOURCE: ETIDI, 2019

A2-4 Cotton varieties and seed supply

Cotton Research, Variety's, Seed supply system and Quality

S/N	Lists of the variety
1	Ionia
2	NEBAH (Stam -59A)
3	Sille-1 (Stoneville 1324)
4	Teysie (Cucurova) 1518)
5	Enat (Caroline queen)
6	Tate (Cu-Okra)
7	Deltapine 90
8	Bulk 202
9	Arba
10	Acala SJ 2
11	Werer 1-84
12	Acala 1517/70
13	Reba B.50*
14	A-333-57*
15	Albar 637*
16	YD223
17	YD211
18	YD206
19	Candia
20	Claudia
21	Gloria
22	STG
23	**Cicikuk, Werer 50, Weyto**

S/N	Quality parameter (Dp-90)	Unit	Measurement
1	steeple length	mm	27 - 28.5
2	Micronair		3.5 - 5.2
3	Strength	gpt	27 - 28
4	Short fiber content	%	10-14
5	Trash content	%	3.5-5
6	Length Uniformity Ratio	%	82
7	Average point of sticky point		1-32
8	Moisture content		<8
9	Maturity Ratio	%	76-83
10	contamination	Gra/b	Medium

- Under **EIAR Werer** and **Assosa** agricultural research centre are National cotton research coordination centres for **Irrigated** and **rain feed** research respectively.
- **Pawe**, **Gambela**, **Gonder**, **Humera** are potential research centres for cotton research
- Although **25 cotton seed verities** available at the research shelf, **DP 90 is the most dominant.**
- **ETIDI, ECPGA, MoANR, EIAR** and **Enterprise Partners (EP)** designed a system and facilitated **access to improved cotton seed.**
- Incentive based **Seed multiplication** and **processing business model** developed and linked to the research centers involving **selected private seed producers, Coops** and **ginneries.**

27

SOURCE : ETIDI, 2019

COTTON VARIETIES RELEASED BY WERER AGRICULTURAL RESEARCH CENTER (WARC) FOR PRODUCTION SINCE 1998

No.	Variety name	Released year	Seed cotton yield kg/ha	Ginning percent (GOT%)	Micronaire	Fiber length mm	Fiber strength g/tex	Recommended for
19	Stam59A	2007	3340	42.0	4.3	29.8	32.5	Irrigated
20	Ionia	2008	2890	38.7	4.2	30.0	31.4	Irrigated
21	YD-206	2011	4200	37.2	3.5	34.4	36.5	Irrigated
22	YD-223	2011	4130	37.5	3.4	33.8	36.6	Irrigated
23	YD_211	2011	4220	35.9	3.3	34.2	36.6	Irrigated
24	YD-670	2013	4000	37.1	3.5	32.0	34.8	Irrigated
25	YD-195	2013	3370	39.2	3.5	31.7	35.2	Irrigated
26	VBCHB 1203	2013	2470	36.6	4.46	30.7	32.2	Irrigated
27	VBCH 1527	2013	2430	29.0	3.6	29.9	34.0	Irrigated
28	STG-14	2014	3880	42.7	4.22	30.0	31.7	Irrigated
29	Candia	2014	4060	44.1	4.1	29.0	30.20	Irrigated
30	Claudia	2014	3840	45.7	4.36	30.9	32.4	Irrigated
31	Gloria	2014	4260	43.0	4.1	29.4	31.96	Irrigated
32	WARC-CC1	2015	4070	44.8	4.3	28.8	25.9	Irrigated
33	WARC-AC2	2015	4300	39.0	3.9	27.7	29.5	Irrigated
34	WARC-GU3	2015	4620	38.2	3.9	26.1	29.5	Irrigated
35	JKCH 1947 (Bt cotton)	2018	3056.2	39.4	4.06	27.78	27.75	Irrigated
36	JKCH 1050 (Bt cotton)	2018	3049.6	39.2	3.95	28.44	28.59	Irrigated

Source: (MOARD, 2009, 2014, 2018 and WARC Progress Report, 2014, 2015, 2018 Unpublished)

SOURCE: GUDETA, 2019

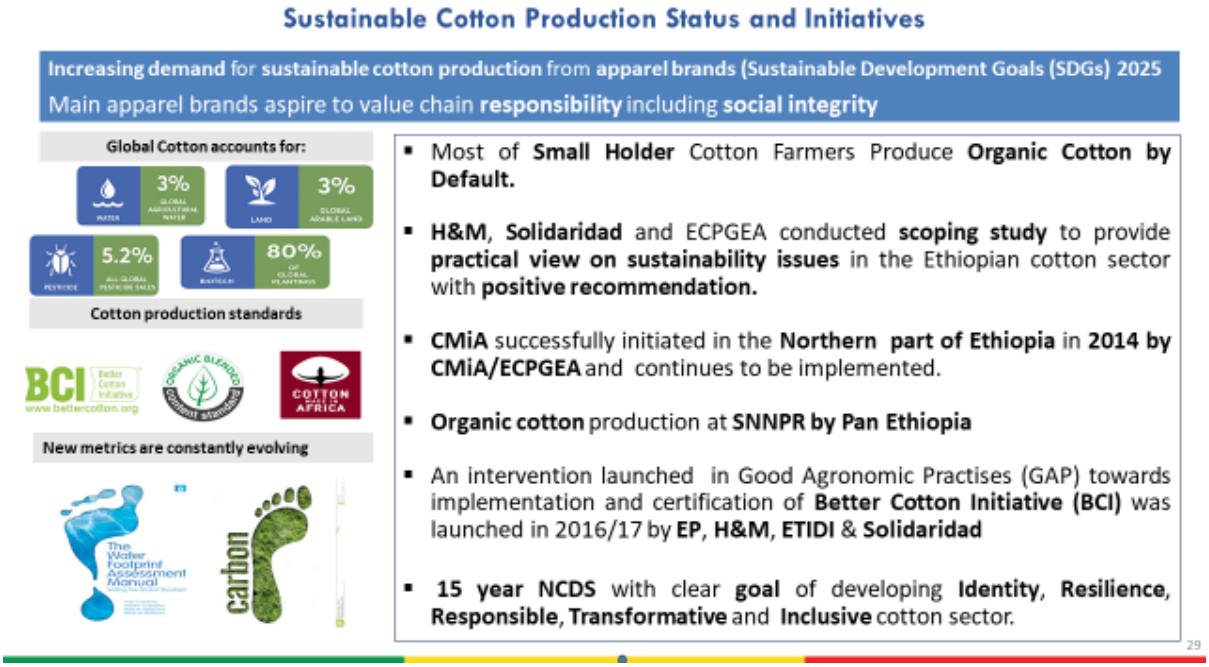
THE RESEARCH PLAN (ETIDI, 2017) (RELATED TO BREEDING)

I) Genetics and Breeding			
1.1) Limited germplasm materials, narrow genetic base and little/no genetic information for some traits of interest			
• Lack of large number of germplasms (Limited germplasm resources) • Narrow genetic bases for different traits of interest at researchers hand • No genetic information of the existing germplasms ((e.g. gene actions (Addition, Dominance and Epistasis and their interactions)), inheritance and combining ability of traits) to base on and plan breeding methods to be attained in order to meet targets	• Enrich the genetic base through collection and introduction, screening and evaluate them for traits of interest (local collections and new introduction from abroad) • Use –molecular techniques to characterize and study genetic variations of the germplasms • Evaluate segregate lines annually for yield, pest resistance, drought, salinity, seed and fiber quality • Transgress Upland cotton into Pima cotton for obtaining transgressive segregation for earliness of maturity	• Continue local collection and introduction of germplasm material from countries like Australia, Pakistan, India and USA to generate crosses with beneficial traits collaborating with ICAC, FAO, CGIAR centers and others • Use mutation breeding for genetic enhancement • Use biotechnological tools for genetic enhancement (e.g. somaclonal variation), to characterize and study genetic variations • Generate genetic information on traits of importance • Evaluate introductions, crossing lines and advanced selections/lines under different level of trials annually	• Use extensively biotechnological tools such as MAS, genomic selection, trait mapping, bio-informatics analysis and genetic markers to make tailored crossings • Design and implement basic trait and resistance inheritance studies • Identification and mapping of novel traits from wild relatives of cotton to introgres in to the improved varieties • Implement diversity analysis and parental lines selection
1.2 Low productivity (1.5 ton/ha (rain-fed), 2.5 ton /ha (irrigated), 1.7 ton/ha (average), GoT (37%)) of the existing varieties in contrast to the demand and potential that could be attained in Ethiopia due to lack of high yielding varieties, abiotic and biotic stress			
• Low productivity: 1.5t/ha (rain-fed) and 2.5t/ha (irrigated) • Lack of varieties that combine high yielding ability with good quality characters • Cotton varietal characters such as short	• Increase yield to 2.0 ton/ha (rain-fed), 3.0 ton/ha (irrigated) • Develop high yielding varieties through exploitation of the available genetic variability among cotton species and varieties • Identify cotton populations and lines that are	• Increase yield to 2.3 ton/ha (rain-fed), 3.5 ton/ha (irrigated) • Develop high yielding varieties through the use of biotechnological tools (genomic selection, trait	• Increase yield to 2.5ton/ha (rain-fed), 4.0 ton/ha (irrigated) • Develop high yielding cotton varieties with desirable traits such as pest resistance • Develop varieties with specific

A2-5 Sustainable Cotton Production

I. Voluntary standards of sustainability (VSS)

Four standards of sustainable –also called identity- cotton (VSS) are possible in the region: organic cotton, CmiA, BCI and Fair trade (FT). Fair trade is often combined with organic. VSS are developing in Ethiopia since 2013.



SOURCE: ETIDI, 2019

1) Organic cotton

The government of Ethiopia through ETIDI is actively promoting organic cotton, by assisting the producers and its supporter (PAN-UK) with marketing. The production started just in 2017 and is reaching in 2019 close to 300 ha (PAN, 2019).
As important as the beginning of the first organic cotton producers and cooperative is the commitment of leading brands for organic cotton and textile. Below some testimonies.

2) CmiA

See 2.9.1

3) BCI

No production so far under this VSS

4) FT

No production so far under this VSS

II. BRANDS AND RETAILERS SOURCING FROM ETHIOPIA- 2 voices

Organic:

H&M

H&M96 stated that: H&M is an expansive company and we always look for new potential sourcing markets. This does not mean we will stop buying from existing production markets; our presence in our production markets is long-term. Ethiopia is a growing and developing country, where we see large potential to contribute to job creation and unemployment alleviation through our business. Due to quality challenges, H&M has since 2014 not been able to use Ethiopian cotton, but our long-term aim is to engage in the development of a sustainable cotton industry in Ethiopia, taking into account both social and environmental issues associated with cotton. Starting 2017, we will initiate a sustainable cotton project, aiming to increase traceability and introduce better economic, social and environmental practices to selected Ethiopian cotton farmers. The long-term aim is to gradually introduce Ethiopian cotton in our products. The challenges that they identified with regard to textile and clothing production in Ethiopia: Logistics, back-linkage in the supply chain, skills development of workers and management and finance are the key areas of improvement identified to develop the market along with our core sustainability work.

Tchibo

To the questionnaire Tchibo replied that indeed they are sourcing from Ethiopia. Reasons for choosing Ethiopia as a sourcing destination:
1) Approached by long-term supplier Ayka100 Textile as they planned to invest in a modern garment factory in Ethiopia
2) Opportunity for Tchibo to commit to a transparent, sustainable, short product chain creating decent jobs in Ethiopia

3) Matches our company DNA, as we also sell coffee from Ethiopia. They furthermore indicated that they work with only one supplier "Ayka Textile" which they said is Turkish owned and completely vertically integrated. In terms of products Tchibo is sourcing knitwear garments and household textiles from Ethiopia. Regarding cotton use Tchibo indicated that: *Yes, 40% of the cotton used comes*
from Ethiopia including 'Cotton made in Africa' from the Metema region. All other cotton is mainly organic which has to be imported at present, as our sourcing criteria are presently not met in-country. We hope to find sources for organic cotton in Ethiopia which meet our criteria for sourcing (e.g. no landgrabbing) in order to increase the sourcing of Ethiopian cotton.

To the Question: What are the challenges regarding sourcing from Ethiopia? Tchibo replied:
- Infrastructure: no ports, no good transportation yet
- Material and resource delivery including cotton, energy and coal needs to be optimised
- Not enough local management capacities, no professional HR management
- A large workforce, but technical skills and knowledge on rights need to be developed
- High labour turnover and absenteeism despite comparatively high wages and good benefit structures
- Limited organising skills on union side (but positive: dialogue-oriented union representatives)
- Many workers not interested in organising collectively but demanding on an individual basis
- No public health care or public transportation (factory clinic and transportation for workers)
- Installing effective systems to prevent discrimination and sexual harassment at the work place101

Source: H&M Supplier List (Source: SOMO 2016)

CMIA
H&M and its sustainable cotton project
To overcome several challenges, the Dutch embassy in Ethiopia provides funding for Solidaridad to conduct a training program that covers a diverse range of issues including working conditions, environmental issues, quality and efficiency, and connections to the international market. H&M was expected to start in 2017 with the implementation of a sustainable cotton project, aiming to increase traceability and introduce better economic, social and environmental practices to selected Ethiopian cotton farmers. The long-term aim is to gradually introduce Ethiopian cotton in our products'20
Source: H&M, H&M response to SOMO questionnaire, December 22, 2016 (email).

III. Organic cotton (from Marquard, 2020; The Whitepaper)

Since 2015, PAN Ethiopia has worked closely with PAN UK to ensure that crop yields and production costs of both trained organic producers and local conventional producers are recorded each year. Trained organic farmers have experienced consistently higher yields compared to their conventional neighbours, though the exact difference depends on climatic conditions and other local factors.

2017 was a bumper year for cotton production in the area. Local (untrained) conventional farmers achieved an average of 2,100 kilograms/hectare (kg/ha) of seed cotton, compared to an average of 2,650 kg/ha among trained organic farmers. The program's "lead," or most experienced among the trained organic farmers, achieved an average of 3,080 kg/ha in the same year, 46 percent higher than the untrained conventional producers.

In 2016, conditions were not so favourable for cotton, but organic cotton production still outpaced conventional, with conventional farmers averaging 1,200 kg/ha and trained organic farmers averaging 1,390 kg/ha (lead farmers averaged 1,570 kg/ha).

The team also works hard to tease out the complex differences in production costs between conventional and organic so that comparisons could be made between net income per ha. In 2017 and 2018, the average net income per hectare was 55-64 percent higher for organic cotton compared to conventional production under local practice.

This program also supported improved productivity in rotation and field boundary crops, which are often food crops, planting alongside, or and even among the organic cotton plants. Currently, PAN is introducing agronomic practices to improve tomato production as a rotation crop in Ethiopia.

In addition, a PAN UK-funded crop monitoring study of organic and conventional farms in Ethiopia found that dependency on synthetic insecticides, which have negative impacts on human health and biodiversity, can be reduced by using eco-friendly pest management options such as a food spray made from natural and local materials (including maize or yeast and sugar). The spray attracts natural enemies of pests into the crops, thereby enhancing natural biological control and biodiversity without the need for synthetic insecticides.
The two most common chain of custody standards are Textile Exchange's Organic Cotton Standard (OCS) and the Global Organic Textile Standard (GOTS). The Organic Content Standard (OCS) verifies the amount of organic cotton in a finished product. There were 6214 OCS-certified facilities in 2019, a 47 percent increase over 2018.121 This included 87 OCS-certified facilities in six African countries including Morocco (41), Mauritius (22), Egypt (17), Ethiopia (3), Madagascar (2), and Tunisia (2).

IV. The plans of the research related to sustainable cotton are:

Conclusions of the Whitepaper on GM-cotton in Africa

There is increasing interest from within the industry itself, as well as pressure from NGOs, to set commitments for sourcing more sustainably grown cotton as indicated by the textile industry's involvement in the 2025 Sustainable Cotton Challenge and other initiatives. Leading designers, manufacturers, and retailers are increasingly making commitments to use more organic cotton as they develop their sustainability strategies, often focused on climate change mitigation. In so doing, they are supporting the more than 182,000 farmers growing organic cotton worldwide – including almost 37,000 in Africa.

With increased production and vertical integration, Africa has the potential to become a significant hub for ethical and sustainable textile-based development. There are numerous benefits to sourcing organic cotton and GM-free preferred cotton from Africa. These include:

● Currently, much of Africa is GM-free. Countries that prohibit genetically modified seed will avoid the difficult and complex issue of crop contamination through genetic drift and handling, which has become a concern in countries such as India and the United States. This puts African countries at an advantage when it comes to organic production.

● Prohibiting or limiting GM production means that African farmers, national research institutes, and ginners will continue saving and breeding their own locally adapted seed, rather than needing to purchase seed every year from a foreign multinational corporation.

● Africa's proximity to European and Middle Eastern manufacturing facilities makes it an increasingly appealing sourcing destination for several reasons, not least is the lower carbon footprint of transportation to both mills and consumers in those areas.

● Increasing manufacturing capacity within Africa will provide added value to the organic cotton fibre produced on the continent (rather than it being exported in raw form).

● Developing organic cotton production and manufacturing in Africa will offer local job opportunities for Africans and create incentives to reduce rural depopulation and emigration.

The Textile Exchange Pan-Africa Sourcing Working Group supports and encourages the growth of preferred cotton programs that prohibit the use of genetic engineering. These currently include organic (specifically those in the IFOAM Family of Standards), Fairtrade, and Cotton made in Africa. These programs embrace organic practices that build organic matter in soils (increasing carbon sequestration), support smallholder farmers, and protect human health and the environment.

2.4. Studies on sustainable cotton production system, its demand and labeling			
• Studies on BCI, CmiA, organic cotton, Fair trade etc production systems and labeling • Suitability map for cotton to have information on potential growing areas of the crop	• Study the feasibility of cotton production for BCI, CmiA, organic cotton, fair trade, etc • Mapping major cotton production areas and systems	• Mapping sub-agro-ecologies of cotton production areas	• Mapping all cotton production areas of the country to use as a reference

Source: ETIDI 2017

Other source: Voora et al, 2019; Global Market Report: Cotton. SUSTAINABLE COMMODITIES MARKETPLACE SERIES 2019. IISD and SSI. https://www.iisd.org/ssi/publications/global-market-report-cotton/

A2-6 Parameters of the ginning and textile sector

Sourced from the EIC/ITA booklet 2016:
Revealing communication to the investors:

- **Major trade associations:** Ethiopian Chamber of Commerce
- **Top textile investments:** Ayka Addis; Kebire Enterprises; Almeda Textiles
- **Major international trade agreements:** Everything but Arms (EBA)
- **Key investment opportunities:** Spinning, weaving and finishing of textile fabrics.
  Production of garments; the manufacturing of knitted and crocheted fabrics, carpets and sportswear, among others.

INCOME TAX EXEMPTION

Investors involved in ICT, agribusiness, manufacturing, and electrical energy production, distribution and supply enjoy income tax exemptions for between one and nine years, dependent on the individual activity and the investor's location.

In addition, any investor who establishes a new enterprise in one of the following regions will enjoy a deduction of 30% in income tax for three years in succession once the income tax period mentioned above expires (Ethiopian Investment Commission).

- **Gambella**
- **Gumuz/Benshangul**
- **Afar (excluding regions within 15 kilometres left and right of the Awash River)**
- **South Omo Zone**
- **Somali**
- **Borena and Guji Zones in Oromia**

Etc.

Labour cost (US$/month)	
Skilled[1]	60–80
Semi-skilled[2]	50–60
Unskilled[3]	40–50
Labour availability	
Skilled	Unavailable
Semi-skilled	Available
Unskilled	Available
Power cost (US cents/kWh)	2–3
Power availability	Moderately consistent
Rent for commercial purpose (US$/sq. m.)	
Cities	2.70–4
Suburbs	0.10
Construction cost (US$/sq. m.)[4]	350–400
Readymade infrastructure	Available

ETHIOPIA'S BALANCE OF TRADE

In the second quarter of 2015, Ethiopia recorded a trade deficit of US$ 3413.10 million. From 2006 to 2015, balance of trade was an average of US$ -1922.54 million. In the second quarter of 20017, it reached an unparalleled high of US$ -956. 70 million and, in the fourth quarter of 2014, it reached an all-time low of US$ -3737 million. In Ethiopia, the National Bank of Ethiopia reports balance of trade.

