



Tackling discrepancies in timber trade data

Comparing China and Mozambique

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This paper is a joint study by Eduardo Mondlane University, Faculty of Agronomy and Forestry Engineering, Centre for Agriculture and Natural Resources Management Studies (CEAGRE) and the Global Environmental Institute (GEI) Overseas Investment, Trade and the Environment with support from the International Institute for Environment and Development (IIED).

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The aim of the Natural Resources Group is to build partnerships, capacity and wise decision-making for fair and sustainable use of natural resources. Our priority in pursuing this purpose is on local control and management of natural resources and other ecosystems.

The Eduardo Mondlane University (UEM) is a national university within Mozambique. It is based in Maputo but conducts research throughout the country. Its mission is to 'produce and disseminate scientific knowledge and promote innovation through research as the foundation of teaching and learning and extension processes, educating generations with human values in order to face the current challenges for the development and benefit of society'.

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The China-Africa Forest Governance Learning Platform was launched in 2013 and thus far brings together forest governance players, including heads of government forest departments, from eight African countries, representatives from the Chinese Academy of Forestry, the Global

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For more information visit www.iied.org/china-africa-forest-governance-project or contact: James Mayers, james.mayers@iied.org

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China is now the largest destination market for African timber exports, having seen significant growth in timber trade with African countries over the last decade. This has important implications to the sustainable development of forests in the exporting countries, where forest resources are being depleted. Regulation on timber trade, especially illegal timber trade, is therefore of increasing importance. This report investigates trade data discrepancies by examining the documentation process and data collection of the customs and other relevant agencies in China and Mozambique. Two studies of timber trade supply chain and customs procedures were conducted separately in Mozambique and in China, by the Faculty of Agronomy and Forestry Engineering of Eduardo Mondlane University (UEM) and Global Environmental Institute (GEI) using data analysis, a literature review, and semi-structured and unstructured interviews with various stakeholders. After comparing the procedures between the two countries, this report identifies differences and gaps in regulations and implementation in the two countries, and finally offers recommendations for future studies and customs engagement.

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Acronyms

AQUA	National Agency of Environment Quality Control
AT	Mozambique Tax Authority
CATIE	Tropical Agricultural Research and Higher Education Centre (Centro Agronómico Tropical de Investigación e Ensino)
CIF	Cost, Insurance and Freight
CITES	Convention on International Trade in Endangered Species
DAP	Diameter at breast height
DINAF	National Directorate of Forests
DNTF	National Directorate of Land and Forests
DPIC	Provincial Directorate of Industry and Trade
EIA	Environmental Investigation Agency
FAOSTAT	Food and Agricultural Organization Corporate Statistical Database
FOB	Free on Board
GEI	Global Environmental Institute
HS	Harmonised Commodity Description and Coding System
INE	National Institute of Statistics
ITTO	International Organization of Tropical Timber
MINAG	Ministry of Agriculture
m ³ LEQ	Cubic meters of logs equivalent
PCF	Piling ConversionFactor
SDAE	District Services for Economic Activities
SPFs	Provincial Forest Service
TSM	Timber Overvaluation Tax
UEM	Eduardo Mondlane University
UN Comtrade	United Nations International Trade Statistics Database

Summary

Timber trade between China and African countries has seen significant growth over the last decade. China has now become the largest destination market for African timber exports. As of 2015, about 10 per cent of China's total import of timber comes from Africa (Chang and Peng, 2015). Timber trade between China and Africa has important implications to the sustainable development of forests in the exporting countries. This is especially true in Mozambique. More than 90 per cent of its timber exports arrived in China in 2013 (Muianga and McQueen, 2015) and timber export value surpassed US\$400 million in 2014 (Hui, 2016). But this timber trade had made a vast contribution to the loss of forest resources in Mozambique.

Mozambique's forest resources have been under scrutiny in recent years. The country is seeing an annual deforestation rate at around 0.58 per cent: this equates to 219,000 hectares of forest lost every year. Regulation on timber trade, especially illegal timber trade, is therefore of particular interest to many. According to a joint study by Eduardo Mondlane University (UEM) and the Food and Agriculture Organization (FAO) (2013) estimated the rate of unlicensed harvested volume of timber in natural forest between 2007 and 2012 has grown from 63% to 70%.

A number of studies have approached the trade legality issue through comparing trade data between China (as an importer) with data from African exporting countries. It has been commonly found that across different international trade data platforms, statistics of export volumes from Mozambique differ from import volumes from Mozambique reported by China and other importing countries. The 2015 timber flow study by GEI found major data discrepancies between China-reported data and those reported by African countries including Mozambique. The report also summarised previous research that had identified a variety of factors that cause or impact these discrepancies, such as the use of different units and conversion factors, log measurement methods, timber classifications, underreporting and smuggling. Many of these possible factors may be linked to official import and export procedures.

This report begins where the 2015 timber flow study ended. It investigates the documentation process and data collection of the customs and other relevant agencies in China and Mozambique. Two studies of timber trade supply chain and customs procedures were conducted separately in Mozambique and in China, by Eduardo Mondlane University (UEM) and Global Environmental Institute (GEI) using data analysis, a literature review, and semi-structured and unstructured interviews with various stakeholders. After comparing the procedures between the two countries, this report identifies differences and gaps in regulations and implementation in the two countries, and finally offers recommendations for future studies and customs engagement.

The combined analysis has found that potential sources of data errors in Mozambique may be due to:

- Inconsistent log diameter measurements during logging,
- Lack of control on volumes exceeding the licensed volume at main landings,
- Lack of effective volume verification at transportation checkpoints, and
- Erroneous volume estimations and verification at packaging sites.

As timber comes into China, differences in data from Mozambican records might also occur due to:

- The lack of means to distinguish between real and false documentation from a wide variety of countries, including Mozambique,
- Differences in data recording methods,
- Differences in classifying imports in categories such as logs or sawn wood, and
- A failure to record information on any possible trans-shipment ports, where re-packaging of containers is possible.

Combining the analyses on both sides, three potential contributors to the trade data discrepancies have been identified:

- Possibilities of volume data errors across all stages of the value chain – from logging, to transportation and packaging, to export from Mozambique – which might also feed into inaccurate records based on that documentation during import to China.
- Possibilities of container repackaging at trans-shipment ports, which might be recorded by Mozambique customs as the destination countries but are then not recorded as such in the Chinese customs notes.
- Differences of data-management methods and styles between Mozambique and China that may contribute to inaccurate uploading to international databases and comparison mismatches.

While it is not yet practically possible to estimate how much of the data discrepancies is due to the potential reasons above, this report still provides an important foundation for further research and action. It provides clues as to how the two countries might better regulate

timber supply chains and manage customs procedures to fill the gaps. Opportunities exist for cooperation between China and Mozambique on several fronts:

- Strengthening the current regulations and implementation which govern licensing, harvesting, transport and export – with particular attention paid to investing in equipment to more reliably estimate volumes both at checkpoints and with more reliable conversion factors to estimate timber volumes loaded within containers.
- Developing and streamlining an electronic data system for timber tracking – to avoid inaccuracies, allow accurate comparisons between licensed and actual volumes, and to improve the accuracy of documentation to importing countries such as China.
- Mutual recognition of trade restrictions and possible use of the Convention on International Trade in Endangered Species (CITES) – including species for which specific export restrictions exist within Mozambique that need recognition by Chinese customs authorities.

