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Bamboo processing potential in Ethiopia

Discussion Document

August, 2021

Ethiopia’s value proposition to attract investment in bamboo pulp

1. **Ethiopia has large and underutilized bamboo resources: lowland bamboo mostly concentrated in Benishangul-Gumuz region and highland bamboo in Amhara and Oromia regions**
   - **Ethiopia** has **Africa's largest bamboo resources with ~1.5 million hectares,** however currently it has been only used by small holder farmers in a haphazard manner
   - **64%** of the resources are **lowland bamboo** that combines **characteristics of both hardwood and softwood** and hence could be feedstock for any **good quality pulp-based products like tissue, printing and writing or packaging paper**
   - **60% of the total bamboo grows** in **Benishangul-Gumuz,** a regional state in Western Ethiopia, all of which is lowland bamboo
2. **Asossa zone has particularly good characteristic for a bamboo pulp processing plant**
   - In the region, **Asossa zone has 25% of the bamboo resource with good geographic features, better infrastructure,** and is also **more secure** compared to the neighboring zones of Metekel and Kamashi
   - Bamboo culm prices are also competitive with other bamboo locations such as China
   - However, maximizing the potential of Asossa bamboo forests requires the training of local farmers in **sustainable harvesting practices that could guarantee long term supply and better yields**
3. **The paper market constitutes a large import substitution opportunity and the demand is expected to grow**
   - The total import substitution potential for pulp-based products is 80,000-130,000 t, taking into account currently imported products along the whole value chain
   - Ethiopian tissue and packaging market are also expected to grow significantly; printing paper to remain stable however
4. **The government is committed to attracting investment in the manufacturing sector**
   - Ethiopia has provided a number of incentives for manufacturers
   - Ethiopia has put up regulatory protections for investors
   - Ethiopia is a member of regional and global trade agreements

Ethiopia offers an attractive opportunity for investment into bamboo based pulp and paper production

Large bamboo resources

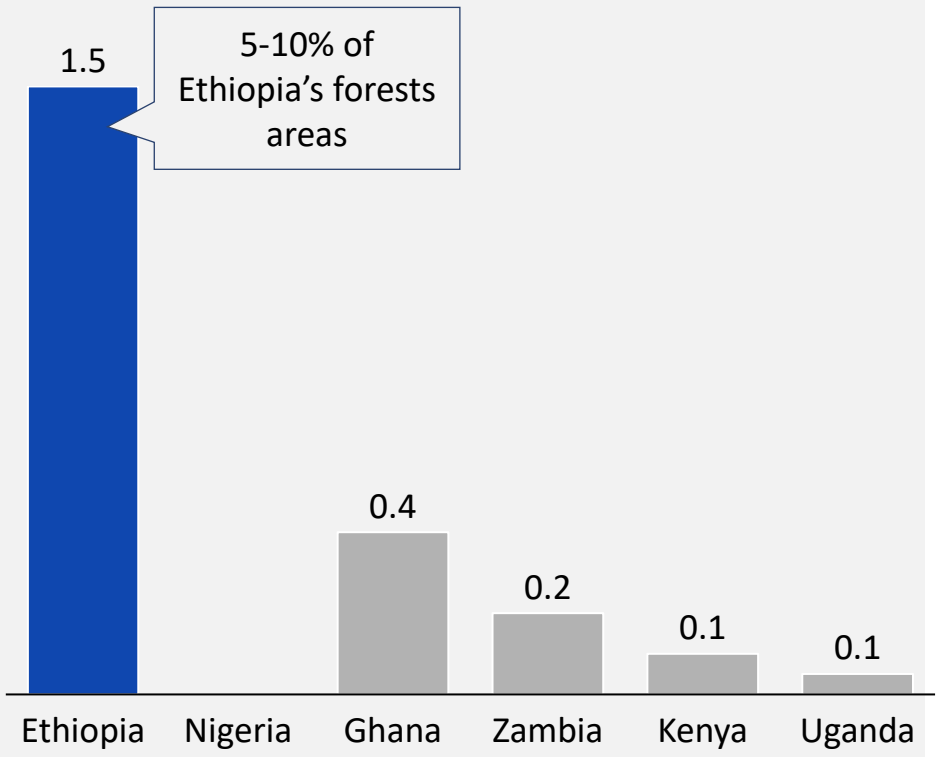
Infrastructure connectivity and local inputs

A growing domestic market for pulp and paper products

Strong government support

Ethiopia has Africa's largest bamboo resources with ~1.5 million hectares but limited investments have been made so far to leverage its potential

Bamboo plantation across African countries[1], Million hectares



However, limited investments have been made so far due to poor infrastructure and lack of knowledge and focus

- **Historically poor infrastructure** in the bamboo regions with significant distance from central Ethiopia and Djibouti seaport
- **Lack of knowledge** on species characteristics by both **authorities** and **manufacturers**; **preference** so far has been limited **to highland bamboo** products (e.g., furniture, lampshades, stick-based products (curtains, table mats) used by **local craftsmen as opposed to lowland bamboo**
- **No prioritization/incentives** by **Ethiopian authorities** to leverage potential of bamboo

Case example on utilizing the bamboo resource

China conducted a national effort to develop the bamboo sector through a combination of applied research, policy reform and business promotion

1. INBAR 2018 Report, United Nations

64% of the Ethiopian resources are lowland bamboo that grows mainly in Benishangul-Gumuz (BNG) region

Ethiopia grows 2 bamboo species…

Lowland bamboo

Scientific species: ***Oxytenanthera abyssinica***

Share of total **bamboo** forests area: **64%**

Thrives even in difficult conditions, such as poor and shallow soils, and low rainfall

Similar characteristics to wood hence considered by experts as one of the best raw material for paper production

Geographies: mainly in Benishangul-Gumuz, but also in Oromia, Amhara, Gambela and SNNPR

