Bamboo processing potential in Ethiopia

Discussion Document

June, 2021

This programmed is funded by UK aid from the UK Government; however, the views expressed do not necessarily reflect the UK government's official policies

Executive summary (1/2)

1 Ethiopia's bamboo resources with a focus on lowland bamboo

Ethiopia has large and underutilized bamboo resources, especially in lowland bamboo that is mostly concentrated in one region, Beninshangul-Gumuz

- **Ethiopia** has **Africa's largest bamboo resources with ~1.5 million hectares,** however currently it has been used by small holder farmers in a haphazard manner and only limited investments have been made to leverage the potential
- **64%** of the resources are **lowland bamboo** that has **similar characteristics to 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
- In the region, **Asossa zone has 25% of the bamboo resource, has good geographic features and better infrastructure,** while it is also **more secure** compared to the neighboring zones of Metekel and Kamashi that makes it an **ideal location for a bamboo pulp processing plant**

2 Best practices and challenges for harvesting lowland bamboo in Benishangul-Gumuz

To fully utilize the bamboo resources both for communities and pulp production, sustainable management of bamboo forests need to be introduced through small holder farmer training

- Maximizing the potential of Asossa bamboo forests requires the **training of local farmers in sustainable harvesting practices while a rehabilitation program of the forests** also needs to be initiated to clean the forests from the old culms
- **Programs** led by international institutions like **INBAR promote sustainable bamboo harvesting** and **increase farmers' income**: **Ghana and China** are good examples of what could be **replicated**
- **Sustainable harvesting** by local farmers would not only ensure long term availability of bamboo forests but could also **lead to improved yields**
- Growing **new** bamboo **plantations** are also required for **experimentation, breeding and higher efficiency of bamboo harvesting**, while it would also benefit the **local communities** through **new jobs and know-how**

Executive summary (2/2)

3 Transportation costs of main logistics routes and costs of raw materials

Ethiopia as a landlocked country faces relatively high transportation costs as well as raw material costs due to import tariffs, however, the bamboo culm price is lower, while a reduction of transportation costs is also expected as the transportation market is getting liberalized

- **Transportation is 25-30% cheaper through Port Djibouti** than through Port Sudan and the **export route is ~25% cheaper than import** due to volume imbalances
- **Transportation** between the forest and the **potential pulp processing plant is USD ~35 for 11 tons,** with the **lowland** bamboo culm costs **only 15-20% of Ethiopian highland** bamboo and **8-10% of bamboo in China or India**
- **Most chemicals would need to be imported with 5-10% import tariff,** while some chemicals are produced locally but exact capacity requires further investigation

4 Sizing of the Ethiopian addressable market for pulp-based and paper products

A new entrant's natural addressable market in the pulp-based and paper product market is imports that amount to 80-130,000 MT per year splitting between 4 main segments: raw pulp, tissue paper, printing and writing paper and packaging material

- **The global paper market** has been slowly **growing by 1.2% p. a.** between 2015-2020, with **packaging and tissue** reaching **2.5% and 3.7% growth** respectively**,** while **printing and writing paper has declined** by 1.6% p. a.
- **Ethiopia** expects **growth in packaging driven by GDP growth,** as well as **growth in tissue paper** driven by increase in **income and urban population,** while **printing and writing paper** is expected to **stagnate**
- The **total pulp-based product and paper market** is estimated to have amounted to **220-280,000 MT in 2018**
- **A new entrant** could directly **address 5-9,000 MT imported chemical pulp,** while with built up paper processing capacity, **imports of 2-6,000 MT tissue, 50-70,000 MT printing and writing paper and 23-44,000 packaging** material could be targeted

Context, objectives and scope of the document

Context

- **Manufacturing Africa (MA)** is a **program backed by the UK** government, seeking to **promote industrialization** in **East and West Africa** by attracting £1 billion in foreign direct investment and create 90,000 jobs by 2026
- MA is assessing the potential of building **a pulp-based/paper manufacturing** plant in Western Ethiopia, **leveraging Ethiopian major lowland bamboo**[1] **resources**

Objectives and scope of this report

1. Disseminate **information** on the **Ethiopian bamboo resources**, and highlight the **characteristics of lowland bamboo** to manufacture **pulp-based/paper** products
2. Highlight **key challenges along the bamboo processing value chain** – from harvesting bamboo culms to manufacturing raw pulp and end products – and present **existing mitigating measures**
3. **Share initial costing data of raw materials and transportation** to use in **future investments** when working on the detailed **financial business case of a bamboo plantation/manufacturing project**
4. Briefly highlight the **global trends** in the **paper industry** and **estimate** the **Ethiopian local addressable market for pulp-based products and paper**

1. Analyses does not include highland bamboo

This report is structured around 4 sections following the bamboo processing value chain

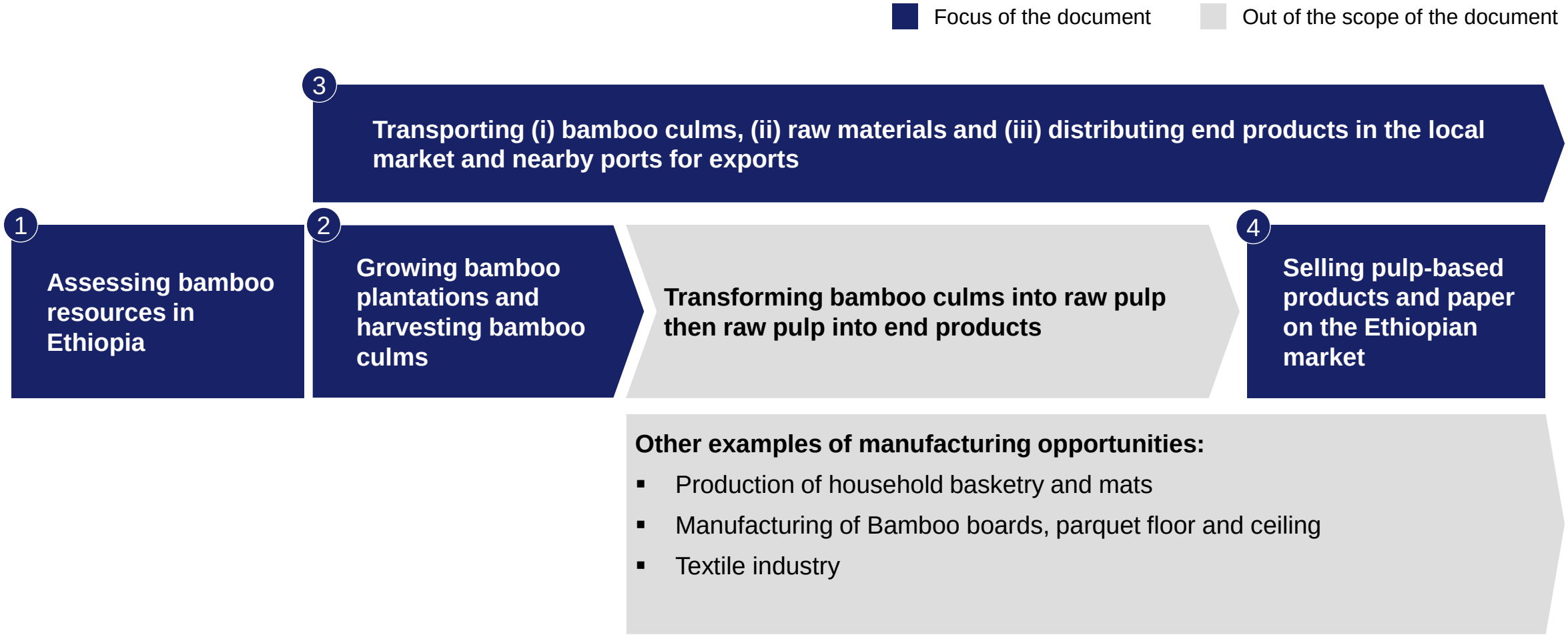
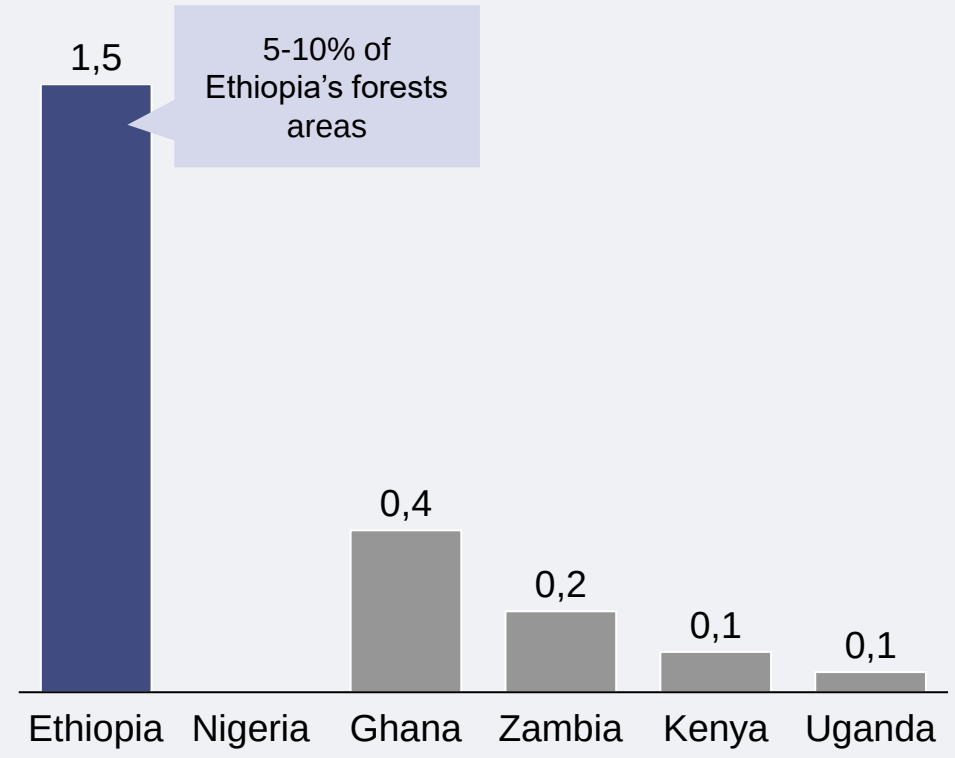


Table of content

1. 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

1. 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

Particularly suitable for **pulp-based** (e.g. paper and fiber), **processed wood** (e.g. tiles, biocomposites) and biomass e.g. **pellets charcoal**)

