COSTS AND THEIR FINANCIAL IMPLICATION FOR SMALLHOLDER TREE GROWERS IN MUFINDI DISTRICT TANZANIA

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ABSTRACT

This study sought to bridge the gap in knowledge by determining costs and their financial implication for smallholder tree growers in Mufindi District, Tanzania. The specific objectives of the study were to determine cost centers for establishment and management, to compare these costs of establishment and management for tree growers and lastly to determine the financial viability of the tree growing systems in the district. Data were collected by using a questionnaire with independent tree growers as respondents, checklists for TGA members as well as service providers and outgrowers. The study used homogenous purposive sampling to identify smallholder tree growers that where located within Mufindi District with woodlot size between 0.4 hectares to 4 hectares. The data were analyzed using the SPSS program version 12.11 and the EXCEL program. The comparison on the cost of establishment and management for the different tree growing systems in the district was made using ONE WAY ANOVA and Fischer's LSD. The discounted cash flow analysis with economic criterion NPV, and IRR were employed for economically evaluating the forestry projects. The study found that independent smallholder tree growers had the lowest costs of establishment and management at 2 679 012.35 TZS per Ha compared to TGAs TZS 2 281 440.00 per Ha, service providers TZS 3 374 554.51 per Ha and outgrowers 4 104 299.52 per Ha. The study concluded that though costs are crucial, the ability to find a suitable market beforehand affects the overall viability for investing into smallholder tree growing in Mufindi district. The study recommends that governance such as FBD, be tasked with addressing these transaction costs and aligning contracting relationships between smallholder tree growers and their commercial partners. Furthermore, to increase the bargaining power of smallholder tree growers, encouragement for independent tree growers to join these tree grower associations must continue.

DECLARATION

I, **Kikolo Raphael Mwakasungula**, do hereby declare to the Senate of Sokoine University of Agriculture, that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any

other institution.

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DEDICATION

This work is dedicated to my Mothers Wende, Neema, Caroline, and Lunyamadzo Maulaga.

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LIST OF ACRONOMYS AND SYMBOLS

AF	African Forestry
CAI	Current Annual Increment
DC	District Council
DED	District Executive Director
DFM	District Forest Manager
DFO	District Forest Officer
FAO	Food and Agriculture Organization
FBD	Forest and Beekeeping Division
FDT	Forestry Development Trust
FEO	Forestry Extension Officer
FFPO's	Forest and Farm Producers Organizations
FL	Field Laboratory
GDP	Gross Domestic Product
GRL	Green Resources Limited
ICFG	Igowole Community and Family Group
IRR	Internal Rate of Return
MAI	Mean Annual Increment
MDC	Mufindi District Council
MNRT	Ministry of Natural Resource and Tourism
MSME's	Micro, Small and Medium Enterprises
MUCOBA	Mufindi Community Bank
MX$	Mexican Peso
NAFORMA	National Forestry Resources Monitoring and Assessment of Tanzania
NBS	National Bureau of Statistics

NFC	New Forests Company
NGO’s	Non-Government Organizations
NPV	Net Present Value
PFP	Private Forestry Programme
PRA	Participatory Research Appraisal
SACCOS	Savings and Credit Cooperative Societies
SAFIA	Saohill Forestry Industry Association
SDG’s	Sustainable Development Goals
SHFSTVC	Smallholder Farmers Sawn Timber Value Chain
SNAL	Sokoine University of Agriculture National Library
SPSS	Statistical Package for Social Science
SUA	Sokoine University of Agriculture
TBS	Tanzania Bureau of Standards
TCE	Transaction Cost Economics
TFSA	Tanzania Forests Service Agency
TGA	Tree Grower Association
TGIS	Tree Grower Incentive Scheme
TRA	Tanzania Revenue Authority
TTGAU	Tanzania Tree Growers Apex Union
TZS	Tanzanian Shillings
UNEP	United Nations Environmental Programme
URT	United Republic of Tanzania
VC	Value Chain
VCA	Value Chain Analysis
VCo	Village Council

VEO	Village Executive Officer
VICOBA	Village Community Bank
WEO	Ward Executive Officer

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background information

In Africa, millions of people rely on the continents' genetic species and eco-system diversity to support livelihoods, health, and nutrition. In Tanzania, Ishengoma (2015) denoted that the provision of energy is mainly wood-based, and the consequence is the destruction of forests and landscapes, and this has dire consequences for ecosystems as well as for the livelihoods of rural and urban residents. It was highlighted that if no action to addressing the rampant deforestation and degradation, the annual deficit will increase exponentially. A reverberation of an assertion by Ngaga, (2011) in a report to the African forest forum; it was predicted that given the age structure and harvesting levels in 2010, after the year 2017, there will be severe deficits for the decade to come.

The private sector in Tanzania, including smallholder tree growers, is viewed by many as key stakeholders to reduce the wood deficit in the country (MNRT, 2000; Mwamakimbullah, 2016). With a rapidly growing economy, increasing demand for timber and limited wood supply from industrial plantations and natural forests unlocked livelihood opportunities for smallholder tree growers in the Southern Highlands of Tanzania (Arvola *et al.,* 2019). This is evident in some renowned smallholder tree growing Districts in Tanzania such as; Iringa rural, Kilolo, Ludewa, Makete, Mufindi, and Njombe, with support from individual efforts and communities at a village level (INDUFOR, 2011; Arvola *et al.,* 2019).

Like forest plantations, smallholder tree growing bear costs from the establishment to terminal operations, and any investment decisions are made for profit maximization; thus, cost management is critical to maximizing returns. Adequate forest management practice

is required to warrant high efficiency and the right quality products from these smallholder tree growers.

Forest management is a practical application of scientific, technical, and economic principles in forestry (MNRT, 2001a). However, forest management is a costly endeavor and effective use of resources is of paramount importance. Cost management strategies used by different forest plantation practitioners entail deciding on how much money will be spent to accomplish specific operations and differs considerably between government and private sector and more noticeable in smallholder plantations (Colin, 2004).

The number of out-grower schemes and woodlots is increasing quite rapidly in Tanzania with tree planting and woodlot establishment by farmers and communities taking place in all the districts, but particularly in the Southern Highlands, especially in Mufindi district in Iringa region (Mankinen *et al.*, 2017). This growth in the number of tree plantation farmers has been a response to the growing demand for timber products. Singunda (2009) illustrated that the income earned by those with trees had stimulated many people to plant trees. This claim has been asserted recently, as the Tanzania smallholder tree grower boom continues to sustain livelihoods particularly in the southern highlands (Arvola *et al.*, 2019).

1.2 Problem statement and justification of the study

Despite the sustained tree growing boom since 2009, it is apparent that essential limitations are facing commercial smallholder tree growers and woodlot owners considering tree planting, harvesting, and marketing in Tanzania. It is observed in developing countries that forestry enterprises have high up-front costs due to lack of information (Tuuka *et al.*, 2014). In Tanzania, initial constraints highlighted by Ngaga

(2011) stem from lack of sufficient knowledge in tree growing and harvesting as well as lack of market information, marketing, and bargaining power.

These challenges that smallholder tree growers are facing result in a smaller profit due to the price for standing woodlots dictated by traders failing to account for all the costs necessary for tree growing. This market imbalance caused by a lack of information introduces transaction costs for tree growers. Compounded by poor infrastructure and lack of modern technologies, most of these farmers have economically inefficient tree growing systems. Furthermore, Ngaga (2011) highlighted that smallholder tree growers lack investment capital/credit, and knowledge on baseline profitability is a constraint in tree growing for commercial purposes.

Costs in both private and public plantations (large scale farming) are well documented as part of the determination of forest royalty and proposal of new royalty rates as well as research reports (FBD, 2011; Malinga, 2012; Akyoo, 2017). However, limited information exists on costs for independent smallholder tree growers as well as their profitability, the transformative cost centers of land, labor and capital have not been fully documented. Furthermore, financial information on the profitability of the various tree growing systems in the district is scanty, recent studies show the benefits to smallholder tree growers is the least. This study, therefore, seeks to determine the cost centers of smallholder tree growers and their financial implication in Mufindi district.

The study is useful in providing informed decisions to the policymakers on new woodlots and tree growers for possible interventions to protect livelihoods. The market imbalance caused by a lack of information leads to higher transaction costs, thus providing access to this information will contribute to promote for relevant market-level interventions. It is also crucial to the tree growers to know profitability calculations for timber growing based on their investment in tree growing for either expansion of their investment or risk

mitigation. This research will also be invaluable to urban investors looking to invest in Mufindi district.

1.3 Research objectives

1.3.1 Main objective

To determine total costs for smallholder tree growing and their financial implication in Mufindi District.

1.3.2 Specific objectives

i. To determine the cost centers for tree growing by an independent smallholder tree grower in Mufindi District.
ii. To compare the costs of smallholder tree growing systems in Mufindi District.
iii. To determine the financial implication of costs on tree growing systems in Mufindi district.

1.4 Research Questions

1. What are the cost centers for tree growing by independent tree growers in Mufindi District?
2. Is there a difference in the costs for the smallholder tree growing systems in Mufindi District?
3. How are the costs of the tree growing systems affecting their financial viability in Mufindi District?

1.5 Research hypothesis

Ho: The mean cost of establishing and managing a woodlot by the smallholder tree growing systems are equal in Mufindi District.

Ha: There is a difference in the mean cost of establishing and managing a woodlot by the smallholder tree growing systems in Mufindi District

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Smallholder tree growers in the world

It has become evident particularly in developing nations that small scale forestry can play a vital role in poverty alleviation, as trees are being planted to support agricultural production systems, community livelihoods and to provide rural poor access to secure food supply (Carle *et al.,* 2002; Robinson, 2016). Despite this overwhelming potential, Anyonge and Roshetko (2003) suggest numerous activities that will support small-scale farm-level timber production to achieve its multiple potentials. They highlighted that it is essential to improve farmers' access to markets and market information; while providing suitable germplasm of adapted species, provenances, varieties, clones, and seed sources of high quality. Besides, farmers need knowledge concerning species selection, tree management, product processing, and required product quality.

Norway, considering all its advancement in economic muscle, has always taken up smallholder tree growing as family heritage. A report by Norwegian ministry for the environment (2008), raised awareness in that more active use of the Norwegian forest (logging, regeneration, etc) increased the capacity of the forest to uptake carbon dioxide. Two years after this report, the Norwegian Government through the Ministry of Agriculture and food advocated a possibility to increase the annual harvest from eight million m^3 to about 15 million m^3 without disregarding environmental compliance. In

response, Follo (2011) highlighted that to meet diverse objectives and fulfill the goals, the responsibility mainly falls to the Norwegian forest owners (smallholder). This was due to the fact they own the land combined with the means to produce, thus the final decision whether to harvest or not is entirely up to the smallholder.

In contrast to the Norwegian smallholder tree growers in Cameroon, the state remains the owner of the land. Traditional domestic forest management in Cameroon changed in 1994, subsistence use of forest or trade-in forest products became no longer authorized without an individual permit from the government as customary rights were restricted. Despite these predicament smallholder tree growers in Cameroon exist, they are locally referred to as Domestic forest owners. The state can impose formal modes of management, including logging concessions and declaration of national parks that supersede local customary rights. In such a case the domestic forest becomes a 'permanent forest estate' which primarily is utilized to achieve or fulfill objectives financially and ecologically on the national level.

2.2 Smallholder tree growing in Tanzania

There has been a lack of a common definition for small, medium, and large tree growers and this has been exhibited by several studies before and existing reports on the fields of agriculture and forestry (Salami *et al.*, 2010). Recently a PFP (2016a) study adopted its working definition for the context of the Southern Highlands and private forestry in Tanzania. In this definition, Tree growers were grouped into size categories based on the total area of land informants reported that they held. Thus, Small tree grower was regarded as one who holds less than 10 acres (approximately 4 ha) while the medium tree grower has a range 10-50 acres (approximately 4-20 ha) and the large tree grower has over 50 acres (approximately 20 ha). In 2011, INDUFOR estimated that there was about

80 000 to 140 000 ha in total of village and farm plantations in the country. Since then there has been a significant increase in the number of smallholder tree growers despite the several constraints to the venture.