Highland bamboo

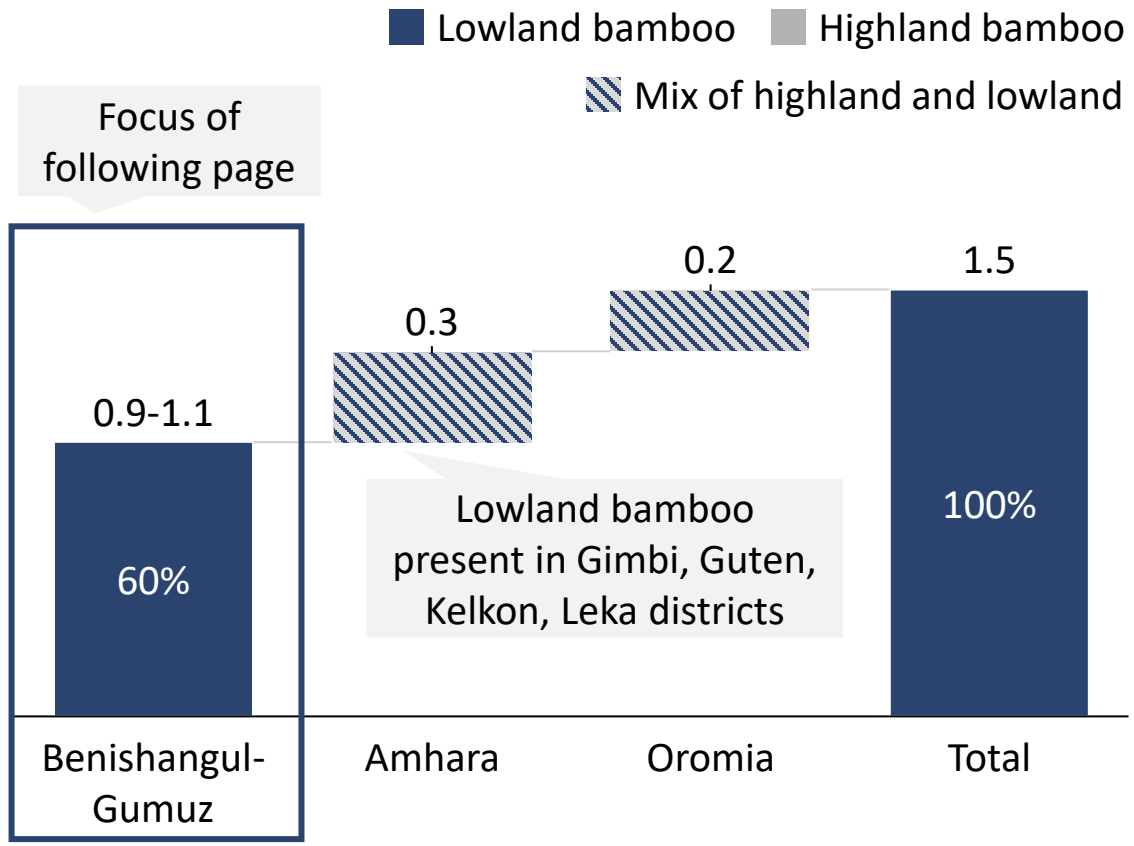
Scientific species: ***Yushania alpina***

Share of total **bamboo** forest area: **36%**

Mainly used for **hand crafted household furniture** and high end applications as **timber substitute** and stick based products (e.g. curtains, mats etc.)

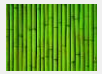
…with bamboo plantations located in 5 regions

Million hectares



Source: INBAR 2018

Lowland bamboo presents an unused opportunity with similar characteristics as wood, well suitable for the pulp industry

	Birch	Aspen	Euca (Chile)	Spruce (softwood)	Lowland bambGoo
	Silver Birch Betula pendula	Quaking Aspen Populus tremuloides	Blue gum E. globulus	Norway Spruce Picea albeas	Oxytenanthera abyssinica
					
Main uses	Cartonboard	Tissue, woodfree	Tissue, woodfree, cartonboard	Packaging, mechanical papers	Packaging, tissue, any printing and writing papers
Advantages	Stronger than euca pulp (Nordic players call it their "EucaStrong")	Bulkier and drains faster than Euca	Smooth paper and soft tissue due to short fibers	Strong paper/paperboard due to long fibre	Fast growth, high productivity, quick maturity
Chemical/fiber properties					
Bone dry density kg/m³	500	500	520	385	310-400
Fiber length mm	0.5-1.2	0.6-1.3	0.4-1.1	2-4	1,8 -3
Wood/Bamboo composition[1]					
Cellulose	40	44	50	42	52
Hemi-cellulose	24	27	18	28	17
Lignin	24	23	24	28	23
Pulp properties					
Strength					
Bulk					
Smoothness					

Key takeaways

Lowland bamboo could be **used for most applications** thanks to its similar composition to wood and the many **advantages** it offers (e.g., **eco-friendly, high yields**)

With its characteristics of (i) **high content cellulose** fiber, (ii) **thin and solid fiber**, and (iii) **fiber length** lying between hardwood and softwood, experts consider **bamboo as the best raw material for paper pulp manufacturing together with wood**

1. No significant difference between species, and wide range within species

Source: The Wood Database; WRI; USDA; Pulp producers; Research papers (e.g. Chemical Composition of Lowland Bamboo Grown Asossa Town); industry expert interviews

Ethiopia offers an attractive opportunity for investment into bamboo based pulp and paper production

Large bamboo resources

Infrastructure connectivity and local inputs

A growing domestic market for pulp and paper products

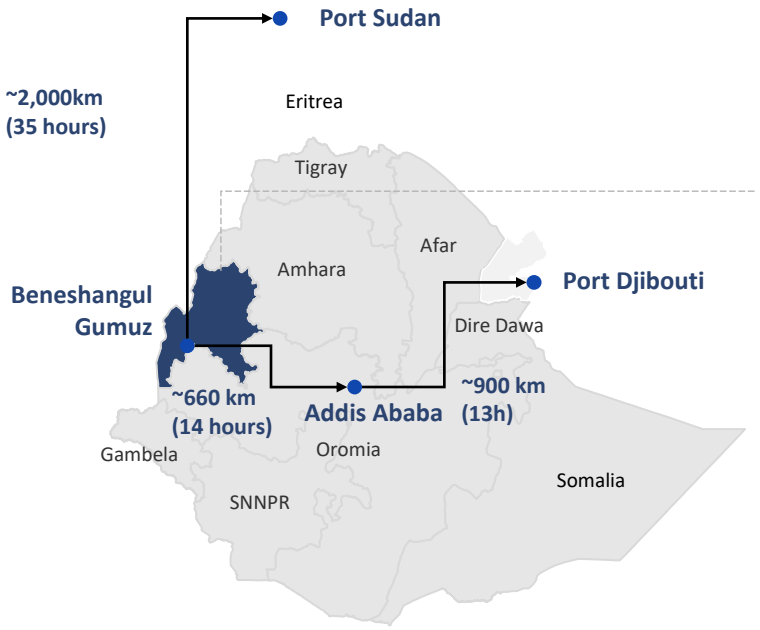
Strong government support

Within Benishangul-Gumuz region, Asossa zone has best logistics and good bamboo quality