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

Highland bamboo

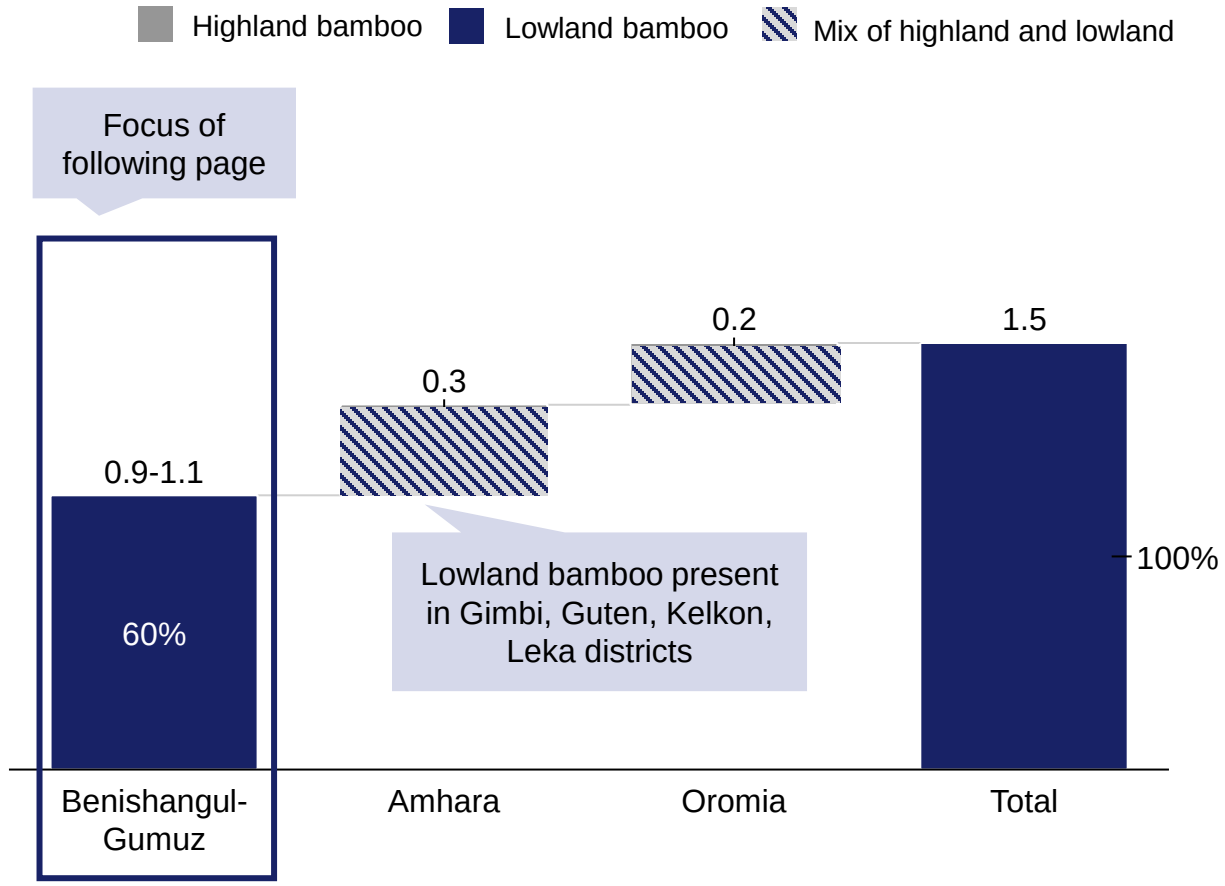
Scientific species: ***Yushania alpina***

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

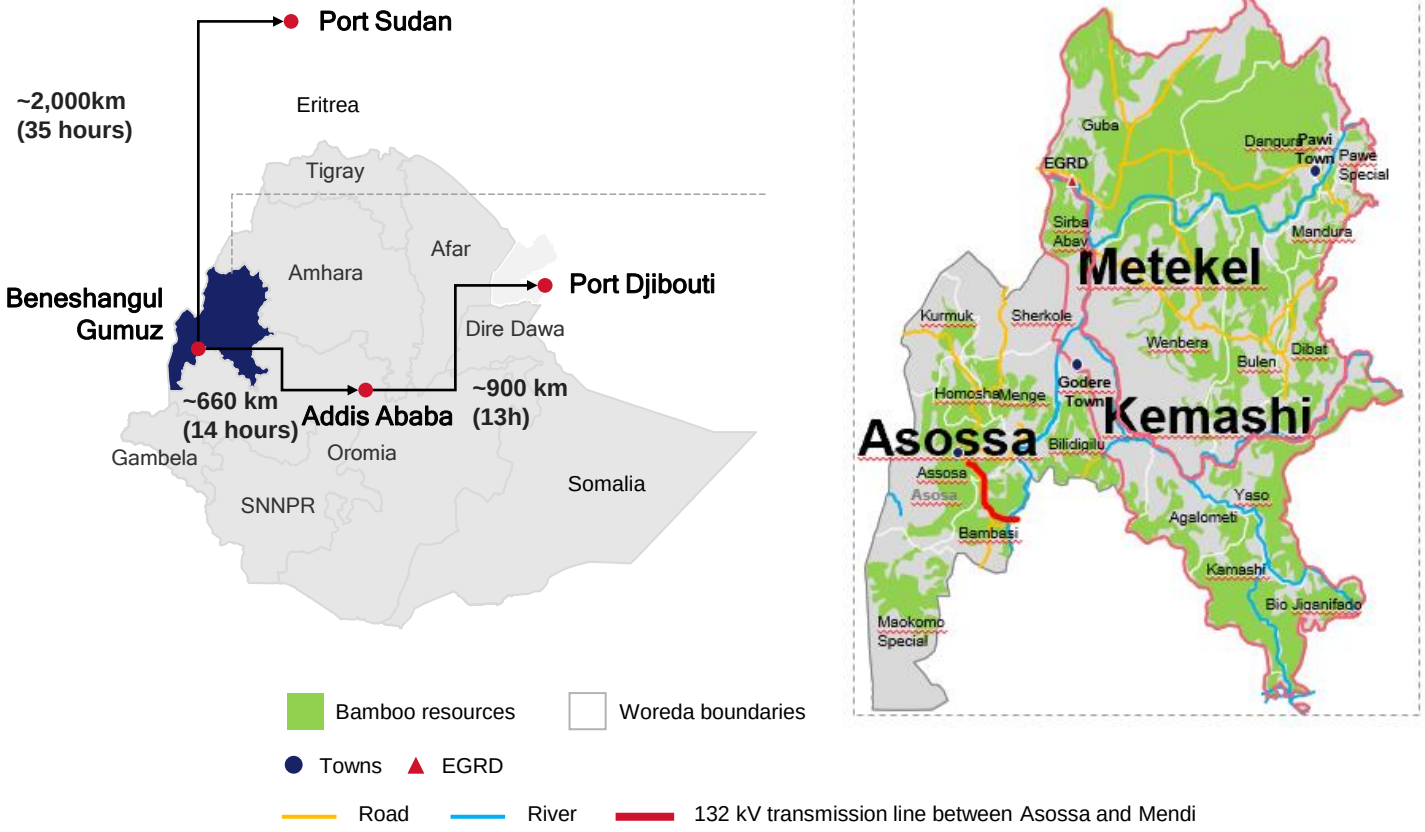
Million hectares



Source: INBAR 2018

1. In BNG, Metekel concentrates the largest bamboo resources, however, Asossa Zone could be prioritized for logistics and bamboo quality reasons

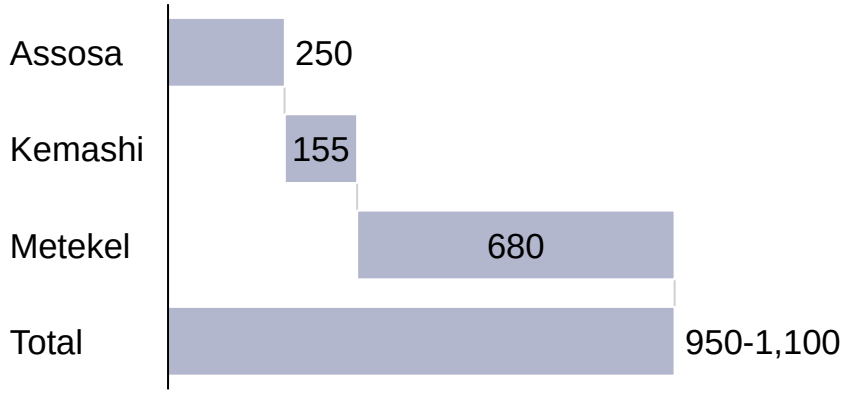
Bamboo resources and logistics routes to and from Benishangul-Gumuz and its specific zones



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

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

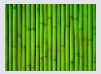


Key takeaways

While Metekel contains the largest bamboo forests, **Asossa Zone seems like a better area for bamboo harvesting** as:

1. It contains a **quarter of the bamboo** in the region with **better quality**
2. 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)
3. Stable area regarding security compared to Metekel and Kemashi[1]

1. Lowland bamboo presents an unused opportunity with similar characteristics as wood and even offers several advantages, especially for the pulp industry

	Birch	Aspen	Euca (Chile)	Spruce (softwood)	Lowland bamboo
	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	Vigorous regeneration, 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					

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

Key takeaways

Lowland bamboo could be **used for most applications** thanks to its similar composition to wood and the many **advantage**s 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**

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

1. With sustainable bamboo foresting, bamboo has versatile use cases: pulp-based products

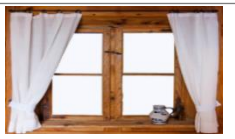
NOR EXHAUSTIVE

	Categories	Demand drivers	Potential products	Images
Paper	Graphic paper	• Demand in graphic paper is declining, overall at -1% to -5% • Newsprint and magazines demand declining, while desktop printing and copying growing in most markets	• Newsprint • Mechanical papers • Wood-free	
	Packaging paper	• Demand growing at ~1-3% p.a. • Majority of growth is driven by e-commerce packaging • Traditional retail and industrial production growing and command significant proportion of market	• Carton board • Containerboard • Kraft and specialty	
	Tissue	• Demand is growing at ~4% globally with rapid adoption in emerging markets • Consumer market driving demand	• Toilet paper • Tissue paper • Napkins	
Fibers	Textiles	• Demand growing at over 3% p.a. • Consumer spending driving demand • High strategic potential for Ethiopia's textile/apparel industry to source fibers locally and sustainably	• Apparel • Rayon	
	Specialty fibers	• Niche market with high market growth • Increasing demand of light-weight and high-strength composite materials	• Baskets • Household artifacts • Toothbrush bristles and handles	

