PANDA MITI KIBIASHARA

PARTICIPATORY PLANTATION FORESTRY PROGRAMME

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ASSESSMENT OF WOODLOTS AND FOREST-BASED ENTERPRISES

United Republic of Tanzania
MINISTRY OF NATURAL RESOURCES AND TOURISM
Forestry and Beekeeping Division

Embassy of Finland
Dar es Salaam

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PFP 2 baseline data collection

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1 November 2021

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ABBREVIATIONS

BW	Bioenergy / wood by-products
DBH	Diameter at breast height
EUR	Euro
FHC	Forest harvesting contractor
FIC	Forest industry development cluster
GIS	Geographic information system
Hdom	Dominant height
HRBA	Human rights-based approach
ODK	Open Data Kit
OSH	Occupational safety and health
PFP	Participatory Plantation Forestry Programme
PGIS	Participatory geographic information system
PPE	Personal protective equipment
RBMF	Results-based monitoring framework
SME	Small and medium enterprises
TFS	Tanzania Forest Services Agency
TGA	Tree growers' association
TIN	Tax identification number
TZS	Tanzanian shilling
WSP	Wood secondary processing

EXCHANGE RATES

EUR to TZS	2 700

EXECUTIVE SUMMARY

Background and methods

This document describes the methodology and findings for two field surveys carried out under the framework of the baseline data collection of the Participatory Plantation Forestry Programme (PFP 2): a survey on smallholders' woodlots and a survey on forest-based businesses.

The baseline data collection described herein was done in two rounds. The first was conducted in 23 villages belonging to Makete Forest Industry Development Cluster (FIC) during September and October of 2020 and the second was conducted in 22 villages belonging to Mafinga and Njombe FICs during June and July of 2021.

The survey on smallholders' woodlots included a participatory GIS exercise carried out prior to the actual field survey. During this exercise, smallholder tree growers, guided by experts, mapped their woodlots using satellite images. The results were used to identify a sample for the subsequent field survey, which included field visits to the selected woodlots to conduct observations and measurements.

The survey on forest-based businesses included interviews with owners of forest-based SMEs in the same target communities where the survey on woodlots was conducted. In addition, field visits were made to the sites on which some of the SMEs operated. A sample of large forest-based companies was targeted separately through a structured questionnaire.

The final sample included 1 445 woodlots mapped through the participatory GIS exercise; 733 woodlot owners, 83% of whom were men; 887 woodlots surveyed in the field; 531 forest-based SMEs, of which 310 were interviewed; and data from 18 large forest-based companies. Data from each of the three FICs was considered in its own stratum.

Results from the survey of smallholders' woodlots

Most of the woodlots surveyed in the field grew pine, some were eucalyptus, and a few were cypress or black wattle. The woodlots were typically small, with the median woodlot size of the three FICs ranging from 0.38 ha to 0.58 ha. In Makete FIC, natural regeneration of pine was commonplace and often yielded woodlots with very high stand densities. In the other clusters, in contrast, natural regeneration was minor or absent. The surveyed woodlots included woodlots up to 19 years of age, but most were cut between the ages of 9 and 13 years.

The observed site indexes were compared to the Sao Hill site index curves. On average, the observed site indexes were very good across the study areas. Therefore, the wood production potential was, in general, high.

The results revealed that the woodlots in each FIC were generally overstocked. The average stand densities were 1 729 stems/ha, 1 513 stems/ha, and 1 194 stems/ha in Makete, Mafinga and Njombe FICs, respectively, but woodlots with a stand density approaching 10 000 stems/ha were observed and signs of thinning were rare (though not completely absent). Overstocking was reflected in the generally low diameters at breast height (DBH) despite the evident growth potential. Implementation of weeding, firebreak preparation, and high pruning generally had shortcomings in all survey areas though there were differences among the clusters. Access pruning, in contrast, was commonly practiced in all areas.

Results from the survey of forest-based businesses

The most common business types of the interviewed SMEs were sawmilling, bioenergy (charcoal making), wood secondary processing (carpentry), and forest harvesting. Some nurseries, timber yards, and equipment suppliers were also represented. There were territorial differences, with sawmillers being the most common type in Mafinga FIC, charcoal makers in Makete FIC, and carpenters in Njombe FIC. The level of technology applied among the different types of SMEs was generally basic.

The interviewed SMEs reported employing altogether 1 754 people, with sawmills collectively the largest provider of employment. The clear majority of employees were hired on a daily or seasonal basis rather than being permanently contracted. The result reflects the seasonality of work within SMEs operating in the forestry sector. Most of the SME employees in all clusters (65–87%) were men. The average salaries were systematically lower among women, both in

SMEs and in large companies, indicating gender-based inequality in remuneration that should be explored further.

The majority of SMEs had no bank account or written business plan, but there were differences among the three clusters.

The average capital investment in machinery and infrastructure as reported by the SMEs was the largest in Njombe FIC, at about TZS 4.3 million (about EUR 1 590), less in Makete FIC, at TZS 2.0 million (EUR 741) and the least in Mafinga FIC, at TZS 2.5 million (EUR 926). Analysis of the stated annual cost and revenue figures revealed that while many SMEs seemed to be making a good profit, almost 30% were actually making a loss. It should be noted that the range of results for each of the financial indicators (capital investment, costs, revenue, and profit and turnover) was quite wide in all FICs.

Concerning work safety, the majority of SMEs (65%) reported that during the 12 months prior to the survey, there had been no accidents that had led to employee downtime or death. Most of the remaining 35% reported only a single accident, but some SMEs had more. Altogether, 309 accidents were reported, with sawmilling SMEs having a higher accident rate than SMES of other business types. In Mafinga FIC, 33% of SMEs reported that they had provided some personal protective equipment (PPE) to their employees, but in Makete FIC this share was just 3%. No more than 14% of SMEs in any cluster reported having received occupation safety and health (OSH) training.

The SMEs often identified the following challenges to their business development: the poor market situation; the lack of capital and access to funding; poor infrastructure; the limited availability of equipment, tools and services; the low level of technology, and the skill gaps of employees and SME owners. During the second survey round, the SMEs were also asked what they wanted to achieve through their businesses. The common answers included expansion of the business itself, raising personal capital, paying for family members' education, and building a house.

The collection of data on large forest-based companies was centred around Mafinga FIC. The large companies that responded to the survey were commonly engaged in multiple types of businesses/activities, the most common being sawmilling, pole production and veneer or plywood manufacturing. Their reported capital investment varied from a few hundred thousand USD up to USD 20 million. Altogether 2 953 people were reported to be employed in these companies. 43% of the positions were permanent. Since large companies operate in a more regulated environment than SMEs do, almost all of them reported providing that they provided social security systems to employees.

Conclusions

Forestry is commonly practiced in the survey areas and it has major potential as a source of livelihood. Sites are by and large highly suitable for tree growing and a large percentage have excellent site indexes. Current silviculture practices, however, are generally suboptimal. The most prominent shortcoming is the lack of proper stand density management, i.e. the lack of commercial or non-commercial thinnings. Premature harvesting exacerbates the problem of low DBH growth rates. Nevertheless, it is important to recognise that, from a smallholder woodlot owner's point of view, given his or her socioeconomic situation, the investment of time and/or money in timely woodlot management as per guidelines may not always be the optimal decision.

Forest-based SMEs and large companies alike were major providers of employment in their communities. Despite there being seemingly different bases for forestry as business in each of the three FICs, there were fewer differences in the observed SME schemes than might have been expected, including, for example, the featured level of technology and the types of forest-based businesses.

Problems with profitability are linked to the overall challenges faced by the SMEs. The low level of processing technology results in low-quality products and the lack of market access and information and poor infrastructure further undermine profits. The weak administrational framework likely contributes further to losses. While there are apparent development needs, the surveyed SMEs themselves typically did not consider their situation as overly negative; instead, they stated that they were content with their businesses.

1. INTRODUCTION

1.1 Scope of the document

This document includes the methodology and findings for two field surveys designed to address the requirements for baseline data and other information of the Participatory Plantation Forestry Programme (PFP 2).

One survey concerned **smallholders' woodlots** and the other **forest-based businesses**. In addition, the document describes a participatory GIS exercise carried out for preliminary data collection.

The field work of the surveys was implemented in two phases – in September and October of 2020 and in June and July of 2021 – in geographically different areas. The results from the surveys have been included as the baseline in the programme monitoring framework. In addition, the methodology described will have relevance for the design of the mid-term and endline assessments of the programme.

1.2 PFP 2 baseline data collection

1.2.1 General framework of the programme's baseline data collection

The baseline data requirements of the PFP 2 concerned an array of indicators included in the programme results-based monitoring framework (RBMF[1]). PFP 2 was able to address many of the indicators through office-based data collection, such as internal reporting and information requests, but needed to carry out field survey to collect other data.

A breakdown of the PFP 2's baseline data collection design is presented in Figure 1. There were three thematically different areas requiring data collection through field surveys: i) community socioeconomics, ii) smallholders' woodlots, and iii) forest-based businesses with particular reference to small and medium enterprises (SMEs). The required field surveys were designed and implemented to collect baseline data on these thematic areas.

In conjunction with the collection of data for the indicator baseline, some additional information was collected so the programme would be able to make informed decisions concerning its operations and approach.

1.2.2 Timing of the field surveys

The official PFP 2 operating area covers seven districts and three towns in the Southern Highlands. The area is grouped into three forest industry development clusters (FICs). The clusters are named Makete, Mafinga, and Njombe after their central business locations. Makete District, included under the eponymous cluster, acted as the pilot area of operations for the first year of programme implementation.

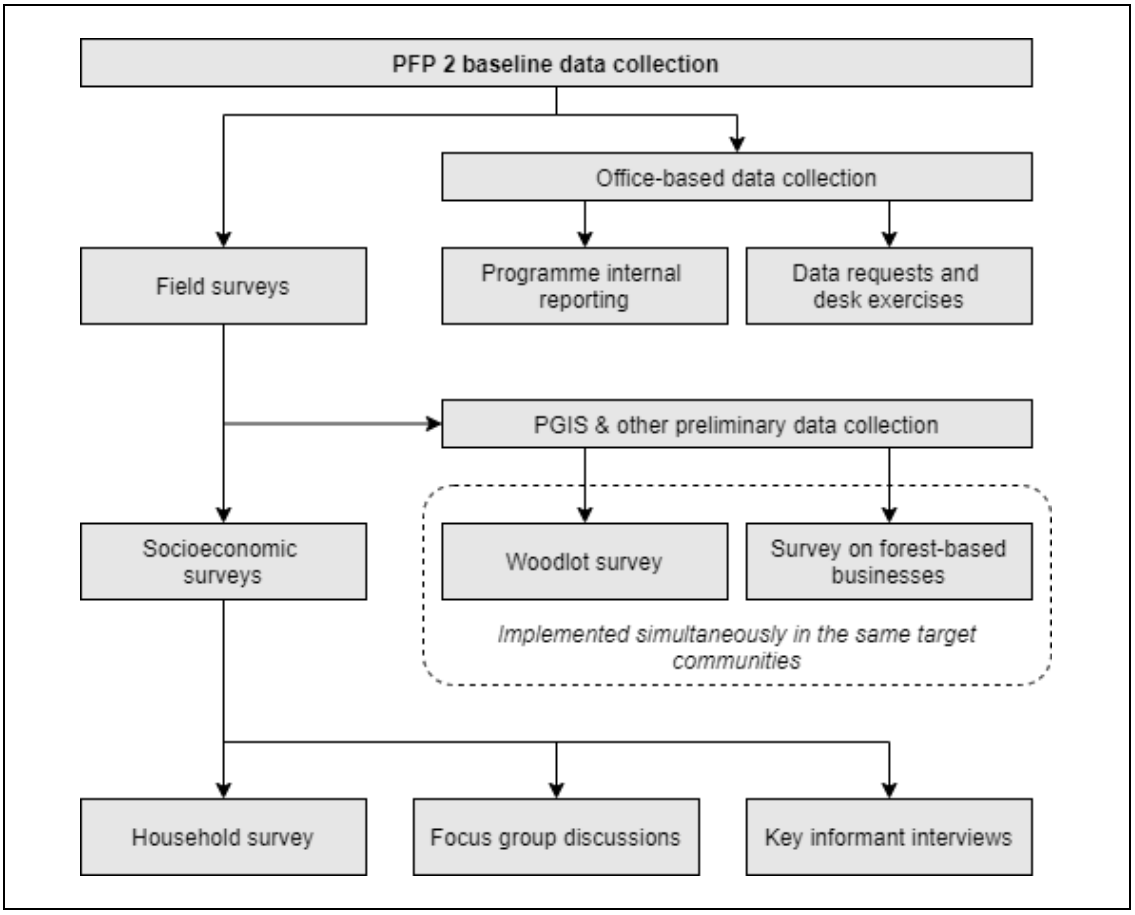
Since programme operations were initiated at different times in different areas, the programme's baseline data collection was designed to apply a rolling approach. In this approach, the relevant data was planned to be collected when the programme expanded its operations to new areas as per its annual work plans.

The baseline data collection was first carried out on a substantial scale during September and October of 2020, when the field surveys were implemented in the pilot area of Makete District. Surveys of smallholders' woodlots and forest-based businesses were conducted, and socioeconomic data was collected in the same target communities. Additional data related to the human rights-based approach (HRBA) and a gender situational assessment was also

[1] Annexed in the Progamme Document of the PFP 2.

gathered. The findings were published in two reports, one concerning the woodlots and forest-based businesses[2] and the other concerning the gender and HRBA assessments[3].

Figure 1 The design of PFP 2's collection of baseline data



During 2021 the programme expanded its operations into additional target communities across the rest of its operating area. The expansion required that it collect baseline data in the new areas. More baseline data, including a second survey of both smallholders' woodlots and forest-based businesses and more socioeconomic data, was collected during June and July of 2021. The surveys were implemented in sampled target communities under the two newly started clusters (Mafinga FIC and Njombe FIC) as well as in sampled target communities in Wanging'ombe District under Makete FIC, where programme operations were also started.

The second round of data collection also included a separate survey of large-scale companies based in the Mafinga and Njombe FICs. Responses from some of the large companies were received only well after the main field surveys had been finished.

[2] PFP (2020). Assessment of woodlots and forest-based SMEs in Makete District. Results from PFP 2 baseline data collection.
Available online: https://www.privateforestry.or.tz/resources/view/assessment-of-woodlots-and-forest-based-smes-in-makete-district

[3] PFP (2020). Human rights based approach and gender situational assessment: a case study of Makete District.
Available online: https://www.privateforestry.or.tz/resources/view/human-rights-based-approach-and-gender-situational-assessment-a-case-study-of-makete-district

2. METHODOLOGY

2.1 Sampling of target communities

In Makete District, the PFP 2 operates in 23 villages. All 23 villages were included in the first round of baseline field surveys in 2020, making for a 100% sample.

During 2021 the PFP 2 expanded its operations to an additional 57 villages across the rest of its operating area: Mafinga and Njombe FICs and Wanging'ombe District in Makete FIC. These 57 villages were divided into 13 management units, each of which included 3–5 villages (with the exception of Wanging'ombe District, which included 10 villages in a single management unit).

During the second round of baseline field surveys in 2021, sampling was used to select 40% of the 57 new PFP 2 villages (23 villages in total) in which to administer the survey. Stratification based on the 13 management units was applied to the selection. The number of villages selected randomly from each management unit for inclusion in the sample depended on the total number of villages in the management unit. The proportions were as follows: 1 village was selected from 3-village units (33%); 2 villages were selected from 4-village units (50%); and 2 villages were selected from 5-village units (40%). Originally, 4 villages were selected from the 10-village Wanging'ombe unit, but only 3 were covered in the final sample. Hence, the final achieved sample size in the baseline field surveys in 2021 was 22 out of 57 villages (39%).

The full sampling framework for Mafinga and Njombe clusters and Wanging'ombe District is included in in Annex 2.

Baseline data was collected from a total of 45 villages during the two survey rounds of 2020 and 2021, representing 56% of all the villages included in the PFP 2. The survey villages are listed in Table 1 and Table 2 and presented among other PFP 2 villages in the map in Figure 2.

The socioeconomic household survey was conducted in the same sample of villages that the woodlot and the forest-based businesses surveys were conducted in.

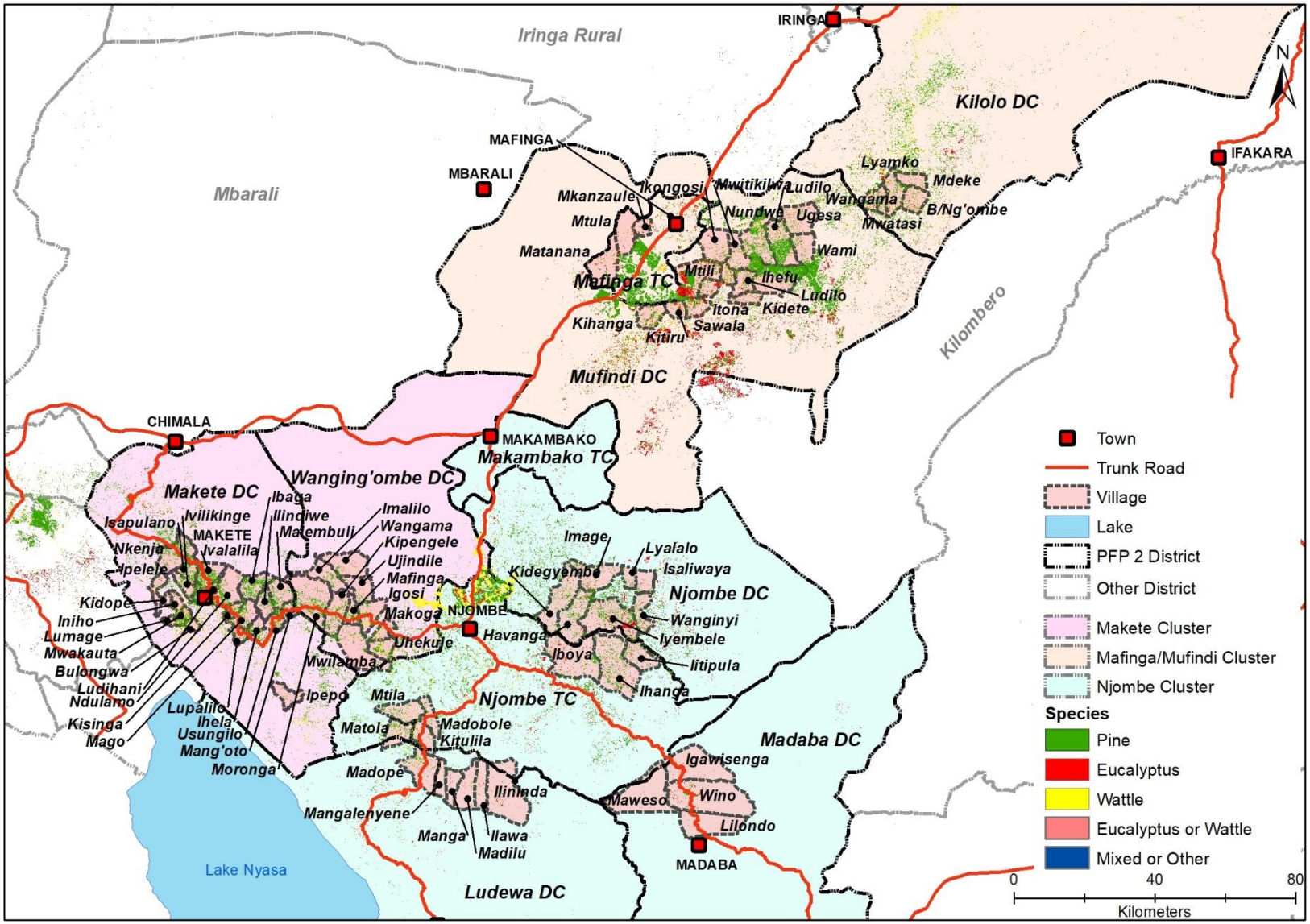
Table 1 Villages included in the first round of PFP 2 baseline field surveys in Makete District in 2020

PFP 2 FIC	Ward	Village	#
Makete FIC	Bulongwa	Bulongwa	1
	Iniho	Iniho	2
		Kidope	3
		Lumage	4
		Mwakauta	5
	Ipelele	Ipelele	6
	Ipepo	Ipepo	7
	Isapulano	Isapulano	8
		Ivilikinge	9
		Luvulunge	10
	Iwawa	Ivalalila	11
		Ludihani	12
		Ndulamo	13
	Kitulo	Nkenja	14
	Lupalilo	Kising'a	15
		Lupalilo	16
		Mago	17
	Mang'oto	Ibaga	18
		Ilindiwe	19
		Malembuli	20
		Mang'oto	21
		Usungilo	22
	Tandala	Ihela	23

Table 2 Villages included in the second round of PFP 2 baseline field surveys in 2021

PFP 2 FIC	District	Village	#
Mafinga FIC	Kilolo DC	Boma la Ngo'mbe	1
		Mwatasi	2
	Mafinga TC	Matanana	3
	Mufindi DC	Ikongosi	4
		Ugesa	5
		Ludilo	6
		Kidete	7
		Kitiru	8
		Mtili	9
Njombe FIC	Ludewa DC	Mangalanyene	10
		Ilawa	11
	Madaba DC	Maweso	12
		Wino	13
	Njombe DC	Isoliwaya	14
		Lyalalo	15
		Kidegembye	16
	Njombe TC	Iboya	17
		Madobole	18
		Mtila	19
Makete FIC	Wanging'ombe DC	Imalilo	20
		Mafinga	21
		Moronga	22

Figure 2 **All PFP 2 villages, including those targeted for baseline data collection**



2.2 PGIS and preliminary data collection

2.2.1 Rationale, objectives, and general approach

Determining the sample for the surveys on smallholders' woodlots and forest-based businesses required that some preliminary information be collected. Doing so necessitated a visit to the target communities prior to conducting the actual field survey work. During that visit, preliminary data was collected and other preparations carried out.

The collected preliminary information generated datasets that have evident standalone value in addition to their utilisation in the sampling for the field surveys.

The requirement for preliminary information was addressed by setting up a separate team to visit target villages 1–2 days ahead of the administration of the two field surveys. The main task of this team was to collect preliminary information from local smallholders' woodlots through a participatory GIS (PGIS) exercise (pictured in Figure 3). Another central task was collecting information concerning local entrepreneurs within the forest-based value chain. In addition, the team informed people in the target villages about the surveys and made practical arrangements for the administration of the field surveys of woodlots and forest-based businesses (Table 3).

Table 3 Tasks and objectives of the preliminary visit to target villages

Task	Related main field surveys	Objectives
Participatory mapping of smallholders' woodlots (PGIS exercise)	Survey on smallholders' woodlots	Collect structured basic information from a pool of smallholder-owned woodlots and their owners.
Identification of local forest-based businesses	Survey on forest-based businesses	Collect structured basic information from local enterprises involved in the forest-based value chain.
Preparations for community participation in the main field surveys	Both main field surveys	Ensure that the community is informed and practical arrangements are in place for smooth implementation of the main field surveys.