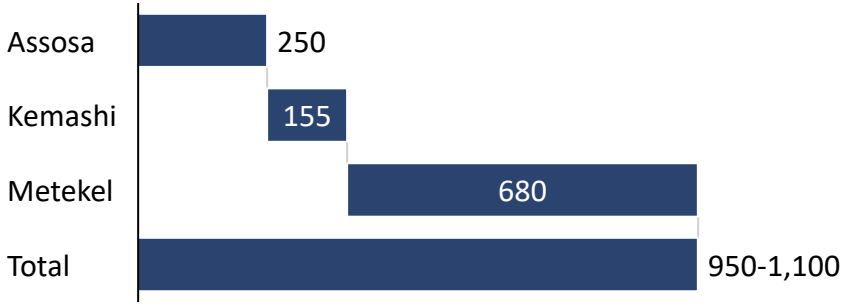
Bamboo resources | Woreda boundaries

Towns | EGRD | Road | River | 132 kV transmission line between Asossa and Mendi

Bamboo resources and logistics routes to and from Benishangul-Gumuz & its specific zones



Breakdown of bamboo forests within Benishangul-Gumuz region, *Thousand hectares*



Key takeaways

- While Metekel contains the largest bamboo forests, **Asossa Zone seems like a better area for bamboo harvesting** as:
- It contains a **quarter of the bamboo** in the region with **better quality**
- Has **good infrastructure,** relatively flat land with red soil that becomes durable and dense for dirt roads even, hence better logistics access to potential manufacturing plant (that also can have ample water supply)
- Stable area regarding security compared to Metekel and Kemashi[1]

1. The majority of clashes happened on the other side of the river in the region and that area is physically disconnected. While there was a plan to build a bridge, right now the only feasible travel option is to go through Oromia.

Source: INBAR 2018

Prices for culms are competitive

xx Price of lowland bamboo compared to benchmarks

30-50 km from forest to local market or to plant

Bamboo forest	Harvesting, chipping and loading	Truck Transportation	Bamboo processing plant
Bamboo forest located in Benishangul-Gumuz, near Asossa	Local farmers harvest & **sell bamboo culms at farm spot price with an average of 5 ETB (USD ~0.12)** per culm (~5.42kg) including loading onto transportation trucks	Bamboo culms are transported by **trucks at a price of 1,500 ETB (USD ~35)** for **2,000 culms** for a distance of 30 KM and with a royalty fee of ETB 1.25 per culm	Bamboo processing plant located nearby Asossa

Benchmark culms are more expensive, potentially due to higher demand

Ethiopian Highland Bamboo: USD 0.7 – 0.9 per culm
Nepal Bamboo: USD 0.7 – 0.9 per culm
Indian Bamboo: USD ~1.5 per culm
China: USD ~1.1 per culm[1]

8-20%

1 culm = 5.42kg

ETB 1 = USD 0.023 (May 2021)

1. Initial quotes were per tons, not per culms because in China prices per culm are less common as there are many differences in size (diameter), height and length, 1 ton is assumed to have 200 culms
2. While bamboo culm prices are likely to increase as the industry matures, impact on current users is estimated to be limited as they mostly use highland bamboo. However, any potential negative economic impact on lowland bamboo users is expected to be smaller than the benefits to the harvesting communities (ie. even current ad hoc users could find stable jobs).

Comments

Manufacturing plant could be located between 30-50 km from Asossa

Total cost for a culm (~5.42kg) to **reach the plant** is **USD ~0.15**:

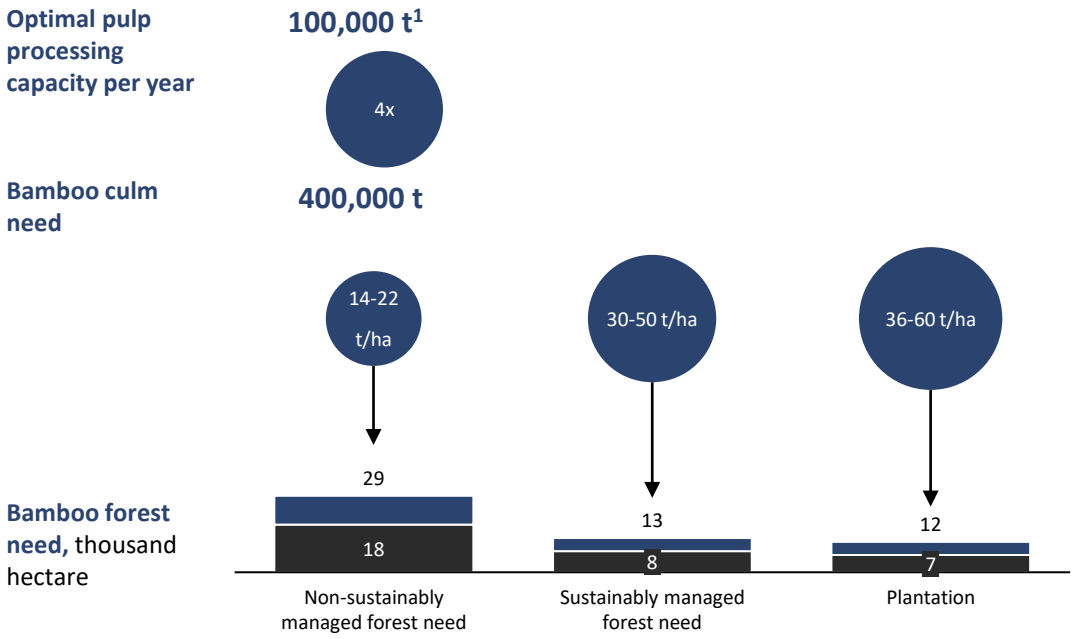
- USD **0.12** for the **culm**
- USD **~0.02** for **transport**

Labor costs at plantation site estimated at **ETB 80-120 per day,** while **processing plant worker** at entry level estimated at **ETB 2,500-3,500 monthly**

Total transportation cost of 1 t of bamboo culms from forest to **Asossa is USD 3–4, including loading/offloading**