Source: Press search

1. With sustainable bamboo foresting, bamboo has versatile use cases: processed bamboo wood

NOR EXHAUSTIVE

	Categories	Demand drivers	Potential products	Images
Lumber-based products	Biocomposites	• Particularly suitable for low-land bamboo with varying quality and use cases • High international demand, to versatile applicability and sustainability (e.g., bio-degradable)	• Construction • Packaging • Flooring	
	Flooring	• Rapid growth in flooring market at ~30% per annum • Bamboo products preferred for durability, aesthetic design, and ease of maintenance	• Tiles • Laminate wooden floors • Veneer	
	Building material	• Rapid growth in use of bamboo products for construction globally at 30% p.a. • Bamboo's high compressive strength and low weight make it a strong building material as support for concrete	• Scaffolding • Bridges • Housing • Window panels	
Stick-based products	Furniture	• Growth of bamboo furniture at 20% • Opportunity to replace traditional bamboo rattan furniture that is not engineering-based	• Tables • Chairs • Stools	
	Utensils	• The chopsticks market is growing at 10% per annum • Asia commands the largest share of the chopsticks market but the US is the fastest growing market • Chopsticks are commonly used as tableware or as a kitchen utensil	• Chopsticks • Toothpicks	
	Flammables	• Ethiopia exports bamboo incense sticks of USD 0.6 Mn per annum to India and the total export market value of incense and agarbatti in India is estimated at USD 900 Mn • Ethiopia imports ~1,600 tons of match sticks (2012) and splits, and it is projected to increase to 2000 tons by 2022	• Incense sticks • Match sticks	

Source: FAO; Press search; Journal of Resources Development and Management; INBAR

1. With sustainable bamboo foresting, bamboo has versatile use cases: biomass with desirable properties that is an effective way to utilize waste from other bamboo processing activities

NOR EXHAUSTIVE

Categories	Demand drivers	Potential products	Images
Wood-based biomass	• Wood pellet market was **at ~37 Mn t** p.a. during 2015 and was expected to hit 60 Mn t by 2020 • EU and China are largest consumers of wood pellets, making up ~80% of market • Pellet production has grown at 18% p.a. • Demand for bamboo pellets is driven by superior qualities over wood alternatives such as high heat value, low emission, easy transportation due to high density, wide application, and high profitability, but unfortunately has higher ash levels	• Pellets • Chips • Culms	
Charcoal	• Demand driven by biomass properties such as large surface area, good absorption ability, high selectivity, and stable physical and mechanical properties • Activated charcoal also has growing demand due to increased porosity and surface area • Several uses such as water purifier, and treatment, and humidifier. Also used in manufacturing for refining and discoloring in sugar and pharma industry	• Charcoal briquettes • Charcoal lumps	

Insights

- Bamboo biomass can be produced from bamboo waste
- Global decline in production of traditional energy resources such as coal and gas, is driving demand for renewable energy
- Bamboo biomass preferred to other sources of wood due to rapid growth rates of bamboo
- Bamboo pellets and charcoal have superior qualities over most biomass alternatives

Source: FAO; Press search; Journal of Resources Development and Management; International Biomass Opportunities; INBAR

Table of content

2. While bamboo forests constitute a significant opportunity, the introduction of sustainable harvesting practices and rehabilitation are critical for long term benefits for the communities and the economy

Currently, there is no practice of sustainable harvesting and forests are not being managed…

Majority of bamboo grows on state-owned and communal lands leaving the forest unmanaged and thus of **poor quality**:

- No **clear ownership and responsibility** of who should be taking care of the forest
- Current **bamboo forests** mostly **dominated by old culms** which is **impacting yields**

Harvesting conducted by small holder farmers living nearby the forests compromises **the sustainability of the forest** as well as the **quality of culms harvested**

- **Farmers using traditional techniques** that don't put into consideration sustainability of the forest (e.g. cutting down culms at any age) and the quality of culms
- No **incentivization to sustainably manage** the forest
- Only recently, individual farmers and PFM cooperatives have started bamboo cultivation and practicing some silvicultural activities through INBAR and the World Bank

… hence forest rehabilitation programs and small holder farmer trainings are required for sustainability

Rehabilitation of the existing forests is critical through:

- **Removal of old** and unusable **culms** (e.g. half cut, bent, malformed and dry culms)
- Coverage of **rhizomes with soil**
- **Protecting young culms** until they reach prime age of 2-3 years

Training of local communities on management and sustainable harvesting techniques hence improving age distribution of bamboo culms and yields

Individual farmers and participatory forest management (PFM) cooperative **recently started sustainable harvesting** supported by **INBAR**; inspired by INBAR's support in China or Ghana for example

As a **connected small business**, **investors** can **further train local communities and provide them with equipment** to adequately **chip the bamboo** and transport to the plant

Higher yields provide a natural incentive for farmers to manage the forest sustainably**, if land use rights are clarified and work in the farmers' favor**

Source: Expert interview, World Bank

2. INBAR trains farmers on sustainable bamboo harvesting – case study Ghana

Context

Demand for bamboo culms in Ghana was growing that created **viable business opportunities** for harvesters

Unfortunately, most **bamboo was not managed** and **approach applied by harvesters degraded** and **lowered the regeneration rate** of new bamboo shoots

Root cause was partly **inadequate knowledge in sustainable bamboo** harvesting and **poor management** from harvesters (both **young and matured bamboo culms were harvested together** that resulted in the **destruction** of bamboo clumps)

The **International Bamboo and Rattan Organisation (INBAR) started training bamboo harvesters in 2020** to promote **sustainable management** and harvesting

Approach

Enabling the **transfer of best practices**, knowledge, **skills and technologies** within Africa and **from China** on how to supply quality culms and do basic marketing

Creating jobs for many young people and contribute to poverty reduction in remote communities

Upscaling and **diversifying existing target country bamboo value chains** and promoting **industrialization** of bamboo products

Facilitating the use of bamboo as a tool to reverse land degradation, reduce erosion, and protect watersheds

Integrating bamboo into country development plans, particularly for climate change

Impact

100+ professionals trained in how to conduct resource assessments in the future[1]

85 harvesters trained on:

- Identifying matured culms;
- Sustainable techniques
- Bamboo stand management
- Storage and safe transportation
- Formation of' cooperatives

1. Using remote sensing and geographic information system technology

Source: INBAR

2. INBAR trains farmers on sustainable bamboo harvesting – case study China

Context

On **May 2008**, a devastating **earthquake struck** Sichuan in China

INBAR saw the **bamboo sector as a strategy** for post-quake reconstruction and **livelihood revival** of the area

Objective of the program was to focus on **technology transfer** and **capacity building activities** for **local communities** to acquire the **knowledge and technology** that would help establishing their own sustainable bamboo enterprises

Approach

Phase I (2009): **technology transfer and capacity building activities** to enable local communities to **acquire the knowledge** and **technologies to establish** their own sustainable bamboo enterprises

Phase II (2010): demonstration and **training** through households and **cooperatives**

Phase III (2011-2012): **overcome gaps** identified from the **first two phases**, particularly limited enterprise access to support services such as **business advisory services, marketing and sales support, and network-building**, **lack of micro-finance knowledge**, skills and linkages, limited access to micro-finance, lack of quality control mechanisms in the supply chain; and limited access to buyers in local and outside-provincial markets

Phase IV (2013-2014): **upscaling the successful models** and experiences gained from previous programs to a new province (Zhejiang)

Impact

300+ persons **trained** in **2009** on scientific **rational harvesting** and **high-yield** and pest and **disease control**

600+ persons **trained** on business **management**

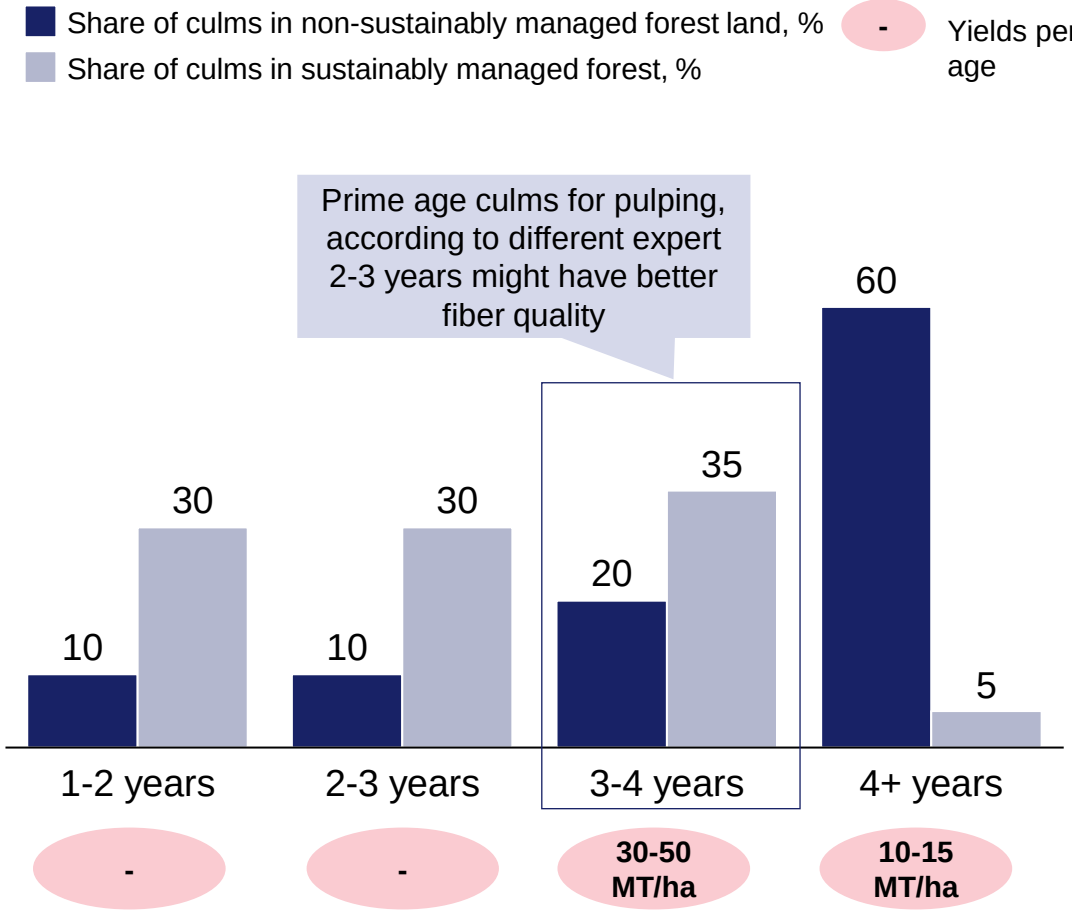
21,957 people benefited from the **241 bamboo processing enterprises** and **28 farmers cooperatives** supported by the program

Average income of the employees in the SMEs and cooperatives has **increased by 30%**

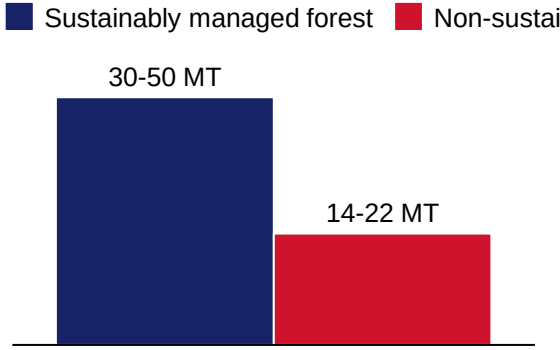
Source: Achieving sustainable rural development in Southern China: The contribution of bamboo forestry (2010)

2. Sustainable harvesting does not only protect the forests but could also increase yields significantly

Sustainably harvesting impacts culms age distribution…



…hence impacts overall volumes harvested: at a steady state, sustainably managed forest could give twice as much harvest



Cutting down 1 hectare of forest

Methodology:
In case of sustainable harvesting, farmers know which culms are prime age and can choose to harvest 1 hectare of that with a yield of 30-50 MT

If harvesting is not sustainable, the 1 hectare would be a mixture of prime age and old culms. 0.2 hectare prime age would give 6-10 MT, while the remaining 0.8 hectare old or very young culm would provide 8-12 MT. The total is 14-22 MT

NB: during sustainable harvesting, only 75% of the prime age culms are recommended to be cut down p. a.

