

**DETERMINANTS OF TECHNICAL EFFICIENCY AND
FINANCIAL SUSTAINABILITY OF SMALL
SCALE SUNFLOWER OIL PROCESSING
FIRMS IN TANZANIA**

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FINANCIAL SUSTAINABILITY OF SMALL
SCALE SUNFLOWER OIL PROCESSING
FIRMS IN TANZANIA**

By

Anastasia R. Njiku

**A Thesis Submitted in Fulfilment of the Requirements for an Award
of a Degree of Doctor of Philosophy of Mzumbe University**

2019

CERTIFICATION

We, the undersigned, certify that have read and hereby recommend for acceptance by the Mzumbe University, a thesis entitled **determinants of technical efficiency and financial sustainability of sunflower oil processing firms in Tanzania** in fulfilment of the requirements for the award of a degree of Doctor of Philosophy of Mzumbe University.

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Finally, I remain merely accountable for any errors and criticisms found in this thesis.

DEDICATION

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ABBREVIATIONS AND ACRONYMS

CAMARTEC	Centre for Agricultural Mechanization and Rural Technology
CEZOSOPA	Central Zone Sunflower Oil Processors Association
DAF	Department of Accounting and Finance
DEA	Data Envelopment Analysis
DRPS	Directorate of Research, Publications and Postgraduate Studies
EAC	East African Countries
ECL	Edenconsult Company Limited
IRDP	Institute of Rural Development Planning
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Statistics
FS	Financial Sustainability
FSS	Financial Self –Sufficiency
HESLB	Higher Education Students’ Loans Board
HMLR	Hierarchical Multiple Linear Regression
LR	Likelihood –Ratio
MDGs	Millennium Development Goals
MLE	Maximum Likelihood Estimate
MLR	Multiple Linear Regression
MU	Mzumbe University
NSGRT	National Strategy for Growth and Reduction of Poverty
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PhD	Doctor of Philosophy
PINs	Price-based Index Numbers
PPC	Postgraduate Programme Committee
RBT	Resource-Based Theory
RBV	Resource-Based View of the firm
RTS	Return To Scale
SFA	Stochastic Frontier Analysis

SIDP	Sustainable Industrial Development Policy
SIDO	Small Industrial Development Organisation
SMEs	Small and Medium Enterprises
SOB	School of Business
SOPFs	Sunflower Oil Processing Firms
SPSS	Statistical Package for Social Sciences
TBS	Tanzania Bureau of Standards
TE	Technical Efficiency
TEMDO	Tanzania Engineering and Manufacturing Design Organization
TFDA	Tanzania Food and Drugs Authority
TFP	Total Factor Productivity
TIRDO	Tanzania Industrial Research and Development Organization
TRA	Tanzania Revenue Authority
UDOM	University of Dodoma
UNICEF	United Nations Children's Emergency Fund
UNIDO	United Nation Industries Development Organisation
URT	United Republic of Tanzania
USA	United States of America
VETA	Vocational and Educational Training Authority
VIF	Variance Inflation Factor

ABSTRACT

Technical Efficiency (TE) and Financial Sustainability (FS) of firms have attracted scholarly attention in both developed and developing world literature over several decades, since they are necessary conditions for maximizing output and institutional permanence respectively. However, little attention has been paid to small scale agro-processing firms' context in developing economies like Tanzania. Sunflower oil agro-processing firms are of no exception as the sub-sector is dominated by small scale firms with no well documented determinants of TE and FS. To bridge this knowledge gap, this study was set to examine the determinants of TE and FS of sunflower oil processing firms (SOPF) in Dodoma and Singida regions.

Firm level cross-sectional data were collected using a questionnaire from 219 SOPF randomly selected, in which firm owners were purposively selected. Nine key informants were likewise purposively selected for a qualitative follow-up interview. One Stage Stochastic Frontier Analysis (SFA), Standard and Hierarchical Multiple Linear Regression models were used to simultaneously estimate TE levels and their determinants, and to study the influence of TE on FS and firm-specific factors on FS of SOPF respectively.

It was found that location of the firm, sole proprietorship form of ownership, firm age, education level and age of the owner contribute significantly to TE. Besides, TE, location and firm size contribute significantly to FS of SOPF in Tanzania.

The obtained findings imply that, firms located along the highways, individually owned firms, youth-owned firms, newly established firms and firms with educated owners are more technical efficient than their counter parts. Moreover, location of the firm is a key determinant for both TE and FS of SOPF. TE is a necessary condition for the firm's FS. Firms' owners, the government and other agencies in the sector should therefore consider clustering firms in the designed industrial locations for easy accessibility of inputs and support services for standard conformity, nurturing entrepreneurial aspirations in tender age and improving TE is a pre-requisite for financial sustainability of SOPF in Tanzania.

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CHAPTER ONE

PROBLEM SETTING

1.1 Introduction

This chapter provides the background information to the research problem by highlighting the contribution of small-scale firms, an overview of agro-processing firms and specifically sunflower oil processing firms from a global to the local context. Furthermore, the chapter highlights the research problem, objectives of the study, research questions, significance of the study to different stakeholders, the scope of the research and finally the organisation of the thesis.

1.2 Background to the Research Problem

A significant body of empirical studies across the globe is currently devoted to the analysis of Technical Efficiency and Financial Sustainability of small scale firms due to the potential contribution, the sub-sector plays in both developed and developing economies. Their contribution in economic and social development is acknowledged worldwide, in terms of employment creation, income generation, regional development and cities' growth, poverty alleviation and economic empowerment for minorities and women (Le & Harvie, 2010; Charoenrat & Harvie, 2012; Ngeh, 2014). Specifically, the agro-processing firms, have emerged as an opportunity for increasing income and creating jobs along the value chain through expansion of forward and backward linkages in the economy worldwide (United Nations Development Program [UNDP], 2012; Ekblom, 2016). The agro-processing firms generate higher added value for agricultural commodities as they convert raw materials from agricultural farm to intermediate inputs or readily consumed products in meeting the demand for processed food which is on the rise worldwide (Yodfiatfinda, 2012). For instance, the growing demand of sunflower oil is reported to be driven by population increase, urban growth, higher disposal income, improved standards of living, better education and information about health nutrition (Rural Livelihood Development Company [RLDC], 2010; Bank of Tanzania [BOT], 2017).

Nevertheless, despite the realized importance and demand of agro-processing products to the livelihood of the majority, including the sunflower oil, Tanzania has

not fully transformed the agricultural sector into agro-processing firms with numerous paybacks to the economy (Tisimia, 2014). For that reason, the sub-sector is characterized as being of low productive, producing below their capacity as expected and with steadily declining technical efficiency (Mushi, 2016). This result in increasing gap between production and consumption of edible oils which is bridged by imports, particularly from Malaysia and Indonesia to cater for the domestic need (RLDC, 2010; Iringo, 2013).

In the same way, low performance of agro-processing firms across the globe is central to debate among researchers, practitioners and policy makers with the question of why some firms perform better (efficient) than others (Kapelko, 2009; Ngeh, 2014). Therefore the extent to which inputs resource of these firms are utilized to maximize output and increasing income is of utmost importance for their improved performance (Radam, Abu & Abdullah, 2008). The evidence which is scanty found in sunflower oil processing firms' context in Tanzania.

Importantly, efficiency of the firms has been associated with their financial sustainability. For instance, the study by Nyamsogoro (2010) on the financial sustainability of rural Microfinance in Tanzania indicated that the more the output at a given level of inputs, the better the contribution towards financial sustainability. Therefore, low technical efficiency of the firms under the study might have an enduring effect on their financial sustainability.

However, it is acknowledged that inefficient firms are unlikely to compete, grow and survive in the long run (Ishengoma, 2005). They can only play their effective role if they perform efficiently by maximizing their output which would eventually sustain themselves financially in the long run and contribute to the national economy. Therefore, examining the determinants of Technical Efficiency (TE) and Financial Sustainability (FS) of these firms in developing countries perspective is vital since TE and FS are necessary conditions for maximizing output, institutional sustainability and long-lasting service (Thela, 2012).

1.2.1 Overview of Agro-processing Sector in Tanzania

Generally, the industrial sector in developing countries, including Tanzania is typically dominated by small scale manufacturing firms (Hawasi, 2006; Tisimia, 2014). Over 60% of them are agro-processing firms which use agricultural products as their main raw materials (Food and Agriculture Organization [FAO], 2008).

In East African countries, agro-processing firms account for more than 80% of all manufacturing firms, however, they only use 28% of their installed capacity (The East African Countries region [EAC], United Nation Industries Development Organization [UNIDO] & FAO, 2011). This implies that, they operate under capacity which results in producing inadequate output. Likewise, three (3) out of five (5) small scale firms fail within their few months of their establishment, where sunflower oil processing firms are of no exception (Bowen, Morara & Mureith, 2009).

Similar experience is also found in Tanzania, where of about 75% small scale agro-processing firms operating below their capacity resulting into low output which cannot meet domestic demand and export (FAO, 2008; Tisimia, 2014). Similarly, the study by Admassie and Matambalya (2002) revealed that food processing firms in Tanzania operate at low technical efficiency levels of about 47%. This is considered as the high level of technical inefficiency because it reduces their output levels significantly and might result in generating low income. Insufficient and seasonal nature of raw materials, low levels of technology used and the high cost of raw materials are some of the factors reported to affect low productivity of these firms (Hawasi, 2006; Tisimia, 2014).

1.2.2 Overview of Sunflower Oil Sub-Sector in Tanzania

Globally, Russia and Ukraine are reported to be the major sunflower oil processors due to their high production of sunflower seeds as they account for nearly 50% of world sunflower production (Mielke, 2013; Mushi, 2016). Other major countries include Argentina, USA, China and India (Mushi, 2016).

In Africa, South Africa is the largest producer of sunflower seeds which is also ranked eighth in the world. Tanzania in particular, is ranked tenth in the world and second largest producer of sunflower oil in Africa respectively (FAOSTAT, 2015). Besides, Sudan, Kenya, Angola, Mozambique, and Zambia are among of sunflower

oil producing countries in Africa after Tanzania. However, most of the sunflower oil produced in these countries is consumed domestically and less than 30% reaches the international markets. This low export of sunflower oil is attributed to high demand in domestic markets, low quality and standards which restrict entrance to international markets and low output of most small-scale processors (Berglund, 2007; Mushi, 2016).

Conversely, most of the processors in tropical countries are reported to experience almost similar problems like: (1) sunflower processing sub-sector being dominated by small scale firms which account for more than 90% of all processors, (2) limited supply of raw materials such as sunflower seeds due to low production by most farmers who depend on rain-fed agriculture, poor mechanization and low quality seeds, (3) poor transport and communication facilities to reach remote areas for supplies, and (4) defragmented and uncoordinated market actors (Mushi, 2016).

Therefore, sunflower oil processing firms are ones of emerging agro-processing industries in Tanzania with great potentials in providing nutritious and cholesterol free oil in both rural and urban areas apart from creating jobs and income (Ekblom, 2016). These industries are predominant in the central sunflower agricultural corridor of Tanzania in Singida and Dodoma regions due to large amount of sunflower seeds produced (Tanzania Edible Oil Actors Association [TEOSA], 2012). This makes sunflower oil the most important and popular edible oil produced since colonial times when sunflower was introduced in Tanzania from Europe and America (RLDC, 2010).

Despite the country being ranked tenth in the world and the predominance of sunflower oil processing firms due to largely grown sunflower seeds, it has been observed that processing of sunflower oil is still at a low level in Tanzania compared to other countries in the world (Mushi, 2016). The sub-sector is dominated by small scale firms which accounts for 95% of all sunflower oil processors in the country (Ziliona, Mwatawala & Swai, 2013; Iringo, Elias & Majid, 2014). They produce low outputs with low standard to meet international markets requirements and hence low profitability (Mpeta, 2015). Thus local production of both factory and home extracted

sunflower oil by these firms contribute to 40 per cent of edible oil requirements in the country. As a result, 60% to 65% of oil is imported to cater for existing high demand (Iringo, 2013; BOT, 2017). In addition, one bag of sunflower seeds with 65 kgs produces between 18 and 22 litres of cooking oil on average, which is far below 30 litres, a level that is generally reached by global millers (Ibid).

Besides, the amount consumed increases with increase in population as reflected on the current population of 44.9 million people from the last census report of the year 2012 which pointed out that Tanzania uses 350,000 tons of sunflower oil litres per year, but the need of oil consumption arises from 5% to 6% each year as population increases (URT, 2012). Likewise, annual consumption per individual is only 6kg which is far less than the recommended amount of 24kg annually (Iringo, 2013). Therefore, the question of how efficient sunflower oil processing firms use their resources is substantial to be studied for improved performance of the sector (Mushi, 2016). Their potentials noted in rural and urban industrialization despite being of small scale can be used as prospective import substitution strategy for highly imported palm oils if their resources are allocated efficiently (ibid).

In addition, firm-level efficiency of small-scale firms' resources has important implications for their financial sustainability in the sense that efficient firms make better use of existing resources and produce their output at the lowest cost, which increases income and thus financial sustainability of the firm (Mushi, 2016). Thus, if small-scale sunflower oil processors in Tanzania are to meet the domestic demand, the analysis of the firm technical efficiency levels in the use of their limited input resources to maximize their output is very useful for their financial sustainability as well. Furthermore, with an increasingly modern agricultural practice in Tanzania heading toward the initiated industrial economy by fifth phase government leadership by 2025, the need for technically efficient agro-processing firms producing maximum output and financially sustainable to cover all operating expenses from its income generated is crucial.

Similar experience is revealed in existing empirical literature from both developed and developing countries that most of the processing firms are technically inefficient

which might have an enduring impact on their financial sustainability. For instance, in Taiwan, Wu, Kao and Cheng (2006) in their study of technical efficiency found out that 50% of the food processing firms in the area were inefficient. Likewise, in Malaysia Tahir and Yusof (2011) studied the technical efficiency of 14 public companies. Their findings show that only one company was relatively efficient and the average overall technical efficiency varies from 13% to 50%.

In Thailand, agro-processing firms were also reported to operate below the average level of technical efficiency in all categories of foods studied with the mean technical efficiency of about 43% (Charoenrat, 2012). In Libya, only 18% of all agro-processing firms are reported to be technically efficient with the mean technical efficiency of 71.3% (Essmui, Berma, Shahadan & Ramlee, 2013). Additionally, Baten, Kamil, and Fatama (2009) in Bangladesh reported that resources in the manufacturing industries especially in under-developed countries are being utilized inefficiently. Also in Liberia through a study by Barchue and Aikaeli (2016) which depicted that SMEs are generally inefficient and this could be the case in other developing countries in Africa.

Moreover, many agro-processing firms are established daily across the globe and the majority of them of about 85% fail after few months of operations since their establishment (Woldie, Leighton & Adesua, 2008). This has been experienced even in developed countries like the USA, approximately 50% of small-scale food processing firms fail within the first year of operation (Islam and Tedford, 2012). Also in China, Yanping and Huanwei (2006) reported that many small processing firms in China have a lifespan of less than three years. A discouraging situation is experienced in South Africa where the rate of failure is higher being between 70% and 80% of the firms fail within the few months of operation (Fatoki, 2011).

Low technical efficiency and the outright failure among firms in other manufacturing sub-sector other than sunflower oil from various countries have been associated with lack of Research and Development, inadequate investment capital and minimal exposure to the international markets (Ngeh, 2014). Not only that but also, inadequate infrastructure, unskilled labour, inexperience in the industry, technological

development challenges and unavailability of business training opportunities are also among the reported factors (Memon and Tahir, 2010; Shah, 2011; Charoenrat, 2012).

On the other hand, performance of these firms is contrary to production theory in which firms are always considered technically efficient given the input factors of production. There exists a large gap between actual and expected production output level of sunflower oil. Firms are not fully efficient in maximizing outputs from factors of production hence low level of production is attained with varying efficiency levels among them. This is because of losses which might be due to random errors out of the control of the firm and possibly inefficiency use of the firm' resources. In the same vein, the resource-based theory of the firm assumes that resources are always applied in the best way by the firm for the superior performance (Penrose, 1959). This claim of the theory has remained at the conceptual level as existing empirical studies on the area are based on different manufacturing subsectors other than sunflower processing firms (Wu, Kao & Cheng ,2006; Baten, Kamil, & Fatama, 2009; Tahir &Yusof, 2011; Charoenrat, 2012; Essmui, Berma, Shahadan & Ramlee, 2013; Ngeh, 2014; Barchue & Aikaeli, 2016) to mention a few. As a result, there is inadequate knowledge about the postulation to small-scale firms, particularly sunflower oil processing firms.

In addition, efficiency studies are relative and specific to firm group and country (Ahmed &Ahmed, 2013). The applicability and generalization of their findings are therefore questionable to other countries and sectors due to contextual differences in infrastructure, cultural, general economic environment and digital divide of which sunflower oil processing firms in Tanzania is of no exception.

Notable efforts have been made by the Government of Tanzania and other stakeholders through policy reforms and programmes to create a dynamic industrial environment to provide support for SMEs to attain better efficiency and sustainability performances. These policies are not limited to the following, to mention a few:

First, The SMEs Development Policy (2003-2013) which aims at fostering job creation, income generation through the creation of new SMEs and improving the

performance and competitiveness of the existing ones. Second, Tanzania Development vision 2025 which aimed to transform from a low productivity agricultural economy to semi-industrialized economy. Third, The National Strategy for Growth and Reduction of Poverty (NSGRT) where the government has committed itself to promote private sector participation including SMEs. Fourth, The Sustainable Industrial Development Policy-(SIDP) (1996-2020) which places specific emphasis on promotion of SMEs through supporting existing and new ones, simplification of taxation, licensing and registration of SMEs and improved access to financial services. Fifth, The National Microfinance Policy (2000) which covers the promotion of financial services to SMEs in both rural and urban areas. Sixth, The National Employment Policy (2008) which recognizes that the private sector including SMEs is the major source of employment in Tanzania and many others.

Apart from these policies and programmes, the government has also established various institutions to support SMEs in Tanzania, to mention a few like Small Industrial Development Organisation (SIDO) which plans, coordinates, promotes and offers every form of services to small industries, Tanzania Industrial Research Development Organisation (TIRDO) which supports local raw materials utilisation, Centre for Agricultural Mechanization and Rural Technology (CAMARTEC) which is involved in the promotion of appropriate rural technology development, Tanzania Engineering and Manufacturing Design Organisation (TEMDO) which is responsible for machine design, Tanzania Bureau of Standards (TBS) which promotes and enforces standards, Tanzania Food and Drugs Authority (TFDA) which provides extension services and facilitates registration of products, and Vocational and Educational Training Authority (VETA) which offers training in different trades (URT, 2003).

Despite all these government efforts and other regulatory agencies, small scale firms are still attributed to low capacity utilization and thus technical efficiency and financial sustainability challenges, failing to unlock their full potential with marginal improvement in their performance (URT, 2003). All these suggest that there could be firm-specific factors contributing to their Technical Efficiency and Financial Sustainability. Therefore this calls for a study on the determinants of technical

efficiency and financial sustainability from sunflower oil processing firms empirical setting in Tanzania, since there are patchy empirical evidences globally and locally on the same.

1.3 Statement of the Problem

Despite the importance, long history of sunflower in Tanzania since colonial times and government initiatives to improve the sector through SME policy (2003-2013) and Millennium Development Goals (MDGs) Vision (2025), yet sunflower oil processing firms operate under capacity with inadequate actual output as expected (Ekblom, 2016; Mushi, 2016). This results in large oil import of about 60% to 65% to cater for the increased demand gap due to increase in population, improved standard of living and increased awareness on the use of nutritious food (RLDC, 2010; Iringo, 2013; BOT, 2017). In the same vein, most of the firms are of small scale unable to grow as expected, with low standard produce to meet the international market, thus generating low income (Mpeti, 2015). Low income generated could not cover their operating expenses. All these raised uncertainty on their technical efficiency and financial sustainability which could be attributed to inefficiencies due to firm specific characteristics. Thus, the vital question of concern addressed by this study is “*What are the important determinants of technical efficiency and financial sustainability of sunflower oil processing firms in Tanzania?*”

Addressing the problem from the demand-side philosophical lens point of view, the study was confined on what small scale sunflower oil processing firms need to do from resources and capabilities they possess internally in terms of their firm specific and owners characteristics to attain technical efficiency and financial sustainability of their firms.

Large body of the reviewed empirical literature from various countries as indicated in chapter two concentrated on other types of manufacturing firms such as those in Vietnam (Le & Harvie, 2010); in Thailand (Amornkitvikai & Harvie, 2011; Charoenrat, 2012), in Libya (Essmui, Berma, Shahadan & Ramlee, 2013), in Cameroon (Ngeh, 2014) and in East Africa (Niringiye, Luvanda & Shitundu, 2010) to mention a few, related inefficiency levels of firms to factors related to owners of

the firms' demographic characteristics, firm characteristics and the typical organisational and management norms of the firm (Battese & Coelli, 1995). Though provided good background information for this study, they provide mixed evidence on the tested relationship, thus inconclusive results which cannot be generalised to all sub-sectors. However, little attention has been given to explain why the identified factors are important predictors of the firms' performance.

In addition, the contribution of technical efficiency on the financial sustainability in processing firms is not well documented in this area as early studies across the world on the manufacturing firms concentrated only on measuring efficiency and their respective determinants (Admassie & Matambalya, 2002; Niringiye *et al.*, 2010; Din *et al.*, 2007; Radam *et al.*, 2008; Faruq & David, 2010; Le and Harvie, 2010; Zulfiqar, 2012; Charoenrat, 2012; Ahmed & Ahmed, 2013; Charoenrat *et al.*, 2013; Ngeh, 2014).

Furthermore, the few available kinds of literature on the determinants of financial sustainability of the firms in Tanzania focused on the Microfinance Institutions other than agro-processing firms (Nyamsogoro, 2010; Kipesha, 2013; Marwa & Aziakpono, 2015). Though they provided a good background on the established relationship, their findings might not be applicable to different sectors due to contextual and methodological differences. For instance, the study by Nyamsogoro (2010) on the financial sustainability of Rural Microfinance Institutions used Panel Regression and found that capital structure, firm size, staff productivity and operating efficiency affect the financial sustainability of the firms under the study. On the other hand, the study suggested that geographical location can be a proxy for some differences in performance.

This study takes it further and investigates whether the location of small scale sunflower oil processing firms can influence its financial sustainability. Likewise, the study by Kipesha (2013) on efficiency, financial sustainability and profitability of Microfinance institution in East Africa revealed that firm characteristics, particularly age and size influence the sustainability of the firm. However, due to differences in institutional background and operations, thus generalisation of the findings to other

different sectors is questionable. This study therefore, tested the applicability of these findings to sunflower oil sub-sector

Besides, the contribution of firm-specific factors as determinants of financial sustainability of sunflower oil processing firms is not well established in this area since most of the previous studies on this relationship concentrated on a different sector of Microfinance Institutions as well (Nyamsogoro, 2010; Kipesha 2013, Ngeh, 2014). Therefore, this part of the study is grounded from the microfinance settings, particularly the study by Nyamsogoro (2010); Kipesha (2013); Marwa and Aziakpono (2015) which established the relationship between various firms specific factors like firm age, size, ownership of the firm, education level and the age of the owner and efficiency of the firms respectively as the determinants of financial sustainability in Microfinance empirical setting other than sunflower oil processing firms which is the focus of this study.

Importantly, patchy empirical evidence on the determinants of technical efficiency and financial sustainability of sunflower oil processing firms might be the cause of the failure of the enterprise to attract the appropriate attention of large firms and government to the sector. Much still has to be known on what sunflower oil processing firms can do in terms of their operating characteristics for improved efficiency and financial sustainability. That is to say, Microfinance Institutions are considered as the supporting institutions (supply side philosophical lens) to small-scale firms since they provide credit for their investments while sunflower oil processing firms are considered as the demand-side philosophical lens point of view.

Therefore, this study attempts to fill the above knowledge gaps in the literature using Tanzanian Small-Scale Sunflower oil Processing Firms. The study employs a different approach and models of analysis for each specific objective compared to other previous studies according to the nature of the research question addressed. This follows the assertion that devising new approaches and methodologies lead to the discovery of new knowledge (Kuhn, 1996; Nyamsogoro, 2010).

1.4 Research Objectives

1.4.1 General research Objective

The general objective of this study is to examine the determinants of technical efficiency and financial sustainability of sunflower oil processing firms (SOPFs) in Tanzania.

1.4.2 Specific Research Objectives

The specific objectives of the study were to:

- i. Determine the influence of firm-specific factors on technical efficiency of sunflower oil processing firms in Tanzania.
- ii. Determine the influence of technical efficiency on the financial sustainability of sunflower oil processing firms in Tanzania.
- iii. Determine the influence of firm-specific factors on the financial sustainability of sunflower oil processing firms in Tanzania.

1.5 Research Questions

The general research question of this study was “what are the determinants of technical efficiency and financial sustainability of sunflower oil processing firms in Tanzania”? The specific research questions of the study were:

- i. Do firm size, age, location, ownership type, education level, and experience of the owner, training of the employees influence the technical efficiency of sunflower oil processing firms in Tanzania?
- ii. Do technical efficiency levels and staff productivity ratios influence the financial sustainability of sunflower oil processing firms in Tanzania?
- iii. Do firm size, age, location, ownership type, education level, age and experience of the owner, training of the employees influence the financial sustainability of sunflower oil processing firms in Tanzania?