2.2.2 Participatory mapping of smallholders' woodlots

General description of the process

Procedures for the participatory satellite image-based mapping of woodlots were developed and piloted during phase 1 of the PFP. The methodology utilised a participatory PGIS approach and involved the specific participatory mapping and planning tools developed for village land-use planning practice[4] and published by the programme.

Prior to the visit to each target village, open-source-based satellite images of the village area were downloaded, prepared digitally into printable map sheets (A0), and printed. Smallholder tree growers in target communities were contacted by the programme's extension personnel and supporting local district staff and invited to a meeting to engage in a participatory woodlot mapping session.

Upon arriving in a village, the PGIS team introduced the participants in the mapping session to the technology used in acquiring satellite images and the principles of identifying landscape features on satellite images. Each participating woodlot owner then identified the boundaries of his or her woodlot on the satellite image printouts with assistance from the PGIS team and marked it by drawing on the printout. A woodlot in this context was defined as a distinguishable area dominated by one cohort of trees (trees of the same species and age). Basic information

[4] PFP (2018). Participatory mapping and planning tools developed for village land use planning practice. Available online: http://www.privateforestry.or.tz/en/resources/view/participatory-mapping-and-planning-tools-developed-for-village-land-use-pla

concerning each participant and each of their mapped woodlots was recorded in the process, and both owners and their mapped woodlots were given temporary codes for later data merging.

When a person owned multiple woodlots, as was common, he or she chose a maximum of 4–5 woodlots for mapping. The team discovered that a maximum of about 15 individual tree growers could be efficiently covered in a half-day mapping session.

An effort was made to include a variety of woodlots from different species, ages, and management regimes in a manner that would reflect the general distribution of commercial woodlots under local smallholder management.

The hand-drawn woodlot boundaries were digitised after the participatory mapping session and merged with the collected woodlot and owner attribute information. Based on the generated dataset, two products were prepared to support the upcoming woodlot survey: i) a list of woodlots for the purpose of sampling and ii) an electronic background map indicating the pre-mapped woodlots to assist in planning work and navigation in the field.

List of recorded information

The following information (Table 4) was recorded during the PGIS process from each of the mapped woodlots of each woodlot owner:

Table 4 List of information recorded in the PGIS process

Scope	#	Recorded information
Woodlot owner	1	Full name
	2	Gender
	3	Phone number
	4	Membership in a tree growers' association (TGA) (yes/no)
	5	Investor type (see Table 5)
Individual woodlot	1	Species group (pine, eucalyptus, wattle, or cypress),
	2	Reported year of stand establishment
	3	Method of stand establishment (planting / natural regeneration)
	4	Local name for the woodlot as stated by the owner (for assistance in communication and navigation during the field survey work)
	5	Woodlot boundaries (spatial data)

The woodlot owners were categorised based on the land investor type that they represented, as per the typology shown in Table 5.

Table 5 Typology of land investors

#	Type
1	Resident villagers
2	Residents of nearby villages
3	Urban investors originating from the area
4	Other urban-based investors
5	Government institutions
6	Religious organisations
7	Other non-governmental organisations

Preparations for community participation in the upcoming survey on woodlots

Access for outsiders to private smallholder woodlots for purposes such as field surveys was known to be potentially controversial in the survey area unless accompanied by the woodlot owner or his/her representative. Hence field visits were not done unless adequate local guides were available. The participatory mapping process that the woodlot owners participated in was effective in encouraging them to also participate in the subsequent field survey of the woodlots.

The PGIS team agreed with the participated smallholder woodlot owners and village representatives for the time and place for meeting with the woodlot field survey team. They also furthermore explained the outline and the rationale of the upcoming survey work.

2.2.3 Identification of local forest-based businesses

General approach

In each village it visited, the PGIS team's objective was to identify as thoroughly as possible the locally active enterprises operating within the forest-based value chain and collect preliminary information from them. All relevant enterprises present in the target villages were categorised as SMEs based on the scale of their operations[5]. Data collection from large-scale companies operating in the programme area was implemented separately using a different approach.

Preliminary information concerning locally active enterprises was acquired mainly through consultations with the village chairperson, village executive officer, and people involved in the local forestry SME network.

List of recorded information

The team recorded following preliminary information (Table 6) about each identified enterprise:

Table 6 List of preliminary information recorded from local enterprises

#	Recorded information
1	Owner's name
2	Owner's phone number
3	Location (village and sub-village)
4	Business types practiced, as per the typology of Table 7

The initial typology employed for business types (Table 7) was based on the main types of a more detailed typology that was employed in the subsequent main survey for forest-based businesses (see Table 17 under section 2.4.4). Any enterprise that was involved in more than one forest-related business activity was allowed to make multiple selections.

Table 7 Initial typology of forest-based businesses

#	Type
1	Sawmill (differentiated as *mobile* or *stationary*)
2	Pole production
3	Veneer production
4	Wood secondary processing
5	Forest management and/or harvesting
6	Wood transportation
7	Timber yard
8	Commercial nursery
9	Bioenergy / Wood by-products
10	Pine resin collection
11	Suppliers (machinery, spare parts, fertilisers etc.)
12	Saw doctoring
13	Forestry consultants

Arranging interviews with enterprises

The identification and preliminary information of the enterprises enabled arrangements for their inclusion in the subsequent interview-based field survey. The persons consulted for information

[5] In the context of Tanzania SMEs are defined as micro, small and medium size enterprises in non-farm activities which include manufacturing, mining, commerce, and services. A micro enterprise is defined as a firm with fewer than five employees whereas a small firm is a firm with 5 to 49 employees, and a medium enterprise is a firm with 50 to 99 employees. https://www.ukessays.com/essays/economics/current-status-of-sme-sector-in-tanzania-economics-essay.php

(village chairperson, village executive officer, and other influential community members) were asked to assist in inviting entrepreneurs to meet the interview team on the date of the main field survey. The interview team also utilised the enterprise contact information included in the preliminary dataset on the locations of enterprises in the village to reach out to entrepreneurs who did not show up.

Figure 3 The PGIS team and mapping participants in Isoliwaya village, Njombe DC

2.3 Survey on smallholders' woodlots

2.3.1 Objectives and general approach

The objectives for the field survey on smallholders' woodlots were as follows:

i. Provide baseline data for woodlot-related programme indicators (Table 8);

ii. Provide additional data concerning silviculture and woodlot ownership to support programme decision-making; and

iii. Populate the programme smallholder woodlot database.

Data was collected through a field assessment involving sample plot measurements on a sample of smallholders' woodlots in communities targeted to receive PFP 2 support. Results from the PGIS mapping of woodlots (see Section 2.2.2) were utilised in the sample selection. The data collection tools included a structured survey form utilising the smartphone-based application Open Data Kit (ODK) Collect.

2.3.2 Information requirements addressed through the survey

Relevant programme indicators

The following programme indicators (Table 8) required baseline data from woodlots owned by smallholder tree growers:

Table 8 Indicators requiring baseline data from woodlots

RBMF level	Indicator
Outcome	Share of PFP 2 supported tree growers in TGAs managing their woodlots according to best operating practices
Output 1.2	Proportion of TGA woodlot area showing improved silvicultural practices in villages supported by PFP 2
	Proportion of TGA tree growers adopting improved silvicultural practices in villages supported by PFP 2

The minimum set of variables that had to be assessed in the survey was based on the requirements of these indicators.

Additional information requirements

The survey also collected data concerning land ownership, forest biometrics, and silviculture (Table 9). This data was collected to support an assessment of the level of silvicultural practices on the sampled woodlots and to improve understanding of the land ownership structure.

Table 9 Additional information requirements related to woodlots

Topic	Information requirement to be addressed
Land ownership	Distribution of investor types of private smallholder woodlots
Silvicultural status of smallholders' woodlots	Site index class distribution
	Age distribution
	Tree genera distribution
	Mean diameter at breast height (DBH) distribution
	Firebreak preparation and maintenance

2.3.3 Sampling of woodlots

Each target community (village/TGA) was included in the survey as an individual stratum. The basic sampling unit of the survey was an individual woodlot.

The set of woodlots mapped during the PGIS was used as the main pool for sampling, with the target sample size in each community being 15–20 woodlots. The woodlots for the field assessment from the pool of PGIS-mapped woodlots were selected as randomly as possible. Factors affecting the selection and the final achieved sample size included the availability of woodlot owners to show their woodlots, the characteristics of the preliminary data acquired

during PGIS, local conditions such as topography, and the available capacity for surveying. In some cases, the woodlots of additional woodlot owners who had not participated in the PGIS exercise but who were willing to participate in the field survey were also included in the final sample in order to expand the pool of data.

For variables requiring measurement-based assessment, each woodlot included in the survey was, by default, represented by one sample plot. For woodlots with an area greater than two hectares, however, the field teams were instructed to measure at least two sample plots.

2.3.4 Structure and placement of sample plots

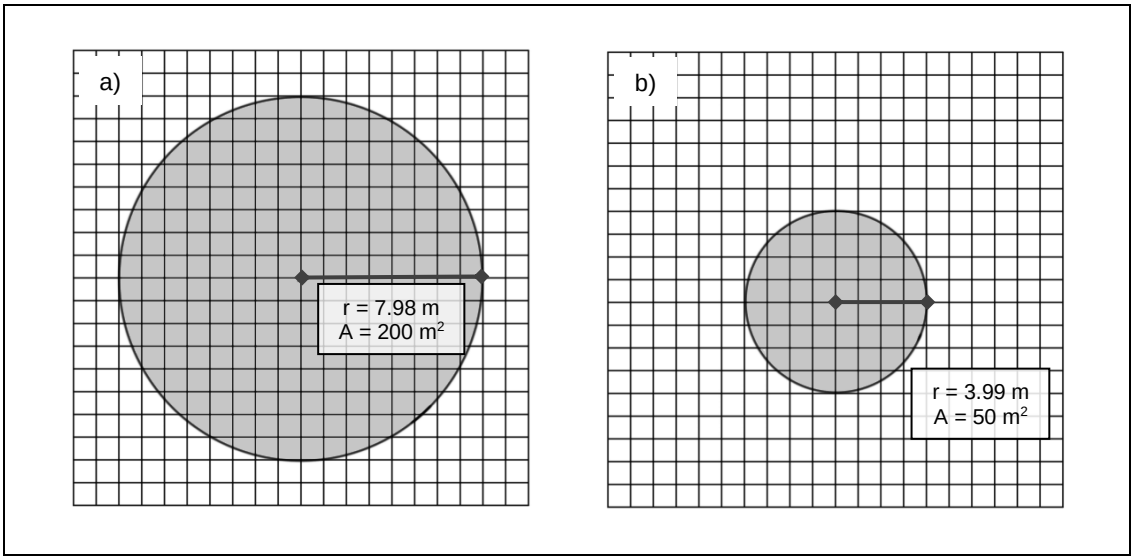
Temporary circular sample plots with two different radiuses were employed in the survey, depending on the estimated stocking of trees in the woodlot (Figure 4).

A circular sample plot with a radius of 7.98 metres (area of 200 m^2) was employed in woodlots with stocking levels estimated to be below 2,500 stems/ha. This was the default sample plot size of the survey.

A circular sample plot with a radius of 3.99 metres (area of 50 m^2) was employed in two special cases: i) overstocked woodlots with stocking levels estimated to be at 2,500 stems/ha or above, and ii) woodlots with a small area or a special shape that made it impossible to use the default sample plot size. This shorter radius was used especially with the naturally regenerated unmanaged woodlots with high stocking levels found in Makete District.

The sample plot radius was selected on location by the survey team based on their initial estimation of the stand density. In case the average distance between the trees seemed to be two metres or less (corresponding to stocking levels of 2,500 stems/ha and above), the shorter radius was selected.

Figure 4 The default circular sample plot (a) and the circular sample plot employed where the stand density was high (b)



The survey team placed each sample plot randomly within any given woodlot but made sure its centre was at least 20 metres from the woodlot boundary (as allowed by the shape and size of the woodlot) and in an area that was considered representative of the whole woodlot.

2.3.5 Variables recorded in the survey

Two types of variables were recorded during the survey: those assessed based on observations of the whole woodlot area and those derived through sample plot measurements. These are described in Table 10 and Table 11, respectively. Figure 5 includes pictures showing sample plot measurements.

In addition, details from the woodlot owner were recorded as specified in Table 4 under Section 2.2.2 if they had not been recorded during the PGIS mapping of woodlots.

Table 10 Variables based on observations of the whole woodlot area

#	Variable	Description
1	Woodlot boundaries	Boundaries were recorded in the field to verify the area of the woodlot and ground-truth the PGIS data.
2	Temporary ID	Links the woodlot with the PGIS dataset. Used to merge data.
3	Woodlot location	District and village.
4	Tree genus	Pine, eucalyptus, wattle, or cypress.
5	Regeneration method	Either planting or natural regeneration. Refers to the current main cohort of trees.
6	Year of establishment / regeneration	Used for determining the age of a woodlot and always verified through destructive sampling of one tree in the woodlot. If verification was not possible, this entry field was left empty.
7	Weeding status	Assessed on a three-tier scale (Table 12).
8	Pruning status	Assessed on a four-tier scale (Table 13).
9	Pruning height	Average height of pruning, from the ground level to the first unpruned branches. Assessed on pruned woodlots only.
10	Firebreaks	Indicates whether or not the woodlot is protected by firebreaks. To qualify, the woodlot had to be surrounded by maintained individual or woodlot cluster firebreaks.
11	Woodlot photo	Taken for later verification of data and quality control purposes.

Table 11 Variables based on sample plot measurements

#	Variable	Description
1	Sample plot radius	Default (7.98 m) or short (3.99 m).
2	GPS coordinates of the sample plot centre	Provides spatial data of the sample plot location.
3	Number of live trees	Trees with green needles/leaves were counted.
4	Number of dead trees	Trees with no green needles/leaves were counted. Fallen dead trees were not considered.
5	Mean diameter	3–5 trees representing the average diameter estimated by the surveyors were measured for diameter at breast height (DBH) and the mean result was calculated.
6	Mean height	Measured either with a hypsometer or, in the case of juvenile trees, a measurement pole from a tree that surveyors estimated to represent the mean height.

The quality and extent of weeding was assessed by field surveyors who scored the overall weeding status as 0, 1, or 2 as per the definitions included in Table 12. Weeding status was assessed in woodlots of all ages based on recent observable activities, independent of the actual silvicultural relevance of weeding in each woodlot.

Table 12 Scores for weeding status

Score	Label	Description
0	No weeding done	There are no or minimal signs of weeding activities having been done in the woodlot.
1	Partial or insufficiently done weeding	Some weeding activities have been done in the woodlot, but either the quality of work is not up to a good silvicultural standard or the weeding has been done only on part of the woodlot.
2	Weeding done according to a good standard	Weeding activities in the woodlot have been done at a good silvicultural standard, efficiently reducing the competition weeds pose to the tree stand. Circle/strip weeding must be complemented by slash weeding.

Field surveyors also assessed the quality of pruning in each woodlot they visited by applying an overall score of 0, 1, 2, or 3 as per the definitions included in Table 13.

Table 13 Scores for pruning quality

Score	Label	Description
0	Not done	No pruning has been done.
1	Poor	Significant stumps of branches are left on the pruned stems and/or significant damage has been done to the bark of the tree.
2	Mediocre	Features from both the good and the poor pruning quality categories are present in the woodlot.
3	Good	Branches are cut clean along the surface of the stem or just above the branch collar and no damage has been done to the bark of the tree.

2.3.6 Determination of slope

After the field work, a value for slope was determined for each woodlot based on the sample plot centre coordinates and a digital elevation model (Shuttle Radar Topography Mission). Slope correction to sample plot areas was applied in the calculation of stand density values.

Figure 5 Field measurements in Ihela village, Makete DC (upper picture), and Ikongosi village, Mufindi DC (lower picture)

2.4 Survey on forest-based businesses

2.4.1 Objectives and general approach

The objectives for the survey on forest-based businesses were as follows:

i. Provide baseline data for various programme indicators (Table 14 and Table 15);

ii. Identify individual enterprises and their businesses within the local forest-based value chain (*i.e.* mapping the value chain); and

iii. Provide information from forest-based businesses to support programme decision-making.

The field survey implemented in the selected target villages considered SMEs only, since no large companies were based in these locations. However, large companies based in the FICs and targeted by the survey were contacted for data collection through a separate exercise. The latter only addressed objectives (ii) and (iii) above since the programme's indicators only consider SMEs.

The businesses surveyed included different types of primary and secondary wood-processing enterprises, harvesting and haulage operators, producers of wood-based energy products (e.g. charcoal), tree seedling nurseries, and other forest-based businesses. Timber yards operating as marketplaces for sawn wood were also surveyed. Both businesses with and without an official registration status were included in the survey. The typology of forest-based businesses used is included in Table 17.

Survey data was collected primarily through interviews with entrepreneurs. In addition, field visits were made to enterprises with stationary operating sites. Figure 6 includes pictures from these. The SME sample selection was based on the preliminary enterprise data collected by the PGIS team and the large company sample selection was based on government records concerning large-scale forest businesses. A structured questionnaire including both questions with limited options and open-ended questions was used to collect data.

2.4.2 Information requirements addressed through the survey

Relevant programme indicators

The following programme indicators (Table 14) required baseline data from forest-based businesses:

Table 14 Indicators requiring baseline data from forest-based businesses

RBMF level	Indicator
Outcome	Share of SMEs supported by PFP 2 adopting innovative processing technologies and/or practices reducing waste and improving profitability
Output 2.1	Proportion of PFP 2 supported SMEs employing women and vulnerable people
	Share of female employees in PFP 2 supported SMEs
	Share of PFP 2 supported SMEs abiding to (i) work safety, and (ii) employee social security payments
	Share of PFP 2 supported SMEs providing equal pay for men and women for same work
	Share of permanent labour (employees with working contracts) in PFP 2-supported SMEs
Output 2.2	Share of PFP 2 supported SMEs having an appropriate business plan
	Share of PFP 2 supported SMEs being (i) registered, and (ii) having a bank account
	Number of PFP 2 supported SMEs financed by impact investment funds, private banks, or investment institutions
Output 2.3	Shares of logs by their delivery to different end uses (e.g. sawmilling, pole production, and bioenergy) in villages supported by PFP 2
	Number of charcoal and briquette making technologies
	Recovery rate in PFP 2 supported sawmilling SMEs
	Number of PFP 2 supported SMEs having long-term timber procurement contracts with private tree growers or TFS

One indicator required data specifically from local tree seedling nurseries (Table 15):

Table 15 Indicator requiring baseline data collection from local nurseries

RBMF level	Indicator
Output 1.2	Share of nurseries using (i) improved seed and (ii) improved practices in villages supported by PFP 2

Additional information requirements

Survey objectives (ii) and (iii) were addressed by collecting the additional information listed in Table 16.

Table 16 Additional information requirements related to forest-based businesses

Topic	Information requirement to be addressed
Mapping the forest-based value chain	Identification of individual enterprises of all sizes and types operating within the local forest-based value chain.
Quantification of wood flows	Annual production rates (volume or mass) of the enterprise for relevant product types. Assessment of the annual consumption of wood as raw material by the enterprise. Annual sales volumes of timber yards.
Taxation	Information on different taxes and levies the businesses pay.
Training needs	Topics in which the enterprises need training and facilitation.
Large companies	Basic information concerning the operations, employment provision, production rates, and finances of large forest-based enterprises.

2.4.3 Sampling of SMEs

The preliminary data collected from SMEs by the PGIS team and on large-scale companies from government records provided the overall framework for sampling. The basic sampling unit of the survey was an individual enterprise. A single enterprise could, however, be engaged in multiple forest-related activities (Table 17).

By default, the objective of the main field survey team was to interview on location in the selected target villages all forest-based SMEs from which preliminary information was available. Limitations included the availability of SME representatives to give interviews. Additional SMEs not covered in the preliminary list were included on location in the village if information was discovered. In case a large number of forest-based SMEs was identified in a single survey village, the maximum number of interviews to be held in any given village was set at 20.

For the sampling of large companies, a shortlist was created based on the government data provided. Rather than being a fully random selection, the shortlist included a variety of business types and utilised the available experience concerning the willingness of companies to engage in dialogue and share information.

2.4.4 Typology of forest-based businesses employed in the survey

The enterprises included in the survey were categorised by main and sub-types based on the types of businesses they engaged in. The typology employed is presented in Table 17.

The typology employed during the preliminary data collection (see Table 7 under section 2.2.3) was based on the main types of this full typology.

Table 17 Detailed typology of forest-based businesses

ID	Type or subtype	Remarks
1	Sawmill*	
1.1	Dingdong (Amec) sawmill	*Mobile*
1.2	Mobile bandsaw	
1.3	Advanced mobile circular sawmill	
1.4	Stationary bandsaw	*Stationary*
1.5	Advanced stationary circular sawmill	
1.6	Multi-rip saw	
2	Pole production	*Notice that pole treatment is under WSP (4).*
2.1	Transmission poles	
2.2	Construction or fencing poles	
3	Veneer production	*Notice that plywood is under WSP (4).*
4	Wood secondary processing (WSP)	
4.1	Carpentry and furniture	
4.2	Plywood/blockboard	
4.3	Wood joinery	
4.4	MDF/particle board	
4.5	Pallets and wood packaging	
4.6	Treatment of sawn wood	
4.7	Treatment of poles	
4.8	Other wood-based products	
5	Forest harvesting contractor (FHC)	*Always includes a provision for the practical work of harvesting trees. Not to be confused with category 13.*
6	Transportation of forest-based products	
6.1	Haulage operator	*> From stump to roadside.*
6.2	Log transporter	*> From roadside to processing.*
6.3	Transportation of processed products	*> Any forest-based products (e.g. charcoal) count*
7	Timber yard	*To be included, the timber yard must operate as a permanent marketplace. Temporary storages / drying sites without a business function do not count.*
7.1	Privately owned	
7.2	Government-owned	
7.3	TGA-owned	
8	Commercial nursery	*To be included, the nursery must be commercially-based and not just for private use.*
8.1	Polytube	
8.2	Containerised	
9	Bioenergy / Wood by-products (BW)	
9.1	Firewood	
9.2	Lump charcoal	
9.3	Charcoal (carbonised) briquettes	
9.4	Uncarbonised briquettes	
9.5	Biochar	*> Biochar as the final product only.*
9.6	Wood tar	
9.7	Wood vinegar	
10	Pine resin collection	
11	Suppliers	*E.g. machinery, spare parts, fertilisers. Specifically for the forestry value chain.*
12	Saw doctoring	
13	Forestry consultants	*Provision of facilitation and other professional services based on expert knowledge. Not to be confused with category 5.*
14	Other (specify)	*Other forest-based businesses that do not fit under any category above. E.g. production of tannin.*

2.4.5 Variables recorded for all SMEs

A standard set of variables was recorded for all participating SMEs regardless of their type of business. A description of these common variables is included in Table 18.