Key takeaways

During sustainable harvesting, farmers can **choose** to **only cut down prime age culms** that helps keeping a **stable age distribution of culms** in the forest and provides **better yields and quality** for pulping

Source: Expert discussions

2. To improve efficiency through experiments and breeding, establishing a plantation could be a viable solution that also helps local communities in acquiring knowledge and revenue

Local farmers could see a plantation as a threat for their incomes…

Local livelihood in the region depends largely on **growing crops** that encourages **illegal cutting of bamboo forests**

Smallholders only **use the forest in a haphazard manner** to receive some sustenance benefits from bamboo cutting that further threatens its long term availability

Since current forests are **mostly state-owned** and naturally grown bamboo stands, **land** could be **leased from the government** on preferential terms for the establishment of a bamboo plantation, but that would mean that farmers might lose some revenue from that forest

…however, with the right structuring, farmers could benefit from jobs and know-how, while the owners could ensure sustainable supply of bamboo

Benefits to smallholder farmers and local community:

- The plantation **creates reliable jobs** for farmers
- The **plantation could become a best practice** showroom for smallholder farmers and **on the job trainings** could be **provided** to **farmers** about sustainable harvesting

Benefits to bamboo processors:

- **Place for experimenting and breeding** for better operational efficiency
- **Sustainable supply of bamboo** in the starting years where natural forest have not been rehabilitated yet and smallholder farmer engagement on sustainable harvesting has not been rolled out yet
- Plantations are likely to **give ~20% higher yields** per hectare compared to a sustainably harvested natural forest

Source: Expert interview

Sustainable harvesting requires half the land and protects the ecosystem…

Optimal pulp processing capacity per year

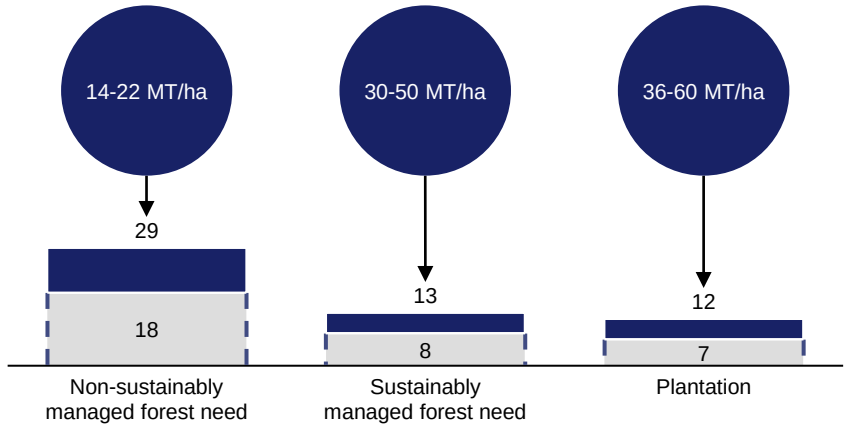
100,000 MT[1]

4x

400,000 MT

Bamboo culm need

Bamboo forest need, thousand hectare

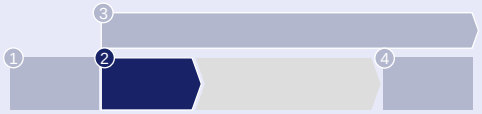


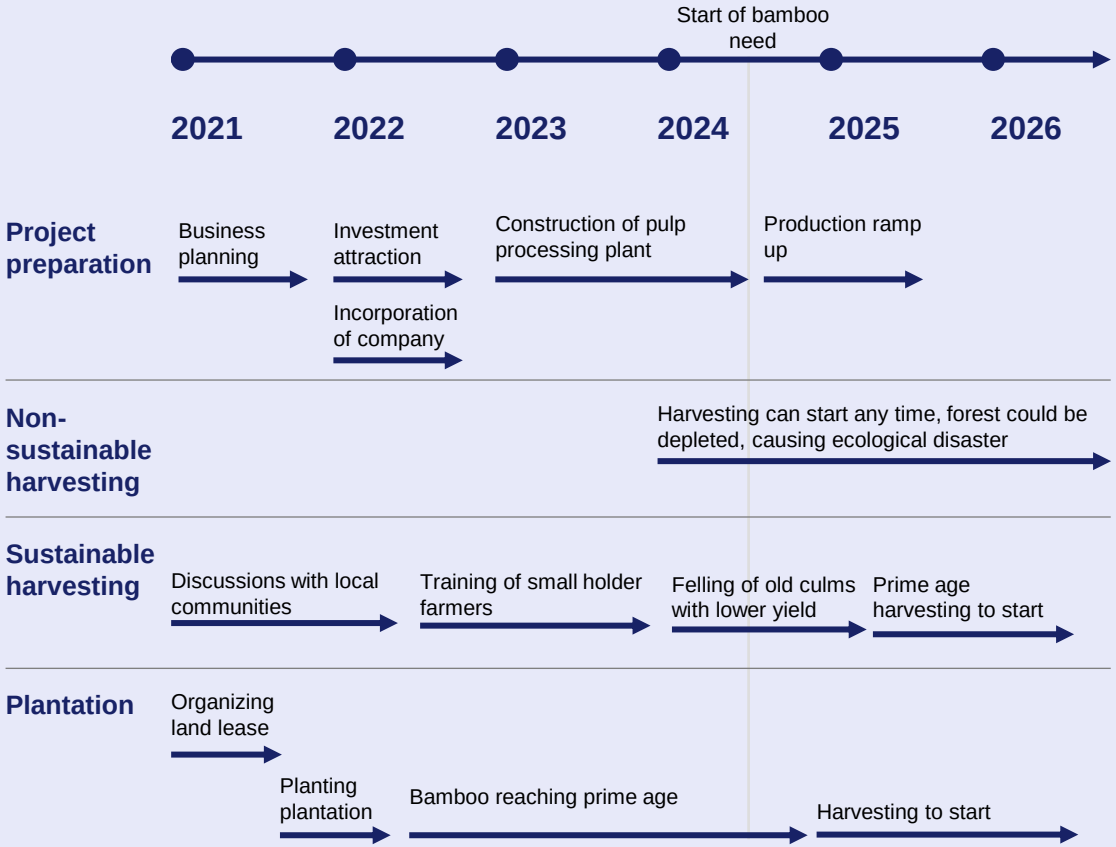
	Non-sustainably managed forest need	Sustainably managed forest need	Plantation
Characteristics	Can be harvested immediately but depletes and endangers the forest and reduces yield and quality	Protects the ecosystem, farmer revenues and provides higher yield Farmers need to be trained to first cut out the old culm (keep <10%) and after only harvest the 2-3 year old ones	Provides the highest yields and created employment Harvesting can only be started in 3-4 year, unless a good quality bamboo forest is chosen for plantation

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 MT, optimal is ~200,000 MT, plant in Ethiopia in the first phase could considered as 100,000 MT

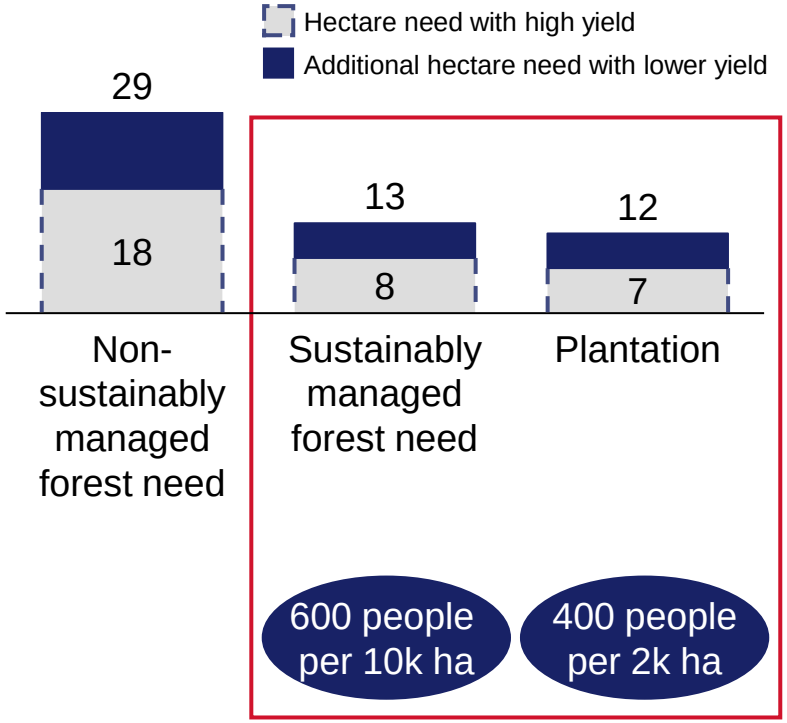
…however, forest rehabilitation and farmer training needs to be ongoing while the plant is being built





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

Bamboo forest need, thousand hectare



Employment need bamboo harvesting

600 people per 10k ha

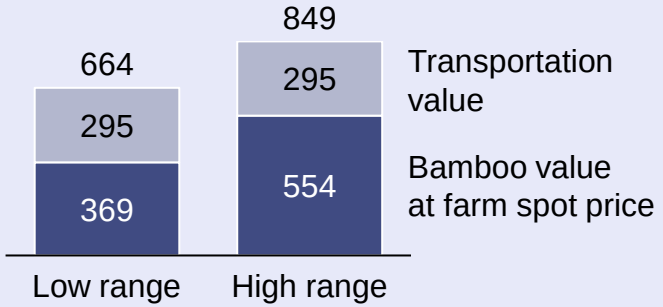
400 people per 2k ha

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

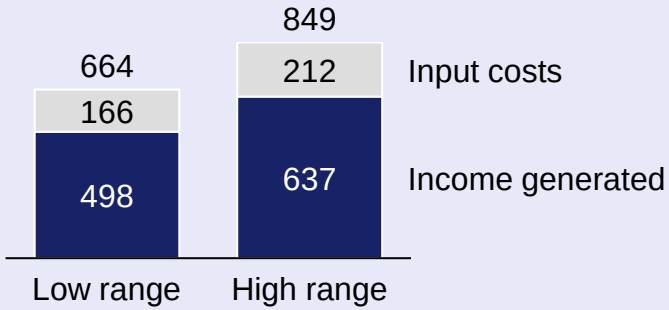
>1,000 people for sustainable forest and plantation management