1.6 Significance of the Study

Despite the low technical efficiency and financial unsustainability of sunflower oil processing firms in developing countries, Tanzania in particular, there are limited empirical evidences on the determinants of technical efficiency and financial sustainability on the same. The findings of this study are therefore important to

various stakeholders like firm owners, researchers, government and private agencies responsible for creating enabling environments for small scale's firm technical efficiency and financial sustainability.

Practically, this study provides a clear picture of technical efficiency levels and their significant determinants for sunflower oil processing firms in Tanzania. This can be used as the benchmark for comparison purpose within the industry in future. Also, an understanding of efficiency levels and their implications for firm resource used indicate the extent to which sunflower oil processing firms have utilised their inputs for maximum output and hence financial sustainability. In other words, the knowledge from this study will be a major stepping stone to enlighten what should be done by owners of firms, particularly on the way they allocate resources for improved technical efficiency and sustained financial performance.

Specifically, owners of the firms will be aware of important key firm- specific factors like strategic location, staff utilization in productivity and sales as well as technical efficiency levels contributing to the technical efficiency and financial sustainability of their firm respectively.

The study is also expected to add knowledge on the limited stock of literature to researchers for future reference on determinants of technical efficiency and financial sustainability from sunflower oil processing firms empirical setting, since there are scanty empirical studies in this area which investigated this link using firm-level data in Tanzania context.

Furthermore, study findings will provide valuable inputs and interventions in devising economic and industrial specific policies likely to improve technical efficiency for enhanced financial sustainability of sunflower oil processing firms.

Theoretically, by synthesizing Resource-Based and Profitability theories in establishing link and relationship among the major concepts of the study undertaken, the study developed a comprehensive theoretical framework which gave a new holistic analytical way of examining the determinants of technical efficiency and financial sustainability of sunflower oil processing firms in Tanzanian context. The

research model synthesized provides a conceptual opportunity to examine the role of firm-specific factors as determinants of technical efficiency and financial sustainability of the firm in a comprehensive way as depicted pictorially in Chapter 2, Figure 2.1 (page 57). This framework might be potentially suitable for testing similar phenomena in the large firms from both developing and developed country perspective.

Methodologically, a measure of the influence of technical efficiency on financial sustainability using technical efficiency levels and controlling staff productivity gives a reflection that sunflower oil processing firms are machine intensive rather than labour intensive. Since there are scant empirical studies which employed this approach previously, this can therefore serve as an added contribution to the methodology on sunflower oil subsector by introducing a frontier model as an alternative measure to a widely-used conventional (ratio) accounting model to measure firm's performance.

Also, the use of Hierarchical Multiple Linear Regression in analysing the influence of firm-specific factors on financial sustainability of sunflower oil processing firms, when technical efficiency levels and staff productivity ratios were controlled to establish the true effect of firm-specific factors on the financial sustainability of the firms under the study. This is also another methodological contribution since there are patchy empirical evidences in the area which employed this approach. Few available prior researches in the area though focused on other manufacturing sub-sectors other than sunflower oil sub-sector (Admassie & Matambalya, 2002; Niringiye *et al.*, 2010) and in Microfinance Institutions (Nyamsogoro, 2010; Thela, 2012; Kipesha, 2013, Marwa and Aziakpono, 2015) used a different methodology in studies the determinants of technical efficiency and Financial sustainability respectively.

Additionally, the use of unit produced in litres as output in measuring technical efficiency level, differently from other previous studies which used sales turnover is also added knowledge. Sales turnover is a function of many variables like selling price, advertisement; competition and quality of the product, therefore, do not have a

direct link with input to output relationship measured in terms of technical efficiency level. Technical efficiency level of the firm is a mere transformation of inputs factors of production to the output produced. In this sense, unit processed in litres as a measure of outputs from input resources is directly linked with input-output relationship estimated. Thus by devising *new approaches and methodologies lead to the discovery of new knowledge* (Kuhn, 1996; Nyamsogoro, 2010).

1.7 Scope of the Study

This study is confined to study the determinants of technical efficiency and financial sustainability of sunflower oil processing firms in Tanzania. Sunflower oil processing firms provide a rich environment for the study since resources play a crucial role in their performance (Kapelko, 2009). Also, efficiency and sustainability are the key aspects of the firm performance. Efficiency refers to the better use of input resources in the production of output. It measures how well the firms use input resources such as human capital and assets in the production of outputs. Financial sustainability refers to the ability of the firm to cover their operating costs using their operating revenue. Therefore understanding the financial sustainability of sunflower oil processing firms is important because it is a necessary condition for institutional permanence/sustainability and long-lasting services to the deprived. Both efficiency and sustainability concepts depend on the ability of the institutions to manage its operating costs, by keeping costs as low as possible increases the firm productivity which in turn results in overall organisational efficiency and financial sustainability. In the same vein, it is an important gauge for researchers, policy-makers, regulators and shareholders in guiding the emerging agro-processing industries like sunflower oil in the desired direction.

Also, Tanzania being the agricultural produce, particularly on central agricultural corridor has attracted the mushrooming of small scale sunflower oil processing firms due to the large amount of sunflower seeds produced compared to other regions (TAOSA, 2012). This resulted in the predominance of sunflower oil processing firms but producing under capacity with low quantity despite the availability of sunflower seeds grown in this area. Also, they are readily available for adequate data and sample representation of the problem across the country (Afzal & Ayaz, 2013).

Moreover, the persisting situation being of small scale and underdeveloped processing firms as most newly established firms have not survived for long, and the surviving ones are operating at low technical efficiency levels and generating low income despite the numerous efforts by the government and other stakeholders to create a dynamic industrial environment (Mbelle,2000; Admassie & Matambalya, 2002; Mpetta, 2015).

This study has only considered internal firm-specific factors as determinants of technical efficiency and financial sustainability of sunflower oil processing firms, since the factors are within the control of the firm and in line with a resource-based theory which has been used to ground the study. Factors considered also align with the demand side philosophical lens point of view in which the research problem of the study has been problematized and philosophised. Thus the study addresses how sunflower oil processing firms can attain their technical efficiency and financial sustainability from what they possess internally.

Likewise, the study is confined to financial sustainability as a key dimension of the firm sustainability and quite often used to mean institutional sustainability. If the firm is financially sustainable it will be able to cover its operating expenses and thus continue to operate and survive in business for a long time (Nyamsogoro, 2010; Thela, 2012).

More importantly, Dodoma and Singida regions have been selected as the area of the study due to a large amount of sunflower seeds production attracting potential oil processing firm of the same compared to other regions in the country but operating at low capacity with inconclusive technical efficiency and low income generated for their financial sustainability. The findings of the study have been generalised to all sunflower oil processing firms across the country due to their similar operating characteristics and the sample used is representative since it has been drawn from large sunflower growing area in the country. Not only that but also, the quantitative methodology used is nomothetic and not ideographic, thus allows generalization of the findings beyond the study sample.

Besides, there exist numerous small scale sunflower oil processing plants in town centres and municipals along Dar-es-Salaam to Mwanza high way due to availability of electricity and market accessibility from passengers travelling along even to the neighbouring countries which offers good market opportunities to sunflower seed producers and oil processors in the area, conversely their technical efficiency and financial sustainability are uncertain.

Furthermore, most of the previous studies in Tanzania on technical efficiency and financial sustainability are confined mainly to farmers side of the value chain and to Microfinance Institutions respectively, and not to agro-processing firms regardless of their low technical efficiency and financial unsustainability. Therefore this study provides a good representation of the problem in Tanzanian sunflower oil processing firms' context as they have similar operating characteristics across the country (Moshi, 2016).

1.8 Organisation of the Thesis

Chapter One

The introduction explores the contribution of SMEs in general from a global perspective narrowed to agro-processing firms, particularly sunflower oil processing firm to developing countries context, specifically in Tanzania where the study was conducted. Also, the need for a technically efficient and financially sustainable firms for the sustained industrial economy has been captured. The chapter also covers problems/challenges resulting into inefficiency and unsustainability of the firms, statement of the problem, objectives of the research, research questions, scope of the study, significance of the study and organisation of the thesis.

Chapter Two

This chapter presents relevant theoretical and empirical literature reviewed in relation to the technical efficiency and financial sustainability of the firms. It mainly focuses on the five major dimensions which consolidate important concepts of the study, theoretical thinking of technical efficiency from the production frontier point of view, resource based theory which established the focus, limit and relationships of the study, linking the Profitability Theory with financial sustainability of the firm

from revenues and expense, empirical review of technical efficiency and financial sustainability studies reviewed from general manufacturing, agro-processing firms and Microfinance institutions settings to identify variables used and their relationship revealed, research model used, refining the research gap of the study are also included here. Finally, the Conceptual Framework of the study constructed from the theories and the empirical literature reviewed indicating the hypothesized conceptual relationships among the major concepts of the study and their variables are also presented.

Chapter Three

The methodology used in the study is presented in the third chapter. This chapter presents the research design which suits the study according to the nature of the study population. Also, the approach of the study based on the nature of the study objectives, the area of the study selected, sampling procedure, sample size and the criteria used to arrive at the representative sample for the study are indicated. Sampling techniques, study population indicating the unit of analysis and unit of enquiry, variables and their measurements, types and sources of data, data collection method and tools, validity and reliability issues, data analysis techniques and ethical issues considered by the study are presented accordingly.

Chapter Four

This chapter presents research findings basing on the study objectives. The information from the surveyed questionnaires and key informants interviewees were analysed and presented both descriptively and by using respective inferential analysis models according to the nature of the dependent variable in each specific objective. Prior to the findings, the chapter begins by presenting a preliminary examination of data such as cleaning and screening of data for detection and correction of outliers, description of the respondents' and firms characteristic involved in this study presented in various frequency tables.

Chapter Five

This chapter deals with the discussion of the study findings according to specific objectives of the study. It provides the meaning of the results as analysed in chapter four and as observed in the survey during data collection. The discussion is enriched with the qualitative information obtained from follow-up interview on the reasons to supplement the quantitative findings and citations from the past studies of the similar nature on technical efficiency and financial sustainability of the firms for comparison and contrasting purposes on what has been revealed by this study.

Chapter Six

This chapter provides the summary, conclusions and policy implication of the results based on the major findings of the study. Based on research findings, several future policies action and interventions are suggested for improving technical efficiency and financial sustainability of sunflower oil processing firms. The chapter also presents a key contribution of the study to knowledge and end up acknowledges some limitations of the study and provides areas for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

This chapter provides both theoretical and empirical literature review on technical efficiency and financial sustainability of the firm as the main concepts of this study. The chapter begins the review with theoretical literature by introducing the key concepts of the study like technical efficiency, financial sustainability, small scale firms based on SMEs and agro-processing firms in Tanzanian context. Subsequently, theories of firms' performance in which the study is grounded are also provided. In the same vein, the chapter provides related empirical literature on technical efficiency and financial sustainability, particularly on measurements of technical efficiency levels and financial sustainability, and methodologies employed in other areas other than sunflower oil subsector to ground the study from both developed and developing countries context. It ends up by summarising the literature by identifying the major research gaps which were addressed by the study and finally developed a conceptual model which was operationalized to a research model and applied in testing the hypothesized relationships of the study.

2.2 Explanation on the key concepts used in the research

2.2.1 Concept of Production and Efficiency

The concept of production has been stemmed from a production function, which describes the maximum output of the product attainable from each level of input used (Coelli, Rao, Donnell & Battese, 2005). In this case the maximum output product attainable would refer to quantity of sunflower oil processed in litres.

Besides, Efficiency of the firm has been referred mostly to two scopes, either Technical Efficiency or Allocative efficiency (Farrell, 1957). Technical efficiency has sometimes been referred to pure efficiency, measured in quantity of input or output while Allocative efficiency has been referred to price efficiency measured in values of cost, revenue and profit (ibid). In addition, Allocative efficiency explains the ability of the firm to use inputs in optimal proportions, given input prices while Technical Efficiency indicate the ability of the firm to attain maximum output

feasible from a given level of input (Coelli et al., 2005). This study focused on technical efficiency in addressing the problem of low quantity of output experienced by sunflower oil processing firms in Tanzania as explained more in the following section.

2.2.2 The Concept of Technical Efficiency

The conception of Technical efficiency has been explained by many scholars in various fields and sub-sectors in different ways, but the main idea is centred on the input-output relationship. It is either when the maximum quantity of output in liters is obtained for a given set of inputs or when the minimum quantity of inputs is used to produce a given output level (Koopmans, 1951; Debreu, 1951; Farrell, 1957; Kumbhakar & Lovell, 2000; Coelli *et al.*, 2005; Charoenrat, 2012; and Ngeh, 2014). In this study, technical efficiency has been considered as the ability of the firm to produce maximum quantity of output measured as the ratio of unit produced in litres (output) to a set of inputs capital, labour and material given a production technology. On the other hand, technical inefficiency reflects a specific firm's failure to attain the maximum possible output level from a given set of inputs and technology.

The input-output relationship originated from production theory which assumes that firms are technically efficiency, but in reality, a gap exists between the theoretical assumption of full technical efficiency and empirical reality. It represents the level of achievement by the firm in utilising the available inputs resources (capital, labour and material) for maximum outputs. Although the importance of efficient use of resources has long been recognized by firms, the actual output is less than what is postulated by the production function. They perform at their best practice (a frontier) which is used to emphasize the idea of maximality of the firm reflecting the current state of technology in the industry. Frontier defines the best combination of inputs that can be used to produce a maximum output. For this case, firms that operate on the frontier are considered technically efficient and those beneath the frontier are technically inefficient (Debreu, 1951; Farrell, 1957).

However, the production theory has been criticised by considering physical amounts of input factors of production in estimating/modelling the production functions of the firms thus its application is problematic due to measurement problems in the physical quantity of inputs in small scale firms, especially with respect to capital and labour. To evade this uncertainty most of the reviewed similar studies used cost value for the number of inputs which guaranteed the use of advanced models like SFA and DEA in measuring technical efficiency levels. For instance, Schmidt and Lovell (1979), Admassie and Matambalya (2002); Charoenrat (2013) used the actual cost of the plant to measure capital input. Similarly, on the labour, most of the study use the cost of labour since it is hard to capture labour hours in small scale firms as most of the employees are casual labour with no specific working hours per day (Le, 2010; Amornkitvikai, 2011; Charoenrat, 2013).

2.2.3 Measurements of Technical Efficiency

Currently, there are two commonly used approaches in measuring technical efficiency of a firm based on the best practice production frontier of the firm (frontier). They are broadly classified as parametric and non-parametric models. These are Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) respectively. This approach of modelling has become into being due to measurement problems in the physical quantity of inputs in small scale firms, especially with respect to capital and labour as required by production theory.

Thus contrary to production theory, in advanced models technical efficiency has been measured by considering the cost value of inputs based on the frontiers. The frontier is considered as their best practice which is used to emphasize the idea of maximality of the firm, reflecting the current state of technology in the industry. Frontier defines the best combination of inputs that can be used to produce a maximum output. For this case, firms that operate on the frontier are considered technically efficient and those beneath the frontier are technically inefficient. These differences might be due to technical inefficiencies or some unanticipated exogenous shocks outside the control of the firm.

For this case, sunflower oil processing firms are assumed to operate either on the frontier if they are technically efficient or beneath the frontier if they are technically inefficient. Both advanced models have been used in measuring technical efficiency studies in various sectors and countries depending on the nature of the sectors and the data available.

DEA is a non-parametric approach that uses the linear programming techniques in estimating technical efficiency of the firm relative to others. It also makes no assumptions concerning the form of the production function; instead the best practice production function is created empirically from observed input and output. Likewise, it does not identify the difference between technical inefficiency and random errors, since it is deterministic in nature that it associates all deviations from the frontier with inefficiency and thus ignoring other factors outside the control of the firm like measurement errors and other random shocks (Admassie & Matambalya, 2002; Vu, 2003; Coelli *et al.*, 2005; Zahid & Mokhtar, 2007).

On the other hand, SFA is a parametric approach where the form of the production function is assumed to be known and the relationships between inputs and outputs follow known functional forms. The approach allows various hypotheses to be tested like suitable production functions that fit the data well. Here, Cobb-Douglas and Translog production functions are the most common functional forms used under SFA (Coelli *et al.*, 2005). The distribution of the error term (u) whether truncated, half normal or exponentially distributed, and the presence or absence of inefficiency in the model can also be tested, which is not the case for DEA. Importantly, SFA can be used to simultaneously estimate firm technical efficiency levels and technical inefficiency effects in one stage approach (Admassie & Matambalya, 2002; Coelli *et al.*, 2005; Zahid & Mokhtar, 2007). This is possible because the model decomposes the error term into inefficiency and measurement terms like noise and other random shocks outside the control of the firm to account for measurement errors and inefficiency respectively. Then inefficiency is modelled as the function of firm-specific factors which is contrary to DEA.

Also, it has been reported that, SFA is more suitable for efficiency analysis in a developing country like Tanzania where there are serious issues with data quality and accuracy (Coelli 1995). Thus accounting for measurement errors for small scale firms is very crucial since they do not keep proper/formal accounting records and their data are based on estimates from primary sources.

Furthermore, in estimating technical efficiency, most of the previous studies in manufacturing and other sub-sectors have used capital, labour and material as input factors of production with the output being measured in annual sales turnover (Admassie & Matambalya, 2002; Wu *et al.*, 2005; Memon & Tahir, 2010). Capital(C) as one of the input in measuring technical efficiency of the firm in previous studies was captured in terms of capital stock at the beginning of the production year and estimated as the value of assets (Admassie & Matambalya, 2002; Wu *et al.*, 2005; Din *et al.*, 2007; Radam *et al.*, 2008; Faruq & David, 2010; Tahir & Yusof, 2011; Charoenrat, 2012). Therefore in this study, capital (C) has also be used as one of the input variable measured as the proxy value for initial investments including machinery, premises and vehicles for each sampled sunflower oil processing firm. But mainly cost of machine, since each firm has a production machine.

Similarly there are a number of variables that have been used to measure labour(L) as one of the input factors of production, including the number of persons employed, number of hours of labour input, number of full-time equivalent employees and the total wages and salaries bill (Admassie & Matambalya, 2002; Coelli *et al.* 2005; Le, 2010; Amornkitvikai, 2011). Due to the nature of the small scale sunflower oil processing firms in Tanzania, mostly use casual labours due to their seasonality nature of the businesses and thus have few permanent employees. Therefore this study has used total wages of workers to measure labour input (L) by considering the average number of workers times the average daily wage paid in yearly.

In the same way material as one of the input factors of production is measured in terms of real monetary value of raw materials, fuel, electricity and water at current prices (Admassie & Matambalya, 2002; Din *et al.*, 2007). Therefore this study also used materials as one of the inputs measured in terms of total cost of raw material,

fuel, electricity and water for each selected sunflower oil processing firm. However, the use of sales turnover in measuring the output of the firm by previous scholars like Admassie and Matambalya (2002); Wu *et al.* (2005); Tahir and Yusof (2011) can be criticised in the sense that sales turnover of the firm is the function of many factors like price, advertisement and other marketing issues, thus it is not directly related to the technical efficiency of the firm which focuses on production and specifically on a mere transformation of inputs to outputs.

Therefore, different from other previous studies, this study has used quantity of sunflower oil processed in litres i.e. the unit processed as a proxy measure of output and the unit costs of input factors of production (capital, labour and material) which were later transformed into their natural log for normal distribution and robustness of the results and thus the variables were used to estimate technical efficiency levels in sunflower oil processing firms prior to their determinants.

The levels of technical efficiency of sunflower oil processing firms anticipated would indicate whether there are losses in oil production that could be attributed to inefficiencies due to differences in firm-specific factors or factors out of the control of the firm like measurement errors and noise. The distribution of the error term due to inefficiency has been indicated clearly since SFA model was used, which decomposes the error term into inefficiency and measurement errors respectively. Therefore, the model is accepted for its ability to deal with stochastic noise and allows statistical tests of hypotheses pertaining to the structure and the extent of inefficiency (Coelli *et al.*, 2005). To apply the model in the analysis, the functional form of the production function and distribution of the random errors have to be specified as indicated on the methodology and finding in chapter 3 and 4 respectively..

2.2.4 Small Scale firms based on SMEs

Globally, there is no single criterion for classifying business enterprises as small or medium scale. There appears to be no consensus on what constitutes or do not constitute SMEs (Mwakujonga & Bwana, 2013). The reference is usually made to some quantifiable measures such as the size of the capital investment, the number of

employees, the sales turnover, the management style, the location, and the market share (ibid).

In Tanzanian context, SMEs are sometimes referred to as Micro, Small and Medium Enterprises (MSMEs) and they cover non-farm activities such as manufacturing, mining, commerce and services (URT, 2003). Like other countries, Tanzania also uses quantitative measurement to define SMEs. The commonly used yardsticks are a total number of employees, amount of capital investment and sales turnover.

Microenterprises are those enterprises engaging up to 4 people and in most cases are family members, with capital amounting up to Tsh. 5 million. Majority of these falls under the informal sector. Small scale enterprises/firms are mostly formalized undertakings engaging between 5 and 49 employees or with capital investment from Tsh.5 million to Tsh.200 million. Medium enterprises employ between 50 and 99 people or use the capital investment from Tsh. 200 million to Tsh. 800 million while large enterprises have more than 100 employees and with capital above 800million (URT, 2003).

Similar definition based on SME Policy of 2003 was adopted by Iringo *et al.* (2014) in the sunflower sub-sector with some modification to suit the small scale nature of the sector. Thus, Micro enterprises employed 1 to 2 people or capital investment of less than Tsh. 10 million, micro with 2 to 5 people and capital investment Tsh. 10-15 million, small with 5 to 15 people and capital investment of Tsh. 50-500 million and medium with 15 people or capital investment Tsh. 500 million to 1.2 billion.

Combining both the capital investment and the number of employees as the criteria in defining SME can really complicate the study because there could be situations where the number of employees would not match the stipulated capital possessed by the firm and hence fail to identify the size of the firm. On the hand, the URT (2012b) suggests that when an enterprise falls under more than one category e.g. one employee but capital investment greater than Tsh. 5 million, then the level of capital investment is considered as the deciding factor in determining the size category. Following the SME rule and Iringo *et al.* (2014) in this study, sunflower oil processing firms considered in this study have their capital ranging from Tsh. 5 to 50

million and the number of employees is from 5 to 29 which fall within the small scale category.

2.2.5 Technical Efficiency and SMEs

Technical efficiency measurement has been used across the global as one of the common technique to gauge the performance of SMEs (Admassie & Matambalya, 2002; Charoenrat *et al.*, 2013; Ngeh, 2014) to mention a few. It indicates the ability of SMEs to maximize output from a given set of inputs and technology through estimated technical efficiency levels. Efficiency levels determined enable the firm to identify areas of improvements besides providing inputs for policy planning and interventions (Mohamed, Majid, Noh & Ahmed, 2010). Most of the studies on manufacturing SMEs in developed and developing countries, particularly in food processing, experience low productivity of physical output from their inputs factors of production (Admassie & Matambalya, 2002; Yanping & Huanwei, 2006; Radam *et al.*, 2008; Fatoki, 2011; Islam & Tedford, 2012).

Efficient SMEs are considered as the one which use its inputs at an optimal level or the one which maximizes output at a given level of inputs. The vice versa is true for inefficient SMEs (Radam *et al.*, 2008). The inefficiency in these firms has been attributed to firm characteristics and owners capabilities since most of them are individually owned (Admassie & Matambalya, 2002; Mohamed *et al.*, 2010; Charoenrat *et al.*, 2013; Ngeh, 2014). However, existing studies on technical efficiency of SMEs in other countries focused on other sub-sectors of manufacturing firms other than sunflower oil. Their findings cannot be generalized to all SMEs since efficiency is relative and specific to firm group and country (Ahmed *et al.*, 2010) . The applicability and generalization of their findings are questionable to other countries and sectors due to contextual differences in infrastructure, cultural, general economic environment and digital divide of which sunflower oil processing firms in Tanzania are of no exception.

2.3 The Concept of Financial Sustainability

Theoretically, sustainability is a wide term and has been defined by many in several dimensions depending on user requirements. For instance, Filene (2011) defined sustainability as the ability of an entity to continue with a defined behaviour indefinitely. It further implies the ability of the firm to meet its goals over the long term. In the same vein, Nyamsogoro (2010) in the Microfinance sector defined sustainability to mean permanence or the ability to repeat performance through time. Similarly the study identified various dimensions including mission sustainability which refers to sustainability of the firm in its mission which keeps the organisation in its chosen path in the long-term, programme sustainability which occurs when customers perceive that the products or services that they receive are of sufficient importance, valuable and are willing to assume responsibility and ownership of them (Ibid). Also human resource sustainability which insisted on well qualified personnel who are capable of delivering the products as required meeting the organisation mission and finally financial sustainability which is considered as the key dimension of the firm sustainability implying its ability to cover all its costs from its own generated income from operations and quite often used in literature to mean institutional sustainability.

Other scholars in a business sector like Hubbard (2009) described sustainability as the ability of the firm to meet the need of its stakeholders without compromising its ability to meet their needs in the future. In other words, financial sustainability means the smooth operation of the firm with the necessary profitability, having adequate liquidity to overcome any challenges of bankruptcy.