1

Overview of Mozambique's timber export to China

Forest resources in Mozambique play a key role in the economic development of the country. In 2015, the export of forest-based products was estimated to be more than US\$53 million, ranking in ninth position out of 21 categories of export products established in the customs tariff (INE 2016). Mozambique exports forest products to several countries, but China is by far the main destination both in terms of volume and value. According to WWF & Miombo Consultores Lda (2015), from 2003 to 2013, China was the destination for 90% of Mozambican timber exports and Mozambique was one of the five largest suppliers of African timber.

Many studies have found that across different international trade data platforms, statistics of export volumes from Mozambique differ from import volumes from Mozambique reported by China and other importing countries. In 2015, GEI conducted a timber flow study that found major data discrepancies between China-reported data and those reported by African countries including Mozambique (Chang and Ren 2015). The report also summarised previous research that had identified a variety of factors that cause or impact these discrepancies, such as the use of different units and conversion factors, log measurement methods, timber classifications, underreporting and smuggling. Yet many of these possible factors can be controlled and managed during the official import and export procedures.

As such, this report takes up the research where the 2015 timber flow study ended by investigating the documentation process and data collection of the customs departments and other relevant agencies in China and Mozambique. Our research aims to compare data recording and verification procedures in the timber supply chain as well as the customs procedures between China and Mozambique to identify differences and gaps in regulations and implementation, and to offer recommendations for future studies and customs engagement. As will be further discussed, we selected Mozambique for this first comparative case study due to its issues of deforestation, timber legality, and the scale of its timber trade with China. We hope this research serves as a model for conducting similar comparative cases between China and other countries supplying timber to China.

1.1 Major traded species

Table 1 provides a list of the most commonly exported timber species from Mozambique to China, with their main uses and classifications according to the Mozambican legal frame. As illustrated, *Dalbergia melanoxylon* is classified as 'precious', and thus can be exported in log form. *Azelia quanzensis*, *Swartzia madagascariensis*, *Combretum imberbe*, and *Milettia stuhlmannii* are listed as Class I, which are prohibited from being exported from Mozambique in log form (though not prohibited from being imported into China).

Table 1. Timber species commonly exported from Mozambique to China

LATIN NAME	COMMON NAME	CLASS (IN MOZAMBIQUE)	MAIN USES IN CHINA	CHINESE STANDARD ROSEWOOD?
<i>Dalbergia melanoxylon</i>	Pau Preto	Precious	Furniture	Yes
<i>Afzelia quanzensis</i>	African Pod Mahogany	Class I	Flooring	No
<i>Swartzia madagascariensis</i>	Pau Ferro	Class I	Furniture	No
<i>Combretum imberbe</i>	Leadwood	Class I	Furniture	No
<i>Milettia stuhlmannii</i>	Jambire	Class I	Furniture and flooring	No
<i>Pterocarpus angolensis</i>	Umbila	Class I	Furniture and flooring	No

Source: You and Ren (2015)

1.2 Deforestation issues in Mozambique

As timber trade has continued to grow over the past several years, Mozambique's forests have suffered increasing deforestation. It has increased to an annual rate of around 0.58 per cent, or 219,000 hectares per year (Marzoli, 2007). Mozambique has attempted to control deforestation with various regulations but the gradual increase has made the management process more difficult. As China is the largest market for Mozambican timber, it can be assumed that Mozambique's timber trade with China contributes to deforestation.

1.3 Timber flow and data discrepancy

A previous study by GEI (Chang and Peng, 2015) analysed different sources of data and found major data discrepancies between China-reported data and those reported by African countries including Mozambique. The main concern about the China–Mozambique trade is that one of the reasons for China–Mozambique timber trade data discrepancies might be illegal timber trading.

It has been difficult to find data from Mozambique on the export of timber specifically to China. However, the volume of logs in 2011–2015 and sawn wood in 2015 reported by UN COMTRADE as imported by China from Mozambique has been higher than that reportedly exported by Mozambique to other countries (Table 2).

The GEI study summarised research that had identified a variety of factors that cause or impact on these discrepancies, such as unit and conversion differences, log-scaling methods, timber classifications, underreported invoicing and smuggling (Chang and Peng, 2015). Many of these possible factors may be controlled and managed during the official import and export procedures. But it is necessary to understand the process of how timber flows out of Mozambique into China and the existing regulations to develop a full context of the issues complicating the trade and possibly enabling an illegal network. As such, the next stage of our research was to hone in on the timber flow procedure itself and each country's respective regulations.

Table 2. Timber export/import data reported by Mozambique and UN COMTRADE (m³)

PRODUCT	SOURCE OF REPORT	2011	2012	2013	2014	2015
Logs	Global export reported by Mozambique	36,013	41,543	54,296	140,307	148,093
	Import to China from Mozambique reported by UN COMTRADE	226,184	321,443	342,115	1,367,019	523,183
Sawn wood	Global export reported by Mozambique	175,982	218,842	226,500	363,925	272,858
	Import to China from Mozambique reported by UN COMTRADE	120,655	121,362	140,332	106,306	1,183,091

2

Research objectives and methodology

This working paper was designed to study and compare data recording and verification procedures in the timber supply chain, including the customs procedures, for timber export and import from Mozambique to China, specifically focusing on the documentation and data-collection stages of timber trade procedures. Our intent was to explore and analyse potential gaps and differences between the procedures in these two countries, and understand the risks of procedural errors that might lead to data discrepancies. The study provides foundation for recommendations for the customs and relevant agencies of both countries to better harmonise data and policies in order to ensure Mozambique achieves its sustainable forest-management goals.

Many countries (most of which are China's timber importing partners) have implemented a ban on timber exports. Therefore, this study also serves as a model for similar comparative case studies between China and other timber-supplying countries, and sheds light on potential cooperation around timber trade policies and regulations.

Feeding into this report, we conducted two studies of timber trade customs procedures: one in Mozambique and one in China, using the following methods:

- In Mozambique, a **literature review** was conducted by UEM for the purpose of this study to learn about forest-related legislation and its role in data standardisation. Recent studies on timber trade

issues were also reviewed. To fill the gaps of the desk study, we conducted **semi-structured interviews** with key staff from relevant organisations, clarifying the key questions of the study. The government entities interviewed include the National Directorate of Forests (DINAF), the National Agency of Environment Quality Control (AQUA), provincial forest services (SPFs), the Mozambique Tax Authority (ATM) and the Provincial Directorate of Industry and Trade (DPIC) at the central and provincial levels. We also interviewed private-sector actors (forest concessions and timber exporters). The list of organisations interviewed can be found in Appendix I. We also used **observations and conducted unstructured interviews** with managers and workers during field visit to processing units and shipyards in order to collect additional information.