To achieve this, the government has targeted three focus areas:

1. **Economic development, focussing on light manufacturing, mainly textile and leather garments.**
2. **Social development by improving the quality of life through integrated progress in health, education and overall living standards.**
3. **Environmental development through the sustainable use of natural resources as well as increasing the resilience of the environment to the adverse impacts of climate change.**

Table 2: Ethiopia's major export items (in US$ millions)

Export commodities	2011/2012		2012/2013	
	Value	Share (%)	Value	Share (%)
Coffee	832 911 521.87	26.33	746 416 325.06	24.22
Oil seeds	472 310 030.60	14.93	443 451 157.28	14.39
Leather and leather products	49 575 223.66	1.57	100 520 795.17	3.26
Textile and garment	84 384 850.18	2.67	97 358 806.13	3.16
Pulses	159 689 150.77	5.05	233 346 330.47	7.57
Meat and meat products	78 808 601.51	2.49	74 256 115.42	2.41
Fruits and vegetables	44 693 809.08	1.41	43 868 874.12	1.42
Live animals	207 078 049.22	6.55	166 399 889.70	5.40
Chat	240 584 960.56	7.61	271 274 513.97	8.80
Gold	613 038 112.59	19.38	578 826 032.65	18.79
Flower	196 965 620.67	6.23	186 658 644.34	6.06
Others not specified	183 264 798.58	2.79	138 835 105.52	4.51
Total	**3 163 304 729.29**	**100**	**3 081 212 589.81**	**100**

Table 3: Status of Ethiopian cotton production in the last six years

Area/production	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15 (estimated)
Total area, ha	82 600	99 250	143 160	81 080	59 000	125 000
Lint, t/ha	0.55	0.55	0.56	0.56	0.59	0.68
Total lint, tons	45 845	55 081	79 452	45 000	35 000	85 560
Total seed, tons	123 900	148 870	214 730	121 620	94 590	231 250

Source: ACTIF Benchmarking reports, 2016

Table 8: Ethiopia's textile and apparel imports (2009–2013)						
(in US$ million)	**2009**	**2010**	**2011**	**2012**	**2013**	**CAGR**
Fibre/filament	5	8	14	15	16	34%
Yarn	21	36	52	56	64	32%
Fabric	83	98	107	125	124	11%
Apparel	102	123	135	223	280	29%
Home textiles	17	74	27	34	58	36%
Other	10	10	27	19	64	59%
Total	**237**	**349**	**362**	**472**	**605**	**26%**

Source: DESA/UNSD, United Nations Comtrade database

Table 9: Ethiopia's top five imported textile and apparel commodities (2013)		
Commodity	**Import value (US$ million)**	**Share**
Woven fabric of synthetic filament yarn	86	14%
Men's or boys' suits, ensembles, not knit, etc.	52	9%
T-shirts, singlets and other vests, knitted or crocheted	43	7%
Women's or girls' suits, ensembles, jackets, blazers, dresses, skirts, divided skirts, trousers, bibs and brace overalls, breeches and shorts	40	7%
Synthetic filament yarn (other than sewing thread), not put up for retail	25	4%

Source: DESA/UNSD, United Nations Comtrade database

Table 4: Ethiopian ginning factories capacity and location				
	List of ginning factories	**Production capacity in tons per day**	**Location**	**Type**
1	Amibara (Birhale) Pvt LC	192	Addis Ababa	**Saw gin**
2	Middle Awash Ginning Factory	174.72	Afar (Middle Awash)	**Saw gin**
3	Omo Valley Ginning Factories	15	SNNPR	**Saw gin**
4	Aribamich Ginning Factory	96	SNNPR	**Saw gin**
5	Mohammed Amiru PLC	60	Afar (Awash)	**Saw gin**
6	Ture Ginning Factory	11	Addis Ababa	**Saw gin**
7	Agricot Pvt Company	15	Oromia (MoJo)	**Saw gin**
8	Studio 3d Pvt Ginning Factory	12	Oromia (MoJo)	**Saw gin**
9	Des Ginning Factory	35	Amara (Gonder)	**Saw gin**
10	Gonder Ginning Factory	18	Amara (Gonder)	**Saw -gin**
11	Shawa Ginning Factory	8	Addis Ababa	**Saw gin**
12	Luci International Ginning	174.72	Afar (Upper Awash)	**Saw gin**
13	Gebre Selam Pvt Ginning	53.3	Oromia (Dukem)	**Saw gin**
14	Hiwot Pvt Ginning Factory	174.72	TIGRAY (Umera)	**Saw gin**
15	Abobo Ginning Factory	144	Gambella	**Saw gin**
16	Nuri Hussen Pvt Ginning	10	Amara (Gonder)	**Saw gin**
17	Else Addis Pvt Ginning Factory	150	Oromiya/Adama	**D/roller gin**
18	Ediget	5	Addis Ababa	**Saw gin**
19	Luci (Deri Kebede)	60	Dukem	**Roller gin**
20	Loyal Tiret	118	Amara	**Roller gin**
21	Abdulkadir	222	Afar	**Saw gin**
Total		**1748.46**		

Source: ACTIF Benchmarking reports, 2016

TEXTILE INDUSTRY

Ethiopia's textile industry is relatively diverse and can be divided broadly into four main areas of production: spinning, knitting and weaving, finishing and garmenting. The Ethiopian textile industry produces a wide range of products, such as yarn (cotton yarn; polyester blended yarn), grey knitted and woven fabric, finished fabrics (bottom weights; workwear; knits and uniform; printed sheeting) and made-ups (curtains; terry towels; blankets; mosquito nets).

There are 122 textile and garment factories, including ginning, spinning, weaving and knitting, and integrated and traditional clothing-making companies. Twenty-one ginning, three spinning mill, 18 weaving and knitting mill, 13 integrated mill, 60 garment and seven traditional handloom companies are found in different parts of Ethiopia.

The factories are located in Tigray, Afar, Amhara, Oromiya, SNNP, Addis Ababa and Dire Dawa. There are also 79 mills in Addis Ababa, 22 mills in Oromiya, seven mills in Amhara, four mills in Afar, three mills in SNNP, three mills in Tigray, two mills Dire Dawa and one mill in Gambelaare that produce cotton fibre, yarn, fabrics and garments.

The installed capacity of each section of the sector is 72 million kilograms of yarn, 122 million metres of woven fabric, 30 million kilograms of knitted fabric, 18 million kilograms of processed knitted fabric, 49 million metres of finished woven fabric, 62 million pieces of knitted garments and 18 million pieces of woven garments. Each section's attained capacity is depicted in table 5. The capacity utilization ranges from 45% to 70% and the average utilization of the industry becomes 58%.

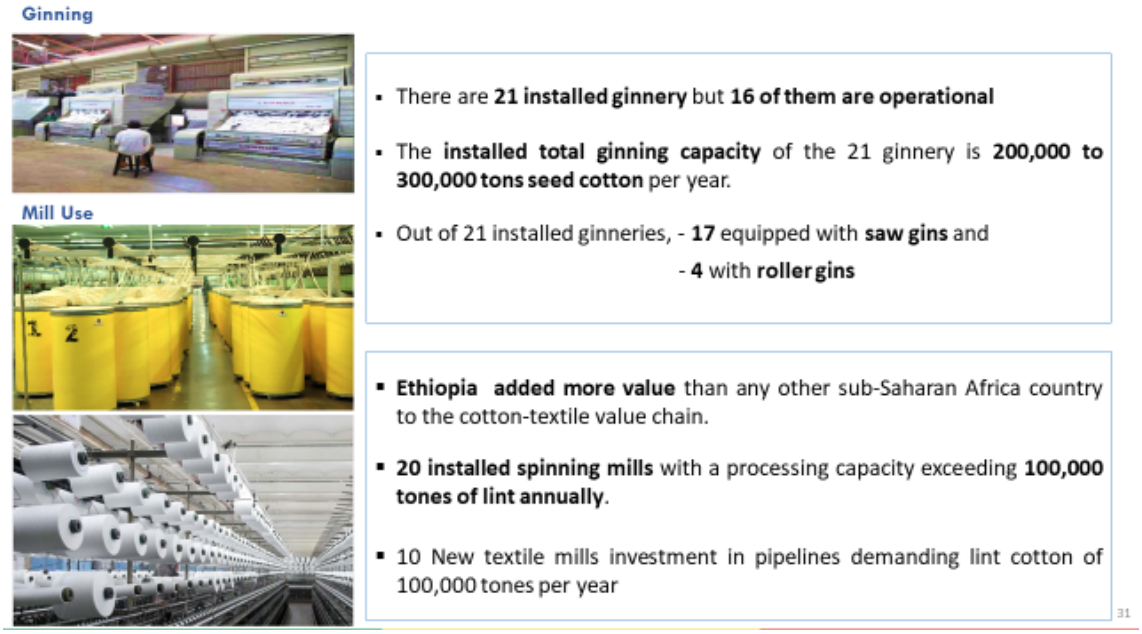
Table 5: Ethiopia's current installed and attained annual capacity of textiles and garments

	Section	Installed annual capacity	Attained annual capacity	Capacity utilization
1	Ginning	106 164 tons of lint cotton	37 300 tons of lint cotton	35%
2	Spinning	72 million kg of yarn	50.4 million kg of yarn	70%
3	Weaving	122 million metres of woven fabric	61 million metres of woven fabric	50%
4	Knitting	30 million kg of knitted fabric	13.5 million kg of knitted fabric	45%
5	Knitting processing	18 million kg of processed knitted fabric	8.64 million kg of processed knitted fabric	48%

Source: ACTIF Benchmarking reports, 2016

Growing imports for the investor-driven enterprises to benefit from cheap labor and energy costs. What is the benefit for Ethiopia? Non at least at short term!

Ginning and Spinning mills



SOURCE: ETIDI, 2019

Project Proposal Evaluating Format

1. Project Name _____

S/n	Evaluation Criteria	Weight	Document information	Given weight	Remark
1	**Pre-condition, if not rejection.** • The project proposal should have content • Copy paste is not allowed • Submission of EIA • Machine layout and area of machinery • Green land area • Success history about prior investment from local Administration • The proposal should be on **Manufacturing sector** ➢ Textile and Apparel:- ➢ Leather and Leather products:- ➢ Agro processing:- ➢ Medical equipment and pharmaceutical ➢ Chemical products ➢ Soft and alcoholic drink ➢ Production of Construction equipment	**Mandatory**			
	➢ power generation ➢ electronics ➢ Mining				
2	**Is the project export oriented or Import substitute?** a. If 81%-100% of the product is for export market ---------- b. If 60%-79% of the product is for export market ---------- c. If 40%-59% product is for export market or 71-100 % is for import substitution ---------- d. If 20%-39% product is for export market or 30- 70% is for import substitution - ---------- e. <20% is product is for export market and < 30% is for import substitution ----------	**20** 20 16 12 8 4			

3	**Employment opportunity**	**18**			
	For new investment				
	a. More than 200 employees----------	18			
	b. 151-200 employees ----------	14			
	c. 101-150 employees ----------	10			
	d. 50-100 employees ----------	7			
	Less than 50 employees----------	4			
	For Model Enterprises				
	a. More than 100 employees ----------	18			
	b. 311-100 employees ----------	13			
	c. 6-30 employees ----------	8			
	d. 1-5 employees----------	5			
4	**Utilization of row material**	**10**			
	a. 100% local row material----------	10			
	b. <20% imported ----------	8			
	c. 20%-39% imported----------	6			
	d. 40%-59% imported ----------	4			
	e. 60%-79% imported ----------	2			
	f. 80%-100% imported----------	1			
5	Technology transfer	**10**			**The weight is calculated by the sum of the**
	Human skill				
	a. If the management and highly qualified technical experts are replaced 100 % by local people in less than one year period	10			
	b. If the management and highly qualified technical experts are replaced 100 % by local people in between one and two years period	7			**human skill transfer and machine model divided by two**
	c. If the management and highly qualified technical experts are replaced 100 % by local people in between more than two years period	3			
	Machinery Model				
	a. If the machine and equipments proposed to use is manufactured in three years period from the current year----------.	15			
	b. If the machine and equipments proposed to use is manufactured in between 4-6 years period from the current year----------	10			
	c. If the machine and equipments proposed to use is manufactured in between 7-10 years period from the current year----------	5			
6	**Financial evaluation (own equity)**	**10**			**The weight is calculate**
	a. 91-100 % of the proposed project capital will cover by own equity ----------	10			
	b. 51-74 % of the proposed project capital will	7			

	cover by own equity ---------- c. 25-50 % of the proposed project capital will cover by own equity ---------- d. < 25 % of the proposed project capital will cover by own equity---------- **Total Amount of Investment Capital** a. If the capital is more than half Billion birr - b. If the capital is in between 250 million and half Billion ---------- c. If the capital is in between 101- 250 million ---------- d. Less than 25 million ----------	4 Rejection 10 7 4 1			d by the sum of the financial evaluation and amount of capital divided by two
7	**Social Responsibility** a. If the investor posed to invest 20% of his profit to the social responsibility ---------- b. If the investor posed to invest 15 % of his profit to the social responsibility ---------- c. If the investor posed to invest 10% of his profit to the social responsibility ---------- d. If the investor posed to invest less 10% of his profit to the social responsibility ---------	10 10 7 4 0			
8	**Currency Type** a. 91-100% own foreign currency----------	17 17			
	b. 71-90% own foreign currency ---------- c. 51-70% own foreign currency---------- d. 31-50% own foreign currency ---------- e. 1- 30% own foreign currency----------	13 10 6 4			
9	**Investment Ownership** a. If the proposal/investment is owned by women b. If the proposal or investment share holders are owned above 50% by women (for Joint venture, Share company, and partnership) c. If the proposal or investment is owned or share holders are owned less than 50% by women (for Joint venture, Share company, and partnership)	5 5 3 1			
	Total	**100**			

Remarks:

1. This procedure is valid since December 2019, but work in progress. Adaptations may be effected during 2020 according to officials from Tigray Investment and Export Commission officer
2. According ETIDI, the Tigray region is the most advanced and initiative and fully applying the current Cotton and textile strategy

A2-7b- Requirements for foreign investor (at national level)

A. Investment license

To meet the requirements for an investment permit, an investor must submit the following documents:

- **An investment application form signed by the investor or agent;**
- **If an agent signs the investment, a photocopy of his power of attorney;**
- **If an individual person signs the investment, a photocopy of his passport page displaying his identity and two recent passport-sized photos;**
- **If an organization incorporated in Ethiopia makes the investment, photocopies of its memorandum of association and articles of association, or where it is to be freshly started. It will also submit photocopies of each shareholders' valid passport displaying his or her identity;**
- **If a foreign business organization branch makes the investment, photocopies of its memorandum of association or a similar parent company document;**
- **If it is a joint investment by foreign and domestic investors, over and above the documents submitted under the previous point, photocopies of identity cards or photocopies verifying the domestic investor's statues, as necessary;**
- **If an agent submits the application, a power of attorney and other related information pertaining to the project details;**
- **A foreign investor who plans to complete a technology transfer agreement associated with the investment is required to hand in a draft agreement and a filled-in application form.**

The Ethiopian Investment Agency (EIA) authorizes and issues investment permits within four hours provided that the above-mentioned documents are submitted in full.

B. Residence permit

When the investment permit is submitted, the Main Department for Immigration and Nationality Affairs issues a foreign investor with a residence permit. An expatriate staff member who has a permit and a foreign investor who is a shareholder of a business or a branch business are also eligible for a residence permit.

C. Land acquisition

The EIA has the directive to enable land allocation for FDI projects all over Ethiopia. For other activities, there is urban land available on an auction basis. The auction prices differ, contingent on demand. The rental and lease prices of rural and urban land differ according to class of land, location and type of investment. The land cannot be sold or mortgaged, but the rental or lease value of the land and its fixed assets can be transferred to a third party or mortgaged.

Source: EIC/ITA 2016

A2-8 "Value chain" and "VC Analysis for Development" definition

We propose to present our understanding of Value chain analyses as it was applied for the functional analyses of the Ethiopian cotton VC. This in order to capture the multiple forms and formations and the geographic variabilities.

1. ***Starting from Parkers definition***

The idea of the value chain is based on the process view of organizations and individual actor that supply material for domestic or international markets, the idea of seeing a manufacturing (or service) organization as a system, made up of subsystems each with inputs, transformation processes and outputs. Inputs, transformation processes, and outputs involve the acquisition and consumption of resources – money, labour, materials, equipment, buildings, land, administration and management which generate value but also have a social and environmental trade-off. How value chain activities are carried out determines costs and affects profits as well as how sustainable the output can be. Value chains differ from traditional conceptions of a supply chain as it explicitly recognises the role of customary practices and 'values.' This is particularly relevant to the Ethiopian context given the parallel and intersecting value chains the supply traditional and mass markets.
— IfM, Cambridge
"Decision Support Tools: Porter's Value Chain" (Porter, 2008). Cambridge University: Institute for Manufacturing (IfM). Archived from the original on 29 October 2013. Retrieved 9 September 2013.
Value chain analysis is a way to visually analyse a company's business activities to see how the company can create a competitive advantage for itself. Value chain analysis helps a company understands how it adds value to something and subsequently how it

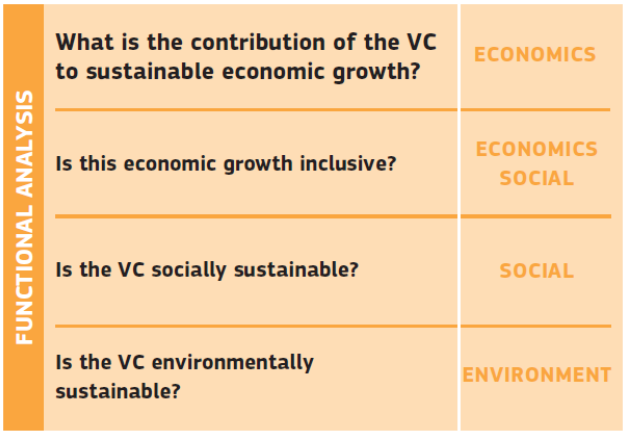
can sell its product or service for more than the cost of adding the value, thereby generating a profit margin. In other words, if they are run efficiently the value obtained should exceed the costs of running them i.e. customers should return to the organisation and transact freely and willingly. Expanding this concept to an economic sector requires consideration of the value added to an economy by the production and sale/consumption of a defined commodity.

2. Input-output conversion and set of organisations

Value is the total amount (i.e. total revenue) that buyers are willing to pay for a firm's product. The difference between the total value and the total cost performing all of the firm's activities provides the margin. Margin implies that organizations realize a profit margin that depends on their ability to manage the linkages between all activities in the value chain. In other words, the organization is able to deliver a product / service for which the customer is willing to pay more than the sum of the costs of all activities in the value chain. A value chain concentrates on the activities starting with raw materials (f.ex. cotton) till the conversion into final goods or services (f.ex. yarn, oilseed). The sources of the competitive advantage of a firm can be seen from its discrete activities and how they interact with one another. The ultimate goals in performing value chain analysis are to maximize value creation while also monitoring and minimizing costs. Most organizations engage in hundreds, even thousands, of activities in the process of converting inputs to outputs. Given the variety of actors within the same position on a supply chain a value chain is arguably better considered as a sum total of "sub-chains" that can be distinguished by meaningful connections between different actors. (E.g. Large scale producers which supply material to modern factories for the export market. However value sub-chains are not static but constantly evolving as producers find new customers or new products are diversified.

3. VCA4D- Agrinatura

VCA4D performs value chain analyses (VCAs) across a range of agricultural commodities and countries in order to appraise their contribution to growth and job creation, taking into account the sustainability and inclusiveness of these value chains (VC). A value chain refers to the sequence of production processes from the primary production to its end uses. It is a system of different types of actors orientated towards the markets (farmers, collectors, processors, wholesalers, retailers…). As such, VCs consider all the stages and all the forms a commodity has to pass through to arrive 'from farm to fork'! The VCA4D does not seek to establish a single indicator or a ranking of value chains. It intends to deliver evidence-based analytical content rather than a definite performance appraisal, so as to inform decision-makers and allow them to make their own judgement.



Taking into account the larger context of the given commodity, specifically the following elements, (but still based on Agrinatura's definition) we can consider a value chain to include:

The flow of the given product (commodity) and its passing through the transformation with the various interfaces of the actors embedded is the core of any VC analyses. However, the "product" is depended on the various commitments of the series of buyers and sellers based on agreed quality standards. So each market remains a social act (White, 2008).

The larger context, or the historic evolution and socio-ecologic dynamics of the VC, including related sub-value chains (including time –and space wise competition by other crops and land uses) is taken into account as embedding structure. The socio-economic characteristics of all institutions and actors that make up the value chain is included, going beyond the description of individual actors and organisations and depicting their relations, ties and figurations and networks, We use the concept of actor arena;
The political-cultural context of the VC, considering trust/power dimensions of the various involved groups and clusters (political/council discipline) and selection mechanism of purification in deciding who is in and who is outside the given arena (village community, investor group, decision maker arena). Constraints and challenges of the VC. This is reported as a conclusion of the analyses based on assumed norms and priorities or agreed topics. We define, based on the above considerations and clarification, a VCA4D as following:

> ***A process of understanding the interactions between the involved actors (identities, including collective actors) and their quality of relations in order to come out with outputs of a material flow which is supposed to be inclusive, ecological sustainable and creating jobs and contributing to economic value addition (to identifiable groups) in a given time period and place. Critical aspects are identified, presented and recommendations made to mitigate them.***

We try with this definition to reconcile economical, sociological and Life Cycle Assessment (LCA) requirements aiming to ensure that the sustainability of the VC is in the focus of the study.

Porter, M. E. (2008). *Competitive Advantage: Creating and Sustaining Superior Performance*: Free Press.
White, H. C. (2008). *Identity and Control: How Social Formations Emerge*: Princeton University Press.

A2-9 Cotton Research Strategy 2016-2030 (EIAR)

Vision

NCR program aspires to become the “center of excellence” in irrigated (at WARC) and rain-fed (at AARC) cotton R4D in East Africa; well-known cotton research centers in African and recognized in the world to the level that the program become comparable and competitive to those of the countries that have been considered as benchmarks for this research strategy development by the year 2030.

Mission

NCR program is committed to generate, develop, adopt, promote and avail proven cotton production and management technologies; capacitate cotton producers in Ethiopia (both under irrigated and rain fed conditions) with continuous provision of technologies, information and knowledge through research, training, skills acquaintance and experience sharing on “integrated cotton management” thereby contributing to the overall GTP of the Country. The main mission of NCR program is to generate/develop/adopt and popularize promote packages of technologies that help the cotton producers to increase profitability, productivity and then the overall production of quality cotton lint thereby leading to the country's self-sufficiency to avail the required amount of cotton lint for the ever increasing textile and garment manufacturing industries substituting the import of cotton lint from abroad and exporting the surplus cotton lint produced in the country.

Goal

The ultimate goal of the NCR program is to contribute to the overall developmental objectives of agricultural sector, viz., assuring social well-being, food security and poverty alleviation by stimulating sustainable economic growth and improving the livelihood of the cotton actors through coordinated, interactive and effective planning,
implementation and equitable use of cotton production and value addition benefits by the stakeholders and partners involved at different levels of cotton supply chain.
Specific objectives
Cognizant of the prevailing authentic situations in cotton sub-sector, the specific objectives of NCR Program are, therefore, to:
· Generate, develop, adopt and promote improved cotton production and management technologies, knowledge and information that would increase cotton production, productivity and profitability under irrigated and rain-fed, small and large scale, and major and sub-agro-ecological production systems.
· Improve cotton fiber qualities (length, strength, and micronaire) to make cotton lint produced in Ethiopia as competitive and acceptable as possible for both domestic and international markets;
· Improve cotton seed oil qualities (edibility and oleo-chemicals) to make cotton oil produced in Ethiopia acceptable and very well fit for human consumption by reducing the gossypol content in case demanded;
· Increase an income earning opportunities of cotton producers, traders, processors and other partners involved in cotton supply chain;
· Ensure that the production, management, processing of cotton and the benefits obtained from production and value addition is socially, economically and environmentally sustainable and brings about an “inclusive growth” through equitable share of the benefits among the partners operating all along cotton supply chain;
· Promote that women"s contributions in the production and value addition processes of cotton is fully recognized thereby increasing opportunities for their empowerment in decision making all along the cotton supply chain;
· Coordinate research activities on irrigated cotton (from WARC) and rain fed cotton (from AARC), that is cotton research being undertaken by various research partners (federal, regional and universities) and play key role in building technical capacity of farmers, development agents (DAs), subject matter specialist (SMS), researchers, partners and others to enhance their uptake and utilization of new technologies, knowledge and information availed by the research system and science think-thank.

Varia on soil fertility:

Cotton: Organic Fertilizer Source
Cotton seed cake is also used for amelioration of soil fertility as organic sources of soil nutrients (fertilizer) reducing the cost of chemical fertilizers for crop/cotton production.
But detail analysis on the macro-and -micro nutrient composition of cotton seedcake is not available demanding further studies for appropriate recommendation as a part of integrated nutrient management to maintain soil health and its productivity.