The Lack of investment capital/credit and knowledge on baseline profitability calculations was one of them as highlighted by Ngaga (2011). This was further compounded on by a PFP report in 2016 which cited that smallholder tree growers were unable to keep up with the high-interest rates and short payback periods of existing financial instruments. This combined with having poor access to land registration and titling, limited knowledge about existing support mechanisms, and lack of access to high-quality genetic material has made tree growing by smallholders inefficient (Ngaga, 2011; FDT, 2015; PFP, 2016).

Arvola *et al.* (2019) found that the strong market demand created dual markets in the southern highlands and larger industries were supplied by higher quality industrial plantations but lower quality smallholder plantations were sources for micro and small enterprises. Furthermore, it illustrates that the markets' quality criteria were expected to tighten, thus capacity building would be required to improve smallholder wood quality to ensure the long-run tree-growing livelihood and competitiveness of smallholder tree growers in the markets. Arvola *et al.* (2019) also highlighted that the future of smallholder tree growing in the country will encounter problems of access to markets. This line of thought stemmed from the likelihood that markets are likely to become more selective and substitutes may replace (poor quality) timber for example as construction material (INDUFOR, 2011). Poor quality smallholder wood is an apparent developing country feature (Putzel *et al.*, 2012; Frey *et al.*, 2018), as harvesting before the optimal rotation age is achieved is common among smallholders in Tanzania.

2.3 Cost concepts, centres and variation in forestry

Costs in this study will fall primarily on the establishment of the woodlot and management of that woodlot to rotation age as deemed by the smallholder as well as transaction costs. It is noteworthy that the distribution of costs in forestry is done based on activities, these are mainly initial clearing and planting followed silvicultural practices and harvesting. The cost concepts in smallholder tree growers, on the other hand, might be different, for example, it is assumed the tree grower takes care of the tree woodlot by himself or herself as such no costs normally incurred unlike in industrial forestry (like company overheads and maintenance) are included (PFP, 2016).

According to Evans and Turnbull (2004), Initial clearing or land preparation is one of the high cost activity in forestry. They further indicate that the intensity of ground preparation will depend on the objective of planting. In some cases, minimum site disturbance is required if the purpose is to protect soil, while other reasons may be the species to be planted for example Eucalypts need entirely cultivated and weed-free sites, while many Pines and tropical Acacias tolerate grass competition. The forest plantation and woodlot technical guideline for Tanzania stipulate that vegetative cover and site and soil conditions are also factors in land clearing. Kalagne and Mansey (1989), reported higher survival rates in fields that have been ploughed to a depth of at least 15cm.

Site clearing is followed by planting the seedlings whether bought from nursery stand or grown from an individual's nursery. Plantations/woodlots should be checked several weeks after planting to assess the survival rate. Seedlings should be planted away from where fertilizer was put (MNRT, 2016). Some seedlings die quickly due to various reasons from weed competition to transport damage thus tree growers often re-plant these seedlings within the same planting season. Silvicultural activities are crucial for optimal

MAI for woodlots as illustrated by Malimbwi (2016). High survival rates of 86.2 and 91.4 for strip weeding and clean weeding respectively are advised for woodlots (Kalagne and Mansey, 1989). While the pruning activity is another Labour cost center which is also a desired practice in forestry; Artificial pruning is the cutting off of tree branches. Some species are natural pruners such as most Eucalyptus species. For other species such as *pinus patula*, dead branches remain on stems for extended periods and pruning is essential if knot-free timber is desired. Tree growers also incur costs for thinning of tree stems; this is done to favor the most vigorous trees with a good form which are likely to make up the final harvested tree products, they also provide an intermediate financial return from the sale of logs for poles, veneer, etc from the thinning especially second thinning onwards. SAIF (2000), illustrated that more trees are initially planted than the required final standing trees so that there are sufficient trees from which the final harvest can be selected and to increase early canopy closure to suppress weed growth and assist in site utilization.

2.3.1 Transaction costs economics in forestry

At an operational level, contractual modes have direct bearing on economic efficiency, particularly from the perspective of transaction costs. Williamson (1985), characterized the TCE (Transaction Cost Economics) approach by a harmonizing orientation with transactions as the unit of analysis, thus the TCE approach is concerned with the transaction cost implications of different governance structures.

Since then, Barzel (1997) defined Transaction costs as costs of capturing and protecting property rights, and transferring them from one agent to another. Pejovich (1995), also illustrated that these costs include the costs of discovering, exchange opportunities, negotiating contracts, monitoring and enforcing implementation, and maintaining and

protecting the institutional structure. North (1990), distinguished Transaction costs from production costs, which is the cost category with which neo-classical analysis has been preoccupied, by dividing the total costs of production into transformation costs. This translates to the costs of land, labor, and capital as inputs involved in transforming the physical attributes of a good, and transaction costs of defining, protecting, and enforcing the property rights to goods.

The once seemingly unrelated and non-economic issues of law, ethics, organization, governments, etc. are better understood with TCE as a tool. The general nature of silviculture roots the transaction costs of hiring, monitoring labor, getting capital, and marketing the products to be relatively high. As a result, it suffers some disadvantages from market exchange.

The concept of property-related transaction costs which encompass costs of establishing and maintaining the property, including the cost of information, negotiating, establishment, enforcement, and control of a restituted property was presented by Allen (1991). This resulted in the recognition of some predominant transaction costs which apply to smallholder forestry in Tanzania i.e;

a) Transaction costs of information on how to establish woodlots, manage it together with more co-owners, and in the transforming states of land, labor, and capital.
b) Social transaction costs or transaction costs of exclusion include the cost of mechanisms that owners need to safeguard their property under pre-defined rules enforced by the state.

2.4 Out-grower Schemes

2.4.1 Definition of forest out-grower schemes

According to Race (1999), an out-grower scheme is defined as a contractual partnership between growers or landholders and a company for the production of commercial forest products. They further outlined that these partnerships contrast considerably in the magnitude to which inputs, costs, risks, and benefits are shared between growers/landholders and the said companies. These schemes can be short or long-term (e.g. 35 years) and could tender only financial benefits or a wider range of benefits to these growers. Mayers (2000), illustrates that several strategies exist in these partnerships for trading wood between growers and the processing industry. Furthermore, there are cases companies would obtain their supplies through trading intermediaries (i.e. market agents) and do not have an outright relationship with growers, while other companies lease land under contract from landholders for growing trees, or contract farmers to grow trees (see Table 1). These Growers further create market strategies, such as establishing cooperatives or employing their market agents, to induce improved commercial returns from forestry. Also, growers may act individually or as a group in partnership with a company and use private or communal land. Out-grower schemes are usually prescribed informal contracts. Within this definition, out-grower schemes may include joint ventures and contract tree farming. Differences between these arrangements are largely in responsibility for silviculture, resource ownership and control, and the financial remuneration of growers. In conventional out-grower schemes, the landholder is contractually responsible for the silviculture and the supply of the product, usually round wood, to the company at harvest. Under the contract, the company may provide inputs or technical support to the grower and guarantees a market for the product.

2.4.2 Types of out-grower scheme arrangements

Generally, forestry out-grower arrangements between growers (co-operatives) and processors may be characterized as either partnership in which growers are largely responsible for production, with company assurance or guarantee. Companies under this arrangement will purchase the product; or partnerships in which the company is largely responsible for production, paying landholders market prices for their wood allocation. There can also be arrangements for land lease agreements in which landholders have little involvement in plantation management and these land lease agreements with additional benefits for landholders.

2.4.3 Forestry out-grower schemes in other countries

Curtis and Race (1998) gave an account of out-grower partnerships in Australia and New Zealand. They referred to them as joint ventures, with three broad types of arrangements i.e. 'lease' joint ventures, 'crop share' joint ventures, and 'market' joint ventures. In an iteration of this Race (2000) indicated that joint ventures that share financial returns following harvest in New Zealand were more common than the 'lease' joint ventures in Australia. It has been apparent in recent times that not all industry investors are 'end-product' processing companies, other industry investors 'on-sell', or simply trade in raw or unprocessed forest products such as woodchips (Curtis and Race, 1998).

Higman *et al.* (1999) highlighted forestry out-grower schemes in Brazil, India, and the Philippines and the potential benefits that some of these farmers were able to realize. Primarily, through the out-grower schemes in the Philippines farmers were able to secure land tenure and increase the clarity over rights to trees being grown; this allowed them to gain access to financial support or alternative sources of income while the trees matured (Arnold, 1991). Out-growers in Brazil, on the other hand, received higher net returns from

trees than from traditional land uses as they managed to secure markets for wood due to good terms of participation with the companies making them appealing to third parties.

In Ghana, farmers have hardwood timber growing contracts with the Swiss Lumber Company in south-western Ghana which aims to meet its future timber needs through timber-growing contracts with farmers. Rather than competing with prime agricultural land, out-grower contracts also emphasize timber growing on degraded land. Swiss Lumber Company offers farmers four payment options: a lump-sum down payment, a percentage share of the timber at harvest (varying from 20 to 50 percent), an annual land rent, and the first option on a weeding contract on the plantation. Farmers are bound by their contract to give the company the first option in the purchase of their share of the timber at prevailing market prices (Kotey *et al.,* 1998; Mayers, 2000).

2.4.4 Out-grower schemes in Tanzania

In 2002 KVTC embarked on a Village Out-Grower Project where annually teak plantations were established in the associated villages. Kilombero Valley Teak Company (KVTC) has helped local tree growers by establishing a formal out-grower scheme and these Out-growers are located up to 100 km from the main plantation. Contracts between KVTC and the out-growers specify that KVTC covers 50 percent of out-grower establishment costs and in exchange, it has the first right of refusal to 25 %t of the timber harvest; out-growers may choose to sell the remaining 75 % of logs or process them themselves. The company guarantees a market at a minimum age of 15 years for the trees. Ultimately, KVTC envisages that local outgrowing will help sustainably improve the economic and social conditions of participating communities. Similar setups have been established by New Forests Company and Green Resources both

operating in the southern highlands of Tanzania, though not much information is available on them (Ngaga, 2011).

2.5 Externalization of services and contractual relations in forestry

WoodEMA (2011), elaborated that the choice between internalization and externalization of services belongs to the basic decisions of the firm. Neoclassical theory dictates that production costs and production effectiveness are important parameters of service provision. Thus, the principal objective of outsourcing is to increase efficiency by introducing a competitive environment for the provision of the services. OECD (2005), reported that the definite business scenarios for outsourcing quote reduction in costs, access to expertise not available in-house to meet ad-hoc needs and access to expertise on a long-term basis in order to be able to vary its quantity and mix over time.

2.5.1 Service providers in Tanzanian forestry sector

There is a wide spectrum of different types of ‘service providers’ offering their services in Tanzania, these different types of providers exist at different levels of formalization and service integration (Kallabaka, 2018; Ntiyamagwa, 2018). Informal service provision involves primarily family relations providing manual support and ‘eyes on the ground’ to urban investors, Relatives normally provide labor-intensive support at critical points through the rotation, such as establishment, planting, and harvesting. Foreman or plantation manager is another informal service provider, Investors often engage with one local person to be their ground coordinator, sourcing labor when required. The foreman acts as a conduit between investor and community and in some cases investors club together to hire plantation managers instead of formalized SPs.

Formal SP’s include input providers, nurseries, and Integrated Service providers. Input providers have direct relationships with some investors, supply them seeds, fertilizers, and pesticides, etc. Nursery operators sometimes provide technical advisory on plantation management and have their demonstration plots to support sales. Many investors buy seedlings and other inputs direct from nursery operators in areas close to their woodlots. They're a small, but growing number, with varying levels of formalization and capacity, of integrated service provision companies supporting activities from land acquisition and establishment, plantation maintenance, to harvesting. Some providers have formalized contracts and Memorandum of understandings in place with their customers.