- In China, for the purpose of this study, GEI first completed **data analysis** from the UN Comtrade International Trade Statistics Database, the Food and Agricultural Organization Corporate Statistical Database (FAOSTAT) and Global Timber to expound on the general timber trade conditions and trends.¹ We also prepared a **literature review** to obtain information on the general customs procedures, documentation process and data record. **Semi-structured interviews** with Customs and CITES experts helped provide us with their professional experience and insights on potential procedural gaps and opportunities for next steps.

¹ See: <https://comtrade.un.org>, www.fao.org/faostat/en/#home and www.globaltimber.org.uk.

3

Mozambique-China timber trade: data-recording procedures

3.1 Pre-export data records

Data records are required from the beginning of the timber supply chain in Mozambique, and some of the way legislative procedures are implemented have implications for the subsequent export processes. This section is an abbreviated summary of timber trade procedures before timber is exported out of Mozambique.

3.1.1 Licensing

Licenses are issued by Mozambican provincial governments as authorisation for timber harvesting, and are a key source of data for authorised harvest volumes. Article 3 of Decree 30/2012 (Government of Mozambique 2012) sets forth requirements for timber operators to submit applications to the SPFs, including proof of national citizenship or published statutes of the company and commercial register. For small areas of harvest, a five-year 'simple license' is issued that requires an annual harvest volume of 500m³. To obtain a long-term concession license for a large area, applicants are required to submit an approved management plan which involves an inventory of available volume and species to be harvested, as well as a maximum allowable annual cut volume that limits the harvest volume every year. The verification procedures for claimed volume estimates in the management plan

are also only variably applied – which means licensed volumes may not be based on what could be sustainably harvested in reality.

During in-field interviews, our research team also found that a major constraint during licensing is the use of non-uniform models for data recording and differences in how data is presented within licenses and transit permits at provincial and national levels, even though the legislation establishes the need for uniformity. We also learnt that there are provinces where licenses are issued manually or filled in by hand, sometimes making it difficult to read or verify facts and introducing doubts about the authenticity of the documents.

3.1.2 Harvesting

Articles 18 and 21 of Decree 12/2002 (Government of Mozambique 2002) require provincial governments to keep records for the number of annually authorised licenses and the recording of species, tree diameter and volume quantities on the licenses. At felling sites, a records book is used to record logs cut at the harvesting site in a given year in sequential order (the first logs cut are the first recorded in the book). In that book, each sheet is prepared to include information for one licensed tree species: date of registration, number of logs derived from the tree, cross-section measurements of diameter at the bottom and top of each log. The volume of a log is calculated using the

average diameter with a set formula. Nevertheless, data inaccuracy may exist as the research team found that the methods used for measuring log diameters vary between different companies. Some operators measure the diameter including the bark, some without, and in other cases a different technique called *meio borne* is used that differs from the former two (see Figure 1). The inconsistency in diameter measurement methods can lead to inaccuracies in volume calculation and records (see Box 1).

BOX 1. EXAMPLE OF ERRONEOUS DIAMETER MEASUREMENT DURING LOGGING

Suppose that an operator has a license for harvesting 200m^3 of a given species with the average cross-diameters based on bottom and top log diameters measurements of 45cm . The thickness of the bark is 1.2cm and the average length of the logs is 3m . Using the average diameter formula, the average volume with bark is 0.4771m^3 and the volume without bark is estimated in 0.4520m^3 . When assessing the diameter and therefore the volume **with** bark, only 419 logs are requested for logging. But when assessing the volume **without** bark, 442 logs are needed, which equates to about 211m^3 of logs with bark. If the operator harvests all the licensed volume, he will cut about 5 per cent of the volume in excess of that assigned in the license. MINAG (2005) establishes a factor of 1.04 for the conversion of volume without bark to volume with bark, which means about 4 per cent of the volume is bark.

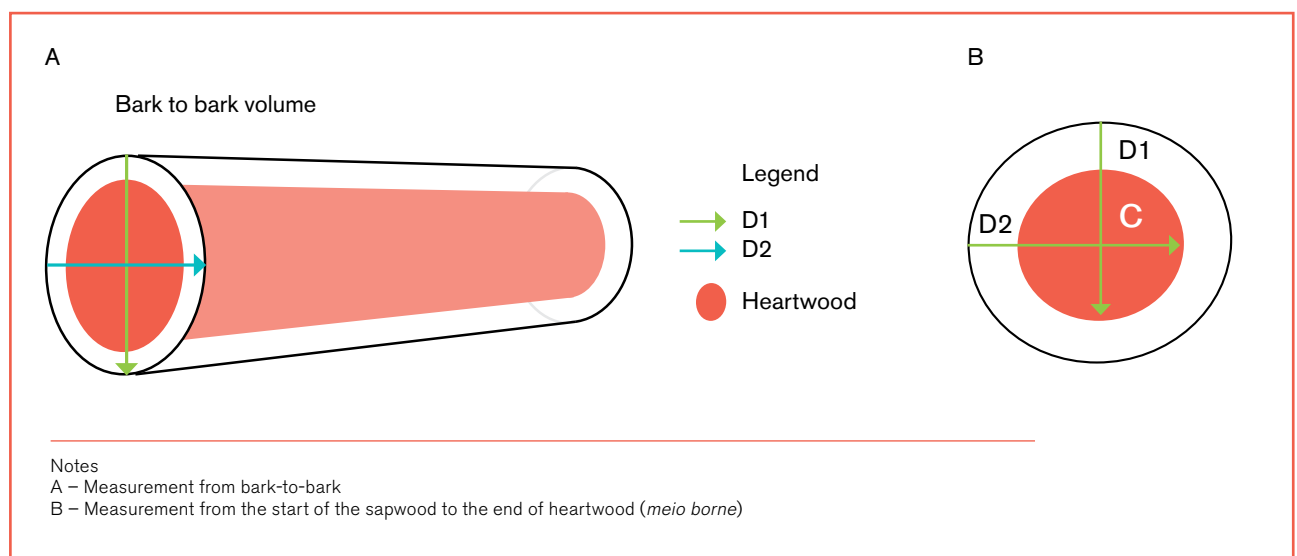
As logs arrive at the main landing, their data is recorded in the landing site's records book in sequence as they arrive (not necessarily in the order in which the logs were cut). This makes it difficult to compare data to the records book at the harvesting site. Both books are intended to be used for one year, although SPFs can authorise the use of the same books for the following year when they consider the books are still in good condition. The records book at the main landing does not contain a specific column to register logs that are to be transported, so the forest operator must be careful to mark logs selected for transport. This manual process may lead to inadvertent loss of log information about which logs brought to the main landing actually end up being transported. The operator should send a monthly sheet with statistical information of logging and wood processing to the local district services for economic activities (SDAE). There is no consistency however of these sheets at national level and an integrated computerized record-based system is therefore needed.

3.1.3 Transport

According to Article 10 of Decree 12/2002, SPFs are responsible for issuing transit permits which contains volume information of the timber being transported. As wood is being transported, the operator needs to fill a transit permit indicating the amount of wood being transported and the specific means of transport. A copy of certified license as well as a completed timber-specification form need also to be prepared to accompany the transit permit for the transportation of timber.