The research plan related to soil fertility management:

IX) Soil Fertility, Health and Irrigation Water Management			
9.1 Lack of agro-ecology based updated recommendations on fertilizers and irrigation water requirement of cotton			
• Limited information and recommendations on fertilizer types, dosages and time of application appropriate for growing cotton under different agro-ecologies, cropping systems and soil types • Recommendations on integrated soil fertility management appropriate for growing cotton under different agro-ecologies, cropping systems and soil types are not available • Limited information and recommendations on cotton-irrigation water requirement for	• Develop recommendations on integrated soil fertility management for different major AEZs of cotton • Update and establish packages of optimum soil nutrient and crop-water requirement for major cotton agro-ecologies and soil types (fertilizer types and rates, application methods, water amount, frequency and methods of application) • Study on soil health, soil biology, soil nutrients, organic sources of nutrients and water quality to develop appropriate recommendations for cotton farmers	• Develop integrated nutrient management (INM) system for cotton sub-agro ecology • Continue study on soil nutrient requirement and management on new cotton varieties in different cotton agro ecologies • Develop model for efficient nutrient management, nutrient index and nutrient curve • Strengthen laboratory and green house facilities for	• Continue refining and developing INM for all agro-ecology • Continue studying soil biota, soil physical and chemical characteristics to improve recommendations for producers • Refining cotton crop model for efficient nutrient management under different soil types and AEZs • Continue in recommending irrigation facilities that are eco-friendly and cost effective

efficient use of water, methods and frequency of application for different cotton agro-ecologies (irrigated and rain-fed)	• Study on crop modeling for efficient nutrient management in different AEZs • Capacitate laboratory and green house facilities • Gathering of primary and secondary information on soil resources base, climatic variables and conducting inventory and detailed characterization of the soil resources	research centers	• Conduct studies on cotton-moisture-soil relationship to develop cutting-edge technologies

[no mention of humus, SOM, mycorrhiza etc.]

The Next Steps

One of the most important bottlenecks to cotton R4D is the absence of technology incubation and multiplication center/unit. This demands strong public-private institution and the establishment and development of strong public and private sectors takes longer time. Thus, as a short term plan, EIAR"s Crop Research Directorate and WARC are expected to play a catalytic role and to multiply available technologies related to cotton improvement in collaboration with regional research centers, agricultural bureaus and the industries. The cotton seed multiplication and supply has to get the highest attention possible in the short period to be on the right course and bring an impact.

Once this NCR strategy document is brought to approval and approved by EIAR top management, the most important issues to be addressed is the preparation of short term implementation plan/projects from the strategic issues. The preparation of the implementation or action plan (short term projects) is very crucial for the reason that it is not possible to materialize the strategy without it. The implementation plan document will come out as a follow up document to the NCR strategy document. The major contents of the implementation plan must address the following topics:

· Implementation plan
· Monitoring and evaluation plan
· Impact assessment plan
· Reassessment plan for the strategy to make an amendment based on the existing and emerging authentic situations in the country and globally.

More importantly, the implementation plan also addresses the resources (human, physical, other facilities) needed to be owned by the NCRP to properly and efficiently implement this strategy, at least for short term.

Economic analyses

A3-1 Parameters for the economic analysis

1. Production (seedcotton)

1.1. Number of smallscale farmers = 26,000 including 19,000 'modern' (SCF) and 7,000 'traditional' (TCF)

Averages per 'modern' farmer:
Cotton area: 0.75 ha
Yield: 1,600 kg seedcotton/ha
Production: 1,200 kg seedcotton, 100% sold to middlemen (price 18 ETB/kg ex-farm)
Costs of production:
Seeds (15 kg/ha) = 315 ETB/ha
Fertilisers (75 kg/ha) = 1,125 ETB/ha
Insecticides & herbicides (6 l/ha) = 1,350 ETB/ha
Sub-total inputs: 2,790 ETB/ha = 1.8 ETB/kg seedcotton
Transport: middlemen
Seasonal labour; 30 days/ha (125 ETB/day) = 2.5 ETB/kg seedcotton
Picking: 1.0 ETB/kg seed cotton
Sub-total labour = 3.5 ETB/kg seedcotton

Averages per 'traditional' farmer:
Cotton area: 0.5 ha
Yield: 1,300 kg seedcotton/ha
Production: 650 kg seedcotton (market price: 30 ETB/kg) ginned and spun by hand
Costs of production:
Seeds: pm (recycled)
Insecticides: pm (molasses)
Fertilisers: pm (organic manure)
Transportation: pm (by household)
Labour: pm (by household including picking)

1.2. Number of commercial farmers (LCF) = 90

Averages per farmer:
Cotton area: 400 ha
Yield: 1,900 kg seedcotton/ha
Production: 760 t seedcotton
- 75% transported and sold to ginners: 570 t (price 20 ETB/kg delivered to gin)
- 25% sold to middlemen: 190 t (price: 18 ETB/kg ex-farm)

Costs of production:
Seeds (15 kg/ha) = 315 ETB/ha
Herbicides (2/ha) = 500 ETB/ha
Fertilisers (125 kg/ha) = 1,875 ETB/ha
Insecticides (9 l/ha) = 2,025 ETB/ha
Mechanised operations: 5,000 ETB/ha
Fixed costs: 500 ETB/ha
Sub-total: 10,215 ETB/ha = 5.4 ETB/kg seedcotton
Transport to ginnery = 1 ETB/kg (for 75% of production)
Permanent employees: 40 (average salary 3,000 ETB/month) = 2 ETB/kg seedcotton
Seasonal labour; 7.5 days/ha (125 ETB/day) = 0.5 ETB/kg seedcotton
Picking = 1.5 ETB/kg seed cotton):
Sub-total labour = 4 ETB/kg seedcotton

2. Seedcotton Marketing

Number of middlemen (MID) = 40
Averages per middleman:
Seedcotton purchased 998 t (price: 18 ETB/kg)
Selling price: 20 ETB/kg
Transport cost from farm to ginnery (50 km): 1 ETB/kg seedcotton

3. Ginning

Number of ginners (GIN) = 19
Averages per ginner (2/3 saw ginned; 1/3 roller ginned):

Seedcotton ginned: 4,800 t (price: 20 ETB/kg delivered to ginnery)
Production:

1. lint (ginning outturn: 37%) = 1,776 t
2. cottonseeds (55% of seedcotton) = 2,640 t

Planting seeds (3% of cottonseeds): 79 t (price: 21 ETB/kg)
Oilseeds (97% of cottonseeds): 2,561 t (price: 5 ETB/kg delivered to oil mill)
Costs of production:
Electricity: 150 KWh/t lint = 90 ETB/t lint
Baling & ties = 300 ETB/t lint
Maintenance & spare parts = 250 ETB/t lint
Other costs = 100 ETB/t lint
Sub-total = 750 ETB/t lint
Transport cost from ginnery to spinning mill (300 km): 1 ETB/kg lint
Permanent employees: 25 (average salary 3,500 ETB/month) = 600 ETB/t lint
Seasonal labour; 45 x 3 months (average salary 2,500 ETB/month) = 200 ETB/t lint
Sub-total labour = 800 ETB/t lint

4. Spinning

Number of spinners (SPI) = 16
Averages per spinner (50% ring; 50% rotor):
Lint cotton spun: 2,109 t (price: 50 ETB/kg delivered to spinning mill)
Spinning ratio = 77% yarn/lint
Production: 1,624 t yarn (average price: 100 ETB/kg ex-spinning mill)
Costs of production:
Electricity (3 kWh/kg yarn) = 1,800 ETB/t yarn
Water (15 m3/t yarn): =100 ETB/t yarn
Spare parts & maintenance = 500 ETB/t yarn
Other costs = 1,000 ETB/t yarn
Sub-total = 3,400 ETB/t yarn
Salaries (250 permanent employees; average salary: 1,800 ETB/month) = 3, 325 ETB/t yarn

5. Cottonseed processing

Number of oilseed processors (OIL): n/a
Cottonseed processed: 48,660 t (price: 5 ETB/kg delivered to oil mill)
Production:

- crude oil (12.5% of cottonseeds = 6,082 t (price 50 ETB/kg ex-oil mill)
- cake (64% of cottonseeds) = 31,142 t (price 5.5 ETB/kg ex-oil mill)

Costs of production:
Electricity: 725 kWh/t crude oil = 435 ETB/t crude oil
Consumables = 500 ETB/t crude oil
Maintenance & spare parts = 500 ETB/t crude oil
Other costs = 1,000 ETB/t crude oil
Sub-total = 2,450 ETB/t crude oil
Salaries (based on 150 permanent, average salary 2,500 ETB/month for annual processing capacity of 50,000 t various oilseeds); 100 ETB/t oilseeds = 800 ETB/t crude oil

6. Traditional production

Estimated number of traditional cotton farmers (TRA): 7,000
Averages per household:
Seedcotton produced: 650 kg (market price: 30 ETB/kg) ginned and spun by hand
Production:

1. lint (ginning outturn: 37% of seedcotton) = 240 kg (market price: 60 ETB/kg)
2. cottonseeds (43% of seedcotton) = 280 kg (self-consumption; market price: 5 ETB/kg)
3. yarn (80% of lint) = 192 kg (market price: 150 ETB/kg)

Cost of production: Transport: pm
Labour: pm (self-employed)

ITEMS OF THE OPERATING ACCOUNTS

Operation	Category	Title	Quantity	Unit Q.	Unit price	Value
Traditional farmer (trading activity)	Production	Yarn	0.1924	Metric Ton	150000	28860
Small-scale farmer	Consumables	Fertilisers	56.25	Kilogram	15	843.75
Small-scale farmer	Consumables	Herbicides	0.75	Liter	225	168.75
Small-scale farmer	Consumables	Insecticides	3.75	Liter	225	843.75
Small-scale farmer	Consumables	Seeds	0.01125	Metric Ton	21000	236.25
Small-scale farmer	Salaries	Cotton picking	1200	Kilogram	1	1200
Small-scale farmer	Salaries	Seasonal labour	22.5	Day	125	2812.5
Commercial farmer (sell to middlemen)	Consumables	Fertilizers	3750	Kilogram	15	56250
Commercial farmer (sell to middlemen)	Consumables	Herbicides	600	Liter	250	150000
Commercial farmer (sell to middlemen)	Consumables	Insecticides	2700	Liter	225	607500
Commercial farmer (sell to middlemen)	Consumables	Mechanised operations	560	Metric Ton	2630	1472800
Commercial farmer (sell to middlemen)	Consumables	Seeds	4	Metric Ton	21000	84000
Commercial farmer (sell to middlemen)	Service	Transport	570000	Kilogram	1	570000
Commercial farmer (sell to middlemen)	Salaries	Cotton picking	590000	Kilogram	1.5	885000
Commercial farmer (sell to middlemen)	Salaries	Permanent labour	30	Month	3000	1080000
Commercial farmer (sell to middlemen)	Salaries	Seasonal labour	2250	Day	125	281250
Commercial farmer (sell to middlemen)	Depreciation	Farm equipment	1		3262500	217500
Commercial farmer (sell to middlemen)	Finance	Interest			114000	114000
Middleman	Service	Transport	997500	Kilogram	1	997500
Middleman	Finance	Interest			200000	200000
Ginner	Production	Planting Seeds	79	Metric Ton	21000	1659000
Ginner	Consumables	Baling	1776	Metric Ton	300	532800
Ginner	Consumables	Electricity	1776	kWh	0.6	159840
Ginner	Consumables	Spare parts	1776	Metric Ton	250	444000
Ginner	Service	Transport lint	1776	Metric Ton	1000	1776000
Ginner	Service	Transport seeds	2561	Metric Ton	150	384150
Ginner	Salaries	Permanent labour	25	Month	3500	1050000

Ginner	Salaries	Seasonal labour	45	Month	2500	337500
Ginner	Depreciation	Ginnery	1		5800000	290000
Ginner	Finance	Interest			1000000	1000000
Spinner	Production	Yarn	1624	Metric Ton	115000	1.87E+08
Spinner	Consumables	Electricity	1624	kWh	0.6	2923200
Spinner	Consumables	Spare parts	1624	Metric Ton	500	812000
Spinner	Consumables	Water	1624	m3	7	170520
Spinner	Salaries	Permanent labour	250	Month	1800	5400000
Spinner	Depreciation	Spinning mill	1		2.90E+07	1450000
Spinner	Finance	Interest			1500000	1500000
Oil processor	Production	Cake	31142.4	Metric Ton	6325	1.97E+08
Oil processor	Production	Crude oil	6082.5	Metric Ton	57500	3.5E+08
Oil processor	Consumables	Chemicals	6082	Metric Ton	500	3041000
Oil processor	Consumables	Electricity	6082	kWh	0.6	2645670
Oil processor	Consumables	Spare parts	6082	Metric Ton	500	3041000
Oil processor	Salaries	Permanent labour	48660	Metric Ton	100	4866000
Oil processor	Depreciation	Oil mill	1		7250000	362500
Oil processor	Finance	Interest			500000	500000
Commercial farmer (sell to ginners)	Consumables	Fertilizers	12500	Kilogram	15	187500
Commercial farmer (sell to ginners)	Consumables	Herbicides	200	Liter	250	50000
Commercial farmer (sell to ginners)	Consumables	Insecticides	900	Liter	225	202500
Commercial farmer (sell to ginners)	Consumables	Mechanised operations	190	Metric Ton	2630	499700
Commercial farmer (sell to ginners)	Consumables	Seeds	1.5	Metric Ton	21000	31500
Commercial farmer (sell to ginners)	Salaries	Cotton picking	190000	Kilogram	1.5	285000
Commercial farmer (sell to ginners)	Salaries	Permanent labour	10	Month	3000	360000
Commercial farmer (sell to ginners)	Salaries	Seasonal labour	750	Day	125	93750
Commercial farmer (sell to ginners)	Depreciation	Farm equipment	1		1087500	72500
Commercial farmer (sell to ginners)	Finance	Interest			34200	34200
Farmers	Consumables in chain	Planting Seeds	1	Metric Ton	21000	21000

A3-2 IMPORT AND EXPORT DATA

Source: ITC Trade Map

Cotton, not carded or combed (HS Code 5201)

		2013	2014	2015	2016	2017	2018	2019 (prov,)
Exports	t					1573	983	414
	k$					2458	1491	685
	$/t					1563	1517	1655
Imports	t		2881	609			189	294
	k$		5181	1063			237	898
	$/t		1798	1745			1254	3054

Cotton waste, incl. yarn waste and garnetted stock (HS Code 5202)

		2013	2014	2015	2016	2017	2018	2019 (prov,)
Exports	t	1423	313	68	136	538	22	
	k$	1758	291	58	197	692	23	
	$/t	1235	930	853	1449	1286	1045	
Imports	t			5	8	111	418	93
	k$		1	5	22	3188 ?	498	95
	$/t			1000	2750	28721	1191	1022

5203 Cotton, carded or combed (HS Code 5203)

		2013	2014	2015	2016	2017	2018	2019 (prov,)
Exports	t	2112	19		19	3251		
	k$	3404	45		44	4892		
	$/t	1612	2368		2316	1505		
Imports	t			505	1	6	0	0
	k$	2		855	1	84 ?	0	1
	$/t			1693	1000	14000		

Cotton sewing thread, whether or not put up for retail sale (HS Code 5204)

		2013	2014	2015	2016	2017	2018	2019 (prov,)
Exports	t					16	10	127
	k$					35	7	65
	$/t					2188	700	512
Imports	t	9	8	23	35	21	47	30
	k$	17	53	56	98	69	270	70
	$/t	1889	6625	2435	2800	3286	5745	2333

Cotton yarn other than sewing thread, containing >= 85% cotton by weight, not put up for retail sale (HS Code 5205)

		2013	2014	2015	2016	2017	2018	2019 (prov,)
Exports	t	9765	5429	5589	3463	1469	1140	791
	k$	26242	14215	12535	7825	3302	2751	1866
	$/t	2687	2618	2243	2260	2248	2413	2359
Imports	t		1		17	29	738	890
	k$		50		54	100	2126	2649
	$/t				3176	3448	2881	2976

Cotton yarn, other than sewing thread, containing less than 85% by weight of cotton, not put up for retail sale (HS Code 5206)

		2013	2014	2015	2016	2017	2018	2019 (prov,)
Exports	t		17	12	3			
	k$		58	116	18			
	$/t							
Imports	t			9	20	24	2326	2528
	k$			15	50	65	7395	7181
	$/t			1667	2500	2708	3179	2841

Palm oil and its fractions, whether or not refined,excluding chemically modified (HS Code 1511)

		2015	2016	2017	2018	2019 (prov,)
Imports	t	445135	459904	457045	164879	64757
	k$	421873	441166	435644	123964	41856
	$/t	948	959	953	752	646

Social analyses

A4-1 Elements of sociological and historic facts of Agriculture of Ethiopia related to cotton VC
A4-2 Historic cotton production: peoples and markets (Westphal 1975).
A4-3 The socio-economics of cotton and textile around Arbaminch
A4-4 ?
A4-5 List of interviews conducted (anonymized)
A4-6 List of consulted literature (mainly for the social/sociological part)

A4-1 Elements of sociological and historic facts of Agriculture of Ethiopia related to cotton VC

Main source: Doda Zerihun 2007. Teaching Material on the Sociology of Agricultural and Pastoral Societies. UNIVERISTY OF HAWASSA, COLLEGE OF AGRICULTURE, DEPARTMETNT OF ANIMAL & RANGE SCIENCES
Compiled and edited by G. Nicolay (March 2020)

The following subjects are treated in this annex:

1. **The three main areas**
2. **Cereals replacing Enset in Southern Ethiopia (19th cent to 1975)**
3. **Agrarian reform under the Derg (1974-1989) and trend towards disaster?**
4. **The current larger picture: migration, national and global networks and policy dimensions**
5. **The case of pastoralism**

(followed by the cited references)

1. The three main socio-biotic areas

Social anthropologists and other social scientists that have done research on Ethiopian societies have classified systems of agriculture in to four general categories (Westphal, 1975): There are

1. The plow and seed based agricultural societies of the north and central Ethiopia
2. The pastoral nomadic societies of Ethiopia
3. The shifting cultivation of tropical rainforest of western Ethiopia
4. The Enset based agriculture of south and southwest Ethiopia

Other writers such as Simmonds (1958, cited in Westphal, *op cit*: 70) classify the Ethiopian agricultural system into "the *enset* - planting economy", "the nomadic cattle herding economy" and the "Amharic - Tigrean plough - and - seed economy"'. However, these classifications of the Ethiopian peoples into over-simplified agricultural - economic systems may be misleading.
Pastoral nomads (in Ethiopia) constitute over 10 million populations according to a recent census (~2000); they occupy the vast majority of peripheral land in the country. The most well known pastoral nomads of Ethiopia are the Boran Oromo, the Afar, the Somali, The Kereyu, Arbore, the Nuer, and other various smaller groups in South and south west Ethiopia.
[we may consider the four main cotton areas as part of these corresponding areas: Northern--> plow and seed abased; Southern/Arba Minch→ Enset based; Afa/Southern plains→ pastoral nomadic; North-East→ shifting cultivation.

2. Cereals replacing Enset in Southern Ethiopia (19th cent to 1975)

In addition to the major five cereals grown in Ethiopia, enset (Ensete ventricosum, sometimes referred to as false banana) is an important staple in large parts of the southern highlands, where it has been estimated that more than 10 million people depend on enset for food, fiber, and other uses (Brandt et al. 1997).

Hamer, writing on the Sidama, stated that the "durability of their staple food *Enset* linked to their healthful ecological and locational factors has created a rich and unique culture" (p.20). The peoples' residence patterns and social – cultural institutions are linked to the *enset* system and ecological factors. Each group of people in the *Enset* complex area have developed a complex nomenclature, instruments, objects, seasonal calendar, use values, species varieties, etc, revolving around *enset*.
One of the distinctive features of peasant agronomy in the *enset* ecology in contrast to the cereal complex areas in Ethiopia is its greater sensitivity to the environment and its more refined approach to natural resource use (Desalegne, 1991). The *enset* growing peoples generally share a common feature in their social organizations.
Overall, the people over the millennia have adapted themselves to their ecology in a particular pattern and with it evolved discernible social-cultural structures and institutions.
One common feature regarding social organization and structural differentiation among the major *Enset* producing peoples of southwest Ethiopia is that they all have had their own traditional systems of political, social, structural arrangements. The peoples used to be organized in feudalistic manner with the society being divided into different strata at the top being the few ruling nobilities and the lowest rung being held by the out casts (Cerulli, 1956). In between are the free citizens and the slaves. However, such a social organization in terms of vivid social hierarchies has progressively lost its significance.
Available literature and experience point to the fact that the *enset* culture complex area of Ethiopia have had for millennia lived in a relative advantage in terms of ecological, social and economic resilience. There were little or no records of massive regular famine history in these areas. But these conditions which have characterized the peoples have changed since the last 3 – 5 decades.

Among other things, the agricultural and related policies pursued so far by the successive Ethiopian regimes have worked against the traditionally resilient ecological and livelihood system in which *enset* occupied central place. The policies of agricultural

modernization, resettlement, villagization, etc, have all worked inimically on the *enset* – driven ecological, social and livelihood systems of the southwest Ethiopia (Alemneh, 1990).

The traditional farming system centering mainly around *enset* has been environment-friendly in many ways such as promoting soil fertility, discouraging soil erosion, deforestation, etc(Alemneh, *op cit*). However, the settlement of many northerners in the southwestern Ethiopia following the occupation of these peoples by the central government brought about a social-cultural element to the weakening of *enset* as a food source. The northerner ruling class has strong dislike for the *enset* product and they as the landlords in many cases discouraged the production of *enset* (Eyasu, 1991; Alemneh, 1990).

Of all *enset* growing peoples of Ethiopia, the case of Wolayta stands out. Famine and poverty have been intensified. Farmers argue that the shift from root crops to cereal farming largely accounts for the 1984 famine, which was the first of its kind in the country the Wolayta people.

Although the preference of cereal crops by the development agents is generally based on the relative conduciveness of such crops in extension promotion activities, there has been a general tendency to equate root and tuber crops as inherently inferior to cereal crops. The *ceralization* process of the *enset* growing peoples of the south was thus part of the general politico-economic and cultural domination.