Despite the increase in the number of service providers, they still face numerous challenges. These range from Limited access to financial services to Misalignment of incentive timeframes between investors and SPs while facing varying investor motivations and profiles.

2.6 Tree grower associations in Tanzania

To stimulate an inclusive forest sector, Private Forestry, and Carbon Trading Project (PF-CP) demonstrated the TGA model. It was a bilateral development cooperation project between the governments of Tanzania and Finland and it was implemented in 2010-2012. Tree grower’s associations in Tanzania are voluntary groups formed by tree farmers at the village level. TGA members come together to have a collective voice in the forestry sector and its related value chains at the local level where, members can increase their lobbying powers and negotiation skills in mutual matters, increase their market and price knowledge and improve their technical skills in tree growing value chain from seeds to market. The main objective of the TGA model is to increase smallholders’ net income at harvest through enhancement of productivity and quality standards in tree farming through providing improved planting materials, technical advice, and creation of

enabling environment. TGAs have taken the role of the focal point for organizing these services in their respective locations.

The increasing enthusiasm to engage in forest investment by small scale tree growers has also been to respond to the ever-increasing demand for sawn wood timber which does not match with decreasing supply from government forest plantations. However, Ngaga (2011) highlighted that very often smallholder tree growers attributed to a low level of knowledge and technical capacity aggravated by limited access to advisory services, improved seeds, and recurrent wildfire and unsystematic wood markets to be the four major barriers to becoming successful commercial forest actors.

High prices of improved seedlings offered by commercial nursery operators of TZS 150 to TZS 200 per seedling is explained by smallholders to be one key hindrance towards adopting the use of improved planting materials. Under TGA common nursery tree growers have been able to get the same material at TZS 70 (TTGAU, 2019). Under this model, members are given seedlings for planting one acre for free and if one needs more than that then has to pay TZS 70 per seedling. This model has enabled members who cannot afford to buy improved seedlings on their own to get seedlings from the TGA. Members mobilize their resources by contributing to the purchase of seeds, polythene tubes, and labor force for the management of the nursery (TTGAU, 2019).

2.7 Socio-economic field laboratories under woodcluster project

The WoodCluster project is funded by the German Ministry for Education to promote partnerships for Sustainable Solutions with Sub-Saharan Africa through measures for Research and Integrated Postgraduate Training and Continuing Training. The research is based primarily on two approaches combining the farming and forestry systems and the sustainable livelihoods approach, both focusing on the small-scale farming families

(farm households) as units of analysis. The assessment of these systems, using socioeconomic field laboratories (FL). “Field laboratories” is an umbrella term for a set of participatory and flexible methods that belong to the action research and uses some elements of the “social learning processes” (Rist *et al.,* 2006). The main purpose is to bring together a large diversity of participants, from small farmers and their representatives in the rural communities to public authorities, members of development organizations, researchers, and academics.

Rist *et al.* (2006) expressed that the focal difference between conventional action research and FL is that all participants become informants, researchers, and teachers in these laboratories. The FL aims to enable the joint production of knowledge based on a collectively constructed systemic view of farming and forestry systems and livelihood strategies in the different areas of intervention. This research process includes description and diagnosis of the farm household system (and their external determinants) leading to an identification of potential opportunities (intervention design) which for the WoodCluster project is to narrow the wood supply gap in East Africa. To provide the necessary information, several tools have been implemented such as local stakeholder and authority meetings, inception workshops in pre-selected communities, direct observation, and the use of secondary data, all to identify the most suitable communities to work within the study area i.e. Mufindi district.

2.7.1 Mufindi district as a socio-economic field laboratory

The WoodCluster project earmarked a total of 8 villages in the Mufindi district for further research based on a defined rural appraisal tool for tree growers in the district. WoodCluster (2018), reported the baseline survey in Mufindi district council four study villages were selected for in-depth studies namely: Mninga village found in Mninga ward,

Igowole village found in Igowole ward, Ifwagi village found in Ifwagi ward and Mwitikilwa village found in Rungemba ward. Four villages were selected for in-depth studies in the Mafinga township council namely: Kisada village found in Bumilayinga ward, Sao Hill village (Ibikititu and Mkanzauli streets) found in Sao Hill ward, Matanana village found in Bumilayinga ward and Lutalawe and Igawa streets found in Changarawe ward.

Recent studies in the field laboratories have focused on villages in Mufindi on which farms were analyzed and innovative strategies to increase wood production assessed. Ombeni (2018) investigated the tree grower's motivations, knowledge base, and challenges to woodlots farming; assessed woodlot tree species, products, and performance; assessed the linkages by analyzing social networks of tree growers with support organizations and evaluated their impacts on the performance of their woodlots. Both survey and case study approaches were used to collect data in the three villages namely: Igowole, Mninga, and Nundwe, in Mufindi district, Tanzania. Among other things, he recommends that Tree grower associations (TGAs) should extend their focus from current production centered to more market and business orientation. This will, in turn, create networks with other business companies such as Green Resources Ltd. (GRL) and New Forest Company (NFC) to make partnership linkages that are necessary to improve production, marketing skills, and processing technologies.

Kallabaka (2018), illustrated that information on roles and forms of brokers in smallholder farming in the sawn timber value chain (SHFSTVC) in Mufindi district was inadequately known. His study, therefore, analyzed the roles and forms of brokers in SHFSTVC, markets, prices, and profit margins of value chain actors at different nodes. He recommends that there is need for transparency regarding the benefits accrued by

smallholder trees farmers who are engaged in tree planting activities and sustainability of services provided by either government institutions or NGO's. Besides, he elaborates on the need for partnerships among these stakeholders and out-grower system arrangements in strengthening tree growers' associations as well as improving the capacities of forestry extension services.

Another study in the FL, Ntiyamagwa (2018) carried out a comparative study of the value chain analysis of smallholder and large-scale tree growing.

2.8 Financial analysis in forestry enterprise

A tree growing business venture, like other business enterprises, can only continue in the long term if it is profitable. One of the most important factors that determine profitability in forestry is the yield capacity of the growing site. Falcao (1998) established the minimum required yield for profitable sawn timber production from *Pinus patula* in the escarpment area of Mpumalanga, using Net Present Value as a financial profitability criterion, cost and price components from 1996 derived from the cost monitoring system of Forestry Economics Services. This study was a reverberation of the marginal MAI problem for South African forestry conditions as illustrated by Olivier (1993) in which 17 m^3/ha/annum was required for profitable sawn timber production from Pinus patula in Kwazulu-Natal with sawn timber production of two or three thinning's. While Du Toit (1992) used NPV and IRR as financial criteria for four different silvicultural regimes exposing a MAI_{20} of 16 m^3/ha/ annum as the minimum yield required for profitable Pinus radiata sawlog production in the Western Cape.

Lopez and Deloya (2018), carried out a similar study to financially analyze small scale Pinus patula plantations in the Mexican states of Veracruz, Puebla, Tlaxcala, and Hidalgo,

among others. Utilizing the Net Present Value (NPV), Benefit/Cost ratio (B/C), and Internal Rate of Return (IRR) indicators, the financial feasibility of a 3000 m^2 *P. patula* plantation, 17 years old, whose production was to be used for making pulp and sawn wood, was assessed. The NPV, B/C ratio, and IRR for the plantation were MX$ 37 959.00, 2.32 %, and 26.61 %, respectively. The costs and benefits that impacted the final financial balance of the project were those occurring at the early stages. Lopez and Deloya (2018), recommend implementation of strategies to decrease costs and increase benefits during the initial stages of the project as well as agroforestry systems.

In Tanzania, PFP (2016b) carried out a forest financing study to evaluate alternative mechanisms for financing private forestry and the wood industry in the long term and to gather recommendations on the best practices to be applied in the country. The study used yield models adapted for the financial calculations from the South African Forestry Handbook as written by Kassier and Kotze (2000) on model growth patterns from TGA woodlots. The study used NPV with a base scenario of a 10% discount rate to identify the optimal rotation age of 18 years for *Pinus patula* saw logs and 15 years for eucalyptus Grandis based on maximum NPV. The underlying assumptions for this model are for small-scale tree growers do not need to purchase any land and that they care for the tree plantation by themselves without hired labor. The model also assumed the tree grower has access to high-quality inputs and paid only unit prices for inputs and transportation that they would if they had TGA membership. This supposition was adopted to simulate a situation in which a well-functioning TGA was present in a village. The study did not however account for smallholder tree growers that were not part of tree grower associations, this gap in information is what the present study seeks to fill.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Overview of study methodology

The data were collected for the determination of cost centers and their financial implication for smallholder tree growing systems in Mufindi district. The study was conducted by adopting a cross-sectional research design, using a questionnaire, literature review, online survey, and personal interviews as tools for data collection. Due to research time and budget constraints, no physical inventory on the respondents' farmlands was conducted. The main respondents were smallholder tree growers in the study area. These smallholder tree growers were then categorized based on the system of establishment and management; Independent smallholder tree grower, outgrower, Tree grower association member, and service providers. The data was collected based on the specific research objectives and in line with these objectives, the data are presented and discussed.

3.2 Description of study area

The study purposely selected Mufindi District as it among the renowned smallholder tree growing Districts in Tanzania (Arvola *et al.,* 2019). Mufindi District is in the Iringa Region in the Southern Highlands of the United Republic of Tanzania. Mufindi district extends between latitudes 8^0 and 9^0 south and longitudes 30^0 and 36^0 east. The District occupies a total area of about 7123 square kilometers and borders with Kilombero and Mbarali Districts to the East and west respectively and borders Iringa Rural and Njombe districts to the north and south respectively. Administratively, Mufindi district council is comprised of 121 villages and 27 wards.

3.3 Research design

Data for this study were collected using a cross-sectional design, whereby a questionnaire was self-administered. The data was collected at a single point in time without repetition from a sample selected to represent some large population as guided by research doctrines (Kothari, 2008). This design was considered useful for descriptive purposes and the determination of baseline cost relationships in the study villages. This design was preferred because it was economical in terms of funds and time.

3.3.1 Questionnaire

The questionnaire for this study was used to collect data for objective I of the study. Its design was structured and semi-structured with both open and close-ended questions. The questions in the questionnaires were structured such that they permit the acquisition of quantitative and qualitative information. The reliability of the data was checked by asking the respondents detailed information about the issue in question and asking the same question in different ways thus comparing the answers. The information collected included demographic data such as occupation, education, and household size but also data on acreage owned, type of farming system, costs of establishment, and management. Other information was on assistance from the government or surrounding plantation companies, cost reduction measures, and assistance required by farmers on tree growing.

3.3.2 Pre-testing

Kothari (2008), credits detail surveys as an essential part of research after a reconnaissance survey. Before the actual surveys, the questionnaire was tested. Pre-testing of the questionnaire was done under field conditions using a randomly selected sample of 10 households from Igowole village and Kisada village each, who were not part

of the final sample, and these were interviewed. Kajembe *et al.* (1996) enunciated that checking the validity and reliability of the questions is an important exercise. Then the initial draft of the questionnaire was modified to fit the conditions based on the pre-test results.

3.4 Sampling procedure

3.4.1 Sampling

The population of this study consisted of independent smallholder tree growers, Tree Grower Associations, Outgrowers supported by Green Resources Limited, and service providers in Mufindi district. For independent smallholder tree growers, a baseline survey carried out by WoodCluster (2018) in Mufindi District using participatory rural appraisal and key informant interviews as tools earmarked villages in the district designated by the WoodCluster project for further study. The survey used criteria such as the population of tree growers, presence of tree grower's associations (TGAs), and presence of brokers, saw-millers, and carpenters as well as accessibility to select 5 villages in the district and Mafinga Township. The study villages (Kisada and Igowole) were then selected at random from this pool of villages that had actively operating TGA.