Transit permits are produced in four copies for different uses: the first is kept in the SPF archive, the second is collected at the province's strategic checkpoint, the third follows the timber load throughout the checkpoints

Figure 1. Two current practices of measuring log diameter



until it reaches its final destination, and the fourth is delivered to the SDAE where the logging took place to be recorded for statistical purposes.

The control of transit permits assigned to the forestry operators is an important key for minimising the possibilities of unlicensed timber being transported. Each company or forest operator is assigned a number of transit permits by the SPFs based on the licensed volume in their annual harvesting licenses. The SPFs keeps records of transit permits being issued by establishing a book for recording transit permits assigned to forest operators. The SPF also has a form for recording the transport of licensed forest products to keep track of the amount of wood being transported by operators, by recording delivered volumes that pass through the strategic checkpoints and updating the remaining volume for harvesting/transport for each license and operator. As already mentioned, these transit-related books and forms are completed manually. Digitising these forms and entering the data into an integrated database could allow greater flexibility in the control of volumes.

At checkpoints, law enforcement officers examine the documentation for the load: the certified copy of the license, the transit permit and the timber specification form. Then the volume of the truck's load is estimated based on the officer's experience – measurements only take place when they suspect there is an excess of volume.

Similar to those available in SPFs, the strategic checkpoints also hold forms for recording the transport of licensed forest products, to record the volume of timber transported throughout those checkpoints based on transit permit data. Additionally, there are forms at the checkpoints to record specific transportation information, including: licensed and transported volume, type of product, species, number of the book and transit permit, provenance, and destination of the product. The original completed forms are periodically returned to the SPFs for verification and control.

For concessions where processing units are located within the boundary of concession's area, there is no need for a transit permit for transporting timber within the concession. In this case, the control of logging

volume is through verification of the log records books kept at the harvesting site, main landing, sawmill (including records of when the product exits the sawmill). Transit permits are deployed for the transportation of processed wood products in those concessions and their registration at checkpoints and in SPFs. Conversion factors of 1.1–1.2 are used to convert the volume of squared processed timber into log volumes and a factor of 1.8 is used for the conversion of the volume of live-sawn planks to log volume. There is no legal requirement for the correct use of conversion factors. What happens is determined on site.

3.1.4 Processing units and shipyards

Once at the sawmill yard/shipyard, it is possible to re-estimate the log volume through calculations based on log diameters using the same method as used at the main landing, although the common practice is only to consider the volume registered in the transit permit. A different formula is used to calculate volume of processed wood (see Appendix 2). The records book for logs delivered to the sawmill and the records book for when the product exits the sawmill are used to record timber volume data at the sawmill yard/shipyard. Both contain fields for recording information of the transit permit (book number, number of the transit permit, date of arrival or exit of the timber, volume, species, nature of the product), license information (date, license number and beneficiary) and a section for observations.

Constraints in volume estimation of unsquared timber are twofold. Firstly, there are problems in reaching consensus regarding the point where the measurement of the width should take place since the width of unsquared boards and planks is not the same throughout the length. This may be a source of data-recording errors. Secondly, a more commonly used method for volume estimation of processed wood is again through conversion factors: 1.8 for logs to sawn timber and 1.1–1.2 for logs to unsquared boards and planks. Either way, there is room for inaccuracy in the estimated volume of unsquared timber boards and planks that may contribute to discrepancies.

3.2 Mozambique export procedures

The procedures for timber export can be found in the legislation, particularly Act 7/2010 under review, and its regulatory instrument Decree 21/2011 (Government of Mozambique 2010; 2011). Even though under review, the instruments and procedures will continue to play a key role in the data records after revision. Summaries of those procedures can also be found in documentation from the Mozambique Tax Authority. This section describes the key steps in customs procedures for timber exported from Mozambique.

3.2.1 Requests to Provincial Forest Services (SPFs)

As set forth in Article 7 of Decree 21/2011, the exporting agent should submit a letter to the SPFs requesting authorisation for timber export and inspection. The letter should specify: the name of the company, its taxpayer's single identification number (NUIT), contact details, location of the timber yard, species of timber, type of product (logs, boards, planks or others), volume, product origin, place for inspection of timber, value of the product to be exported (which is estimated by the exporter based on the reference wood tariff for export from the Ministry of Agriculture and Food Security), the consignee, country of destination, place/port for shipment, means of transport (by sea, land) and the name of vessel. Volume data should also be attached: for logs, this is done by attaching a copy of the transit permit, and for sawn wood, by attaching a document listing the volume of each board or plank.

3.2.2 Document verification

After an initial screening, the request is delivered to the SPF inspection office, where verification takes place regarding the legality of the transit permit and the routes used to transport the timber to the yard. SPFs also need to verify transit permits issued within the province where the export will take place, to record the data using the form for recording transport of licensed forest products. Additionally, the total volume marked on the transit permit is compared to the annual licensed volume of the

forest operator. While volume data for logs are directly compared, those for unsquared wood is verified after applying a conversion factor of 1.1–1.2 (depending on the province). Verification is to confirm whether the volume of unsquared wood to be exported (in cubic meters of log equivalent) is 10–20 per cent higher than the total volume recorded in the transit permits attached to the process. These varying conversion factors across different provinces are undoubtedly a source of discrepancies in data records.

After document verification, the product is inspected at the processing unit shipyard to verify there is enough volume for export and to detect any irregularities on the product (site verification). The inspection basically consists comparing the volume requested by the applicant for export the existing volume in the yard an estimate based on the experience of the SPFs officers, verification of species as well as the verification of the maximum thickness of processed wood. an inspection report which serves as the basis for issuing the export authorization by the SPFs is produced by the inspection team. The SPFs then issue an export authorisation and the exporter is then able to move to the next step in the customs procedure. According to Article 8.2, the SPF issues a five-fold export authorisation: the original copy is kept for customs, while a copy is attached to the exporter's process with SPFs, a copy is sent to both the Provincial Directorate of Industry and Commerce and to the exporter, and a final copy remains in the SPF files.

3.3.3 Requests to customs

In accordance with Decree 21/2011, the operator (through its customs agent) submits an export request to the local customs office. The request form is available online.² It consists of an application for authorisation for timber export and a request for assistance in packaging. When submitted, other documents should be attached to the form, such as the SPF export authorisation, a phytosanitary certificate, certificate of origin and a commercial invoice, among others. The information required by the form includes the names of the customs agent and exporter, type of merchandise to be exported, quantities/volume of the product according to the SPF authorisation for the export, customs value and export fees.

² See: www.at.gov.mz or www.mcnet.co.mz

3.2.4 Packaging and inspection

Once the request has been approved, a packaging assistance team is formed, which includes an SPF's law-enforcement officer and an agent of the Mozambican Tax Authority as per Decree 21/2011. Packaging can be done at a shipyard within or outside of the city or within the port area, and the exporter covers all costs of moving the team to the packaging place.