3. Agrarian reform under the Derg (1974-1989) and trend towards disaster?

The most popular, radical form of agrarian reform measures in Ethiopia were taken during the Dergue Regime. According to Tadesse (2002: 117) " beginning in the late 1985, as part of its plan of 'rapid rural transformation' and greater control of peasant farms [the Dergue] implemented a villagization program throughout the country... at the end of 1989, nearly 40% of the country's rural population, numbering about 14 million peasant farmers had forcibly been villagized". Although it was meant for better socio-economic transformation and development of the rural peasant societies and the nation in general, it ended up bringing one of the untold human sufferings in the Third World.

Situation since 1991: towards an ecological disaster?

Ethiopia has successively been hit by severe droughts and resulting famine which claimed the lives of innumerable citizens and those of animals. The trend in recent years has worsened so much that in 2001/ 2002, there were about 14 million Ethiopians exposed to the danger of famine. The famines of early 62, 1970s and 1984 were so severe that they were talking issues for the whole world. The problem is now one of the top agenda items for the Government of Ethiopia. It is no wonder that many people associate Ethiopia with famine, drought and poverty. The name of Ethiopia was so much popularized that some world famous individuals have amassed money through fund raising campaigns in the name of helping the starving Ethiopians and used the money for their personal gains (Mesfin, 1984; Nigussie, 2004). The rural population is more vulnerable to famine. The quality of life

Peasant poverty description by unknown scholar (Tedla?) around 2000

"Because of the poverty it wallows in, the majority of the country's population relies for its energy on wood and/or cattle dung; on forests for its supply of medicines; on rivers and springs for its water supply; on wood cut from forests, grass mowed from the fields, and on mud taken from the soil in order to build its huts; on cotton and hide for its clothing. The land on which it produces its food is farmed year in year out without any break; the animals it uses either for farming or as food sources sustain themselves through their own effort by grazing the surrounding lands, with no care and protection from anywhere. Because of such poverty, the majority of our people completely rely for their livelihood on what nature provides. Consequently, the plants that are cut down, with no replacement at all; the land that is being farmed, without any break, year in year out; the domestic animals that breed without any human care and protection; the wildlife hunted down without any compassion; all these constitute a complex of reasons for the country's environmental crisis.»

of the rural people has as a result deteriorated very much. The most important sections of society that are more affected by the famine and drought are often children, women and the aged. Of the death toll due to famine, these categories constitute of the largest proportion (Fasil, *op cit*)

The issues of population explosion and ecological deterioration are now major social issue and the Ethiopian Government has taken them as priority areas.

According to (Shifalu Tedla) , and of course as can easily be observed, the main and visible environmental problems in Ethiopia, as well as in other developing countries, are the following:

- Population increase;
- Soil erosion by water and wind;
- Degradation of soil fertility and decrease in productivity;
- Deforestation and soil exposure;
- Inability to improve the contribution of the agricultural sector to growth; the sector's stagnation and, in fact, degeneration;
- Lack of appropriate policies, strategies, and regulations, or inability to implement those that are available

Ethiopia is currently [2005] engaged in massive national, regional and local level socio-economic development activities. The centuries old complex historical, socio-cultural, political, natural and other factors have contributed to what some writers call as the "n**ear ecological disaster**" in which we find ourselves (Fasil, 1993; Kottack, 2002). Environmental degradation and resource deteriorations have become key issues in the contemporary environment and society dialogue in Ethiopia.

4. The current larger picture: migration, national and global networks and policy dimensions

Ethiopia as a Sub-Saharan African country has experienced the sweeping influence of the wave of migration that is better understood in the political, economic, ecological and socio-cultural contexts of the contemporary world. The most significant event

in the place of Ethiopians in international migration is the period following the downfall of the (Ethiopian) imperial rule and the onset of the communist-oriented, revolutionary rule by the Derg regime. What might be called the Ethiopian Diaspora came into the world scene in the late 1960s and 1970's (Bekele, 2002). Innumerable Ethiopians constituting particularly the intellectuals fled the country as forced migrants mainly to the USA, and scattering well over the world. The incessant flow of Ethiopian migrants, as part of the international migration, mainly spurred by the search for better living opportunities, often masked under the facade of fleeing political persecution, has still continued unabated. The impact of this on the country's socio-economic landscape, be it negative or positive, is incalculable, particularly the migration of intellectuals and the ensuing brain drain is no simple matter (Dutoit, 1990).
The following processes have significant places in the drama of **internal migration** in the country:

- The government actions of resettling people from one region to another such as the rather massive, involuntary villageization program of the Derg or the (current) EPRDF resettlement program as part of the country's socio-economic development efforts;
- The civil wars that have raged between the various bodies for long period of time;
- The conquest of the demised successive imperial systems as an empire building agenda;
- The ever-recurring drought and the perennial, romanticized famine question and food insecurity of the country;
- The rapidly growing population and the resultant resource depletion and ecological deterioration;
- The increasing urbanization and the seeming presence of better opportunities therein that act as pull factors; and
- The weakening of the traditional social-cultural and political structure of the various ethnic groups; among others.

Sociological and social anthropological literature is replete with cases of how **development projects planned without the consultation of (sociologists and) anthropologists** and intended beneficiaries have done more harm to the people, their cultural heritages, and their local ecosystems than the benefits of improved living standard. Any development project should be culturally compatible and such projects are found to be "twice as much successful as the incompatible ones" (Kottack, 2002: 586). Culturally compatible development projects take into account, among other things, the traditional, cultural heritages of the local people concerned; their indigenous knowledge and wisdom; including respecting the peoples' ethical concerns for nature and local ecosystems.
Indigenous peoples all over the world have been increasingly exposed to the forces of capitalist global markets, with often adverse consequences for their livelihoods. The broader context of social and agrarian changes has increasingly limited indigenous peoples' access to critical natural resources in their own local ecosystems; local people's lands, trees and range products which have for centuries been used and managed by them are exposed to market forces; their domestic labor supplies are strained; and their local institutions of managing natural resources are weakened (Little and Brokensha, 1987: 207).

The forces of outside interventions are also highly felt among inhabitant of forest areas. Ecologically oriented, mutuality relationships between forests and people are disappearing and changing due to market forces, government forest policies, and changes in the government's values of indigenous peoples (Becker and Leon 2000: 163). In short, development activities (projects) implemented at different times have caused damages to the environment. The main source of the damages is the fact that the projects were undertaken **without the appropriate feasibility stud**y.
Land holding as per 2005: Land holdings are small and often fragmented into many parcels. Farms of less than a hectare comprise more than 26 percent of agricultural land; almost 60 percent is in holdings of less than two hectares and the rest in holdings between 2-2.5 hectares (Alemayehu, n d.).

5. The case of pastoralism

Pastoral nomadic societies are facing growing challenges that affect their livelihoods, socio-economic conditions, traditions and cultural heritages as well as their ecosystems. One the sources of these challenges are the impact of western based development interventions, and the impacts of national development efforts that are meant to change and improve their lives. Since the developments projects that are meant to help these societies are not often participatory of the affected people and do not take into account the unique socio-cultural milieu of these people, the projects are bound to fail.
Many researchers have drawn attention of concerned bodies towards the challenge of famine and drought among pastoralist societies. Such problems have been very acute particularly in the Horn of Africa, including Ethiopia. Heallnd (2000) argues that the pastoral societies of the Horn of Africa are probably facing the most complex set of issues in their entire history. Failing food security is a vitally important issue but it is necessary to pay renewed attention to a much wider set of problems if pastoral societies are to survive into the next century. While settled farmers usually develop relatively explicit systems of tenure, many pastoral peoples have fluid systems that are hard to pin down. This is in keeping with their opportunistic grazing strategies. When pasture is extremely patchy and likely to appear at different sites each year, investing heavily in ownership of a specific piece of land is hardly worthwhile. FAO states (p.84): "The tenure of pastoralists in all parts of the world is not deemed sufficiently strong to prevent it from being overridden by the State in its search for minerals. Land can be appropriated for building and transport infrastructure, generally without compensation. There is no doubt that, if pastoralism is to survive, effective tenure must be developed in many parts of the world. This is proving difficult, because few governments have the political will to protect pastoralists against the vested interests of urban groups. The usual indicator of tenure in the ranching areas is the fence, a high-investment strategy that is only effective in countries where specific legal frameworks are in place".
The lowlands, which cover some 60 percent of the land area of the country, are home to only some 10 percent of the population. The majority of these are engaged in extensive livestock herding, which forms the backbone of their economies. Ethiopia's pastoral groups manage some 40 percent of the national cattle herd, one quarter of the sheep, three quarters of the goats and nearly all the camels. Some 90 percent of the country's live animals for export come from the lowlands. (UNDP-EUE, 1997).
The majority of the country's pastoralists are made up of Somali, Afar and Borana living in the southeast, north-east and southern rangelands. Within and between each of these groups there are different adaptive specializations dependent on varying ecological, economic and cultural factors (Alemayeu, n. d.).

Pastoral areas cover 60 % of Ethiopia and include 12-15 % of the human population, as well as a very large number of livestock. In fact, Ethiopia is said to have the largest animal population in Africa. The livestock sector contributes 12-16% of total GDP and 30-35 % of agricultural GDP according to government estimates (Halderman, 2004). He mentions the following functions of livestock in Ethiopia:

- Valuable-essential in pastoral areas in providing food for subsistence
- Essential in many areas for the cultivation of crops as sources of dung and draught power
- Essential in transporting goods and peoples
- The most important source of cash income for people living in rural areas
- The most important and widespread form of asset accumulation for rural residents, particularly assets used as hedges against risks and disasters
- Used to invest in traditional security system through for example bride price.

The lowlands, the major grazing land of Ethiopia, form a wide apron surrounding the highland massif and part of the Great Rift Valley. This arid, hot zone, with up to 90 growing days per year, is suited mainly to extensive grazing. It includes the lowest elevation in the country at 126 meters below sea level. The lowlands make up nearly 61 - 65 percent of the land-mass, and are the major nomadic pastoralist and agro-pastoralist areas (Alemayehu, n. d.). [To note that this area is the main potential and target area for the cotton expansion plan 2016-2030., GN]. (UND-EUE 1997) also provides a detail description of pastoral mode of production, confirming also the dominant pastoral groups as mentioned above by others:

> Pastoralists exploit grazing land in arid and semi arid areas. Among the most notable pastoralists are the Borana, Somali and the Afar's around the southern, Eastern and Northeastern part to the country respectively. The pastoral population is estimated at 12-15 million. They have no permanent home and move with their herds within their traditional territory. Livestock is for subsistence and seasonal milk production. Yield per cow per day is 0.5-1 litre. The average land area per animal is from 5-10 hectares. Livestock include: cattle, sheep, goats and camels. Inputs include veterinary (supply of drugs and vaccines) services, water and road development. These areas sell young bulls to highland farmers (for traction) through exchange for cereals (mainly maize); and also contribute the highest number of animals for export.

Pastoral societies of Ethiopia are known for their elaborate safety net, mutual support mechanism, by which they try to ensure redistribution of communal resources among clan members. Bezabih, *ET al (n. d.) note* the following*: «*The pastoral communities have developed different safety net mechanisms for their poor clan members. Small supports such as sharing livestock products are crosscutting support mechanisms that are used by all communities. In Afar and Somali, this type of sharing resources and benefits is so extreme to the extent that private saving is discouraged. However, the size of livestock holding determines the application of the concept of mutual help. The indigenous resources and benefits distribution to improve equity provides potential means of targeting the poor and women in development interventions since the pastoralists perceive resources as belonging to the community."

Their traditional veterinary and livestock knowledge and management systems have often proven very valuable. Some of the traditional (adaptation) strategies include (Alemayehu, n.d.):

- Maintenance of multi-species herds and supplementation of pastoral resources with agricultural by-products;
- Herd splitting into spatially appropriate units, to minimize the effect of localized overgrazing and over-browsing, disease, and other environmental vagaries;
- Establishment and maintenance of social systems for sharing, borrowing, giving, and conservation of common resources. There are well-defined and extensive institutional frameworks for sharing resources and rehabilitation of members' herds after a time of crisis;
- Maintenance of as large herds as possible to minimize the chance of losing all and maximize the chance of having some left over after hazards;
- Reduction of the number of household members during bad times, such as severe drought and disease outbreaks, by sending away all able-bodied people, not required in the system, to work in agro pastoral and other agricultural areas.

In Ethiopia these environments are further characterized by the extreme variability and unreliability of rainfall both between different years and between different places in the same year, by the scarcity and seasonal variability of vegetation, and by vulnerability to drought. Pastoral areas, while they may produce crops in good years, are generally marginal to intensive crop production (*op cit)*.

Many pastoral societies were only incorporated into the Ethiopian polity in the last one hundred years or so. Historically, the defining characteristic of the relationship between the pastoralists and the central government has been extractive and authoritarian*.* However, the condition of marginalization seems to be declining since the fall of the Socialist Regime. The present Regime has attempted to redress the wrongs of the past governments; a separate government body is now instituted to oversee pastoralist affairs in the country. However, pastoralist marginalization still needs to be squarely addressed.

The pastoral societies are often misunderstood as completely ignorant of any viable form of crop cultivation. They are misconceived as heartless people who are ready to strike you at the slightest stare at them. All of these and other conceptions are simply wrong conceptions and do not represent the pastoral societies in reality. [this indicating the hostile relation among these two major groups or networks]. The traditional systems such as the *Gada* system are challenged by the expansion of farm lands, shrinking rangelands, religious influence, poverty, resource use conflict, internal changes, and state influences. Diminishing roles of the traditional system of management of natural resources is associated with increased natural resources degradation. Natural resources degradation is also intensified due to lack of alternative survival strategies for the poor social groups (Bezabih, *et al*, n. d.).

Another often cited and observed problem that faces the pastoral societies of Ethiopia is land alienation. Land alienation involves the expropriation by the state for various development projects purposes of the pasture lands that have traditionally been the collective properties of the pastoral communities [reported cases as well documented in relation to cotton in the South]. Helland (2000) documents such a case among the Borana.

Socio-economic characteristics of the Lowlands:

In Ethiopia pastoralists inhabit the lowland periphery which encircles the highlands. Because of their remoteness and distance from major towns, infrastructure and communications are generally poorly developed. Long distances to market on poor roads impose constraints to the development of commerce and the availability and cost of grain and other products. At the same time their relative proximity to Ethiopia's international borders means that cross-border trade links are often even more important than internal trade links with the highlands. Most marketed livestock in the Ogaden for example is sold in markets in Somalia and Somaliland rather than Ethiopia. (Alemayehu, n. d.).

The fact that pastoral groups in Ethiopia occupy margin, peripheral, border lands is too obvious to be mentioned here: "The pastoral lands of Ethiopia are in the border regions and the ethnic groups are often trans-boundary. For example: Afar pastoralists are found in Eritrea, Ethiopia, and Djibouti; Somali pastoralists of eastern Ethiopia are also found in Djibouti, Somalia, and Kenya, and the Borana homeland is between Ethiopia and Kenya" (UNDP-EUE, 1997*)*

Helland (2006) maintains that the main contemporary problem in Ethiopian pastoral societies, however, is that various indigenous forms of tenure that no doubt evolved as indicated above now are increasingly subordinated to unitary national land tenure legislation. The restructuring of tenure arrangements in pastoral societies may be seen as an aspect of the general process of marginalization of pastoral society in Ethiopia. This process is partly the outcome of historical processes of political subjugation and partly due to the incorporation of pastoral societies into a state dominated by an outlook strongly biased in favor of agriculture [note the difference between agriculture (small a) and Agriculture (bigA). Latter includes pastoralism/livestock as well as fisheries]. The pastoralists have to an increasing extent lost influence over policies and events that in fact are central to their livelihood. Land rights to agricultural land in Ethiopia are obviously much more elaborate than rights to land and resources in the pastoral areas, specifying the terms and conditions under which farmers gain and maintain access and security of tenure to land. In practical terms, the pastoral lands have not been covered by specific national legislation granting security of tenure to the people who live from pastoralism (*Ibid, p4).*

Drought is a recurrent and normal phenomenon in Ethiopia's rangelands. Boran and Somali pastoralists experience a mini-drought each dry season. During this time they expect a degree of belt tightening as milk yields decline and grain prices increase. What transforms a dry season into a drought is the failure of the rains over one or more rainfall seasons. Normally, both Boran and Somali expect such a widespread failure once every 4 -5 years and a major drought once every 10 years (UNDP-EUE, 1997).

Regarding the current transition process, UNDP-EUE (1997:5) summed up as follows: "Ethiopia's pastoral societies are in transition. State incorporation has restricted mobility, while market penetration has increased dependence on markets for food. Many pastoral groups, such as Afar, have lost important grazing land to the State and to their pastoral neighbors, which has increased their vulnerability to drought. Similarly, Borana in the southern rangelands are being shunted westward by the expansion of Somali speaking groups to their east. This has resulted in the loss of control of important well complexes. Throughout the rangelands agriculture is expanding, while former communal grazing areas are being enclosed. These changes are likely to have long-term consequences for food security in these areas as old adaptations give way to new ways of doing things.

As pastoralists become more dependent on the market for food they are increasingly exposed to the effects of a volatile market. This particularly affects the poor. Poor people have to sell proportionately more of their herd products on the market to obtain food than the rich. In times of drought this dependence is exacerbated which in turn accelerates the processes of economic differentiation within society. The ongoing market integration tends to make the rich richer and the poor poorer and, inevitably, more vulnerable to drought.

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A4-2 Historic cotton production: peoples and markets

(main source: Westphal 1975).
Here cotton is also mentioned under oil crops. For the rest: other crop, or cash crop.

People	Role of cotton
Awash	Middle and lower Awash region This region is situated in the rift country of Shoa, Hararge and Wollo between Nazret and beyond Tendaho, at altitudes from 1500 m to 500 m. Soils are mainly Aridisols, rainfall is uncertain and low, and evaporation rates are high. Cropping depends on irrigation from the Awash river and its tributaries. The chief crops are cotton, sugarcane (Saccharum officinarum) and sorghum. There are considerable areas of swamp and upland, which are grazed seasonally by the herds of nomadic graziers.
Northern part Highlands	Northern part of the Ethiopian Highlands This is a highly dissected country in Eritrea and Tigre with less rainfall (450—950 mm annually) than in the central part of the Ethiopian Highlands, and with mostly less productive soils derived from basement complex rocks and sandstones. Wheat, barley, tef, sorghum and oilseeds, including groundnut (Arachis liypogaea), are grown, but there is also considerable production of fruit and cotton (Gossypium spp.), and of meat and milk, and of cattle, sheep and goats.
Western Lowlands	Western Lowlands Plains are found at the foot of the western escarpment and foothills of the Ethiopian Highlands below ca 1000 m, which gradually slope into the Sudanese plains. Temperatures are high and average annual rainfall varies from ca 1200 mm at Gambela to less than 150 mm in north Eritrea. Agriculture with or without irrigation is performed. Between the Setit and Angereb in north-west Begemdir, for instance, with an annual rainfall between 500—700 mm, rain-fed crops like cotton, sesame (Sesamum indicum) and sorghum are grown (Kline et al., 1969). The Baro river plain in Ulubabor is potentially a very important area for agricultural production.
Gumuz	The Gumuz dwell in the k'olla of western Ethiopia, from Metemma in Begemdir south in the lowland of the Balas in Gojam to the valleys of the Abbay, Dura and Oidessa. Sorghum is the main food crop, cotton a prominent cash crop. Other food crops are maize, finger millet, sesame, groundnut and pumpkin. Simoons (1960) supposed that the Gumuz have neither tuber crops nor fruit trees and seem to have no knowledge of vegetative reproduction techniques. Kuls (1962), however, reported for the Gumuz in the Balas region the cultivation of yam and ginger. Irregular plots, far from the settlements, are cultivated for one or two years and then left to be covered with woodland [shifting cultivation]. The suitability of a piece of such woodland or repeated agriculture is judged on certain indicator plants, in particular grasses. During the dry January and February period, pieces of land are cleared and in March they are set on fire. When the rains come, the crops are sown. Important implements are the bamboo planting stick and the hoe. The Gumuz distinguish the following five field types, depending on the crops. (1) Fields for a mixture of sorghum and finger millet are sown between the end of March and May. Afterwards beans ('hopa'). pumpkin, bottle gourd and cabbage are sown in between. The cereals are harvested in December. The next year sorghum sprouts a second time from first season's shoots (ratoon), together with new sowings of sorghum, beans and pumpkin. Finger millet remains absent. (2) Fields for pure sesame are found on level ground further away from the settlements. After clearing and burning they are sown once (in June and July) and harvested in December. Next year the cultivation is not repeated.

(3) Fields for cotton are sown in June and harvested end December/January till May, after the sorghum. Afterwards the cotton fields are used for a second time. Sometimes sesame and sorghum are sown in between. Cotton is an important product on the highland markets of Begemdir and Gojam.
(4) Fields for ginger occur on the steep slopes of narrow valleys. Before burning, only the undergrowth is cleared. Ginger is an important product on the highland markets.
(5) Garden-like fields are close to the huts. Several crops are grown together, such as sorghum, cabbage, pumpkin, bottle gourd, yam Oeca'), maize, pea and beans. Simoons (I960) did not find yam with the Gumuz of Begemdir but reported lablab (Dolichos lablab).

Gamu Gofa

Contrary to the dispersed homesteads of most Gamu tribes, the Ochoilo live in villages (east of the Dorse). In some aspects, they resemble the people of the Konso cluster, and they use human manure. In their gardens, starting at ca 1600 m altitude, they mainly grow cabbage, ensat and grain amaranth, together with sorre barley and many flowers. Most fields are on stone terraces on the eastern escarpment of the Gamu Highland: the important crops on manured fields are barley, wheat, maize, tef and Galla potato. Some fields are in the lowlands: there they are irrigated and cultivated with cotton, maize, lemon and banana.

Wollomo (Omo valley)

The first Wollamo settlements appear between 1400 and 1500 m, close to the Omo river already at i 100 m. In this rather extensive lower cereal zone sorghum, maize, beans, yam. taro, tobacco and cotton are important crops. Around the huts dense stands of manured sorghum and maize are present, but already 10 to 20 m away manuring abruptly stops. Close to the homesteads, on plots of a few square meters, various yams grow. Further away, the crops are grown in rotation and large areas are under grass. Plots are often terraced, unlike those in the corresponding zone of the Sidamo and related tribes.

Sorghum-hoe-terrace complex of the Konso cluster

Despite the unfavourable ecological conditions, coffee is quite frequent and larger plantations are present, at ca 1850 m, in west Konso. During the dry season, it seems to die, but after heavy rainfall in ‘spring’ it sprouts again. The fruits are roasted in butter, from the leaves a kind of tea is prepared. Cotton is an important cash crop; the yields enable the Konso to buy extra cereals. Its upper cultivation limit coincides with that of sorghum. Two types are grown: Gossypium herbaceum var. acerifolium and G. hirsutum var. punctaium (Kuls, 1958). Except sometimes sorghum and cotton, all these plants are grown in mixed stands.Sorghum, sometimes even wheat and barley occur together with beans, Amorphophallus abyssinicus and cotton. Consequently, no rotation or any other regular change in land use is practised. Sometimes fields are found with merely sorghum or cotton. Pure cotton fields occur in general on the periphery of the settlements. They are cultivated as long as the crop is profitable, which means for at least three successive years. Afterwards the fields are left fallow for a certain time.