3.4.2.1 Independent smallholder tree grower

A total of 270 respondents were chosen randomly from a list of tree growers in from both villages. The following formula was used to determine sample size.

$$\mathbf{n = z^2pq/e^2}$$

Equation 1: Sample Size determination

Where n = required sample size,

t = confidence level at 95% (standard value of 1.96)

p = proportion of the number of tree growers in the study area (65% estimated)

e = margin of error at 10% (standard value of 0.10).

Using the above equation, a sample of 270 tree growers was obtained. From the calculated sample size, 69 respondents were dropped as they had woodlots outside of the adopted definition for smallholder tree grower (greater than 0.4 Hectare but less than or equal to four Hectares) and those that belonged to a TGA. This reduced the sample size to 204 independent smallholder tree growers for analysis.

3.4.2.2 Tree grower associations

The TGA for this study were purposely selected from a list of 156 registered active tree grower associations with Tanzania Tree Growers Apex Union in the Southern Highlands. The study narrowed the selection to TGAs operating in the same villages as the independent smallholder tree growers i.e. Kisada and Igowole. These associations were Igowole community and Family Group (ICFG) and *Umoja wa Wapandaji wa Miti Kisada* (UPAMIKI). ICFG TGA had 30 household members, while UPAMIKI TGA had 28 members. A total of 20 tree growers were purposely sampled for this study, the study assumed TGA members will have similar costs due to their cost sharing function. This was optimal for representation of TGA members. As previously illustrated by Yin (2006), a minimum sample of 10% is adequate to be representative of the study population. Thus, the samples for TGAs are representative and analytical results and inferences were generalized to whole TGA samples in Igowole and Kisada villages in Mufindi District.

3.4.2.3 Service providers

The population of service providers operating in Mufindi District and the southern highlands of Tanzania is not known due to them being largely informal. A list of ten trained service providers who had received support and training on woodlot establishment

was obtained from the Forestry Development Trust. The list included service providers operating in Kilolo, Makete, Njombe, and Mufindi District. The study purposely sampled service providers operating in Mufindi district only to be part of the socio-economic field laboratory under the WoodCluster project. Thus, those that were sampled for analysis were three namely, Mufindi Holdings limited, Ubora Forestry solutions, and Forestry business innovative company.

3.4.2.4 Outgrowers

Outgrowers operating in Mufindi District were the sample for this study from a population of tree growers supported by Green Resources Limited. The list of 250 tree growers supported by GRL was used to select 39 of these outgrowers which were in Mufindi District for analysis, this was done to ensure data collected was part of the socio-economic field laboratory under the WoodCluster project. Thus, the outgrowers population in Mufindi District for this study was 39 tree growers.

3.5 Data collection

3.5.1 Data requirement and source

Both primary and secondary data were required for this study.

3.5.2 Primary data

Primary data were collected by using a questionnaire for independent tree growers as respondents and a checklist for TGA members and service providers. The study also employed personal interviews with outgrowers program officers from New Forests Company and Green Resources Limited as well as Director of Tanzania Tree Growers Association union. The data that were obtained using these tools included both qualitative and quantitative. Quantitative data included total establishment and management cost per

Ha of farm trees, the cost of inputs such as land, labor, and capital for independent tree growers in Kisada and Igowole villages, outgrowers, service providers, and tree grower associations in Mufindi District. While the qualitative data yielded suggested innovative strategies to reduce cost by the smallholder tree farmers in the study villages.

3.5.2.1 Key informant interview

Discussion with key informants involved, The Mufindi DFO, Community development officers, Village government leaders, and other informed people about woodlots. The discussions concentrated on the cost of establishing and managing a woodlot in the district. Information collected included costs in terms of land, labor and capital, rotation age, cost reduction measures, markets, and prices.

3.5.2.2 Direct observation

Participant observation as the name implies is distinguished by the fact that the observer him/herself becomes part of the situation he or she is studying and collects information by simply observing what is going on in the area. According to Katani (1999) much information can be obtained simply by observing what goes on. This method was used to counter-check information from the survey especially from those aspects concerning income, woodlot age, size, and areas harvested.

3.5.2.3 Field surveys

A simple survey of woodlots was carried out to assess the spread of the woodlots in the study area using causal observation. The survey gave a general picture indicating the availability of the woodlots concerning the responses from the interviewee. The survey was conducted with the help of the informants (village executive officer) and it was based on the indicated number of stems, spacing, and species, this information was recorded for

estimations of sales and prices. The survey included a total of 66 smallholder tree growers who were selected randomly using Equation 1 for optimal sample size to represent independent tree growers.

3.5.3 Secondary data

Primary data was complemented by secondary data, which were obtained from reports and other documents from relevant institutions at the district level. Secondary data (whether published or unpublished) was sought from various sources inclusive, extension officers at divisional and ward level, village office, non-governmental organizations (FDT, PFP, TTGAU, AF, and SAFIA) documented information in libraries, internet websites (Miti-Biashara Platform and Jamii Forums). Key informants from government institutions (Mufindi District Forest Office) were interviewed and consulted to gather secondary information to complement the primary data.

3.6 Data analysis

3.6.1 Quantitative data analysis

3.6.1.1 Determination of cost centers for independent smallholder tree growers

Quantitative data on independent smallholder tree grower costs from the questionnaire were coded and analyzed descriptively by using SPSS version 16 software and Microsoft excel 2016, the results are summarized in tables and graphs. Costs for land were extracted from land acquisition, for capital costs, the seedlings and other inputs bought, while the labor costs were simply the number of man-days multiplied by the cost of labor per day of TZS 5 000. This was on the assumption that tree growers have an opportunity to work as casual laborers for this Minimum wage of TZS 5 000 per day.

3.6.1.2 Comparing the cost of establishing and managing a woodlot versus other smallholder tree growing systems in Mufindi district

From the secondary data sources, the cost of establishing and managing a woodlot through Service Providers and outgrowers was compared to the independent smallholder tree growers and TGA members. The data were analyzed using One Way ANOVA at a confidence level of 95% with the hypothesis:

H_o: *The mean cost of establishing and managing a woodlot by the smallholder tree growing systems are equal in Mufindi District.*

H_a: *There is a difference in the mean cost of establishing and managing a woodlot by the smallholder tree growing systems in Mufindi District.*

In addition, Fischer's least significant difference test was then used to identify the least significant difference among the smallholder tree growing systems in the study area. Initially, the study sought to create a dual optimization farm model for cost minimization and profit maximization. When this cost data was modelled using the Tanzania national tree guidelines for establishment and management as constraints, the costs increased instead of being minimized. The preliminary results also indicated that smallholder tree growers had problems with cost data recording and storing, the majority used estimates to provide information on costs. The discounted cash flow analysis was then opted to show the profitability of the tree growing systems. The analysis still showed how different regimes can maximize their profits while essentially minimizing costs. It was carried out from cost and revenue data gathered through primary and secondary sources. The analysis used the financial criteria of NPV, and IRR to establish the profitability of the smallholder tree growing systems in the study area. The choice of using both NPV and IRR was on

the basis that the methods are closely related, both are time-adjusted measures of profitability, and their mathematical formulae are almost identical. Since the choice in tree growing system was mutually exclusive for dependent tree growing projects, the combination of the two methods allowed for the best investment decision.

In the Mufindi District area, the Real Cost of Capital can differ substantially between individuals and groups. As a result, a scenario approach was followed in the Discounted Cash Flow analysis. In the base case scenario, 17% was used as the discount rate. In the other two scenarios, a low discount rate of 10% and a high discount rate of 24 % was used. For these different rates, the NPV and IRR were calculated using the formulae below while the IRR was calculated using EXCEL software based on the NPV and discount rates. The study also used discount factors (see appendices).

$$\mathrm{NPV} = \frac{R_t}{(1+i)^t}$$

Equation 2: Net present value formula

NPV = net present value

R_t = net cash flow at time t

i = discount rate

t = time of the cash flow

$$NPV = \sum_{n=0}^{N} \frac{C_n}{(1+r)^n}$$

Equation 3: Internal rate of return formula

3.7 Limitations of the study

The respondent choice was gender insensitive thus more results are skewed towards males. Since costs are perceived from gender perspective different specifically how are labor costs accounted for, this was a research design error. Smallholder tree growers also had problems with cost data recording and storing, the majority used estimates to provide information on costs. Some claimed to have performed weeding and pruning but upon visitation of the woodlots, this was not the case. The study used direct observations to verify claims of silvicultural practices by tree growers thus minimising the inaccuracy of the data collected.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

This chapter presents the findings from smallholder tree growers in Igowole and Kisada village in Mufindi District, Iringa. The first section presents the data on the demographic characteristics of the smallholder tree growers that were involved in the study. These characteristics included sex, age, marital status, education level, occupation, ethnicity, land size, acquisition age of woodlots, etc. The second section of the chapter presents data on the cost centers of establishing and managing tree growing system by a smallholder farmer in Kisada village. The third section of this chapter presents data on the comparison of the cost of establishment and management of independent Smallholder tree growers, GRL supported outgrowers, TGAs, and service providers in Mufindi District. The last part of this chapter presents the minimum yield for a profitable tree growing undertaking.

4.1 Characteristics of independent small holder tree growers

The objective of the study was to determine the cost of a smallholder tree growing venture and understand the role played by demographics in explaining cost implications. The respondents were requested to provide their background/ demographic information, expecting that these demographic attributes affected the cost data for respondent smallholder tree growers.

An overview of the socio-economic characteristics of the sample tree growers is given in Table 1. Most of the respondents, i.e. 171(83.8%) were males while 33 (16.2%) were females with an ethnic background of either Hehe or Bena. The average respondent was

aged between 21 and 35 years have at least some form of primary education. Socially, most of the respondents were married commoners who were primarily engaged in farming as an occupation. The household income level of respondents in the study area was mainly below 100 000 Tanzanian shillings monthly with 48.5% of the respondents citing this.

Table 1: Characteristics of independent small holder tree growers

Household Characteristics		Respondents	percentage	Total
Sex	Male	171	83.8	204
	Female	33	16.2	
Age	<21	9	4.4	204
	21-35	90	44.1	
	36-50	40	19.6	
	50>	45	31.9	
Marital Status	Married	159	77.9	204
	Widowed	7	3.4	
	Single	38	18.6	
Education Level	No Formal Education	14	6.9	204
	Primary	108	52.9	
	Secondary	69	33.8	
	Tertiary	3	1.5	
	Adult Education	10	4.9	
Social Position	Common Person	178	87.3	204
	Village Leader	15	7.4	
	Religious Leader	11	5.4	
Main Occupation	Farmer	130	63.7	204
	Plantation Worker	6	2.9	
	Employed Shopkeeper	9	4.4	
	Private Business	42	20.6	
	Government Employee	9	4.4	
	Employed Livestock Attendant	8	3.9	
Income Level	<100,000	99	48.5	204
	100,000 - 250,000	69	33.8	
	251,000 - 500,000	27	13.2	
	> 500,00	9	4.4	
Ethnicity	Bena	79	38.7	204
	Kinga	17	8.3	

Hehe	105	51.5
Tumbuka	3	1.5

The socio-economic data gave the insight to labor cost implications for smallholder tree growers, the willingness to accept TZS 5000 per day for tree growing activities such as weeding, or pruning was also deduced from this. The study also found that tree growing was mainly a family enterprise and the majority of the respondents worked on farms together with their spouse and children, with a low allocation of household income to this was more pronounced among respondents with less than TZS 100 000 monthly income.

4.2 Respondent woodlot characteristics

A summary of the respondent woodlot characteristics is given in Table 2. The average respondent woodlot size was 0.2 to 1 hectare which was acquired through purchasing or inheritance. This was lower than findings from an FDT survey in 2015 and Kallabaka (2018) typified that on average woodlot owners in Mufindi district had 2.5 Ha dedicated to tree growing. The significant difference between the findings of this study and Kallabaka (2018) did not differentiate between smallholder tree growers and higher categories. This was also the case for the FDT survey in 2015. The Woodlot size was important for the study to focus only on smallholder tree growers.