… 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 MT pulp processing capacity, requiring 400k MT 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)

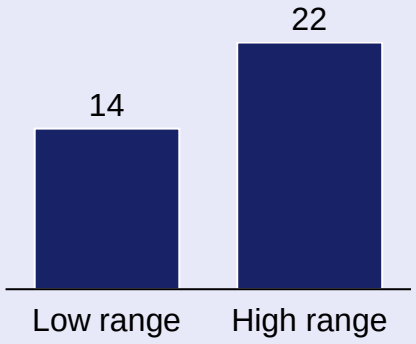


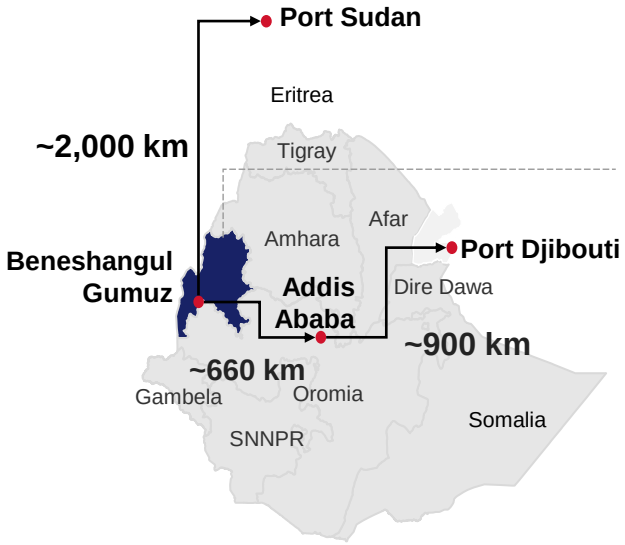
Table of content

3. Setting up a manufacturing plant in BNG requires importing raw chemicals then distributing end products: focus on transportation steps

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	✗

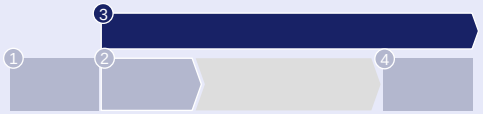
Comments

- 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

3.A. Culms are transported from the forest to the local markets for USD ~35 for 2,000 culms (~11 MT)



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 and **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)

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 MT 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]

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).

3.B. Processing bamboo into pulp requires chemicals currently not 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/MT, FOB	10%	China	NA
Sulphuric acid (H_2SO_4)	KP (bleaching)	Awash Melkasa aluminum sulphate and sulphuric acid S.C	15 – 80 USD/MT, 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/MT	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/MT, **CFR SEA**	10%	Southeast Asia	Netherland, Belgium

Comments

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

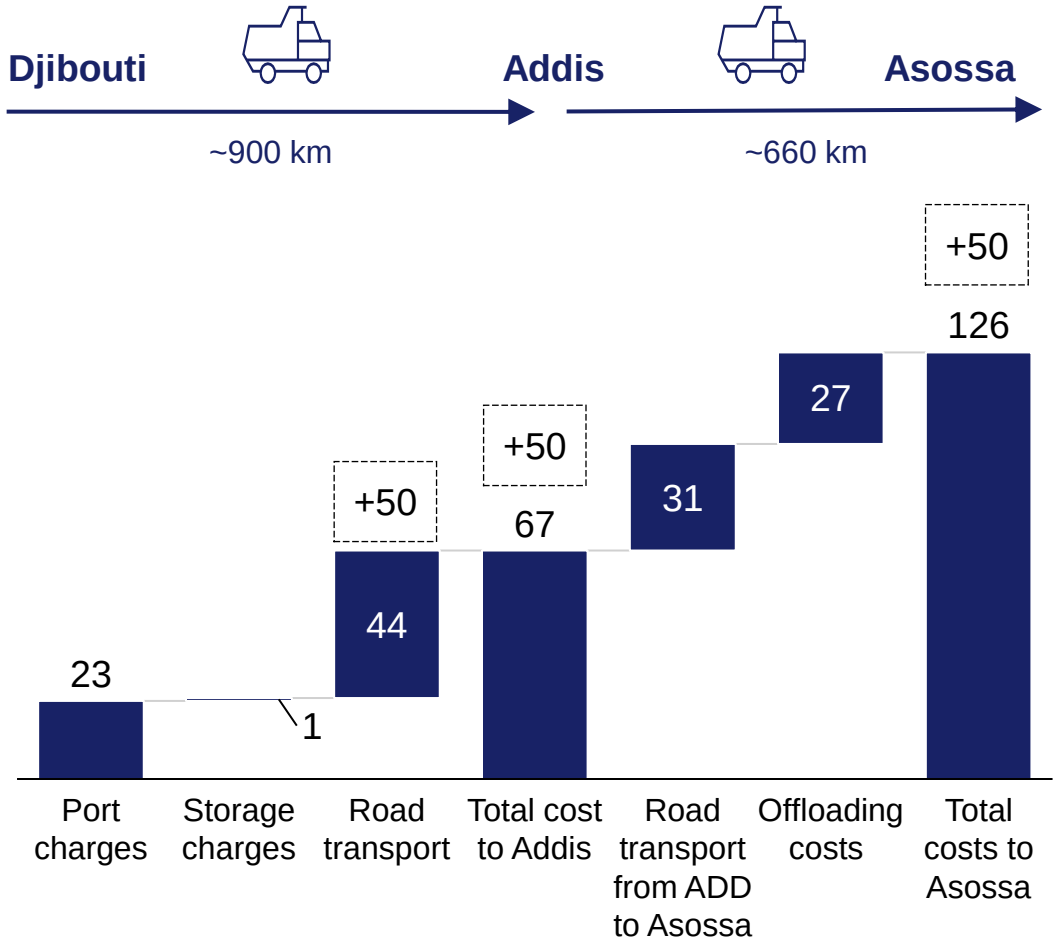
Caustic Soda is available in Ethiopia but reported to be of poor quality, mainly serving the recycling paper manufacturers

Capacity of local manufacturers have to be further explored

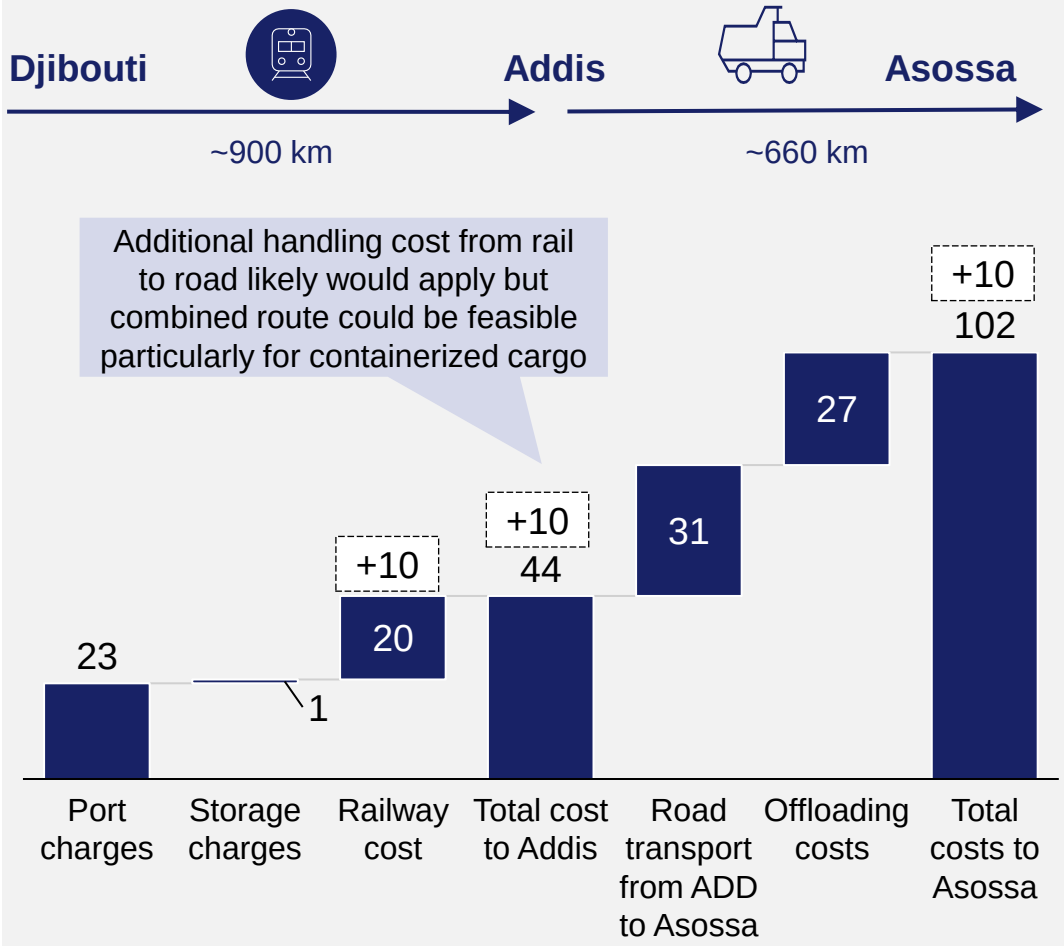
Source: IHMS, CCIIDI

3.B&C… that need to be imported through Port Djibouti: focus on the transportation costs from Port Djibouti to BNG