Table 18 Variables recorded for all SMEs

#	Variable	Remarks
1	Name of the enterprise	Name of the enterprise. Only recorded for registered enterprises with an official name.
2	Owner details	Includes name, gender, and contact information.
3	Location	District and village/town. Refers to the main operating site.
4	Types of business	As per the typology included in Table 17. The enterprises practicing more than one forest-related businesses were allowed to select multiple answers.
5	No. of employees	Disaggregated by gender and by permanent/daily labour.
6	Salary levels	The average salary level in each of the four disaggregated employee categories defined above was collected.
7	No. of vulnerable and disabled employees	The number of i) vulnerable employees (mainly people involved in TASAF list), and ii) employees with disability[6] was recorded. The two figures were reported independently of each other.
8	Registration status	Indicated the most advanced level of SME registration. Selected from a list.
9	Bank account	Indicated whether the SME had a bank account. A personal bank account of the owner did not qualify herein.
10	Business plan	Indicated whether or not the SME had a written business plan.
11	Capital investment	Estimated capital investment in machinery and infrastructure, as stated by the interviewee.
12	Sources of funding	Reported external sources of funding, if any. Selected from a list.
13	Annual operational costs	Estimated annual total operational costs, as stated by the interviewee.
14	Annual revenue	Estimated annual revenue, as stated by the interviewee.
15	Taxation	The interviewee was asked to list the different taxes and levies they paid for his or her business.
16	Social security system for employees	Indicated whether the SME provided any social security system to employees. Selected from a list.
17	Workplace accidents	The number of serious accidents (injuries leading to employee downtime or death) during the past year of operations.
18	Usage of PPE	Type of personal protective equipment (PPE) provided to employees, if any.
19	OSH training	Indicated whether the enterprise management had received any training in occupational safety and health (OSH).
20	Training and facilitation needs	The topics the interviewee would like to see covered in training and facilitation. Selected from a thematic list (Table 19).
21	Main challenges	Three main constraints to the growth of the SME's business.
22	Business goals	Reflection on what the interviewee was seeking to achieve with his or her business.
23	GPS coordinates for field location	GPS coordinates for the location of the enterprise. Only recorded for enterprises with a stationary operating site or an office.

The questionnaire also included a field for additional remarks so that any further information concerning the enterprise or the course of the interview could be recorded.

[6] The UN Convention on the Rights of Persons with Disabilities (UNCRPD) recognises that 'disability is an evolving concept' (UNCRPD, 2006, p. 1). 'Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others' (UNCRPD, 2006, p. 4).

In questions concerning financial figures, the surveyors aided the interviewees in making an assessment, including doing the related calculations, to ensure that the results were delivered in the right unit and as truthfully as possible.

Descriptions for the thematic categories of training and facilitation needs presented for the interviewees to select from are included in Table 19.

Table 19 Training and facilitation needs

#	Topic	Description
1	Development of a business plan	Development of a business plan to provide the big picture of the business environment, to set up priorities and strategic focus, and to develop financial management and accounting. Includes assessments of the chances of making a profit and of business growth and start-up and investment costs.
2	Business registration	Information on the requirements for registering a business, the process and the costs involved, and the benefits of registration.
3	Access to financing	Ability of the enterprise to obtain financial services, including accessing credit and engaging in risk management. Programme facilitation seeks to address businesses' limited access to credit information, lack of business premises, and lack of financial management and record-keeping skills.
4	Marketing	Basics of simple marketing strategies for selling the products of the enterprise.
5	Technical skills	Enhancing technical skills within the enterprise for better employee capacity and performance leading to improvements in the rate of production or quality of product. Also involves the improvement of work safety.
6	Technologies and machinery	Exposure to and demonstration of alternative technologies and machinery for improving processing and production rates or product quality.
7	Occupational safety and health (OSH)	Basic skills and practical knowledge on protecting employees from accidents, injuries, and exposure to harmful substances. Includes information on personal protective equipment.
8	Other (specify)	As stated by the interviewee.

2.4.6 Variables recorded from SMEs of specific business types

In addition to the common variables, some special variables were recorded for SMEs with certain types of businesses. A description of these variables is included in Table 20.

Table 20 Variables recorded for SMEs of specific business types

#	Variable	Description	Business types
1	Processing technologies	Processing technologies applied by the SME. Selected from a list.	Sawmills, BW
2	Innovative practices	Open-ended question concerning newly adopted practices that have improved profitability and reduced waste.	Sawmills, Poles, Veneer, WSP, BW, Pine resin
3	Production rate	Estimation of the annual production rates, mainly as total volume or total mass and disaggregated by types of products. Assessed by the interviewee.	Sawmills, Poles, Veneer, WSP, Nurseries, BW, Pine resin
4	Volume of sold timber	Estimation of the total volume of timber sold annually in the timber yard.	Timber yards
6	Timber procurement contracts	Indicates whether the SME has a timber procurement contract with TFS or private suppliers, and if it does, for how long a period.	Sawmills
7	Chainsaw training	Indicates whether operators have received any technical training in using a chainsaw.	FHC
8	Percentage of logs sorted for different use	Shares of harvested logs by their delivery to five pre-defined end-use categories.	FHC
9	Application of improved seed	Indicates whether any of the seed used by the nursery originates from improved sources.	Nurseries
10	Application of improved practices	Eight aspects related to nursery practices were checked. See Table 21.	Nurseries

As with the questions concerning financial issues, the surveyors assisted the interviewees in assessing annual production rates.

With nurseries, the eight aspects that were checked in relation to the level of the applied nursery practices are described in Table 21.

Table 21 List of standard and improved nursery practices

#	Aspect	Standard practice	Improved practice
1	Nursery management	Nurseries are established and managed based on experience and local knowledge	Training of nursery staff on, for example, good management practices, record-keeping, entrepreneurship, and marketing
2	Seed source	Seeds are collected from mature stands or regenerants without considering phenotypical or genetical characteristics	Using improved seed with tested and proven superior characteristics.
3	Seed treatment	No seed treatment before sowing	Adequate seed soaking before sowing
4	Planting medium	Soil used as a medium for planting	Soil-less medium which provides environmental benefits, reduces root damage, and lightweight
5	Fertilisation	No fertiliser application	Root and foliar fertilisation, for example, NPK and polyfeed
6	Soil treatment	No treatment of soil, leading to infection and poor germination	Standard seed-bed preparation, including the following: • Treated sieved river sand and top forest soil in a 50/50 ratio • Wire mesh to prevent rodents • Gravel for good drainage • Shading to prevent direct sunlight
7	Transportation	Use of polythene tubes that cause environmental pollution and root damage during transportation	Use of reusable containers (trays) which allow for easier inventory, transportation and improved seedling survival
8	Root pruning	Roots pruned manually, causing damage and potential slowdown of seedling growth	Air pruning of roots, which effectively prevents the harsh effects of manual root pruning

2.4.7 Data collection from large forest-based companies

Large forest-based companies were targeted through a separate data collection exercise. In the first step, large forest-based companies operating in each FIC were identified and listed based on the records of the TFS and the programme's local staff members. No large companies were identified in Makete FIC. In Njombe FIC one large company suitable for the target group of this survey was identified. The vast majority of large companies were based in Mafinga FIC. In Mafinga FIC, the initial list was screened by PFP experts with the help of TFS staff members to determine the final sample with respect to the available time and resources as well as previous experience concerning how cooperative the companies were.

The questionnaire presented in Table 18 and Table 20 was modified to be more relevant to large companies. A hard copy of the modified questionnaire was delivered to the selected companies in person. The modified questionnaire is included in Annex 4. The companies were given adequate time to provide responses and then the filled-in questionnaires were collected. Some additional interviews with company representatives were conducted when the questionnaires were collected in order to gather additional information.

Figure 6 **Carpenters being interviewed in Ipepo village (upper picture) and dingdong sawmillers showing their machinery during a site visit in Mang'oto village (lower picture), Makete DC**

3. RESULTS

3.1 Description of the covered sample

3.1.1 Number of surveyed woodlots

Information from a total of 1 445 woodlots was collected through the PGIS procedures. Altogether 841 woodlots in Makete District were surveyed in 2020 and another 604 woodlots were added in 2021. Spatial information on the woodlot boundaries collected through participatory mapping was included for a total of 1 343 of these woodlots; the rest of the woodlots were recorded without mapping their boundaries on a satellite image because there were no images with sufficient quality to allow for such mapping. The satellite imagery used to map boundaries was, to a large extent, quite recent, as shown in Annex 1. The total area covered by the woodlots mapped through the PGIS exercise was about 2 380 ha.

The total number of woodlots that were subsequently surveyed in the field was 887 (466 during 2020 and 421 during 2021). While the sample was mainly based on the PGIS data, it also included some additional woodlots and woodlot owners that had not been included in the participatory mapping. Boundary information was verified with GPS measurements for 879 of the visited woodlots and the total area covered was 778 ha. The figures are not directly comparable with the results of the participatory woodlot mapping since some of the woodlot information in the two exercises did not match exactly.

As Table 22 and Table 23 show, the sample sizes of the field-surveyed woodlots varied between 12 and 33 woodlots per village. As seen in the same tables, the variation in the total areas of the surveyed woodlots per village was substantial. This is attributable to the overall large variation in the individual woodlot sizes. The distribution of woodlot sizes is discussed further in section 3.2.1.

Table 22 Numbers and areas of field-surveyed woodlots by village (2020)

District	Ward	#	Village	No. of surveyed woodlots	Total area of surveyed woodlots (ha)
Makete DC	Bulongwa	1	Bulongwa	25	5.5
	Iniho	2	Iniho	19	6.9
		3	Kidope	12	4.3
		4	Lumage	24	20.8
		5	Mwakauta	19	11.3
	Ipelele	6	Ipelele	12	10.4
	Ipepo	7	Ipepo	20	15.3
	Isapulano	8	Isapulano	25	16.3
		9	Ivilikinge	28	11.4
		10	Luvulunge	15	6.6
	Iwawa	11	Ivalalila	22	11.9
		12	Ludihani	33	10.6
		13	Ndulamo	28	9.6
	Kitulo	14	Nkenja	18	15.7
	Lupalilo	15	Kising'a	16	43.8
		16	Lupalilo	23	12.8
		17	Mago	17	21.2
	Mang'oto	18	Ibaga	13	6.3
		19	Ilindiwe	20	13.2
		20	Malembuli	16	14.7
		21	Mang'oto	25	19.3
		22	Usungilo	18	11.7
	Tandala	23	Ihela	18	10.2
Total				466	309.7

Table 23 Numbers and areas of field-surveyed woodlots by village (2021)

PFP 2 FIC	District	#	Village	No. of surveyed woodlots	Total area of surveyed woodlots (ha)
Mafinga FIC	Kilolo DC	1	Boma la Ngo'mbe	18	10.1
		2	Mwatasi	18	12.8
	Mafinga TC	3	Matanana	18	62.9
	Mufindi DC	4	Ikongosi	19	16.1
		5	Ugesa	20	15.7
		6	Ludilo	24	11.0
		7	Kidete	22	8.2
		8	Kitiru	21	8.2
		9	Mtili	19	11.1
Njombe FIC	Ludewa DC	10	Mangalanyene	21	22.7
		11	Ilawa	19	11.1
	Madaba DC	12	Maweso	21	18.6
		13	Wino	15	49.0
	Njombe DC	14	Isoliwaya	19	7.0
		15	Lyalalo	12	9.6
		16	Kidegembye	21	34.7
	Njombe TC	17	Iboya	20	53.7
		18	Madobole	19	14.0
		19	Mtila	18	20.2
Makete FIC	Wanging'ombe DC	20	Imalilo	20	25.1
		21	Mafinga	18	17.9
		22	Moronga	19	25.5
Total				421	465.3

In Makete and Njombe FICs, the GPS-verified areas of the woodlots were smaller on average than the areas mapped during the PGIS procedure. In Mafinga, in contrast, the average difference was close to negligible.

The different results for these clusters are likely attributable to differences in landscape characteristics that affected how precisely PGIS participants were able to identify the boundaries of their woodlots. In Mafinga FIC for example, the prevalence of maintained easily identifiable firebreaks round woodlots in satellite images was higher than in the other two clusters (see Section 3.2.12). In Makete FIC, which had the highest deviation between the PGIS and the field-verified areas, forested areas were extensive, natural regeneration was pervasive, and there was a lack of identifiable landmarks. Such landscape appeared relatively homogenous on the satellite images, making boundary identification challenging.

The date of the available satellite imagery also affected participants' ability to map boundaries precisely. In some cases, PGIS participants marked large areas (such as family-owned farms) rather than the actual individual woodlots if the latter were not easily identifiable in the satellite images.

3.1.2 Featured woodlot owners

The 1 445 woodlots mapped in the PGIS were owned by 667 owners. Hence, the PGIS participants each mapped about 2.2 woodlots on average. This figure does not represent the total number of woodlots owned by local smallholders on average but is a result of the chosen sampling strategy.

Adding in the woodlot owners who did not participate in PGIS but only participated in the subsequent field surveyed, information was collected from a total of 733 woodlot owners. In addition, nine institutions were included. About 17% of the surveyed private individuals were women and 83% were men. In Mafinga FIC, the share of women was somewhat higher, than the average (23%); in both of the other clusters it was 15%. It is not possible to assess how

precisely the share of women in the data reflects the share of women among smallholder tree growers in the target communities.

There were large differences between the three clusters in TGA membership among the participated tree growers (Table 24). In Mafinga FIC, two-thirds of the tree growers participating in the survey were TGA members, whereas in Makete FIC the share was only 22%. During the survey in Makete District in 2020, TGA members were only encountered in eight out of the 23 villages surveyed, reflecting the general lack of established TGAs in Makete at the time of the survey.

Table 24 TGA membership among participating tree growers

TGA membership	Makete FIC	Mafinga FIC	Njombe FIC
Yes	22%	67%	54%
No	78%	33%	46%

By a large margin resident villagers were the dominant investor type among the participating tree growers, and it is apparent that their representation was amplified by the sampling strategy selected. In Njombe FIC, the share of government institutions as woodlot owners (6%) was also noteworthy. Only occasional few representatives of the other categories were included in the three clusters (Table 25).

Table 25 Distribution of investor types among participating tree growers

Type of investor	Share of participants		
	Makete FIC	Mafinga FIC	Njombe FIC
Resident villagers	98%	98%	92%
Residents of nearby villages	0%	0%	1%
Urban investors originating from the area	0%	0%	0%
Other urban-based investors	0%	1%	0%
Government institutions	1%	1%	6%
Religious organisations	1%	1%	1%
Other NGOs	0%	0%	1%

3.1.3 Sample of the SME survey

Number of SMEs and interviews

A total of 531 individual forest-based SMEs were identified in the target communities during the baseline surveys. This number includes both the SMEs from which preliminary information was collected in conjunction with the PGIS exercise as well as additional SMEs identified later during the field survey visit. Out of this pool of SMEs, 310 were interviewed for more detailed information during the field survey visit. A breakdown of the figures by village is presented in Table 26 and Table 27. Almost all interviewed SMEs were represented by the business owners themselves; only nine SMEs sent a representative.

Table 26 Number of identified and interviewed SMEs by village (2020)

District	Ward	#	Village	Total no. of identified SMEs	No. of interviewed SMEs
Makete DC	Bulongwa	1	Bulongwa	26	13
	Iniho	2	Iniho	16	6
		3	Kidope	9	5
		4	Lumage	7	5
		5	Mwakauta	13	7
	Ipelele	6	Ipelele	12	3
	Ipepo	7	Ipepo	5	5
	Isapulano	8	Isapulano	13	5
		9	Ivilikinge	6	5
		10	Luvulunge	2	2
	Iwawa	11	Ivalalila	8	8
		12	Ludihani	23	15
		13	Ndulamo	14	12
	Kitulo	14	Nkenja	21	13
	Lupalilo	15	Kising'a	20	9
		16	Lupalilo	18	10
		17	Mago	15	9
	Mang'oto	18	Ibaga	10	4
		19	Ilindiwe	4	3
		20	Malembuli	10	6
		21	Mang'oto	16	7
		22	Usungilo	23	11
	Tandala	23	Ihela	13	11
Total				304	174

Table 27 Number of identified and interviewed SMEs by village (2021)

PFP 2 FIC	District	#	Village	Total no. of identified SMEs	No. of interviewed SMEs
Mafinga FIC	Kilolo DC	1	Boma la Ngo'mbe	12	7
		2	Mwatasi	13	5
	Mafinga TC	3	Matanana	8	2
	Mufindi DC	4	Ikongosi	11	8
		5	Ugesa	17	12
		6	Ludilo	15	11
		7	Kidete	12	10
		8	Kitiru	11	8
		9	Mtili	17	10
Njombe FIC	Ludewa DC	10	Mangalanyene	9	7
		11	Ilawa	9	7
	Madaba DC	12	Maweso	8	6
		13	Wino	12	7
	Njombe DC	14	Isoliwaya	7	0
		15	Lyalalo	11	7
		16	Kidegembye	10	3
	Njombe TC	17	Iboya	9	6
		18	Madobole	3	3
		19	Mtila	9	4
Makete FIC	Wanging'ombe DC	20	Imalilo	6	4
		21	Mafinga	7	3
		22	Moronga	11	6
Total				227	136

3.1.4 Gender distribution of respondents

Entrepreneurship at a small or medium scale within the forestry sector was found to be predominantly men's business in the survey area. In Mafinga and Njombe FICs, only one respondent in both clusters (out of the total of 73 and 51 respondents respectively) was female, meaning that the share of female business owners was a mere 1–2%.

One exception was charcoal-making in Makete FIC, which involved a lot of female entrepreneurs. Charcoal-making SMEs also constituted the largest proportion of SME types in the cluster, increasing the share of female entrepreneurs to 11% in Makete FIC.

The sampling strategy selected suggests that these figures represent the actual female representation in ownership of the forest-based businesses in the target communities relatively well.

3.1.5 Response from large forest-based companies

The questionnaire (Annex 4) was delivered to a total of 25 large forest-based companies (24 in Mafinga FIC and one in Njombe FIC). A list of these companies is included in Annex 5. Out of the 25 companies, at least a partial response was received from 18 companies (17 in Mafinga FIC and one in Njombe FIC) resulting in a response rate of 72%. Seven companies refused to provide any information.

3.2 Results from the survey on smallholders' woodlots

3.2.1 Distribution of woodlot sizes

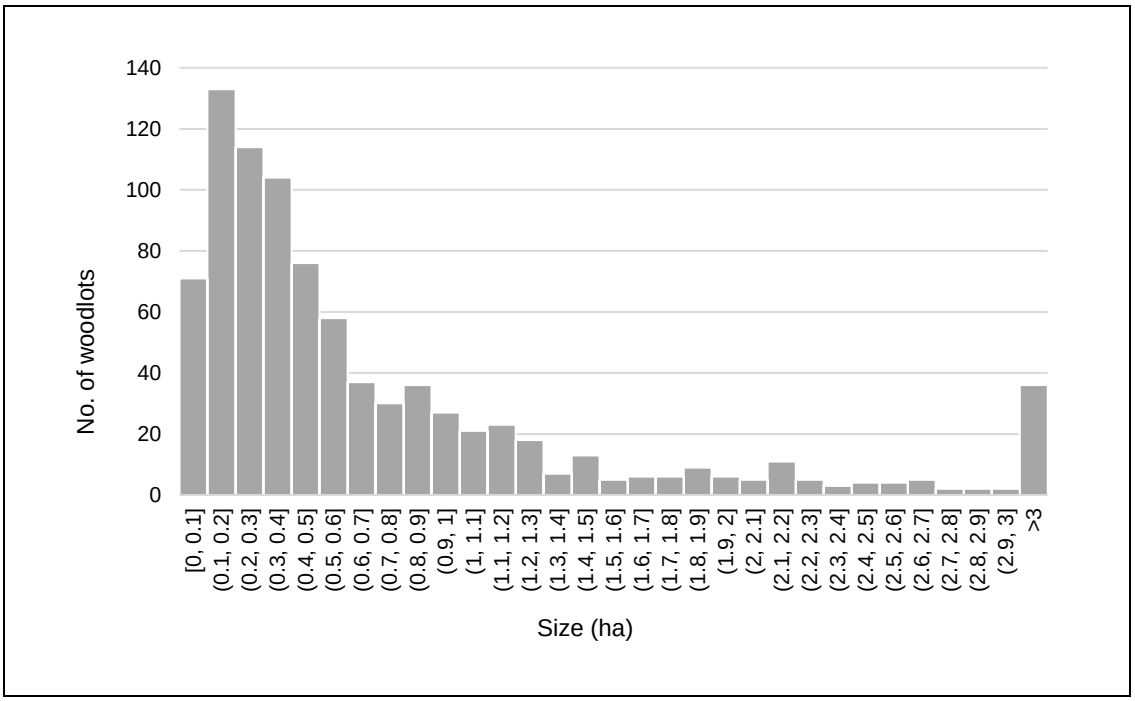
Woodlot boundaries were verified in the field with GPS for 879 surveyed woodlots. The greatest area was covered in Makete FIC, which was also represented by the largest sample of woodlots. The average woodlot size in Makete FIC, however, was the smallest of the three clusters (Table 28). Njombe FIC stands out with substantially larger woodlots than those in the other two clusters, a fact made evident by both the average and the median woodlot sizes.

Table 28 Summary of woodlot area statistics

Variable	Makete FIC	Mafinga FIC	Njombe FIC
Total area of surveyed woodlots (ha)	378	156	241
Average woodlot size (ha)	0.73	0.87	1.30
Median woodlot size (ha)	0.38	0.46	0.58

The woodlot sizes were found to follow a relatively similar pattern of distribution across all three clusters. The distribution was heavily skewed towards smaller woodlots, with the greatest number between 0.2 ha and 0.4 ha and just a few each of larger woodlot sizes. The aggregate distribution is shown in Figure 7.

Figure 7 Distribution of the sizes of the surveyed woodlots



A total of 37 woodlots had an area of 3.0 ha or more. Eight of these had an area of 10.0 ha or more. The two largest woodlots had areas of 22.3 ha and 19.2 ha respectively. Both were located in Njombe FIC.

In addition, the field team verified woodlot area sizes as large as 104 ha and 90 ha during the field work. However, these were categorised as large investor woodlots and included in a separate dataset not addressed in this report.

3.2.2 Tree genera

The survey included woodlots of four tree genera: **pine**, **eucalyptus**, **cypress**, and **acacia** (black wattle).

Pine was the most common genus in the surveyed woodlots in all three clusters. In Makete FIC, 99% of all surveyed woodlots were pine woodlots. Each of the other three genera were represented by only one or two woodlots.

Pine also dominated the woodlots surveyed in Mafinga and Njombe FICs. However, unlike in Makete FIC, these two clusters also had a notable share of eucalyptus woodlots, too: 13% and 10%, respectively. Cypress and black wattle woodlots were represented by only two woodlots in each cluster.