Packaging timber using a front loader © Andrade F. Egas



Packaged wood is loaded onto containers © Andrade F. Egas



A container loaded with unsquared planks ready for transportation © Andrade F. Egas

During packaging, the SPF's officer is responsible for inspecting the volume and species of timber products to be exported, and detecting any irregularities. Based on their experience, the SPF's officers compare the volume requested by the applicant for export with the existing volume in the yard. For example, usually random samples of sawn wood are selected for volume estimation (measuring the length, width and thickness), and the sample volume is then multiplied by the total number of units that fit in the container to obtain the total volume. In the case of logs, the SPF officer estimates the volume by measuring the cross diameters (bark to bark) at both ends and applies the average diameter formula. However, because it is a slow process with cost implications, those procedures are not often used the volume claimed by the exporter is often used instead. As an example of cost implications, in Nacala, the packaging assistance is provided in the special cargo terminal. Packaging here must be done within a maximum of three days. The cost per container to be packed is Mt 7,800. If the process exceeds three days, there is an additional cost of Mt 250 per day per container.

An alternative and faster method to estimate timber volume is done on the basis of reference volume per 20-foot container. Reference volumes ranging from 10 to 12.5m³ for logs and 13 to 15m³ for unsquared timber were pointed out during our field visits for this study. In a study conducted by WWF & Miombo Consultores Lda (2015), based on interviews with the private timber sector in different provinces, the range of 11 to 12m³ per container for both logs and processed timber was also cited as the norm.

The containers are sealed once the packaging is completed. The container seal is then never opened again except in adverse instances (such as if the container is crushed or if there is a suspicion that a false declaration of volumes and species has been made etc). The team then produces a joint packaging assistance report, containing information of quantity, type, individual volume, and volume by tariff heading, volume per tree species, container number and stamp number. A volume check is done by comparing the volume designated on the transit permit and that on the packaging report. If the total of the transit permit indicates a higher volume than that being exported, the balance must be included in the packaging report. And for the authorisation of the remaining volume for the next stage of packaging/export, the exporter must submit an application to the SPF's and customs. The joint packaging assistance report is the background document for the subsequent export process and for recording timber export statistics.

3.2.5 Timber overvaluation tax (TSM)

In addition to the regular customs procedures where export volume data is recorded, the timber overvaluation tax (TSM) is another legislative instrument that requires the recording of export data. Article 1 of Act 7/2010 establishes TSM as one element of the national taxing system. TSM is charged for logs or processed timbers for export. Decree 21/2011 details information that is necessary for the application of TSM, namely the requirements of the timber exporter, export application, export authorisation, packaging and sealing of containers, and inspection of the export process.

3.3 Potential sources of data errors in Mozambique

Based on the available information, we see that potential sources of volume data discrepancy can include differing procedures for measuring diameter, recording and verifying timber volumes in the logging areas, main landings and checkpoints as well as during the packaging stage. The volume errors are not cumulative. There is one set of errors that can be introduced during felling and transport – and a different set of errors that can be introduced during packaging.

3.3.1 Logging

During logging, inconsistent diameter-measurement procedures can create data errors. Once the trees are felled, their cross diameters with bark are measured at the bottom and top of the logs as well as the length of the logs. However, there are cases where operators measure diameters without the bark, and in others cases the diameters are measured from the beginning of the sapwood to the end of heartwood, a technique called *meio borne*. Taking account that the licensed volume refers to volume with bark, the later procedures for diameter measurement lead to an underestimation of the licensed volume registered in the records books at the harvesting site and the main landing, as well as in transit permits (see Figure 1).

3.3.2 Main landing

At the main landing, the lack of control on volumes that exceed the licensed volume could also contribute to data error. Timber loading is carried out by the operators themselves, who record the volume of timber being loaded on the timber specification form. There is no mechanism for direct and systematic control of loading by SPF law-enforcement officers or other government agents. UEM (2013) found that harvesting volumes in excess of the licensed volume is one of the main

irregularities, ranking fourth among eight irregularities for forest concessions and third among six irregularities for simple license operators. Because field inspection can be difficult and impractical, loading volumes in excess of the annual licensed volume is often overlooked at the main landing site.

3.3.3 Transport and verification at checkpoints

Volume verification at checkpoints, although meant to limit or discourage transporting timber in excess, is also unreliable in detecting excess volume. As wood is transported, it passes through checkpoints. These are meant to conduct detailed verification of whether the volume is in accordance with legislation. Yet in practice, checkpoint officers check wood species and their diameters and volumes mainly based on their own experience. If there is any suspicion of volume excess, a sample of logs is selected for immediate measurement and the average volume is calculated. The average volume is then used to calculate the total volume of the load based on the total number of logs in the truck. Due to the large variation in diameter, length and shape of the logs, this procedure does not seem to be reliable for detecting any underestimation of the transported volume.

Exceeding licensed volumes from the main landing to the processing unit or shipyard can be caused by a number of factors:

- Transporting loads with valid transit permits but with an undetected volume excess,
- Using false transport permits (such as unused permits for previous timber loads), or
- Transporting timber without permits (by circumventing checkpoints).

These factors may result in lower volumes than the real volume being transported and recorded at checkpoints. For reasons discussed below, it may be in the operator's interest to get more timber to the packing sites than their annual licensed volume.

3.3.4 Packaging

Volume estimation and verification at packaging site is constrained due to limited time to measure individual boards, planks or logs. Due to high loading volumes and the slow process of loading wood into the containers, packaging usually takes several days and it is practically impossible to count or verify the volume of each log, board or plank with only one SPF officer.

To quickly estimate the volume being packaged, a reference volume per container of 20ft is used with a piling conversion factor (PCF), which is the ratio of the solid volume of logs or processed wood to the corresponding container volume. In Mozambique, empirical reference volumes per container of 20 feet are usually applied ranging from 10 to 12.5m³ for logs and 13 to 15m³ for unsquared processed wood. Taking into account that a 20-foot container has an internal volume of about 33m³, the reference volumes adopted correspond to piling conversion factors ranging from 0.30 to 0.38 for logs and 0.39 to 0.45 for unsquared processed wood. Thus, it can be assumed that between 30 and 38 per cent of the useful capacity of a container is filled by the actual volume of logs and between 39 and 45 per cent by the volume of unsquared processed wood. This instinctively seems rather low.

The use of piling conversion factors of volume in containers to solid volume has been recommended in the literature by different authors and for different species due to its practicality for quick estimation of volumes of logs. However, the literature often refers to piling conversion factors for small diameter logs, as summarised further in Appendix 2. No piling conversion factors were found in the literature for commercial logs of large-diameter hardwoods. Nevertheless, available evidence should lead us towards a conclusion that the real PCF of large diameter logs should be much higher than the values of 0.30 to 0.38 used in Mozambique. For example, a PCF for other hardwood logs of 0.65 was recommended by CATIE (2012) based on firewood logs. With references to these, and other previous studies, it is estimated that the real reference value would allow roughly 21.45m³ of logs per container. This means that in current Mozambique systems, 72 per cent of the packaged log volume should not be recorded for the completely filled container.

These volume differences – between the volume estimated to be within containers using faulty piling conversion factors and the real volume in those containers – show how volumes that exceed the annual licensed volume can be packed undetected into containers. These excess volumes then reach shipyards and are exported without record in official export statistics which is based only on the joint packaging assistance report – as long as they remain undetected during the processes of logging, landing and transport. Previous research has also suggested other factors which affect wood volumes in containers. We suggest that rigorous studies be carried out taking into account these factors in order to obtain more accurate piling conversion factors for the wood being exported from Mozambique and confirm the hypotheses stated above.