It is also considered as a necessary condition for institutional sustainability which is the most important requirement for any business. In the same nature, Doicui (2009) stresses that financial sustainability is a full cost recovery or profit making and is associated with the aim of building an institution that can last into the future without continual reliance on government subsidies or donor funds. Nevertheless, Thela (2012) defined financial sustainability as the ability of an institution to meet its operational costs from income generated from services or products provided and have enough reserves for recapitalization. In this study the concept of financial

sustainability referred to the ability of sunflower oil processing firm to survive in the business and be able to meet its operational and financing expenses from its generated income, thus has enough profit for recapitalization in a long run. Specifically, it is the ability of a sunflower oil processing firms to generate income that exceeds its total costs for survival in business for a long time. Profitability is therefore considered as a residual and a proxy measure of the firm's financial sustainability.

2.3.1 Measurements of Financial Sustainability

Previous literature categorized the measurements of financial sustainability in two levels of indicators Operational self-sufficiency and financial self-sufficiency (Nyamsogoro, 2010; Kipesha, 2013; Marwa and Aziakpono, 2015). Operational Self-sufficiency has been used to assess how far an institution has come in covering its operating expenses with its operating income while financial self-sufficiency measures the extent to which operating revenue can cover institution's direct and indirect costs (Thela, 2012). Moreover, Financial Self-Sufficiency is considered to be a more appropriate measure of sustainability as it attempts to show the financial picture of the firm on the unsubsidized basis (Nyamsogoro; 2010; Thela.2012). It is defined as the ratio of adjusted financial revenue to total expenses. The ratio above 1 indicates sustainability while below 1 indicates the incapability of the firm to pay all of their expenses from their own generated income and therefore not financially sustainable

$$FSS = \frac{\text{Adjusted Financial Revenue}}{\text{Adjusted Operating Expenses}}$$

In this study, Financial Self- sufficiency (FSS) has been adopted as a measure of the sunflower oil processing firm financial sustainability as the ratio of total expenses to total revenue. This is due to their nature of being small scale firms constrained by collateral challenges in acquiring loans and thus use the internally generated fund as a main source of capital. Additionally, sunflower oil processing firms sell their products on a cash basis due to their open market nature of the business and thus no any accruals to be adjusted for.

2.3.2 Financial Sustainability and SMEs

Theoretically, the conception of financial sustainability to SMEs also means the same as applied to other sub-sectors like in Microfinance institutions. Therefore, this concept of financial sustainability in this study is conceived from Microfinance Institutions settings due to limited theoretical and empirical evidence on the same from agro-processing settings. It is thus referred as the ability of SMEs to meet operational and financing expenses from their generated income (Thela, 2012). However, sunflower oil processing firms under the study fall under small scale category with low income generated and thus considered financially unsustainable (Mpetta, 2015).

2.3.3 The Concept of Agro-Processing Firms.

The term “agro-processing firms” has been defined by many scholars to mean a subset of manufacturing firms that process raw materials and intermediate products derived from the agricultural sector into other commodities for the market and for consumption (Hawasi, 2006; Tisimia, 2014). Also, Ekblom (2016) defined agro-processing as any of a variety of operations by which raw materials are made suitable for consumption, cooking, or storage. It generally includes the basic alteration of agricultural product into another form, preservation and packaging techniques. In this study, agro-processing firms have been confined to small scaled sunflower oil processing firms in Singida and Dodoma regions involved in extraction/processing of oil from sunflower seeds.

2.4 Theories Underpinning the Study

The theoretical foundation of this study is based on Resource-Based and Profitability theories, which established the theoretical link in explaining relationship and measurement of technical efficiency and financial sustainability of sunflower oil processing firms as major concepts of the study.

Therefore the preceding sections explain how these theories inform the study as well as the theoretical synthesis of variables influencing technical efficiency and financial sustainability which were also previously used in other studies than in sunflower oil processing firms is also provided as explained below:

2.4.1 Resource - Based Theory (RBT)

Originally, the theory as developed by Penrose (1959) perceives organisations as bundles of resources which are combined in a best way to create organisational capabilities (Barney, 1991). The theory argues that a firm's resources and capabilities are the fundamental determinants of competitive advantage and superior performance. Thus the resource based theory emphasized and addresses the resources of the firm as underlying factors for performance. It further emphasizes that both structural characteristics of the firm and the environment in explaining performance, i.e. internal capabilities and external competitive strategies. It thus treats organization as potential creators of valued capabilities and postulates that assets and resources of the firm have to be viewed from knowledge based perspective. The conceptualized resources include all assets, capabilities, organizational processes, firm attributes, information and knowledge owned and controlled by a firm that enables the firm to improve its efficiency. Therefore, this theory was used in this study to link SOPFs resources in terms of firm attributes and capabilities of the owners with technical efficiency and financial sustainability as measures of the firms' performance.

That is to say, this study adopted resource-based theory to establish the focus, limit and the relationship among variables of the study, by linking firm-specific resources with technical efficiency and financial sustainability as measures of the superior performance of sunflower oil processing firms under the study.

The theory further links technical efficiency with financial sustainability of the firms by considering technical efficiency of the firm as short-term competitive advantage which can be sustained over time due to resource imitability, substantiality and mobility for improved financial sustainability of the firm in a long run.

Besides , the theory throws light on how firms in the same industry perform better than others while suggesting that organisational internal firm specific factors like firm size, age, and location, and ownership type, education level of the owner, experience and training of the employees are responsible for the technical efficiency and superior financial performance of the firms. Furthermore, the resource-based theory describes how business owners build their businesses from the resources and capabilities that they currently own or can acquire (Barney, 1991).

However, the theory holds that not all resources of the firm are important to enable it to generate a competitive advantage in a short run and in order to have a sustainable competitive advantage by making above average profits, these resources must be valuable, inimitable, non-substitutable and non-transferable (Barney, 1991). This means that differences in the performance among firms are the result of their distinct resources and capabilities as this factors are both firm-specific and industry-specific (Barney, 2001). Therefore, some firms are efficient than others (inefficient) because they are different and possess varied resources (Barney, 1991). Efficiency is embedded in the notion of the creation of specialized resources and resource heterogeneity. Thus, cause and effect relationship between resources and efficiency has two directions that creation of specialized resources is based on operating efficiently, while firms with superior resources are able to produce more efficiently.

Several empirical studies have also used the Resource-Based Theory to examine determinants of microenterprise performance in various countries. For instance, the study by Masakure, Henson, and Cranfield (2008, 2009) used resource-based theory to assess whether firm-specific resources influence microenterprise performance and in studying the Financial Performance of Non-farm Microenterprises in Ghana respectively. The former study recognized that factors embodied in firm-specific resources jointly impact enterprise performance while the latter revealed that firm characteristics significantly contribute to the financial performance of non-farm Microenterprises in Ghana. Also, Okeyo (2013) used RBT to examine the relationship between entrepreneurial orientations, business environment, business development services and performance of small and medium manufacturing enterprises in Kenya, to mention a few.

Therefore, this study has used the Resource-Based Theory of the firm to study the determinants of technical efficiency and financial sustainability for sunflower oil processing firms by considering internal firm-specific factors as resources and capabilities that can be combined in a best way for better performance. In this light, we hypothesize that efficiency utilisation of input resources (capital, labour and materials) of the firm for maximising output and profit depends on skills and capabilities possessed by the firm, which includes: firm size, age, location, experience, and age and education level of the owner, ownership type and training of employees as indicated below:

2.4.1.1 Firm Size

Theoretically, firm size influences technical efficiency. The theory of the passive learning model of firm dynamics by Jovanovic's (1982) predicts that larger firms are more efficient than smaller ones due to more acquired competence and experience in management. A selection process leads to an outcome in which efficient firms grow and survive, while inefficient firms stagnate or exit the industry. Firm size has been defined in different ways depending on the nature of firms and context under the study but not limited to either the value of total sales, value added, fixed assets or the number of employees. This study considered the number of employees as the measure of firm size due to the nature of the firms under the study as it is difficult to consider other possible measures; therefore a positive relationship with technical efficiency is expected as all firms under the study fall under small scale. Thus few employees imply cost minimization for higher efficiency levels.

2.4.1.2 Firm Age

Theoretically, firm age influence technical efficiency in the sense that older firms are considered more efficient than younger ones due to gained experience from past operations. Firm age may capture the extent of a firm's learning experience where older firms are usually considered to be more efficient than younger ones because owners/managers and employees have gained experience from past operations (Admassie & Matambalya, 2002; Niringiye *et al.* (2010).

2.4.1.3 Ownership Type

Theoretically, ownership type represents the legal ownership structure of the firm under the study which can either be a sole proprietorship, partnership, government-owned or foreign ownership. It is believed to influence the firm's technical efficiency due to their relative benefits over others depending on the nature of the business (Ngeh, 2014).

2.4.1.4 Location

In theory, location is the area where the firm operates and has been used by many researchers to mean urban, rural, municipals, regions, zones, or countries in which the study is conducted. Different locations may affect the technical efficiency of the firm due to transport costs, infrastructure, spillover effects and natural resources (Niringiye *et al.*, 2010). Also is assumed that SMEs located in the urban area perform better than those in rural areas as they are likely to have greater market and credit facilities access, higher managerial training and greater market opportunities. Others include ample transport infrastructure, industrial network and discussion forums (Tran, Grafton & Kompas, 2008). However, they may face greater competition than their counterparts.

2.4.1.5 Age of the Owner

From a resource based theoretical point of view, as the person grows older, his/her sense of obligations also gains maturity and resultantly the individuals in the high age group possess more performance. This is theoretically supported by the decremented theory of ageing which establishes the relationship between age and performance (Giniger, Dispenzieri, & Eisenberg, 1983). Older owners of the firm are therefore expected to display more technical efficiency in their firms than younger ones since they may have accumulated more resources, experience and networks over time.

2.4.1.6 Experience of the Owner

Theoretically, processors with more years of industrial experience are expected to have better knowledge on machine operation, better knowledge of efficient allocation of resources and thus expected to run a more efficient and profitable enterprise than those with little or no years of processing experience (Dzever *et al.*, 2016).

Something which might also be applicable to sunflower oil processing firms. As one acquires more work experience, s/he acquires more skills, techniques and methods, that improve performance capabilities (Katozai, 2005; Nsubuga, 2009). This means that an increase in work experience results in higher job knowledge and task performance.

2.4.1.7 Education Level of the Owner

Theoretically, the education level of the owner is expected to influence the technical efficiency of the firm including sunflower oil processing firms. When an owner increases his/her education level, s/he gains more stock of human knowledge which aids adoption of requisite technologies and consequently increases efficiency (Jude, 2007; Dzever *et al.*, 2016).

2.4.1.8 Training of the Employees

Theoretically, firms with well-trained work-force are likely to be more efficient because of their greater capability in absorbing and effectively utilising new technology (Admassie & Matambalya, 2002; Zahid & Mokhtar, 2007; Amornkitvikai & Harvie, 2010, 2011; Charoenrat, 2012). It is considered as a human resource management practice that can help firms to improve human capital and thus leading to performance improvement because employees' knowledge, skills, and abilities can be developed (Rouse, 2006; Charoenrat & Harvie, 2014). It introduces progressive production techniques, focused on enterprise skills, such as distribution and business management which can support them to identify the technologies that would be of benefit to them (Charoenrat, 2012).

Conversely, the use of resource based theory could not hold relevant in explaining the theoretical measurement of financial sustainability of the firms due to the variables required to operationalize it. It just links firm specific factors with Technical Efficiency and Financial Sustainability as well as Technical Efficiency with Financial Sustainability. Due to this weakness, the study at hand used, Profitability Theory as the second theory to complement the relationship as explained in the following section.

2.4.2 Profitability Theory and Financial Sustainability of the Firm

The profitability theory considers the profit as the residual, calculated as an excess of income over expenditure (Glautier & Underdown, 2001; Nyamsogoro, 2010). In other words, profits are what remain after costs of productions have been paid for (Marriott, Edwards & Mellett, 2004). If profit is considered as a residual, then profitability can be used as a proxy measure of financial sustainability since it considers covering all costs incurred in earning plus any costs necessary to at least maintain the current level of operations (ibid). The theory indicates how profitability of the firm can be used to indicate its financial sustainability, measured by Financial Self- Sufficiency as the ratio of Revenue to Expenses.

Consequently, the profit of the firm can be increased by either increasing income while holding expenses constant, or by holding income constant and reducing expenses or both. It comes, therefore, that determinants of income and expenses are equally the determinants of the profit (Collier, 2006). All things being equal profits have been considered to be a key variable in measuring a firm's financial sustainability in other sectors other than in agro-processing firms (Nyamsogoro, 2010; Thela, 2012; Marwa & Aziakpono, 2015).

Therefore in this study financial sustainability have been viewed as the ability of sunflower oil processing firms to generate income that exceeds its total costs and be able to survive in business for a long time. Also, on Rural Microfinance study reported that a sustainable firm is the one whose income exceeds the total cost incurred to earn the same (Nyamsogoro, 2010).

Therefore Profitability Theory has been adopted to study the determinants of the financial sustainability of sunflower oil processing firms by considering profit as a residual and a proxy measure financial sustainability of the firm by using financial self-sufficiency (FSS) indicator expressed as the ratio of Revenue to Expenses.

Also following the Resource-Based Theory conception which considers firms as bundles of resources that can be joined in a best way to create organizational capabilities for superior performance (Barney,1991), firm size, age, location,

ownership type, education level, age and experience of the owner-manager, training of the employees and technical efficiency are considered by this study as resources and capabilities which can explain the financial sustainability of sunflower oil processing firms in Tanzania. Moreover, it has been suggested in other sub-sectors other than sunflower that measures of efficiency (in this case are technical efficiency levels and staff productivity ratio) indicate that the more the output at a given level of input the better the contribution toward the financial sustainability of the firm (Nyamsogoro, 2010). Thus, more output of the firm results in increased sales and hence profitability of the firm.

Also the location of the firm near to the source of raw material reduces transport and middlemen costs and hence increases the output of the firm for improved financial sustainability. Likewise, strategic industrial location of the processing firms increases sales due to easy customer accessibility of the product which might improve the profitability of the firm for financial sustainability.

Besides, firm size, measured by a number of employees in the firm is theoretically expected to increase productions which eventually increases profit for improved financial sustainability of the firm.

Importantly, education levels of the owner contribute to the financial sustainability of the firms, as it is considered as the source of knowledge, expertise, self-control, inspiration and self-confidence (Isaga, 2012). Thus, education level facilitates vigorous and effective participation in production for improved financial sustainability.

Furthermore sole proprietorship form of ownership expected to contribute to the financial sustainability of the firm since individuals have complete control over their business and get all the profits earned by the business (Charoenrat, 2012).

2.5 Empirical Literature Review

Empirical evidences reviewed in this study are confined to technical efficiency and financial sustainability literature, from both developed and developing countries perspectives to provide the background on the established relationships. Though most of the studies on this areas have concentrated on general manufacturing firms and in Microfinance Institutions setting other than sunflower oil sub-sector in studying the determinants of the firm's technical efficiency and financial sustainability, they have provided a good background to this study on the established relationship. Therefore due to limited empirical evidences on the agro-processing and sunflower oil sub-sector in particular, the study tested the applicability of the findings from other manufacturing firms and Microfinance institutions settings respectively to establish knowledge in this area. The application of knowledge from a different discipline is known as abduction and Retroduction (Milanzi, 2009).

2.5.1. Firm-Specific Factors and Technical Efficiency of SMEs

Globalization and trade liberalization has created new opportunities as well as challenges for SMEs, which can be grouped into firm/organisation specific and system specific (Organisation for Economic Co-operation and Development [OECD], 2004). Firm-specific factors can be controlled by the firm while system-specific factors cannot be controlled by the firm like competition, corruption, barriers to trade, and bureaucracies in the legal and regulatory framework (Aikaeli, 2007). This study focused only on firm-specific factors since they can be controlled by the firm and are in line with resources based theory from which the study is grounded. Thus, potential firm-specific factors hypothesized to influence the technical efficiency based on theoretical and empirical literature is as follows:

2.5.1.1 Firm Size

Empirical results are still ambiguous on the effect of firm size on technical efficiency depending on countries and sectors analysed. For instance, a number of empirical studies conducted in various countries including Thailand (Lundvall & Battese, 2000; Batra & Tan, 2003; Charoenrat, 2012, 2013), in Vietnam (Amornkitvikai & Harvie, 2010, 2011) in Tanzania (Admassie & Matambalya, 2002) and in Malaysia (Zahid & Morkhtar, 2007) respectively, have found that the size has a significant and positive

relationship with SMEs' technical efficiency. Jovanovic (1982) also acknowledges that larger firms are much more efficient than smaller firms.

However, a number of empirical studies have also highlighted that firm size can have a negative association with SME technical efficiency (Biggs, 2002; Yang and Chen, 2009; Le, 2010) reported the following benefits of being small firms: (1) They have the flexibility to adjust and quickly diversify their activities in a rapidly changing transition economy to become more and more efficient (2) Small firms add dynamism to business activities which can improve economic performance (3) Small firms are likely to have a cost advantage relative to medium and large sized firms (Biggs, 2002; Cheah & Cheah, 2005; Le, 2010). The value of total sales, value added, fixed assets and the number of employees are the reported variables that can be utilised to capture firm size (Lundavall & Battese, 2000; Le, 2010; Amornkitvikai, 2011; Charoenrat, 2012).

In this study, the number of employees has been used as the proxy for firm size, consistent with the definition of SMEs which is generally based on the value of assets or the number of employees in Tanzania context (URT, 2003). Also due to the nature of the small scale sunflower oil processing firms under the study which is seasonal in nature with no permanent working hours per person per day. Despite the merits of small firms over large there are still mixed results depending on countries and sectors analysed. Thus the study investigated the influence of firm size on the technical efficiency of Small Scale Sunflower Oil Processing Firm.

2.5.1.2 Firm Age

Empirically, the effect of firm age on technical efficiency is still inconclusive depending on countries and sectors as well. For instance, Admassie and Matambalya (2002); Batra and Tan (2003); Amornkitvikai and Harvie (2010, 2011) reported that firm age has a statistically positive impact on a firm's technical efficiency that older firms can be more experienced than younger firms due to superior management experience, knowledge and learning- by- doing. Therefore, with longer production experience older firms are likely to be more efficient than their younger counterparts.

In contrary, firm age was reported being negatively related to technical efficiency (Le, 2010; Le & Harvie, 2010). For example, Niringiye *et al.*(2010) pointed out that, young firms are more proactive, flexible and aggressive compared to old firms. Also, learning by doing process for older firms could be offset by obsolete technology as compared with younger firms. Tran *et al.* (2008) found that firm age was associated with lower technical efficiency level in non-state small and medium manufacturing industries in Vietnam under the argument that older firms tend to possess older machinery and equipment while younger firms have just entered the market and equipped with modern technology. The number of years since a firm's establishment is the variable used for firm age (Lundavall & Battese, 2000; Le, 2010; Amornkitvikai & Harvie, 2011; Charoenrat, 2012). This study was meant to establish the applicability of these findings in Small Scale Sunflower Oil Processing Firms in Tanzania.

2.5.1.3 Experience of the Owner

Empirical literature also report that the performance of individuals differs from culture to culture and country to country depending upon the knowledge and experience of the firm owner. Some studies reveal positive relationship, some reveal negative and other did not find any correlation. For instance the study by Dzever *et al.*, (2016) revealed a positive relationship of experience of the owner with the technical efficiency of the firm. This implies that owners with more years of industrial working experience are more likely to be efficient than their counterparts with less or no experience. This implies further they have a better knowledge of machine operation, on resources allocation which will help in running their firm more efficiently for more profitability (ibid). Thus, industrial experience of the owner was also considered as one of the factors that could influence the technical efficiency of Sunflower oil processing firms in Tanzania.

2.5.1.4 Education Level of the Owner

Education of the owner has been reported to be one of the fundamental aspects of human capital since it is the source of knowledge, skills, discipline, motivation and self-confidence (Isaga, 2012). Based on this conception, it has been suggested that owners with a higher level of education are able to manage their firms better than

those with a lower level of education. This is due to the fact that education contributes towards developing the analytical and managerial capabilities of the owner that are needed for a firm to perform well. Thus, the education level of the owner is expected to influence the technical efficiency of the firm including sunflower oil processing firms. When an owner increases his/her education level, s/he gains more stock of human knowledge which consequently increases efficiency. This is even supported previously through the by Admassie and Matambalya (2002), Batra and Tan (2003), Jude (2007), Charoenrat and Harvie (2014) which revealed that education of an individual plays a significant role in improving the efficiency of the firm by aiding adoption of requisite technologies. Therefore, education level of the owner was considered in this study among firm specific factors to influence technical efficiency of sunflower oil processing firms.

2.5.1.5 Training of the Employees

Empirically, there are mixed views on the relationship between training of employees and technical efficiency of the firms. Some studies revealed a positive relationship and others negative. A positive relationship is supported empirically by the study done by Admassie and Matambalya (2002), Zahid and Mokhtar (2007), Amornkitvikai and Harvie (2010, 2011) and Charoenrat (2012) respectively. They revealed that enterprise with well-trained personnel perform better than those without trained and thus training is positively related to technical efficiency.

However, the study by Admassie and Matambalya (2002) involved four types of firms (Food, Textile and tourism) and contrary to other firms in the study, training does not contribute toward improving efficiency in food processing firms. Could this be the case in Sunflower oil Processing firms in Tanzania? This study investigated the influence of industrial training of employees on technical efficiency of sunflower oil processing firms.

2.5.1.6 Firm Location

The influence of location on technical efficiency of the firm is uncertain due to different locational factors like transport costs, infrastructure, spillover effects and natural resources (Niringiye *et al.*, 2010, Charoenrat, 2012). These views are

supported empirically in the previous studies. For example, Le and Harvie (2010) revealed that firms located in urban centres had lower technical efficiency compared to the ones in rural areas due to high labour costs. Likewise, Tran *et al.* (2008) found that firms located in urban areas are more technically efficient than their counterparts located in less developed areas. Since there is a noted mixed result on the influence of firm location on technical efficiency. This study determines the influence that location may have on the technical efficiency of sunflower oil processing firms.

2.5.1.7 Ownership Type

Ownership type especially sole proprietorship and partnership are reported previously to have a positive relationship with the firm's technical efficiency (Ha, 2006; Liu, Liao, & Yang, 2010). In Tanzania, previous studies on SMEs revealed that most of the firms are owner managed which fall under sole proprietorship (Admassie & Matambalya, 2002; Isaga, 2012). Only few are reported under partnership which is mainly formed by family members (Hawassi, 2006). However, government and state-owned firms in other countries were found negatively associated with the firm technical efficiency (Le & Harvie, 2010; Charoenrat, 2012). This implies that government-owned SMEs are inefficient due to weak corporate governance and business practices, corruption and competition (Sahakijpicharn, 2007). Regardless of the positive and negative association found previously, scholars failed to recommend the most suitable and efficient type of ownership. Where do these findings stand on Small Scale Sunflower Oil Processing Firms? This study was meant to bridge this knowledge gap.

2.5.1.8. Age of the Owner

Previous studies on the performance of firms reported that as the person grows older, his/her sense of obligations also gains maturity and resultantly the individuals in the high age group possess more performance (Khan, Khan, Nawaz & Yar, 2013). This is theoretically supported by the decremented theory of aging which establishes the relationship between age and performance (Giniger *et al.*, 1983). In this light, older owners of the firm are therefore expected to display more technical efficiency in their firms than younger ones. Amangala (2013), Met and Ali (2014) respectively, revealed that age is positively and significantly related to work performance in other

sectors than sunflower oil processing firms. On the other hand, Birren and Schaie (2001) did not find any significant relation between age and work performance.

Besides, other studies argued that older managers may have much experience, but they lack ample energy to work effectively. For instance, the study by Cortes, Garcia and Ramon (2008) contended that while older proprietors are likely to be more experienced than younger ones, they may also be less inclined or less able to make their firms grow. In line with these conflicting evidences, a middle-aged proposition aroused with an argument that middle-aged people are likely to have experience and energy, thus perform better than either of the group (Isaga, 2012). This is considered as an inverted U-shaped relationship.

Though conflicting results are previously found in other sectors, age was also considered as a variable of interest in this study since sunflower oil are of small scale in nature and individually owned. Therefore, characteristics of the owner including age are worth considered for their influence on the performance of the firms.

2.5.2 Technical Efficiency and Financial Sustainability of SMEs

There are limited empirical studies which specifically link technical efficiency to financial sustainability in the agro-processing industry, particularly on sunflower oil processing firms. Moreover, the few available kinds of literature focus on general efficiency of the firm and on a quite different area of Microfinance (Cull *et al.* 2007; Nyamsogoro, 2010; Thela, 2012; Kipesha, 2013). The Microfinance Institutions deal with the provision of small-scale financial services to the unbanked poor while agro-processing firms, particularly sunflower oil deal with the processing of oil and seedcakes from various inputs. Though they provide a good background to the study, they differ in terms of their nature of inputs and outputs thus their results cannot be generalised to all types of firms. Efficiency is relative and tends to be specific to firms' groups. It has been established that efficiency and sustainability are the key aspects of the firm performance (Kipesha, 2013).