The results do not exactly reflect the areas of the four tree species cultivated in the target communities. Instead, it reflects what smallholder tree growers consider as their commercially relevant woodlots and is a result of the sampling methodology employed.

While cypress was found to be an uncommon species in the landscape surveyed, the team did observe black wattle woodlots clustered in the survey areas in all three FICs. They therefore concluded that black wattle was not represented in the survey sample in a proportional manner, a conclusion supported by the remote sensing-based forest plantation mapping conducted by PFP 1 in 2017[7].

Many of the black wattle stands observed outside of the survey sample showed strong natural regeneration and high stand density and had no signs of commercial or science-based management. It is possible that, because of the context of the survey, smallholder tree growers were not motivated to take surveyors to such woodlots and preferred instead to show their pine and eucalyptus woodlots that typically involved some level of silvicultural input by the growers.

Some stands with mixed species composition were encountered in the survey, especially in Makete FIC. In this cluster, the strong natural regeneration of pine, along with the natural regeneration of eucalyptus, black wattle, indigenous hardwoods, and bamboo, as well as low level of silviculture, occasionally produced quite heterogenic woodlots. However, in the majority of cases, the determination of the main tree cohort (and, accordingly, the main genus) was not problematic.

3.2.3 Planted woodlots vs. natural regeneration

The natural regeneration of pine (specifically the predominant *Pinus patula*) was a special feature of Makete FIC due to propitious climate and edaphic conditions in both Makete and Wanging'ombe districts. One-third (33%) of pine stands surveyed in Makete FIC were assessed to have emerged through natural regeneration. In addition, some pine woodlots in Njombe FIC (4%) were classified as naturally regenerated. In Mafinga FIC, in contrast, natural regeneration was a marginal phenomenon.

Pine woodlots with a mixture of the two establishment methods were also frequently observed in Makete FIC, but they were classified based on the predominant method of establishment.

Of the surveyed eucalyptus woodlots, which were mainly present in Mafinga and Njombe FICs, 11% were classified as having emerged mainly through natural regeneration. However, some natural regeneration was often present in maturing eucalyptus woodlots which were nonetheless classified as planted.

The assessment of the method of establishment referred to the current main cohort of trees on the site and did not consider the method of establishment of any preceding tree generation on the same site.

As with the observed tree genera, the results do not exactly reflect the distribution of the total forest resources between these two establishment methods in any of the target communities, especially in Makete FIC. Additional observations from the field as well as satellite images indicate that the share of naturally regenerated pine forest resources in the targeted communities in Makete FIC may be higher than the observed one-third.

The woodlots included in the survey mainly represent what smallholder growers consider to be their commercially relevant properties. It is suggested that naturally regenerated pine stands in Makete FIC, which often exhibit extremely high stand densities with suppressed diameter growth and hence low economic value, are not necessarily brought within the scope of a woodlot owner's main silvicultural focus.

[7] PFP (2017). Forest plantation mapping of the Southern Highlands. Final report. Iringa, Tanzania.

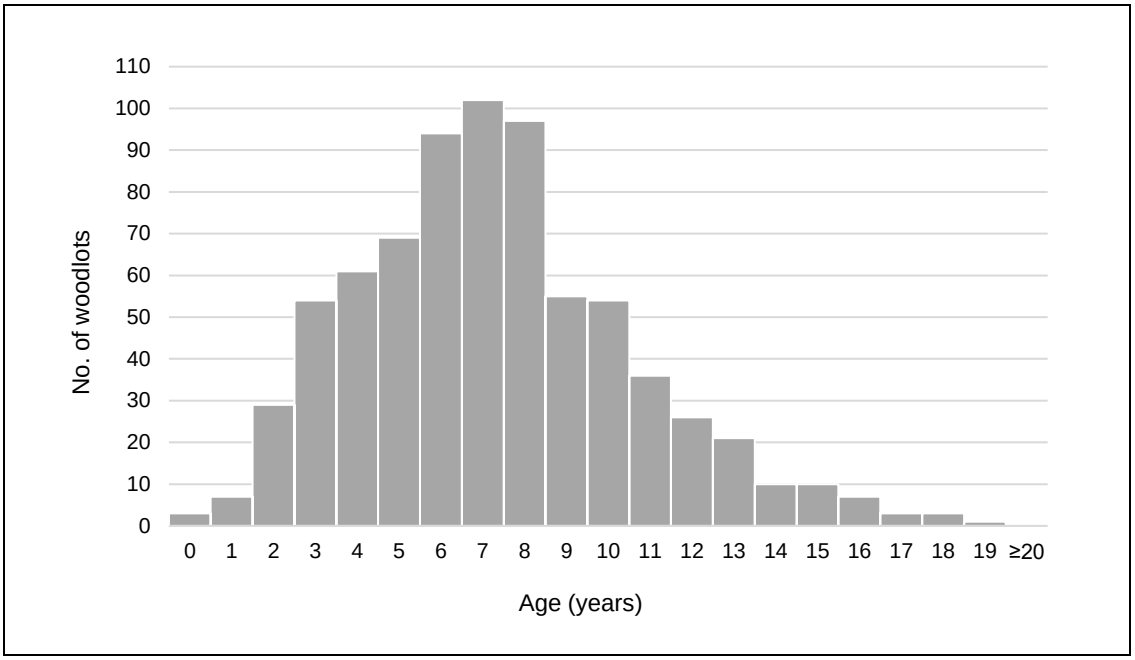
3.2.4 Age distribution of the surveyed woodlots

A sample tree representing the main tree cohort was selected for destructive sampling in 742 woodlots and the annual rings were counted to verify its age. Destructive sampling was carried out only with the woodlot owner's approval.

The most common ages for surveyed woodlots were six, seven, and eight years (Figure 8). The oldest woodlot included in the survey with a verified age had been established 19 years earlier. Some of the visited eucalyptus woodlots with large trees were reportedly older, but their exact age could not be verified. Makete FIC demonstrated a slightly older age structure than the other two clusters.

The results show that smallholder woodlots were commonly cut between 9 and 13 years of age. The majority of the observed woodlots above 14 years of age were in Makete FIC. In fact, in Makete FIC the frequently quoted issue of premature harvesting was found to be more linked with the size (especially DBH) than the age of trees. The pine natural regeneration characteristic of Makete FIC had, together with the lack of forest management, commonly produced high stand densities with suppressed diameter growth. This suppression delayed harvesting opportunities.

Figure 8 Age distribution of the surveyed woodlots



It should be noted that woodlots below six years of age were underrepresented in the data. The sampling procedures favoured the inclusion of maturing woodlots instead of recently established plantations, hence skewing the age distribution of the data towards older woodlots. Hence, the observed younger side (the left-hand side) of the age distribution graph shown in Figure 8 does not reflect the real situation; on the contrary, it underestimates the share of younger woodlots.

3.2.5 Height growth and site indexes

Measurements were used to determine the mean height of the trees in each woodlot. An estimate of the dominant height in woodlots aged 5 or more years was calculated by adding two metres to the measured mean height. This allowed the surveyors to estimate site indexes for the surveyed pine woodlots. Sao Hill site index curves[8] were used as a reference.

On average, the observed site indexes were very good throughout the study areas, with some differences among the three clusters. Figure 9 shows how all the survey data on pine woodlots

[8] Malimbwi, R.E., Mugasha, W.A. and Mauya, E. (2016). Pinus Patula Yield Tables for Sao Hill Forest Plantations, Tanzania. Sokoine University of Agriculture, Morogoro. 38 pp.

of five years and above is positioned in relation to the site index curves for Sao Hill classes I–IV. Table 29 shows the distribution disaggregated by cluster. Data from woodlots younger than five years was omitted since the site index system is not applicable with them.

Figure 9 Dominant height vs. age of pines with Sao Hill site index curves I–IV

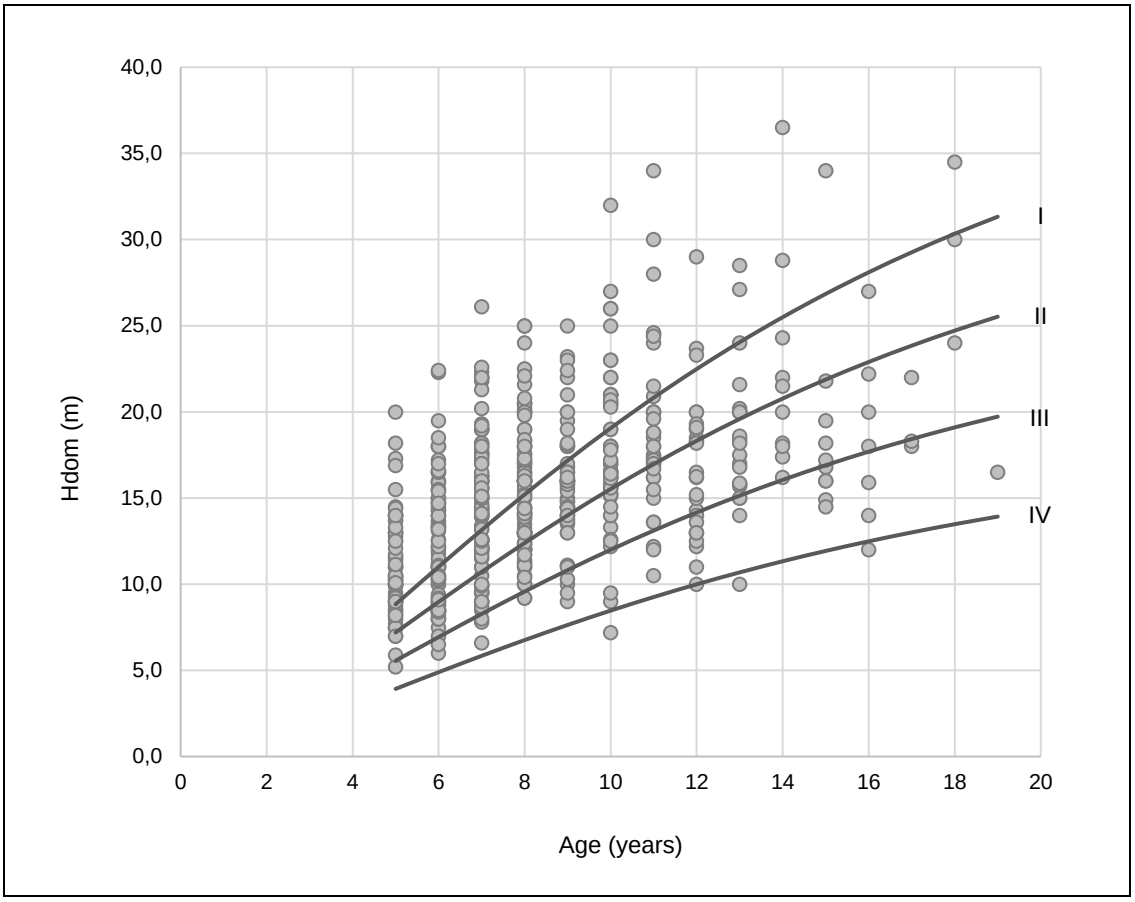


Table 29 Distribution of pine woodlots according to the Sao Hill site index curves

Upper curve	Lower curve	Makete FIC	Mafinga FIC	Njombe FIC
(no limit)	Site index I	40%	62%	52%
Site index I	Site index II	29%	26%	26%
Site index II	Site index III	21%	9%	19%
Site index III	Site index IV	9%	2%	3%
Site index IV	(no limit)	1%	0%	0%
Total		100%	100%	100%

Note: Only woodlots aged 5 or more years are included.

Mafinga FIC showed the best growth potential on average, with 62% of the pine woodlots meeting or exceeding the performance of Sao Hill class I and about nine out of ten pine woodlots performing better than Sao Hill class II.

In Njombe FIC, the performances of about half of the pine woodlots were equal or better than that of Sao Hill class I. In Makete FIC this share was 40%. The latter finding verified the result from another PFP-facilitated study that concerned natural regeneration in Makete District. This study found that 41% of measured woodlots exceeded the performance of Sao Hill class I.

As seen in Figure 9, a large share of the woodlots performed much better than Sao Hill class I. This result calls for including an additional class above the current class I. Sao Hill site class IV, on the other hand, was found to be less useful for classifying the growing sites in the survey areas due to the low number of matching observations.

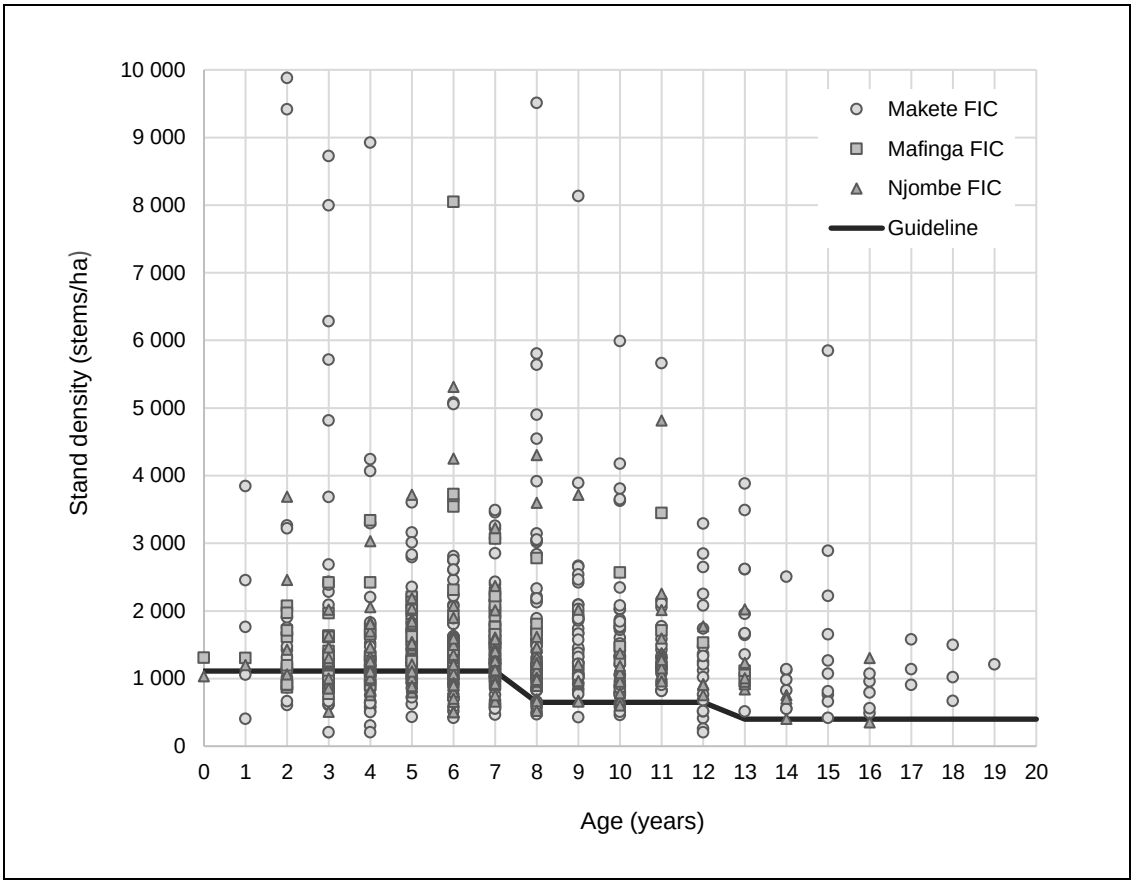
3.2.6 Stand density

The measured stand densities (stocking) in the smallholder woodlots were generally characterised by overstocking to various degrees throughout the survey areas.

The observed stand densities were compared with the general planting density and thinning guidelines for sawlog production endorsed in Tanzania by the TFS and the Forestry and Beekeeping Division of the Ministry of Natural Resources and Tourism[9,10]. The guidelines recommend a planting density of 1 111 stems/ha, a figure resulting from a 3 x 3 m planting grid. That density is then reduced to 650 stems/ha at the age of eight years and still more to 400 stems/ha at the age of 13 years.

Figure 10 shows the observed stand densities by age in each of the three clusters, along with a line depicting the guidelines values for stand density Overstocking is prominent in every cluster.

Figure 10 Observed stand densities vs. the guideline value



Makete FIC generally had the most drastic levels of overstocking. The average stand density in Makete FIC was 1 729 stems/ha. This figure took into consideration woodlots of all ages, including older ones that, according to the national guidelines, should have been thinned. In the 33% of Makete FIC woodlots that were categorised as naturally regenerated, the average stocking was as high as 2 332 stems/ha, more than double the recommended initial planting density. The highest recorded stockings approached 10 000 stems/ha and additional observations from some juvenile woodlots that had emerged through natural regeneration in the landscape indicated that stand density figures may even be considerably higher than this.

In Mafinga FIC the average stand density was 1 513 stems/ha. The average stand density in Njombe FIC was 1 194 tems/ha, the closest to the generally recommended planting density of

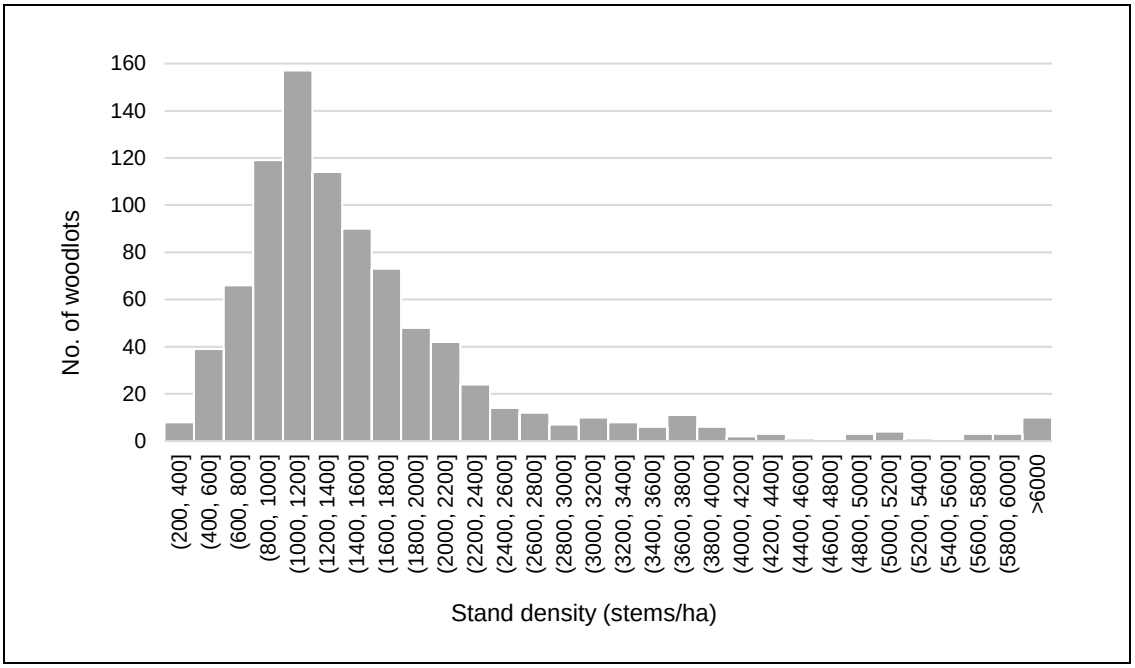
[9] Forestry and Beekeeping Division (2021). Technical order No. 1 of 2021. 13 pp.

[10] Forestry and Beekeeping Division (2017). Forest plantation and woodlot technical guidelines. 55 pp.

1 111 stems/ha. However, considering the thinning guidelines for maturing woodlots, this cluster was also overstocked on average.

Figure 11 shows the distribution of all stand densities recorded in the survey and, also considering the observed age distribution (Figure 8), demonstrates the disproportionally small share of woodlots complying with the thinning guidelines. Woodlots with lower stand densities than recommended were also recorded in the survey, but in many cases the underlying cause of such low density was a high mortality rate that had occurred in conjunction with planting or later through damage. Nevertheless, the survey teams also observed that some commercial thinning had been carried out in some of the surveyed woodlots. This fact proved that, although rare, thinning was practiced to some extent in some of the target communities.

Figure 11 Distribution of stand density in the surveyed woodlots



Njombe FIC had the highest share of maturing woodlots with an adequate stocking level: 12% of woodlots over eight years of age had a stand density of 650 stems/ha or below. In Makete FIC this share was 9% and in Mafinga FIC it was zero, though the latter result was likely affected by the relatively small total number of older woodlots in the sample.

In Makete FIC it was not uncommon to encounter early re-spacing of naturally regenerated stands; however, stand densities were often still high even after this activity, indicating that not enough stems had been removed.

3.2.7 Diameter growth

Mean diameter at breast height (DBH) was determined for each measured woodlot. The distribution of the recorded DBHs by woodlot age is shown in Figure 12. The data confirms that there is potential for fast diameter growth, as the observed prevalence of high site indexes suggests would be the case. However, the bulk of the data was skewed towards smaller DBHs, a finding attributable to the overstocking of woodlots.

The suppression of DBH was greatest in Makete FIC, where only 40% of the woodlots aged 12 or more years had reached a mean DBH of 20 cm. The observed distribution of site indexes in Makete FIC predicted that this DBH would have been reachable by at least 70% of the woodlots if adequate spacing had been provided.

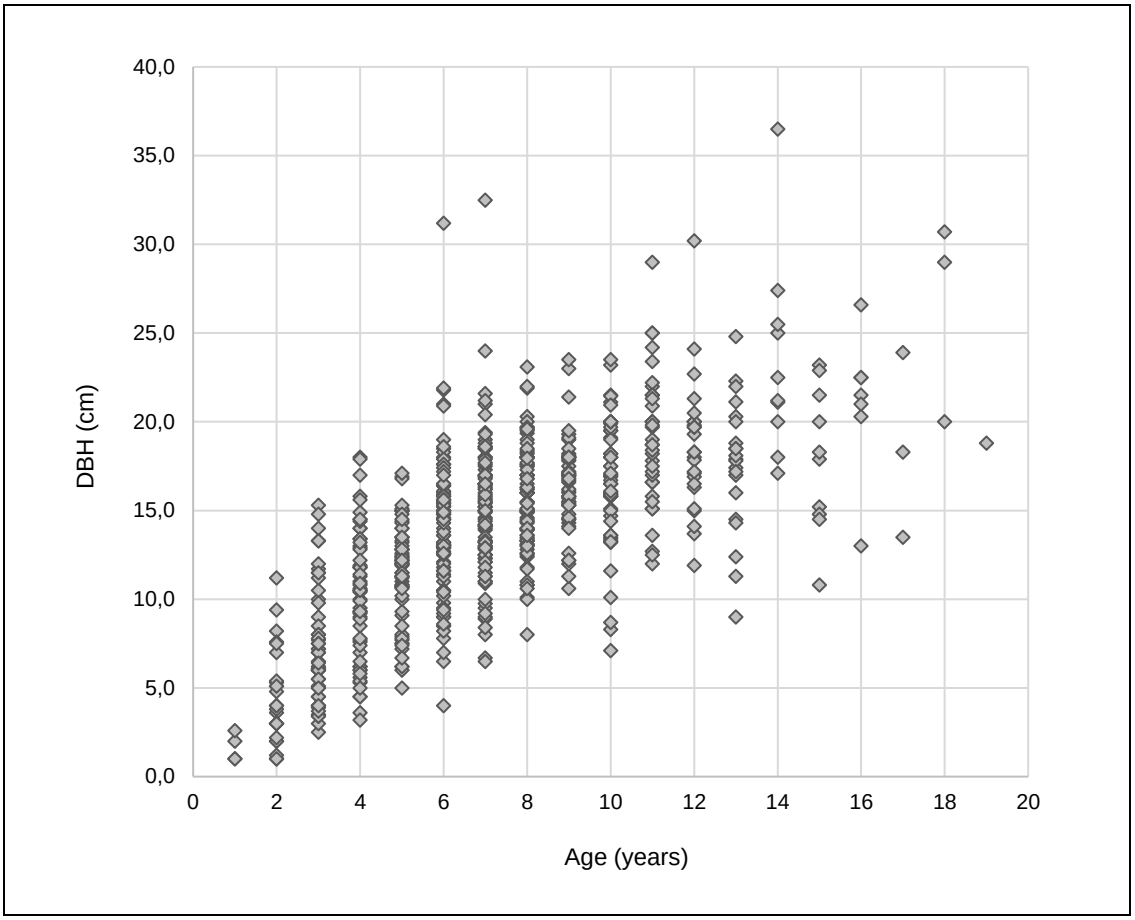
In Mafinga and Njombe FICs the observed DBH growth was better, with the respective share of DBH of 20 cm or more in woodlots aged 12 or more years around 70% in both. However, this rate also fell below the growth potential predicted by the observed site index distributions.