Islands of Lake Ziwai

The islands in Lake Ziwai are inhabited by the Lak'i, culturally distinct from the Galla and speaking a Semitic language. Their intensive agriculture on terraced fields includes finger millet, sorghum and cotton, manured with dung and ashes of burnt crop residues. Under the Pax Amharica many Lak’i settled on the lake shores, changed to ploughing, and now cultivate mainly maize, tef, wheat, finger millet, barley and horse bean. Fallow land, and areas unsuitable for agriculture are used as pasture for the large cattle herds. The mode of life of the Lak’i strongly resembles that of the settled lowland Arussi (Haberland, 1963).

Gurage

Additional in the lower parts are tef, maize, sorghum and niger seed, in the daga barley, pea, horse bean and linseed: the woyna daga is favourable for coffee, tobacco and ch'at. Cotton is grown in the river valleys in the west (Shack, 1966).
Social and economic life of the Gurage rests on the cultivation of ensat. Which satisfies many of their essential needs. They practise a system of semi-permanent cultivation marked by an extensive use of manure and crop rotation that enables them to use the same plots indefinitely

Sidamo

In the dry lowlands of the Rift valley, between Lake Abaya and Lake Awasa, the Sidamo tend cattle herds and agriculture is rare (only some small, carefully fenced
plots with cotton occur). At ca 1500 m fields with maize and sorghum are present around permanent settlements. Ensat is absent there but appears from 1600 m on. Up to ca 1800 m, at the lower limit of the coffee zone of the ensat area, land is mainly used for pasture.

Janjero

(*wiki: Although one of the Sidamo kingdoms, until its conquest in 1894 Janjero was "isolated, and had little to do with its neighbours, its rivers being very difficult to cross. Although first visited by Europeans in 1614, until the late 1950s this region remained poorly known to outsiders. As a result, its people were said to have preserved a number of "customs so barbarious and strange that there cannot be any more so. Jimma conquered part of Janjero in the 1880s. The rest of the kingdom was annexed in the reign of Menelik II in 1894, and its last king, Abba Bagibo, fled to the Gurage country, but eventually made his submission to Emperor Menelik. His son Abba Chabsa became a Christian, and adopted the name Gabra Madhen, and served the Ethiopian who held the fief*).
The Janjero inhabit the area between the Little Gibe and Omo rivers. Recent cultural influences are obvious because of their extraordinary rich stock of food plants. The diet is based on about equal parts of ensat, barley and wheat; pulses and several cabbage types are important. Tef, sorghum, finger millet and maize are also grown. Pea (three types), horse bean (four types) and lentils are popular, horse bean being the most important. Besides ensat, Galla potato with red and white types, yam and taro are cultivated. In ensat plantations a wild Arisaema occurs as a weed but it

is not eaten. In the forest of the Omo valley a climbing tuberous plant ('kusho') occurs whose tubers serve as a food; sometimes it is planted in the gardens. Straube
(1963) assumed it to be a yam, as it resembles a wild one used by the Chako in Gimirra called 'karka bada'. Tiffin (1965) reported the cultivation of potato, sweet potato and 'ajjo?, not mentioned by Straube. According to Mooney (1963), 'ajjo' is Coleus edulis, but Straube gives for the latter the name 'duna\ Cabbage is found in every garden; six types are distinguished, three belonging to Brassica carinata. Oil plants in Janjero are safflower, linseed and sesame; spices and condiments include ginger, coriander, black cumin, and others (Straube, 1963). In the lower areas, fields with cotton, maize, sesame, finger millet and sorghum occur. Most fields, however, are in the middle zone (above 2000 m), as is the case with the settlements.

Yields around 1970:

Some crop yields (in kg/ha)*.

Cereals		Oil crops		Tuber crops		Pulses	
barley	860	castor	560	ensat	2400	chickpea	630
finger millet	510	cotton seed	330	potato	5300	common bean	770
maize	1070	'gomanzar'	410	yam	4270	fenugreek	600
sorghum	860	groundnut	560			horse bean	960
t'ef	610	linseed	520			lentil	610
wheat	760	niger seed	640			pea	940
		safflower	550				
		sesame	490				
Condiments & Spices		**Stimulants**		**Other crops**			
buckthorn	1020	ch'at	990	cotton	170		
Capsicum pepper	420	coffee	270	ensat fibre	100		
		tobacco	560	sisal	770		
				sugarcane	150,6 ton/ha		

*) Imperial Ethiopian Government, Central Statistical Office. Statistical Abstract 1970: 41.

In 1963, cotton is still benefitting from its reputation as an important oil crop. Afterwards it was definitively overshadowed by soy oil.

Table 7. Oil crops[1, 2].

	% of markets (for each of the 11 agro-ecological regions) where item has been found										
	1	2	3	4	5	6	7	8	9	10	11
Number of markets visited	(16)	(2)	(8)	(17)	(11)	(26)	(10)	(1)	(12)	(0)	(2)
1 castor	50	—	88	29	45	62	70	100	33	—	—
2 cotton seed	56	—	13	29	55	27	50	100	42	—	—
3 'gomanzar' (*Brassica carinata*)[3]	81	100	63	88	55	96	70	100	83	—	—
4 groundnut	6	—	—	—	—	23	—	—	25	—	50
5 'kalawa' (*Maesa lanceolata*)	6	—	—	24	—	4	20	—	—	—	—
6 linseed	75	100	100	82	82	88	60	100	83	—	50
7 'madafé' (*Argemone mexicana*)[4]	—	—	50	—	—	—	—	—	—	—	—
8 niger seed	75	100	25	41	45	50	50	100	67	—	—
9 safflower	38	50	38	24	18	35	30	100	75	—	—
10 'senafich' (*Brassica nigra*)	63	50	75	18	9	50	30	100	58	—	—
11 sesame	44	—	13	35	9	46	30	—	67	—	50
12 sunflower	19	—	—	6	—	—	—	—	—	—	—

A4-3 The socio-economics of cotton and textile around Arbaminch

Source: "Feyso A. 2018; Cotton Value Chain Analysis: The Case of Smallholder Farmers Arbaminch Zuria District, Gamo Gofa Zone, Ethiopia. Pelagia Research Library. Asian Journal of Plant Science and Research, 2018, 8(2):19-30"

Cotton value chain actors and their functions

The cotton value chain varies from simple to complex. It can be very simple or short when producers sell directly to textile factories, textile factories sell to garment firms and garment firms directly sell their cotton products to consumers, or it can be a bit complex when a lot of chain actors were involved. In the case of cotton value chain in Arbaminch Zuria district, chain actors include input suppliers, cotton producers, traders, processors, retailers and consumers. Support institutions include financial or non-financial service providers such as credit institutions, government offices, non-government offices, and research centers. Each of these actors adds value in the process of changing product title. Functions of each actor were discussed in-depth below.

a. Inputs suppliers

These are cotton value chain actors which supply cotton seed, chemicals, farm equipments, technologies to produce seed cotton. Actors who lie in this category are traders, NGOs like; Integrated Pest Management and Technical Vocational and Educational Training Centers (TVETC) and traders.

b. Producers

Smallholder farmers (large in number). To produce quality seed cotton, they perform land preparation, sowing, weeding, chemical spraying, harvesting, storage and transport raw cotton to storage and finally to market.

c. Traders

In the study area traders can be classified into three based on quantity of cotton they handle. Those are local collectors, wholesalers and retailers.

Local collectors: small in number, who buys raw cotton from smallholder farmers at local markets and sells to wholesalers at the same market place.

Wholesalers: very small in numbers, who buy cotton from smallholder farmers as well as from local collectors and sell after processing or ginning raw cotton into lint and seed. They sell lint for textile factories and seed for oil factories and cotton producer farmers.

Retailers: were individuals who buy raw cotton from smallholders and sell to local level ginneries at different markets in highland districts of Gamo Gofa zone.

d. Processors

Ginneries: Modern level ginners separate seed cotton into lint and seed through contract rental agreement bases with wholesalers. The principal function of the cotton gin is to separate lint from seed and produce the highest monetary return for the resulting lint and seeds. For this study two modern ginneries; Amibara General Aviation and Four –D-ginning factories were included.

Weavers and textile companies: Following the ginning phase, the separated lint and seed gone through a secondary transformation process. The cotton lint goes to textile mills for transformation into yarn, while the cottonseed goes to seed processors for transformation into raw oil and seed cake.

Textile manufacturing refers to the transformation of cotton lint to yarn and fabrics and ultimately to clothing. It includes yarn spinners, fabric and garment producers. For this study Arbaminch and Hawassa textile companies were addressed.

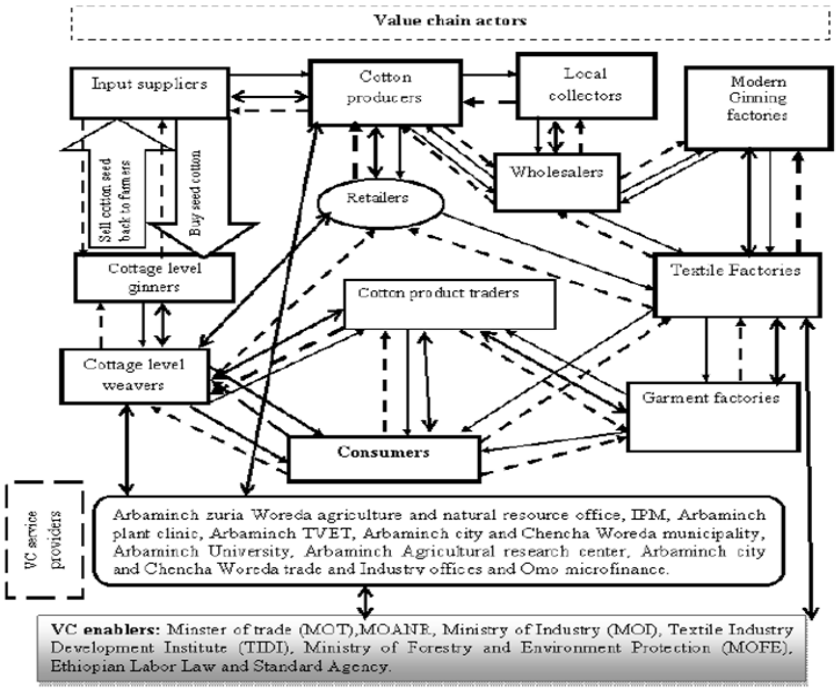

Figure 3: Cotton value chain map of Arbaminch Zuria district
Source: Own sketch from survey result, 2016.

Key: ——→ commodity flow, ←→ information flow, – – → currency flow

e. Transport and logistics
Both traditional means of transport like donkeys and donkey pulled carts and the modern ones are used to transport raw cotton to producers' house, market place, storage area and to ginners' house. Lorries were commonly used to transport raw cotton to ginners' house and the ginned products to textile factories and warehouses.
f. Consumers
Consumers in cotton value chain ranges from individual to government and non-government institutions. Consumers of cotton product are government offices (hospitals, educational institutions, meeting halls, training centers, health clinics and the like), non-government organizations, hotels, cafeterias, groceries, bar and restaurants, public and private transport agencies, tourists, individuals and communities.

Recommendations
Based on result of this study, the following recommendations were made.

1. Agricultural offices, Universities and research institutions should pay attention for provision of improved, high yielding and diseases resistant cotton varieties because majority of sampled households did not use improved cotton varieties. Production, productivity and sustainability of cotton production requires the presence of good extension services, seed supply and quality inputs.
2. Land use plans and resource allocation system of cotton producers' farmers need to be monitored. Agricultural offices should create awareness among farmers to delegate appropriate land for cotton and to produce in irrigation as of other crops.
3. National and regional governments may pay attention not only for establishment of new industry parks, but also strengthen the existing textile factories to he help them to absorb quantities of cotton produced by cotton producer farmers.
4. Agriculture and natural resource offices, trade and industry offices should work for the regulation and implementation of cotton price tariffs and production related polices. At national level price of cotton was determined by Minster of Agriculture, Minister of Industry, Minster of Trade and Textile Industry Development Institute, but in the case of Arbaminch Zuria District wholesalers were determining cotton price which not benefiting all chain actors equally.
5. Cotton value chain should be developed in the study area. Survey result shows that only wholesalers and retailers marketing system was efficient and marketing extra benefits, while other chain actors were not. Value development has power to alleviate cheat and quality adulteration among chain actors and build trust within chain actors.

Some metrics of the Arba Minch cotton farms

Table 4: Cotton land allocation system and cropping pattern

Variables	Indicators	Frequency	Percent
Use of crop rotation	Yes	123	100
Land used for cotton	Maize	123	100
Crops sown after cotton harvest	Maize	95	77.23
	Teff	28	22.77
	Total	123	100
Cropping system	Mono cropping	107	87
	Inter cropping	16	13

Source: Own Computation, 2016.

Table 5: Cotton varieties cultivated in Arbaminch Zuria district

Variable	Indicators	Frequency	Percent
Use of improved varieties	Yes	23	18.7
	No	100	81.3
Name of varieties used	Local variety	100	81.3
	Deltapine-90	13	10.57
	Not know the name of variety	10	8.13
Source of cotton seed	Traders	100	81.3
	NGOs	23	18.7

Source: Own Computation, 2016.

Table 6: Cotton farming financial analysis per hectare and per 100kg

No.	Cost items	Cost in ETB	Percent share
1	Labor cost		
	For land clearing	500	7.24
	For plowing and seeding	400	5.79
	For weeding	800	11.58
	For picking/harvesting	2000	28.94
	For packaging	220	3.18
2	Oxen rent	1500	21.70
3	Inputs cost		
	Seed cost	175	2.53
	Chemical (endosulfan)	575	8.32
4	Packaging material cost	500	7.24
5	Transport cost	200	2.9
7	Land tax per hectare	40	0.58
	Average cost per hectare	6910	100
6	Average yield kg per hectare	1083.6	
	Average cost per 100kg	637.69	
	Average sales price per kg(Birr)	10	
	Revenue per 100 Kg	1000	
	Revenue per hectare(Birr)	10836	
	Gross profit per hectare	3926	
	Gross profit per 100kg	362.31	

Source: own computation, 2016.

A4-4 Varia on labour conditions and productivity related with the socio-economic context

1. Labor and Other Social Condition in Cotton VC (Farm, Ginnery and Textile Mill)
1.1 Cotton Farm
1.2 Ginnery
1.3 Textile Mill
1.4 . Reasons for low productivity – EP Labor Survey
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2. Varia on productvity, value addition and impacts
2.1 Labour Productivity – EP Labor Survey
2.2 Environmental and social impacts summary - Scoping Study
2.3 Farms production data and unit price –
2.4 NCDS - Thematic Area A - Production and Productivity
2.5 NCDS - Thematic Area B - Processing and Value Addition
2.6 NCDS - Thematic Area F – Social Impact and Environmental Compliance
2.7 . SIRAYE: A programme on Advancing Decent Work and inclusive industrialization in Ethiopia:
3. On ginneries- Info from the Institute for Applied Ecology

1.**Labour and Other Social Condition in Cotton VC (Farm, Ginnery and Textile Mill)**

1.1 Cotton Farm

	North West (Amhara and Tigray)	South (Gamo Gofa and South Omo)	East (Afar)	West (Gambella and Benshangule)
Farming system and livelihood contribution	Small holders and commercial farms engaged in cotton production; Sesame and sorghum as competing crops and shift towards to these crops associated with less profitability of cotton.	Commercial farm and smallholder farm. A number of commercial farm under development. Existing farms with access to irrigation switching to Banana.	Big farms were growing cotton were switching to sugar cane in the past few years and now more attention to low land wheat and cotton production (with ambition of growing two crops in a year).	Similar to other areas where cotton is less profitable switching more to Mung beans;
Employment creation and labor condition	Many seasonal labor migrating from highland part of Amhara and Tigray regions to Metema/Humera to East from Southern part of the country during high peak seasons (weeding and harvesting). Commercial farms provide temporary shelter, transport, meal (flour), and health service (focused in malaria medication). Government and NGOs provide health services. With nature of the activity and harsh environment, mostly the workers are male. The local community in pastoralist areas not interested in engaging in farming wage activity in the commercial farms rather they are employed as guards and other light activity. Presence of commercial farms positively impacts households' livelihood as well as the access of farms' surrounding neighbors to new resources (ex: tracks rehabilitation facilitating contacts with remote social services). Workers exposure to pesticides is generally high, due to frequent lack of personnel protective equipment but varies with the region and the practices. For example, one big farm claim that for workers protection in handling harmful substances provides Uniform & Clothing, protective device, Dust allowance, Milk & Chemical allowance and Insurance coverage. Despite the freedom of association, no workers association operates in the cotton farming industry[13] except in few instances where established during the state farm ownership stage. On the same line as per ILO observations in the sector, poor working conditions and low wages resulting in low productivity, high turnover and absentee rates; as well as weak regulatory institutions, coupled with the limited capacity of the workers' and employers' organisations, hinder the proper functioning of the labour market and businesses environment. Cotton pickers, as all seasonal workers, are especially vulnerable to bad working conditions and low wages because there is no national minimum wage level in Ethiopia except the labor rate competition from other economic activity like construction that is attracting many daily workers that is happening in many part of the country. Temporary political instability makes difficult seasonal labor movement that affected cotton farms like in Humera and Metema.			

1.2 Ginnery

Contribution to poverty reduction	There are about 23 ginneries in the country with additional new establishment in areas where there is limited ginnery like in Omo and Benshangule Gumuze. It adds value in the cotton produced where the ginnery located and creates employment opportunity for the surrounding community. For example, from a visited ginnery that is located in Gondar town created employment for 93 individuals and a ginnery that is located in Afar region created job opportunity for 92 permanent and 375 seasonal workers. A number of ginneries also provide ginning service to small and large commercial farms, cooperatives and other traders ginning service.
Job condition	In most cases, the labor condition is similar to the farm where the ginnery offers health Shelter, Water & electric supply as additional benefit package like in case observed in a ginnery. Except guarding, women are engaged in almost in all activity.

1.3 Textile Mill

Contribution to poverty reduction	Ethiopia has tremendous employment opportunity in the textile and garments sector. Textile and garments sector, particularly garments sector, is the most labor-intensive industry in the world, which offers significant job opportunity to those strata of people who do not have any access to education, training or previous job experience due to acute poverty. Most textile mill are integrated and create many jobs mainly youth and women. For example, in Hawassa Industrial Park (HIP), 18 factories in the park employed 17,503 individuals from that 93% are women taking 2019 data. According to the Plan of Action for Job Creation 2020- 2025, employment in the textiles and apparel industry is estimated at 798,752 in 2018 and is forecast to grow 86% through 2025, creating more than 683,000 new direct jobs and almost 868,000 new indirect jobs[14].
Job condition	The wage paid and working environment needs improvement that is indicated in many reports. The factories associate that low wage with sector competiveness and labor productivity. A case study reveals that, a factory giving lunch and transportation facility and doing exit interview were among the efforts the factory tried to reduce the effects of employee turnover. However, the study revealed that the salary and benefits do not

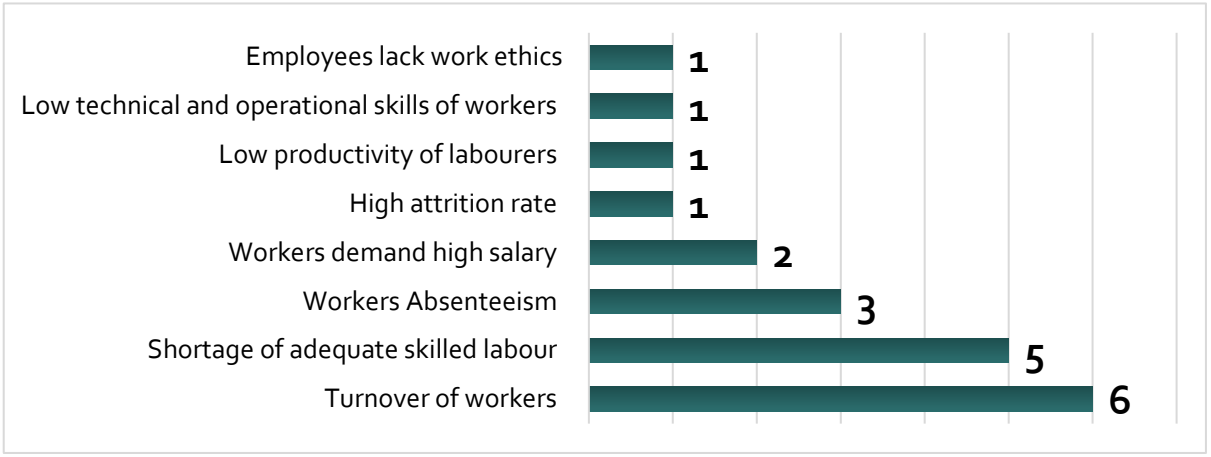
[13] NCDS, December 2017

[14] ilo.org/africa/technical-cooperation/WCMS_687547/lang--en/index.htm

attract 74% of the participants and 60% of the respondents not satisfied with the working environment conditions of the factory. Similarly a number of factories in industrial parks provide meal and transport. With a survey conducted in Bole Lemi IP and outside the park, operators turnover is 49%[15] and with 17% absenteeism that may be strongly associated with low job satisfaction, unattractive reward system and own work attitude.

In general, as outlined in Ethiopia Cotton Development Strategy, labour rights, participation processes, land use (no land-use management plans) and respect of minority rights, adaptation to climate change are among the main social issues that needs attention while developing the cotton sector.

1.4 Reasons for low productivity – EP Labor Survey



1.5 FACTORS AFFECTING EMPLOYEE TURNOVER ON AYKA ADDIS TEXTILE AND INVESTMENT GROUP PLC

Source: SISAY MOREDA GELASHE, MASTER OF BUSINESS ADMINISTRATION ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERISTY, FEBRUARY 2018

Salary paying of the factory does not balance the position and experience of employees. There are workers with the same profession and same experience getting different salary in the factory. The factory has no recognition and motivation system, reward and incentive system for best performing workers. In addition to the above, there is no enough opportunity for employee's personal growth and development. For the available growth and development there is no equal treatment for all employees. As explained by (DeNisi and Griffin, 2008:198) perhaps not surprisingly an employee's level of satisfaction on the job is affected by the extent to which the employee is satisfied with pay and benefits. In general, higher levels of pay and more attractive benefits tend to result in greater satisfaction. Furthermore, In order to achieve higher productivity, the influence of pay and job satisfaction as a denominator cannot be over emphasized.