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



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



Source: Expert interviews, quotes from logistics companies

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

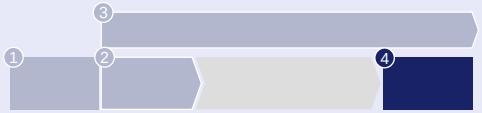
Table of content

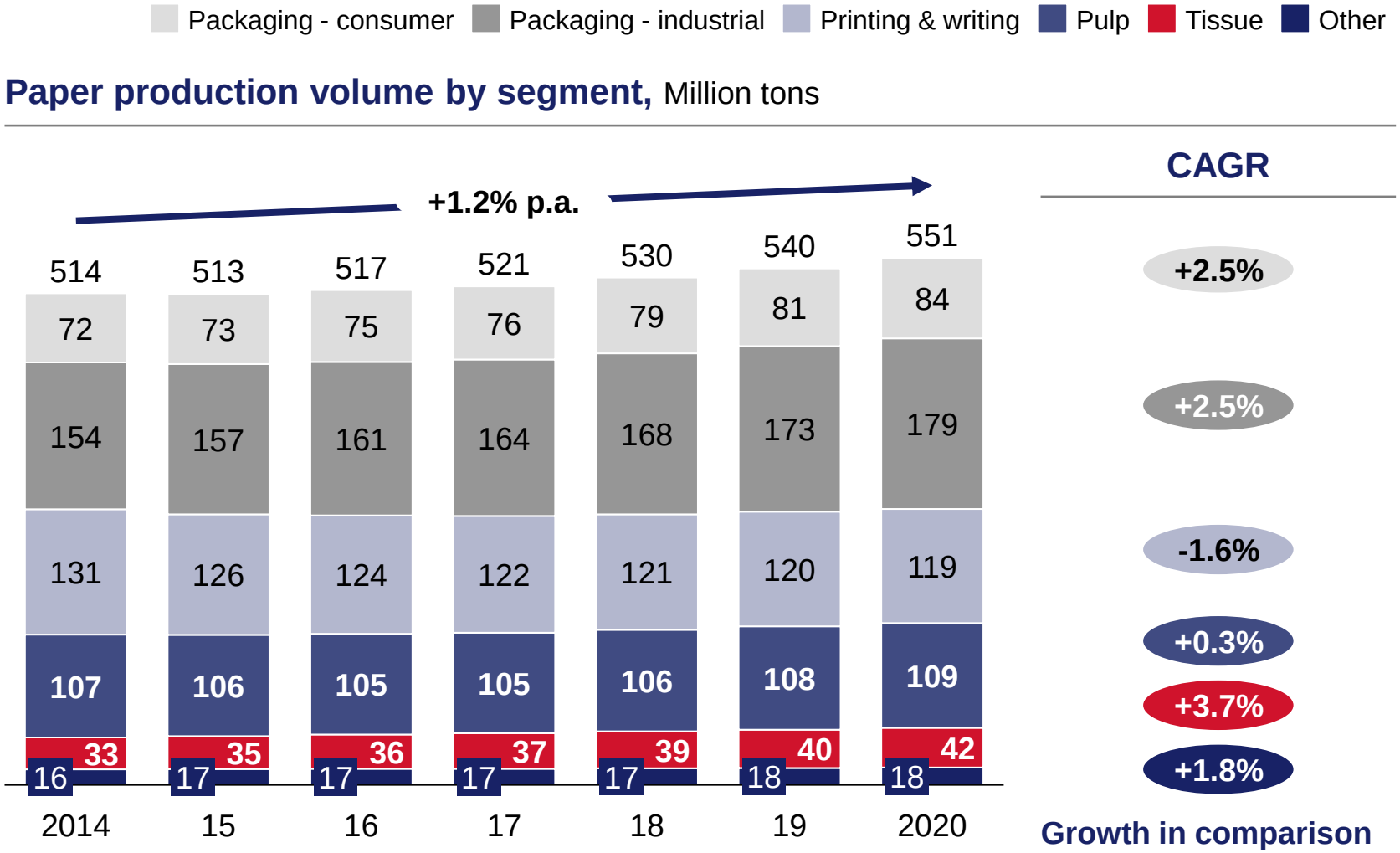
4. Pulp-based end product market splits between 3 main segments: packaging material, tissue and printing and writing paper

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	

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





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**

4. 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

4. Different sources have been leveraged to assess the Ethiopian pulp-based products market

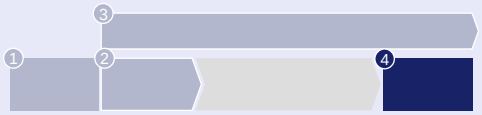
Data available No Data

Sources		Total demand		Imports only	
		Value (USD)	**Volume** (MT)	**Value** (USD)	**Volume** (MT)
FAO – Food and Agriculture Organization of the United Nations	Raw pulp				
	Packaging material				
	Tissue				
	Printing & writing paper				
	Packaging and paper rolls				
International Trade Centre – Trademap (ITC)	Raw pulp				
	Packaging material (incl. rolls)				
	Tissue				
	Printing paper (incl. rolls)				
CCIIDI – Chemical and Construction Input industry Development Institute	Raw pulp				
	Packaging material				
	Tissue				
	Printing & writing paper				
	Packaging and paper rolls				

Comments

- ITC and CCIIDI do not provide information on local production; data available only on imports
- Data on printing and writing paper and packaging imports from FAO and ITC are aligned; information from CCIIDI are significantly different which could be partly explained by different categorization
- On top of end products paper and packaging, ITC provides details on paper rolls and packaging rolls that still need to be cut locally to produce end products

4. In Ethiopia, an integrated new player would not limit its market to end products; addressable clients exist all along the value chain



Imports, natural addressable market | Local production

Segment	Raw material[1]	Paper and packaging rolls to be cut		End products	
Tissue paper	Chemical kraft pulp	NA		Napkins, toilet paper, facial tissue, etc.	Napkins, toilet paper, facial tissue, etc.
Writing and printing paper	Recovered paper	Negligible amount of carbon paper, self-copy paper and other copying or transfer papers		Mainly uncoated papers, coated papers, envelopes and newsprint	
	Pulp from fibers other than wood	NA		Mainly envelopes and other papers, then coated and uncoated paper	
Paper based packaging material	Recovered paper	Uncoated kraft paper and cellulose wadding/webs of cellulose fibres	NA	Mainly cartonboard	Mainly containerboard and uncoated kraft paper

1. No information found so far on mechanical pulp, to be validated if included in the category “Pulp from fibers other than wood”

Comments

- Total **market** could be seen as the **sum between imports and local production**
- A new player’s **addressable market** focuses mainly on **import substitutions**
- An **integrated player** could then be positioned in:
  - **Raw material:** substitution to **chemical wood pulp**
  - **Rolls:** Supply of uncoated kraft papers in rolls of a width of >36 cm + uncoated paper in rolls of width of >36 cm
  - **End products**: tissue, printing and writing paper and cartonboards not satisfied today by local production

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

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

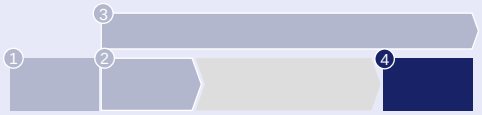
Segments	Raw material, *'000 MT*	Product in rolls and end products, *'000 MT*
Tissue paper	2 **5-9** of chemical wood pulp	**2-6** **~9-14** based on local expert (3)
Printing and writing paper	**~12** of pulp from other wood fibres	**50-70,** breakdown: uncoated paper: ~35, coated papers: ~10, newsprint: 3-5 MT and others: 2-15 **~50** breakdown: uncoated paper: ~22, coated papers: ~16, newsprint: ~13
Packaging material	1 **~30** of recovered paper based on local expert	**23-44:** paperboard in rolls of a width > 36 cm, cartons, boxes, cases, bags and other packing containers, uncoated kraft paper and paperboard and corrugated paper (4) **~40** breakdown: cartonboard ~1, other paper and paperboard for packaging ~39 (4)

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

Comments

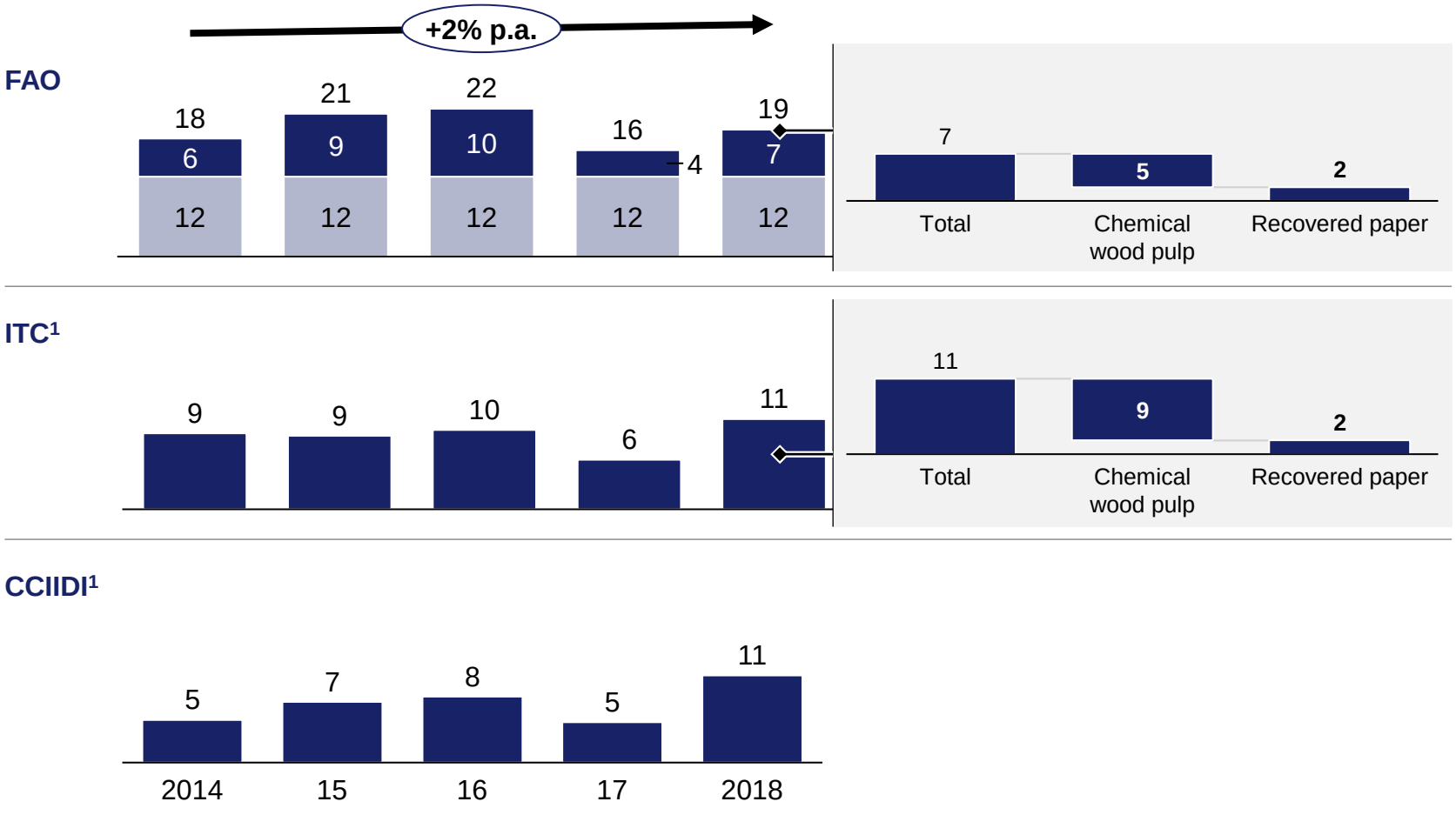
1. Total volume of raw material at FAO (2,000 MT) seems low compared to total local production of tissue, paper and packaging material, however local expert indicated ~30,000 MT of recovered paper
2. A new player could partner with the 2 local players processing pulp in Ethiopia to sell up to 9,000 MT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