Most of the respondent woodlots had mixed wood production systems with some sort of intercropping, translating to 61.8 % of the total respondents. Respondents that had a mixed wood production system mainly combined Maize with wood production. This was also sighted in Kenya, where smallholders grow mainly maize, beans, or potatoes for a period of four or five years, after which the plantation is grown on as a monoculture forestry crop until ready for harvesting (Umrani and Jain, 2010). Agroforestry is yet to be fully embraced by woodlot owners in Mufindi District with the average perception being that other crops and tree growing must be done on separate pieces of land or in rotation. The results in Table 2 show that most of the respondent’s woodlots established (53%)

were aged between four and ten years. This is in line with findings by Ombeni, (2018) who also highlighted that majority of the woodlots in Mufindi district had juvenile trees.

The study also found that the respondent's woodlots had mainly a mixed woodlot with both pine and eucalyptus species, this translated to 46 percent of all respondent woodlots. The data obtained also show an increase in the number of Eucalyptus growers in the district contrary to previous studies (Ngaga, 2011 and PFP, 2016), a further study may be required to quantify this growth. Respondents cited the increase in demand for eucalyptus poles as the drive behind establishing eucalyptus woodlots.

Table 2: Woodlot characteristics of respondent small holder tree growers

Respondent Woodlot Characteristics		Respondents	Percentage	Total
Farm Wood System	Wood Production Only	78	38.2	204
	Mixed Production	126	61.8	
Mixed Production Crops	Maize	73	57.9	204
	Maize & Beans	29	23.0	
	Maize & potatoes	9	7.1	
	maize &tomatoes	6	4.7	
	Papaya	2	1.6	
	Pears	2	1.6	
	Potatoes	2	1.6	
	Tomato	3	2.4	
Woodlot size	0.2-1.0	118	57.8	204
	1.0 -1.8	38	18.6	
	1.9- 2.7	21	10.3	
	> 2.7	27	13.2	
Woodlot Land Acquisition	Family	44	21.6	204
	Inheritance	65	31.9	
	Bought	95	46.6	
Age of Woodlots	Recently Established	62	30.4	204
	Established	108	53.0	
	Matured	34	16.6	
Tree Specie Planted	Eucalyptus	52	25.5	204
	Pine	57	27.9	
	Both	95	46.6	

4.3 Determination of the cost centers for independent smallholder tree grower in Mufindi district

To determine the establishment costs, one needs to know the cost attributes or costs centers. The following are the findings on cost centers common to respondents who are independent tree growers in Igowole and Kisada villages. The survey indicated that the costs in the two villages could not be differentiated and thus reported as costs for both villages being identical. Besides, these costs outlined in Table 3 for establishing and managing a woodlot according to the respondents did not differentiate among species of pine and eucalyptus in line with their practice.

Table 3: Cost centers for establishing and managing a Ha of pine tree by independent smallholder tree growers for a 10-year rotation

S/N	Stage of Cost	Cost Category	Cost Centers	Unit Cost per Ha (TZS)	Percentage of Total Cost
1	Establishment	Land	Land Acquisition	246 913.58	9.2
2		Capital	Seedlings (Approx. 1500)	555 555.56	20.7
3		Labour	Land Preparation	493 827.16	18.4
4			Transportation to site	49 382.72	1.8
5			Planting	148 148.15	5.5
6			Fireline	98 765.43	3.7
7			Re-Planting	24 691.36	0.9
		Subtotal		***1 617 283.96***	
8	Management		Weeding	148 148.15	5.5
9			Pruning	172 839.51	6.5
10			Fireline maintenance	740 740.74	27.6
	Subtotal			***1 061 728.4***	
Total				**2 679 012.35**	**100.0**

The average respondent reported that a total of TZS 246 913.58 (9.2 percent of total cost) was required to acquire one hectare. For respondents that inherited or are using family

land, they were excluded from the average calculation for land costs to avoid skewing the results. It is also important to note that respondents indicated that this price will only be for those purchasing land from the same village community and not for outsiders. Land tenure for respondents was village land, and The Village Land Act of 1999 allows the village government to enter into agreements and enterprises that provide well-being for villagers. This tenure exempts all landowners from paying land rent if it is below 50 acres which is the maximum for the village category. No respondents rented land for wood production for other villagers in the study area. This could be because most of the respondents inherited land or are on family land which is secure land tenure. Ombeni (2018), reported that older people who planted trees in the land that they are unable to use entirely for crop cultivation to secure it. This has been a common practice in developing countries due to fear of encroachment as highlighted by Fenske, (2011).

The respondents also reported that on average a total of TZS 555 555.56 was required in total capital costs per Hectare. This was purely the cost of seedlings at TZS 150 per seedling and it was estimated by the respondents that they plant roughly 1500 seedlings per Hectare. The capital cost had a proportion of 20.7 % of the total cost of establishment and management. The seeds were mainly sourced locally with some establishing their makeshift nursery using old slabs. Despite PFP (2014), illustrating that the program '*panda miti kibiashara'* delivered improved seeds and seedlings to farmers most of these farmers did not receive these inputs as they were not part of TGAs. Anyonge and Rotsheko (2003) also found that farmers have grown trees using local seed sources to provide products and services that support their livelihood needs and are known to be compatible with the annual crop and livestock components of their farming systems. This was further apparent from respondents when queried for the basis of growing pines, the response was that it helps improve land productivity for maize. This was supported by

Kallabaka, (2018) who highlighted this notion in the study villages citing that tree growers in Mufindi District are guided by the belief that pine trees enhance soil conditions for growing other crops after harvesting and takes short time to mature. It has been highlighted by Singunda, (2010) that tree growers in Mufindi preferred pines because after harvesting could plant crops for three seasons without using fertilizers. Agroforestry has been known to contribute to sustainable agricultural production (Roshetko and Bertomeu, 2015).

The lack of improved planting material has been noted for over three decades. Studies show an application of improved quality germplasm and improved varieties, provenances and clones could raise the profitability of smallholder production of tree products, including timber (Franzel *et al.*, 1998), Yet these farmers in Mufindi District have little access to quality germplasm of either indigenous or exotic tree species (Ngaga, 2011; FDT, 2015; PFP, 2016; UNIQUE, 2017). The respondents also indicated that they do not apply any sort of fertilizer to their woodlots, this suggests the survival and growth rate will be significantly affected as studies have shown an increase in yield and survival rate with its usage (Prasad, 1985).

The respondents on labor costs attributed them to land preparation, transportation to site, planting, fire line creation, re-planting, weeding, and pruning. The cost was calculated on the premise that the average hired laborer was paid TZS 5000 per day and these averages of cost were not calculated for family labor as the respondents did not have alternative formal employment. This is dissimilar to a PFP study in 2016 on forest financing that assumed a daily wage rate of TZS 10 000 to compensate for the tree grower's loss of income from other activities to hire his or her own daily laborer's. The study was carried at a time when most plantations were carrying out thinning and pruning schemes thus

employment was available. Fireline creation and maintenance had a combined proportion of 30.2 percent of the total cost. Fire in the area has been a constant threat to smallholder tree growing in the southern highlands evidenced by Ngaga (2011), and Malinga (2011), and respondents in the study area asserted that the fire line creation was a priority each year. While land preparation also contributed to the total cost significantly with TZS 493 827.16 indicating an 18.4 % contribution (Figure 1). Pruning on the other hand was reported to cost TZS 172 839.51. The significant cost of land preparation concurs with Chamshama and Hall (1987) who stipulated that more rigorous land preparation such as complete cultivation (deep ploughing and harrowing) where appropriate, results in improved survival.

Personal observations of the visited woodlots in the study villages indicate that most trees are planted and left without proper management. Farmers were quick to respond to doing silvicultural practices but to what extent they are carrying them out needs to be studied. The outline by Anyonge and Roshetko (2003), depicts this challenge in small-scale systems for developing countries timber production and expressed that generally, it is not intensive; once trees are planted there is little proactive management i.e. fertilizer application, thinning, pruning or weeding. It was further suggested that if these activities are taken on, they are usually intended to benefit crops.

These low costs clearly show that the plantation guidelines developed by the Tanzania forest and beekeeping division are not properly disseminated to these tree growers in the district. It also shows that while the prospect of tree growing has been deemed lucrative by many of these independent smallholder tree growers, the majority actually are not able to afford the best forestry practices and thus will not make the expected profit from it.

Transaction costs are also not accounted for by smallholder tree growers, the costs of information on how to establish woodlots, manage it together with more co-owners while factoring in the transforming states of land, labor, and capital is not quantified by smallholder tree growers in the study area. Furthermore, the Social transaction costs for respondents also included the time spent and mechanisms that woodlot owners needed to safeguard their property from illegal logging and fire alerts. While Tuuka *et al.* (2014) observed in developing countries that forestry enterprises have high up-front costs due to lack of information, this study shows that information has a cost that most smallholders in Mufindi district are not willing to add it as a cost centre nor are they willing to incorporate non-conventional costs as with the TCE theories.

4.4 Comparison of the costs of establishment and management for an independent smallholder farm versus other smallholder tree growing systems

The study sought to establish whether a difference in the costs for various smallholder tree growing systems in Mufindi District was significant. The cost of establishment and management of the independent smallholder tree growers was compared against other known forms of smallholder tree growing systems in the district. The other tree growing systems in the district included tree grower associations (TGAs), outgrower schemes, and forestry service provider contracts.

The tree growers' associations from the study villages included ICFG from Igowole and UPAMIKI from Kisada village. The deduction by Ombeni, (2018) was that most of these associations in the district were formed to attract support from organizations (PFP in particular) and that the formation was mainly triggered by this support. This was noted by Kallabaka, (2018) that support included free seedlings, access to tree planting training, and financial assistance from Village Community Banks (VICOBA), Mufindi

Community Bank (MUCOBA), SACCOS and other financial institutions in small coverage. It was also illustrated that weeding costs were reduced for the acres under TGAs programs as they worked in groups to help each other in doing silvicultural activities. Field observations during the study showed that despite the interventions of PFP, most tree growers abandoned the TGAs once the support was no longer their thus sustainability of these associations must be studied further. On average the study found that the average cost of establishment and management a *Pinus Patula* woodlot up to a 15-year rotation for TGA members was TZS 2 281 440.00 per ha. A PFP study on private sector financing in 2016 found dissimilar results for the cost of growing *Pinus Patula* in the Mufindi district area indicating a TZS as the average cost for TGA's as 1 816 200.00 per ha. The difference in the cost was because of the underlying assumption made in the PFP study was that the models were for small-scale tree growers who did not need to purchase any land, contrary to the current study in which a TGA bought the land.

Green resources limited ran its outgrowing scheme from 2010 onwards and slowed down in recent years as they are no longer planting with the same intensity as before. They currently distribute approximately 100 000 improved seedlings from their nursery in Mufindi District. These seedlings are then distributed to individuals in the surrounding communities of their plantations to reduce the risk of fire and encroachment while also improving livelihoods as part of corporate social responsibility. Upon delivering these seedlings, individuals are given training on how to plant, which spacing to use, what fertilizer to use as well as fire risk management. The company however does not guarantee a market for the individual, unlike the outgrower scheme run by KVTC. The study found that the average cost of these outgrowers supported by GRL was TZS 3 374 554.51 per Ha

Recent studies found that apart from producers, brokers, processors, wholesalers, retailers, and consumers who are actively engaged in timber trading activities in Mufindi district, there were also non-trading service providers who are supporting the smallholder tree growers and urban investors (Kallabaka, 2018 and Ntiyamagwa, 2018). These were found to involve support services under commercial and public services. The support service providers were found to be engaged in the provision of equipment and materials, financial services, research, and extension services as well as the enforcement of laws and regulations. The service providers mainly facilitated urban investors in establishing and managing woodlots in Mufindi and Kilolo and in recent years Njombe and Makete districts in the southern highlands. The service providers interviewed for this study in Mufindi district included Mufindi Holdings limited, Ubora Forestry solutions, and Forestry business innovative company. The study found that average cost from these enterprises for establishing and managing a 15-year rotation of *Pinus Patula* woodlot for a client to be TZS 4 104 299.52 per Ha.