The working environment of the factory is not suitable for work. As explained by (AHM Shamsuzzoha, Md. And Rezaul Hasan Shumon, 2008), if working conditions are substandard or the workplace lacks important facilities such as proper lighting, furniture, restrooms and other health and safety provisions, employees will not be willing to put up with the inconvenience for long time.

The factory does not arrange related training and educational opportunity to empower the employees. There is no good relationship between management and employees. They don't trust employees. As a result, management involve in every routine activity rather than focusing on strategic issues. According to (Anantha Raj A. and Arokiasomy, 2013),if employees feel that their managers are fair, reasonable and supportive, levels of job satisfaction increase. Secondly, if the manager shows interest in the well-being of employees and is supportive and sensitive towards employees emotionally, employee job satisfaction increases. Furthermore, autonomy is valued by employees and decreases turnover.

The factory has no flexible work-schedule that balances work and family life of the employees. Empirical studies have demonstrated that turnover is associated in particular situations with demographic and biographical characteristics of workers. Some turnover is demographically specific, particularly for women who are balancing significant work and family duties at the same time.

Respondents replied that there is exit interview for employees leaving the factory. But since it is made before they take their resignation letter, clearance and other relevant documents it does not give freedom for leaving employees to express their real feelings.

2. Varia on productivity, value addition and impacts

Additional Note/Reference Summary Note from Secondary Data Review

2.1 Labour Productivity – EP Labor Survey

[15] Turnover calculated as number of people hired over number of people that left within six months of 2009 E.C.

EP conducted an assessment interviewing 9 factories in Bole-Lemi IP (4) and outside (5) to understand labour market related constraints and to devise an attribution strategy for EP interventions. From constraints point of view, it was evident that factories are unable to fully utilize their capacity due to different labour market related issues.

Reports	Category	Workers utilization (%)	Machine utilization (%)	Production utilization (%)
EP baseline	Bole Lemi IP factories	**62%**	82%	73%
	Outside Bole Lemi IP factories	**80%**	60%	74%
	Both Bole and non bole Lemi	**72%**	70%	74%

2.2 Environmental and social impacts summary - Scoping Study

The various **adverse environmental and social impacts presented** in the Scoping Study can be summarized into three strategic thematic issues:

Policy and governance issues, encompassing the lack of efficiency of the environmental and social prevention legal tools (EIA, code of conduct, corporate certification);

Environmental issues, referring to water pollution and the utilisation of water resources, soil pollution and loss of fertility, loss of biodiversity due to pollution, the transformation or disappearance of ecosystems due to inappropriate land use;

Social issues, labour rights, participation processes, land use (no land-use management plans) and respect of minority rights, adaptation to climate change.

2.3 Farms production data and unit price –

19 farms using Improved Planting Seed in Afar, Gambela, Amhara, Tigray, SNNPR)

Improved Planting Seed Production and VC Value	2017/18	2018/19
	Total	Total
Amount of raw cotton sold (Quintal)	7,600	1,200
Price of raw cotton sold (ETB/Quintal)	2,100	2,100
Total sales from raw cotton (ETB)	15,960,000	2,520,000
Amount of lint cotton sold (Quintal)	38,737	38,438
Price of lint cotton (ETB/Quintal)	4,826	4,784
Total sales from lint cotton(ETB)	186,953,758	183,892,951
Amount of fuzzy seed sold(Quintal)	48,190	14,820
Price of fuzzy seed (ETB/Quintal)	1,160	1,160
Total sales from fuzz seed(ETB)	55,900,400	17,191,200
Amount of IPS sold(Quintal)	3,342	N/A
Price of IPS (ETB/Quintal)	4,021	N/A
Total sales from IPS(ETB)	13,436,833	N/A
Grand Total	272,250,991	203,604,151

2.4 NCDS - Thematic Area A - Production and Productivity

Ethiopian farmers have been growing cotton for centuries and it still remains the traditional smallholder cash crop grown from first rains (mid-June to end September) to harvest (September – December) on est. 80,000 ha, out of which 24,000 ha by small producers (including 30% irrigated) and 56,000 ha by commercial farms. The 136,000 tonnes/year national production is built from yields ranging from 2-3 t/ha raw cotton in irrigated areas to 1.2 – 1.7 t/ha in rainfed farms. The lint gap (20,000 tonnes/year) is compensated by imports now monopolised by a state company.

The value chain provides incomes to est. 57,000 smallholding cotton farmers, jobs to est. 150,000 workers employed in 1,020 cotton producing commercial farms and est. 2,000 jobs in 21 ginneries.

Large-scale "commercial" and medium-scale cotton farms contribute to more than 70% to the nation's lint production, many of them producing under irrigation (Awash and Omo valleys) while Western Ethiopia (Humera, Metema, Benishangul-Gumuz, Gambela) depends on rainfalls. Smallholder production is mainly constrained by low technical productivity (compared to large-scale irrigated or mechanised farming), climatic changes effects and the competition of more profitable cash crops.

Cultivation practices are quite different from large mechanised farms to smallholder farms. Regarding the latter, irrigated cropping in the Afar Region and South Omo area follows mono-cropping whereas the cropping system in the rainfed areas of Western Ethiopia is mixed (i.e. sesame, sorghum and maize).

Farmers in North Gondar (Amhara Region) recently adopted the CmiA sustainable production system while farmers in the Arba Minch area (SNNPR) try to start organic cotton production.

The "no change" long-term trend partly explains the very modest improvement of technical productivity or production. Apparently no cotton growers use herbicides although weeding is a serious issue requiring a lot of hand labour difficult to get. However, progress is noticed (ex: jute instead of polypropylene bags to control contamination).

Unlike lint, there is no seed-cotton market price system but there has been a steady decline in the price of seed-cotton during the last two years. Although there are no clear data on this issue, most of the cotton produced in Ethiopia is actually sold as lint and seed, after commission ginning. The high trash content in seed-cotton is directly correlated to the absence of quality-supportive incentive.

Lint (and consequently seed-cotton) price decrease lead to very low even negative gross margin of the cotton crop. Unless productivity increases (yields) and/or some of the costs can be reduced, only an increase of the price of seed-cotton, up to at least 12 ETB/kg, can make cotton an attractive crop for farmers and lead to a significant increase of production.
Technical constraints to improving cotton productivity and production may easily be reduced or removed in the short-term but the medium to long-term binding constraint require a proper strategy of development of the sector. Challenges as land development, input supply, availability of farm machineries and implements, ginneries, oil pressing mills could be considered as potential investment opportunity areas whereas others like cotton classification and grading, marketing, technology generation and dissemination can be addressed through coordination, collaboration, partnership, information technology, training and professional management.

2.5 NCDS - Thematic Area B - Processing and Value Addition
There are 21 installed plants, out of which 16 ginneries are operational, providing approximately 2 000 jobs. Most plants are using the saw ginning technology (17). Global estimated capacity is 200,000-300,000 tonnes seed-cotton per season but their geographical distribution leads to ginning capacity gaps (2,000 t/year in Gambela up to 16,000 t/year in Tigray) except in Addis Ababa (4 units 37,000 tonnes with one not functional) and Oromia (5 units 116,000 tonnes). This unbalanced geographical distribution is being compensated by a trend to relocate westwards, when cotton competes with other crops for water resources.
Poor infrastructure and outdated technology impact production and maintenance costs as well as the lint and seed quality when seed-cotton is handpicked with high trash and contaminant concentration. Other negatively impacting factors are: storage infrastructure deficiency, missing equipment along the processing line (feed control, lint cleaning, moisture restoration, bad quality bales cover, rare fire protection), lack of quality control.
Ginning yield only is 36 % in Ethiopia, to be compared to 42 % in Western Africa (both handpicked)
Ginneries operation face numerous constraints: due to inadequate geographical capacity distribution, frequent long distance raw cotton transport leads to high costs and insufficient moisture content at ginning impacting fibre quality, raw cotton contamination (stones, polypropylene,..), shortage of labour force in Addis and Afar Regions linked to low wages and mitigated by migrants from the South, frequent power cuts, difficult access to spare parts (and to foreign currency), long terms of payments and poor support from the banks, no curriculum and resource for specific staff training.
Three major business models share the ginning sector: a majority of self-standing and farm-integrated units, as well as an emerging fully integrated model (ex: ELSE/from farm to garment inclusive).
Contract farming is poorly developed due to the following factors: delivery time and schedule are generally not met, product remote quality control is practically impossible, rain-fed production contracted quantity delivery is at high risk.
Middlemen are managing the cotton marketing scheme and are missing real market links and no raw cotton quality control is applied.

2.6 NCDS - Thematic Area F – Social Impact and Environmental Compliance
Agro-climatic conditions are good (as for instance in the Gamo Gofa zone, SNNPR), conventional practices, along with limited diversification efforts appear sufficient to secure satisfactory margin, despite high costs and delays of imported inputs, coupled with high logistics costs. The economic attractiveness of organic production is limited.

Social impact: commercial farms provide a series of benefits on top of wages, usually including housing, food, drinking water and medical treatment. It positively impacts households' livelihood as well as the access of farms' surrounding neighbours to new resources (ex: tracks rehabilitation facilitating contacts with remote social services). Workers exposure to pesticides is generally high, due to frequent lack of personnel protective equipment but varies with the region and the practices. Despite the freedom of association, no workers association operates in the cotton farming industry.

Environmental impact: there are significant variations in the proper use of pesticides on cotton, depending on regions.
Water management: surface irrigation is the only methods practiced on cotton but farmers are sometimes facing increasing difficulties in getting sufficient amounts of water (for instance: Omo Valley). Salinisation represents an acute problem for land use, and is in progress. The Werer Agricultural Research Centre has been studying water management practices but its findings did not reach end users and practices are largely unchanged.
Soil conservation: large scale commercial farms have sometimes been growing cotton for many years, without any rotation and mostly without fertilisers. Good soils (volcanic, black cotton soils) offer the "mining agriculture" farming system opportunity, which is not sustainable in the long run. While alternative conservation agriculture on large cotton farms is becoming in many countries a major agronomic issue (for instance: no tillage in Brazil), they have not reached Ethiopia so far.
Biodiversity and land use: in many areas (for instance: South Omo area), the number of trees to be kept in the fields for environmental protection and biodiversity are not considered by investors, some of them being even engaged in charcoal production while clearing the forest. In some cases, local communities are being pushed towards National Parks (for instance: Mago, Hamar and Bana National Parks) and the game population is drastically reducing. It should be noted that cotton growing shall not be blamed as the only reason for such situation. Change in natural conditions and other factors are contributing to these resettlements.
Climate change: country wide studies and projections have shown that average climatic variables will shift and weather variability will intensify; future temperature projections of the IPCC mid-range scenario (compared to the 1961 to 1990 normal) predict an average rise of temperature by 0.9 ºC to 1.1ºC by 2032, 1.7 ºC to 2.1ºC by 2050 and 2.7 ºC to 3.4ºC by 2080. Rainfalls should increase by 1.4 to 4.5%, 3.1 to 8.4%, and 5.1 to 13.8% over 20, 30 and 50 years respectively. While cotton production is not likely to be affected unfavourably by these two factors, the increase in frequency of extreme climatic events is critical: 4 out the 7 censored floods and one of the 3 censored droughts in the 1960- 2010 period occurred in the last 12 years. In 2014, violent floods in Middle Awash practically destroyed all cotton crops. Against this background, weather insurance packages relevant to small farmers were introduced in 2010 by a company operating in the region, based on a rainfall deficit computation panel. Farmers' unions are the main availing channel of such micro-insurance products. By the end of 2010, the number of farmers insured was over 2,000, for

food crops essentially, notably grain legumes. No cotton producers union joined the scheme yet, and no commercial investor has really expressed interest for such a scheme.
Sustainable cotton requirements and trends on export markets: the supply increased significantly in the last few years. It was estimated to represent 8% of global production in 2014 and its share should reach 13% in 2015. Nearly 2 million tonnes of Better Cotton were produced in 2014 and the gap between production and consumption however is widening. Better Cotton ginner uptake was just below 50% of production in 2014. In spite of major brands and retailers having committed to source more sustainable cotton, sustainable sourcing has slipped down the agenda of many others mainly due to a lack of awareness of sustainable cotton, a confusing number of labels on the consumer side, and difficulties to manage sustainable cotton supply on company side.
The Voluntary Sustainability Initiatives (VSIs) are stepping stones on the way to organic production and Fair Trade, which are the most demanding systems requiring sustainable cotton farming complex systems (but similar systemic concepts may also be applied to other VSI) and also requiring a sustainable cotton farm environment, involving trade relations between farmers and the value chain, and supporting services in terms of finance, research and education.
Lobbying and advocacy for sustainable cotton projects in buyer countries: it falls under the framework of the four pillars - GoE's green economy strategy. Ethiopia could tap into climate funding for GHG abatement, notably the carbon market and emerging international funds under the UNFCCC (cf. Australia's industry's best management practice program and specific module for the management of cotton farms natural assets).

2.7. SIRAYE: A programme on Advancing Decent Work and inclusive industrialization in Ethiopia:
https://www.ilo.org/africa/technical-cooperation/WCMS_687547/lang--en/index.htm
A comprehensive and coordinated programme involving ILO's key components: BetterWork, Vision Zero Fund, SCORE, LABADMIN and INWORK to promote decent work and inclusive industrialization in Ethiopia.

When:	1 April 2019 - 31 December 2023
Development partner(s):	DFID, BMZ, SECO, NORAD, GIZ, BMAS, Siemens, European Commission, Governments of France, Sweden and the Netherlands
Budget:	USD 5,000,000
Project code:	ETH/17/01/MUL

The Programme
With an initial focus on the garment and textile industries, the ILO in collaboration with tripartite partners has developed a comprehensive and coordinated programme to promote Decent Work and Inclusive Industrialization in Ethiopia.

The garment and textile industries are among the priorities of the Ethiopian Government under the Growth and Transformation Plan (GTPII) in the move of lifting Ethiopia to a middle-income country by 2025. According to the Plan of Action for Job Creation 2020- 2025, employment in the textiles and apparel industry is estimated at 798,752 in 2018 and is forecast to grow 86% through 2025, creating more that 683,000 new direct jobs and almost 868,000 new indirect jobs. However, poor working conditions and low wages resulting in low productivity, high turnover and absentee rates; as well as weak regulatory institutions, coupled with the limited capacity of the workers' and employers' organisations, hinder the proper functioning of the labour market and businesses environment.

The overarching development goal of the programme is to see improved respect of workers' rights leading to greater incomes and compensation, enhanced safety, equality, voice, and representation. The programme also aims to lift industrial productivity and competitiveness to enable a global competitive textile and garment sector; and encourage accountable and transparent government institutions.

Programme Intervention
The programme works at national, regional and factory levels involving different ILO departments and global programmes to address the key challenges to advance decent work in Ethiopia.

At the national level, under the leadership of the tripartite partners, the programme facilitates dialogue among multiple stakeholders to develop a common vision and strategies to make Ethiopia an African hub of socially responsible production of garment for both global and domestic market. The programme also supports the tripartite constituents in fixing a minimum wage as well as enhance the capacity of government institutions to prevent and resolve labour disputes.

At the regional and sectoral level, the programme will focus on strengthening employers' and workers' organization capacity for social dialogue and collective barraging. It also assists the labour inspectorate in building the capacity of its inspectors. To ensure occupational health and safety, the programme aims to establish a sustainable work place injury prevention, protection and compensation system.

At the factory level, the Programme aims to establish a robust, sustainable and inclusive compliance system. It provides demand-driven capacity building support to improve factory productivity, working conditions and industrial relations. At the same time, the programme. This includes improving management systems, supervisory and human resources skills; and incorporates gender equality and diversity principles to encourage women workers to assume leadership positions.

Holistic Intervention

Advancing Decent Work and Inclusive Industrialization Programme brings not only the vast ILO experiences in different countries but also new way of delivering support in a holistic and coordinated manner. The programme brings together ILO's key departments and global programmes such as Better Work, Vision Zero Fund, SCORE, LABADMIN/OSH and INWORK to promote sound industrial relations, strengthen enterprise level practices, improve factory productivity, build labour inspectorate capacity, and ultimately, provide a blueprint for the rollout of decent work practices into other industries.

Service Model
The programme service model is based on assuring continuous improvement with in factories to benefit the workers, factory and the industry at large. The learnings from the factory level will be used to inform interventions and policy dialogue at sectoral and national levels

SIRAYE's service delivery method ***coordinates key ILO departments and global programmes to deliver service on the following;****Better Work:* SIRAYE works very closely with government, enterprises, workers, and brands through a robust, sustainable and inclusive compliance assessment and remediation system. In addition, the programme provides demand driven trainings targeting workers, managers and other stakeholders to improve compliance with ILO core labour standards and national legislations, working conditions, win-win social dialogue and, at the same time enhance factories' productivity and profitability.
Better work - a collaborative and comprehensive programme between the ILO and the International Finance Cooperation (IFC).

Enhance productivity: with a focus on improving factory level productivity, SIRAYE's programme service package rolls ILO's Sustaining Competitive and Responsible Enterprises (SCORE) modular training and in factory coaching related to quality management, efficient use of resources and industrial engineering concepts of productivity improvement. The training and advisory services also reinforces concepts of workplace cooperation needed to improve productivity by focusing on building trust, respect and communication between managers and workers; and setting performance improvement teams.

Occupational safety and health (OSH): with the aim of preventing work-related death, injuries and diseases, SIRAYE's programme service package works on creating enabling environment for the promotion of safe and healthy working conditions. The programme works closely with key stakeholders to improve legal and policy frameworks that promote and enforce OSH; as well as to ensure workers are covered by a sustainable prevention, protection and compensation system.

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Labour Administration and Inspection: As part of SIRAYE's service package, ILO supports the strengthening of labour administration in building more effective labour inspection systems. In doing so, ILO aims to enhance capacity of the labour inspectorate in strategic compliance planning and implementation. As part of this, training curriculum and labour inspection information and knowledge management system will be designed and applied.

3. On ginneries- Info from the Institute for Applied Ecology
(October 2018, Table A.4-6, p. 198, code D3)

Arba Minch Ginnery
The cotton ginnery is a saw ginnery that was installed in 1991. The manufacturer, Lummus, still is "the world's leading supplier of machinery and replacement parts for the cotton ginning industry"12. The ginnery was manufactured in the USA and initially exported to Cuba, then forwarded to Ethiopia.
According to the manager, the key data of the ginnery are as follows:
The produced shares by weight are: 37% lint cotton, 58% seed cotton and around 5% waste.
Ginning service costs are between 175 and 200 Birr to gin 100 kg of raw cotton.
Operating capacity of the ginnery is 800 kg lint cotton per hour.
Typically, cotton harvest in Arba Minch starts around the end of October and is carried out throughout November. At the ginnery, the arriving harvested cotton is first stored in a feeding room, as the ginnery should always run at 100% capacity. Once enough cotton has been collected, the ginning process is started around December and continued throughout several months. The cotton seed is either sold for the production of oil or is used as seed for new cotton fields for the next season. In order to prepare the seeds for plantation, they are treated with sulfuric acid at a proportion of 100 kg of cotton to 5 litres of sulfuric acid. In the following, the seeds are separated in a water barrel. The output lint cotton is mechanically baled and weighted for further sale and transportation. For more information on ginneries in Ethiopia regarding technologies, quality and volumes see (SOFRECO 2017).

Genda Wuha and Chagni Ginnery

Beyond the ginnery visited in Arba Minch, the research team could interview the CEO of two ginneries operated in the Amhara region, North-Western Ethiopia. However, the ginnery could not be visited. The Genda Wuha Ginnery is the only CmiA certified ginnery in Ethiopia. The following key data were provided by the Genda Wuha Ginnery in North-Western Ethiopia:
The capacity of the ginnery is 20,000 t of raw cotton per year
Cotton is received and transported from 20,000 farms in Metema area, Amhara region
Staple length of the received cotton is max. 27 mm
Costs for the CmiA certificate are 5,000 ETB per year
According to information, the first problem the ginnery is facing in the daily business with regards to certification is the poor traceability of the cotton. The identity of the farms cannot be guaranteed, which would make an Identity Preserved (IP) system impossible. Secondly, the ginneries are faced with considerable costs while cleaning the ginnery for certified cotton. Altogether it takes a ginnery around 5 hours to clean the machines from conventional fibres before certified cotton can be ginned. Finally, the ginnery is faced with contradicting information regarding the amount of certified, ginned cotton. The officially reported amount of 1,500,000 metric tons (MT) of CmiA certified cotton per year is much higher than the own ginning capacity. Furthermore, the CmiA approach focusses on training cotton smallholders in the region. However, it is reported that, for a total number of 20,000 smallholders, the certification scheme only provides a number of 12 trainers. In light of this proportion that implies very little training resources, an effective training with regards to quality, harvest, yield and environment can be questioned.