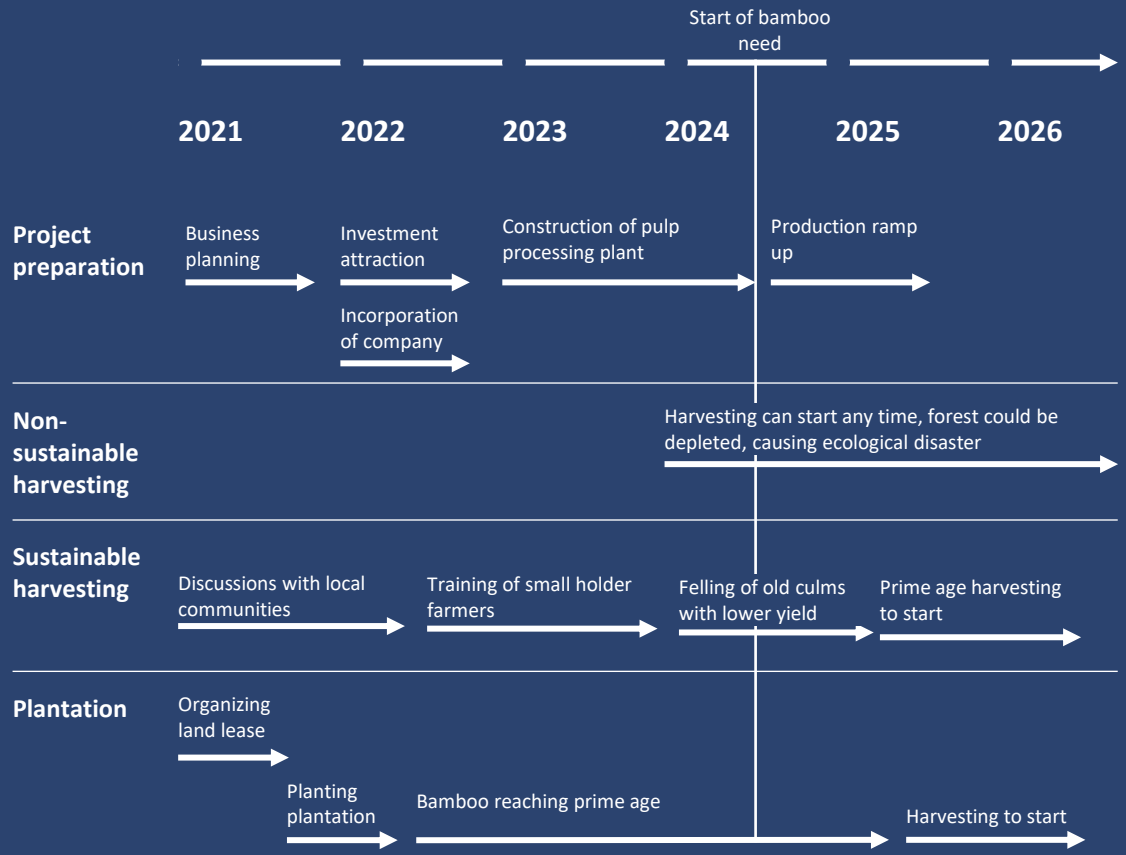
As of **today**, **little volumes** are harvested **in BNG** (e.g., only **personal consumption** like furnitures); a **new plant** would **increase demand**, hence likely **prices**[2]

Sustainable sourcing practices or plantations can guarantee long term supply



The mix of sustainable harvesting done by farmers or the potential investor depends on the risk appetite and business plan of the investor

1. Smallest capacity in China is 50,000 t, optimal is above 200,000 t; 100,000 t considered for first phase of plant in Ethiopia



Several chemicals required for pulp processing are available in Ethiopia

Available in Ethiopia

Chemicals to trans-form culm into pulp	Used in	Local producers	2018-21 Spot price ranges observed	Ethiopia Tariffs	Main exporters	Other exporters
Sodium hydroxide Caustic soda (NaOH)	Kraft Pulping (KP)	Caustic Soda Share Company	290 – 380 USD/t, FOB	10%	China	NA
Sulphuric acid (H_2SO_4)	KP (bleaching)	Awash Melkasa aluminum sulphate and sulphuric acid S.C	15 – 80 USD/t, FOB	10%	China	Japan, Korea, Canada
Sodium carbonate (Na_2CO_3)	KP (cooking)	Bearing lakes Abijata, Shalla and Chitu in central Main Ethiopian Rift Valley with minable reserves	*Quotation not received*	10%		
Chlorate (ClO_3)	KP (bleaching)	NA	520 – 630 USD/t	5%	Western Europe	North America, Asia
Sodium sulfite (Na_2SO_4)	KP (cooking)	NA	300 – 340 USD/T	10%	China	Italy, Thailand, India, Turkey
Sodium sulfide (Na_2S)	KP (cooking)	NA	350 – 500 USD/T	10%	China	US, Belgium, France
Sodium thiosulfate (Na_2S2O_3)	KP (bleaching)	NA	300 – 320 USD/T	10%	China	US, Belgium, France
Hydrogen peroxide (H_2O_2)	KP (bleaching)	Awash Melkasa aluminum sulphate and sulphuric acid S.C	350 – 400 USD/t, **CFR SEA**	10%	Southeast Asia	Netherland, Belgium

Comments

Treatment of effluent water has to be planned carefully to avoid environmental damage

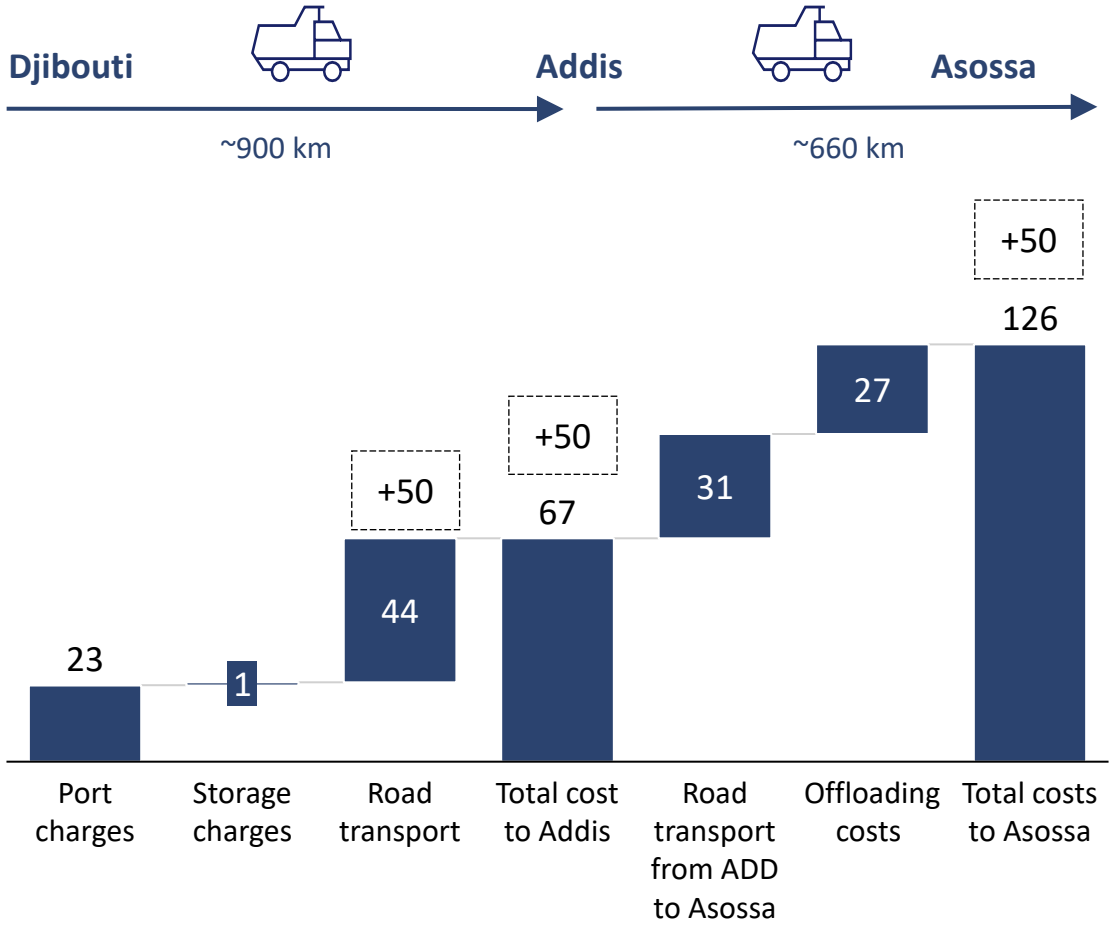
Caustic Soda is available in Ethiopia but reported to be of poor quality, mainly serving the recycling paper manufacturers