Fischer's least significant difference (LSD) test was used in the context of the analysis of variance, as the F-ratio suggested a rejection of the null hypothesis H_0 at a 95% confidence interval, that is, the difference between the mean cost of establishing and managing a woodlot by the three tree growing systems is significant. This test helped to identify the tree growing systems whose means (Total cost per Hectare) were statistically different. The Fischer's LSD test results depicted that there was a significant difference for the mean cost of establishing and managing a woodlot by the three tree growing systems except for the mean pairs of outgrower schemes and independent smallholder tree growers.

Table 4: One way ANOVA result for tree growing systems in the study area

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	41146864742497.5	3	1 371 562 158 0832.5	14 703 202 491.400	0.000	2.697
Within Groups	289178.000	266	932.832			
Total	41146865031675.5	269				

Table 5: Fischer's LSD results for tree growing systems in the study area

	TGA	Outgrowers	Independent smallholder Tree Grower	Service Provider
Service Provider	1	1	1	1
TGA	1	1	0	1
Outgrower	1	1	1	1
Independent smallholder Tree Grower	0	1	1	1

*1 Represents a significant difference between the pairs and 0 represents an insignificant difference

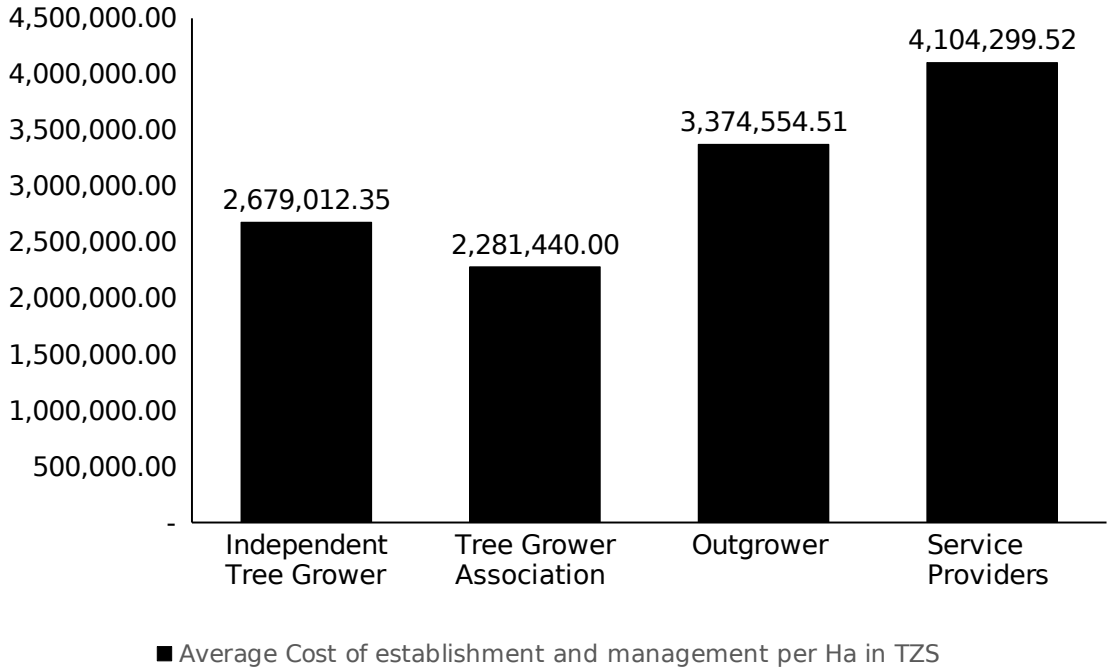

Figure 1: Average cost (in TZS) of establishment and management by tree growers in Mufindi District

4.4.5 Financial Analysis for a Profitable Smallholder Tree Growing System

It was illustrated by Falcao, (1998) that the real discount rate or real cost of capital is a function of the nominal cost of capital and the inflation rate. The DCF analysis was done for *Pinus Patula* and *Eucalyptus Grandis* tree growing ventures only in the study area and the final revenue was in stumpage value. These species were chosen for observation due to most southern highlands being covered by these species (PFP, 2016)**.** The result was the NPV, and IRR of the four-smallholder tree growing systems in the district at discount rates of 10, 17, and 24 percent for both species (Table 6 and 7*)*. The rotation age for *Pinus Patula* tree growing was ten years apart from TGA's which had a rotation age of 15 years; while rotation age for *Eucalyptus Grandis* was eight years except for TGA's which had a ten-year rotation.

Table 6: *Pinus Patula* NPV and IRR of Smallholder tree growing systems in Mufindi District

Tree Growing System	Discount Rate	NPV (TZS)	IRR %
Service Providers	10.00	-52 355.48	-1
	17.00	1 481 641.98	10
	24.00	-804 817.07	-6
Tree Grower Associations	10.00	610 663.61	3
	17.00	3 466 581.39	9
	24.00	-489 940.32	-3
Outgrowers	10.00	-310 720.83	4
	17.00	578 279.52	4
	24.00	-768 180.61	-8
Independent Smallholder Tree grower	10.00	-631 619.32	-10
	17.00	568 630.03	4
	24.00	-1 226 032.59	-9

Table 7: *Eucalyptus grandis* NPV, and IRR of smallholder tree growing systems in Mufindi District

Tree Growing System	Discount Rate	NPV (TZS)	IRR %
Service Providers	10.00	-60 194.70	-1
	17.00	1 271 002.75	10
	24.00	-731 624.19	-6
Tree Grower Associations	10.00	438 258.41	3
	17.00	1 876 689.49	10
	24.00	-309 577.79	-3
Outgrowers	10.00	487 560.67	4
	17.00	1 708 049.33	10
	24.00	-214 568.89	-2
Independent Smallholder Tree grower	10.00	-631 619.32	-10
	17.00	568 630.03	10
	24.00	-1 226 032.59	-9

4.4.5.1 Net Present value for smallholder tree growing in Mufindi district

The financial analysis on smallholder tree growing systems indicated that the tree growing is viable as the net present value was positive in all systems. Specifically, NPV for *Pinus Patula* with a real discount rate of 17% was highest in tree grower associations followed by service providers and outgrowers while independent smallholder

tree growers had the lowest NPV in the study. The sensitivity analysis at a low 10% and a high 24% also supported this trend for the four systems (Table 7).

Though studies on NPV of tree growing systems in Tanzania are scanty; PFP (2016b) used a growth model and the expert-estimated cost of establishing smallholder tree plantation in Tanzania to suggest the rotation period which maximizes the NPV in TGA's. Using a discount rate of 10% the study concludes that at an 18-year rotation will yield a maximum net present value of TZS 2 211 216 which is slightly consistent with the current study findings for TGA at 10.8% real cost of capital of TZS 2 980 814.62. PFP (2016b) also highlighted that a decrease in the rotation age for smallholder tree growers in Tanzania will result in a decrease in NPV. This was also consistent for this study as the smallholder tree growing systems with rotation ages of 10 years all had significantly lower Net present values. It can also be said the presence of a second product such as pulpwood and veneer would significantly lower the rotation age and increase the profitability of a smallholder plantation. This has been the suggestion for this type of project to achieve a tree growing system in which the first few years have the minimum possible costs and even generate income (Lopez and Deloya, 2018). The former can be realized by incorporating high tree densities to carry out commercial thinning in the first 5 to 10 years in which poles or the recent booming veneer market can be utilized as retaliated by Brown, (2000).

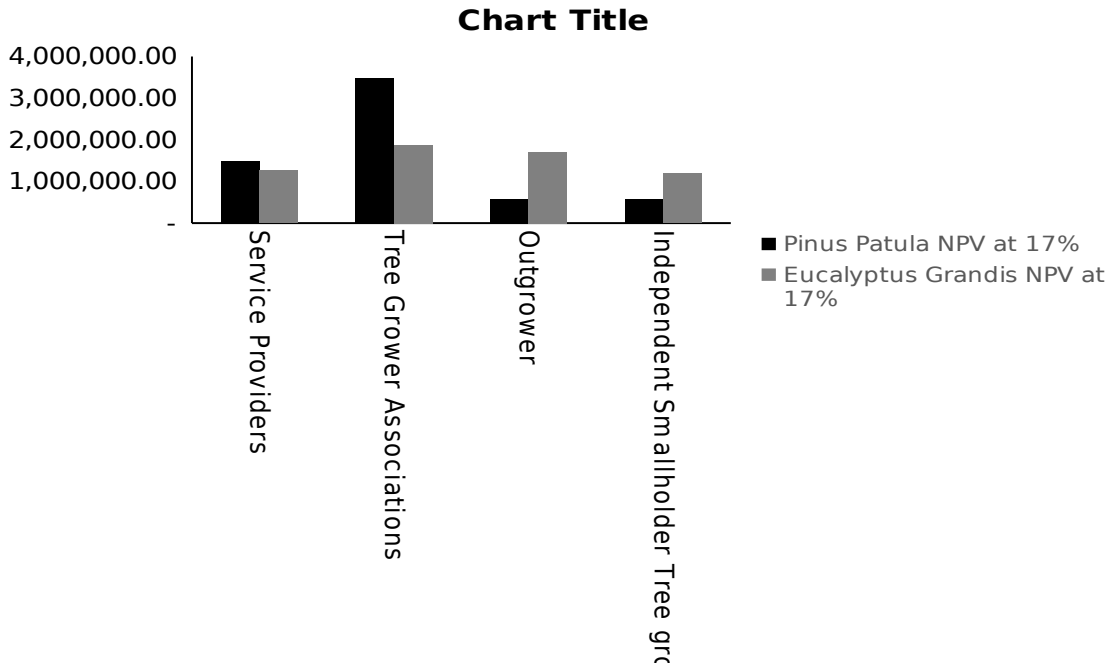

Figure 2: *Pinus Patula* NPV vs *Eucalyptus grandis* NPV of smallholder tree growing systems at a discount rate 17% in Mufindi District

Kallabaka (2018), stipulated that the profit from tree growers per year in ten-year rotation (Without discounting) in Mufindi district was TZS 483 000. Several studies in the district have already highlighted that tree growers get the least per year vis a vis other actors along the value chain such saw millers, carpenters, etc (Kallabaka, 2018; Ntiyamagwa, 2018 and Ombeni, 2018). In an assertion, Singunda, (2011) elucidated that though tree growers received less along the value chain, these amounts are higher and attractive compared to district per capita income which was estimated at TZS 253 000 in 2004.

Several constraints have led to a relatively low profit margin in retrospect to other value chain actors. It was pointed out by Ngaga (2011) that a lack of sufficient knowledge in tree growing and harvesting while also highlighting the deficiency of market information and price data on timber products in key markets are some reasons behind this notion.

Furthermore, the lack of bargaining power as highlighted in 2011 is still a constraint nearly a decade after (Ombeni, 2018 and Kallabaka, 2018). The study found the TGAs because of their collective nature had a much higher revenue than the rest of the tree growing systems in the district. These groups will allow smallholders to wait out for a longer period due to the shared right to harvest thus a longer rotation period of 15 years and in some cases 18 years. For the unorganized smallholder tree growers, it is not the case.

It has been established that a large proportion of these smallholder tree growers harvest or sell their trees at the average age of 10 years, which is significantly before the optimum maturity and size can be obtained due to financial constraints. Recent Literature has regarded it as a common problem for smallholder tree growers in the developing nations, resulting in low-quality woodlots due to immaturity of the trees and poor management thus making the market value of the standing tree decrease significantly (Kallio, 2013 and CIFOR, 2015).