A4-5 List of interviews conducted (anonymized)

Code	date/place	description
I1	13.1.20/AA	ECPGEA,
I2	13.1.20/AA	ETGAMA
I3	14.1.20/AA	Esayas/Cotton team
I4	14.1.20/AA	ETIDI team
I5	1.0 Birr/kg	EP
I6	14.1.20/AA	Solidardad
I7	15.1/Gondar	Sanja Woreda, crop extension.
I8	15.1/Gondar	FGD farmers
I9	15.1/Gondar	DES ginnery in Gondar
I10	16.1 /Gondar	Zonal agric officer
I11	16.1/Kisha K.	cotton producers
I12	17.1/Dansha	young banker
I13	17.1/Dansha	Danshu Aurora Farmer Union
I14	17.1/Dansha	Ginning factory
I15	17.1/Dansha	Hiwot cotton farm
I16	17.1/Dansha	Feraasi cooperative, 3 prod.
I17	18.1/Dansha	Sure Dansha producers
I18	18.1/Gondar	Weaver training center
I19	18.1/Gondar	market
I20	20.1/Arbaminch	3 labourers
I21	20.1/Arbaminch	Christian Aid (iNGO)
I22	20.1/Arbaminch	Tourist guide

I22	21.1/ Gamo	Zonal office
I23	21.1/ Gamo	Organic cotton farmers coop
I24	21.1/ Gamo	Lucy farm
I25	22.1/Dorze	Weavers
I26	23.1/ AA	EIAR/
I27	23.1/ AA	PRIN consultancy
I28	23.1/ AA	MoEFCC/Biosafety
I29	26/1/AA	Stakeholder
I30	28/1/AA	ECPGEA
I31		Helvetas (iNGO)
I32	29.1/Mekelle	Indust. Park
I33	29.1/Mekelle	BEA Mekelle
I34	29.1/Mekelle	TARI/
I35	29.1/Mekelle	Cotton consultant
I36	29.1/Mekelle	Helvetas Mekelle
I37	30.1/Mekelle	Investment bureau
I38	31.1/AA	ETIDI
I39	1.2/AA	Shiro Meda
I40	1.2/AA	Entoto Beth Artisans
I41	1.2/AA	Taxidriver and guide
I42	April/written	Amibara farm, Awash
I43	April/written	Middle Awash Ginning
I44	April/written	Adama spinning

A4-6 List of consulted literature (mainly for the social/sociological part)

code D	title
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D3	Ökoinstitut_2018; The Cotton Supply Chain in Ethiopia. A country-focused commodity analysis in the context of the Bio-Macht project
D4	ICAC_2014; COTTON : Review of the World Situation
D5	Alderlin_2014; Made in Ethiopia. Challenges and opportunities in the emerging textile industry in Ethiopia. Uppsala
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D7	FDRE_2015; Growth and Transformation Plan II (GTP II) (2015/16-2019/20). Main text
D8	National Indicative Programme (NIP) for Ethiopia 2014 to 2020
D9	Gudeta et al 2019; Cotton production potential areas, production trends, research status, gaps and future directions of cotton improvement in Ethiopia. Greener Journal of Agricultural Sciences. 9(2): 163-170, http://doi.org/10.15580/GJAS.2019.2.040619064.
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A4-7 The ambiguity of Gambela as a future place for cotton

Gambela is the only region, in which we have currently only commercial cotton farms and at the same time an impressive theoretical potential for cotton (200'000 ha), by far the highest. Land and other conflicts with land and water users, pastoralists and peasant farmers are still unsolved and the existence of the largest National Park are at stake. The challenge will be to make the developments in this resource rich region beneficiary as well for the inhabitants and the region as a public space and not just for the foreign investors.

We see from Table A that Gambela is foreseen to provide about ¼ of the national future cotton area (or 200'000 ha). Interesting that the SCF of this region show no interest in cotton production. The Ethiopian state has sought to attract –amongst others- Indian agricultural investors with the promise of extremely cheap and abundant fertile land, along with cheap labour, in the peripheral lowland provinces such as Gambela. In return, the Ethiopian state expects Indian companies to either enhance national food availability or contribute to the state's foreign exchange reserves through commodity exports (Gill, 2018).

Table A: Cotton land expansion potential (base year 2016) for large scale (right) and small-scale cotton farms (left) in Ethiopia's

Regions	Area 2016 (ha)	Potential Low Option (ha)	Potential High Option (ha)	Ratio: Low Option/2016 Area	Ratio: High Option/2016 Area
Afar	7,800	40,000	65,000	5.13	8.33
Amhara	13,000	36,000	75,000	2.77	5.77
Benishangul-Gumuz	6,000	30,000	50,000	5.00	8.33
Gambela	5,000	50,000	200,000	10.00	40.00
SNNP	8,500	35,000	70,000	4.12	8.24
Somali	0	10,000	50,000	-	-
Tigray	10,000	22,000	30,000	2.20	3.00
Total	50,300	223,000	540,000	4.43	10.74

Regions (cotton zones only)	Total annual crops area in 2016 (ha)	Cotton area cropped in 2016 (ha)	% Cotton/ total in 2016	Potential cotton area	
				% of total annual crops	Potential cotton area (ha)
Afar	4,783	1,323	27.66%	27.66%	1,323
Amhara	999,915	26,240	2.62%	20.00%	199,983
Benishangul-Gumuz	244,163	0	0.00%	5.00%	12,208
SNNP	396,888	4,672	1.18%	10.00%	39,689
Tigray	289,660	0	0.00%	5.00%	14,483
Total	**1,935,410**	**32,235**	**1.67%**	**13.80%**	**267,686**

(Source: NCDS)

With temperatures of up to 48 degrees Celsius, classic savannah landscapes as well as swamp areas are intertwined , which, however, are mostly dried out during the dry season. Unlike most regions of Ethiopia, which are almost exclusively inhabited by one ethnic group each, five different ethnic groups share Gambella. The Nuer (about 46%), Anyuak (about 21%) and Highlander (about 9%) make up the largest part. However, members of the Mejengir, Omo and Komo tribes also live there. These minorities live as hunters, gatherers and shifting farmers. They are hardly to be found in the cities, but populate the savannah and forest areas in small villages. The Nuer and Anyuaks also live in the countryside, mostly in the traditional way without electricity and running water. There the Nuer live mainly from cattle breeding. They also hunt, fish and do agriculture to a very small extent. The Anyuaks also hunt and fish, but their subsistence farming is mainly based on agriculture along the Baro River. There the Nuer live mainly from cattle breeding. They also hunt and fish and do agriculture to a very small extent. The Anyuaks also hunt and fish, but their subsistence agriculture is mainly agriculture along the Baro River. In Anyuak quarters, however, you will not find any Nuer and in Nuer quarters no Anyuaks. This is the result of a centuries-old conflict between these two peoples. Especially in the countryside there are deadly clashes that often go unnoticed by the state authorities or the general public.

But these bloody tribal wars are not Gambela's only big problem. Since the area with a lot of water and great heat is ideal for the spread of malaria and the health care is miserable, this actually curable disease causes countless deaths every year. In addition, the HIV rate is above average and alcoholism is not uncommon, especially among the men in the villages. In Gambela, the standard of education is extremely poor even by Ethiopian standards, as children are often abused as cheap labour instead of being sent to school. Furthermore, young women are often treated by their families almost like a commodity. Thus they are sometimes sold at the age of 12 to a groom from whom she is pregnant a short time later. As you can imagine, there are frighteningly often complications during the births. Just to name a few of the thousands of problems. (Source: Report from Bachmann Foundation, Swiss NGO active in the region)

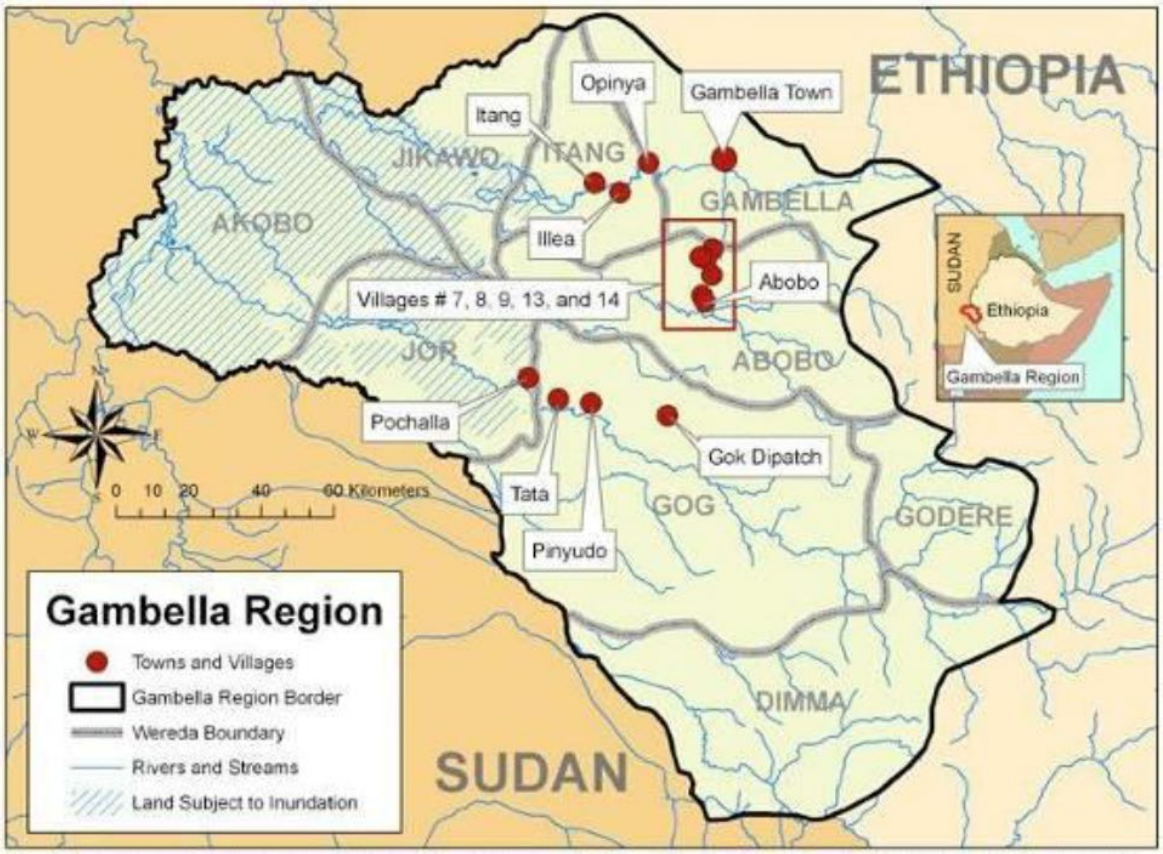


Figure A: Gamela region; Source: Anyuakmedia (2006). Etrievd in Cascao

The political history of the Gambella (according to Cascao 2013)
Located in a strategic geographical corridor, where the border between Ethiopia and South Sudan now lies, the region has been the stage of several colonial political power games. The Gambella region (in particular the lowland areas) had been under nominal British control during the 17th and 18th centuries, and as such was part of the British empire and later the Anglo-Egyptian Condominium; at the end of the 19th century, the region was occupied by Ethiopia, which was by then conquering territory southwards of its stronghold in the Ethiopian highlands (Bahru, 1976). Officially, Gambella only became part of Ethiopia in 1902, after long and complex negotiations between Emperor Menelik II and the British, which were translated into a swap of territories between the two empires – Gambella was exchanged for Kassala, located in the northern border of the two empires (Markakis, 2011). After the adoption of the bilateral agreement, Gambella became then the westernmost border of Ethiopia – until 2011 bordering Sudan and after separation bordering the new country of South Sudan.

The main cause of the conflicts may be ethnicity, religion, inequality, underdevelopment, colonial past, etc – but natural resources play a role in fuelling conflicts. The navigable rivers placed Gambela long ago on the map for an important trade corridor at regional level. But conflicts stopped this plan. Gambela is since a marginal and neglected region. Conflict and cooperation have historically characterised the socioeconomic and political dynamics between the three groups. The Anuak have always lived along the Baro and Gilo rivers, practising recessive agriculture – meaning agriculture on the river banks in the period after the floods- as rainfall levels in the region are high from May to August and agriculture usually takes places in the remaining months. Land and water resources are abundant in the Gambela region but this has not prevented resource-based conflict in the region. One of the main factors is the concentration of long-standing and newcomers in the same geographical areas, namely the Baro and Gilo river banks, that has contributed to increasing social tensions between the different groups due to competition for the same natural resources. Nevertheless, the intensity of the resource-based conflicts has exponentially increased due to political motivations related to the management and allocation of the natural resources, and more recently a race for political power resources (Cascao, 2013). Then the same author continues:

> *The mid-1980s are a tipping point in the history of the Gambela region, with two extreme events that changed the socio-economic and political dynamics to an unprecedented extent. The population of Gambella was estimated to be 50,000 people in 1984, and in the following couple of years the population in the region increased sevenfold in a very short period of time (Mengistu, 2005). The first event was the arrival of 150,000 settlers, mainly Ethiopia highlanders, as a result of a resettlement programme including a forced migration policy by the Derg regime in 1984 (Mengistu, 2005). The second event was the arrival of 300,000 South Sudanese*

refugees and military contingencies soon after the resumption of the Sudanese civil war on the other side of the border. The Gambella region was not only the location of three of the main refugee camps for Southern Sudanese (Itang, Punydo and Bonga), but also where the SPLA headquarters was located. The SPLA received military, logistical and financial support from the Ethiopian Derg regime until its fall in 1991 (Johnson, 1998).

But in brief, five major consequential changes can be identified:

a) Population density: most of the newcomers (from Ethiopia and South Sudan) moved to overlapping or adjoining areas where local populations where already living, helping to increase social tensions.
b) Competition for resources: access to land and water became more competitive, and severe challenges occurred in terms of land tenure and rights to use the water resources.
c) Disruption of customary conflict resolution mechanisms: the efficiency of the traditional mechanisms to resolve conflicts among different sectors of the population were disrupted or dismantled, and not necessarily replaced by an efficient new way of dealing with the new types of conflicts.
d) New layers of power relations: the arrival of the newcomers contributed to the complexity of power relations in the region and increased asymmetries – the already existing ones (empowering some of the local communities at the expense of others) and new layers (newcomers had political resources and networks that the local populations could not benefit from).
e) Increasing dependency on aid: with the arrival Southern Sudanese refugees, also a lot of international aid agencies arrived providing all kind of humanitarian assistance. This also included food aid, which contributed greatly to the disruption of agricultural production in the region.

A further landmark event which was to change the landscape of Gambela was the 2009 Global Financial crises. Cascao:

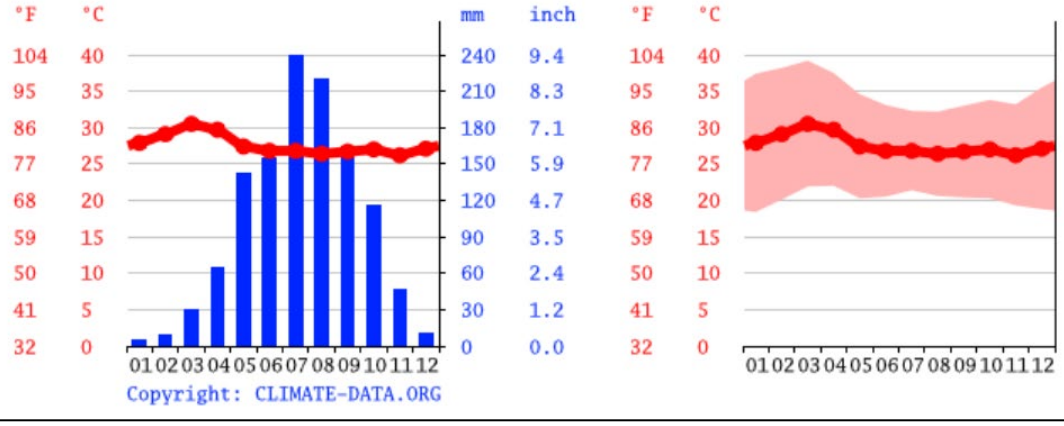
Gambela and its water and land resources are back on the agenda of the Ethiopian government and once again a grandiose plan is dominating the decision-making process. This time we are talking not about navigation but about large-scale agriculture, but where trade is still the key word. The story goes that in 2008 the world woke up to a global food crisis, with an unprecedented spike in the prices of several food staples like rice and cereals. This propelled governments and private companies, mainly from water-scarce countries (such as the Gulf countries), to lease land for agriculture production in many African countries (Pearce, 2012). Ethiopia, and in particular the Gambella region, became particularly attractive to these new ventures. This was because there was plenty of land and water resources available and the Ethiopian government had been offering attractive incentives for direct foreign investment (Cotula, et. al., 2009; Weissleder, 2009). Because of its fertile land, high levels of rainfall and the riverine areas Gambela became a main region for these land deals – and at the same time Mengistu's past slogan that land in Gambela was virgin (i.e. not being currently used) came back to the limelight. For the first time in history, Gambela was making headlines in the international media as the example of what is called "land and water grabbing.

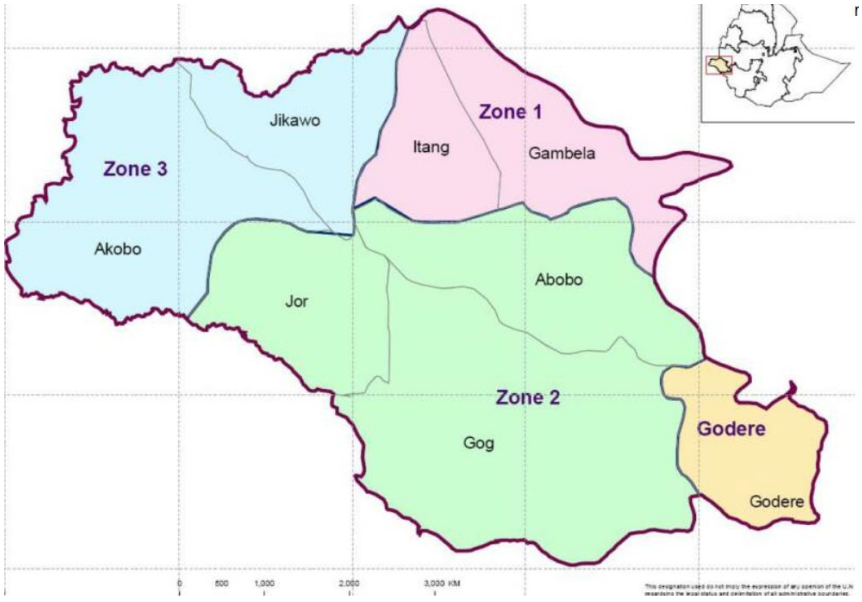
As of 2013, two large agricultural projects are starting in the Gambela region. A large-scale rice farm (potential: 140,000 ha of land) in the Abobo area, that will soon start using the water stored in the Alwero Dam reservoir once the irrigation canals are . This project is run by Saudi Star Agriculture Development, a private joint venture between Saudi and Ethiopian investors. The other is a large-scale sugar-cane and corn farm (potential: 400,000 ha of land) run by Karuturi, an India-based private agro-business company operating globally. The farms are currently undertaking rain-fed agriculture, but have shown an interest in moving towards irrigated agriculture using the water in the Alwero Dam and/or the Baro River. The lease contracts include deals on the extension (in hectares) of land that the private companies can use for their agricultural activities, though they are somehow omissive about the water resources – but it is a given that they will need water to expand agricultural production. How much water the projects are going to use in the future is still unclear.

Will these projects contribute positively to the socio-economic development of Ethiopia and the Gambella region in particular? Or will these projects impact negatively on the already-complex dynamics in the region, by increasing resource-based competition and conflict of interests between the different users?

The questions has most probably not changed much since 2013. Unfortunately, our mission could not visit Gambela to have first sight information and make up a more concrete analyses related to the cotton VC. No sustainable solution to the conflicts will be found without consulting the locals and reinforcing the governance structure of this very fragile region of Ethiopia.

Gambela climate summary (source: www. climate-data.org/africa/ethiopia/Gambela)
The Gambela lies on 445m above sea level The climate is tropical in Gambela. In winter, there is much less rainfall than in summer. This location is classified as Aw by Köppen and Geiger. The average annual temperature in Gambela is 27.6 °C | 81.7 °F. The annual rainfall is 1148 mm | 45.2 inch.



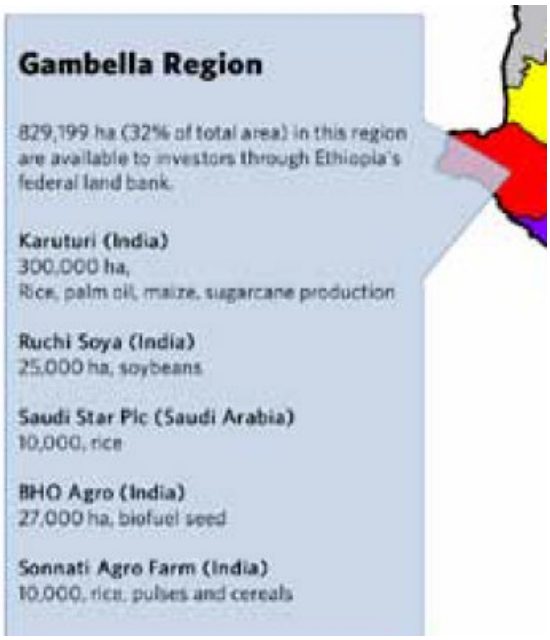


Source: http://www.ocha-eth.org/Maps/downloadables/BENESHANGUL.pdf
Figure B: Zones and districts in Gambela

As the land distributed by lease expands the 5'000 ha, it is dealt directly by the federal land banks in Addis Ababa. We see from Table B that about1/3 or 32% of the region is offered to investors. This is eventually a world record in our days.
Table B: Number and size of commercial farms allocated by the land banks (year unknown, ev. 2013)

TABLE 6: LANDS IN FEDERAL LAND BANK AND MARKETED BY FDRE					
	Overall ha available	Number of parcels	Average Size	Area of region	% of region being offered
Gambella	829,199	7	118,457	2,580,200	32%
SNNPR	180,625	4	45,156	11,093,100	2%
Benishangul	691,984	4	172,996	4,928,900	14%
Afar	409,678	9	45,520	9,670,700	4%
Total	2,111,486	24	87,979		

Local Ethiopians miss out as big agriculture firms struggle in Gambela – A report by Oakland Institute (2011)
Commercial farming, with its vast tracts of land, is running into problems in Ethiopia's Gambella region – and local communities are reaping few benefits. In the opposite direction, across the asphalt road that leads to South Sudan, lies the farm of BHO Bioproducts, an Anglo-Indian company growing rice and cotton on the 27,000 hectares (67,000 acres) it has leased… Pouch says the company doesn't care about the people of his village, Wath-Gach. Grazing land has been lost, and BHO has built a wooden cage around a water pump to prevent locals using it. "From the beginning we did not have a good relationship," he says. "It was given without consultation. There has been lots of negative impact." The company didn't respond to a request for comment… BHO's operation, which began in 2010, is one of many concessions Ethiopia's government has granted in Gambella, including one plot leased to the Indian company Karuturi Global [16]of 100,000 hectares. Commercial farmers are expected to bring knowhow, technology and jobs to one of the country's poorest and most remote regions. By converting uncultivated bush into productive farms, officials believed food security and export revenues would improve in a country dominated by subsistence agriculture… Karuturi's project has stalled after managers discovered that four-fifths of the land is in a floodplain. The firm also failed to build relations with residents, according to the elders. Complaints include reduced land for farming and hunting, no promised health clinic, cattle dying from ingesting pesticides, the burning of unwanted maize, and only a handful of jobs for villagers. "The government benefits from the tax but the community does not benefit," says Obang Wudo, one of the elders. But despite those worthy ambitions, progress has been hampered by Gambella's logistical difficulties, and a failure to ensure local communities benefit…Gambella has been the focus of a political fallout between the central government and advocacy groups such as Human Rights Watch and the Oakland Institute – with donors uncomfortably positioned in the middle. The critics claim that a resettlement programme to move scattered rural populations to larger settlements was coercive and designed to clear the way for investors. Ethiopia says rights groups from the global north are ideologically opposed to its state-heavy development model and that the voluntary resettlement programme was to make public service delivery more cost-efficient. The UK's Department for International Development and the World Bank are facing legal inquiries for funding the salaries of civil servants who staffed the enlarged villages.