3.4 Chinese import procedures

China employs a unified customs procedure for imported products including timber. This section summarises the customs procedures for products being imported in China, with an emphasis on special conditions for timber-related products.

3.4.1 Quarantine inspection

Imported timber is first required to undergo a quarantine inspection carried out by the China Entry-Exit Inspection and Quarantine Bureau. As imported timber products should not carry any forbidden pests or tree bark, an official phytosanitary certificate or plant quarantine certificate from the exporting country is required. Any logs with tree bark or those lacking the required certification need to successfully pass pest control in order to obtain a certificate of pest control. This certification must specify the method, pesticide used, and the time of pest control. After the quarantine process is confirmed, the bureau issues a customs paper for imported goods that is later presented to the customs agency to officially start the customs process (Zhangjiagang Entry-Exit Inspection and Quarantine Bureau 2001).

Quarantine inspection is charged at around 0.2 per cent of the total price of the imported timber. The price is reported by the importing individual or company who should also provide the receipt for the timber products.

3.4.2 Product verification

Following the quarantine inspection, the official customs procedure starts when the importer files a customs declaration for the import of timber products. The customs agency then conducts product verification by confirming the required product information and documentation, including product name, specifications, classification, Harmonised Commodity Description and Coding System (HS) code, after-tax price, and the certificate of origin. Product samples are also required when necessary.

Product classification is determined according to the Catalogue of Customs Statistics of the People's Republic of China. The catalogue follows the internationally-unified HS code, which was formulated by the Customs Cooperation Council, as well as other systems and rules related to domestic sub-categories and customs tariffs.

An eight-digit HS code is used in China. The first six digits are the internationally unified HS code while the additional last two digits are determined by each country's domestic customs tariff, statistics and trade management conditions. Therefore, while records of Chinese timber trade data may go into detail for each eight-digit sub-category, one should only compare the data available for six-digit categories with the data from Mozambique or other countries, to safeguard against potential differences in the domestic sub-categories. For example, while many studies are specifically concerned with rosewood logs (eight-digit HS code 44039930) imported from Mozambique to China, it is not possible to find the same eight-digit code in Mozambique to match the same rosewood log. In this way, tracking a log across customs can be very difficult, if not impossible.

3.4.3 Electronic document verification

After product verification is completed, the document verification process begins. Since the Chinese customs have become digitised, electronic document verification is usually used to process all possible documents from a customs declaration. Using pre-set data and parameters, the customs computers automatically process declaration data and determine whether to reject or accept the declaration. If rejected, the declarant receives a formal notice of the rejected declaration and may make modifications for a new declaration. If the electronic declaration is verified and accepted, the computer system automatically records the acceptance time and determines its next channel.

3.4.4 Manual verification and customs passage

Based on the computer system's risk evaluation, documents and tariff issues, the declaration may be passed on from electronic verification to manual verification. Manual verification is executed by the Centre for Document Verification directly under the General Administration of Customs. The customs officers conduct a comprehensive verification review process by examining electronic declaration data with paper declaration and proof documents, i.e. processing trade manual, tax exempt approval, business credit of the importing company, electronic data of the manifest and price information documents etc. The cross comparison between electronic and paper documents is done to ensure that electronic data match the paper declaration data and that declaration data match the information on the proof documents. Importers will be given a notice of processing pending when their declaration is put forward for manual document verification.

For timber imports specifically, the documents required include the trade contract, receipt, packing list, processing trade manual, delivery bill and customs power of attorney, authorisation letter for inspection request, inspection certificate of fumigation, certificate of origin, phytosanitary certificate, and import/export permit (see Table 3). Additionally, depending on whether the timber species is listed in the CITES appendices, a different certificate may be required for different timber species.³

For example, importing CITES-listed timber species also requires that the application be completed for a CITES import license from the China CITES office; this license checks and verifies the CITES export license from the exporting country, as well as other proof of timber sources and trade contracts. If the timber species to be imported is not listed in the CITES appendices, such as the ones imported from Mozambique, the application then requires a certificate for non-regulated species listed in the HS commodity appendix of import and export on wild fauna and flora. To obtain the non-CITES certificate, a wild fauna and flora and related products application should be filed to the provincial forestry bureau and the provincial CITES office at the entry port of the timber products. Required documents include an export and import contract agreement and a source verification document (which can be an export certificate from exporting countries), CITES document and certificate of origin (or another document that shows approval for export from exporting countries). The provincial CITES office then examines the documents to make an initial decision that is later transferred to the national CITES office and the State Forestry Administration for verification and approval.

In addition to securing all required species documentation, the prices for importing must be settled. Price arbitration may occur during the verification process if the Centre for Verification believes that the declared product price is lower than expected. In this case, the Customs Assessment Office produces a price estimation through product examination and communication with the product owner. The customs may also adjust the price after examination. Only when a price agreement is reached can the customs procedure continue to the next stage of review. If the price cannot be settled, the importer may make a security deposit to allow the product to be released from the customs first, and make payment or get refunded when a price is determined. As we discuss in the next section, price arbitration is a potential reason for discrepancies in recorded timber trade values.

Besides the manual verification process, there are three other possible scenarios that could happen after electronic document verification. First, the declaration

³ See www.cites.org/eng/app/appendices.php#flora5

Table 3. Requirements for CITES vs. non-CITES timber species importation

CITES	NON-CITES
<p>Apply for CITES import license from China CITES office</p> <ul style="list-style-type: none"> ✓ CITES export license from the exporting country ✓ Proof of timber sources and trade contracts 	<p>Apply for non-CITES certificate</p> <p>Certificate for non-regulated species listed in the HS commodity appendix of import and export on wild fauna & flora</p> <ul style="list-style-type: none"> ✓ Wild fauna and flora and related products application ✓ Export and import contract agreement ✓ Source verification document <p>The certificate is obtained through the provincial forestry bureau and the provincial CITES office → national CITES office and the state forestry administration</p>

Source: Compiled from Yue (2014)

may be passed on for onsite examination of documents and tax collection, with a notice of onsite document acceptance sent to the importing entity. Second, the declaration may go to Customs Discharge to be double checked, sending a notice of discharge document acceptance. Third, when a notice of discharge without paper documentation is given, the declaration may be sent to Customs Discharge without paper documentation.

As the verification and passage procedures are completed, the customs computer-management system will automatically mark and archive relevant documents and data.

3.4.5 Product examination

Product examination is the legal execution action of the customs assessment of the products, and confirms that the declared data are in accordance with the actual volume of timber being imported. Product examination should be carried out by at least two customs examination officers, both of whom must wear official uniforms. Examination may be conducted either as a spot check or a thorough check and can be done manually by looking at the outside appearance, by opening the container to check inside, or by machinery that uses more advanced technology.

It should be noted that while customs examinations are free of charge, the importer is responsible for any moving, unpacking and repackaging of the products required during the examination.