Capacity of local manufacturers have to be further explored

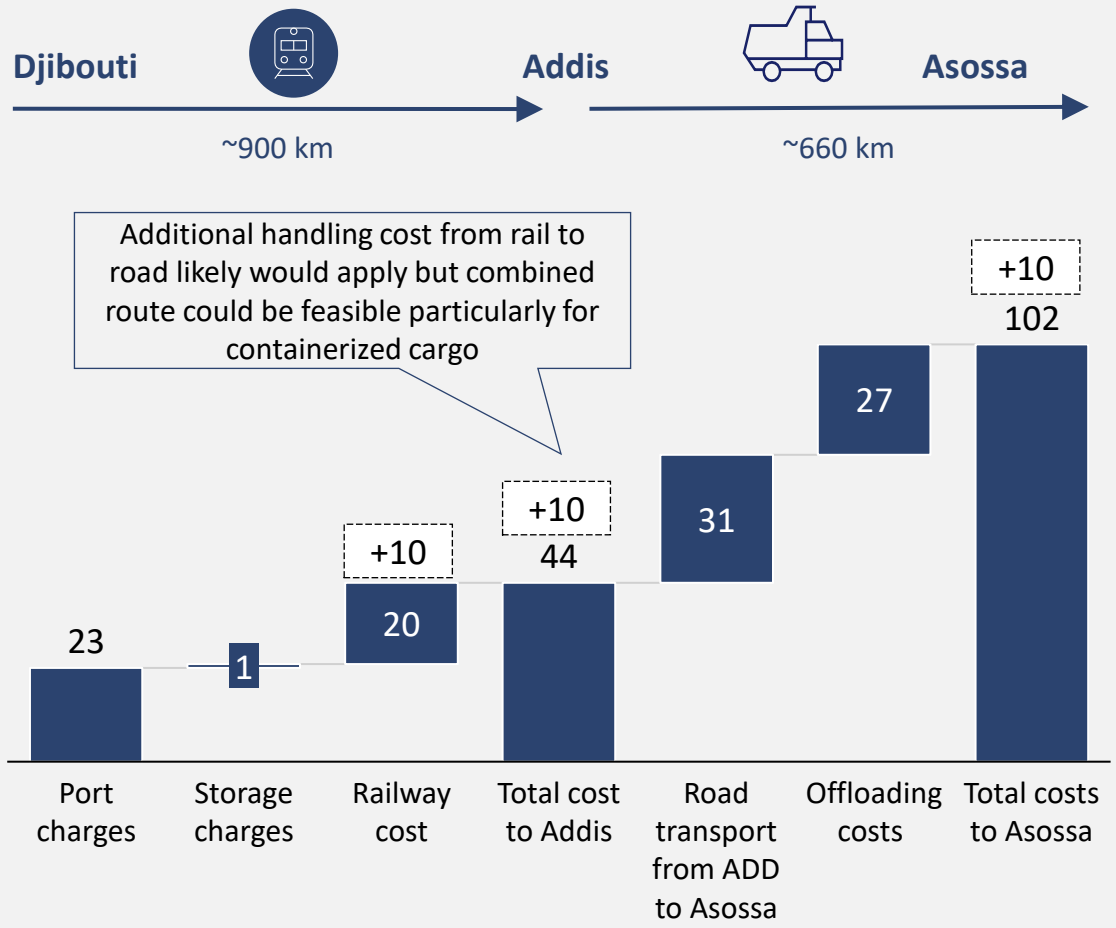
Source: IHMS, CCIIDI

Other chemicals could be imported from Djibouti, using rail to Addis

Option 1: Breakdown of transportation prices from Djibouti to Addis then from Addis to Asossa in trucks, *USD/t*



Option 2: Breakdown of prices using railway[1] between Djibouti and Addis then trucks to Asossa, *USD/t*



1. Assumes that a full wagon of 38 tons (max. capacity per wagon) is used

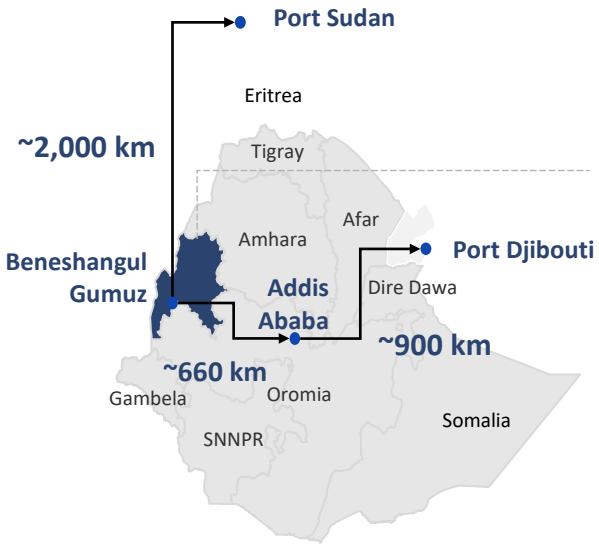
Source: Expert interviews, quotes from logistics companies