As seen in Figure 12 there were only a few observations of large DBHs in the data. A mean DBH of 25 cm or above was reached by only 1.4% and 1.7% of the woodlots in Makete and

Mafinga FICs, respectively. In Njombe FIC, which had the lowest stand densities, this share was 5.4%.

The highest mean DBH observed during the field work was 46 cm. It occurred in a mature eucalyptus woodlot whose age could not be verified.

Figure 12 DBH vs. age in the surveyed woodlots



To further inspect the effect of stand density on DBH growth, Figure 13 presents a case in which the effect of the site quality has been reduced and the stand density is the single major factor explaining the observed DBH differences.

The left graph (a) of Figure 13 presents all the DBH vs. age data from Makete District, where the observed variations in DBH were generally radical. The right graph (b) of Figure 13 presents data on the relatively homogenous site quality group between Sao Hill site curves I and II in Makete District.

Graph (a) shows how the DBH distribution widens as the age of a woodlot increases. By the age of four years the difference between the smallest and the largest recorded DBHs had reached 10 cm, and from the age of ten years onwards this gap had widened to about 15 cm and more. The volume of an average tree can be radically different in woodlots of the same age, especially in maturing plantations.

Narrowing down the inspection to woodlots with similar site conditions has a rather limited effect on the observed DBH differences, as can be seen by comparing graphs (a) and (b). Even when site conditions are similar, the DBH differences between woodlots of the same ages remain large, around 10–15 cm in woodlots around 10 years of age.

The effect of the stand density on DBH development is further explored in Figure 14, which also makes use of Makete District data. The figure adds stand density as a third parameter in the age vs. DBH graph. The data shows that the DBH growth of overstocked woodlots (with stand densities of over 2 000 stems/ha) stagnates within the range of 15–20 cm. In fact, all the observations of a mean DBH above 20 cm are from woodlots with a mean stand density less

than 2 000 stems/ha. However, it does seem that the DBH has the potential to develop up to this level within the observed age range even on woodlots with stand densities of 4 000 stems/ha and above.

Figure 13 DBH vs. age in all Makete District woodlots (a) and in Makete District woodlots with a site index between Sao Hill classes I and II (b)

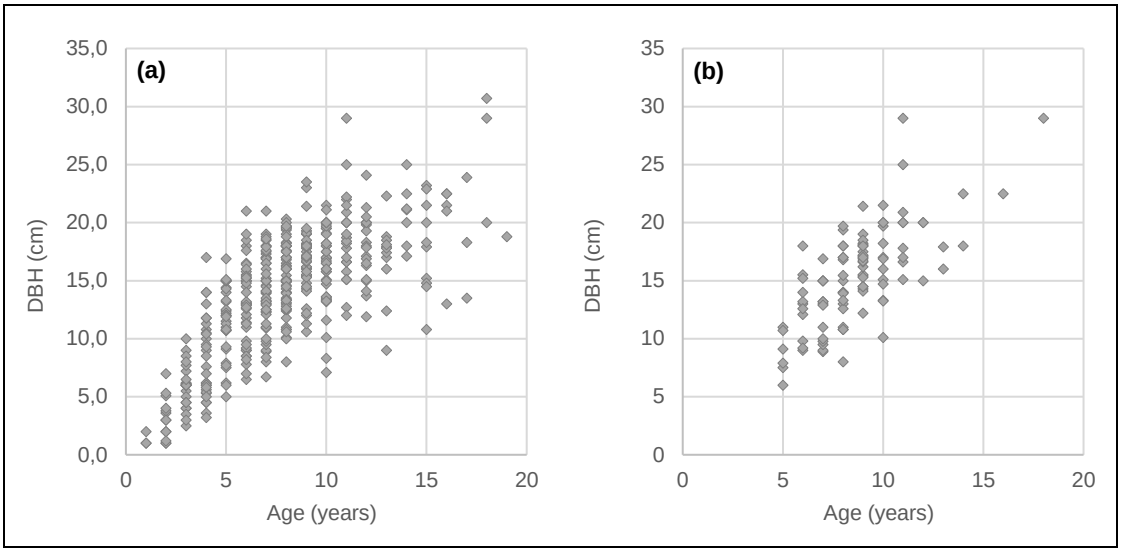
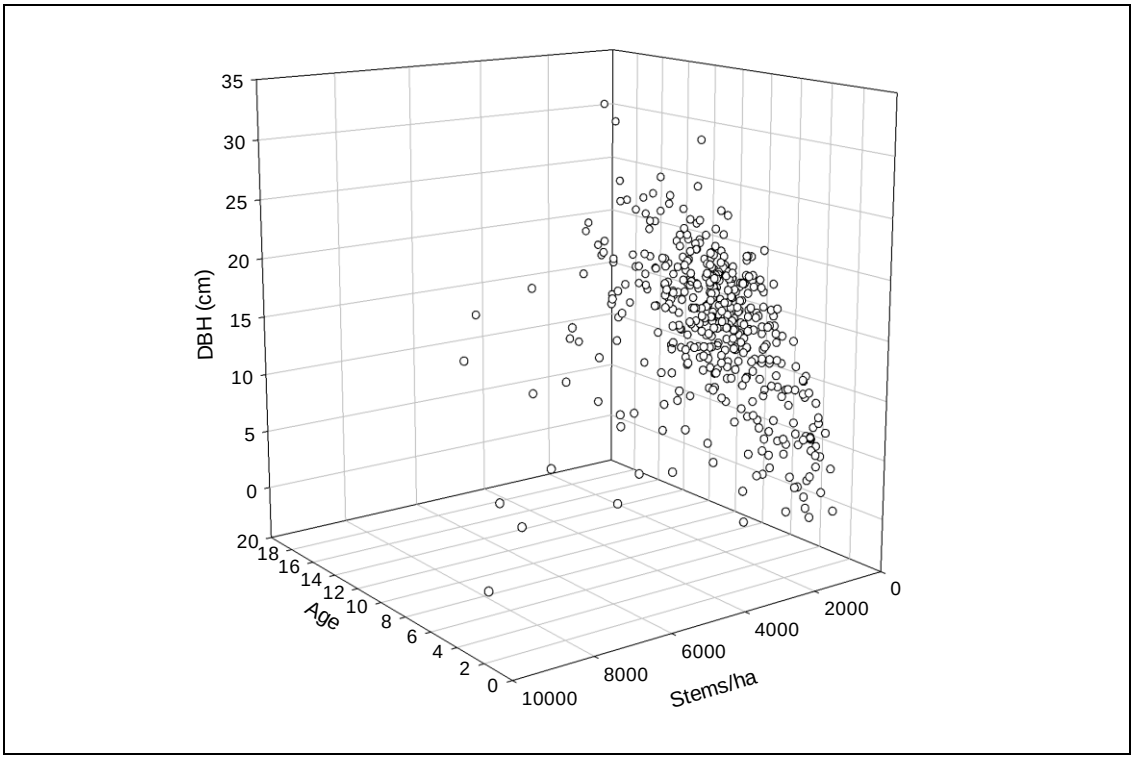


Figure 14 Age vs. DBH vs. stand density in Makete District woodlots



The results show that the management of stand density has a significant impact on the development of the mean DBH and volume. Management should be timely and enough stems should be removed to prevent the stagnation of growth.

3.2.8 Survival of trees

The number of standing dead trees on sample plots was counted to determined rates of tree survival. While this procedure was done on all the sample plots, special attention was given woodlots of 0–2 years of age to determine the post-planting and juvenile mortality of trees.

In Mafinga FIC the observed survival rate of woodlots younger than two years was 90%; in Njombe FIC it was 84%. While these figures are relatively normal for plantation-based forestry in the region, they were nonetheless affected by small sample sizes (11 woodlots in Mafinga FIC and four in Njombe FIC), a fact that added uncertainty to the results. The lowest survival rate was 33%, measured in a juvenile eucalyptus woodlot that had been planted too late, at the end of the rainy season. In Makete FIC, which had the largest sample of woodlots aged 0–2 years (24), the survival of woodlots in this age range was excellent, with a mere 1% rate of mortality. Low mortality among saplings which emerge through natural regeneration instead of being planted may partially explain this result.

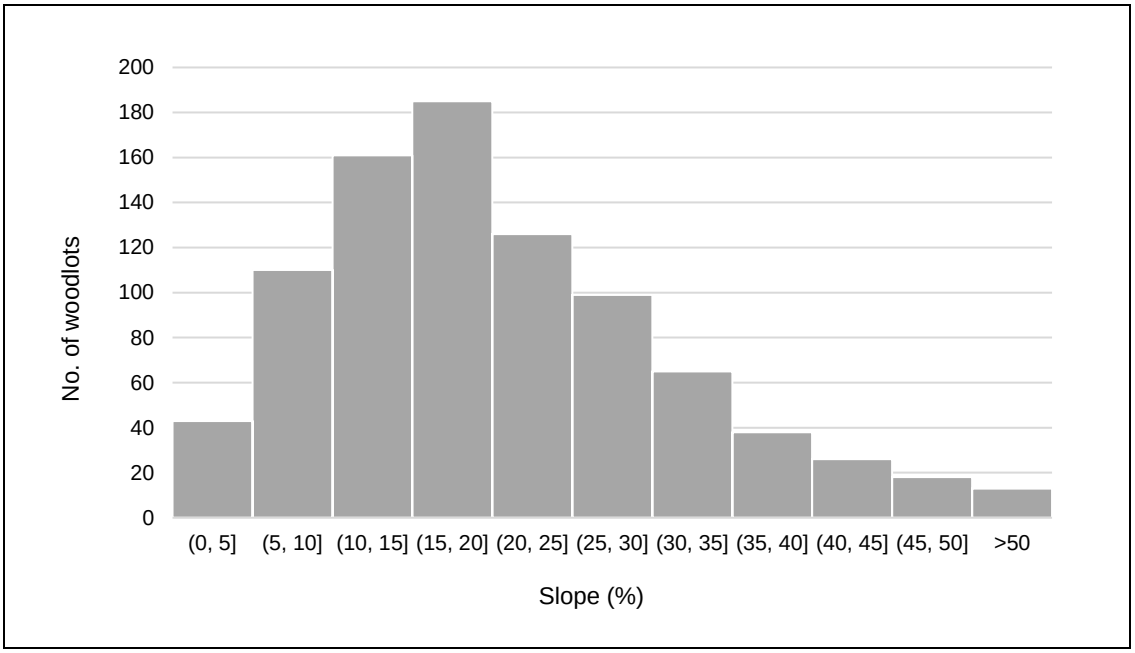
High mortality was also encountered in some older individual woodlots due to damage from events such as wildfires. Eight woodlots in the whole survey had a survival rate lower than 70% and 17 had a survival rate lower than 80%. The overall survival rate in all clusters was 96.7–99.5%. The good overall figures are partially the result of the survey methodology, which considered standing dead trees but not fallen ones. Hence, mortality could be recorded only for a limited time after its occurrence while the dead trees were still standing. After they had fallen, the mortality rate was reflected in the data as lower stand densities rather than lower survival rates.

3.2.9 Slope

The slope class distribution of the surveyed woodlots based on sample plot coordinates and a digital elevation model is shown in Figure 15.

The steepest slopes were encountered in the woodlots of Makete FIC, which had an average slope of 23% (13°). The woodlots in Mafinga FIC had been established on the flattest lands, with an average slope of 15%. The average slope in Njombe FIC, 19%, fell between the slopes of the other two clusters. These slopes are gradual enough to make forestry operations feasible.

Figure 15 Distribution of the slope classes of the surveyed woodlots



Individual woodlots were found to have been established on considerably steep slopes, especially in Makete FIC. A total of 95 woodlots, 62 of which were in Makete FIC, had been established on a slope greater than 35%, a gradient generally considered steep enough to hamper mechanised forestry operations. A TFS guideline[11] instructs woodlot owners not to plant

[11] Tanzania Forest Services Agency (2018). Technical order no. 1 of 2018. Technical specifications for management of TFS forest plantations in Tanzania. 18 pp.

trees on slopes steeper than 60%. One woodlot included in the survey exceeded this value, having a slope of 94% (43°). It was considerably steeper than any other surveyed woodlot.

3.2.10 Weeding

Each surveyed woodlot was given a score of 0, 1 or 2 for the level of weeding performed on it. The definitions presented in Table 12 were used to determine the score. During data analysis, special emphasis was given to the weeding practices on woodlots aged 0–2 years as weeding has the greatest silvicultural relevance at that age range. The results for this age group are shown in Table 30.

Table 30 Observed weeding status for woodlots aged 0–2 years

Weeding status	Makete FIC		Mafinga FIC		Njombe FIC	
	N	%	N	%	N	%
Not done	21	88%	7	64%	2	50%
Partial/insufficent	2	8%	3	27%	2	50%
Good standard	1	4%	1	9%	0	0%
Total	24	100%	11	100%	4	100%

Juvenile woodlots, it was found, were rarely weeded at a good silvicultural standard, if at all. Especially in Makete FIC, the levels of weeding for woodlots aged 0–2 years was very low. In Mafinga FIC, about two-thirds of woodlots of this age had not been weeded at all. The small sample size in Njombe FIC adds uncertainty to the results but indicates that abidance by weeding guidelines is low in that cluster, too.

Unexpectedly, weeding was observed also on older woodlots, with as much as about one out of four woodlots of all ages in both Mafinga and Njombe FICs showing some signs of weeding (in Makete FIC this share was 6%). It was assumed that these activities were being done mainly for reasons other than actual silvicultural requirements, such as improving access to or the aesthetics of the older woodlots.

3.2.11 Pruning

The pruning status of each woodlot was assessed and given a score of 0–3 as per the definitions presented in Table 13. If pruning had been done, the focus of the surveyors was in assessing the technical quality of the pruning. Eucalyptus woodlots are not pruned, but the results from pine woodlots are shown in Table 31. In addition, the average hight of pruning was measured in pruned woodlots. Additional statistics from pruning are included in Table 32.

Table 31 Observed pruning status of pine woodlots

Pruning status	Makete FIC	Mafinga FIC	Njombe FIC
Not done	12%	23%	15%
Poor	13%	14%	21%
Mediocre	53%	48%	54%
Good	23%	15%	10%
Total	100%	100%	100%

Table 32 Additional pruning statistics

Variable	Makete FIC	Mafinga FIC	Njombe FIC
Average score of pruned woodlots (1–3)	2.1	2.0	1.9
Average pruning height	2.3 m	2.5 m	2.6 m
Share of pruned woodlots with pruning height ≥3.7 m	4%	6%	9%

The results show that pruning was a common practice in the survey areas but that it was mostly limited to the first pruning (access pruning). The prevalence of pruning in Mafinga FIC was somewhat less than in the other two clusters.

The technical quality achieved was largely mediocre because the bush knife (panga knife / machete) was practically the only tool used to prune the survey areas, and this tool often causes

defects in pruned trees. The resulting scores would have been lower since freshly pruned woodlots often scored poorly, but in many cases the defects had healed by the time the survey was conducted.

Relatively few woodlots had been pruned for the second time. In the available national guidelines, 3.7 metres (high pruning) is the minimum second pruning height, but, as Table 32 shows, this height was rarely achieved in the pruned woodlots. Even in Njombe FIC, where the share of high-pruned woodlots was the highest, only 9% of the pruned woodlots met this standard.

3.2.12 Firebreaks

Majority of the woodlots included in the survey had no firebreak protection. Either no firebreaks had been prepared at all, or firebreaks had been prepared but not maintained.

The situation with firebreaks in Mafinga and Njombe FICs was notably better than it was in Makete FIC, as is shown in Table 33. In Makete FIC 93% of the surveyed woodlots had no firebreak protection at all.

Table 33 Prevalence of maintained firebreaks around the woodlots

Firebreaks	Makete FIC	Mafinga FIC	Njombe FIC
Yes	7%	28%	21%
No	93%	72%	79%
Total	100%	100%	100%

The field work conducted in Makete District in 2020 was conducted in the middle of the most wildfire-prone time of the year. Fire was observed to be a major issue in the landscape and, as such, a major risk for forestry. In fact, the survey teams participated in efforts to put out wildfires in forest plantations in three different villages even as they conducted the survey work.

3.3 Results from SMEs that participated in the survey on forest-based businesses

3.3.1 SME business types

Distribution as per the main SME typology

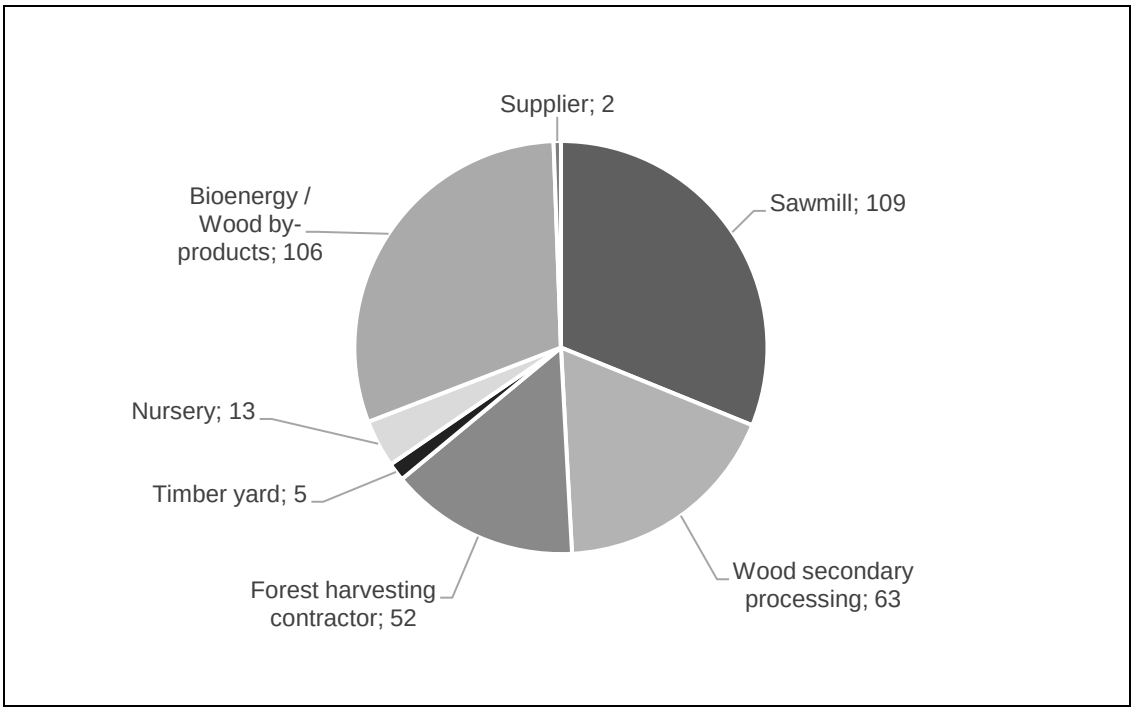
The 310 SMEs that participated in the survey were engaged in a total of 350 forest-related businesses. The difference between the total number of SMEs and the total number of businesses is due to the fact that some SMEs had more than one type of business.

Figure 16 shows the distribution of the businesses of all the SMEs included in the survey as per the main SME typology (see Table 7).

The most common business type was sawmilling, which 109 SMEs engage in. Sawmilling was followed by the category of bioenergy and wood by-products, which had an almost equally large number of SMEs, 106. Two other notable business types were wood secondary processing (63 SMEs) and forest harvesting contractors (52 SMEs). Other featured business types (nurseries, timber yards, and suppliers) were rare in comparison to these four.

The surveyors did not encounter any SMEs engaged in pole or veneer production, pine resin collection, saw doctoring, wood transportation, or forestry consultancy work. The preliminary data collected from the target communities indicated that a few SMEs that engaged in the latter three categories were present in the surveyed villages, but they could not be reached for interviews.

Figure 16 Distribution of SME business types



There were differences in the distribution of business types between the three clusters. Table 34 shows the disaggregation of discovered business types by cluster. In Makete FIC the largest business type was bioenergy manufacturing (due to charcoal-making) and in Njombe FIC it was wood secondary processing (due to carpentry). Sawmilling was common in each cluster, but it was the largest business type only in Makete FIC, where it dominated by a great margin.

Table 34 SME business types by FIC

Business type	Makete FIC		Mafinga FIC		Njombe FIC	
	N	%	N	%	N	%
Sawmill	60	28%	34	43%	15	29%
Wood secondary processing	32	15%	13	16%	18	35%
Forest harvesting contractor	42	19%	5	6%	5	10%
Timber yard	1	0%	3	4%	1	2%
Nursery	5	2%	4	5%	4	8%
Bioenergy / Wood by-products	77	35%	20	25%	9	17%
Supplier	1	0%	1	1%	0	0%
Total	218	100%	80	100 %	52	100%

Business subtypes based on products, services, and technology

The survey identified business subtypes for most of the main categories, providing further information of the types of services, products, or technologies applied by the SMEs. Little variation in terms of subtypes was discovered, however.

The three major business types featured in the survey were each found to represent only a single subtype: all featured sawmills were mobile dingdong (amec) saws, the bioenergy category only featured lump charcoal producers who used pit kilns, and all wood secondary processors were carpenters. The only featured SME nursery type was polytube nursery. Forest harvesting contractors meant chainsaw operators in the survey target communities.