3.4.6 Tax payment

Customs duties for imported products are calculated in accordance with the regulations of the People's Republic of China on import and export duties and other related laws. After product verification and examination, the customs agency must send a due payment form

to the importer/tax payer who is required to go to an authorised bank to make the payment within 15 days.

To encourage timber imports, China collects no import tariff on timber products imported into China. China further privileges the import of logs by requiring a value-added tax rate of 13 per cent for logs, 17 per cent for sawn woods and 20.5 per cent for veneers (Forest Legality Alliance 2014).

3.4.7 Customs release

Once tax payment is cleared, the products can then be released with customs releasing appropriate signals that all the verification and monitoring of the declaration data, documents and the actual products have been completed. While customs release is a necessary prerequisite for product discharge, the actual release of the products out of the port also depends on logistics, transportation and management issues. Many timber and related products are required to be fumigated and disinfected before being released out of the port.

3.4.8 Payment verification

Import payment verification is the conducted by the State Administration of Foreign Exchange or Foreign Exchange Authorised Bank checking if a foreign exchange payment is matched with the products being imported. An importing company usually needs to first acquire an import-export permit, and register as a foreign trade company with a China electronic port entry certificate. It should also ask to be added into the importing company directory at its local registry.

One month of after the customs declaration, the importing company must go to the Foreign Exchange Bureau to have the import verifications marked, and take the related documents to the authorised banks for payment verification.

3.4.9 Nationwide general customs statistics

The customs statistics of the trade of products is calculated based on the declaration data. The recorded information includes product HS code, number, price, country or region of origin, trading company, destination in China (for imported goods), origin in China (for exported goods), forms of commerce, transportation method and the entry port, etc. It is also important to note that, when considering annual statistics, Chinese customs statistics follow a solar calendar that begins in January, rather than a fiscal year.

When determining price, imported products follow the Cost, Insurance and Freight (CIF) international shipping agreement as they arrive in port, while exported products follow the Free on Board Agreement (FOB) as they leave the port, with the importer paying for insurance and freight. Importantly, the specific definitions of CIF and FOB are not the same in each country. Given this, it is likely that the different recorded price for the products in China and Mozambique may reflect general discrepancies in the timber trade values.

For nationwide recording and statistics of the products, the customs declaration data is transferred to local statistics departments for data checking and verification. Every month, the local statistics departments report to the General Statistics Department of the General Administration of Customs. The General Statistics Department and the Customs Information Centre are responsible for trade statistics report and periodically release public data. Furthermore, the department is also responsible for reporting China's trade data to international databases including UN Comtrade and FAOSTAT. It is unclear if these databases consult other sources of information, however, future efforts to harmonise the data are likely to involve coordinating these databases to conduct data collection in both China and African countries.

3.5 Potential sources of data errors in China

With this description of the general customs procedure and data-recording process, we see that China employs many methods across different stages to ensure that the imported timber is in accordance with domestic regulations as well as the international CITES agreement. China's customs procedures also maintain a complete record of all the timber products being imported through customs. But despite being a fairly thorough process, potential misrepresentations and risks still exist and may allow timber products to pass through customs with an incorrect record. There are five main ways by which differences between data reported by the two countries can exist.

3.5.1 Forged documents

First, it is unclear how the Chinese customs and the China CITES office distinguish between real and forged documents from exporting countries such as the certificate of origin and the CITES export license. While presentation of these documents is required for product and document verification processes, these documents are usually photocopies rather than original copies, thereby raising the risk of using forged documents.

3.5.2 Difference in data-recording methods

Data-recording methods are a second reason for the difference between China's and Mozambique's figures. During the document verification stage, possible price arbitration may lead to differences in values recorded by the two countries. Also, while many countries conduct trade statistics using the fiscal year, China customs trade data statistics reflect the calendar year. With these differences, it is necessary to compare the time periods used by Mozambique and China. Additionally, it should be noted that when cross referencing the trade data reported by different countries, only the first six digits of the HS code can be used, as inclusion of the seventh and eighth digits vary by country.

3.5.3 Classification: logs versus sawn wood

There is also anecdotal speculation that China and Mozambique's differing timber classification standards can also result in data discrepancies. For example, in China sawn woods are defined as woods that have undergone a certain extent of processing. This 'extent of processing' for sawn wood in Mozambique is comparatively much lower: in fact, logs that are roughly cut into pieces may be classified as sawn woods in Mozambique. This difference in log and sawn wood definitions can result in unmatched data feeding into the different classifications.

3.5.4 Trans-shipment

It is also worth noting that transportation may also create potential issues in documentation and recording. In fact, timber shipments from Mozambique usually transfer through other countries and regions for repackaging and sorting, such as Comoros, Singapore, Malaysia and Hong Kong, before continuing on to China and other Asian countries (Ekman *et al.* 2013). There are also accounts that some timber exports from Mozambique are actually first transported to Tanzania, Zambia and Uganda, and then shipped out from these countries. Such complicated transportation routes may confuse the country of origin records at Chinese customs, as well as the country of destination records at Mozambican customs.

4

Analysis combining the Mozambique and China procedures

4.1 What's causing volume data errors?

Analysis of Mozambican export procedures shows the potential for major errors at several stages of the supply chain, such as circumventing checkpoints and volume estimation errors during packaging. When using reference volume per container to estimate the total volume of timber being packaged and exported, if each container is completely filled it can actually hold more than the volume that is officially recorded. This can cause significant differences between the officially recorded volume and the actual exported volume.

It is as yet unclear whether such differences also explain the trade data discrepancy as reported by the two countries respectively. Abiding by official procedures, the Chinese customs verify imported timber volume by checking contracted volume and export permits from Mozambique, which should therefore reflect the same volumes recorded in Mozambican official record. If timber that circumvents Mozambican checkpoints was to enter Chinese customs, the only possible way would be through the use of forged documentation to match the actual imported amount. In cases where Chinese

customs conduct an examination and discover that the actual volume is larger than the documents have claimed, it is timber that has been illegally smuggled and so therefore is not reflected in the official record of import.

4.2 Possible errors during container repackaging at transit ports

As noted above, trans-shipment may also introduce data errors. For example, in the case of trans-shipment in Hong Kong, the sealed packages may be opened and the timber redistributed to different countries. The destination country as recorded at the Mozambican customs may be Hong Kong. As the Chinese customs requires information about the country of origin, Mozambique would still be in the record no matter where the timber was transferred and re-packaged. As such, the import volume recorded in China might exceed that of export in Mozambique, which is in accordance with the pattern observed in UN Comtrade data in 2014 and 2015, and that in FAOSTAT.

4.3 Differences in data management

While comparing Mozambican and Chinese procedures for the export and import of timber products, we found that the different methods and styles of data management in the two countries have complicated the comparison. For example, in Mozambique it seems that the estimation of volume is based on the reference volume per container while the Chinese customs rely solely on the claimed volume except for occasional

irregularity checks. Also, the first-order unit for the timber trade record in China is weight in kilograms, instead of the commonly used volume unit of cubic metres in Mozambique. Additionally, China uses HS codes for timber specification, but Mozambique does not mention using it, making it difficult to compare the same kind of export and import. We also found that the official data records kept by Mozambican SPFs and national forestry departments is different to the UN Comtrade database, further confusing the analysis of data discrepancies.