Djibouti is the closest port, Port Sudan is a possible alternative

Logistics costs are indicative and should be validated by EIC

✓ Can be paid in ETB ✓ Partially can be paid in ETB ✗ Cannot be paid in ETB ● Details to follow

Ethiopia Map



	Transportation steps		Options	Cost, *USD/T*	Time	ETB payment
A	Bamboo culms transportation **from Asossa forests to plants**		Trucks	**3-4**	1-2h	✓
B	Raw material (e.g., chemicals) **imports from Port Djibouti to Asossa**		Trucks	**130-180**[1]	2-3 day	✓
		Or	Railway then trucks	**130-180**	2-3 day	✓
C	Local Distribution from **Asossa to Addis**		Trucks	**50-70**	14h	✓
D	Option 1: Exports of end products **from Asossa to Port Djibouti**		Trucks	**100-150**	2-3 day	✓
		Or	Railway then trucks	**100-150**	2-3 day	✓
Dbis	Option 2: Exports **from Asossa to Port Sudan**		Trucks	**150 - 200**	2-3 days	✗

Comments

In the medium term, **transportation cost might go down** as the market is increasingly liberalized, additional **rolling stock on the rail** would ease the current capacity constraints

As Ethiopia is **importing ~8x more than exporting**, much of the outward route goes empty that **reduces the export route price by ~25%** compared to imports

Exporting is **25-30% cheaper through Port Djibouti** than through Port Sudan

1. Assumes that a full wagon of 38 tons (max. capacity per wagon) is used

Source: Expert interviews

Ethiopia offers an attractive opportunity for investment into bamboo based pulp and paper production

Large bamboo resources

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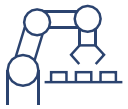
A growing domestic market for pulp and paper products

Strong government support

Depending on the production process bamboo pulp could have various end uses

Production process		Description	End uses
Mechanical 	**Stone grounding**	Wood particles ground into relatively short fibers	Coated/ uncoated mechanical printing and writing papers, newsprint and some packages
	Thermo-mechanical pulping	Wood particles softened by steam before grinding	Coated/ uncoated mechanical printing and writing papers, newsprint and packages
Semi-chemical 	**Semi-chemical pulping**	Wood particles treated chemically and softened by steam before grinding	Tissue Woodfree coated and uncoated printing and writing papers
Chemical 	**Sulphite pulping**	Wood chips cooked in a pressure vessel in the presence of bisulphite liquor	Woodfree coated and uncoated printing and writing papers, tissue and all kind of packages
	Sulphate pulping (Kraft Pulping)	Wood chips cooked in a pressure vessel in the presence of sodium hydroxide liquor	Woodfree coated and uncoated printing and writing papers, tissue and all kind of packages

Pulp-based end product market splits between 3 main segments: packaging material, tissue and printing and writing paper

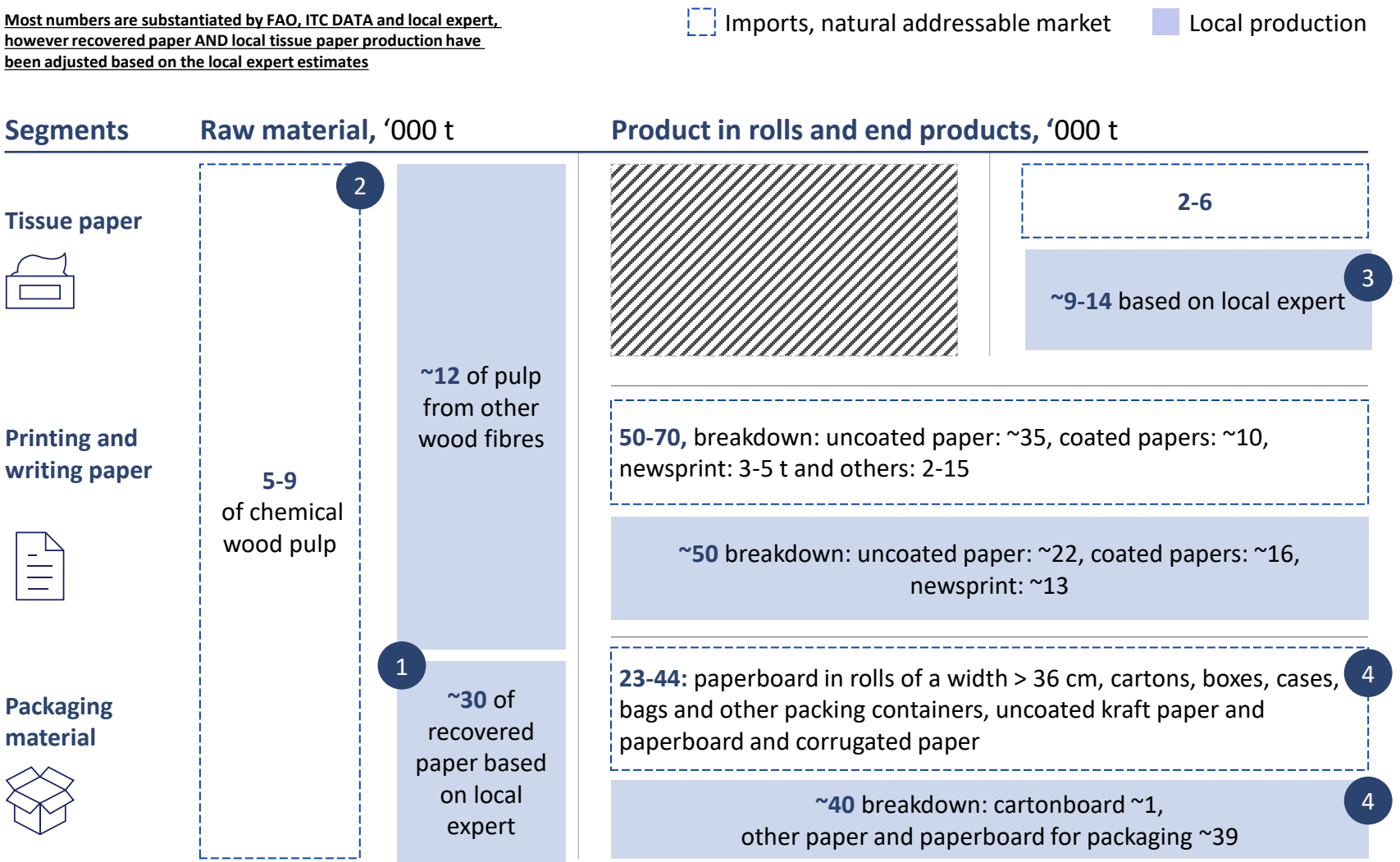
Players able to process pulp in Ethiopia