Nyamsogoro (2010) and Thela (2012) in the area of Microfinance analysed the relationship between efficiency and financial sustainability by looking at various cost, revenue elements like liquidity ratio, operating expense ratio and staff productivity by

employing a traditional approach(financial ratios) and found that efficiency helps microfinance institutions to attain their financial sustainability. It is in this sense that efficiency of the firm informs on whether existing resources have been used effectively as it involves cost minimisation and income maximisation at a given level of operation thus have an enduring impact on the financial sustainability of the firm (Essmui *et al.*,2013; Ngeh, 2014).

Likewise, the study by Nyamsogoro (2010) revealed that more efficient firms tend to have relatively lower expenditure and higher revenue generated per unit. In other words, the efficiency of the firm affects the financial sustainability either through cost reduction or revenue increase or both.

Moreover, financial sustainability of the firm has been considered by previous scholars as a function of many different factors from both internal and external of the firm operations depending on the research question(s) addressed and data availability. For instance, the study by Marwa and Aziakpono (2015) used return on assets, technical efficiency levels /scores, loan size and deposit mobilization and cost per loan portfolio as explanatory variables in predicting financial sustainability of SACCOs in Tanzania. Contrary to other studies, the study by Marwa and Aziakpono (2015) found that the influence of technical efficiency on the financial sustainability on SACCOS was insignificant.

2.5.2.1 Technical Efficiency Levels

Technical efficiency levels from each specific firm have been used as a proxy measure of technical efficiency in sunflower oil processing firm. These were estimated by using the stochastic frontier model as the ratio of inputs to outputs factors of production of the firm (input-output relationship). It is a measure of effectiveness transformation of inputs into maximum outputs of the firms and thus provides a more comprehensive measure of effective use of the firms' resources in maximising their output. Maximising the output of the firm will mean a high technical efficiency level is attained and hence the financial sustainability of the firm can be accomplished (Marwa & Aziakpono, 2015). Previous studies on technical efficiency used either DEA or SFA in estimating technical efficiency levels

depending on sectors analysed. However, Data Envelopment Approach (DEA) is a non-parametric model which has been criticized by being deterministic in nature. It does not account for measurement errors and thus any deviation from the frontier is associated with inefficiency (Admassie & Matambalya, 2002; Vu, 2003; Coelli *et al.*, 2005). On the other hand, DEA measures relative efficiency and not specific technical efficiency levels of the firm. SFA is more suitable for efficiency analysis in a developing country like Tanzania where there are serious issues with data quality and accuracy (Coelli, 1995). The model decomposes the error term into two components to capture both measurement errors due to factors within the control of the firm (inefficiency) and those due to noise and other shocks outside the control of the firm. Therefore, each firm score was obtained as continuous variable estimated from a parametric model, the Stochastic Frontier Analysis (SFA) by using capital, labour and material costs as inputs and unit processed in litres as output for each specific firm.

2.5.2.2 Staff Productivity Ratio

The staff productivity ratio captures the overall productivity of the firms' total human resources in a business. It is calculated by dividing the number of units produced by the number of staff involved. The ratio provides information on how efficiently the firm uses its personnel resources in maximising their output. In the same vein, the ratio indicates how well the firm utilises its staff in general in enhancing income and reducing the overall expenditure. Not only that but also it indicates how efficiently the firm is using its resources and the role played by the staff in managing its production, bringing about profitability and hence financial sustainability of the firm. All things held constant, studies in Microfinance Institutions revealed that the higher the number of units per staff would indicate the firm high efficiency in utilising its staff and hence high profitability of the firm for financial sustainability (Nyamsogoro, 2010; Thela 2012). This study used staff productivity to test the applicability of this finding in sunflower oil processing firms' empirical settings.

Different from the approach used in other manufacturing firms and in Microfinance Institutions settings, this study used both technical efficiency scores estimated from advanced model Stochastic Frontier Analysis (SFA) from the ratio of each firms 'inputs and output, which formed a column of continuous variable and staff productivity ratio from the traditional ratio approach as a combined measure of efficiency in explaining the financial sustainability of sunflower oil processing firms. This has been grounded following the assertion by Kuhn (1996) and Nyamsogoro (2010) that “*devising new approaches and methodologies may lead to the discovery of new knowledge*”.

2.5.3 Firm-Specific Factors and Financial Sustainability of the Firms

Financial sustainability of the firm has been considered in previous studies as a function of many factors ranging from both internal and external point of view depending on the research question(s) addressed and the data availability. However, there are patchy empirical evidences on this area from SMEs settings. This study is based on factors documented in previous studies as influencing financial sustainability of firms. These factors from different study settings and firm orientation were used in this study in investigating the factors that could affect the financial sustainability of Small Scale Sunflower Oil Processing Firms.

These include: location of the business; number of employees as a measure of firm size; education level; ownership type (Nyamsogoro, 2010); number of years in operations as a measure of firm age (Minniti, 2006; Nyamsogoro, 2010); training of employees and age of the owner (Nyamsogoro, 2010; Belenzon & Zarutskie, 2013), experience (Borga *et al.*, 2009); and efficiency (Nyamsogoro, 2010; Marwa & Aziakpono, 2015). Although these empirical evidences have provided a good background on the established relationship among the variables, the available empirical work is limited to Microfinance Institutions, thus, makes a generalisation of the findings across sectors and sub-sectors questionable due to differences in institutional background and operating characteristics. For instance, the study by Cull *et al.* (2007) and Nyamsogoro (2010) respectively on their study in the area of microfinance institutions revealed that firm size is positively linked to its financial performance. Firm size in terms of assets owned by the firm can efficiently be

employed in the production and hence profitability of the firm can be attained. Similarly, the study revealed that sustainability of the firm can also be linked to its size through profitability. The higher the profit, the more the financial sustainability of the firm (Nyamsogoro, 2010).

On the same vein, the age of the firm through accumulated experience has been linked to its financial sustainability (ibid). The learning by doing of both management and the labour force has positively affected the production of the firm and hence profitability of the microfinance firms which is a proxy measure of the firm sustainability. This study intended to find out if this could be the case for sunflower oil processing firms.

Importantly, the problem of financial unsustainability to the firms can be caused by either institutions supporting them or by the factors within the firms themselves. If the problem is viewed and addressed from institutions supporting them point of view, then it could be regarded as the supply side philosophical lens/ thinking. But if the determinants of financial sustainability are viewed from within the firms themselves, this thinking is considered as a demand-side philosophical dimension of the problem.

Therefore, this empirical evidence falls under the demand side philosophical lens point of view, to examine how sunflower oil processing firms can attain their financial sustainability from what they possess internally. This poses a knowledge gap in small scale processing firms, particularly on sunflower oil sub-sector and thus calls for the study in determining the influence of firm-specific on the financial sustainability of sunflower oil processing firms in Tanzania since they are scantily found. It focused on firm-specific characteristics, which play a crucial role in explaining their performance since they are within the control of the firm. From the resource-based theory point of view; we consider the firm-specific factors as bundles of resources which are combined in the best way to create organisational capabilities for superior performance (Barney, 1991). That is, firm size, age, location, ownership type, education level, age and experience of the owner-manager, training of the employees and technical efficiency are considered as resources and capabilities

which can be combined in explaining the financial sustainability of sunflower oil processing firms in Tanzania.

Next is the matrix summary of related empirical literature reviewed to identify the relationship between the variables and methodologies used so as to refine the study gap as presented in Table 2.1.

Table 2.1: Matrix Summary of the Related Selected Empirical Literature Reviewed

S/N	Author & Year	Place	Theme	Variables Studied	Relationship Identified	Model Used
1	Marwa & Aziakpono (2015)	Tanzania	Financial Sustainability of Tanzanian Saving and Credit Cooperatives (SACCOS)	TE levels , Return on assets loan size, deposit mobilization, and cost per loan portfolio	Return on assets, deposit mobilization and cost per loan portfolio affect financial sustainability.	The linear Regression model, DEA
2	Mpeta, D (2015)	Tanzania	The effect of contract farming in production and Income of Sunflower farmers in Kongwa District in Central Agricultural zone	TE, Productivity, Income	Contract farming leads to an average increase in technical efficiency of a farmer and 7 sunflower oil processors and land productivity.	SFA, Propensity Score Matching (PSM)
3	Charoenrat et al. (2013)	Thailand	To determine the technical efficiency of Thai Manufacturing SMEs.	Two inputs: Capital, Labour One Output: Value-added FS F Firm age, size, Location, Ownership	Firm age, size, skilled labour, location, region, ownership, export and government assistance affects the technical efficiency of SMEs.	SFA and inefficient model
4	Ahmed and Ahmed (2013)	Bangladesh	To estimate the technical efficiency of the seafood processing	Two inputs: Capital, Labour One Output: Value-added Firm-specific factors Firm age, size, Location, ownership	Industry runs on an average of 80% technical efficiency firms" age and size are the main sources of inefficiency.	Stochastic Frontier Approach (SFA)
5	Kipesha, F (2013)	Tanzania	Technical efficiency of Microfinance Institutions in Tanzania for the period of 2009-2011	Time, money, raw materials, machine, labour,	Average efficient, input resources should be improved.	DEA
6	Charoenrat, T (2012)	Thailand	To estimated technical efficiency of Thai manufacturing SMEs a comparison between pre- and post-financial of 1997 (PhD Thesis)	Two inputs: Capital, Labour One Output: Value-added FSF Firm age, size, Location, ownership government assistance	Firm size, age skilled, location, ownership characteristics and export contribute to the technical efficiency of Thai manufacturing SMEs in both 1997 and 2007.	SFA, A two-stage DEA and Tobit model on cross-sectional data

S/N	Author & Year	Place	Theme	Variables Studied	Relationship Identified	Model Used
7	Zulfiqar, S(2012)	Pakistan	To analyse the Input-Output Relationship of SMEs in Pakistan	Eight Inputs: Capital, labour male and female, local and imported material, sales tax, excise duty and advertisement One Output: Productivity	Capital, male labour, local material, imported material, Sales Tax, Excise duty and advertisement have a positive and significant role in the productivity of SMEs.	Extended Cobb Douglas, OLS on the secondary , cross-section data on 48 SMEs
8	Tahir and Yusof (2011)	Malaysia	To estimate the technical and scale efficiency of 14 Malaysian public listed companies.	Two Inputs Total expenses Total assets One Output: Sales revenue.	Only one company was relatively efficient while the average overall technical efficiency varies from 13% to 50%.	DEA-CCR and DEA-BCC on 14 firms.
9	Faruq and David (2010)	Ghana	To estimate the technical efficiency of manufacturing firms in Ghana	Two Inputs: Capital, and Labour One Output: Productivity Firm-specific factors Firm size, age, foreign ownership	results reveal that Ghana manufacturing firms were significantly less efficient than their counterparts and affected by firm size, age and foreign ownership	Data Envelopm ent Analysis(DEA)
10	Nyamsogoro, D.G (2010)	Tanzania	Financial sustainability of Rural Microfinance Institutions in Tanzania.	Assets and liabilities management; portfolio quality; and human resource productivity	Operating efficiency, liquidity ratio, MFI Size, capital structure, interest rates, different types of lending	Multiple Linear regression models on panel data with Random and fixed effect.
11	Le and Harvie (2010)	Vietnam	To evaluate the technical efficiency performance of Vietnamese manufacturing SMEs.	Three Inputs: capital, labour, and material energy One Output: Value-added per year	The coefficient for labour and other intermediate inputs are significant. However, the capital input is insignificant, small and negative.	Translog SFA on cross-sectional data.
12	Liu et al. (2010)	China and Turkey	To determine the relative efficiency of manufacturing companies of China and Turkey.	Four Inputs # Employees, Inventory turnover, asset, Current Ratio. three Output Net income per employee, sales growth, income	Results indicate that Chinese manufacturing firms are more highly efficient than Turkish manufacturing firms.	DEA and canonical correlation analysis,

S/N	Author & Year	Place	Theme	Variables Studied	Relationship Identified	Model Used
13	Memon and Tahir (2010)	Pakistan	To determine a relative efficiency of manufacturing companies in Pakistan	Four inputs raw material, staff expenses, plant & machinery and Two output: Net sales, Earnings after tax	Many inefficient companies are under-utilising their staff expenses and plant and machinery.	DEA model under CRS and VRS was employed on 49 firms
14	Niringiye et al.(2010)	Uganda and Tanzania	To Investigate the relationship between technical efficiency and firm size in the manufacturing sector.	One firm-specific factor Firm size.	The result showed a negative association between a firm's size and technical efficiency in both countries.	SFA and OLS Method.
15	Radam,et ..al ,2008	Malaysian	To determine the technical efficiency of SMEs in Malaysia.	Four Inputs : Capital, labour, water and energy One Output: Value-added yearly	Malaysian SMEs are inefficient where Small enterprises were reported to be more technically efficient than the medium enterprise.	A stochastic frontier model (SFA)
16	Din et al.(2007)	Pakistan	To investigate the technical efficiency of the large scale manufacturing sector in Pakistan	Four inputs : Capital, labour, industrial cost and non-industrial cost One Output: contribution to GDP	Mean efficiency has improved from 0.23 in 1995-96 to 0.42 with only 2 industries maintaining their ranking.	DEA model under CRS and VRS on 101 industries
17	Wu et al. (2005)	Taiwan	To examine the performance of the retailing industry in Taiwan	Two inputs Total capital Employees Two outputs the productivity of staff, sales	On average almost half of the retailing companies were inefficient.	DEA-Based approach,
18	Admassie and Matambalya (2002)	Tanzania	To determine technical efficiency for SMEs in Tanzania.	Three Inputs: Capital, labour, material, One Output: Sales turnover, FSF Firm, age, size, skill of labour and, ICT	There is a high level of technical inefficiency TE from 41% food to 71% of textiles. firm age, firm size, and human capital development factors.	Cobb-Douglas SFA and OLS, cross sectional data on 95 SMEs.
19	Msuya & Ashimogo (2002)	Mtibwa Sugar estate-tz	To estimate the technical efficiency of sugarcane Production	Firm Age Education Experiences Origin of the farmer Farm area location	Results showed a significant positive relationship btwn age, education and experiences with TE.	Cobb-Douglas SFA on 140 samples.

2.5.4 Research GAP

Tanzania, like other developing countries, has limited empirical evidences on the determinants of technical efficiency and financial sustainability of agro-processing firms, particularly in the sunflower oil processing industry subsector. Little available literature on the area focused on other sectors other than Sunflower. For instance, the study by Mpetta (2015) focused on small holder sunflower farmers based in Dodoma and Singida regions, though included and measured the technical efficiency of few (of about 7) sunflower oil processing firms under contract farming. The findings of this study cannot be generalised to the whole sunflower oil processing population due to inadequate sample size considered. Also the study by Admassie and Matambalya (2002) estimated the technical efficiency of manufacturing SMEs in Tanzania considering food processing sub-sector in general. This also could not be generalised to all processing firms since efficiency is specific to firm group studied. However, the contribution of firm-specific factors on technical efficiency from other countries and sectors is not straightforward and certain. They reported mixed evidence on the established relationships with little attention on the reasons as to why some factors are important determinants of the firms' performance.

Moreover, technical efficiency of the firms varies with studies since efficiency is relative and specific to firm group and country (Ahmed *et al.*, 2010). Therefore, though technical efficiency has been studied for processing firms in developed countries, the applicability and generalisation of their findings are questionable to developing countries and sectors like sunflower oil processing firms in Tanzania due to differences in infrastructure, cultural, economic environment and digital divide contexts.

In addition, previous studies on manufacturing sectors did not link technical efficiency with the financial sustainability of the firm; they only concentrated on technical efficiency and their determinants. Thus the questions of whether technical efficiency is the determinant of the firms' financial sustainability remain relatively under-researched, especially in small scale agro-processing firms. Therefore this has been considered as a vital research gap to be addressed in this study where technical efficiency scores and staff productivity ratio has been used as independent variables

and proxy measures of the firm efficiency to explain the financial sustainability of sunflower oil processing firm's empirical setting.

On the other hand, little available literature on technical efficiency and financial sustainability from both developed and developing countries concentrated mainly on the Microfinance Institutions settings other than sunflower oil processing sub-sector. Microfinance is quite a different sector from agro-processing firms in terms of inputs, outputs and general operating characteristics thus their findings cannot be applicable to firms under the study. In addition, they used different methodologies in studying this relationship which has some weaknesses. For instance, the study by Nyamsogoro (2010) on the financial sustainability of rural microfinance institutions in Tanzania used only financial ratios in measuring the general microfinance efficiency and financial sustainability.

However, this approach has limitations that financial ratios can only be an appropriated method for the firms that manage a single input to generate a single output (Liu, 2010). Thus, the approach does not provide sufficient information when considering multiple inputs situation like in this study. Thus, Stochastic Frontier Analysis (SFA) was also used to measure technical efficiency as one of the advanced models to overcome this limitation. Staff productivity ratio was only used to determine the extent to which SOPF utilises their staff in maximising their output. Not only that but also its inclusion in the regression model was to control for staff productivity differences, so that we could ensure the internal validity of the influence of technical efficiency on the financial sustainability.

Also, the study by Kipesha (2013; 2014) as well as by Marwa and Aziakpono (2015) measured the relative efficiency of Microfinance Institutions in East Africa and in SACCOs respectively by employing Data Envelopment Approach (DEA). Although DEA model has been proven to be an essential tool due to its' main advantage of incorporating multiple inputs and outputs to calculate technical efficiency in various fields including manufacturing sector, hospitals, pharmaceutical companies, banks, education and transportation, it only measures relative efficiency across similar firms and therefore cannot be appropriate in measuring specific firms technical efficiency

levels. In addition, it is deterministic in nature that it associates any deviation from the frontier with inefficiency while ignoring measurement errors and other factors outside the control of the firm.

This is not the case in this study since SFA (parametric model) was used instead of DEA. Stochastic Frontier model decomposed the error term into inefficiency and measurement errors components to account for inefficiency factors within the firm and random shocks (errors) which are outside of the firms' control. It is more suitable for efficiency analysis in a developing country like Tanzania where there are serious issues with data quality and accuracy (Coelli 1995).

Whilst these studies are helpful in providing an aggregate picture of the efficiency of the firm and financial sustainability, a more refined theoretical and methodological approach for small scale sunflower oil processing firms was necessary. By devising new approaches and methodologies new knowledge can be discovered (Nyamsogoro, 2010).

In addition, the Resource-Based Theory of the firm has been criticized for assuming that firms' resources are always applied in the best way for the superior performance, ignoring how this is actually done. However, the proclamations of this theory have remained at the conceptual level in small scale agro-processing firm sub-sector as few empirical studies in place are based on large firms in developed countries and different subsectors of manufacturing as well. Therefore this offers inadequate knowledge about the postulation to small scale firms, particularly sunflower oil processing firms in developing countries like Tanzania. This empirical study employed quantitative analysis technique to measure the relationship among the variables of the study established through intergrading resource-based and profitability theories. These two theories were used to ground the study by establishing focus, limit and relationship among variables to address the problem at hand. They have been adopted from the reviewed literature but have been customized by integrating them and through the addition of more variables to add the explanatory power of the operational model. According to Zulfiqar (2012), additional or decrease of one variable in the model may change the results.

2.6 Conceptual Framework and Research Model

The conceptual model as indicated on Figure 2.1 (page 57) has been synthesized from theoretical and empirical literature review, indicating the relationship between the regressors and regressants variables based on the determinants of technical efficiency and financial sustainability of sunflower oil processing firms derived from both theoretical and empirical review.

The hypothesised relationships of the study reflecting the specific objectives as indicated on the conceptual framework have been established from Resource-Based Theory of the firm as the main theory, complemented by Profitability Theory. Thus, for objective one (1) and three (3), firm-specific factors which includes firm size, age, location, ownership type, training of employees, education level of the owner, total industrial experience and age of the owners are considered as the firm resources and capabilities that can be combined in a best way for superior performance measured in terms of Technical Efficiency and Financial Sustainability.

Likewise, for objective two (2), Technical Efficiency is one of the firm capabilities which can either reduce cost or increase income and thus lead to the financial sustainability of sunflower oil processing firms measured by Financial Self Sufficiency ratio (FSS). Besides, Profitability Theory has been used to ground the measurement of Financial Sustainability by considering profit as residual after covering the operating expenses of the firm from revenue generated internally. In a similar sense, efficiency can also mean either cost minimisation or revenue maximisation and hence profitability of the firm to imply financial sustainability.

The relationships indicated by arrows in the Conceptual Framework reflect specific objectives of the study that explain the causal- effect relationships of the major concepts of the study.

Prior to the analysis of this hypothesised relationship, technical efficiency of sunflower oil processing firms has been measured by technical efficiency levels estimated by using Stochastic Frontier Analysis(SFA) model where capital, labour and material were used as inputs while unit produced in litres was used as output. This input-output relationship has been grounded from production frontier function

based on Cobb-Douglas. Estimated technical efficiency levels for each specific firm forms a column of continuous variables to be regressed with firm-specific factors as their determinants. Since One Stage SFA model was used, there were simultaneously estimated under the Maximum Likelihood Estimate (MLE). Though Technical efficiency levels and staff productivity ratios are indicated at the same level as reflected in figure 2.1 (page 57) of Conceptual Framework, they have been treated differently according to what they measure.

Staff Productivity Ratio measures efficiency and not technical efficiency. It is measured as the ratio of unit processed per staff, to indicate the extent to which sunflower oil processing firms utilise their human resources while technical efficiency levels indicate the extent to which sunflower oil processing firms transform their input resources for enhanced financial sustainability respectively.

Therefore the study intended to control staff productivity by including it in the regression in order to establish a true effect of technical efficiency (measured by technical efficiency levels) on the financial sustainability of the firms under the study. Also its inclusion in objective two, added the explanatory power of the regression in predicting financial sustainability of the firms. It was not included in objective one due to the following reasons: Firstly, the relationship in objective one was meant to model a stochastic frontier production function under MLE which is a non-linear relationship. Secondly, it is not a measure of technical efficiency but rather a measure of efficiency in utilising staff in explaining the financial sustainability of the firms. Thirdly, its inclusion in objective one could result into endogeneity problem with firm size, since they both have a common key variable (firm size measured in terms of a number of employees). Thus, it worth for inclusion in objective two, to determine the role of both human capital and machines (capital) in enhancing the profitability of the firm for financial sustainability.

Noticeably, the study tested the direct relationship among variables as supported by theories and empirical literature underpinning the study. The relationships are based on specific objectives of the study as reflected pictorially on Figure 2.1

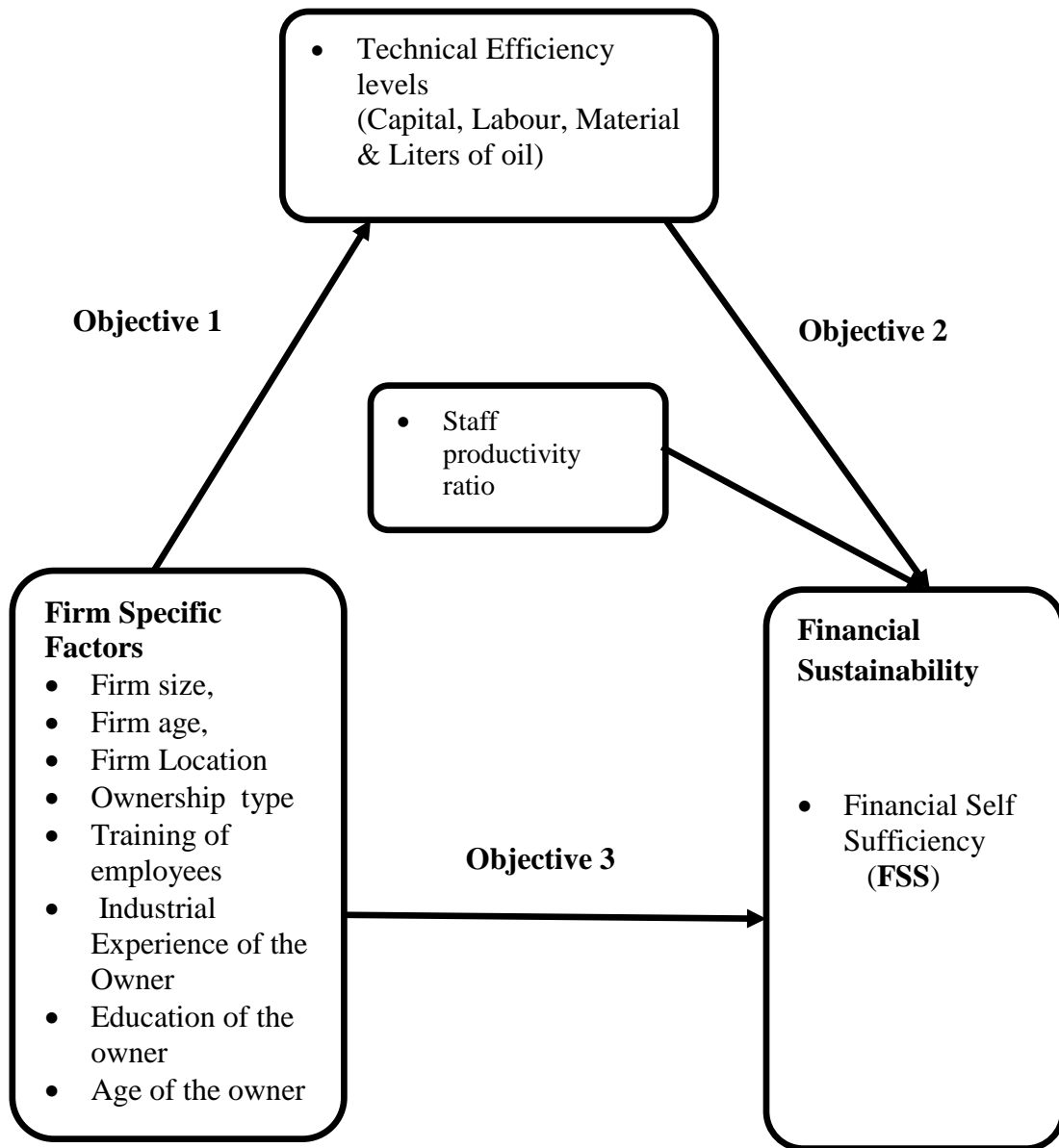


Figure 2.1: Conceptual Framework of the Study.