Because there is a need for increased foreign currency reserves, most incentives and marketing efforts encourage investment in cash crops for export (sugarcane, cotton, rice, etc). The OI team spoke to many investors and government departments who believed this form of investment would increase food security in the long term.
While rates vary, a 10,000 ha lease could provide between USD 17,500 and USD 42,700 into woreda coffers each year. However, the criterion of "lack of human settlement" is clearly arbitrary. In the case of Gambella, the lands that are identified as part of the federal land bank contain numerous small settlements of Nuer and Anuak, ranging from a few scattered households to villages of up to 1,000 people. These large parcels of lands are marketed as being suitable for a variety of crops (approximately 32 percent or 1.7 million ha of the total land base in Gambella is currently available in the federal land bank).
The lease areas visited by OI that are currently under production are all near major water sources, adjacent to road networks, and rely on limited human labor (but in almost all cases, some degree of human labor is used). In the majority of these cases, the land was partially or completely covered by woodland and/or forest, which needed to be cleared. EWCA estimates that 438,000 ha of land have been leased in the vicinity of the park, all without Environmental Impact Assessments. The Gambella Regional Council is able to grant land leases under 5,000 ha and, according to EWCA, has committed to not award any lands for investment in areas that are candidates for protected area status. Wetlands, with abundant fish populations and bird life, are presently being altered for rice production by Karuturi. Extensive forest cover in nearby areas has also been completely cleared. It appears to be too late to protect some areas of this park, despite EWCA efforts.

[16] See Gill 2016. The dissertation on land grabbing in Gambella

This complex situation is then presented by WIKI (retrieved in may 2020) as follows:

> *"Ninety percent of the population of Gambela is rural and most of the people are thus subsistence farmers, selling some of their produce on local markets." Other economic activities include coffee cultivation, exploration for gold (Dimma Wereda), continued work on the remaining state farms (primarily cotton in Alwero-Peno Wereda), and exploration for oil by Malaysian and Chinese companies [4]. The Anuak "...are mainly crop dependent people with fishing and hunting as their supplementary income sources[while the Nuer] are largely livestock dependent" [2] As elsewhere in the country the pressure on land has increased due to the doubling of the population in the last quarter century as well as the resettlement, in the Gambella region, of highland populations from other regions namely, Amhara, Tigray, and SNNP. "Population has increased, but farming techniques have not changed and the land that is used is believed to be overused. The problem is exacerbated by insecurity, as government schemes to address farming issues—such as the National Agricultural Extension Package—do not reach most places in Gambella*

Why are Indian companies interested in Gambela? Gill (2016)

As an examination of the expansion of Indian agricultural production into the Gambela province of Ethiopia reveals, the cheap food provisioned from the frontier remains premised upon the "Cortesian" racialized appropriation and erasure of indigenous knowledge and practice... Rather, the core constituencies of the Ethiopian state have been central to Gambela's conceptualization as a frontier of unused nature by drawing on long standing "internal" racialized distinctions between "civilized" highlanders and "primitive" lowlanders. It is necessary, therefore, to clarify how India's agricultural expansion into Gambela is actively enabled and embraced by the Ethiopian state in its own pursuit of a cheap food strategy capable of advancing the national project of agrarian transition.(p.197). Forcibly incorporated into the highlander dominated Ethiopian state via imperial conquests, in the late 19th century, Gambela has historically come to be known, by successive governmental regimes – imperial, the socialist Derg, and the contemporary Ethiopian Peoples Democratic Revolutionary Front (EPDRF) – as containing lush and fertile lands that, in so much as they were "unused," could resolve the land constraint in the northern highlands and potentially serve as a breadbasket region for Ethiopia, provisioning the cheap inputs that could underwrite the desired national transition from agrarian to industrial economy.

Large-scale agriculture would facilitate the transition by providing cheap food for an emergent industrial proletariat, and by generating foreign exchange, through the export of surplus food, that could then be used to finance the import of the technology and machinery necessary for industrialization (p.200)...

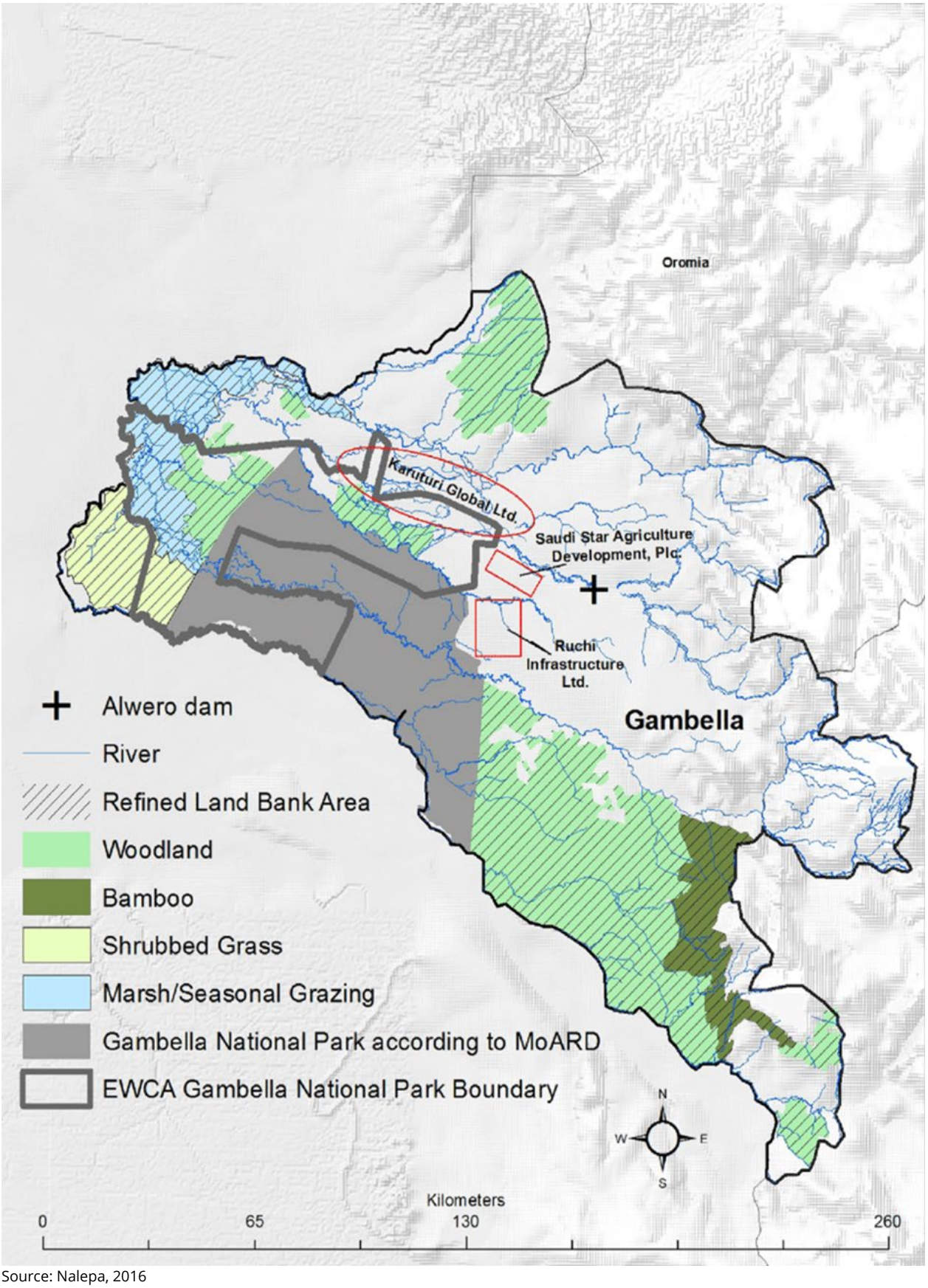
Within the South-South strategy, India has emerged as a particularly prominent partner in the field of agricultural investment and co-operation, as Ethiopia's desire to attract foreign investment in agriculture has converged with India's growing recognition of the need to secure offshore resources for food production.

Agriculture as main driver of deforestation

Deforestation is an other serious problem, both ecologic and social, for Gambela and its people. Citing from Othow (2017)[17]:

The extent and distribution of forest resource in the study area decreased from (23%) in 2002 to (18%) in 2017 with annual destruction rate (-1.45/year). In total, between the year 1990-2017 the district lost (-0.91%) of forest per year where farm land increased from (4.86%) in 2002 to (23%) in 2017 with annual expansion rate (24.88%) in the study area. In total between the years 1990-2017 farm land expanded by annual rate (0.20%) per year. Generally the rapid expansion of farm land leads to further decrease in forest cover which in turn leads to widespread soil erosion and loss of biodiversity in the study area... Analysis of the socioeconomic data and field observation also revealed that large scale commercial agricultural has forcefully asserted environmental pressure on environment and forest covers, creating undesirable condition to the livelihoods of the community living in Gog district. The result of this finding is in line with study carried out by Ref. [41 = Kefelegn G, Van Rompaey A, Poesan J (2015). Impact of resettlement on deforestation of Afromontane forest in southwest Ethiopia. Journal of Mountain Research and Development 37: 474-486.], showed that agriculture and resettlement program to be the leading causes of deforestation in South Western Ethiopia. Finally, the finding of this research study shows that agriculture is the leading driver of deforestation in the study area. Similar condition was also outlined in Ref. [1 = FAO (2010) Global forest resource assessment. In: FAO Forestry paper 163, Main Report, Rome, Italy.] document that large scale agriculture is the leading cause for widespread deforestation in Africa which is mainly due to the conversion of forest land in to agriculture.

[17] Othow et al (2017); Analyzing the Rate of Land Use and Land Cover Change and Determining the Causes of Forest Cover Change in Gog District, Gambella Regional State, Ethiopia. J Remote Sensing & GIS 6: 219. doi: 10.4172/2469-4134.1000219



Source: Nalepa, 2016

Gambela National Park is a 4,575-square-kilometre (1,766 sq mi) national park in Ethiopia, near the South Sudanese border. It is the nation's largest national park.[2]Gambella is located several hundred kilometers from Addis Ababa,[1] Gambella was established in 1974,[3] but is not fully protected and has not been effectively managed for much of its history.

Gambela was established during 1974–1975 to protect habitat and wildlife, especially the Nile lechwe and white-eared kob, two endangered antelope species. Animal populations in the park have declined because of agriculture, cotton farming, hunting, poaching, and the creation of refugee camps, especially following the 1983–1985 famine in Ethiopia and by displaced Sudanese.Illegal deforestation by local communities has also led to conflict.
In 2012, Bantayehu Wasyihun, head of the park's office, said infrastructure development was underway to make Gambela more accommodating to tourists The conservation organization African Parks and Addis Ababa University's Horn of Africa Research Centre worked with park officials to draft plans to improve Gambella's security and structure.
From a tour operator we can read the following advertisement:

> *The Gambela National Park is located in the western lowlands and covers about 5,061 km². It is a marshy area, which is home to numerous native species of animals. In addition to typical savannah landscapes, slow-flowing waters, riverside forests and floodplains also characterize the landscape. Elephants, waterbucks and kaffir buffalos spend the evenings at the waterholes. The animal world is widely diversified and includes numerous species in need of protection. Among the most impressive animals in Gambela National Park are the giraffe, the nile crocodile and the hippopotamus. As in many national parks in Ethiopia, the birdlife is also diverse. Basrah Warbler, Bush Sparrow and Shoebill are just some of the well-known bird species of the region. Due to political and social events, however, the park is in danger and can no longer be adequately protected. There is a lack of funds to adequately protect the national park. In addition, the partial settlement is carried out by the inhabitants of the country. Whoever makes a tour in this region will have the pleasure of seeing many species of animals in their natural environment.*
> *Despite the problems, the region has lost nothing of its fascination and beauty and a visit should not be missing on any Ethiopia tour. If you want to see animals in their natural environment, which you can otherwise only see in the zoo, then a national park is just the right destination on your Ethiopia tours.*

To see how Ethiopia and the Gambela people together with the investors and the international opinion can contribute to make this amazing place, ecologically, socially, historically and from the diversity of people, both indigenous and migrants, a better place for all. Cotton VC, one of the best organized VC of all but surely in Africa, would have here a great opportunity to contribute to a better system of land use and market opportunities. It would be a breakthrough if the commercial farms could be convinced to convert to organic cotton and other crops in order to change the trends a send out clear signals to consumers and markets for sustainability and respect against the people living in this region. For time being, the region has been marked by the Federal government for GMO cotton.

The challenges are huge, and go beyond national capacities. But missing them is just no option. The team of the cotton VCA4D Ethiopia would be more than willing to contribute to a constructive proposal on how a sustainable cotton system could be planned in a participatory way.

Environmental analyses

A5-1 Snapshot LCA results from a commercial farm following conversion from Sugar cane.

The inventory results are based significantly on the questionnaire response from a commercial farm commercial farm. This is included for comparison as reflects the first year in a farm that has transitioned from Sugar Cane to cotton and therefore reflects activities that are not routine. This farm reflects a high degree of mechanisation and a low yield of 0.7 tonnes of seed cotton per year. Because this snapshot is not likely to be representative of cotton production in general it was not considered appropriate to include with the other examples.
A key disintinguishing feasture in this farm is the tractor activity which was supplied directly by the questionnaire response. As this farm was transitioning from sugar to cotton in its first year it included a large number activities that would not be considered part of the conventional cultivation cycle. The range of tractor sizes were supplied, and it was assumed that the largest tractor (300 hp) was deployed in ploughing, the activity which required most time per hectare. For that reason, and the low yield of the first year under cotton, the estimated energy demand in L/tonnes of seedcotton was multiple times that of the previous farm. The results of this farm are summarised in the table below along with the previous.
Table A5: Comparison of Midpoint results of 1 kg of seedcotton

Damage category	Unit	New Rotation	SHRF1	SHRF2	SHRF3	LCI
Ecosystem quality	PDF*m2*yr	**16**	10.91	8.55	15.17	6.89
Resources	MJ	**43**	0.66	0.01	2.12	5.48
Climate change	kg CO2 eq	**3**	0.06	0.01	0.17	0.35
Human health	DALY	**1.67E-06**	9.96E-08	3.35E-08	5.71E-07	5.45E-07

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As can be seen from the table above, (with the exception of Ecosystem Quality) the results are significantly in excess of other impact score. This is mostly driven by the large quantity of diesel consumed in ploughing, scarification, spreading etc. as well as pumping

energy required to pump the large amount of water applied to the farm. This also manifests in the higher health impacts associated with particulate emissions associated diesel combustion.

A6-1 The situation with GM food crops and GM cotton in Ethiopia

The intention of the government is to confine GM cotton to Gambela region, where only larger commercial farms produce cotton (ev. as well in Benjangul-Gumuz and Amhara). The Biosafety department within MoFCC is monitoring the situation and managing the permits for field trials.

Bt-cotton production is practiced in few larger farms in selected locations. But many scholars and a coalition of civil society launched a strong campaign recently against the cultivation of Genetically Modified Organisms in Ethiopia that includes Bt-cotton. The issue becomes a serious discussion point when United States Department of Agriculture (USDA) Foreign Agricultural Service published a report that revealed the government approval of commercial cultivation of genetically modified (GM) insect-resistant cotton (Bt-cotton) and confined trial of GM enset and maize in Ethiopia. The process started without public awareness in 2015, when Ethiopian parliament opened up the country to genetically modified organisms (GMOs) by loosening the safeguards built into a 2009 biosafety law. Three years later, the government approved commercial cultivation of a strain of cotton. The move is a critical shift from its forefront position of the anti-GMO movement in Africa. Arguments raised against GMO promotion include:

- Ethiopia enacted a highly restrictive biosafety law in 2009 that prohibited the deliberate release of GMOs into the environment to protect its uniquely high crop diversity from GMO contamination and genetic erosion considering the global lessons. According to International Journal of Food Contamination, almost 400 cases of contamination occurred between 1997 and 2013 in 63 countries.
- The restrictive laws in Ethiopia were developed to protect smallholder farmers from becoming indebted to and dependent on multinational corporations for seeds. The country proclamations established (e.g. Proclamation No.1068/2017) farmers' rights to save, re-use, exchange and sell seeds of all kinds from their produce. This rights and practice need to be protected.
- In 2015, when the parliament made the amendment of the law, the main argument was to allow Bt-cotton to meet the needs of the growing textile industry in Ethiopia. Professionals were arguing there is no independent studies that show improved yield, disease-resistance nor socio-economic benefits for smallholder farmers from use of genetically modified crops compared to conventionally bread varieties. As an example, Bt-cotton failed (at least temporally) in Burkina Faso due to loss over time of its insect-resistant traits and yield potential but mainly because of the lower selling price[18]. This has incurred economic losses as well for farmers due to high prices for seeds and associated agrochemicals. Besides, farmers were not able to use the seeds for food due to lack of confidence about its safety for their health. Similar experiences have been documented in India.
- With weakness of Ethiopia's regulatory system, with limited awareness of the community and with waivers provided to different entity with regulatory vacuum, many people may consume GMO products without knowledge. A strong regulatory system should be in place, public research should be improved, and studies of GMOs' socioeconomic values should be conducted by an independent body before moving ahead.
- The effective dissemination of conventionally bred, well-adapted crop varieties coupled with good agronomic practices can improve crop production and productivity among Ethiopian smallholders without the need for GMOs.

Cotton certified to organic agricultural standards is currently grown in eight African countries – Benin, Burkina Faso, Egypt, Mali, Ethiopia, Senegal, Tanzania, and Uganda. With production in the region increasing by 20 percent between 2016/17 and 2017/18, Africa now accounts for more than four percent of global organic cotton production (Marquard, 2020)
With increased production and vertical integration, Africa has the potential to become a significant hub for ethical and sustainable textile-based development. There are numerous benefits to sourcing organic cotton and GM-free

[18] The first reason why Burkina returned to conventional cotton was the lower quality of GM seeds (shorter staple length, hence lower selling price of lint and tens of millions of $ loss). The decision was taken by the ginners, having faced serious problems in selling the Bt-cotton (Dowd-Uribe, 2016).

How to deal with GM cotton in Ethiopia?

(Source: From the Whitepaper on outlining the risks of scaling genetically modified cotton in Africa and the opportunities of organic and other preferred cotton initiatives; Marquard 2020)

GM cotton has been created by altering the plant's genetic material (DNA) in a manner that does not occur naturally by mating or by natural recombination. While GM cotton offers many promises, adoption of the technology comes with several concerns. These include economic risks for farming communities, due to higher costs of production associated with higher input requirements, as well as increased pesticide resistance, genetic drift, seed ownership monopoly, and the irreversibility of the technology.
In Africa, several initiatives have been developed to increase the sustainability of cotton production on the continent. Most of them – such as organic, Fairtrade and Cotton made in Africa (CmiA) – prohibit the use of GM cotton seed due to the concerns previously mentioned. Cotton certified to organic agricultural standards is currently grown in eight African countries – Benin, Burkina Faso, Egypt, Mali, Ethiopia, Senegal, Tanzania, and Uganda. With production in the region increasing by 20 percent between 2016/17 and 2017/18, Africa now accounts for more than four percent of global organic cotton production.
Given that ***organic production standards prohibit the use of GM technology***, which the majority of African nations have not adopted, the continent is ideally situated to become a significant player in the organic cotton market. Indeed, African organic cotton is well-positioned to be integrated into the continent's own manufacturing infrastructure as well as by companies in nearby European and Middle Eastern manufacturing markets searching for smaller textile trade footprints.
Should countries move forward in adopting genetic engineering, the Working Group urges governments to adopt the precautionary principle, develop stringent biosafety regulations addressing the research and use of GM crops, including strict liability provisions for seed patent holders and clear rules to support coexistence with GM-free preferred cotton supply chains, starting with seed development, production, and supply systems.

A6-2 Recommendations related to Covid-19 for the cotton sector

Source, Ecotextile, 2020; The impact of Covid-19 on global cotton supply. Ecotextile news, special supplement

Recommendations for a post-Covid cotton sector

- Pandemics are here to stay. There will be another. And there will be other major disruptions – perhaps even conflicts. Business as usual is not an option, the cotton sector needs to be ready to respond.
- Be prepared to support farmers, workers and businesses, and look at new innovations that could build sector resilience.
- Test technological interventions to ensure they support farmers and workers rather than making them more risk and debt prone. Farmers need to reduce costs, build resilience to climate change and enable work to continue even in a lock down.
- Specifically, that means crop level interventions focusing on growing healthy crops rather than expensive seed technologies. Using weeding robots rather than herbicide resistance and robots that work on small farms. Profits and benefits from these technologies need to be shared and not only serve corporate concentration.
- For all the criticism of government interventions and subsidies, mechanisms like India's MSP (Minimum Support Price) do support farmers in a crisis. The industry needs to implement stabilisation mechanisms that reserve money from good years to support farmers in bad years.
- Develop insurance mechanisms that cover all eventualities yet that are affordable to all farmers, both large and small.
- Farmers are most resilient when not dependent on a single crop, especially smallholders. In a crisis like Covid-19, with returning migrants needing support and food shortages in cities, their role is more important than ever. Priority should be given to supporting multi-functional and biodiverse agriculture and food and fibre systems in cotton growing regions.
- Full transparency and traceability in cotton supply networks is essential, so that the behaviours of all parties in terms of respecting contracts, payments and terms can be seen by consumers and supply chain parties, including on sustainability performance and engagement.
- Technical support and training to farmers and workers can be delivered digitally and connections made globally. Such efforts can support improvements although due attention to privacy, data ownership, costs and rights must also be given, especially where poor governance could place people at risk.
- Sustainability is critical and must not be ignored or cut during recovery from this Covid-19 crisis. It is especially critical that scrutiny of social and labour issues remains high on the agenda, as well as climate change and poverty, factors that can aggravate the impact of future disruptions in cotton and the global economy.
- The global nature of the pandemic and its impacts highlight the importance of global solidarity, collaboration and openness. The cotton sector needs to do its part to keep collaboration and exchange and mutual support going.
- Workers and especially migrant workers are some of the most vulnerable people during the virus outbreak, yet they are the furthest removed from much of the help offered by governments and others. Global solidarity means that support mechanisms and safety nets must be developed to support workers in times of crisis and against future disruptions, including from responses to this crisis that may cause more unemployment in future.
- The cotton sector will be hit heavily by the novel coronavirus outbreak. It will need time to recover and to see trust and partnership both repaired – and improved. This requires collaboration and mutual support. The cotton sector can emerge stronger with all these positive reforms detailed here.