Segments	Grades		End use applications	Current players
Packaging material (consumer and industrial)	Containerboard/corrugated paper		B2B Packaging	Yekatit paper converting PLC Ghion packaging products manufacturing
	Cartonboard		Food and consumer packaging	
	Uncoated kraft paper		Consumer bags	
Tissue paper	Tissue		Toiler paper, towels, napkins	Yekatit paper converting Ethiopia paper and pulp share company
Printing and writing paper	Coated/uncoated mechanical paper		Magazines, catalogues (coated)	Wonji paper manufacturing Barguba PLC
	Coated/uncoated woodfree		Office paper, books	
	Newsprint		Newspapers	
	Wrapping paper		Gifts	
	Other paper and paper board		Envelopes, notebooks	

A new entrant focusing on substituting imports along the value chain could address a market of 80,000-130,000 t

Most numbers are substantiated by FAO, ITC DATA and local expert, however recovered paper AND local tissue paper production have been adjusted based on the local expert estimates

Imports, natural addressable market Local production



Comments

1. Total volume of raw material at FAO (2,000 t) seems low compared to total local production of tissue, paper and packaging material, however local expert indicated ~30,000 t of recovered paper
2. A new player could partner with the 2 local players processing pulp in Ethiopia to sell up to 9,000 t of Bamboo chemical (kraft) pulp, replacing imported chemical pulp
3. FAO number of 15,000 t seems a bit high compared to information shared by local expert whose estimations of locally produced tissue is ~9-14,000 t
4. According to a local paper recycling manufacturer, total market of packaging (incl. imports and local pro-duction) would amount to 60,000 t

Source: FAO and ITC data used as low and high end of range for imports, FAO used for local production

Ethiopian tissue and packaging market are also expected to grow significantly; printing paper to remain stable however

Macroeconomic indicators (2018)	**GDP: USD ~80 bn,** *+8% p.a. in 2015-18*	**GDP per Capita: ~750 USD**	**Population: ~112 Mn,** *+2.5% p.a. in 2015-18*	**Urbanization rate: ~21%** *+4.8% p.a. in 2015-18*
Outlook 2018-30	**GDP: USD 175 bn,** *+4.5% p.a.*	**GDP per Capita: ~1,250 USD**	**Population: ~145 Mn,** *+2.2% p.a.*	**Urbanization rate: ~27%** *+4.4% p.a.*

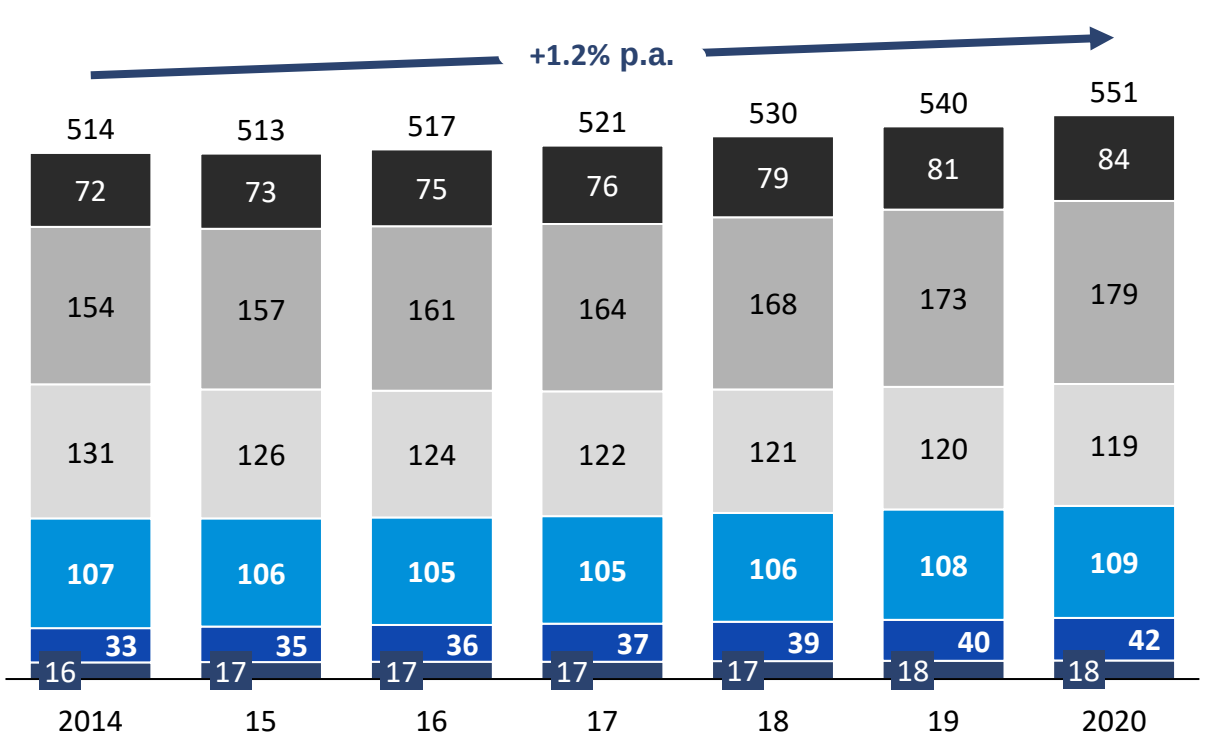
Segments	Global trend *2014-20 % p.a.*	Ethiopian growth *2014-18, % p.a., ITC imports*	Growth drivers	Expected trend
Packaging material	↑ **+2.5% p.a.**	↑ **+5%**	Global demand driven by growing e-commerce trend Growth in Ethiopia to be mostly driven by food/drinks consumptions with growing population Urbanization to keep growing at a high pace by 2030	↑
Tissue paper	↑ **+3.7% p.a.**	↓ **-3%**	91% of global consumption growth to be generated by people in cities from 2015-2030[1] Low consumption per capita compared to other countries at similar development level that indicates room for growth: • **China: ~1.4 kg/person** in 1997 for a GDP/capita of USD ~780 and **~2.2 kg/person** in 2003 with GDP/per capita of USD ~1,288 • **Philippines: ~0.40 kg/person** in 1991 with GDP/capita of USD ~715, and **~0.44 kg/person** in 2005 with GDP/capita of USD of USD ~1,244 • **Ethiopia: ~0.2 kg/person, expected growth between 1-5%**	↑
Printing and writing paper	↓ **-1.6% p.a.**	↑ **+4%**	Global demand for graphic paper declining as digital media grows; Ethiopia to experience similar trend at some point in the medium/ long-term In the short-term, growing population, urbanization and industrialization to drive growth similarly to the past 5 years	→

1. According to a study by McKinsey Consumer Packaged Goods Practice

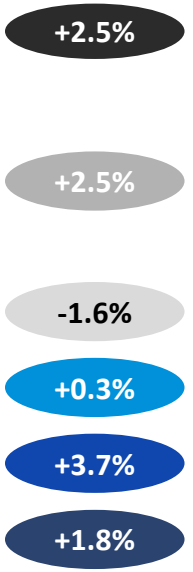
Source: HIS Markit for all macroeconomic indicators, RISI, the World Bank, IMF, ITC

Global paper production volume grew with a CAGR of +1.2% between 2014 and 2020

Paper production volume by segment, Million tons



CAGR



Growth in comparison

- Global GDP[1]: +2.1% p.a.
- Population: +1.1% p.a.
- Urban population: +2% p.a.