Source: Researcher Conception from Theoretical Empirical Literature Review (2015).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology used in this study. It covers the justification and description of the research design and approach, study area, study population, units of analysis, sample size and sampling techniques, types and sources of data, data collection methods, validity and reliability issues, ethical issues adhered, variables used and their measurements, data analysis methods based on specific objectives of the study.

3.2. Research Design and Approach

This study used a cross-sectional survey research design to provide a snapshot of the outcome and the characteristics associated with the sunflower oil processing firms at one specific point in time (Kothari, 2007). The design is more appropriate where there is a lack of secondary data like in this small scale sunflower oil processing firms, thus data was collected from the primary sources. Being a survey design it enables the researcher to collect a large amount of data from a sizeable population in a highly economical way (Saunders, Lewis & Thornhill, 2012).

Also, since cross-section design uses survey techniques to gather data, it is relatively inexpensive, accurate and takes up little time to conduct a study with detail information about the population for the analysis. Not only that but also the size and geographical dispersion of the sample units provide the rationale for adopting a survey method and in particular, a questionnaire-based survey since the target population is scattered across the selected regions.

In addition, this study is positioned under positivism research continuum to study the determinants of technical efficiency and financial sustainability of sunflower oil processing firms in Tanzania. It is mainly quantitative due to the nature of the study objectives as all three specific objectives tested the causal- effect relationship as detailed and reflected on the conceptual framework of the study in chapter two. This required quantitative data and models for objective analysis of the relationship

hypothesised to address the main research problem. Besides, Davis (2000) depicted that quantitative techniques can only measure particular characteristics through structured data collection procedure from a large representative sample so that the results can be anticipated to the entire population.

The quantitative approach used was supplemented by the qualitative follow up interview to some key informants for reasons to enhance quantitative results after the analysis. This was used as the means of triangulation of the findings through narrations of various reasons given by the respondents on the behaviour of the regressors toward the regressants revealed by the quantitative models. A detailed qualitative follow-up was necessary to understand the key reasons of the observed behaviour since most of the variables from the quantitative analysis revealed a non-linear relationship with theories and contrary to some literature as expected.

Moreover, Breedle (2002) proposed that a basic quantitative outcome can be reinforced through in-depth investigation using qualitative inputs and thus provide concise answers to the research proposition through the acquisition and analysis of information that can be combined from the surveyed data. This method also works as a part of data triangulation as it provided the contextual understanding of the quantitative outcomes. Similarly, Steckler, McElroy, Goodman, Bird, and McCormick (1992), Creswell and Clark (2011) and Creswell (2014) proposed this approach, where the qualitative approach is used to explain quantitative findings in the study i.e. Qualitative follow up is nested within a quantitative finding to enhance the findings of the study. The same applies to Saunders *et al.* (2012) for a more complete understanding of a research problem which allows for greater diversity of views to inform in order to enhance confidence in ensuing findings. Figure 3.1 below illustrates the integration of qualitative methods into quantitative methods in this study.

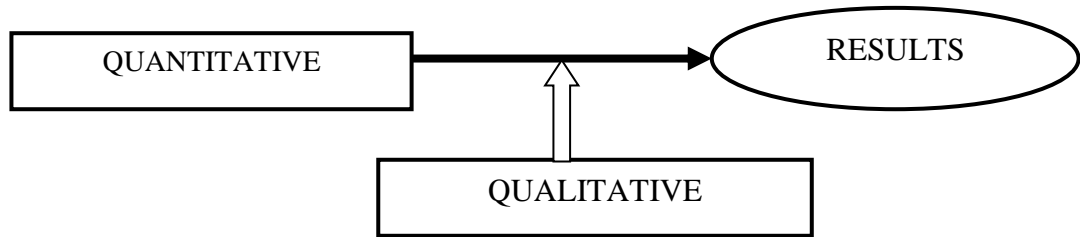


Figure 3.1: Qualitative Follow-up in Quantitative Findings.

Source: Steckler *et al.* (1992)

3.3 Study Area

Dodoma and Singida regions were selected as the study area to represent a significant central agricultural corridor and processing potential in Tanzania since sunflower seeds are largely grown and produced in these regions compared to others in the country (Tanzania Edible Oil Actors Association [TEOSA], 2012). The selection of Dodoma and Singida was also guided by a study done by Mpeta (2015) which involves sunflower seed producers and few processors who are under contract farming, revealed that sunflower oil processing firms (SOPFs) operate with a steadily declining technical efficiency. In the same way, small-scale sunflower oil processing sub-sector is the most common processing industry in these agricultural and processing zones in Tanzania, operating under capacity despite their big number and availability of materials (Ekblom, 2016). Moreover, cooking oil processing firms and in most cases, the sunflower oil, utilized only 29% of their installed capacity (Tisimia, 2014).

Therefore the area was purposely selected due to the predominance of sunflower oil processing plants along eastern-central to lake zones highway supplying oil even to the neighbouring countries like Rwanda and Burundi. Strolling along the streets of Dodoma urban and Singida will prove that there are multiple small scale processing plants scattered all over towns. Though the general environment favours the sunflower oil processing industries due the availability of raw materials in these central regions due to their semi-arid nature of the climate, the majority of sunflower oil processing firm operate at low technical efficiency levels and thus generating low income (Mpeta, 2015). This poor performance is what makes this setting particularly

interesting, and therefore research in this place should prove highly valuable to stakeholders to reveal the determinants of performance improvement. Also understanding the determinants of technical efficiency and financial sustainability can help to address productivity gains in output for improved technical efficiency and financial sustainability as well.

3.4 Study Population

3.4.1 Target Population and Unit of Analysis

The target population of this study was sunflower oil processing firms selected from Dodoma and Singida township/municipal areas and thus forms the unit of analysis. Most of the Sunflower oil processing firms are located in municipal or township areas due to the availability of electricity and improved infrastructure networks, mainly along Dar-salaam to Mwanza highway which is Kongwa, Kibaigwa, Panda mbili, Dodoma urban, Bahi, Manyoni, Ikungi, Singida urban, Mkalama/Ulemo and Kiomboi. The study population considered only small scale sunflower oil processing firms classified by their number of employees which ranges from 5 to 30 with capital ranging from 5 to 100 million Tsh. This falls within the small scale category of 5 to 49 employees and capital of 5 to 200 million Tsh. (URT, 2003).

Besides, Hair, Black, Babin, Anderson and Tatham (2006) suggested that the identified target population should align with study objectives and scope, access to the study cases, familiarity with the topic of interest, time-frame and resource availability.

Also, the units of inquiry of the study in sunflower oil processing firms under the study were mainly firm owners. They are the key players in business decision making and managing resources for the overall performance of the firm and therefore were considered as the main source of data required.

In addition, SIDO, CEZOSOPA, TFDA officials and some firm owners were used as key informants to supplement quantitative information for a deeper understanding on the research problem concerning the performance of sunflower oil processing industries and thus ease the discussion of the variables of the study. It was essential to select appropriate knowledgeable key informants who were directly engaged with

small scale industries and having great knowledge regarding the issues under discussion (Patton, 2002).

3.4.2 Sample Size

The sample size selection criterion was influenced by the following factors: First was to have representation for generalizability. Since the study sample was taken from largely grown sunflower seeds' area with many sunflower oil processing firms (SOPFs), the results can be generalised to all SOPF in the country due to similar firm operating characteristics. However, future studies can suggest otherwise. Secondly, variables under the study should be fulfilled and the model requirement expected to be used in analysing the data was also one of the criteria considered. Also, to make inference about the population known as generalisation, the study considered the rule of thumb in determining the desired sample size which proposes that the ratio of number of observation to the number of variables should never fall below 5:1 i.e. five observations are made for each independent variable in the variety (Hair *et al*, 2006).

The desired level is between 15 to 20 observations for each independent variable (ibid). Thus, this study had 9 independent variables and therefore resulted in 180 observations. Since the study intended to have a representative sample for generalisation of the findings, thus the whole sample of 250 small scale sunflower oil processing firms retrieved the list of food processing sampling frame of 667 obtained from TFDA and SIDO offices was intended for the survey. Among 250 firms intended for the main survey, 219 sunflower oil processing firms were reached which form observations of the study and considered adequate for analysis. This account to a response rate of 87.6%. Also, 9 key informants were included in the study for a detailed qualitative follow-up interview to understand the key reasons for the observed behaviour of the variables from the quantitative analysis as a means of triangulation. This includes six (6) sunflower oil firm owners where three (3) in each region were purposely selected among firm owners due to experiences and locations, One Central Zone Sunflower Oil Processors Association chairperson, SIDO and TFDA zonal officers respectively. Only three (3) SOPFs' owners from each region were considered adequate for the qualitative-follow-up interview because there were

no more emerging new issues raised during the interview with the key informants and thus saturation point.

3.5 Sampling Frame and Sampling Techniques

The sampling process relied on the Sampling Frame of 667 firms that was established from the updated list of registered food processing firms by Tanzania Food and Drugs Authority (TFDA), supplemented by the list from Small Industrial Development Organisation (SIDO) in the regions under the study and from the processors network association known as Central Zone Sunflower Oil Processors Association (CEZOSOPA) situated in Dodoma region. Thus 250 small scale sunflower oil processing firms were identified and considered in the study.

Since this is a quantitative study, both probability and non-probability sampling techniques were used in sample selection and area of the study respectively. Purposive sampling was used to select Singida and Dodoma regions due to the highest produced amount of sunflower seeds in this area which led to predominance of small scale sunflower oil processing firms, though producing low quantity of oil to cater for the need and thus generating low income. Also, the choice of districts in municipals and township centres of the central agricultural corridor area was purposely based on the availability of sunflower oil processing firms. The availability of many SOPFs is due to good infrastructure network for easy material and market accessibility of the processed products. However, simple random sampling was used to select sunflower oil processing firms in each region as they had equal chances of being selected due to similar operating characteristics.

Therefore, the sample was considered fairly adequate representing other sunflower oil agro-processing regions due to their similar firm orientation. The findings of this study are considered valid and reliable to be generalised beyond the study sample in the country since the sample is representative.

3.6. Data Types and Sources

The study used mainly quantitative data obtained from primary sources which were sunflower oil processing firms as the targeted population for the study, but supplemented by some qualitative follow-up for a deeper understanding of the

quantitative results. Most of the firms are individually owned and thus owner-managers of the firm were able to retrieve important data from their informal financial records like unit processed per day/monthly, materials used in bags, cost per bag and the unit price per litre of oil as they daily deal with the business transactions and interact with their customers. Data were mainly collected using structured questionnaires as the main tool with closed-ended questions whereby respondents were given alternative answers to select the appropriate ones and other figures/quantities to be provided in numerals. The questionnaires were filled with the aid of three (3) enumerators who were among of my fellow PhD candidates and were trained before the survey.

The quantitative data were collected for three consecutive processing years, 2013, 2014 and 2015 and treated as average production to form single production data. This is due to the lack of secondary data in small scale firms, thus the study relied on primary data sources in which quantitative data could have suffered from low precision from year to year. Using average data give more accurate data with less deviation from the actual data. This was supplemented by qualitative data which were sequentially collected to enhance the quantitative findings. A triangulation approach was considered important to ensure consistency and reliability of the information provided by the respondents.

3.7 Data Collection Methods and Tools

3.7.1 Surveyed Questionnaire

Primary quantitative data were collected through structured questionnaires where 219 firms were considered in the analysis instead of 250 sunflower oil processing firms intended for the main survey in the regions under the study. A questionnaire as the tool for data collection was selected due to its ability to cover a large area within a short period of time with no bias between the researcher and the respondent (Komba, 2006). It is also a major tool in survey method like this which provides an efficient way of collecting data from a large sample prior to quantitative analysis (Nyamsogoro, 2010). In addition, questionnaire analysis enabled the researcher to explain cause and effects relationships between variables in explanatory studies like this (Saunders *et al.*, 2012).

To guarantee that the validity of the tools and reliability of study results were maintained, the main data collection process was preceded by four important stages of questionnaire development, pilot study and pre-testing for refinement of the tool before the main survey.

Step 1: Questionnaire Design

Based on the specific objectives of the study developed, a structured questionnaire was designed where each of the questions was used as a source of data for study variables and was adapted from previous similar studies but with modifications to context, adjustment to ensure validity and clarity of expression for the interviewees. Some new measurements of variables were also developed from relevant literature. The questionnaire was validated through pre-testing, pilot study and refinement before conducting the main survey.

Step 2: Pre-testing of the Questionnaire

The objective of pre-testing was to contextualize the instruments and also to ensure reliability of the questions. This was done in order to test all the aspects of the questionnaire including contents, wording, sequence, format and layout, ambiguities and instructions given to the participants. Experts in sunflower sub-sector, my fellow PhD candidates and some academicians were invited to pre-test the questionnaire. During the questionnaires pre-testing phase, these professionals and experts scrutinized the questionnaire from different perspectives and provided their feedback which enhanced the content validity of the questionnaire.

Step 3: Pilot Study

A pilot test was also undertaken administering a mini sample survey to test if the tool was ready for a wide circulation for the final data collection. The instrument was therefore piloted to 10 sunflower oil processing firms in Dodoma region conveniently selected to check the relevance of the questions before the main survey.

The pilot study enabled us to rephrase some of the items in the questionnaire in order to change the sequencing of questions in cases when respondents were not comfortable and with ambiguities. Therefore, the questionnaire was again revised to incorporate respondents' suggestions to ensure a valid and reliable questionnaire.

Step 4: Questionnaire Refinement

In this stage, the questionnaire was modified in accordance with feedback received from the respondents during pre-testing and piloting to ensure that it was ready for a wide circulation for the final data collection. Therefore the tentative instrument was refined through a careful revision of the questionnaire. The changes, adjustments and modifications adopted during this stage resulted in the final questionnaire for the main study survey.

3.7.2 Interviews

The interview guide was constructed from the preliminary quantitative result and thus used for the qualitative follow-up nested within a quantitative finding in order to understand a research problem more completely (Saunders et al., 2012).

The results from quantitative data from each objective were used as a base for preparing interview questions probed to the owner and other key informants aimed to gather information to compliment on quantitative results. In this, various reasons were developed from an in-depth interview on the behaviour relationship of the variables observed after the analysis of quantitative data. This approach is further guided by Creswell *et al.* (2003) that a researcher should first collect and analyse the quantitative data, thereafter, qualitative data are collected and their analysis of qualitative data refine and explain those quantitative results through exploring participants' views in more depth.

A total of 9 interviews were conducted, each with duration of around 50 minutes. This was deemed to be an appropriate length since it allowed the researcher to probe and make some follow-up into each variable of interest without exhausting the respondent. The interviews with firm owners were conducted at the processing plants where the business is located for more reliable justifications of the reasons for the behaviour practices. The key informants were interviewed in their respective offices. These were CEZOSOPA chairperson in Dodoma region, who is also among the owner owning sunflower oil processing firm, two SIDO officers, and one in Dodoma and in Singida region respectively. Finally, three owners from each region were purposely selected for a detailed qualitative follow-up in understanding the key drivers of the observed behaviour on quantitative results.

There are no precise guides to the number of respondents to be included in a qualitative study. Patton (1990) viewed that literature does not provide an exact number or range of cases that could serve as guidelines for researchers. Therefore the decision of sample size is left to the researcher' to decide. However, in order to get quality data, identification of the participants who possess three basic qualities is crucial: (i) the expertise, knowledge and experience in the sector that meet the conceptual and informational requirements of the study; (ii) the ability to articulate their experiences and (iii) their availability/accessibility to share their experiences. In this case, the key informants purposely selected were the individuals responsible for making decisions on matters related to sunflower oil processing sub-sector.

3.8 Validity and Reliability of Data

The quality of research instruments and the consistency of results from different respondents were considered to ensure the quality of the findings. This was achieved through construct, internal and external validity and hence ensuring reliability.

In construct validity, the study pre-tested the survey instrument before a comprehensive data collection phase. This was carried out to ensure that the instrument measures what was intended to measure and if data were consistent over time and could fit in different settings. This approach is supported by scholars such as Kothari (2007) that prior to data collection; the designed instruments such as questionnaires should be subjected to pre-testing to ensure the quality of the findings.

Also, the research assistants were trained in data collection techniques before data collection exercise as well were involved in pre-testing the study instrument. They were taken through the do's and don'ts of data collection and then made to practice them in the pilot study.

Besides, the triangulation method was used in this study as a validity procedure in which quantitative findings were supplemented by qualitative follow-up interview after quantitative analysis in order to enhance the reliability of the findings. The idea of combining methods has been advocated by Webb et al. (1966) by imposing the proposition that *"once a proposition has been confirmed by two or more independent measurement processes, the uncertainty of its interpretation is greatly reduced"*. This

has been supported by Patton (2001) who pointed out the importance of using a triangulation method, by stating that “triangulation strengthens a study by combining methods”

In addition, the established operationalization of the variables studied in the study were drawn from previous researches and thus have been proven to be reliable.

Furthermore, to ensure internal validity, the causal-effect relationship of the study was established from the theoretical framework based on previous studies to ensure that the assertions made in this study are supported by evidence. Also the qualitative follow-up interview used captured the lived experience of the respondents on the reasons to supplement quantitative results from causal effect revealed.

In line with this, before proceeding with analysis, data screening was done for data quality audit and control by checking if data were correctly entered, checking for missing values, outliers, normality and other model specification requirements were considered. This was done by using parametric and non- parametric tests like frequency tables, histogram, skewness and kurtosis test as Q-Q plot and Kolmogorov Smirnov and Wilk tests.

Moreover, to ensure external validity, the regions chosen as the study area reflect the true picture of sunflower oil processing firms in Tanzania. They represent the central sunflower agricultural corridor where sunflower is largely grown leading to a predominance of sunflower oil processing firms compared to other regions but having similar operating characteristics thus guarantee the findings to be generalised beyond the study sample.

3.9 Ethical Issues

The study adhered to ethical standards and code of ethics to ensure that participants' rights were protected and that the findings are as trustworthy as possible. Mainly, the following ethical standards were observed during the research process from data collection, analysis to report writing stages.

- Voluntary nature of the participants was adhered where the respondents were not forced to be involved in the study interview.

- Participants were clearly informed of the purpose, procedures and the importance of being involved in the study.
- The confidentiality of the results was considered and assured to the participants where the information gathered was only for research purpose and not otherwise.
- Written permission was obtained from TFDA, CEZOSOPA and SIDO offices to the areas where data was collected. To facilitate the exercise; the researcher obtained the introduction letter from the Directorate of Research and Postgraduate Studies (DRPS) at Mzumbe University.
- The owner-managers of the firm in the present study were not compensated for their participation. But, free drinks and bites were provided to them during the interview. This is to show kindness to the respondent for giving out their time to fill out the questionnaire.
- Respondents (sunflower processing firms) were randomly selected as all had equal chances to participate in the study due to their nature.
- Appropriate data collection tools and statistical analysis techniques were used.
- Efforts were made and care was taken to avoid intentional *misrepresentation* and *deception* of the findings: reporting only the findings obtained (without exaggerations), avoiding results suppression (self-censoring) by reporting all the findings.
- All reviewed literature and sources of empirical evidence cited are explicitly acknowledged.

3.10 Operationalization of the Study Variables and Their Expected Effects on the Dependent Variable

Measurements of variables involved in the study and their expected theoretical effect on the dependent variable together with their reviewed literature where the variables have been used are indicated in Table 3. 1.

Table 3.1: Operationalization of the Study Variables

S/N	Variable	Definition and measurement	Expected sign on TE	Comments	Reference(where applicable)
	Constant	Magnitude	+	Large size means the large effect	
1	Capital (input)	The continuous variable measured as the proxy value of an initial investment cost which includes machinery, premises and vehicles	+	The positive parameter, means high contribution on the output	Le and Harvie(2010), Zulfiqar (2012), Charoenrat (2012; 2013), Ahmed and Ahmed (2013);
2	Labour cost (input)	The continuous variable measured in terms of the total average daily wages multiplied by the number of employees	-	Reduced labour cost means a high contribution to the output	Radam <i>et al.</i> (2008), Faruq and David(2010) Charoenrat (2012), Charoenrat <i>et al.</i> (2013),
3	Materials costs	The continuous variable measured as the unit cost of raw materials used	-	Reduced material costs mean a high contribution to output vice versa	Admassie and Matambalya(2002), Din <i>et al.</i> (2007),
4	Unit produced	Continuous measured in quantity of Litres processed per year	+	More units produced means enhanced efficiency.	Zulfiqar, S(2012)
	Firm-Specific Factors				
1	Firm Size	The continuous variable measured by the number of employees in the firm.	+	Larger firms mean a big number of employees to maximise output hence high efficiency	Le and Harvie (2010), Faruq and David (2010), Niringiye <i>et al.</i> (2010), Charoenrat (2012), Ahmed and Ahmed (2013), Charoenrat <i>et al.</i> (2013).
2	Firm age	Continuous variable in the number of years of the firm in operation since the establishment	+	Old age means more experiences and thus enhance performance	Admassie and Matambalya (2002), Radam <i>et al.</i> (2008), Le and Harvie (2010), Niringiye <i>et al.</i> (2010), Charoenrat <i>et al.</i> (2013).
3	Firm location	Dummy variable that was assigned numbers according to regions. 1 for Singida and 0 for Dodoma	+	Firms located in strategic areas are expected to be efficient compared to other location.	Niringiye <i>et al.</i> (2010), Charoenrat (2012), Ahmed and Ahmed (2013), Charoenrat <i>et al.</i> (2013),
4	Ownership type	Dummy variable measured as types of business ownership 1 sole proprietor and 0 partnership	+	One type of the firm ownership is expected to enhance efficiency than	Radam <i>et al.</i> (2008), Le and Harvie (2010), Faruq and David (2010), Charoenrat (2012), Ahmed and

S/N	Variable	Definition and measurement	Expected sign on TE	Comments	Reference(where applicable)
5	Training of employees	Dummy variable measured as 1 for trained and 0 for untrained employees	+	other types Industrial trained employees improve TE compared to those untrained	Ahmed (2013), Admassie and Matambalya(2002), Msuya and Ashimogo(2002)
6	Industrial experience of the owner	Continuous variable in the number of years of accumulated industrial experience of the owner	+	Accumulated experience enhance efficiency	Charoenrat (2012), Ahmed and Ahmed (2013),
7	Years of education of the owner	the continuous variable measured by the number of schooling years of the owner	+	More years means high education levels to enhance technical efficiency	Admassie and Matambalya(2002), Charoenrat <i>et al.</i> (2013).
8	Age of the owner	Continuous variable, measured in years.	+	Older is more experienced, through learning by doing hence more efficiency	Niringiye et al,(2010); Charoenrat et al. (2013); Marwa & Aziakpono(2015)
Technical Efficiency Indicators.			Expected sign on FSS		
8	Technical Efficiency levels	A continuous variable with the value between 0 and 1 estimated from SFA for each firm.	+	High efficiency level enhances the financial sustainability of the firm.	Marwa & Aziakpono (2015).
9	Staff Productivity Ratio	Continuous variable, measured as the ratio of unit produced per staff.	+	More units produced per staff means efficiency utilisation of staff for high profitability.	Nyamsogoro(2010); Thela (2012)
Financial Sustainability indicator					
(Dependent Variable)					
10	Financial Self Sufficient (FSS)	Continuous variable, a measure of financial sustainability as the ratio of Revenue/Expenses.	(depended variable)	Ratio >1 means Financially sustainable Ratio <1 means not financially sustainable.	Nyamsogoro (2010); Marwa & Aziakpono (2015).

3.11. Data Processing and Analysis

A total of 250 questionnaires were distributed to the study area, out of which 219 were complete and thus were used for analysis giving a response rate of 88%. According to Mugenda and Mugenda, (1999), 50% response rate is adequate, 60% good and above 70% rated very good. Based on this contention, the response rate for this study was considered to be very good as most of the intended sample population was surveyed to have a reliable representation for generalisation. This high response rate can be attributed to the data collection procedures, where the researcher pre-notified the potential participants (owner-managers) of the intended survey as well as self-administering the questionnaire with an assistance of three (3) trained research assistants.