5

Conclusion and future opportunities

Based on the understanding of export-import customs procedures and other stages of data recording in the timber trade supply chain from Mozambique to China, we have identified various possible sources of data discrepancies. Acknowledging that it is not yet practically possible to estimate to what extent the data discrepancies are due to these procedures, our analysis still provides an important foundation and clues as to how the two countries might better regulate the timber supply chain and manage customs procedures to fill the data gaps. Opportunities exist for cooperation between China and Mozambique on several fronts.

5.1 Strengthen regulations and implementation

Mozambique has already established a fairly comprehensive legal framework for the licensing, harvesting, transportation and export of timber products in the earlier stages of the supply chain. However, our study has found that monitoring at the actual operational level can be improved to ensure more accurate and consistent data records that are legitimate for comparison. For Mozambique, it is especially important that a more reliable method for verifying the volume of transported timber be established at checkpoints and more reliable conversion factors are used in estimating timber volumes within containers.

5.2 Develop and streamline data systems for timber tracking

While there is a legal requirement for harmonisation nationally, different provinces in Mozambique have differing operation procedures and data-recording styles. Therefore, when data from different provinces are gathered at the national level, harmonisation is problematic. We recommend that Mozambique develops a standardised data system for improved management across the whole country. Additionally, as documents in Mozambique are still mostly completed by hand at each stage of the export process, which presents problems in terms of accuracy and harmonisation, there may be opportunities for close collaboration between the two countries to construct an electronic system that can better integrate the processes and data. China may be able to provide assistance on other customs-related roles such as uploading timber trade data to international databases. For timber and other products that need monitoring from the start of their supply chain through to export, a tracking system may also be a good idea to allow for consistent data matching throughout the whole supply chain.

5.3 Mutual recognition of trade restrictions and possible use of CITES

Beyond documentation and data recording, which are both critically important to sound recordkeeping, a mechanism has yet to exist to foster bilateral recognition of trade restrictions on specific products. In fact, while Chinese customs strictly enforce control and management procedures according to domestic laws and regulations and the CITES agreement, Mozambican laws that forbid the export of many species of timber are not taken into consideration as logs come into the Chinese customs. Moving forward, the bilateral

cooperation between Chinese and Mozambican customs with mutual recognition of relevant policies could provide the pre-conditions for effective policy implementation and illegal timber trade prevention.

The China–Mozambique case could serve as an example for other countries in Africa where timber trade with China has found discrepancies in data. We hope that the customs departments, forestry departments and other relevant stakeholders in China and Mozambique will take advantage of the findings from this study to foster communication and exchange, and eventually work together to fill the gaps in policy, regulations and operational capacity, so that procedural causes for data discrepancy can be eliminated.

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Appendices

Appendix 1. Organisations interviewed

ENTITY	CATEGORY
City of Maputo	
National Directorate of Forest	
Mozambican Tax Authority	
Province of Sofala	
Provincial Forest Services of Sofala	
Commercial Chamber of Beira	
Provincial Custom Services of Sofala	
Indústria Madeireira de Moçambique	Forest concession
Madeiras Preciosas de Moçambique	Forest concession
Easter Trading	Exporter
Chang Commercial	Exporter
Province of Zambézia	
Provincial Forest Services of Zambézia	
Provincial Directorate of Industry and Commerce of Zambézia	
Provincial Custom Services of Zambézia	
MADEIRAS ALMAN	Forest concession
CHUNPING WU	Exporter/ Forest concession
SUNFLOWER, LDA	Exporter/ Forest concession
Province of Nampula	
District Services of Economic Activities of Nacala	
Provincial Custom Services of Nampula	
M.A.O Concession	Forest concession
F. N. Concession	Forest concession
Rovuma Sawmill	Exporter of Nacala
Province of Cabo Delgado	
Provincial Forest Services of Cabo Delgado	
Provincial Directorate of Industry and Commerce of Zambézia	
Provincial Custom Services of Cabo Delgado	
M. Z. Concession	Forest concession and exporter
Mahate Florestal	Forest concession

Appendix 2. Formula to calculate volume of processed wood

The volume of processed wood is calculated through the following formula.

$$V_p = C \times L \times E \quad (2)$$

Where:

V_p – volume of processed wood (m^3)

C, L e E – length, width and thickness of processed boards or planks (m)

Appendix 3. Literature review on piling conversion factors

The use of piling conversion factors of volume in esters to solid volume has been recommended in the literature by different authors and for different species due to its practicality for quick estimation of volumes of logs. However, the literature often refers to piling conversion factors for small diameter logs, as summarized in the table below. Batista and Couto (2002) pointed out, piling conversion factors ranging from 0.58 to 0.64 for logs of 2.2 m of *Eucalyptus sp.* of different diameters. Fringer (1992) as cited by Barros (2006) observed an increase in the conversion factor in stacked wood of *Eucalyptus sp.* from 0.52 in the diameter class 5-9.9cm to 0.71 in the diameter class 30-35cm. Câmpu et al. (2015) obtained conversion factors ranging from 0.51 for logs of 13 cm in diameter to 0.72 for logs of 23 cm in diameter for different European species. González et al. (2010) obtained the equation $y = 0.212\ln(x) - 0.063$ for the estimation of the conversion factor *Pinus caribaea* as a function of the smaller log diameter, from which it is estimated that stacked logs of 35 cm at smaller diameter has a piling conversion factor of 0.69.

Table 4. Piling conversion factors of log wood from different studies

STUDY	RELEVANT INFORMATION	PCF
Batista and Couto (2002)	<i>Eucalyptus sp.</i> Logs of different diameters	0.58 to 0.64
Fringer (1992) as cited by Barros (2006)	<i>Eucalyptus sp.</i> Logs, diameter 5–9.9cm	0.52
	<i>Eucalyptus sp.</i> Logs, diameter 30–35cm	0.71
Câmpu et al. (2015)	Logs of European species, diameter of 13cm	0.51
	Logs of European species, diameter of 23cm	0.72
González et al. (2010)	<i>Pinus caribaea</i> Logs, diameter of 35cm	0.69
CATIE (2012)	Logs of tropical hardwood for firewood, non-specified diameter	0.65
Key informants in this study	Industrial hardwood logs	0.30 to 0.38

China is now the largest destination market for African timber exports, having seen significant growth in timber trade with African countries over the last decade. This has important implications to the sustainable development of forests in the exporting countries, where forest resources are being depleted. Regulation on timber trade, especially illegal timber trade, is therefore of increasing importance. This report investigates trade data discrepancies by examining the documentation process and data collection of the customs and other relevant agencies in China and Mozambique. Two studies of timber trade supply chain and customs procedures were conducted separately in Mozambique and in China, by the Faculty of Agronomy and Forestry Engineering of Eduardo Mondlane University (UEM) and Global Environmental Institute (GEI) using data analysis, a literature review, and semi-structured and unstructured interviews with various stakeholders. After comparing the procedures between the two countries, this report identifies differences and gaps in regulations and implementation in the two countries, and finally offers recommendations for future studies and customs engagement.

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