4.4.5.2 Internal rate of return for smallholder tree growers in Mufindi district

The internal rate of return for smallholder tree growing in Mufindi district was calculated based on the discounted cash flows over the 10-year and 15-year rotations for *Pinus Patula* and an eight to ten-year *Eucalyptus Grandis* rotation for the smallholder systems. The study found that the independent smallholder tree growers had the lowest IRR at a base discount rate of 17% for *Pinus patula* and E*ucalyptus grandis* (4 % and 10 % respectively). This is an ideal situation as it has been illustrated that if the IRR is as high as the discount rate, the NPV would be zero for smallholder forest plantations (Lopez and Deloya, 2018). It has been further articulated that given a discount rate lower than the internal rate of return the financial viability of the project is right.

In line with this the study showed that at the base discount rate of 8.3% and the low discount rate of 5.8%, none of the four tree growing systems is viable. The results further indicated that viability using the IRR alone as a financial criterion must be at a discount rate of at least 10.8% for all the tree growing systems to be viable. Thus, at a 5.8% discount rate, only outgrowers would be a viable venture, at 8.3% only outgrowers and independent growers would be viable.

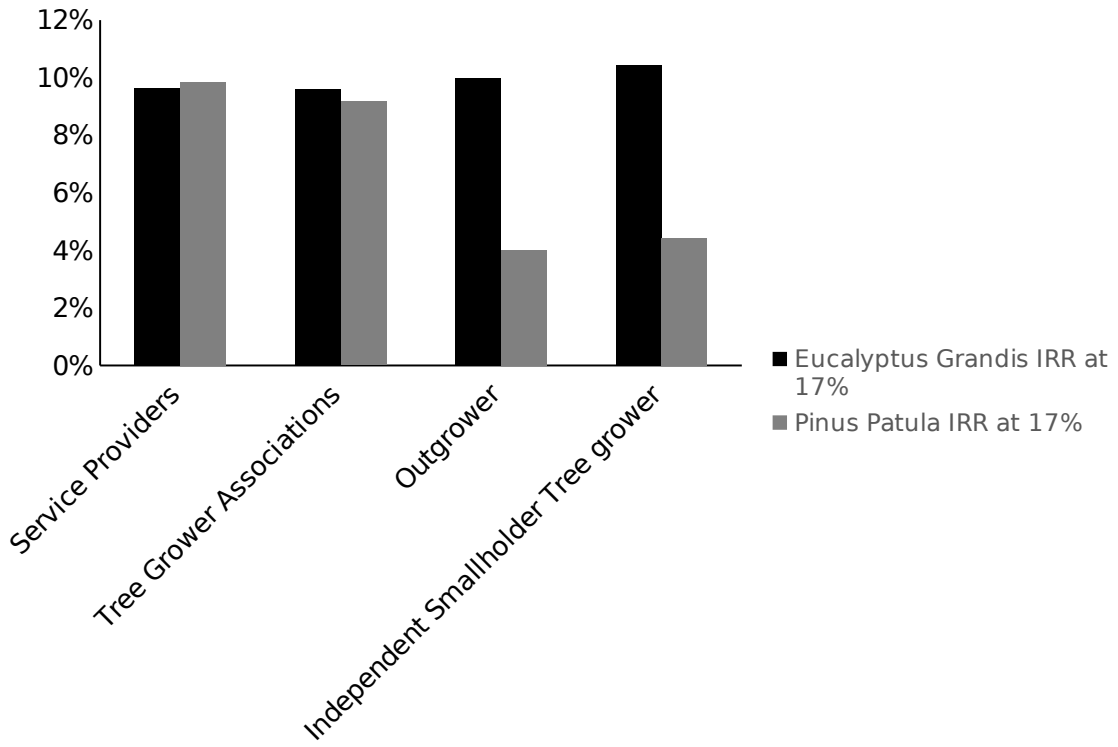

Figure 3: IRR *Eucalyptus grandis* and *Pinus patula* of smallholder tree growing systems at discount rates of 17% in Mufindi district

4.4.5.3 Financial and economic implications on smallholder tree growers

A strong assertion was made by Antinori (2005) that participation in the timber industry and its markets left communities unprotected to different forms of opportunistic behavior

from timber Traders/buyers because external service providers control the quality of harvesting practices, marketing of goods, and jobs.

This was well expressed in the WoodCluster baseline report, citing that brokers had an upper hand in price negotiation such that the tree growers earned less compared to what they deserve when they later sold their products whether mature or immature in Mufindi district (WoodCluster, 2018). These transaction costs stemming from opportunism and small volumes adversely affect the profitability of tree growing by independent smallholder farmers in the district. The lack of market-related information by independent and outgrowers in the area has led them to relatively low NPV and revenue in comparison to those growing trees in TGA's and through service providers. Without sorting out these externalities in the market for Mufindi district, the smallholder tree grower will continue being at a disadvantaged position during negotiations for the trees.

CHAPTER FIVE

5.0 CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Conclusions

The findings revealed that the cost of establishing and managing woodlot by an independent smallholder tree grower in Mufindi District was TZS 2 679 012.35 per Hectare. The largest contributor to total cost was Labor which was necessary for land clearing, planting, weeding fire line creation as well maintenance, and pruning this constituted a total of 70.1 %. Capital costs for these growers on the other hand were found to be a cost center only for seedlings reflecting 20.7 percent of the total cost of establishment and management. The study also deduced the land cost center which was only present for those few tree growers that did not inherit land or were not allocated village land, but this still had a 9.2% contribution to total costs.

The study found that key cost centers for independent tree growers were missing and thus these tree growers did not follow plantation guidelines for establishing and managing their respective woodlots. The lack of fertilizer application entirely shows that the growth of these woodlots will be significantly slower. Transaction costs are also not accounted for by smallholder tree growers, the costs of information on how to establish woodlots, manage it together with more co-owners while factoring in the transforming states of land, labor, and capital is not quantified by smallholder tree growers in the study area. Furthermore, the Social transaction costs for respondents also included the time spent and mechanisms that woodlot owners needed to safeguard their property from illegal logging and fire alerts.

Field observations of younger woodlots gave rise to questions of tree grower's understanding of weeding practices for tree growing. Furthermore, the study found that independent tree growers do not carry out thinning schemes to increase their stand health and volume. Due to these missing cost centers for independent tree growers, they appear to have relatively low costs of establishment and management compared to the other growing systems.

The discounted cash flow analysis for *Pinus patula* and *Eucalyptus grandis* depicted that in both species it was much more profitable for TGA members. The results based on NPV and IRR indicated that those independent tree growers and outgrowers are better off with Eucalyptus tree growing ventures as the cost is minimized while at the same time offering a higher revenue for the eight-year rotation.

Lastly, the study found that without a contractual agreement with the companies to increase overall profit; outgrowers despite having improved planting material will continue to struggle.

5.2 Policy implications

Smallholders that want to benefit from commercial forestry face considerable transaction costs in their relationships with external service providers and buyers. Opportunistic behavior from brokers/ traders to secure additional rents can transpire at all levels of vertical integration. The study recommends that governance such as FBD, be tasked with addressing these transaction costs and aligning contracting relationships between smallholder tree growers and their commercial partners. Furthermore, to increase the bargaining power of smallholder tree growers; independent tree growers must continue to be incentivized to join these tree grower associations as they will also benefit from

sharing of labor costs which ultimately lower the cost of establishment and management while at the same time increase the potential revenue at harvest.

The information on the small profit margins and annuities from smallholder tree growers has been long proved to be a threat to future investment for tree growing. The promotion of forwarding vertical integration is recommended, the smallholder tree grower must move from simply growing the trees to primary processing. Furthermore, the promotion of pulpwood and veneer as supplementary products would significantly improve these parameters among these growers.

The study recommends outgrower contracts with guaranteed markets to be championed by local governments at the district level, to ensure increased profit for outgrower arrangements.

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APPENDICES

Appendix 1: Questionnaire for independent woodlot owners

Institute: Sokoine University of Agriculture

Research Topic: **Cost Diagnosis of independent smallholder tree growers in Mufindi district Tanzania**

Respondent Consent

I would like to request for your support in participating in providing information for a research study that seeks to diagnose the costs of establishing smallholder farm wood production systems in Kisada village/ Igowole village, Mufindi District. Your information in the research is important as the findings of this study will be useful in providing informed decision to the policy makers on the managing new woodlots and tree farmers. If farmers are given the means to reduce the cost of establishing a farm wood system more will plant trees helping to narrow the wood supply gap and they will have the long-term commitment to it. Furthermore, the information to be obtained in this study may help other researchers once the initial costs have been documented in the district further studies can be done.

You are free to refuse to participate in this activity and to stop filling out the study at any time.

Are you willing to participate in this study? 1. YES 2. NO

"I, the undersigned state that I understand the purpose and nature of this study and that I voluntarily decide to participate in it."

_____

Signature

Questionnaire for Household Survey

Date of interview……

Name of enumerator……

Village……..Ward……

Division……

Respondent Code……

General Information

1. Name of head of household/Respondent

   ……

2. Gender:
   a. Male
   b. Female
3. Age……..
4. Ethnicity……..
5. Are you a member of any TGA, If yes which one?

   ……

6. Social position
   a. Common Person
   b. TGA Leader
   c. Village Leader
   d. Religious Leader
   e. Others (Specify)…….
7. Marital Status
   a. Married

b. Single

8. Religion

a. Christian

b. Other…….

9. What are you considering as your main type of farm production?

a. Wood production

b. Mixed production(wood plus other crop)

Crop name……..

10. What are you considering as your secondary occupation?

a. Farmer

b. Plantation worker

c. Driver

d. Shopkeeper

e. Private Business

f. Government Employee

g. Livestock attendant

h. Other……

11. Did you attend school? A. Yes B. Non

12. If Yes; What is the number of years spent on education

a. Primary(7years)

b. Secondary(….years)

c. Tertiary(…..Years)

d. Adult education(…..Years)

13. How is your Family Size? .....

a. Number of Adult Male always involve in wood production…….

b. Number of adult Female always involve in wood production……..

14. What is your monthly income level?

    i. <100 000
    ii. 100 000 -250 000
    iii. 251 000 -500 000
    iv. > 500 000

Section B: Establishment and management costs

15. Do you own land? A. Yes B. No
16. Acquisition mode of the cultivated land
    a. Family b. heritance c. Government c. Association d. Bought/private
17. How many plots do you have? .....
18. Their total size in ……..ha
19. How many plots are dedicating to wood production? .....
20. What is the real size under wood production?.....ha
21. What is the cost of that land dedicated to wood production……..……?
22. If you do not own land what is the rent cost…….and Size….……?
23. If you could sale your land how much could it be per acre? …….
24. How much was land (1 acre) in 2017? …….…….
25. Which tree species do you plant and what size is the area planted?
    i. Pine ……
    ii. Eucalyptus……
    iii. Teak……
    iv. Other……

26. How old are your tree stand(s)

……

……

27. Capital costs

S/N	Item/Operation	Cost Per Unit	Totalcost
1	Variety		
2	Size of cultivated area		
3	Seedlings		
4	Fertilizers		
5	Insecticides		
6	Water charges		
7	Other		
	TOTAL		

28. Labour establishment costs

S/N	Item/ Operation	Family Labour					Hired Labour				
		Hrs/ day	Number of people			No of days	Hrs/ day	Number of people			
			Male	Female	Child			Male	Female	Child	No. of Days
1	Land Clearing										
2	Ploughing										
3	Weeding										
4	Nursery Preparation										
5	Transplanting/ Planting										
6	Transportation										
	TOTAL										

29. Labour Management costs

S/N	Item/ Operation	Family Labour					Hired Labour				
		Hrs/ day	Number of people			No of days	Hrs/ day	Number of people			
			Male	Female	Child			Male	Female	Child	No of Days
1	Weeding										
2	Pruning										
3	Thinning										
4	Forest fire protection Costs.										
5	Herbicides application										
	TOTAL										