The study used quantitative methods of data analysis in order to address the main research question. However, a qualitative follow-up interview was also made to seek a deep understanding of the reasons to justify the quantitative results in their context. A qualitative approach seeks a deep understanding of factors and how individual conceives their context. According to Hsieh and Shannon (2005), a qualitative research approach, cannot generate statistical evidence based on probability sampling, but is able to provide a deeper insight of the research problem by systematically describing the meaning of qualitative material and identifying themes.

3.11.1 Quantitative Data Analysis

Quantitative data collected through structured questionnaires were summarized, coded and analysed by using various Quantitative modes like Stochastic Frontier Analysis (SFA), Multiple Linear Regression Analysis (MLRA) and Hierarchical Multiple Linear Regression Analysis (HMLRA) according to the requirement of each specific objective as explained in Table 3.2.

The analysis was done with the help of the Statistical Package for Social Sciences (SPSS) Version 21 IBM and STATA Software Version 12. SPSS software was specifically used in descriptive statistics and in running Standard and Hierarchical Multiple Linear Regression Analysis models for the determinants of financial sustainability of sunflower oil processing firms in objective two and three respectively. STATA Software was used to model stochastic production frontier

function with inefficiency model in objective one for simultaneous estimate of technical efficiency levels and their determinants. This analysis could not be possible with the use of SPSS software due to its inability to model frontier functions. Moreover, descriptive data were analysed with the aim of describing and gaining an understanding of various sample characteristics (Hair *et al.*, 2006). Thus various descriptive statistics such as frequency distribution, chi-square and cross-tabulations were used to examine the data pattern. This helped to provide a useful historical account of a return behaviour of each variable used in this study before including the variable to respective models used in each objective. It also helped to gain insights into the general characteristics of the sample and other useful information about the relationship between the variables.

The goodness-of-fit of the models used were measured by the Chi-square test, Log-likelihood values as the basis of inference and other specific model assumptions like Normality, Linearity, Homoscedasticity and Multicollinearity tests for Multiple Linear Regression Analysis were also checked as indicated in Chapter 4 (Schmidt, 2007; Sinchic, Benson, & McClave, 2005).

Moreover, the following criteria were also employed to verify the goodness-of-fit of the model used in each study objective: (i) statistical tests of significance (p-tests) (ii) inspection of the signs of the estimated parameters to verify whether they agreed with expectations (iii) values of the standard errors of the variables included in the model and (iv) whether the empirical model was correctly predicted. On the basis of these criteria, the empirical models used in this study were found to be appropriate in determining the main factors that significantly influence the technical efficiency and financial sustainability of Sunflower oil processing firms. This is partly because the standard errors of all variables included in the models were found to be small and most of the estimated coefficients of some hypothesised variables had the expected logical signs (Linsley, 2005).

In addition, Hair *et al.* (2006) reported that a significance level represents the probability that the researcher is willing to accept the estimated coefficient classified as different from zero when it is actually zero. Since the analysis is based on a sample

of the population rather than the entire population, therefore setting the levels of significance to accept the estimated parameter coefficients of the predictor variables from the results of the predicted model on each specific objective was deemed essential and pertinent.

The significance level test ascertains whether the impact represented by the coefficients can be generalised and applied to other samples from this population. It ranges from 0.01 to 0.10, though decreasing the significant level to a lower value such as 0.01 but it allows for a lower chance of being wrong and the statistical test becomes more demanding. Similarly, increasing the significance level to a higher value such as 0.10 allows for a larger chance of being wrong though makes it easier to uncover the significance (Ibid). To avoid both risks associated with either of the choices, most of the previous studies widely used 0.05 (or 5%) level of significance, which was also used in this study.

Specifically, each specific objective of the study was analysed using a different model of analysis depending on the requirement and the nature of the dependent variables as indicated in the summary Table 3.2.

Table 3.2: Summary Table of the Models Used in each Specific Objective

Objective	The model used in the analysis	Reasons
The influence of firm-specific factors on Technical Efficiency of sunflower oil processing firms	One stage SFA under MLE Based on Cobb Douglass Production Function	For a simultaneous estimate of both parameters of the stochastic production frontier function and those of the inefficiency model.
The influences of technical efficiency on the financial sustainability of sunflower oil processing firms.	Multiple Linear Regression Analysis	A continuous dependent variable with more than one continuous independent variables.
The influence of firm-specific factors on the financial sustainability of sunflower oil processing firms.	Hierarchical Multiple Linear Regression Analysis	Proper Methodology for addressing the control variable effect of TE on financial sustainability so that to establish the true effect of firm-specific factors on FS when TE is controlled.

Source: Researcher, 2016

3.11.1.1 SFA Model Specification

This model was used in objective one to simultaneously estimate technical efficiency levels and their determinants. Specifically, the objective aimed to determine the influence of firm-specific factors on the technical efficiency of sunflower oil processing firms in Tanzania. But prior to the determinants, the preliminary analysis of estimating technical efficiency levels (the dependent variable) was vital. This required a particular functional form of the production function to be imposed for a reliable estimate. Here, several methods like Ordinary Least Squares (OLS) regression, Stochastic Frontier Analysis (SFA) using Maximum Likelihood Estimate approach (MLE), Data Envelopment Analysis (DEA) and Total Factor Productivity (TFP) indices using Price-Based Index Numbers (PINs) are commonly used techniques for the estimation of technical efficiency levels in various firms and sectors as indicated on the literature part in Chapter 2.

The OLS methods are well known and easy to implement, however, it has been documented to provide information about the average (mean) performance of the firm rather than frontier performance that determine maximum possible production given a set of inputs. OLS fit a function through the centre of the data by assuming that all observed firms are efficient and that all deviations from the estimated line are due to noise (factors outside the control of the firm). This cannot hold true for sunflower oil processing firms due to their nature of small scale industry where accuracy and quality of data are always uncertain.

On the other hand, DEA is a non- parametric method which does not impose a functional form on the production function and measures relative efficiency of homogeneous unity. Besides, DEA method is non-stochastic and does not capture random noise such as strikes or measurement error and thus any deviation from the estimated frontier is associated with inefficiency. With DEA also it is not possible to conduct statistical tests of the hypothesis regarding the inefficiencies effects (Ahmed, & Ahmed, 2013).

Likewise, PIN methods like Total Factor Productivity (TFP) index suffer from the problem that it requires access to the reliable price information from the respective

firms which is difficult to find in Sunflower oil processing firms as they do not prepare financial reports and thus rely on memorized information.

Contrary to OLS, DEA and PIN methods, SFA is a parametric frontiers technique that addresses the latter problems by imposing a functional form on the production function and make assumptions about the data, specifying a composed error-term, with one part capturing data noise and the other the inefficiency component. Unlike the other parametric frontier like deterministic frontiers which assume that all the deviations from the frontier are a result of firms' inefficiency, SFA assume that part of the deviations from the frontier is due to random events which reflect measurement errors and statistical noise and the other part being due to inefficiency which might be due to firm-specific factors as proposed by Battese (1992) and Coelli et al. (1998) respectively.

The SFA model preferred by this study uses Maximum Likelihood Estimate principle which chooses those values of the parameters of the likelihood function that maximise the probability of observing the sample values of the random variables. Usually, it is recommended for large samples like this because it is handy, applicable to most models, different types of data and produces the most precise estimates.

Moreover, it allows us to perform hypotheses test concerning the existence of inefficiencies, the structure of the production technology and economies of scale. Since SFA was deemed appropriate, a range of functional forms for the production function frontier is available; with the most frequently used being Cobb-Douglas production functions and the alternative production functions being the translog production functions, which is a second-order log-linear form with all cross-terms included and thus can be given by:

$$\ln y_i = \beta_0 + \sum_{i=1}^3 \beta_i \ln x_i + \frac{1}{2} \sum_{i=1}^3 \beta_{ii} \ln x_i^2 + \sum_{i=1}^3 \sum_{j=1}^3 -\beta_{ij} \ln x_i \ln x_j + \varepsilon \quad (1)$$

And the Cobb-Douglas Production Function is given by:

$$\ln y_i = \beta_0 + \sum_{i=1}^3 \beta_i \ln x_i + \varepsilon_i \quad (2)$$

Where y_i represent the quantity of output, β_0 is the constant, β_i , β_{ii} , β_{ij} are the production function parameters to be estimated for each input. As can be seen, the Cobb-Douglas is a special case of the translog production function where all $b_{i,k} = 0$ and composed error (ε_i) representing v_i and u_i .

Coelli, (1992) argued that the selection of the functional form to represent the data and the distributional term of the error depends on imposition of restrictions and Log likelihood test are conducted to select the appropriateness of the model to represent the data where the Null hypothesis forms the restricted version and alternative is the unrestricted form; the results are compared with Critical values from Kodde and Palm (1996) for valid and reliable model decision.

Thus, a series of hypothesis tests have been conducted in this study as indicated on chapter 4 (section 4.3.1.1) to test the specification of the production frontier model that fit the data well whether Cobb-Douglas or Translog, the distribution of one-sided error term (U) whether exponential or half normal and presence or absence of inefficiency in the model. These were tested through imposing restrictions, which form the null hypothesis and unrestricted model became an alternative hypothesis by using the Generalised Likelihood Ratio statistic (LR) to determine the significance of the restriction. The generalised likelihood ratio statistic also known as the LR test is given by:

$$\lambda = -2[\ln\{L(H_0)\} - \ln\{L(H_1)\}] \quad (3)$$

Where $\ln\{L(H_0)\}$ and $\ln\{L(H_1)\}$ are the values of the log-likelihood function under the null (H_0) and alternative (H_1) hypotheses.

The restrictions form the basis of the null hypothesis, with the unrestricted model being the alternative hypothesis. The value of the Likelihood Ratio test has a chi-square distribution with the degrees of freedom given by the number of restrictions imposed.

These have been compared with the critical value table published in Kodde and Palm (1986) where restrictions were representing the ‘degrees of freedom’ in the model. Standard statistical practice is to compare the results at the five per cent level of

significance, which allows for less than a five per cent probability that the results are false (i.e. a 95 per cent probability that the relationship is valid). In this case, either of the models can satisfy the requirements of the test by either having the values which are less than the critical values which suggests that Cobb -Douglas function to fit the data or Translog function by having Likelihood Ratio (LR) value greater than the critical tabulated chi-square table value obtained from Kodde and Palm (1986).

The LR values computed in this study as shown on Chapter 4 (Table 4.11) were less than the critical values from Kodde and Palm table (1986) which suggests that Cobb Douglas function fit the data well.

Thus, the stochastic frontier model based on Cobb Douglas function decomposes the error term into a two-sided random error that captures both the random effects outside the control of the firm (measurement errors and statistical noise) and the one-sided inefficiency component under the control of the specific firm can be defined as:

$$Y_i = \exp(x_i\beta + V_i - U_i) \quad (4)$$

$$E_i = \exp(-U_i) = \exp(-Z_i\delta - W_i) \quad (5)$$

Y_i in the operational model (4) represents the output of the i th firm, X_i is a vector of productive inputs and indicator variables for the i th firm. The parameter vectors β and δ are estimated together with the variance parameters.

Technical efficiency is measured using the conditional expectation given the composed error term $E_i = \exp(-U_i)$ in the operational model (5).

The first component (V_i), in the operational model (4) accounts for random events. The second component U_i is a non-negative random variable which captures unobservable inefficiency effects relative to the stochastic frontier. The random component, v is assumed to be independently and identically distributed with $N(0, \delta_v^2)$. The technical inefficiency component, u , is assumed to follow an arbitrary distributional form, in this case, a half-normal distribution $N(Z_i\delta, \delta_u^2)$. The inefficiency model random component is not identically distributed nor is it required to be non-negative (Battese and Coelli, 1995).

Furthermore, the reviewed literature suggested two methodological approaches to analyzing the sources of technical efficiency of any business firm based on stochastic production functions. The first approach is the two-stage estimation procedure where the stochastic production function is first estimated, then from which efficiency scores are derived. In the second stage, the derived efficiency scores are regressed on explanatory variables using either Ordinary Least Square methods or Tobit regression. However, this approach has been criticized on grounds that the firm's knowledge of its level of technical inefficiency affects its input choices; hence inefficiency may be dependent on the explanatory variables (Kumbhakar, Ghosh, & McGuckin, 1991; Battese & Coelli, 1995).

The second approach advocates a one stage simultaneous estimation approach as in Battese and Coelli (1995), in which the inefficiency effects are expressed as an explicit function of a vector of firm-specific variables. In this, the parameters of the frontier production function are simultaneously estimated with those of an inefficiency model in which the technical inefficiency effects are specified as a function of other variables. One Stage simultaneous approach is executed in STATA software where the basic parameters of the production frontier and coefficients for the technical inefficiency model are both provided. Therefore this study followed Battese (1992) and Battese and Coelli (1995) models to specify a stochastic frontier production function of the firm. Unlike other approaches, the stochastic frontier approach introduces a disturbance term representing noise, measurement errors and exogenous shocks beyond the control of the firm like weather, where none of the other approaches makes any accommodation for such phenomena.

This empirical analysis is based on the estimation of a Cobb-Douglas Stochastic production function frontier with Output Oriented Approach under the Maximum Likelihood Estimate (MLE) to indicate the maximum possible output obtained from a given amount of inputs. The approach is preferred to other techniques in measuring technical efficiency of sunflower oil processing firms because it considers both factors beyond the control of the firm like measurement errors and firm-specific factors that may affect technical inefficiency. Also its ability to provide firm-specific

estimates of technical efficiency. Importantly, the model is more suitable for efficiency analysis in a developing country setting where there are serious issues with data quality and accuracy (Coelli, 1995).

The parameters of both stochastic frontier production function representing the technical efficiency levels and technical inefficiency effect model for respective firms are simultaneously estimated under Maximum Likelihood Estimate Method following the Kumbhakar *et al.* (1991); Battese and Coelli (1995). The technique is adopted in this study due to its ability to decompose error term into two parts one being symmetric which captures stochastic effects which are measurement errors and other random shocks outside the control of the firm and another being technical inefficiency factors within the control of the firm.

Therefore the operational stochastic frontier model (6) below is specified under a Cobb- Douglas production function which was justified to fit the data well against translog as indicated on Chapter 4 (section 4. 3.1.1). Also the model is widely applied in the measurement of firm efficiency in both developed and developing countries.

$$\ln Y_i = \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + V_i - U_i \quad (6)$$

Where Y_i = Total output of sunflower oil (Litters)

X_1 = total Capital invested (Tsh.)

X_2 = Total Materials cost used (Tsh.)

X_3 = Labour cost used (Tsh.)

V_i = random error term with normal distribution $N(0, \sigma^2)$

U_i = a non- negative random variable called technical inefficiency associated with the factors within processing firm

\ln = the natural logarithm

$\beta_0 - \beta_1$ = coefficients to be estimated

The operational model specified in equation (6) was estimated under Maximum likelihood Estimate method using STATA Software version 12, in which both the stochastic frontier model expressed in equation (6) and the inefficiency effect model specified on equation (7) below were estimated simultaneously to disclose technical

efficiency levels and their determinants. Equation (7) below indicates the operational model in which specified firm-specific factors were regressed against the outcome contains the error term (U_i) from equation (6). The inefficiency term (U_i) is expressed as a function of firm-specific factors as specified in the model below.

$$U_i = \alpha_0 + \alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + \alpha_6 Z_6 + \alpha_7 Z_7 + \alpha_8 Z_8 \quad (7)$$

Where U_i = the inefficiency error term (as from equation 6)

Z_1 = Firm age measured in number of years since the establishment

Z_2 = Firm size measured in number of employees

Z_3 = Ownership type dummy whether sole proprietor (1) or (0) for partnership

Z_4 = Experience measured in years (prior and current work experience)

Z_5 = Years of education of the owner

Z_6 = Location of the firm dummy whether in Singida (1) or (0) for Dodoma

Z_7 = Training of employees whether trained (1) or (0) not trained

Z_8 = Age of the owner in years

α_0 -8 = estimated inefficiency model coefficients.

Therefore the use of the Maximum Likelihood Estimate (MLE) method accomplishes the described procedure in a single stage.

This is contrary to early approaches which estimated the variation in inefficiency through a two-step procedure, which consists of first estimating the inefficiency component of the error term and then the exogenous variables are regressed against it in the second stage. The problem with this procedure is that in the first stage inefficiencies are assumed to be identically distributed, however, in the second stage this assumption is contradicted as inefficiencies are given a functional form. Furthermore, in the first stage the expected value of the inefficiency is a constant, but in the second stage, it is assumed to vary with the exogenous variables (Coelli, Battese & Rao, 1998).

So the inclusion of exogenous variables to recent approaches has brought important changes to the early ones as today's frontier programs can estimate the variation in inefficiency with a simultaneous estimation approach using Maximum Likelihood Estimate(MLE) technique as employed in this study.

The analysis in objective one was not extended to include staff productivity ratio (from the traditional ratio approach) since it not a measure of technical efficiency, but rather, a measure of the efficiency of the firm as it indicates how sunflower oil processing firms utilise their staff in maximising outputs for higher financial performance. It was thus included in objective two, as one of the determinants of financial sustainability as it is explained in the following section.

Noticeably, though the framework of the Research Model in Chapter Two would suggest the use of Structural Equation Modelling (SEM) to test both direct and indirect effect of firm specific factors on financial sustainability, this could not hold valid and relevant model of analysis for this relationship as depicted in objective two and three due to the following arguments:

Firstly, lack of strong theoretical and empirical justification on the existence of indirect effect of firm specific factors on financial sustainability through technical efficiency which would require the use of SEM. Existing literatures (Charoenrat, 2012; Ahmed & Ahmed, 2013; Mushi, 2016) in manufacturing firms and in other sectors like MFI (Marwa & Aziakpono, 2015) together with theories used in particular, Resource- Based and Profitability Theories only suggest the direct effect of firm specific factors to TE and FS respectively. Also those which linked TE with FS (Nyamsogoro, 2010; Kipasha, 2013; Marwa & Aziakpono, 2015) to mention the few.

Secondly, the relationship in objective one required the use of Stochastic Frontier Analysis (SFA) with inefficiency effect model to model a production frontier function, which simultaneously estimated technical efficiency levels of the firms and their determinants (Kumbhakar *et al.*, 1991). Thus forms a conversely non- linear relationship as it involves iterations which could not suite for SEM. This has been supported by Hair (2006) that Structural Equation Modelling (SEM) is a method for representing, estimating and testing a theoretical network of (mostly) linear complex relations between variables, where those variables may be either observable or directly unobservable.

Also, Ho (2006) stated that SEM is a multivariate technique that can best allow the analyst to examine the series of dependence relationships between exogenous and

endogenous variables simultaneously. In addition, it seeks to represent hypothesis about the means, variances and covariance's of observed data in terms of a smaller number of structural parameters defined by the hypothesized underlying model (Nguyen et al., 2008). It is therefore deals with not only single simple or multiple linear regressions, but with a system of regression equation (ibid).

However, the use of SEM could be valid in this analysis if there could be non-existence of inefficiency in sunflower oil processing and thus Ordinary Least Square (OLS) model could have been used as it assumes that the firms are technically efficiency and thus an ordinary regression analysis as it is a linear relationship (Pitt & Lee, 1981).

In line with these arguments, the relationships depicted by research model in figure 2.1 have been treated as independent regressions objective wise. Thus Multiple Linear Regression model has been used in analysing these relationship for objective two and three respectively, as detailed in the following sections.

3.11.1.2 Multiple Linear Regression Model

Multiple Linear Regression Model was used in objective two to determine the influence of technical efficiency on the financial sustainability of sunflower oil processing firms. The model suits this objective due to the nature of the dependent variable (Financial Sustainability) which was continuous and involved more than one explanatory variable in explaining the relationship. This was measured by technical efficiency levels while including staff productivity ratio to control staff productivity for unbiased results which can be reliably generalized. To add on that, the variable was included as a means of controlling it because it was found to influence financial sustainability in other sectors (Nyamsogoro, 2010).

Both variables, technical efficiency levels and staff productivity ratio were estimated from each specific firm as continuous to measures the role of efficiency in explaining the financial sustainability of sunflower oil processing firms as in previous studies (Nyamsogoro, 2010).

In addition, the use of technical efficiency levels and staff productivity ratio estimated from two different approaches was meant to have a methodological contribution resulted from a combined measure of efficiency by using advanced parametric model approach (SFA) in estimating technical efficiency levels and the traditional ratio approach where staff productivity ratio was computed. They both show the extent to which the resources (capital in terms of the processing machines and human capital (staff) of the firm have been used in maximising output for improved financial sustainability respectively.

Moreover, Financial Sustainability concept was measured by Financial Self-Sufficiency (FSS) as the ratio of revenue to expenses of the firms under the study. The FSS measures the ability of the firm to cover its operating expenses from the income generated internally. It is an indicator of financial sustainability which measures the firm's ability to generate sufficient revenue to cover its operating costs in the unsubsidized base. If the firm is able to generate high revenue to cover its operating expenses this will also mean the profitability of the firm for sustained financial performance.

Dependent and independent variables involved in this objective were continuous and thus suit for Multiple Linear Regression Analysis (MLRA) model in studying their relationship with the help of SPSS software. In MLRA, a dependent variable is modelled as a function of several independent variables with corresponding coefficients along with the constant term as expressed in the general linear regression operational equation below.

$$E(Y_i) = \beta_0 + \beta_1 x_1 + \dots + \beta_p x_p \quad (8)$$

Where, $E(Y_i)$ is the mean of the response variable which was Financial Self-Sufficiency (FSS) in this case, x_i 's are independent variables used in this objective which are technical efficiency levels and staff productivity ratio from each specific firm and β_i 's are their respective parameters estimated.

According to Field (2009), R square (R^2) which is the coefficient of multiple determinations, is one of the useful statistics used to examine the amount of variance explained in the outcome variable by the predictors in the model. Therefore, as a percentage, it presents the percentage of variation in the outcome variable that can be explained by the model (Field, 2009).

Importantly, in applying the Multiple Linear Regression models, some groundwork analyses were performed to ensure that no violation of the assumptions of multiple linear regressions for valid and reliable results was checked as presented in Chapter 4. Important assumptions which were observed prior to the application of the model to suit the analysis include:

- i. The model requires the dependent variable to be measured on a continuous scale, in either interval or ratio variable.
- ii. There should be two or more independent variables, which can be either continuous or categorical.
- iii. There should be a linear relationship between (a) the dependent variable and each of the independent variables, and (b) the dependent variable and the independent variables collectively. In case of a non-linear, the transformation of the data into their natural log can be done as a remedy.
- iv. The data at hand needs to show homoscedasticity, where the variances along the line of best fit remain similar as you move along the line.
- v. The data must not show multicollinearity problem, which occurs when you have two or more independent variables that are highly correlated with each other.
- vi. Finally, you need to check that the residuals (errors) if they are approximately normally distributed.

3.11.1.3 Hierarchical Multiple Linear Regression Model

Hierarchical Multiple Linear Regression Model was used in objective three to establish the exactly true effect of firm-specific factors on the financial sustainability of sunflower oil processing firms when the effect of technical efficiency levels and staff productivity ratio was controlled. This is because the same group of independent

variables (firm-specific factors) were involved as determinants in predicting both technical efficiency and financial sustainability of the firms under the study, thus the problem of endogeneity was thought to exist which could affect the findings of the study.

To avoid this problem, the study first tested if there was any existence of endogeneity by performing first a pairwise correlation among the variables as well as by conducting multicollinearity test by checking Variance Inflation Factor (VIF) as indicated on Chapter 4. Not only that but also the study used a proper methodology by introducing technical efficiency levels and staff productivity ratios as the control variables which was best analysed by using Hierarchical Multiple Linear Regression Analysis Model in SPSS. By controlling the differences in technical efficiency levels and staff productivity ratios across the firms, the study was able to establish the true effect of firm-specific factors on financial sustainability as presented in Chapter 4.

Therefore, the use of Hierarchical Multiple Linear Regression Analysis Model in this objective ruled out the endogeneity problem by establishing the true effect of firm specific factors on financial sustainability of the firms under the study when the effect of the interfering variables (Technical Efficiency levels and staff productivity ratios) were controlled.

Likewise, Regression diagnostic tests were conducted as in objective two for valid and reliable results, which includes; Linear relationship between (a) the dependent variable and each of the independent variables, and (b) the dependent variable and the independent variables collectively. The independence of observations (residuals), homoscedasticity of data, checking of multicollinearity problem, and finally the normal distribution of the residuals. Regression diagnostic tests did not reveal any problem that might affect the reliability of the regression model results. Similar general linear regression operational equation as of Multiple Linear Regression models as indicated below but the analysis is done in two blocks as presented in chapter 4.

$$E(Y_i) = \beta_0 + \beta_1 x_1 + \dots + \beta_p x_p \quad (9)$$

Where, $E(Y_i)$ is the mean of the response (dependent) variable, in this case, Financial Self-Sufficiency (FSS) for both blocks while x_i 's are independent variables used in this objective. Therefore independent variables for inclusion in block one were technical efficiency levels and staff productivity ratio, which were then controlled. Variables in block two includes those in block one and location of the business, firm size measured in number of employees, education level of the owner, ownership type, firm age, training of employees measured as a dummy variable, age of owner, industrial experience of owner from each firm while β_i 's are their respective parameters to be estimated. The two blocks in a Hierarchical Multiple Linear Regression Analysis Model (HMLRA) model indicate the extent to which firm-specific factors explain the financial sustainability of sunflower oil processing firms when technical efficiency is kept constant.