4. Raw materials: Ethiopia mostly imports chemical pulp that could be replaced by lowland bamboo



Imported Locally produced[2]

Evolution of local production and imports of pulp and recovered paper in Ethiopia, '000 MT, between 2016-2018



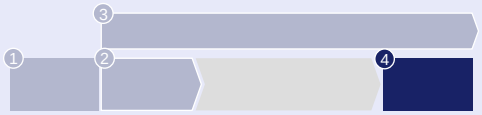
1. No information on local production | 2. FAO likely calculated local capacity as local production as numbers are stable over the years

Source: CCIIDI, ITC, FAO, Expert interviews

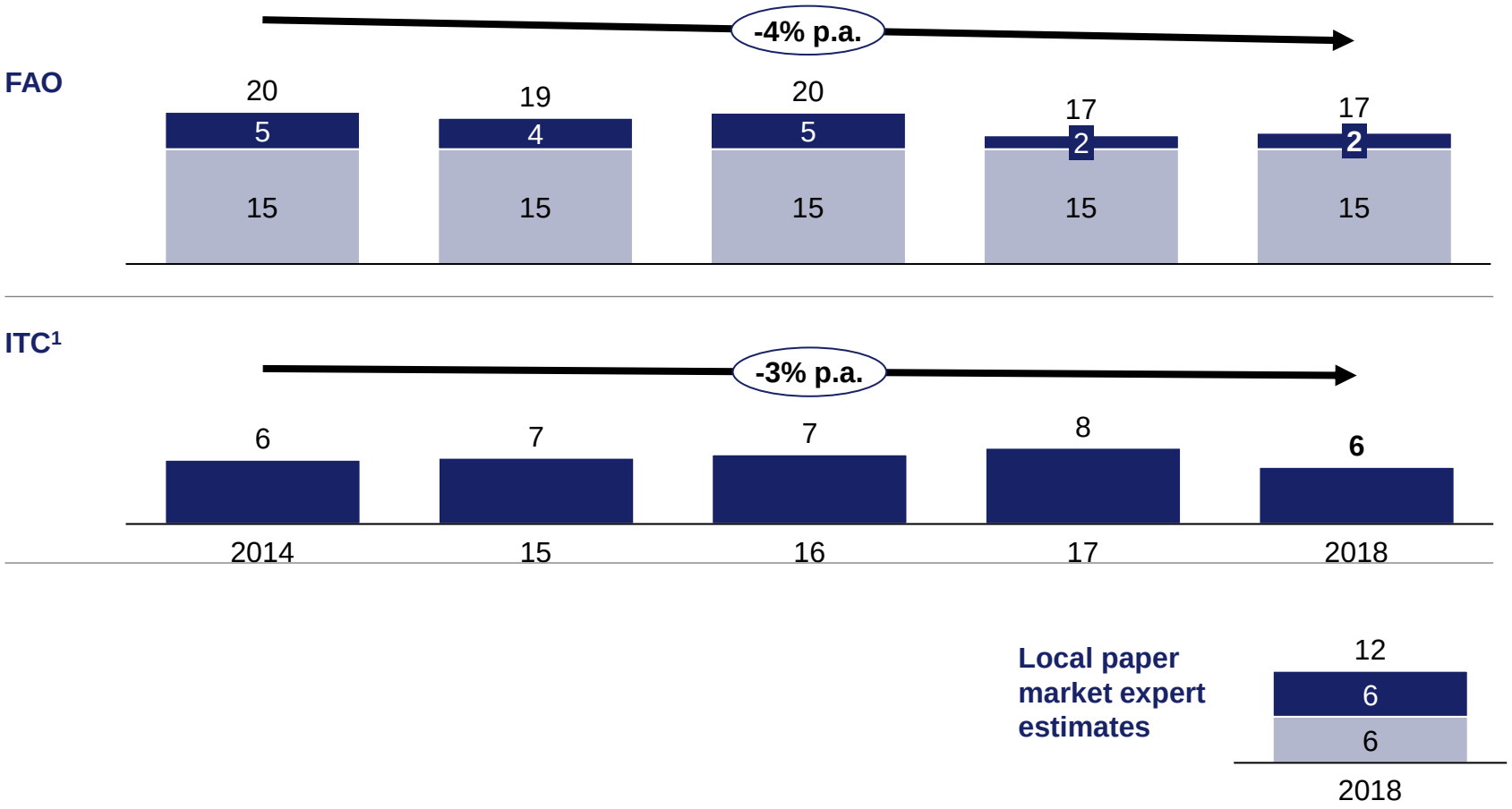
Comments

- **Ethiopia imports mainly chemical wood pulp** that could potentially be replaced by lowland bamboo pulp for pulp-based products
- The **reasonable addressable market** focusing on substitution of chemical pulp imports hence amounts to a market size of **5-9,000 MT**

4. Tissue paper: total market is 15-20,000 MT, however the distribution between import and local production is ambiguous



Evolution of local production and imports of tissue in Ethiopia,
'000 MT, between 2016-2018



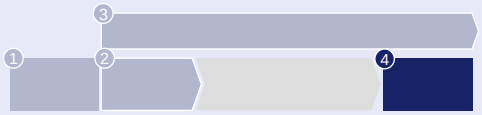
1. No information on local production | 2. FAO likely calculated local capacity as local production as numbers are stable over the years

Source: CCIIDI, ITC, FAO, Expert interviews

Comments

- The 3 **different sources** show **differences** in total **imported tissue**; hence we could estimate a range for the tissue addressable market
- Ethiopian tissue **addressable market** would reach **2-6,000 MT (2018)**
- According to a local expert in the paper industry, the **total Ethiopian tissue market** (imports + local production) should amount to **15-20,000 MT** per year which is aligned with the FAO consolidated figures, local production of tissue seems however too high in FAO dataset

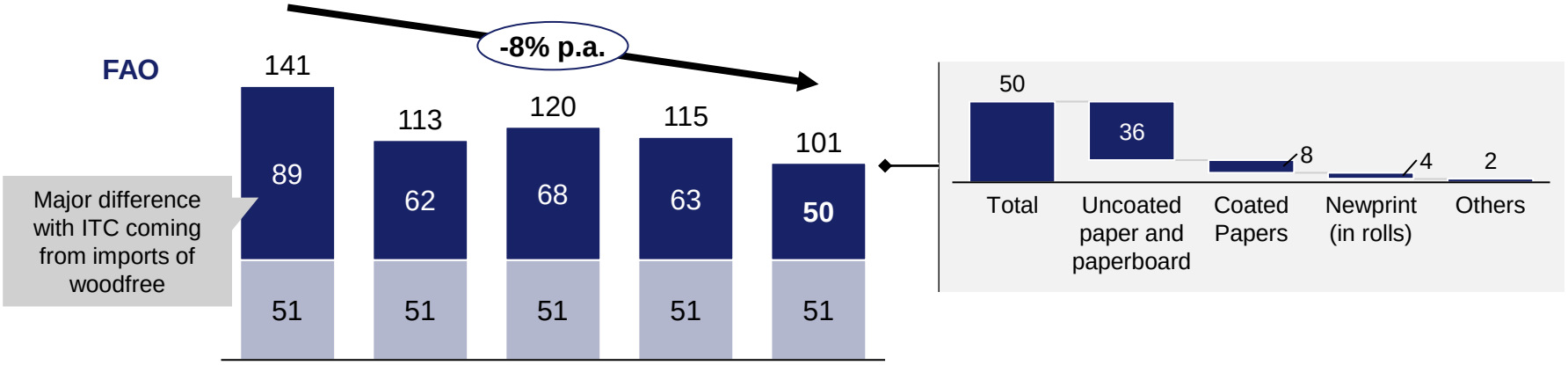
4. Printing and writing paper market: total market is ~100,000 MT with 50-70% of import



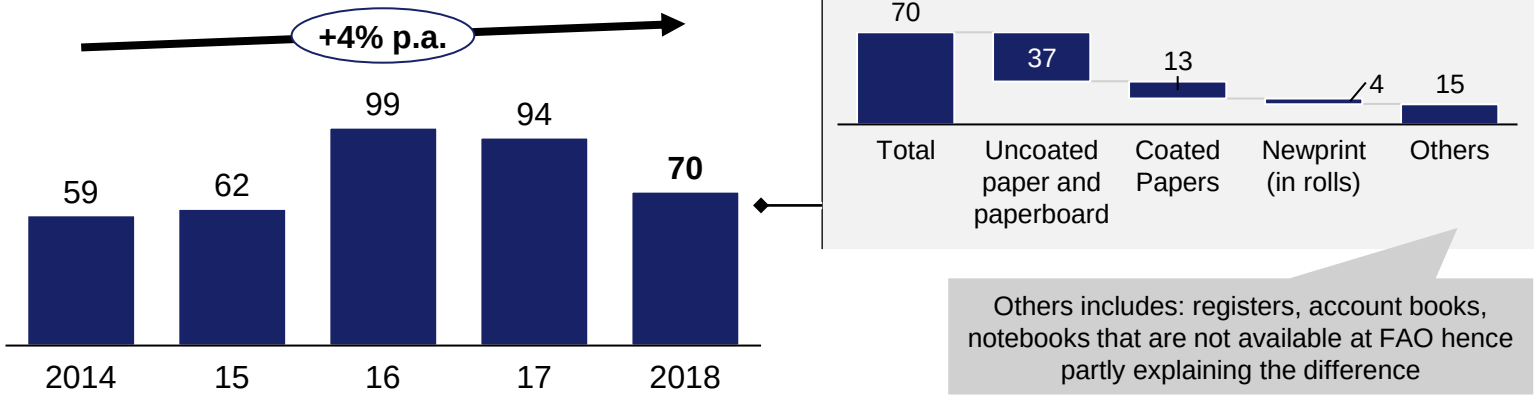
Imported Locally produced [1]

Evolution of local production and imports of printing and writing paper in Ethiopia, '000 MT, between 2016-2018

FAO



ITC



Others includes: registers, account books, notebooks that are not available at FAO hence partly explaining the difference

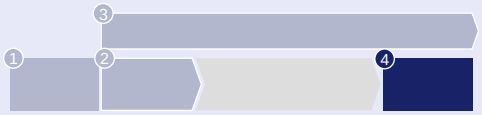
1. FAO likely calculated local capacity as local production as numbers are stable over the years