Section D: Cost Minimization Strategy

1. What is the cost structure which contributes to your total cost for a farm tree production?

Cost Item	Contribution to Overall Cost (Rank)				
	Large Contribution	**Moderate contribution**	**Normal Contribution**	**least contribution**	**Marginal contribution**
Land acquisition cost					
Land Clearing					
Ploughing					
Weeding					
Nursery preparation					
Transplanting/ Planting					
Transportation					
Weeding					
Pruning					
Thinning					
Forest fire protection Costs./insurance					
Herbicides application					
Seedlings					
Fertilizers					
Insecticides					
Water charges					
Land					

2. What do you do to reduce the costs?

   ……

   ……

3. What cost reduction measure do you adopt from plantations if any?

   ……

   ……

4. What can organizations do to help lower the costs?

   ……

   ……

Appendix 2: TGA, Service Provider and outgrower cost data checklist

Activity	Units	Total cost	Revenue
Establishment	Hectare		
Land preparation			
1. Buying land	Hectare		
2. Clearing pitting	Hectare		
Planting			
1. Seedlings per Hectare	Seedling		
2. Seedling transportation			
3. Planting and beating up	Hectare		
Maintenance			
1. Fire break (……yrs)	Hectare		
2. Weeding	Hectare 1st		
	Hectare 2nd		
3. Pruning	Hectare 4th yr		
4. Second pruning	Hectare 10th yr		
5. Supervision	Hectare		
Sub Total			
6. Thinning			
i. At …….yrs age	Harvest at least …… trees		0
ii. At …….. yrs age	Harvest at least …… trees		0
Sub Total			
Harvesting (….% survival rate) at ….years, harvest (……) trees			
Cutting	@ ……		
Delimbing and collection assume 2 pcs and removing trashes	@ …….		
Sale price per tree (…….)			

Appendix 3: Discount factor (p.a.) for a range of discount rates

Present Value of TZS 1 in the Future at Discount Rate r%

Year	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
0	1	1	1	1	1	1	1	1	1	1	1	1	1
1	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696
2	0.9426	0.9246	0.9070	0.8900	0.8734	0.8573	0.8417	0.8264	0.8116	0.7972	0.7831	0.7695	0.7561
3	0.9151	0.8890	0.8638	0.8396	0.8163	0.7938	0.7722	0.7513	0.7312	0.7118	0.6931	0.6750	0.6575
4	0.8885	0.8548	0.8227	0.7921	0.7629	0.7350	0.7084	0.6830	0.6587	0.6355	0.6133	0.5921	0.5718
5	0.8626	0.8219	0.7835	0.7473	0.7130	0.6806	0.6499	0.6209	0.5935	0.5674	0.5428	0.5194	0.4972
6	0.8375	0.7903	0.7462	0.7050	0.6663	0.6302	0.5963	0.5645	0.5346	0.5066	0.4803	0.4556	0.4323
7	0.8131	0.7599	0.7107	0.6651	0.6227	0.5835	0.5470	0.5132	0.4817	0.4523	0.4251	0.3996	0.3759
8	0.7894	0.7307	0.6768	0.6274	0.5820	0.5403	0.5019	0.4665	0.4339	0.4039	0.3762	0.3506	0.3269
9	0.7664	0.7026	0.6446	0.5919	0.5439	0.5002	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843
10	0.7441	0.6756	0.6139	0.5584	0.5083	0.4632	0.4224	0.3855	0.3522	0.3220	0.2946	0.2697	0.2472
11	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	0.3173	0.2875	0.2607	0.2366	0.2149
12	0.7014	0.6246	0.5568	0.4970	0.4440	0.3971	0.3555	0.3186	0.2858	0.2567	0.2307	0.2076	0.1869
13	0.6810	0.6006	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897	0.2575	0.2292	0.2042	0.1821	0.1625
14	0.6611	0.5775	0.5051	0.4423	0.3878	0.3405	0.2992	0.2633	0.2320	0.2046	0.1807	0.1597	0.1413
15	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	0.2394	0.2090	0.1827	0.1599	0.1401	0.1229
16	0.6232	0.5339	0.4581	0.3936	0.3387	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069
17	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929
18	0.5874	0.4936	0.4155	0.3503	0.2959	0.2502	0.2120	0.1799	0.1528	0.1300	0.1108	0.0946	0.0808
19	0.5703	0.4746	0.3957	0.3305	0.2765	0.2317	0.1945	0.1635	0.1377	0.1161	0.0981	0.0829	0.0703
20	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486	0.1240	0.1037	0.0868	0.0728	0.0611

Appendix 4: Discounted cash flow analysis for independent smallholder tree growers

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Net Cash Flow	-1 666 666.68	- 131 687.24	- 131 687.24	- 82 304.53	- 255,144.04	- 82 304.53
Discount Factor at 10%	1	0.945179584	0.893364446	0.844389836	0.798100034	0.754347858
Discount Factor at 17%	1	0.923361034	0.852595599	0.787253554	0.726919256	0.671208916
Discount Factor at 24%	1	0.902527076	0.814555123	0.735158053	0.663500048	0.598826758
Discounted Cash Flow 10%	-1 666 666.68	-124 468.09	- 117 644.70	- 69 497.11	- 203,630.46	- 62 086.24
Discounted Cash Flow 17%	-1 666 666.68	-121 594.87	- 112 275.96	-64 794.53	- 185,469.11	-55 243.53
Discounted Cash Flow 24%	-1 666 666.68	-118 851.30	- 107 266.52	- 60 506.84	- 169,288.08	- 49 286.15

Year 6	Year 7	Year 8	Year 9	Year 10		
-82 304.53	-82 304.53	-82 304.53	- 82 304.53	7 555 695.47		
0.712994195	0.673907556	0.636963664	0.602045051	0.569040691		
0.619768159	0.572269768	0.528411605	0.487914686	0.450521409		
0.540457363	0.487777403	0.440232313	0.397321582	0.358593486	NPV	IRR
- 58 682.65	-55 465.64	-52 424.99	-49 551.03	4 299 498.17	1 839 380.57	10%
- 51 009.72	-47 100.39	-43 490.67	-40 157.59	3 404 002.57	1 016 199.51	7%
- 44 482.09	-40 146.29	- 36 233.11	- 32 701.36	2 709 423.18	383 994.76	3%

Appendix 5: Discounted cash flow analysis for tree grower associations

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Yea
Net Cash Flow	-1 158 000.00	-114 000.00	-114 000.00	-30 000.00	- 174 000.00	- 30 000.00	598,000.00	- 30 000
Discount Factor at 10%	1	0.945179584	0.893364446	0.844389836	0.798100034	0.754347858	0.712994195	0.673907
Discount Factor at 17%	1	0.923361034	0.852595599	0.787253554	0.726919256	0.671208916	0.619768159	0.572269
Discount Factor at 24%	1	0.902527076	0.814555123	0.735158053	0.663500048	0.598826758	0.540457363	0.487777
Discounted Cash Flow 10%	-1 158 000.00	-107 750.47	-101 843.55	-25 331.70	-138 869.41	- 22 630.44	426,370.53	- 20,217
Discounted Cash Flow 17%	-1 158 000.00	-105 263.16	- 97 195.90	-23 617.61	-126 483.95	- 20 136.27	370,621.36	- 17,168
Discounted Cash Flow 24%	-1 158 000.00	-102 888.09	- 92 859.28	-22 054.74	-115 449.01	- 17 964.80	323 193.50	- 14 633

Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15		
- 30 000.00	- 30 000.00	- 222 000.00	598 000.00	- 30 000.00	- 30 000.00	- 30 000.00	19 170,000.00		
0.636963664	0.602045051	0.56904069	0.537845644	0.508360722	0.480492176	0.454151395	0.429254626		
0.528411605	0.487914686	0.45052141	0.415993914	0.384112571	0.354674581	0.327492688	0.302393987		
0.440232313	0.397321582	0.35859349	0.32364033	0.292094161	0.263622889	0.237926795	0.214735375	NPV	I
- 19 108.91	- 18 061.35	- 126 327.03	321 631.69	- 15 250.82	- 14 414.77	- 13 624.54	8 228,811.19	7 195 383.20	14
- 15 852.35	- 14 637.44	- 100 015.75	248 764.36	- 11 523.38	- 10 640.24	- 9 824.78	5 796,892.72	4 705 919.53	11
- 13 206.97	- 11 919.65	- 79 607.75	193 536.92	- 8 762.82	- 7 908.69	- 7 137.80	4 116 477.13	2 980 814.62	8

Appendix 6: Discounted cash flow analysis for outgrowers

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Net Cash Flow	-1 152 000.00	-240 000	- 96 000.00	- 30 000.00	-96 000	480 000
Discount Factor at 5.8%	1	0.945179584	0.893364446	0.8443898	0.798100034	0.754347858
Discount Factor at 8.3%	1	0.923361034	0.852595599	0.7872536	0.726919256	0.671208916
Discount Factor at10.8%	1	0.902527076	0.814555123	0.7351581	0.663500048	0.598826758
Discounted Cash Flow 5.8%	-1 152 000.00	- 226 843.10	-85762.99	- 25 331.70	- 76 617.60	362 086.97
Discounted Cash Flow 8.3%	-1 152 000.00	-221 606.65	- 81 849.18	- 23 617.61	- 69 784.25	322 180.28
Discounted Cash Flow 10.8%	-1 152 000.00	-216 606.50	- 78 197.29	- 22 054.74	- 63 696.00	287 436.84

Year 6	Year 7	Year 8	Year 9	Year 10		
-120 000	-30 000	-30 000	-30 000	5 000 000.00		
0.712994195	0.673907556	0.636963664	0.602045051	0.569040691		
0.619768159	0.572269768	0.528411605	0.487914686	0.450521409		
0.540457363	0.487777403	0.440232313	0.397321582	0.358593486	NPV	IRR
- 85 559.30	-20 217.23	-19 108.91	- 18 061.35	2 845 203.45	1 497 788.25	5%
-74 372.18	-17 168.09	-15 852.35	- 14 637.44	2 252 607.05	903 899.58	3%
- 64 854.88	- 14 633.32	-13 206.97	- 11 919.65	1 792 967.43	443 234.91	3%

Appendix 7: Discounted cash flow analysis for service providers

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Net Cash Flow	-1166 880.00	-294 000	-294 000	-186 000	-402 000	-186 000
Discount Factor at 5.8%	1	0.945179584	0.893364446	0.844389836	0.798100034	0.754347858
Discount Factor at 8.3%	1	0.923361034	0.852595599	0.787253554	0.726919256	0.671208916
Discount Factor at10.8%	1	0.902527076	0.814555123	0.735158053	0.663500048	0.598826758
Discounted Cash Flow 5.8%	-1 166 880.00	-277 882.80	-262 649.15	-157 056.51	-320 836.21	-140 308.70
Discounted Cash Flow 8.3%	-1 166 880.00	-271 468.14	-250 663.11	-146 429.16	-292 221.54	-124 844.86
Discounted Cash Flow 10.8%	-1 166 880.00	-265 342.96	-239 479.21	-136,739.40	-266,727.02	-111,381.78

Year 6	Year 7	Year 8	Year 9	Year 10		
294 000	-186 000	-186 000	-186 000	9 814 000.00		
0.712994195	0.673907556	0.636963664	0.602045051	0.569040691		
0.619768159	0.572269768	0.528411605	0.487914686	0.450521409		
0.540457363	0.487777403	0.440232313	0.397321582	0.358593486	NPV	IRR
209 620.29	- 125 346.81	- 118 475.24	- 111 980.38	5 584 565.34	3 112 769.84	15%
182 211.84	- 106 442.18	- 98 284.56	- 90 752.13	4 421 417.11	2 055 643.27	12%
158 894.46	- 90 726.60	- 81 883.21	- 73 901.81	3 519 236.47	1 245 068.95	9%