3.11.2 Qualitative Data Analysis

A detailed qualitative follow-up to supplement quantitative findings in understanding the key reasons for the observed behaviour of the variables from quantitative analysis results was deemed necessary to enhance the study results. This was done as a means of triangulation to improve and justify the quantitative findings of the study in addressing the main research questions.

According to Cho and Lee (2014), there are two major approaches in qualitative data analysis, namely deductive and inductive approach. The deductive approach is used when qualitative research is a smaller component of a larger quantitative study while the inductive approach is used when qualitative research is a major design of the study with a purpose of generating theory. Likewise, several methods of qualitative analysis exist such as content analysis and grounded theory (ibid). Since the aim of qualitative information in this study was meant to complement the results of quantitative analysis, therefore deductive approach using qualitative content analysis was considered more appropriate than inductive approach.

The qualitative content analysis helps the interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns (Patton, 2001). Thematic content analysis, helped to reduce the volume of

recorded information or communication to a set of categories that represented some characteristics and behaviour of sunflower oil processing firms. In this study both conceptual and relational analyses were applied in content analysis.

In conceptual analysis, important concepts (themes) were established and analyzed based on the frequency of occurrence during discussions with the participants and its trend in a text or communications. Procedures for analysing qualitative data depend on the steps as suggested by Creswell (2014) as follows: (i) Audio-recorded interviews transcribed verbatim to generate interview transcripts (ii) Then transcripts read several times in order to get a sense of the entire data set and interesting phrases and concepts noted (iii) Codes assigned to specific meanings or themes in the textual data (iv) As new perspectives emerge, close related codes are sorted and merged into themes.

This was supported by Cho and Lee (2014) that the process of content analysis involves four main steps: familiarising with data while compiling all replies from open ended questions, coding (unit of analysis), creating categories and establishing themes. These findings are presented in Section 4.6 of the study finding in chapter four where the summary of the main theme (reasons) are shown in summary Table 4.33 and 4.34 in Chapter 4. Based on the research questions, some findings were discussed using actual quotes in Chapter 5 in relation to the theoretical and empirical literature as well as conceptual framework. The details of the reasons have been integrated with the quantitative findings from chapter 4 and all featured in the discussion of the findings in chapter 5 for a greater diversity of views to inform and broaden understanding of the research problem. This has also been supported by Webb et al. (1966) that *“Once a proposition has been confirmed by two or more independent measurement processes, the uncertainty of its interpretation is greatly reduced”*

CHAPTER FOUR

PRESENTATION OF FINDINGS

4.1 Overview

This chapter presents the study findings which have been presented under the key theme and in line with the study objectives. The study has three specific objectives which include to: determine the influence of firm-specific factors on technical efficiency of sunflower oil processing firms in Tanzania; determine the influence of technical efficiency on the financial sustainability of sunflower oil processing firms in Tanzania; and determine the influence of firm-specific factors on the financial sustainability of sunflower oil processing firms in Tanzania.

Prior to presenting the findings for respective objectives, the chapter begins by presenting the preliminary examination of data which was done through frequency tables with the help of SPSS software to ensure the quality of data by identifying if there were any missing data or incorrectly entered from the questionnaire. Description of the respondents, firms' characteristics, inputs and output factors of production involved in this study were also considered.

4.2 Preliminary Data Analysis

In this section, the information related to data accuracy is presented for reliable analysis and results. This was done through descriptive results obtained after the descriptive statistical analysis in the SPSS software IBM version 21 where frequency tables were easily processed. The basic descriptive statistics and frequency distributions of key variables of the research were computed for the purpose. In the frequency distribution tables, the values that were found to be out of the specified range or improperly coded were detected with a straightforward check and corrected since the questionnaires were numbered. Also some firm owners were contacted through phones to handle missing data identified.

4.2.1. Checking for Outliers

The outliers were checked against questionnaires as each questionnaire was numbered accordingly before data entries. Outliers could pull the regression line towards itself and this can result in a solution that is more accurate for the outlier, but less accurate for all of the other cases in the data set thus removing an outlier may improve the distribution of a variable. In this study, large and medium firms which do not qualify to be small processors as per our definition were not considered since they are few and they could be considered as an outlier. For instance some sunflower oil processing firms had a higher number of employees like Sunshine oil mills had 55, Singida fresh Oil mills and Mount Meru Millers had more than 70 employees, therefore were not included in the sample as they could affect the results.

4.2.2. Demographic Characteristics of the Owner

This section presents the descriptive characteristics of the respondents since the unit of analysis of this study was sunflower oil processing firms where their owners were selected as respondents. They are part and parcel of the firm performance as the majority of the firm are individual/family owned and managed. The respondent's demographic characteristics of interest included gender, age distribution and the highest level of education attained.

4.2.2.1 Gender of the Respondents

The results indicating gender composition of the respondent in the surveyed sunflower oil processing firms across the study areas of Dodoma and Singida regions are presented in Table 4.1. Majority of the firm owners in this study were males as indicated in Table 4.1 of gender of respondents.

Table 4.1: Gender of Respondents in Study Regions (n=219)

Gender of the owner		Location		Total
		Singida	Dodoma	
Male	n	86	61	147
	%	58.5%	41.5%	100.0%
Female	n	47	25	72
	%	65.3%	34.7%	100.0%
Total	n	133	86	219
	%	60.7%	39.3%	100.0%

Source: Researcher, 2016

The results in Table 4.1 indicate that the overall number of male owners of the surveyed sunflower oil processing firms was higher at 67.1% (n=147) than of females (32.9%) in all regions under the study. Also region wise the same group of male-dominated, for instance in Singida there are of about 58.5 % (n= 86) and 41.5 % (n= 61) in Dodoma respectively. The higher percentage of males does not imply that only males were involved in this particular study, rather it indicates that more males do manage and engage much on the small scale sunflower oil processing firms than females. This is due to the nature of sunflower oil processing activities like purchasing a large amount of raw materials from farmers who might be in a far distance to an industrial area, extraction/ milling and packaging of the product involves a lot of processes which require energetic and high mobility group-like males.

Also, the study revealed that most of the male who involve in the sunflower oil processing firms are the owner-managers while most of the female are only managers as indicated in Table 4.2. This is because most of the women in African societies use most of their time in domestic activities like taking care of the family more closely than males and most of the hard decisions are made by males especially those involving business and family welfare. The findings are also in line with the study by Dzever *et al.*(2016) on Technical Efficiency among Small and Medium Scale Entrepreneurs in High-Quality Cassava Flour in Four Geo-Political Zones of Nigeria which found that that dominant involvement of about 82.7% of cassava processors were male. This is due to the fact that male processors are more able to endure the

rigorous demands of processing activities and procedures such as machine operation, repairs and staff management compared to their female counterparts.

Table 4.2: The Relationship Between Sex and the Role of the Owner

Sex of the owner		The role of the Business		Total
		Manager	Owner- Manager	
Male	n	37	110	147
	%	25.2%	74.8%	100.0%
Female	n	40	32	72
	%	55.6%	44.4%	100.0%
Total	n	77	142	219
	%	35.2%	64.8%	100.0%

Source: Researcher, 2016

The result in Table 4.2 depicted that majority of the male processors of about 74.8 % (n= 110) are the owner-managers of the business. This implies that they are the key players in the decision making for the survival of the business by engaging themselves in processing, purchasing of raw materials, seeking for labour force and the market for the processed goods.

4.2.2.2 Age of the Respondents.

The results reflecting the age distribution of respondents involved in the study area which were mainly owners are represented in Table 4.3.

Table 4.3: Age Distribution of the Respondents

Age in Groups	n	%
18-25	20	9.1
26-35	43	19.6
36- 45	103	47.0
46-55	48	21.9
56-65	3	1.4
above 65	2	0.9
Total	219	100.0

Source: Researcher, 2016.

The study revealed that the age of most of the owners in sunflower oil processing firms, of about 47 % (n=103) falls between 36 to 45 years. This means that the majority of the players in the sunflower oil small scale processing firms are relatively young and energetic. In other words, this implies that most of sunflower oil processors in the study areas are economical of productive active age group with the ability and highly ambitious to manage businesses of their own.

These observations are in line with the findings by Mungai, Ouko and Heiden (2000), and Hawassi (2006) in their respective studies on the analysis of Processing, Marketing and Demand for processed fruits and vegetables in Kenya and Tanzania who found that most of the small-scale entrepreneur’s workforce in this industry is constituted of economically active age group. Moreover, the higher percentage of youth and middle-aged people as an active age group indicated in Table 4.3 gives an insight that their participation in the processing activities is due to the high ambition of alleviating poverty, social responsibility and mobility factor as they are energetic enough to undertake various fieldwork.

4.2.2.3 Education Level of the Respondents.

The education level of the owners, which were the respondents of the surveyed sunflower oil processing firm across the study regions, is presented in Table 4.4

Table 4.4: Education Level of the Respondents

Education Level	No of schooling years	n	%
Primary education	4-7	114	52.1
Secondary Education	8-14	84	38.4
Certificate/Diploma	15-17	7	3.2
Bachelor/Master’s Degree	18 and above	14	5.3
Total		219	100.0

Source: Researcher, 2016

The overall results from Table 4.4 of education level of the respondents indicate that majority of sunflower oil processing firm owners of about 52%(n=114) had 4 to 7 years of schooling to imply that they attained primary education level followed by 38.5% (n=84) who possess secondary education and very few of about 8.5% (n=21) attained’ higher levels of education. From these results, it is reasonable to argue that,

most of the sunflower oil processing firms had primary education and very few have a higher education level. Though the level of education is low as most of the respondents just completed primary education, it plays a significant role for the owners of the firm to understand and easily adopt any new technology. This is due to the fact that, education was found to be among the determinants of the firm technical efficiency. Other similar studies have also revealed the same results suggesting that typically most of SMEs are owned by people with low levels of education (Isaga, 2012).

4.2.3 Key Firm-Specific Characteristics under the Study

This section provides the description of key specific characteristics of the sampled sunflower oil processing firms as well as comparing the descriptive results with findings from other studies. The key firm-specific characteristics of interest for this study were firm size, measured in terms of number of employees; firm age measured in terms of the number of years the enterprise has been in operation; the enterprise ownership structure measured in terms of legal structure as whether the enterprise is sole proprietor or partnership, location of the business as dummy variable measured as 1 representing business operating in Singida and 0 Dodoma regions respectively. Also training of employees measures as dummy variable as for whether the employees have got industrial training on the processing activities or not and finally the experience of the owner/ managers measures in years of total industrial and working experience.

4.2.3.1. Firm Size

The descriptive results in Table 4.5 indicate number of employees across the surveyed sunflower oil processing firms under the study which was used as a measure of firm size.

Table 4.5: The Results on a Number of Employees

Number of employees	n	%
5-9	156	71.2
10-14	41	18.7
15-19	11	5.0
20-24	6	2.7
25-29	5	2.3
Total	219	100.0

Source: Researcher, 2016

Essentially, looking at the distribution of firms by size, the results in Table 4.5 indicate that majority of the sunflower oil processing firms of about 71.2% (n=156) had 5-9 employees, followed by 18.7% (n= 41) with employees from 10 - 14. Also of about 5 % (n=11) had employees ranges from 15-19, then of about 2.7 % (n = 6) had 20-24 and finally of about 2.3 %(n=5) had 25-29 employees. This implies that they all fall under small scale enterprise category on account of the number of employees as most have a number of workers that is less than 30 and had investment capital that does not exceed 50 million Tsh. Thus, according to national classification of firms (URT, 2003) small firms are those employing between 5 to 49 employees or with capital ranging between 5 to 200 million Tsh. while medium firms employ between 50 to 99 employees or with capital between 200 to 800 million Tsh. and large firms are those employing above 100 people and with capital above 800 million Tsh. Basing on these grounds as the classification of firms by size considers a number of employees in a firm and the capital employed, this study confined on small scale sunflower oil processing firm with employees less than 30 and a capital of less than 100 million Tsh.

4.2.3.2. Firm Age

Firm age is also among the variables involved in the study. The results in Table 4.6 indicate number of years in the operation of sunflower oil processing firms under the study since their establishment.

Table 4.6: Firm Age Distribution

Years in Groups	n	%
2-4	94	42.9
5 -7	103	47.1
8-10	16	7.3
11-13	6	2.7
Total	219	100.0

Source: Researcher, 2016

The results in Table 4.6 revealed that most the firm have 2 to 7 years of operation of about 90 % (n=197) with only 2.7% (n= 6) of the processing firm in operating for more than 10 years. The above results imply that there is continuous in-flow of new entrants into the sub-sector as most firms have less than ten years in business and this is in line with the fact that, sunflower sub-sector in Tanzania is relatively a new sector that is undergoing gradual but significant commercialization after cereals. This can also mean that most of the sunflower oil processing firm fail soon after their establishment despite their significant contribution to the national economy. This is in line with the study by Bowen *et al.* (2009) which revealed that three out of five daily established manufacturing SMEs fail within their few months of operations.

Conversely, firm age is reported to be an important attribute of the firm's performance as it tells about the experience possessed by the firm operations (Kipsha, 2014). Also, Ericson and Pakes (1995) revealed that firms are learning and over time they discover what they are good at and learn how to be more efficient. Likewise, Jovanovic (1982) stated that firms are born with fixed productivity levels which increase with time.

4.2.3.3. Ownership Type

Likewise, the results of the ownership type among sunflower oil processing firms involved in the study are also presented in Table 4.7.

Table 4.7: Ownership Type Across Firms

Ownership type	n	%
Sole proprietor	151	68.9
Partnership	68	31.1
Total	219	100.0

Source: Researcher, 2016

Looking into the ownership types of sunflower oil processing firms under the study, the results in Table 4.7 indicate that the most of the industries of about 68.9 % (n=151) are under single ownership and about 31.1 % (n= 68) are owned by more than one individual (partnership) but remarkably higher composition among owners these industries are among family members. The dominance of sole proprietorship form of organisation indicating one-man show in the management of units and partnership being among family members imply that sunflower oil processing sub-sector tend to confine ownership of the units to the family only.

4.2.3.4. Experience of the Owner

Total working experience of the owner in years by considering past and current working experiences was one of the variables considered by the study as indicated in Table 4.8 results on experience of owners.

Table 4.8 Experience of the Owners

Experience in years	n	%
0-2	69	31.5
3-5	118	53.9
6-8	28	12.8
9-11	4	1.8
Total	219	100.0

Source: Researcher, 2016

The overall results presented in Table 4.8 revealed that most of the sunflower oil firm owners of about 53.9 % (n= 118) had 3-5 years of industrial working experience, while of about 31.5 % (n= 69) had 0-2 years, 12.8% (n=28) had 6 - 8 years and few of about 1.8% (n= 4) had 9-11 years of experience. Thus, the experience gained enhances the skills, abilities and knowledge for managing employees and other

resources in processing firm for improved performance. In addition, learning-by-doing from past experience helps firm owners to acquire better knowledge and skills through accumulated experience as compared to those with no experience in the similar business.

4.2.3.5 Training of the Employees

The results in Table 4.9 on training of employees reflect whether the sunflower oil processing firms under the study provide industrial training to their employees to enhance their skills or not.

Table 4.9: Training of the Employees

Employees Training	n	%
Trained	148	67.6
Not trained	71	32.4
Total	219	100.0

Source: Researcher, 2016

The results revealed in Table 4.9 indicate that most of the processing firms under the study of about 67.8 % (n=148) offers training to their employees while 32.4 % (n=71) do not provide training to their employees.

4.2.3.6 Location of the Firms

The distribution of the surveyed sunflower oil processing firms based on location across regions (n = 219) under the study is presented by the results in Table 4.10. This represents the sample size used for the analysis obtained among 250 firms from the list of the sampling frame provided by Tanzania Food and Drugs Authority (TFDA) central zone office in Dodoma region which indicated the updated database of all registered food processing firms in the area where sunflower oil processing firms were found to dominate and thus extracted for the survey. This was supplemented by the list from Small Industrial Development Organisation (SIDO) offices in Dodoma and Singida regions respectively and from Central Zone Sunflower Oil Processors Association (CEZOSOPA) located in Dodoma region.

Table 4.10: Distribution of the Firms across the Study Area

Location	n	%
Dodoma	86	39.3
Singida	133	60.7
Total	219	100.0

Source: Researcher, 2016

The results in Table 4. 10 indicate that 60.7 % (n=133) of the firm is found in Singida region while 39.3 % (n= 86) operate in Dodoma region.

There are more sunflower oil processing firms located in Singida region as compared to Dodoma due to the fact that more sunflower seeds are produced across many districts in Singida region to favour the establishment of sunflower oil processing firms mainly in Iramba/Mkalama district where most of the sunflower seeds are produced in large quantity of about 100,525 tons (TAOSA, 2012).

4.2.4 Descriptive Information on Inputs and Output Factors of Production

This study has used capital, material and labours as input variables which were originally measured at their cost value in Tanzania Shillings (Tshs) while output was measured by total unit (quantity) of oil produced per year in litres to estimate technical efficiency level as input – output relationship. The results of descriptive statistics in Table 4.11 indicate an average amount of inputs and output factors of production used for the purpose per year.

Table 4.11: Descriptive Statistics for inputs and output factors of productions

Variables	Cost of Capital (Tshs)	Cost of material (Tshs)	Cost of labour (Tshs)	Total unit produced (In litres)
n	219	219	219	219
Mean	26,093,607.31	157,302,061.64	7,711,452.05	69,912.03
Std. Deviation	12,433,214.441	152,414,467.433	3,600,064.583	67,739.763
Minimum	5,000,000	1,125,000	2,160,000	500
Maximum	49,000,000	765,000,000	17,200,000	340,000

Source: Surveyed field data, 2016

As it is reflected in Table 4.11, standard deviations and respective ranges of values among the variables from minimum to maximum are high, indicating the greater variation among them. Thus, the variables were later transformed into their natural log to improve their distribution into normal for robust results.

On average, the cost of capital for sunflower oil processing firms is Tshs 26,093,607.31 million ranges from a minimum of Tshs 5,000,000 to maximum of Tsh. 49,000,000 million This value comprised of mainly the cost of machines for oil extraction, cars and premises owned and used by the firms. Most of the firms under the study use handily supported machines with their prices ranging from Tshs 4,000,000 million and above depending on the financial capacity of the firm.

Likewise with the cost of materials used to purchase raw materials for production per season (year). Since materials are not available throughout the year, the firms always buy material at harvesting season with the cost per bag ranging from Tsh. 30,000 to 45, 000. This makes an average of 40 to 3495 bags per year. Sometimes the price does rise to Tsh 60,000. at off-season. However, due to seasonality nature of the business, most of the firm uses casual labour with few permanent employees to reduce administrative expenses. Thus the cost of labour ranges from a minimum of Tsh. 2,160,000 to a maximum of Tshs 17,200,000 per year.

The average output was measured in total litres of oil processed in a years, ranges from 500 to 340,000 litres with an average of 69,912 litres per season. Usually, 18 to 20 litres of oil are extracted from one bag of 70kgs, depending on the quality of raw material and machine used.

4.3 The Empirical Results

The empirical results of this study are presented according to specific objectives of the study as follows:

4.3.1 The influence of Firm-Specific Factors on Technical Efficiency

The aim of this objective was to find out the determinants of technical efficiency in sunflower oil processing firms in Tanzania. Firm-specific factors were considered as the main predictors of technical efficiency. Thus, technical efficiency levels of the

firms were modelled as the function of firm-specific factors using One Stage Stochastic Frontier Analysis. Thus, the preliminary estimates of technical efficiency levels and their determinants were simultaneously computed using Stochastic Production Frontier Function under the Maximum Likelihood Estimate (MLE) method prior to the analysis. The Stochastic Production Frontier specifies the output of each firm as bounded above by a frontier that is stochastic in the sense that its placement is allowed to vary randomly across the firms. Therefore technical efficiency scores/levels were estimated as a continuous variable from each specific firm. Since SFA was used, it allows statistical testing of the hypothesis to ensure the validity and reliability of the study results estimated, thus prior to the main analysis, three testable hypotheses were performed using generalised likelihood-ratio (LR) test. These include the selection of the appropriate stochastic production function which fits the data well whether Cobb-Douglas or Translog, the distribution of the error term(inefficiency effect) whether half-normal, exponential or truncated normal and finally we tested the presence or absence of technical inefficiency effect on the data, as explained in chapter 3.

According to Coelli and Battese (1996), technical inefficiencies parameters would only be estimated if the technical inefficiency effects are stochastic and have particular distribution properties. Being stochastic in nature, it considers both factors beyond the control of the firm like measurement errors and firm-specific factors that may affect technical inefficiency. The approach is more suitable for efficiency analysis in a developing country setting where there are serious issues with data quality and accuracy (Coelli 1995).

4.3.1.1 Hypothesis Testing

SFA used in this objective is a parametric model that allows testing of the important statistical hypothesis before the analysis as explained in chapter 3.

The first hypothesis was on the specification of the production functional form that represents the data well, whether Cobb- Douglas or Translog production functions accommodated by the stochastic frontier. Instead of assuming an offhand form, we tested for the appropriate specification that best fits the data. This is due to the fact that, the results of the empirical study can be considerably affected by the choice of

the functional form. Both the Cobb-Douglas and Translog production functions were estimated using STATA software by imposing restrictions on Cobb Douglas function that the coefficients of the second – order variable in the Translog model are zero($\beta_{ij}=0$) forming the null hypothesis implying that the Cobb Douglas function is an appropriate function that best fit for the data. On fitting the two frontier model functions on the STATA Software, the values of the log likelihood functions for both models were -297.899 and -292.892 respectively. Output Tables of the results of their respective log-likelihood values are presented in Table 12 and 13 respectively to back up the selections.

Table 4.12: Cobb -Douglas Stochastic Production Frontier

Number of observations = 219
Wald chi2 (3) = 10.36 with
Prob > chi2 = 0.0158
Log likelihood = -297.89969

LogUnitProduced	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
LogCapital	0.792	0.048	16.04	0.001	0.129	0.420
LogMaterials	-0.127	0.052	-2.43	0.015	-0.064	0.331
LogLabour	0.179	0.139	0.94	0.164	-0.142	0.404
_cons	4.563	2.252	2.03	0.043	0.149	8.976
/lnsig2v	-0.581	0.159	-3.64	0.000	-0.895	-0.268
/lnsig2u	-1.107	0.347	-3.19	0.001	-1.787	-0.427
Sigma	0.748	0.059			0.639	0.875
Sigma u	0.575	0.099			0.409	0.808
sigma2	0.889	0.099			0.695	1.085
Lambda	0.768	0.142			0.491	1.047

Likelihood-ratio test of sigma_u=0: chibar2 (01) = 14.36, Prob>=chibar2 = 0.000.

Table 4.13: Tran-slog Stochastic Production Frontier /Half-Normal Model

Number of observations = 219

Wald chi2 (9) = 21.97

Prob > chi2 = 0.009

Log likelihood = -292.892

LogUnitProduced	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
LogCapxMaterial	0.197	0.171	1.15	0.249	-0.138	0.532
LogCapxLabour	-0.066	0.321	-0.21	0.834	-0.695	0.561
LogMatexLabour	0.327	0.200	1.63	0.102	-0.065	0.719
HalfLogCapSquare	-0.108	0.514	-0.21	0.833	-1.115	0.898
HalfLogMatrSquare	0.037	0.177	0.21	0.832	-0.308	0.383
HalfLogLabSquare	-1.049	0.492	-2.13	0.033	-2.014	0.085
LogCapital	-0.214	6.475	-0.03	0.974	-12.906	12.477
LogMaterials	-8.921	4.970	-1.79	0.073	-18.663	0.820
LogLabour	12.258	7.088	1.73	0.084	-1.636	26.152
_cons	-12.459	64.765	-0.19	0.847	-139.396	114.478
/Insig2v	-0.677	0.167	-4.05	0.000	-1.004	-0.349
/Insig2u	-1.058	0.333	-3.18	0.001	-1.712	-0.405
sigma	0.713	0.059	.	.	0.605	0.839
Sigma	0.589	0.098	.	.	0.425	0.817
sigma2	0.855	0.097	.	.	0.663	1.047
Lambda	0.826	0.141	.	.	0.551	1.102

Likelihood-ratio test of sigma=0: chibar2 (01) = 16.02 Prob>=chibar2 = 0.000

The generalised likelihood ratio test using the results from both models was used to decide the best functional form based on the computed values when compared with the values from Kodde and Palm Table of 1986 as follows.

$$\begin{aligned}
 \text{LR test} &= -2[\text{Ln}H_0 - \text{Ln}H_1] \\
 &= -2[-297.889 - (-292.892)] \\
 &= -2[-5.007] \\
 &= 10.014
 \end{aligned}$$

The calculated/computed Likelihood ratio test of 10.014 was compared with the critical chi-square value 11.911 from Kodde and Palm table (1986) with 6 degree of freedom, the computed value of the likelihood ratio statistical test was less than that of the critical value. This resulted in the failure of rejecting null hypothesis implying that Cobb-Douglas stochastic production function is the appropriate functional form in this case.

Given that the Cobb-Douglas production function is the generally accepted functional form in this case, therefore, in what follows we reported the estimation results on another hypothesis exclusively based on the Cobb-Douglas function.