These results indicated a universally low level of technology among the participated SMEs. It should be noted, however, that some individual carpenters were observed to have relatively advanced machinery in their workshops.

3.3.2 SME employees

Permanent labour vs. daily labour

The interviewed SMEs reported that they employed a total of 1 754 people. This figure did not include the SME owners themselves.

The majority of employees were hired on a daily or seasonal basis rather than being contracted as permanent staff members. In Mafinga and Njombe FICs, the shares of permanent staff members out of all employees were 23% and 27%, respectively, while in Makete FIC this share was merely 11%. The result reflects the seasonality of work within SMEs operating in the forestry sector.

Bioenergy and forest harvesting SMEs in Makete FIC stood out with an especially low share of permanent employees, just 2% and 1%, respectively. Such a low share was not, however, observed in SMEs with similar activities in the other two clusters.

Sawmills were collectively the largest employment provider, with a total of 1 300 jobs provided (17% of which were permanent positions). Many sawmills did not employ any people permanently, but the average was increased because some sawmills had large numbers of permanently contracted staff members.

About 15% of the SMEs did not employ any people outside of the SME owner.

Gender distribution of SME employees

In Njombe FIC only 12% of SMEs had at least one female employee. In Makete FIC, one out of three SMEs employed women and in Mafinga FIC one out of four SMEs employed women.

The share of women out of all 1 754 employees reported in the survey was 31%. The share of women in permanent positions (19%) was notably lower than the share of women performing daily labour (34%).

There was practically no difference in the gender distribution of hired employees in SMEs owned by women and in those owned by men.

Disaggregated figures by cluster are presented in the matrix of **Error! Reference source not found.**. Njombe FIC had a considerably lower share of women SME employees – merely 2% of permanent positions and 13% altogether – than did the other two clusters.

Table 35 SME employee distribution by gender and employment type in each FIC

Employment type	Makete FIC			Mafinga FIC			Njombe FIC		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
Permanent	21%	79%	11%	23%	77%	23%	2%	98%	27%
Daily labour	37%	63%	89%	31%	69%	77%	17%	83%	73%
Total	35%	65%	100%	29%	71%	100%	13%	87%	100%

Concerning different business types, the share of women was the highest in nurseries, with 47% of the workforce comprising women. In SMEs with sawmilling activities the share of female employees was 37%. Other business types had notably smaller shares of female employees. The 27 SMEs that reported forest harvesting as their sole activity had no female employees at all.

Vulnerable and disabled SME employees

The share of SMEs employing vulnerable or disabled people differed greatly across the three clusters. In Makete FIC, 29% of SMEs had at least one vulnerable or disabled employee, while in Mafinga FIC this share was 15%. In Njombe FIC not a single SME reported employing any vulnerable or disabled people, hence the share was 0%.

The SMEs reported employing a total of 202 vulnerable persons (e.g. orphans or employees with HIV/AIDS) with reference to TASAF list and 26 persons with disability[12]. Their shares of the total workforce reported in the survey were about 12% and 1.5%, respectively. The distribution of vulnerable and disabled employees was relatively even across the different types of SMEs.

3.3.3 Average salaries

SMEs were asked the average daily salaries they paid for the four employee types – daily and contracted women and men. This data was collected only during the survey of 2021. Hence, results are not available for all of Makete FIC, but only for Wanging'ombe District in that cluster. Altogether, 102 SMEs with employees provided data on the salaries they paid.

The results for the average daily salaries are presented in Table 36. They varied between TZS 5 381 and TSZ 24 000 (about EUR 2.00–8.90) per day for different employee groups.

Table 36 Distribution of average daily salary by gender and employment type in each FIC (in TZS)

Employment type	Wanging'ombe DC		Mafinga FIC		Njombe FIC	
	Female	Male	Female	Male	Female	Male
Permanent	6 000	8 881	5 381	13 427	24 000	10 908
Daily labour	8 333	9 444	9 551	12 455	9 800	11 293

The results show that women were paid less than men under both employment types and in almost all clusters (with the limitation that Makete FIC was represented only by the data from Wanging'ombe District). This pattern was evident even though the heavy disaggregation of data made the number of observations in each salary category on the low side. The data for the salaries of permanent female employees was very thin, being based on only one or two observations in each cluster. This shortage of data explains the aberrant figure of TZS 24 000

[12] The UN Convention on the Rights of Persons with Disabilities (UNCRPD) recognises that 'disability is an evolving concept' (UNCRPD, 2006, p. 1). 'Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others' (UNCRPD, 2006, p. 4).

for permanent female staff in Njombe FIC: that figure is based on the reported salary of a single person.

The data also did not consider differences in the job descriptions of women and men. Hence, some of the observed differences in salaries may be attributable to the fact that women and men are typically assigned to different types of jobs in SMEs. Even so, the phenomenon of women getting paid less is recurrent in the data and indicates the possibility that there is systematic gender inequality in remuneration.

3.3.4 Registration status

SMEs were asked whether or not they were registered. The highest level of registration for each SME was recorded.

As seen in Table 37, the vast majority of the surveyed SMEs had not been officially registered under any authority or institution. A notable deviation from the other two clusters is seen in Makete FIC, where 19% of the interviewed SMEs reported being registered at the district level. However, this result can be explained by different interpretations of the questions asked during data collection in 2020, when an expired type of registration was still counted within the category.

Table 37 SME registration status by cluster

Registration type	Makete FIC	Mafinga FIC	Njombe FIC
Not registered	79%	90%	94%
Registered at district level	19%	3%	2%
Tax Identification Number (TIN) only	2%	1%	2%
Business Licence	1%	4%	2%
Registered at TFS	0%	1%	0%
Total	100%	100%	100%

Tax identification numbers (TIN) and business licence were two other categories with some positive answers. Only one SME reported having been registered at the TFS.

No SME reported having been registered at the Business Registrations and Licensing Authority (BRELA) even though this was also presented as an option in the questionnaire.

3.3.5 Bank account and business plan

The prevalence of bank accounts and written business plans in SMEs were not, as shown in Table 38, correlated in any of the three FICs.

Table 38 Prevalence of bank account and business plan by cluster

Feature	Makete FIC	Mafinga FIC	Njombe FIC
Share of SMEs with a bank account	22%	16%	10%
Share of SMEs with a written business plan	2%	25%	18%

Makete FIC had the highest prevalence of SME bank accounts (22%) but the lowest prevalence of written business plans (2%).

In all areas, the share of SMEs having a bank account (38%) was higher among those SMEs that were officially registered than those that were not.

Only a bank account registered for the SME was considered in this question. Any personal bank account of the owner was not considered.

3.3.6 Capital investment

The total capital investment in machinery and infrastructure reported by the SMEs varied widely (Figure 17). About 41% of all SMEs reported having invested a maximum of TZS 500 000 in total (EUR 185), but some SMEs reported having invested up to tens of millions of shillings.

Differences were discovered among clusters (Table 39). The average investment was the highest by a large margin in Njombe FIC, at about TZS 4.3 million (about EUR 1 590). The

average investments in Makete and Mafinga FICs were just TZS 2.0 million and TZS 2.5 million (EUR 741 and EUR 926) respectively. However, in Njombe FIC, the median capital investment, at TZS 800 000, was, in fact, lower than that in Makete FIC and as low as in Mafinga FIC. This result was due to some high-investing SMEs in Njombe FIC (one in particular), a condition which increased the average.

Figure 17 Distribution of capital investment by SMEs

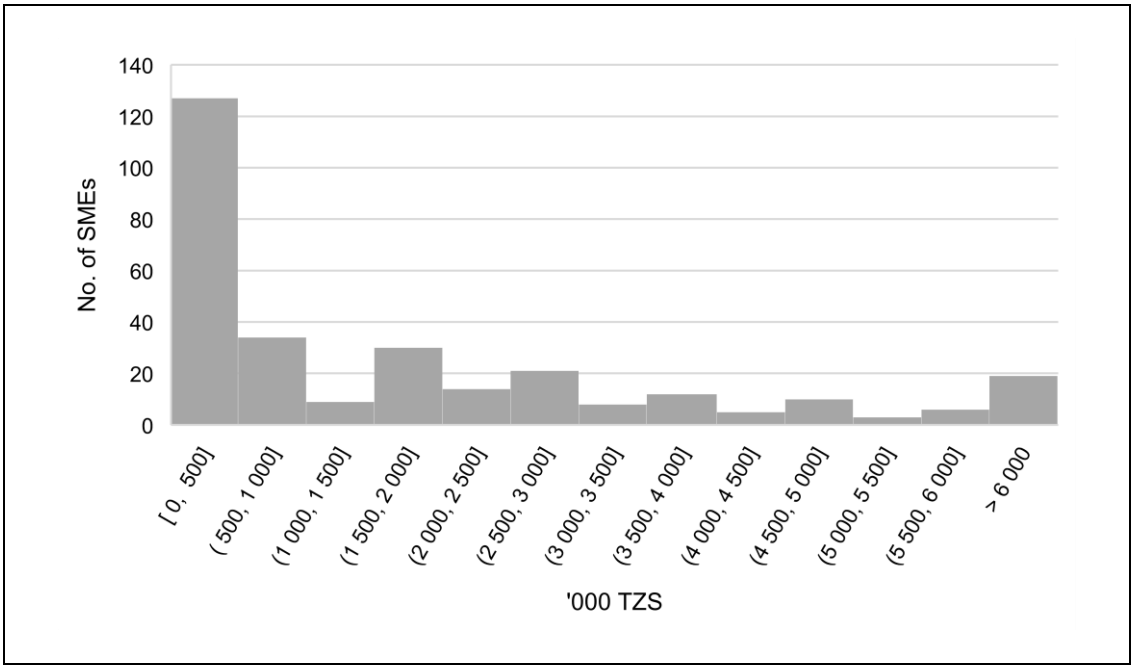


Table 39 Capital investment by cluster (in '000 TZS)

Variable	Makete FIC		Mafinga FIC		Njombe FIC	
	Mean	Median	Mean	Median	Mean	Median
Capital investment	2 029	1 050	2 455	800	4 336	800

3.3.7 Costs, revenue, turnover, and profit

Table 40 shows the results for the annual costs, revenue, profit, and turnover of the SMEs. The figures are based on what the SME owners reported during their interviews.

Table 40 Financial indicators of SMEs (in '000 TZS)

Variable	Makete FIC		Mafinga FIC		Njombe FIC	
	Mean	Median	Mean	Median	Mean	Median
Costs	3 728	1 511	6 453	1 550	9 001	3 000
Revenue	6 660	2 000	7 206	2 400	18 313	2 000
Profit	3 002	651	754	192	8 949	700
Turnover	10 537	4 560	13 659	4 250	27 677	5 000

There were relatively large differences in the averages of the financial indicators of the three clusters. The averages were strongly affected by the large values stated by some individual SMEs; a phenomenon clearly seen in the long tails of the distributions presented in Figure 18 and Figure 19. To balance this distortion, medians are presented as an additional indicator in Table 40.

While it should be kept in mind that individual observations must be interpreted with caution as they cannot be verified, the results generally show that SMEs within the forestry sector in the survey areas vary widely from one to the other in terms of their financial volume. While most of the SMEs operate with relatively low financial volumes, some SMEs have significantly higher

turnovers. Notably, the majority of the SMEs seem to be making a decent profit from a relatively low investment

However, as can be seen in Figure 19, a large share of SMEs (almost 30%) also appears to be making a loss instead ofa profit.

Figure 18 Distribution of the annual turnover of SMEs

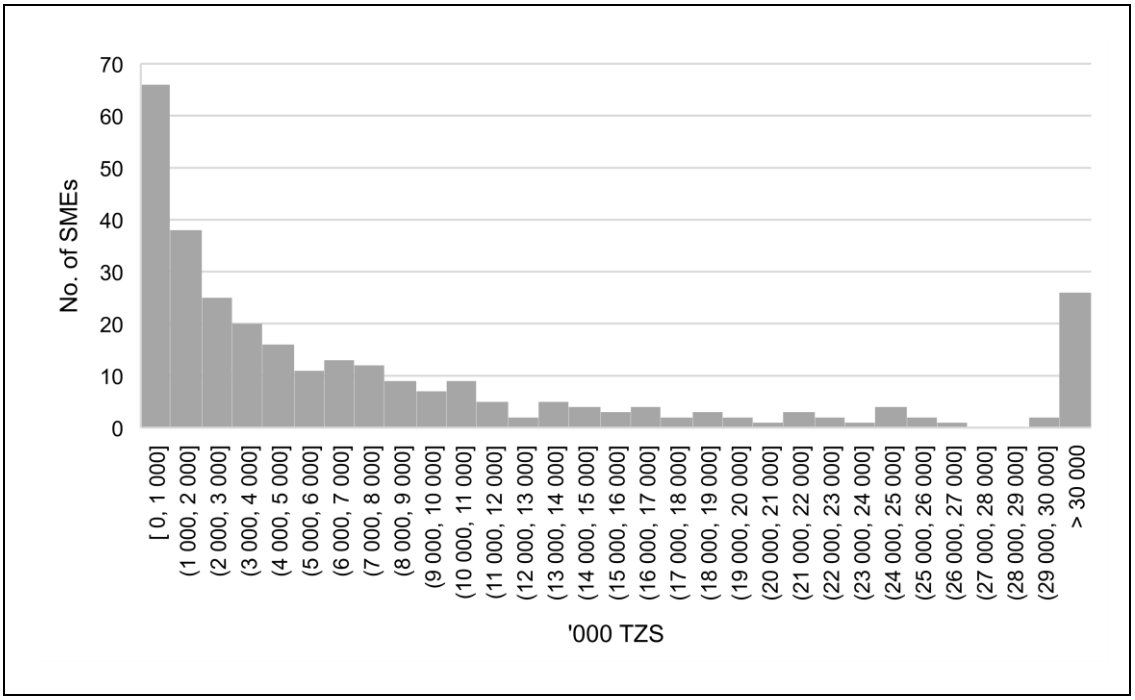
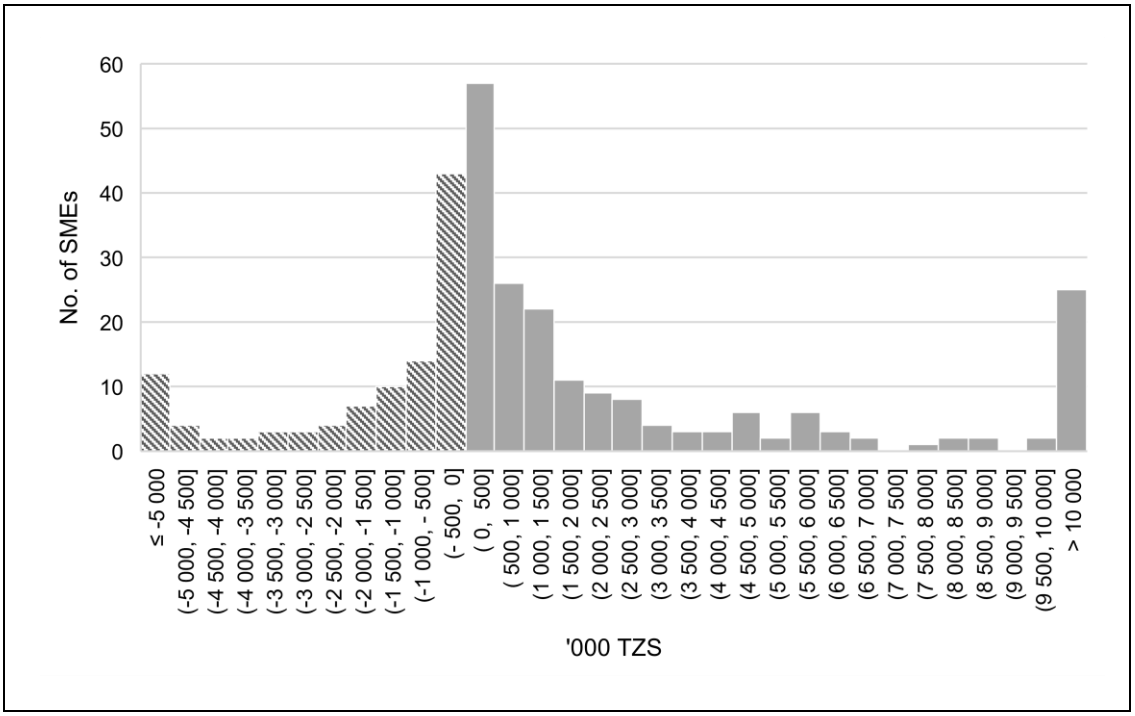


Figure 19 Distribution of the annual profit/loss of SMEs



The fact that SMEs seem to be making losses instead of profits may be partially explained by the SME owners' assumed preference to downplay their revenues and exaggerate their costs

during interviews. However, a market systems assessment[13] conducted by PFP in Makete District also concluded that it is not uncommon for SMEs to make losses.

3.3.8 Sources of external funding

The majority of the SMEs had not received or been promised any external funding. In Njombe and Mafinga FICs, microfinance schemes such as VICOBA appeared in the results as somewhat notable sources of external funding (Table 41). In Mafinga FIC, 5% of the SMEs had received a loan from a commercial bank. It was rare that any SME in any of the three clusters had access to any other external funding sources.

The lack of opportunities for external funding was also generally reported as one of the challenges faced by the SMEs (see Section 3.3.20).

Table 41 Sources of external funding

Funding source	Makete FIC	Mafinga FIC	Njombe FIC
No external funding received	92%	81%	76%
VICOBA, VSLA, SACCOS etc.	6%	14%	22%
Impact investment fund	1%	0%	0%
Major commercial bank	1%	5%	2%
EFTA	1%	0%	0%
Total	100%	100%	100%

Many SMEs reported receiving money for their business from other activities such as agriculture, but these were not considered to be external funding sources.

3.3.9 Taxes and levies

The interviewees were asked which mandatory payments such as taxes and levies they were obliged to make to authorities during their operations. This information was collected only during the survey of 2021; thus, only limited data is available from Makete FIC.

Both in Mafinga and Njombe FICs, about 40% of the SMEs reported that they were paying mandatory fees of some kind, while the remaining SMEs reported that they made no payments. In Wanging'ombe District the share of SMEs paying fees was, at 54%, higher but this result was based on a limited sample size.

The most common types of mandatory payments mentioned by the interviewees were VAT, CESS, service levies and village taxes. Some SMEs also mentioned transit passes.

3.3.10 Social security systems

The provision of social security systems by SMEs to their employees was extremely rare in all three clusters. A total of four SMEs scattered across all three clusters reported that they provided the NSSF scheme to their employees. No other positive responses for this question were reported.

3.3.11 OSH training

Training in occupational safety and health (OSH) issues had reportedly been received by 5% of the SME owners in Makete FIC, 14% in Mafinga FIC, and 10% in Njombe FIC.

3.3.12 Workplace accidents

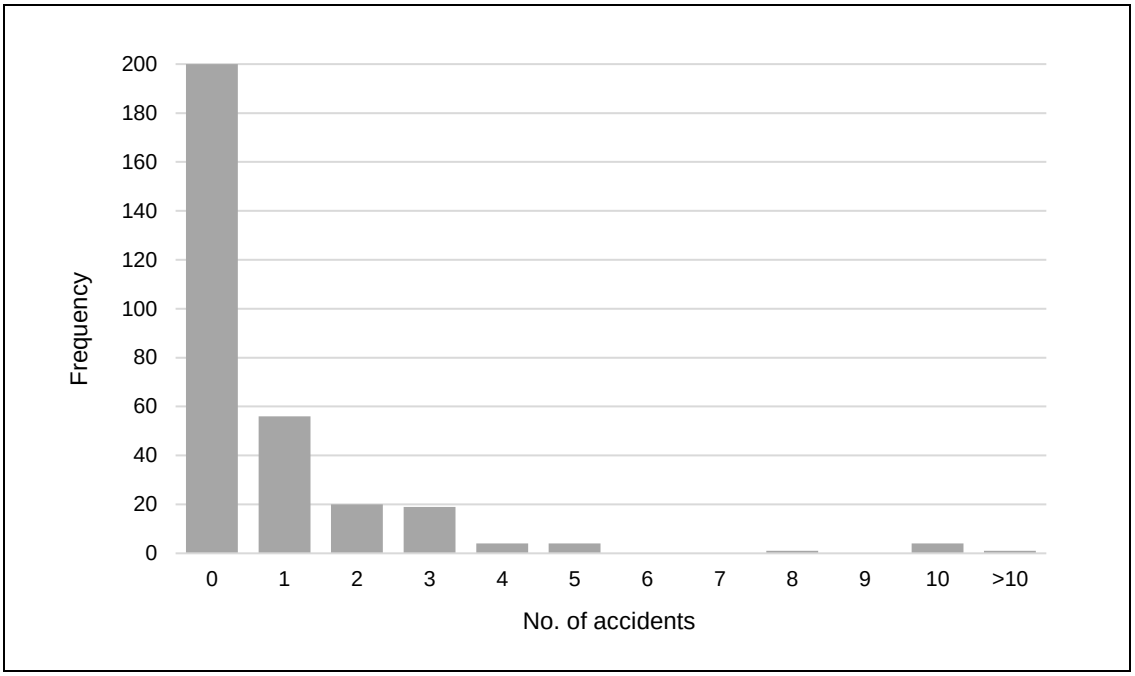
Two hundred SMEs (65%) reported that no accidents resulting in worker downtime or the death of an employee had occurred within the past 12 months. Furthermore, the majority of the remaining 35% of SMEs reported only a single accident. However, there were individual SMEs

[13] PFP (2020). Makete forest-resource market system assessment. Iringa, Tanzania. Available online: https://www.privateforestry.or.tz/resources/view/makete-forest-resource-market-systems-assessment

with considerably higher accident rates. The distribution of the reported accident frequencies is shown in Figure 20. No considerable differences were found in that distribution across the three clusters.

About half of all reported accidents had taken place in SMEs engaged in sawmilling. The average accident rate in all SMEs was 0.8 accidents per year, while the rate in sawmilling SMEs was 1.2 accidents per year.

Figure 20 Accident frequencies in SMEs



3.3.13 Provision of PPE

Some SMEs provided personal protective equipment (PPE) to their employees. The share of such SMEs was the highest in Makete FIC, where 33% of SMEs provided some type of PPE. In Njombe FIC this share was 16%, while in Makete FIC that rate dropped to just 3%.

The most common types of PPE that SMEs said they provided were gloves, safety boots, masks, and helmets. Hearing protection of any type was rarely mentioned by the interviewees

3.3.14 Training and facilitation needs

Preferred training and facilitation topics were pointed out from the seven predetermined categories shown in Table 42. This data was collected only during the survey of 2021.

Table 42 Frequencies of the training and facilitation topics preferred by the SMEs

Training/facilitation topic	Total (All areas)	Wanging'ombe DC	Mafinga FIC	Njombe FIC
Development of a business plan	59	4	33	22
Business registration	26	0	16	10
Access to financing	53	6	27	20
Marketing	66	7	41	18
Technical skills	66	8	39	19
Technologies and machinery	67	8	34	25
Occupational safety and health	50	2	27	21
Total	387	35	217	135

The overall interest in the presented training and facilitation topics was relatively even, apart from the topic of business registration, which appeared less popular than other topics among the respondents.