Source: ITC, FAO

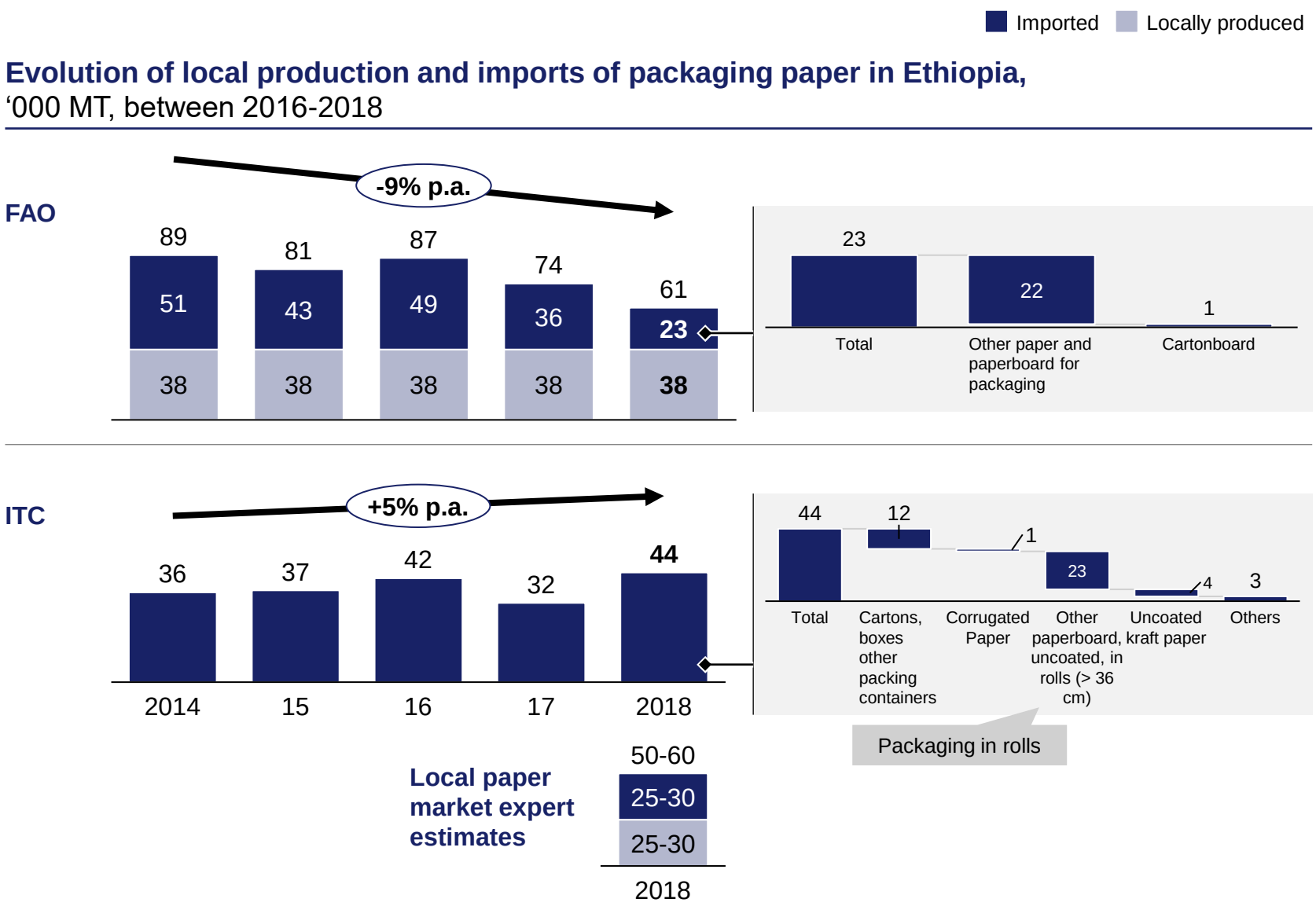
Comments

- Ethiopia's **total printing and writing papers' market** amounts to ~**100,000 MT in 2018**, **50% of which are imported; downward trend noticed that is aligned with global dynamics** (e.g., shift to online)
- Total **addressable market** could reach **50-70,000 MT**
- Ethiopia **imports mainly uncoated paper** (50% woodfree and 50% mechanical)
- Note: a **part of the uncoated paperboard** could have been **classified** into the **packaging section**

4. Packaging paper: market is estimated at 50-60,000 MT with 23-45,000 MT import



Evolution of local production and imports of packaging paper in Ethiopia, ‘000 MT, between 2016-2018



1. FAO likely calculated local capacity as local production as numbers are stable over the years

Source: CCIIDI, ITC, FAO, Expert interviews

Comments

- Significant **differences** noticed **between FAO and ITC** in 2018 for the **imported packaging segment: explained by the categories “carton, boxes…” almost inexistent at FAO as well as the uncoated kraft paper**
- According to **local manufacturers**, total consumption (incl. local production and imports) would be around **50-60,000 MT p.a.**, hence **matching FAO numbers**
- **Addressable market** as substitution to imports would amount to **23-45,000 MT**

High-level next steps before initiating operations

PRELIMINARY

		Description
1	**Complete qualitative business case**	• Acquire **quotes** on the **different products** from **local manufacturers/wholesalers** and assess the **market size in value** • Assess the **possibility** to **produce locally** at a **cheaper** cost than imports (deep-dives required for financial feasibility) • Complete information on **sourcing of chemicals** through **discussions with CCIDI**
2	**Validate major strategic and production choices**	• Validate **location** of potential **manufacturing plant** • Define **sourcing** strategy for **bamboo,** including the mix of plantation vs. sustainable forest management • Define **targeted segments** and **end-products** to sell
3	**Run a detailed business plan**	• **Estimate** required **CAPEX** for the manufacturing plant (e.g., depending on segments of products) • Estimate **costs** of **training farmers** and growing own plantation • Project **future revenue** and assess **exports** opportunity
4	**Validate overall strategy and timeline with local authorities**	• **Produce pitch** insisting on **value added** for local communities • Discuss with **local and national government** about the value add and the **training of small holder farmers**
5	**Conduct an Environmental, Gender Equality and Social Inclusion research**	• Commission **environmental impact study** to review risks and mitigation (e.g. loss of diversity, water management, illegal cutting etc.) • Assess **impact on gender equality and social inclusion** and highlight linkages with communities
6	**Prepare for operational launch**	• Secure **funding** (e.g., CAPEX, training of local farmers) • Ensure **alignment and operational support/expertise from INBAR** (International Bamboo and Rattan Organisation) • Identify and **start** recruiting **key leadership and technical positions with Bamboo experts, plant managers, etc.**

Backup

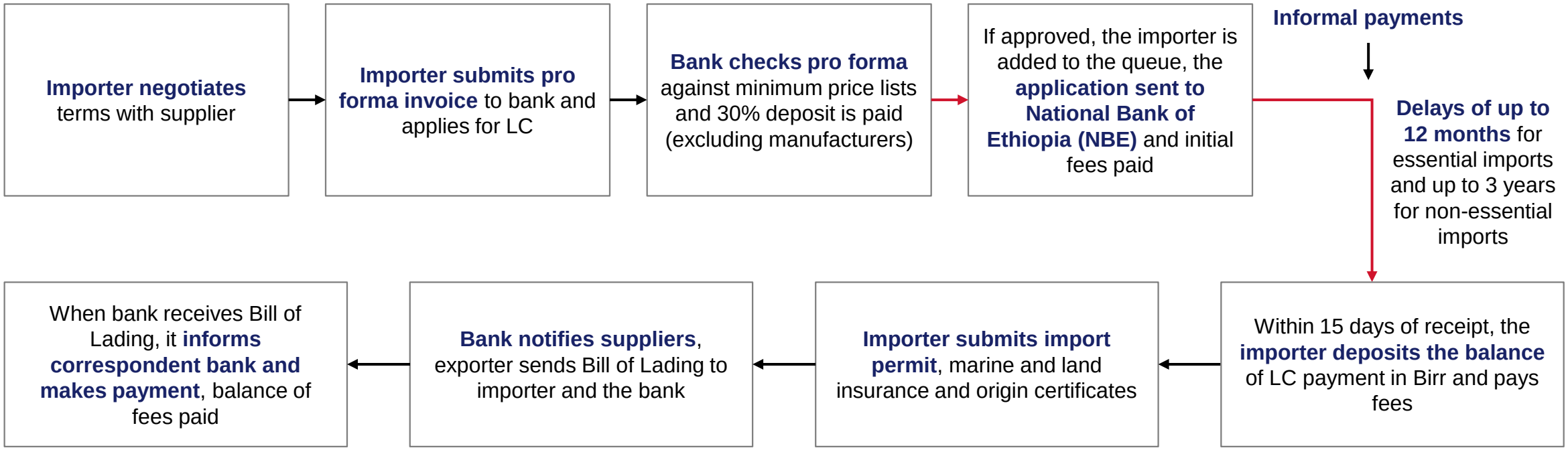
Depending on the production process bamboo pulp could have various end uses

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

3.B. Receiving Forex for importation of inputs could take up to 1-3 years, significantly disrupting production for local manufacturers

→ Potential bottlenecks

Process businesses follow to import through a Letter of Credit (LC)



Using a letter of credit is the **most commonly used** mechanism for imports; other mechanisms used include Cash Against Documents (CAD), telegraphic transfers, retention & non-resident accounts, franco valuta & supplier credit

Delays could be **up to 12 months for essential imports**, and **up to 3 years for non-essential imports**, with delays differing across banks

Source: BERF Report: Foreign Exchange Allocation and Access for Businesses in Ethiopia (2018); OEC data

4. Methodological approach to assess the addressable pulp-based & paper market for new entrant in the Ethiopian market

Step	1	2	3	4	5
	Segmenting of the market between **raw material** and 3 **segments** of **pulp-based end-products**	**Alignment** on the **addressable market** for a new entrant	Presentation the **sources leveraged** to size the market and the challenges	Estimation of the **total demand** in volumes[2] and **focus on the imported volumes**	Assessment of the **main trends** in terms of **growth potential** for each segment
Overview on the outcome	**Raw material** (chemical pulp, mechanical pulp, recovery paper etc.) **Printing and writing paper** **Packaging** **Tissue**	**Import substitution** of raw material, intermediary products and end products in the 3 segments	ITC (Trademap) FAO[1] CCIIDI (data based on Ethiopian local customs)	Addressable market[3]: – Raw Chemical pulp: 5-9,000 MT – Printing & Writing paper: 50-70,000 0MT – Packaging: 23-44,000 MT – Tissue: 2-6,000 MT	Global trends showing (i) decline in printing & writing paper consumption, (ii) light growth in packaging and (iii) strong growth in tissue consumption Ethiopia's overall market expected to follow growing trends since 2014, driven by growing population, developing economy and urbanization rates

1. Food and Agriculture Organization of the United Nations
2. In tons, based on 2018 data
3. Imports, based on 2018 figures and expert input