1. Current prices

Source: RISI; the World Bank, IMF

Key takeaway

- **Packaging paper grew** both on the consumer and industrial parts that COVID-19 only helped with the **growth in e-commerce**
- **Tissue paper tends to grow with the urbanization** rate but even outgrew it with the **highest growth rate of 3.7%** among the paper segments
- **Printing and writing paper** however **declined by 1.6%** due to the **expansion of digital media**

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A growing domestic market for pulp and paper products

Strong government support

The government is committed to attracting investment in the manufacturing sector

Participant in regional and global trade agreements

There have been several developments that have creating a enabling trade and regulatory environment to support manufacturers:

- **Ratification of the Africa Free Trade Agreement** which aims to remove tariffs from 90% of goods will boost intra-African trade, which aims to make Africa a single market of cumulative GDP of US$ 3.4Tn
- Ethiopia is part of the **Common Market for Eastern and Southern Africa (COMESA)**
- Ethiopia is eligible for **preferential access to the U.S. market** under the African Growth and Opportunity Act (**AGOA)**
- Everything but arms free trade agreement with the **European Union**

Competitive incentives

The country has provided a number of incentives such as:

- **Exemption of payment of customs duties and other taxes** levied on imports to all capital goods
- **Exemption of Business income tax** (4 years for glass, metal and paper packaging, 2 years for Plastic packaging)
- **Loss carry forward** for up to five years

Regulatory protections

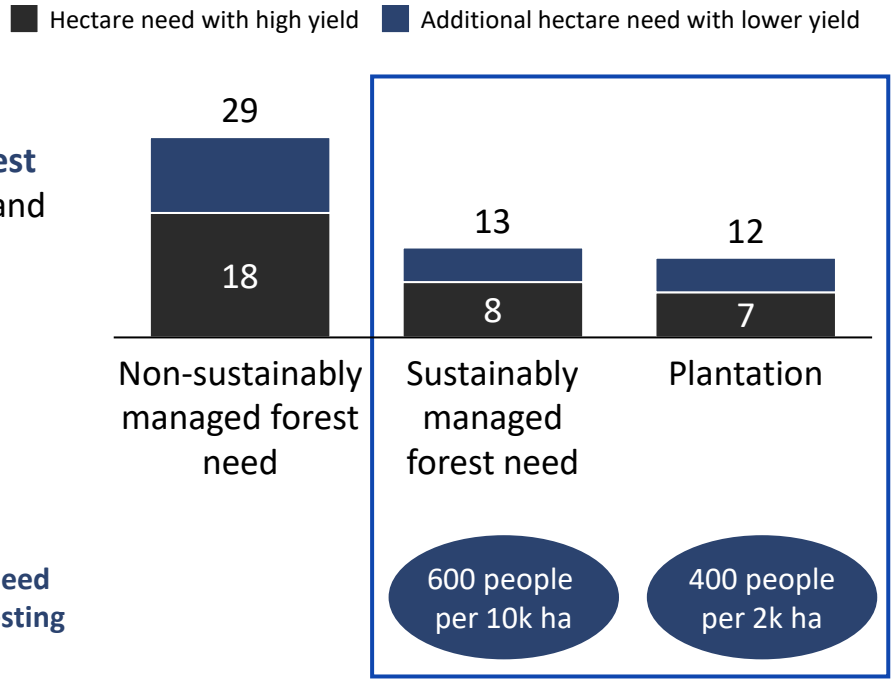
Regulatory schemes have been put in place to protect foreign investors

- **Constitutional guarantee** against expropriation or nationalization
- **Signatory of multilateral investment guarantee agency** & has concluded bilateral investment promotion & protection treaties with 30 countries
- **Right to employ** expatriate managers and experts
- **Double taxation avoidance** treaties with 18 countries

Source: EIC, press research

Backup

A pulp processing plant could create >1,000 full time jobs in bamboo forest management…

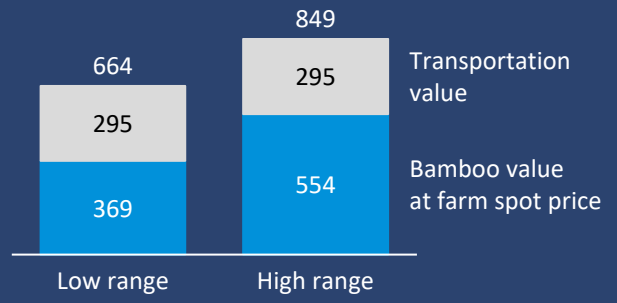


Employment need to supply the processing plant
(assuming 11k ha forest and 2k plantation)

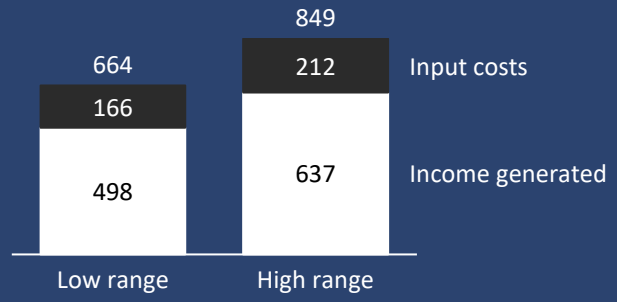
>1,000 people for sustainable forest and plantation management

… and livelihoods for 14-22k workers in the overall bamboo value chain and induced economic activity

Value generated, Mn ETB
(based on a plant with a 100k t pulp processing capacity, requiring 400k t bamboo culms, with current bamboo culm prices for low range and 50% increase in prices for high range)



Use of value generated, Mn ETB
(25% of value is assumed to be used for inputs like equipment and machinery, 75% assumed to go into income and livelihoods)



Number of people sustained from generated income, thousand

(ETB 2,400-2,880 assumed as monthly income need)