3.3.15 Results specific to sawmills

Annual production rate

Surveyors assisted the interviewees representing sawmilling SMEs in calculating their annual production rates. Major differences were discovered both between individual SMEs and across the three clusters (Table 43). It should be noted that some SMEs employed multiple sawmill machines while others had only one.

Table 43 Annual production of sawn timber by sawmilling SMEs (in m^3)

Variable	Makete FIC		Mafinga FIC		Njombe FIC	
	Mean	Median	Mean	Median	Mean	Median
Annual production	805	422	4 052	720	3 526	550

While the median production was of a comparable scale in all three clusters, the average production was considerably higher in Mafinga and Njombe FICs than in Makete FIC. This difference was due to the greater presence of larger sawmilling SMEs with high production rates in Mafinga and Njombe FICs.

Innovative practices

SMEs with sawmilling activities were asked whether or not they had adopted any new and better practices during the previous two years that would have helped to improve their operations.

13 SMEs (12%) responded positively to this question with a valid example (Table 44). Most of the positive responses were received in Mafinga FIC.

Table 44 Reported innovative practices introduced in sawmills during the previous two years

Reported innovative practices	No. of responses
Improvements in applied saw blades	2
Improvements related to technical skills	3
Introduction of better saw doctoring practices	2
Introduction of better machinery	4
Improved timing of harvesting	1
Improved monitoring	1

3.3.16 Timber procurement contracts

Three out of the 106 sawmilling SMEs reported having a timber procurement contract for sourcing their raw material. All three operated in Makete FIC.

3.3.17 Results specific to forest harvesting contractors

Chainsaw training

One out of the total of five interviewed SMEs engaged in forest harvesting in Mafinga FIC reported that they had received technical training in operating chainsaw. Three responded that they had not received such training and one did not answer this question.

In Njombe FIC, too, only one out the total of five interviewed SMEs engaged in forest harvesting reported that they had received this kind of training.

None of the interviewed 41 SMEs doing forest harvesting in Makete FIC reported having received any technical chainsaw training.

Sorting of logs for different end uses

About 46% of the forest harvesting contractors reported that they delivered harvested wood for more than one end-use. The remaining 54% reported that they delivered harvested wood for a single use only. That use was almost exclusively sawmilling.

Table 45 shows the shares of harvested logs by end-use in each cluster. A special feature of Mafinga FIC was more diversity in end-uses than in the other two clusters. However, the limited number of observations from harvesting SMEs in Mafinga and Njombe FICs prevent from drawing detailed conclusions from the wood flows.

Table 45 Delivery of harvested logs by end use

End use type	Makete FIC	Mafinga FIC	Njombe FIC
Sawmilling	83%	81%	64%
Pole production	0%	13%	0%
Veneer production	0%	4%	0%
Bioenergy	17%	2%	36%
Total	100%	100%	100%

3.3.18 Results specific to tree seedling nurseries

Annual production rate

The 13 tree seedling nurseries included in the survey were distributed quite evenly across the three clusters. The number of seedlings produced was asked only during the data survey of 2021. Reporting on production quantities were quite limited, but the variation was high, from 1 200 seedlings to 100 000 seedlings per annum. The average production rate was about 22 000 seedlings per year. The results indicate that the volume in the nursery businesses of SMEs is relatively small.

Standard vs. improved nursery practices

The nurseries were asked the level of their practices in each of eight specified aspects of nursery operations (as detailed in Table 21). Each aspect was ranked as representing either a standard or improved level of practice and the share of improved practices out of the total was calculated.

While the data was limited to only 13 nurseries there were major differences across the three clusters. In Mafinga FIC the share of improved practices was 31%, while in Njombe FIC the share was 18%. In Makete FIC no improved practices were reported at all.

Use of improved seed

The nurseries responded to the query concerning use of seed from improved origins as detailed in Table 46.

Table 46 Use of improved seed in SME-based nurseries

Use of improved seed	Makete FIC		Mafinga FIC		Njombe FIC	
	N	%	N	%	N	%
All seed is from improved sources	1	20%	1	25%	2	50%
Part of the seed is from improved sources	2	40%	0	0%	0	0%
No seed is from improved sources	2	40%	3	75%	2	50%
Total	5	100%	4	100%	4	100%

3.3.19 Results specific to producers of bioenergy / wood by-products

Annual production rate

Surveyors assisted the interviewees representing production of bioenergy / wood by-products in calculating their annual production rates. The only type of product encountered within this SME type was lump charcoal. The resulting production rates are presented in Table 47 by cluster. They are of comparable scale, but Mafinga FIC has a higher average due to the presence of some large-scale producers.

Table 47 Annual production of lump charcoal by SMEs (in tonnes)

Variable	Makete FIC		Mafinga FIC		Njombe FIC	
	Mean	Median	Mean	Median	Mean	Median
Annual production	8.15	5.71	14.85	6.75	5.98	4.10

3.3.20 Challenges listed by SMEs

SMEs were asked about the challenges that they face in their businesses. The presentation of the question varied slightly between the survey of 2020 and that of 2021. During the former, the SMEs were asked to provide a free description of the challenges they faced. During the latter, the SMEs were instead requested to list the three main barriers that they face in the development of their businesses.

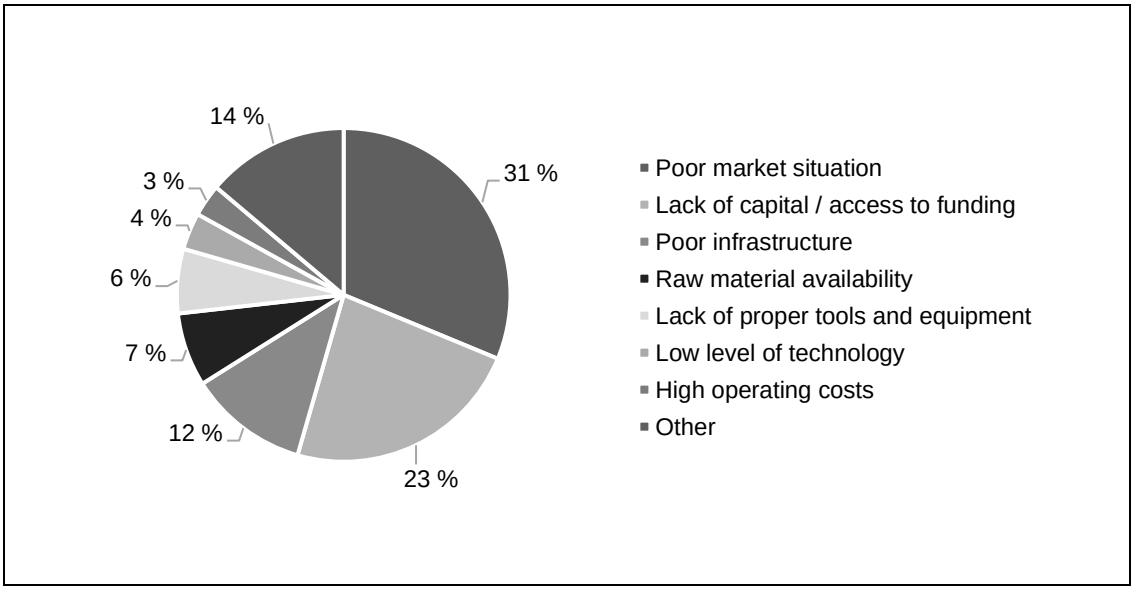
The responses acquired during 2020 in Makete District were mainly related to the following topics.

- Poor access to finance. A common issue SMEs faced was the lack of external funding opportunities, limiting their investment to the SME.
- Poor and fluctuating market situation.
- Low level of technology.
- Limited availability of equipment and services.
- Gaps in the skills of employees and SME owners.
- Poor road network and hard topography.

A detailed summary of these topics is included in Annex 3.

During 2021 the SMEs listed their challenges as shown in Figure 21. The most commonly mentioned challenge was poor market situation (31% of the listed responses after they were categorised), followed by poor access to finance (23%). Poor infrastructure, which mainly considered a limited road network and shortages in the electricity supply, also featured, accounting for 12% of the responses. The category “other” was comprised of other challenges brought up by multiple SMEs. It featured topics such as the lack of cooperation among different actors in the value chain, the lack of technical skills and knowledge, high taxation and the lack of clarity in taxes and levies, the availability and reliability of seasonal workforce, OSH issues, theft, and outstanding payments by customers.

Figure 21 Main challenges identified by SMEs during the survey of 2021

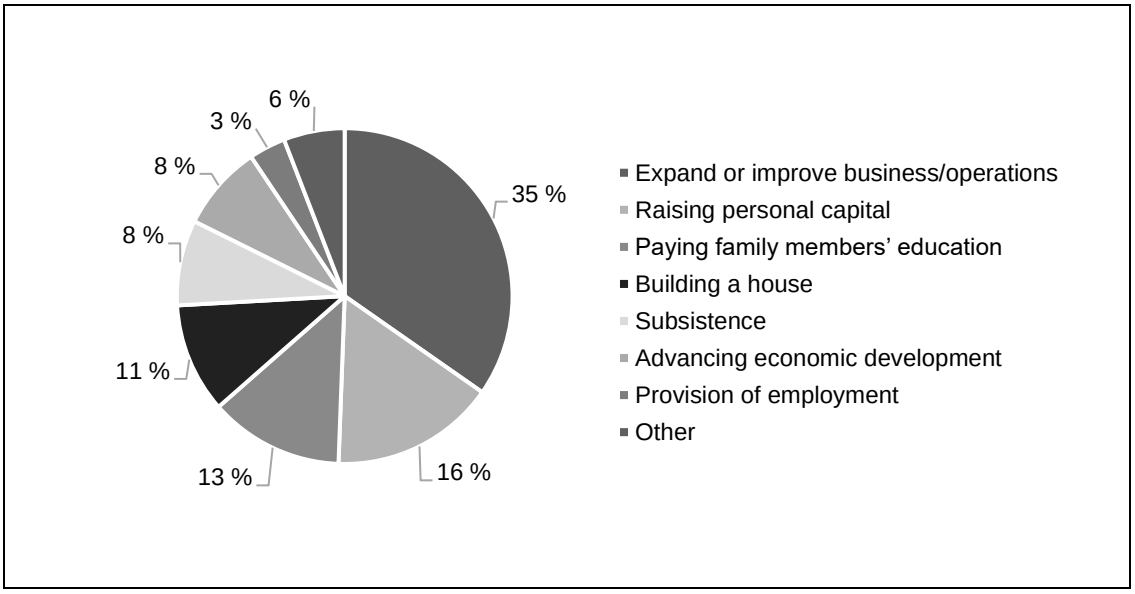


3.3.21 What SMEs wish to achieve through their businesses

During data collection in 2021 the SMEs were presented with a question concerning what they ultimately wanted to achieve through their business. This question was asked to acquire a better understanding of the goals and the different operating rationales of the SMEs. The question was open-ended and the type and number of issues reported by the SMEs was not limited in any manner.

The responses acquired from Mafinga and Njombe FICs and Wanging'ombe District were grouped thematically. The results are presented in Figure 21.

Figure 22 Business goals identified by SMEs during the survey of 2021



Some interviewees mentioned a single goal while others mentioned multiple goals.

Often the goals were related to the use of funds acquired through the business but this was not always the case. The most common theme featured in the responses was a borderline case concerning this issue: the expansion or improvement of the businesses and operations of the SMEs. This theme was included in 35% of the categorised responses, hence accounting on its own for more than one-third of the mentioned business goals.

While the entrepreneurs often seemed to have the mindset, or a wish, to level up their businesses, this was far from being their only type of goal. The second-most featured theme (16%) was the desire to raise personal capital to improve their family's standard of living.

In third place, with 13% of the responses, was the acquisition of funds to pay for the education of a family member, most typically children's school fees. This goal was followed by raising money to build a house (11%) and earning income for subsistence (8%).

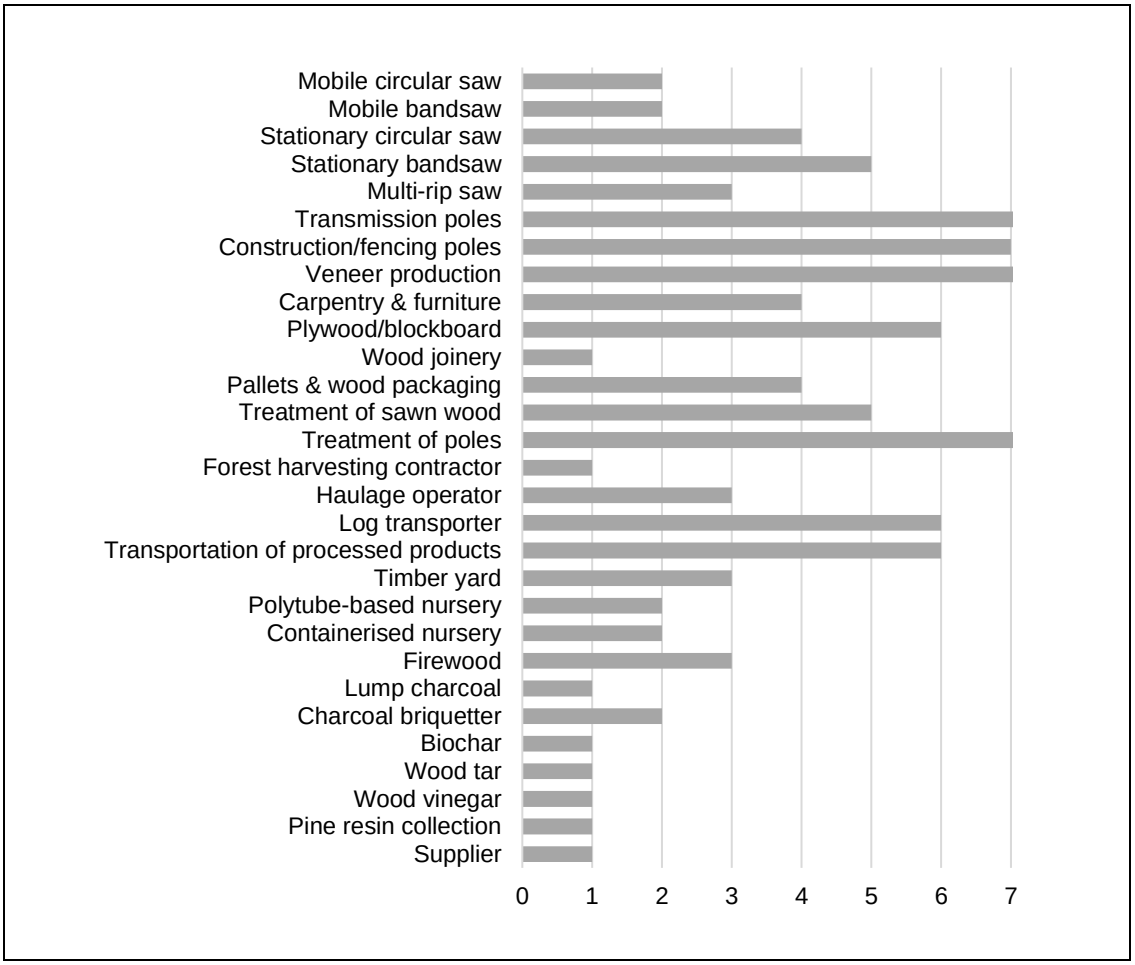
Other purposes mentioned by the owners for their businesses were the provision of employment, the procurement of commodities or a means of transport such as a car, and raising money for other types of investments like procuring land.

3.4 Results from large forest-based companies

3.4.1 Business types

The 18 large companies that provided data (17 in Mafinga FIC and one in Njombe FIC) generally carried out many different activities around their core businesses. On average, one company was engaged in 5.6 forest-based businesses. The frequency of responses as per the applied typology is shown in Figure 23. Almost all companies had more than one activity while a couple of them had more than ten. There was a notable difference in the average number of business types between SMEs and large companies, consistent with the scales of their operations.

Figure 23 Frequencies of the business types of the surveyed large companies



The business types commonly featured in the sample included sawmilling applying various types of technology, the production and treatment of poles, and the manufacturing of veneer and plywood. In addition, transportation activities were commonplace.

3.4.2 Finances and production rates

Three companies did not report any financial indicators at all and another four companies reported only some of the asked-for financial indicators. A summary of the results based on the data received is presented in Table 48.

Table 48 Financial indicators of the surveyed large companies (in USD)

Variable	Average value (USD)
Capital investment	3 891 906
Annual operational costs	2 915 097
Annual revenue	4 547 035
Annual turnover	8 071 284
Annual profit	1 022 785

While the average reported capital investment was about USD 3.9 million, it varied considerably, from a few hundred thousand USD up to USD 20 million. The distribution of the other financial indicators showed a similar pattern.

Six sawmilling companies reported their sawn timber production rates. The average was about 4 000 m^3 of sawn timber per annum. However, the range was wide, with the lowest reported production rate being around 1 000 m^3 and the highest over 10 000 m^3. One respondent reported having started preparations to produce sawn timber at the scale of several tens of thousands of cubic metres per annum.

Poles were produced by eight companies, seven of which reported their production rates. The average production rate was about 100 000 poles per annum and, range from some tens of thousands to over 200 thousand poles per annum, depending on the company. Most of the companies produced construction or fencing poles in addition to transmission poles, but the production rates of the different pole types could not be disaggregated from the provided information.

Reported plywood production rates were around 5 000 m^3 per annum.

It was not meaningful to derive the average production statistics for multiple product groups due to the smallness of the sample sizes, made even smaller by the lack of thorough reporting.

3.4.3 Employees

The large companies reported employing 2 953 people. The reported employee numbers between individual large companies varied mainly between some tens of employees and a couple of hundred employees. One company reported over thousand employees. This, however, did not have a radical effect on the overall gender distribution or the share of permanent employees.

Less than half (43%) of the employees in the companies were reported as being employed on a permanent basis (having working contracts), while the rest were seasonal or daily workers. The share of permanent labour in large companies was considerably bigger than in SMEs in any of the three clusters, reflecting the different operating framework of the large companies as compared to SMEs.

28% of all employees were women. The employee aggregate statistics are included in Table 49.

Table 49 The number of employees in the surveyed large companies disaggregated by gender and type of employment

Employment type	Female		Male		Total	
	N	%	N	%	N	%
Permanent labour	308	24%	963	76%	1 271	43%
Seasonal and daily labour	523	31%	1 159	69%	1 682	57%
Total	831	28%	2 122	72%	2 953	100%

Two companies reported that they employed vulnerable persons but only one company reported having disabled employees.

The reported average daily salaries revealed a major difference between the salaries of women and men in both types of employment. Women employed as permanent labour earned TZS 21 583 per day on average, while men in the same category earned TZS 31 113 per day on average. Women who did seasonal and daily labour had an average remuneration of TZS 10 002 per day, whereas the average remuneration for men doing seasonal or daily labour was TZS 19 965. Part of the salary differences between women and men were attributable to differences in the job descriptions of women and men. For example, one company reported that practically all senior management positions were held by men. Several companies also reported same salary levels to women and men. No company reported paying less than TZS 5 000 per day to any employee category. The calculated average salaries were not weighted with employee numbers of the companies.

3.4.4 Social security and workplace safety

Seventeen out of the 18 companies that submitted data reported that they applied social security systems and the remaining one company provided no response to the question. The most commonly featured social security systems were NSSF (17 responses) and WCF (15 responses). The two systems were typically applied parallel to each other.

All companies reported that they provided PPE to their employees, and 17 out of 18 companies reported having received OSH training. Eight companies reported they had had no serious accidents during the previous 12 months. The remaining ten companies reported having had accidents, but the maximum number of accidents reported by any company was three.

3.4.5 Challenges

When asked what challenges they faced in their operations, the large companies provided answers relating to the following topics:

- Delay in payments from government-related customers
- Ambiguity in tax and levy requirements
- Unofficial actors in the market avoiding mandatory fees and creating a cost disadvantage
- Poor availability of wood/trees as raw material
- Poor availability of chemicals and equipment
- Poor markets and low prices
- High operational costs
- The security requirements of financial institutions

3.5 Limitations

The surveys described in this document had a number of limitations that affected the acquired results and their interpretation. The key limitations are discussed below.

The sampling strategy applied in the survey of smallholders' woodlots, based on the preliminary woodlot mapping through PGIS, targeted "mass data collection", enabling the efficient collection of a large dataset. Other considered methodologies, such as transects and random field points, were eventually deemed too laborious, slow, and inefficient for delivering the key data needs. However, the selected methodology also meant that the data from some variables, notably woodlot age (specifically young woodlots) and the typology of land investors, did not produce distributions that fully reflected the real situation. It was mainly representatives of the "resident villagers" land investor type that were present in the target villages, leaving gaps in the data concerning forest resources under the ownership of different land investor types (e.g. all urban-based investors).Such information will need to be acquired through separate, additional means, if needed.

Out of the two main genera of pine and eucalyptus found in the survey, age verification through destructive sampling was feasible only with pine since eucalyptus growth rings are not reliably countable. Hence analysis requiring verifying age data was only able to be carried out with the pine woodlots included in the survey.

The majority of the data acquired from the SMEs, including production quantities and financial information, was based on the statements of the SME representatives (mainly SME owners). While the surveyors assisted the interviewees in assessing and calculating these figures and made field visits to many SMEs to observe their operations in the field, there was no way to verify the presented figures with certainty. The results, then, should be considered indicative rather than precise. This limitation also applies to the results from the large companies, but the issue can be considered less severe in this latter case.

The selection of large companies to participate in the survey was not random; instead, it considered the expected level of cooperation. The survey design had to consider that the companies had no obligation to provide information, and thus chose to target getting a maximum number of responses instead of a potentially much smaller dataset based on a more randomised sample.

This survey did not have a clear definition differentiating SMEs from large companies; thus, in the pre-selection of the latter, the assessment of professionals who supported the data collection was used as the basis of differentiation. The different survey strategies targeting the two groups resulted in groups comprising the desired kind of enterprises. The data collected in this survey, however, may assist in preparing forest industry-specific definitions to differentiate between small, medium, and large forest-based enterprises.

4. CONCLUSIONS

4.1 Conclusions from the survey on smallholders' woodlots

4.1.1 Suitability of forestry sites for tree growing in the target communities

The observed site index distribution included a large share of high-performing woodlots in all three clusters. A comparison of height growth of the surveyed woodlots against the Tanzanian site index classes applied in the Sao Hill plantation revealed that the majority of the surveyed woodlots were highly suitable for growing trees, especially pines. The share of woodlots meeting or exceeding the performance of the best Sao Hill class was as high as 62% in Mafinga FIC. The share was lowest in Makete FIC, and even there it was high, about 40%.

To get a regional reference point, the results can be compared against the site index system applied in South Africa[14]. The growth for *P. patula* in South Africa's site classes is slightly more moderate than in it is in the respective classes of the current Tanzanian system. In other words, the growth rates observed in the target communities are very good compared to the rates elsewhere in the region.

The site index distribution shows that the potential timber growth and yield can, by and large, be considered excellent in the target communities. The other results from this survey showed that the reasons why this growth potential seems to be left partially unrealised are mainly related to the silvicultural practices applied.

4.1.2 Silvicultural status of commercial woodlots in the target communities

Timber growing was a common livelihood throughout the target communities. However, assuming that the target is to grow large-diameter sawlogs quickly, the silviculture practices were found to be generally suboptimal in all areas.

The main reason that the full growth potential of large-diameter wood was unrealised in the woodlots was that they had too high stand densities. The applied planting densities were often higher than those recommended in the national guidelines and, more importantly, there was a general lack of thinnings. It appeared that clear-cutting was typically carried out in woodlots that featured their initial planting densities. This was the case in all three clusters, though the phenomenon was least severe in Njombe FIC and most severe in Makete FIC, where stand densities were very high due to the prevalence of strong natural regeneration and, hence, greatly suppressed diameter growth. Emphasis should also be placed on adequate early stand density management (respacing) of naturally regenerated woodlots in Makete FIC. This practice was carried out in Makete but not usually with sufficient intensity. That said, the survey teams also observed woodlots where commercial thinnings had been carried out, meaning that this practice is not completely absent from among the smallholders.

Overstocking has a radical effect on the realised average volume of the harvested trees. For comparison: a single *Pinus patula* tree with a DBH of 25 cm generally has a trunk volume of about 600 litres[15]. An equally tall *P. patula* with a DBH of 15 cm has a trunk volume of about 270 litres. Hence, a 10 cm DBH difference causes a reduction of 55% in the trunk volume. For this reason, ensuring suitable stand densities should arguably be the single greatest priority in the development of local silviculture. The situation is most pressing in Makete FIC, which has the highest average stand densities, but attention to the issue is required in all three clusters.

There were shortages in other silvicultural activities across the field areas as well, but they varied in extent. Firebreaks were prepared for only a minority of woodlots in every cluster. In Makete FIC, firebreaks were almost absent despite the evident risk posed by fire in the cluster. Weeding of juvenile woodlots was rare in every cluster, as was the high pruning of trees (second and third prunings). Nevertheless, it was rare to find a woodlot in any of the three clusters which had not had a first pruning (access pruning). The shortages in these management activities,

[14] Kotze et al. (2012). Growth modelling and yield tables. In: South African forestry handbook, 5th edition. The Southern African Institute of Forestry. p. 175–228

[15] Calculations based on the height and volume equations presented by Malimbwi et al. (2016).

particularly the lack of weeding, had a presumed adverse effect on early growth rates and quality, increased the risk of property loss due to fire damage, and reduced the quality of the produced sawn timber since low volumes of knotless wood were being grown.

It should be noted that this conclusion looks at silvicultural status strictly from a technical forestry perspective and it explores neither smallholders' practical capability to conduct science-based silviculture down to every recommended detail nor their motivation to do so. It is important to recognise that from a smallholder woodlot owner's point of view, the investment of time or money in timely woodlot management as per guidelines may not always be the optimal decision based on their overall socioeconomic situation. This financial reality needs to be understood before the technical aspects of forestry can be effectively advanced.

4.2 Conclusions from the survey on forest-based businesses

4.2.1 SME business types and the level of technology they employ

Though the three survey clusters present seemingly different bases for forestry, for example within Mafinga FIC is the nationally significant Sao Hill plantation and the Mafinga Town industrial hub, there were arguably fewer differences in the observed forestry SME schemes across the three clusters than might have been expected. While there were differences in the shares of the major business types across the three clusters, the observed main types were practically the same. In addition, the level of technology applied within these types was commonly the same throughout the areas surveyed.

The level of technology used by the SMEs was universally rudimentary. Concerning the two major business types featured in the survey, the only featured sawmill type was the dingdong (amec) sawmill and the only type of bioenergy product was lump charcoal produced in pit kilns. Only carpenters were encountered within the wood secondary processing type.

Even in Mafinga FIC, where the survey target communities were outside the immediate surroundings of the business and industrial hub of Mafinga Town, the types of forestry-based businesses and the observed level of technology was similar to those found in the other areas and not considerably more versatile or of a higher standard.

The surveyed SMEs generally reported facing the issue of a lack of capital for investment. However, many sawmillers also stated that the level of technology was adequate for the operating environment and easier to transport between operating sites than other technologies. They added that more advanced machinery would be considerably more expensive to purchase and more difficult to repair and maintain.

4.2.2 Administration, profits, and losses

The SME scheme in all three clusters was based mainly on unofficial small enterprises, the majority of which were not registered under any official authority. Written business plans and bank accounts were rare.

Profit was often deemed insecure by the SMEs, who reported markets as the main challenge they faced. The survey results indicate that a notable share of SMEs was in fact making a loss instead of a profit. This indicative result will require deeper study to increase understanding of the situation.

The finding concerning profitability is linked to the overall challenges faced by the SMEs, including low-quality processing technology leading to low-quality products, lack of market access and market information, and poor infrastructure reducing access to and increasing the cost of forest resources. The weak administrational framework, such as the lack of written business plans and adequate bookkeeping, likely contributes to the problem while at the same time reducing SMEs' capability to detect losses.

However, the SMEs themselves did not consider that their situation was as negative these results suggest; for them, this was a normal operating environment and business as usual. The SMEs had a variety of goals, from acquiring a better standard of living to managing day-to-day costs such as children's school fees, but most commonly they hoped to be able to scale up or improve their business further.

4.2.3 Employment

Both the forestry-based SMEs and large companies were collectively major providers of employment in the target communities. Sawmills especially employed large numbers of people. The jobs, however, were mainly seasonal, and the proportion of permanent positions was low. For employees, such seasonality was expected to reduce security of income, while for SME owners it was expected to result in less commitment by workers, and thereby high rates of absenteeism and irregular skill sets.

Market fluctuations as an underlying cause of the seasonality of work in the forestry industry is an aspect outside of SMEs' control. Aspects that could help to mitigate this seasonality include improving processing technology, a change that would offer better working conditions and higher production rate and thereby increase the share of the permanent staff required in the workforce. For example, stationary sawmills with improved features could be adopted. Better market information and improvements in administrational procedures would allow for better planning, another change that would decrease the effects of seasonality. Providing the currently absent social security systems to workers through their jobs is another change that would reduce the high turnover rates in the workforce.

Few of the surveyed SMEs had adopted any sort of social support system for their employees, however, and there was a general need to improve the status of OSH within SMEs. Severe accidents were not very common but reportedly did occur, with sawmills found to be most accident-prone type of business. Because there were no social support systems, there was allegedly little security for the livelihoods of severely injured employees. Very few SMEs had received any training in OSH issues. While in Makete FIC any PPE was practically absent, in the other two clusters the situation regarding protective equipment was better.

The situation could be improved through better and safer processing technology, increased knowledge about OSH issues, and the enforcement of safety regulations within the forestry sector. Under current conditions, few SMEs in any of the three clusters are able to provide decent jobs to their employees.

Large companies as were able to provide permanent contracts to a somewhat larger share of their employees than SMEs were. They also reported generally applying PPE.

Results from the workers' salaries indicated that women were systematically paid less than men in both SMEs and large companies, indicating gender inequality and potential discrimination. It was noted that at least part of this result was attributable to differences in the job descriptions of women and men, differences that existed in all sizes of enterprises. This difference is unlikely to be the only reason for the gap in remuneration, however, and it does not justify why women would be consistently hired for lower paid jobs. While this phenomenon could not be studied in detail in the framework of this survey, the results do raise a red flag. They call for conducting a more detailed and holistic study into this issue.

4.2.4 Link between growers and processors

The low quality of sawn timber products was a result not only of the poor processing technology but by the poor quality of the raw material used. The findings of the survey on woodlots showed that smallholder woodlots were generally grown under suboptimal silvicultural regimes. This included shortages in standard silvicultural practices and harvesting despite there being low mean diameters. The SMEs alone cannot level up their production rates or shift into high-quality products, there must be an improvement in the raw material base as well.

Annex 1 Years of origin for PGIS satellite imagery by village

Satellite imagery used during the first round of surveys (2020)

Ward	#	Village	Imagery date range	
			Earliest year	Latest year
Bulongwa	1	Bulongwa	2019	2020
Iniho	2	Iniho	-	2017
	3	Kidope	-	2017
	4	Lumage	2017	2020
	5	Mwakauta	2017	2020
Ipelele	6	Ipelele	2017	2019
Ipepo	7	Ipepo	-	2019
Isapulano	8	Isapulano	-	2017
	9	Ivilikinge	-	2017
	10	Luvulunge	-	2017
Iwawa	11	Ivalalila	2015	2018
	12	Ludihani	2015	2016
	13	Ndulamo	2015	2019
Kitulo	14	Nkenja	2017	2019
Lupalilo	15	Kising'a	2012	2019
	16	Lupalilo	-	2019
	17	Mago	-	2019
Mang'oto	18	Ibaga	2010	2012
	19	Ilindiwe	2012	2019
	20	Malembuli	2010	2019
	21	Mang'oto	-	2019
	22	Usungilo	-	2019
Tandala	23	Ihela	-	2019

Satellite imagery used during the second round of surveys (2021)

PFP 2 FIC	District	#	Village	Imagery date range	
				Earliest year	Latest year
Mafinga FIC	Kilolo DC	1	Boma la Ngo'mbe	-	2010
		2	Mwatasi	-	2014
	Mafinga TC	3	Matanana	-	2019
	Mufindi DC	4	Ikongosi	-	2017
		5	Ugesa	2003	2017
		6	Ludilo	-	2017
		7	Kidete	-	2017
		8	Kitiru	2007	2020
		9	Mtili	2017	2019
Njombe FIC	Ludewa DC	10	Mangalanyene	-	2018
		11	Ilawa	-	2019
	Madaba DC	12	Maweso	2017	2018
		13	Wino	2017	2018
	Njombe DC	14	Isoliwaya	-	2018
		15	Lyalalo	-	2018
		16	Kidegembye	2017	2018
	Njombe TC	17	Iboya	-	2018
		18	Madobole	-	2018
		19	Mtila	-	2018
Makete FIC	Wanging'ombe DC	20	Imalilo	2016	2019
		21	Mafinga	-	2019
		22	Moronga	2016	2019

Annex 2 Sampling framework for selection of survey villages in Mafinga cluster, Njombe cluster, and Wanging'ombe district

District	Management unit (sampling stratum)	No. of villages in the stratum	Target sample size	Village	Total plantation area (ha) *	Selected
Kilolo DC	"Mafinga 6"	5	2	Boma la Ngo'mbe	568	x
				Lyamko	838	
				Mdeke	317	
				Mwatasi	245	x
				Wangama	698	
Ludewa DC	"Njombe 5"	3	1	Madope	573	
				Manga	42	
				Mangalanyene	56	x
	"Njombe 6"	3	1	Ilawa	93	x
				Ilininda	226	
				Madilu	113	
Madaba DC	"Njombe 7"	4	2	Igawisenga	176	
				Lilondo	42	
				Maweso	30	x
				Wino	708	x
Mafinga TC	"Mafinga 4"	3	1	Matanana	334	x
				Mkanzaule	152	
				Mtula	221	
Mufindi DC	"Mafinga 1"	5	2	Ikongosi	523	x
				Nundwe	1 168	
				Ugesa	600	x
				Vikula	518	
				Wami	234	
	"Mafinga 2"	5	2	Ifwagi	434	
				Ihefu	572	
				Kidete	289	x
				Ludilo	516	x
				Mwitikilwa	389	
	"Mafinga 3"	5	2	Itona	234	
				Kihanga	866	
				Kitiru	298	x
				Mtili	934	x
				Sawala	273	
Njombe DC	"Njombe 1"	4	2	Isoliwaya	157	x
				Lyalalo	165	x
				Lyembele	2 478	
				Wanginyi	710	
	"Njombe 2"	3	1	Havanga	1 196	
				Image	773	
				Kidegembye	987	x
Njombe TC	"Njombe 3"	3	1	Iboya	1 066	x
				Ihanga	1 842	
				Itipula	562	
	"Njombe 4"	4	2	Kitulila	389	
				Madobole	245	x
				Matola	559	
				Mtila	620	x
	"Makete 4"	10	4	Igosi	551	

District	Management unit (sampling stratum)	No. of villages in the stratum	Target sample size	Village	Total plantation area (ha) *	Selected
Wanging'ombe DC				Imalilo	470	x
				Kipengele	1 088	
				Mafinga	500	x
				Makoga	348	
				Moronga	1 684	x
				Mwilamba	752	
				Uhekule	760	
				Ujindile	358	
				Wangama	354	
Total		57	23	n/a		22

* The total plantation area is based on the results by UTU/FAO (2017).

Annex 3 Challenges described by SMEs in Makete District during the survey of 2020

Theme	Listed challenges
Finances and market	Limited access to capital, i.e. lack of external funding sources
	SMEs should be facilitated in organisation and management of SME groups to enable them to access finances together
	Poor and unreliable market for sawn timber
	Long storage periods of unsold timber during rainy season lead to decrease in quality of the timber
	Poor market for charcoal
	No price fixing for sawn timber
	Low bargaining power among sawmillers
	High CESS charges for charcoal
	Facilitation is needed in marketing of sawn timber and charcoal products
Costs	High fuel costs in in operating sawmills and chainsaws
	High maintenance costs for sawmills and chainsaws
Technology and processing techniques	Low level of wood processing technology; no exposure to modern technologies
	Poor processing techniques and low recovery rate in charcoal production
	Sometimes charcoal kilns collapse during night
Availability of equipment and services	Limited availability of spare parts and maintenance services
	Limited availability of proper tools
	Lack of saw doctors
	Poor maintenance of saw blade leads to low quality of sawn timber
	PPE is not available
	Training services are not available for improving practices
	Chainsaw operators are few and often not available in time
	Unreliable supply of eucalyptus and cypress wood for carpentry
Skill gaps	Lack of skills in chainsaw operations
	Lack of skilled maintenance personnel
	Lack of skills and awareness related to OHS issues
	Training needed in efficient and profitable charcoal production; need of training on the use of metal kilns
Infrastructure and topography	Road network is insufficient, leading into difficulties in harvesting and transporting the forest resources
	Road access during rainy season is poor
	High transport costs from forest to roadside
	Hard topography for forestry operations, increasing costs
	Lack of power supply for carpentry machinery
Workforce	Limited availability of skilled labour
	Worker absenteeism is an issue; sometimes workers disappear after receiving their advance payments

Annex 4 Questionnaire form used with large forest-based companies

Participatory Plantation Forestry Programme (PFP 2) *July 2021*

Enterprise information form

1.1 Name of the enterprise

The official name of the enterprise: _____

1.2 Details of the respondent

Name: _____

Position: _____

Gender: ☐ Female ☐ Male

Phone number: _____ email: _____

2.1 Types of activities

Below is a list of different activities of forest-based enterprises. Please tick all that apply for your enterprise:

1. Sawmill

1.1. Mobile circular saw ..... ☐	*Mobile circular blade sawmill that has advanced features, allowing for good quality of sawn timber. E.g. mobile models of KARA, LAIMET, Slidetec etc.*
1.2. Mobile bandsaw ..... ☐	*Mobile bandsaw with horizontal blade. E.g. Wood-Mizer, Saw Specialists, Norwood etc.*
1.3. Stationary circular saw ..... ☐	*Permanently established circular blade sawmill that has advanced features. E.g. stationary models of KARA, LAIMET, Slidetec etc.*
1.4. Stationary bandsaw ..... ☐	*Stationary bandsaw with one or multiple horizontal and/or vertical blades.*
1.5. Multi-rip saw ..... ☐	*Stationary sawmill with multiple adjacent blades. E.g. Shengong, HewSaw, etc.*

2. Pole production

2.1. Transmission poles ..... ☐	*Please note that treatment of poles is covered separately under category 4 (Wood secondary processing).*
2.2. Construction or fencing poles..... ☐	

3. Veneer production ..... ☐ *Please note that plywood manufacturing is under category 4 (Wood secondary processing).*

4. Wood secondary processing

4.1. Carpentry and furniture ..... ☐
4.2. Plywood/blockboard ..... ☐
4.3. Wood joinery..... ☐
4.4. MDF/particle board ..... ☐
4.5. Pallets & wood packaging ..... ☐
4.6. Treatment of sawn wood ..... ☐
4.7. Treatment of poles ..... ☐

5. Forest harvesting contractor ..... ☐	*Involves the technical work of harvesting trees.*
6. Transportation of forest-based products	
6.1. Haulage operator ..... ☐	*From stump to roadside.*
6.2. Log transporter ..... ☐	*From roadside to processing.*
6.3. Transportation of processed products ..... ☐	*Transportation of any forest-based processed products.*
7. Timber yard ..... ☐	*Timber yard in this context refers to a marketplace for timber. Drying sites and storage sites are not included.*
8. Tree seedling nursery	
8.1. Polytube-based nursery ..... ☐	
8.2. Containerised nursery ..... ☐	
9. Bioenergy and wood by-products	
9.1. Firewood ..... ☐	
9.2. Lump charcoal ..... ☐	
9.3. Charcoal (carbonized) briquettes ..... ☐	
9.4. Uncarbonised briquettes ..... ☐	
9.5. Biochar ..... ☐	
9.6. Wood tar ..... ☐	
9.7. Wood vinegar ..... ☐	
10. Pine resin collection ..... ☐	
11. Supply of machinery, spare parts, fertilisers etc. ..... ☐	*Specifically for the forest value chain.*
12. Saw doctoring ..... ☐	
13. Forestry consulting ..... ☐	*Provision of facilitation and other professional services based on expert knowledge.*

14. Other activities – Please specify: _____

_____

3.1 Location for head office / main operating site

Town/village: _____ Ward: _____ District: _____

4.1 Number of employees / Average salary

Please fill in the number of employees and their average daily salary for days worked in the enterprise, as per the four categories below. Monthly salary can be converted into daily salary by dividing it with the average number of working days per month (usually 21 days).

Since the number of employees in seasonal and daily labour is likely to have seasonal variation throughout a financial year, please use daily average *(e.g. 10 people employed for 6 months per year: daily average corresponds to 5 people).*

i. Permanent staff (contracted): Female _____ Average daily payment: _____ TZS
ii. Permanent staff (contracted): Male _____ Average daily payment: _____ TZS
iii. Seasonal and daily labour: Female _____ Average daily payment: _____ TZS
iv. Seasonal and daily labour: Male _____ Average daily payment: _____ TZS

Additionally, please fill in the number of employees with disability and number of employees belonging to vulnerable groups employed by the enterprise:

i. No. of disabled employees: _____ *Includes persons with long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others.*
ii. No. of vulnerable employees: _____ *These people are typically included in TASAF list. E.g. orphans, employees with HIV/AIDS etc.*

4.2 Annual production

Based on the types of activities (see question 2.1 above), what are the main products of the enterprise? (E.g. sawn timber, poles, veneer, charcoal, seedlings.) Please estimate their average annual production rate. Also state the right unit. (E.g. m^3, tonnes, number of seedlings).

Product 1: _____ Annual production: _____ Unit: _____
Product 2: _____ Annual production: _____ Unit: _____
Product 3: _____ Annual production: _____ Unit: _____
Product 4: _____ Annual production: _____ Unit: _____

4.3 Capital investment

Please state the estimated total capital investment in machinery or infrastructure of the enterprise, in TZS or USD.

Total capital investment: _____ TZS / USD

4.4 Operational costs and revenue

Please provide estimates for: i) the total annual operational costs of the enterprise, and ii) the total annual revenue of the enterprise.

The difference between these figures should correspond with the company EBIT.

Annual operational costs: _____ TZS / USD

Annual revenue: _____ TZS / USD

5.1 Social security system for employees

Please state if the enterprise provides any specific social security system for the employees:

1. No social security system provided ..... ☐
2. NSSF system provided to employees ..... ☐
3. WCF system provided to employees ..... ☐
4. Other arrangement – Please specify: _____

_____

5.2 Workplace accidents

During the past 12 months, how many such accidents there have been that have caused either an injury (resulting to temporary or permanent incapacity to work) or death of an employee?

Number: _____

5.3 Personal protective equipment

Does the enterprise provide some personal protective equipment (PPE) to the employees? These may include hearing protection (earmuffs, ear plugs), eye protection (safety goggles, visor), helmet, working gloves, mask, safety boots and reflective vest, among others. If yes, please state the type(s) of PPE:

_____

5.4 Occupational safety and health training

Have the enterprise management or employees received any formal training on occupational safety and health (OSH)?

Yes ☐ No ☐

6.1 Training needs

Is the enterprise interested to receive any technical training to develop the skills of the employees? If yes, please state the preferred training topics:

_____

_____

6.2 Business challenges

Please list the three most considerable barriers that the enterprise is facing in developing the business:

1. _____
2. _____
3. _____

6.3 Business goals

How do you see the development of the enterprise in the next five years? What would be the enterprise's main goals for this period and the general strategies in achieving them?

_____

_____

_____

_____

6.4 Suggestions to PFP 2

Please let us know of your suggestions for the programme. From your point of view, what aspects of forestry value chain development should the programme focus on? What could be the areas for cooperation between the enterprise and PFP 2?

_____

_____

_____

Annex 5 Contacted large companies and response

#	Company	Cluster	Submitted data
1	Agora Wood Products Ltd	Mafinga	Yes
2	East Africa bornwood Ltd	Mafinga	No
3	En Xin Company Ltd	Mafinga	Yes
4	Ever green wood co Ltd	Mafinga	Yes
5	Halidi Enterprises Ltd	Mafinga	Yes
6	Hong Lim Ltd	Mafinga	Yes
7	Lesheya Investment Co. Ltd.	Mafinga	Yes
8	Lusian sawmill	Mafinga	No
9	Mintian timber co. Ltd	Mafinga	No
10	Mufindi Paper Mills Ltd	Mafinga	No
11	Mufindi Wood Poles Plant & Timber Ltd.	Mafinga	Yes
12	MW Ltd.	Mafinga	Yes
13	New Forests Company Ltd	Mafinga	Yes
14	Poles Tanzania Ltd	Mafinga	No
15	Quanshun wood industry import and export company Ltd	Mafinga	No
16	Qwihaya general enterprises co. Ltd	Mafinga	No
17	Ronglan Int trade and industry co Ltd	Mafinga	Yes
18	Ruin Da Wood co Ltd	Mafinga	Yes
19	Sao Hill Industries Ltd.	Mafinga	Yes
20	Sheda General Supplies	Mafinga	Yes
21	Song Yuan Lin Hua Ltd	Mafinga	Yes
22	Tanganyika Plywood Ltd.	Mafinga	Yes
23	Tractors Ltd (Mkaa endelevu)	Mafinga	Yes
24	Villa hardware co. Ltd	Mafinga	Yes
25	Tanganyika Wattle Company Ltd	Njombe	Yes

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