On the second hypothesis, the distribution of one-sided error term was tested as to whether it was a half-normal ($\mu=0$), truncated normal or exponential U_i ($\mu>0$) distribution. Since the study used STATA software in which the frontier is designed for all three distribution but the truncated form of distribution provided infinity iterations during execution and unable to provide the log likelihood value. Thus, the half-normal distribution formed a restricted form of the exponential distribution with the restriction that $\mu=0$. In other words, the half-normal distributions formed the null hypothesis (H_0) while the exponential distribution formed the alternative hypothesis (H_1). Thus, the values of the log likelihood functions from restricted model distribution (Half Normal) and unrestricted model (exponential) were -297.889 and -292.89 respectively. Similar to the first hypothesis, the LR test value was then estimated and compared with the chi-square critical value from Kodde and Palm table (1986) as follows.

$$\begin{aligned} \text{LR test} &= -2[\text{Ln}H_0 - \text{Ln}H_1] \\ &= -2[-297.889 - (-292.89)] \\ &= -2[-3.017] \\ &= 6.034 \end{aligned}$$

Using the chi-square table from Kodde and Palm Table at 1 degree of freedom (since the same Cob-Douglass production function) was used under half-normal and an exponential distribution) thus the differences in parameters give 1 degree of freedom. The critical value provided from the table was 3.841 while the computed value of the

generalised likelihood ratio statistic, in this case, was 6.034. In comparison, the calculated likelihood ratio value (LR) is greater than the critical value from Kodde and Palm Chi-square Table which is 3.841. This suggests rejecting the null hypothesis implying that exponential distribution assumption of the one-sided error term is more appropriate for sunflower oil processing firms than the half normal.

The third hypothesis concerned with testing the presence or absence of the technical inefficiency effects in the model. This part forms the main idea of this study as it set to examine whether sunflower oil processing firms under the study are producing along the frontier (efficient) or not to justify the need to study the factors contributing to reducing their inefficiency. In other words, if inefficiency effects did not matter then we could not need to estimate a stochastic frontier model but rather an average production function by using OLS because the firm would be already operating on the technically efficient frontier.

This hypothesis stated that technical inefficiency effects are absent from the model by setting $\gamma = 0$. If $\gamma = 0$ and all the δ - coefficients are zero ($\gamma = \delta_0 = \delta_1 = \dots = \delta_6 = 0$), therefore firm-specific factors do not influence the technical inefficiencies and the stochastic frontier model would be reduced to a traditional average production function that is off without technical inefficiency. In other words, the stochastic frontier production function would be the same as the mean production function that does not account for the inefficiency effect and would be estimated by using Ordinary Least Squares (OLS) model. Likewise, if there would be output differences among sunflower oil processing firms given equal inputs, this difference would purely be due to the differences on random shocks that are outside of the control of the firm rather than inefficiency factors within the control of the firm. Therefore by imposing a restriction on the original model under MLE with inefficiency components, the values of the loglikelihood function from the restricted and unrestricted model were -297.889 and -278.408 respectively. The LR ratio test was estimated as :

$$\begin{aligned}
\text{LR test} &= -2[\text{LnH}_0 - \text{LnH}_1] \\
&= -2[-297.889 - (-278.408)] \\
&= -2[-19.491] \\
&= 38.982
\end{aligned}$$

The value of the likelihood ratio statistical test computed was 38.982 which is greater than the critical chi-square value of 11.911 from Kodde and Palm table (1986) with 6 degree of freedom. This suggested that the null hypothesis of no technical efficiency was strongly rejected at 5% significance level by implying that the existence of technical inefficiency effect on the sunflower oil processing firms production model. Therefore the traditional average function under OLS is not suitable /appropriate representation of the data in this objective. Hence, one stage SFA with inefficiency effect model under the maximum likelihood estimation (MLE) method was suitable and thus used in the analysis.

The presence of technical inefficiency was also supported by the large value of γ parameter estimated as it is associated with the variance value of 0.744 estimated from the stochastic frontier fitted model to indicate a large amount of the technical inefficiency in sunflower oil processing firms under the study (Table 4.16 page 109). The summary results of three hypotheses tested above and their decisions are presented in Table 4. 14

Table 4.14: Log-likelihood Test for Underlying Hypothesis

Null Hypothesis (n= 219)	df	λ	Critical Values	Decision
H₀: $\beta_{ij}=0$ (frontier is Cobb Douglas)	6	10.014	11.911	Not Rejected
H₀: $\mu = 0$.(Half Normal)	1	6.034	3.841	Rejected
H₀: $\gamma = 0, \gamma = \delta_0 = \delta_1 = \dots = \delta_6 = 0$ (no inefficiency effect)	6	38.982	11.911	Rejected

Source: Researcher, 2016

Therefore, the results in Table 4.14 indicate that the first null hypothesis which suggested that the frontier is Cobb Douglas was not rejected to mean that Cobb Douglas production function fits the data well. Also in the second hypothesis, the null hypothesis which suggested that the error term was half normal distributed was rejected in favour of the alternative hypothesis that the error term (u) is exponentially

distributed and finally the third hypothesis which suggested the absence of inefficiency in the model was also rejected in favour of the alternative that there is existence of technical inefficiency.

The decision from testing of the statistical hypothesis above guaranteed the use the Stochastic Frontier Analysis approach/model to determine the influence of inputs variables of production (Capital, Labour and Material) on output measured in litres of sunflower oil processed as well as analysing factors influencing their technical efficiency as follows.

4.3.1.2 Production Frontier

Prior to stochastic production frontier estimate parameters, the average/ conventional production function using Ordinary Least Squares was estimated in order to assess the potential contribution of physical inputs to the level of sunflower oil output processed. The inputs factors of production originally measured in costs of capital, labour, material and one output measured in litres processed in each firm were all transformed into natural logarithm to improve their distribution into normal since all were continuous variable with great variation from firm to firm.

Table 4.15 indicate the conventional production function estimated using Ordinary Least Square (OLS).

Table 4.15: Conventional Production Function

Variable	Production function(OLS)			
	Coefficients	Standard Error	t-statistics	P- values
(Constant)	9.96	0.718	13.87	0.001 **
<i>ln</i> Capital	0.83	0.047	17.62	0.001 **
<i>ln</i> Material	- 0.12	0.054	-2.15	0.033 **
<i>ln</i> Lbour	0.01	0.051	0.169	0.866
Adj.R ²	0.60			

Source: Researcher, 2016

The results in Table 4.15 indicate that 60% ($\text{Adj } R^2 = 0.60$) of the sunflower oil processing firms output variation is explained by capital and materials inputs of production. This was also reflected in the Cobb-Douglas stochastic production frontier with inefficiency model estimated in Table 4.16.

Since the study used a one stage stochastic frontier model under MLE technique, both parameters of stochastic production frontier in which technical efficiency levels and the inefficiency affect model for the factors influencing technical efficiency were simultaneously estimated.

Thus Table 4.16 indicates the results of parameters of both Frontier and Inefficiency Effect Models in Maximum Likelihood Estimates (MLE). Both Stochastic Production Frontier and Inefficiency Model Parameters have been estimated simultaneously and the two models as reflected in Table 4.16. The upper part represents the stochastic frontier model parameters where technical efficiency (the dependent variable) is estimated with the factors contributing to the maximum output being shown while the lower part of the table indicates the inefficiency effect model parameters respectively.

Table 4.16: Maximum Likelihood Estimates of the Parameters for both Stochastic Frontier and Inefficiency Model.

LogUnitProduced	Parameter	Coefficient	Std. Err	z	P> z
Frontier model					
Constant	β_0	4.563	2.252	2.03	0.043 **
LogCapital	β_1	0.792	0.048	16.60	0.001**
LogMaterials	β_2	- 0.126	0.052	- 2.43	0.015**
LogLabour	β_3	0.179	0.128	1.39	0.164
Technical Efficiency levels	Mean	0. 529			
	Minimum	0. 032			
	Maximum	0.792			
Inefficiency model					
Constant	α_0	-31.061	15.007	- 2.07	0.038**
Location(Singida)	α_1	-9.438	4.708	-2.00	0.045**
Firm Size	α_2		0. 441	- 0.63	0.527
		- 0.279			
Firm Age	α_3	2.205	1.024	2.15	0.032**
Experience	α_4	- 0.235	0.361	-0.65	0.514
Ownership(Sole proprietor)	α_5	-11.399	5.692	-2.001	0.047**
Education Level	α_6	-11.420	5.584	-2.04	0.041**
Training of Employees(Trained)	α_7	- 48.56217	867.727	-0.06	0.955
Age of the Owner	α_8	0.309	0.150	2.06	0.039**
#observations (n)		219			
Wald chi2(4)		11.48			
Prob > chi2		0.0094			
Log-likelihood		-294.882			
Variance parameters					
	σu^2	0.889			
	λ	0.769			
	γ	0.744			

Source: Researcher, 2016,

** Significant at 5% level

The parameters of the stochastic frontier and inefficiency effect model simultaneously estimated under the Maximum Likelihood Estimate (MLE) technique are as shown in Table 4.16. The upper part represents the frontier model parameters revealing the contribution of inputs (capital, labour and material) on how they

respond to the output of the firms while the lower part indicates the inefficiency model parameters for inefficiency/efficiency factors respectively.

Thus, the Log Likelihood for sunflower oil processing firms indicated in Table 4.16 results is -294.882 (Wald (χ^2) of 11.48 with the p-value for the overall model fit being less than the conventional ($p < 0.05$) to imply that at least one of the variables included in the model are significant determinants of technical efficiency in sunflower oil processing firms under the study.

Likewise, the overall, constant (β_0) on the frontier model on the upper part of the table is positive and statistically significant (4.56) suggesting that the inputs used in the stochastic production frontier model jointly contribute to the output of the firms measured in litres processed.

Specifically, the results in Table 4.16 on Maximum Likelihood Estimated parameters indicate that capital contributes positively and significantly to the output of the firms at 5% level while material contributes negatively but significantly.

A positive direction of capital implies that it is an important determinant of the output in sunflower oil processing firms. An increase in capital will result in an increase in output level by 0.792%. On the other hand, a negative coefficient of material implies over commitment of materials by sunflower oil processing firms in the production. An increase in the material does not guarantee an increase in output. That is, in where there is inefficiency, firms with more materials perform poorly in output.

Furthermore, a positive estimated coefficients of for capital to the stochastic production frontier implying that a positive relationship exists between a firm's output of oil and capital. The positive sign of the coefficient implies that increasing capital of the firm will result to increase the output of sunflower oil in the study area. Since capital was measured mainly by machines used in processing, the MLE results above imply further that sunflower oil processing firm under the study are primarily capital-intensive as they are more dependent on the machinery rather than on labour as they mostly use unskilled casual labour. Oil extraction process is done by machine

with little support from personnel, particularly on packaging, labelling of the products and distribution for marketing purpose.

On the other hand, negative coefficients for material in sunflower oil processing firms indicate a negative relationship with the output of the firm. Any increase in materials will result in a decline in outputs of sunflower oil firms.

In the same vein, the sensitivity of output processed to inputs used has been determined through the elasticities/coefficients estimated from stochastic production frontier function. Since capital revealed a positive relationship with output, it implies that a 1% increase in capital results in an increase in output level by 79%. On the other hand, 1% increases in material result in a decrease in the output of the firms under the study of 12.6%. High elasticity of capital implies that most of the significant increase in output of the firm comes from high capital invested in machines.

These findings contrast with the study by Admassie and Matambalya (2002) on technical efficiency for food processing firms which revealed that the capital, material and labour are highly significant and positive to the output but the elasticities of material and labour being higher than that of capital. This might be due to the fact that, the study involved various food processing firms which are not homogeneous in terms of inputs and outputs and therefore hard to specify the results revealed.

Importantly, the elasticity of the frontier production function measures the sensitivity of output to 1% change in any input used. Thus a measure of return to scale (RTS) represents the percentage change in output due to a proportional change in the use of all inputs of production. It is estimated as the sum of output elasticities for all inputs used and if the estimated value is greater than, equal to or less than 1, would mean that the respective firms under the study operate either in increasing, constant or decreasing returns to scale respectively.

In this study, the summation of the elasticities of the production function inputs ($0.792 + 0.179 - 0.126$) is 0.845, which is less than one indicating that sunflower oil processing firms operate under decreasing return to scale. Thus, if sunflower oil processing firms increased all inputs by 1 %, production would increase by about 0.845%. In other words, sunflower oil processing firm under the study have not worked in the optimum production scales due to inefficiencies and that the majority do not fully achieve the potential economies of scale. They need to improve their productivity to operate in an increasing return to scale.

We also found that sunflower oil processing firms operate at a mean technical efficiency of about 53 % and ranges from a minimum of 3.2 % to a maximum of 79.2 %. This implies that there is an opportunity for firms to increase their current level of output through more efficient utilisation of resources by 47 % under the same level of inputs and technology.

Furthermore, the likelihood-ratio test was conducted assuming the null hypothesis of fully technical efficiency in the fitted model for the sunflower oil processing firms, i.e. there is no technical inefficiency ($H_0 : \text{Sigma}_u = 0$) against the alternative hypothesis ($H_1 : \text{Sigma}_u > 0$) which presume the existence of technical inefficiency on the firms. The results in Table 4.16 (page 106) depict that the inefficiency component of the disturbance term (u) is significantly different from zero and thus the null hypothesis of fully technical efficiency ($H_0 : \text{Sigma}_u = 0$) is rejected at 14.36 % ($p = 0.001$). These results suggest that there is a statistically significant inefficiency performance in all sunflower oil processing firms under the study.

In addition, the variance parameters represented by sigma squared (σ^2), Lambda (λ) and gamma (γ) support the presence of inefficiency respectively as follows:

The value of the sigma square (σ^2), is large enough at 0.88 and significantly different from zero at 5% level to indicate goodness of fit as well as the correctness of the distributional form assumed for the composite error term.

This is supported by the greater value of lambda (λ) of 0.769 which clearly shows the dominant share of the estimated variance of the one-sided error term, u over the estimated variance of the whole error term. This empirical evidence implies that a greater part of the residual variation in output among small scale sunflower oil processors in Dodoma and Singida regions is associated with the variation in technical efficiency caused by firm inefficiency rather than with measurement error related to uncontrollable factors of the production process.

This has also been justified by the quite large values of gamma (γ) computed of about 0.744 for sunflower oil processing firms implying that the variation in maximum output reflected by technical efficiency levels of the firms under the study is due to technical inefficiency from the part of the processors rather than random variability. This means that the difference between the actual and potential output levels in sunflower oil processing firms are mainly due to the firm-specific factors controllable by the firm and need to be improved in order to raise the technical efficiency. Thus, the dominance of the one-sided error component in the model is confirming that the average production function (Ordinary Least Square, OLS) is inadequate in representing the data.

However, a great variation in technical efficiency revealed among similar firms from a minimum level of 3.2% to a maximum of 79.2% validates the next stage of analysis to determine the sources of inter-firm technical efficiency differences among sunflower oil processing firms in Tanzania which results into low income generated as well.

This observation is in line with the study by Oleg et al .(2006) which revealed that while some firms operate at the technological frontier and potentially earns high profits, others lag considerably behind and are barely able to survive.

4.3.1.3 Inefficiency Effect Model

Determining the factors affecting technical efficiency was paramount in this study since the existence of technical inefficiencies in sunflower oil processing firms under the study was revealed by the low levels of technical efficiency estimated as well as from the hypothesis on the presence of technical inefficiency. This would help

sunflower oil processing firms to have effective measures and strategies to improve their technical efficiency levels for maximum output and hence the financial sustainability of the firm will be attained. Also, Admassie and Matambalya (2002) pointed out that just knowing that some firms are technically inefficiency is useless unless the sources of technical inefficiencies are identified. Therefore since the technical inefficiency in sunflower oil processing firm was proven to exist, the study went further to identify the factors influencing this performance.

Therefore from one stage SFA model used in estimating the technical efficiency levels and their determinants reflected on the lower part of Table 4.16 results, the coefficients of technical inefficiency parameters estimated from the inefficiency effect model are indicated. Conversely, a negative sign on a parameter that is explaining inefficiencies in the inefficiency effect model means that the variables improve technical efficiency of sunflower oil processing firms by reducing inefficiency, while the reverse is true for a positive sign to mean that they increase inefficiency of the firms.

Five (5) out of eight (8) firm-specific factors included in the inefficiency effect model were found to contribute statistically significantly to the technical inefficiency of sunflower oil processing firms at 5% level. These includes location of the firm, ownership type and education level of the owner which are negatively related with the technical inefficiency to imply that they reduce inefficiency while firm age and age of the owner are positively related to the technical inefficiency in sunflower oil processing firms in Tanzania to mean that they increase technical inefficiency of the firms under the study. The respective variables are as explained below.

4.3.2 Location of the Firm

The results in Table 4.16 of Maximum Likelihood estimated parameters indicate that location of the firm contributes negatively and statistically significantly at 5% level to the technical inefficiency of sunflower oil processing firms as theoretically expected. This implies that technical inefficiency decreases with the location of the firm. Since location of the firm was captured as dummy variable where 1 for a sunflower oil processing firm operating in Singida region and 0 for those firms located in Dodoma

region. Keeping Dodoma region as a reference category, the negative sign with location implies that sunflower oil processing firms located in Singida are more likely to reduce inefficiency as compared to those in Dodoma. This further means that firms located in Singida are more efficient than firms in Dodoma by about 9.438 % more. This is also reflected on the summary of technical efficiency levels according to location of the firms as indicated in Table 4.17

Table 4.17: Summary of Technical Efficiency levels Vs Location of the firm

Location of the firm (n = 219)	Technical Efficiency levels	Statistic	Std. Error
Dodoma	Mean	0.51	0.019
	Variance	0.03	
	Std. Deviation	0.17	
	Minimum	0.03	
	Maximum	0.79	
	Range	0.76	
Singida	Mean	0.54	0.012
	Variance	0.01	
	Std. Deviation	0.13	
	Minimum	0.23	
	Maximum	0.78	
	Range	0.54	

Source: Researcher, 2016,

The results in Table 4.17 indicate that, mean technical efficiency levels of the firms located in Singida is 54% which is higher than that of the firms located in Dodoma region of about 51.1%. Likewise, the standard deviation and the range between the minimum and maximum values of technical efficiency levels among the firms located in Singida are less than those of the firms located in Dodoma region. All these evidences justify that sunflower oil processing firms located in Singida are more efficient than those in Dodoma region. This performance difference of sunflower oil processing firms in Singida is due to high production of sunflower seeds across districts as the region is ranked the highest (TEOSA, 2012).

Also, most of the firms in Singida region are strategically located in township/municipal areas mainly along Mwanza-Arusha-Dar-es-Salaam high way where there are improved infrastructure and transport networks connecting districts and regions bordering it for easy access and transport of raw materials. Moreover, these firms have greater access to resources such as credits for investment capital, labour,

information and communication technology infrastructure since the firms in this area are clustered around SIDO area. This also gives a good opportunity to get support services from TFDA and TBS for standard conformity. These study findings are in line with the study by Tran et al., (2008); Le and Harvie (2010) and Charoenrat (2012) on their technical efficiency studies which reveal that location reduces the technical inefficiency of the firms.

4.3.3 Ownership Type

The legal ownership structure of the firm also revealed a negative and statistically significant relationship with the technical inefficiency of sunflower oil processing firms in line with theoretical expectation. The negative relation implies that inefficiency in sunflower oil processing firms' decreases with the ownership type. The legal ownership of the firm was captured as dummy 1 for sole proprietorship and 0 for partnership, thus as compared to the partnership, sole proprietorship revealed a negative and significant relationship with the technical inefficiency of sunflower oil processing to imply that inefficiency of sunflower oil processing firms' decreases with being a sole proprietor. The same observation is also reflected on the summary of technical efficiency levels according to ownership types as indicated in Table 4.18.

Table 4.18: Summary of Technical Efficiency levels Vs Ownership type

Ownership Type (n=219)	Technical efficiency levels	Statistic	Std. Error
Partnership	Mean	0.52	0.019
	Variance	0.03	
	Std. Deviation	0.16	
	Minimum	0.03	
	Maximum	0.75	
	Range	0.72	
Sole proprietorship	Mean	0.53	0.012
	Variance	0.02	
	Std. Deviation	0.14	
	Minimum	0.13	
	Maximum	0.79	
	Range	0.66	

Source: Researcher, 2016,

Results in Table 4.18 indicate that the mean technical efficiency level of the firms under sole proprietorship form of ownership is 53.2%, greater than those firms under partnership which is 52.1 %. In a similar way, the range between the minimum (3% and 13% respectively) and maximum value of technical efficiency level (75% and 79 respectively) among firms as well as the variance and standard deviation are all less under sole proprietorship than in partnership. This implies that sunflower oil processing firms under sole proprietorship are more efficient than their counterparts.

Although a partnership type of ownership, have the benefits of allowing the owner to draw on resources and expertise of co-partners, share risk and management skills and solve barriers to doing business collectively but a sole proprietor has a complete control within the parameters of the law and decision-making power over a business, which is crucial for small scale firms. The findings are in line with the study by Ha (2006) which revealed that technical inefficiency decreases with a sole proprietorship type of ownership.

Importantly, the sole proprietorship form of organisation indicating one-man show in the management of the firm is the predominant legal structure revealed in this sub-sector as indicated in Table 4.7 (page 98) of descriptive results that of about 68.9% firms are under sole proprietorship while only 31.1% were revealed under the partnership. However, the partnership was formed among family members. In view of this, it can be concluded that there is a tendency in this sector to confine ownership of the firm to the family only. Various withdrawing by owner and family members reduces the working capital of the firm and hence inefficiency.

4.3.4 Education Level of the Owners

The education level of the owners revealed a negative and statistically significant relationship with the inefficiency effect model as theoretically expected. This means that technical inefficiency in sunflower oil processing firms decreases with the education level of the owner. This implies further that one additional year of schooling enhances the technical efficiency of the sunflower oil processor to great extent. In the same way, education level enhances the stock of human knowledge which consequently increases efficiency. This evidence has also been justified by the

summary of technical efficiency levels according to years of schooling (education levels) of the firm owners as indicated in Table 4.19

Table 4.19: Summary of Technical Efficiency Levels Vs Education of the Owners

Education Level of the Owner (n=219)	Technical Efficiency Levels	Statistic	Std. Error
Primary Education (4-7) years	Mean	0.48	0.029
	Variance	0.01	
	Std. Deviation	0.10	
	Minimum	0.31	
	Maximum	0.64	
	Range	0.33	
Secondary Education (8 -14) years	Mean	0.52	0.017
	Variance	0.02	
	Std. Deviation	0.15	
	Minimum	0.06	
	Maximum	0.79	
	Range	0.74	
Certificate/Diploma (15-17) years	Mean	0.53	0.014
	Variance	0.02	
	Std. Deviation	0.15	
	Minimum	0.03	
	Maximum	0.78	
	Range	0.75	
Bachelor and above (18 years and above)	Mean	0.60	0.026
	Variance	0.01	
	Std. Deviation	0.07	
	Minimum	0.52	
	Maximum	0.70	
	Range	0.18	

Source: Researcher, 2016

Therefore, results in Table 4.19 indicate that the mean technical efficiency level increases as the years of schooling of the owner increases.

This finding is in line with the study by Jude (2007) on technical efficiency of rice producers in Uganda which revealed that education of an individual plays a significant role in improving the efficiency of the firm by aiding adoption of requisite technologies. Well educated owners are expected to make rational decisions that improve efficiency. Most of the sunflower oil firms are owner managed with highly centralized decision-making power thus education of the owners positively influence the efficiency of the firm independently of the workforce capabilities.

4.3.5 Firm Age

The results in Table 4.16 of inefficiency model indicate that the estimated coefficient associated with firm age is positively and statistically significantly related to technical inefficiency in sunflower oil processing firms. This implies that inefficiency in sunflower oil processing firms increases with the age of the firm. Therefore, older processing firms are less efficient than younger firms. This performance has also been reflected on the mean summary of technical efficiency levels of the firm according to their years of operation as indicated in Table 4.20.

Table 4.20: Summary of Technical Efficiency Levels Vs Firm Age

Firm Age in Groups (n = 219)	Technical Efficiency levels	Statistic	Std. Error
2-4	Mean	0.53	0.014
	Variance	0.02	
	Std. Deviation	0.13	
	Minimum	0.06	
	Maximum	0.79	
	Range	0.74	
5-7	Mean	0.53	0.016
	Variance	0.03	
	Std. Deviation	0.16	
	Minimum	0.03	
	Maximum	0.78	
	Range	0.74	
8-10	Mean	0.50	0.039
	Variance	0.03	
	Std. Deviation	0.16	
	Minimum	0.24	
	Maximum	0.73	
	Range	0.49	
11-13	Mean	0.50	0.042
	Variance	0.01	
	Std. Deviation	0.10	
	Minimum	0.43	
	Maximum	0.65	
	Range	0.22	

Source: Researcher, 2016

The mean technical efficiency levels indicated in Table 4.20 reflect that technical efficiency level of sunflower oil processing firms' decreases with increase in firm age. Despite the fact that older firms may have more experience, this can be offset by greater indifference through possession of older machinery as most of them own single refined machines rather than double refined ones. It becomes too expensive for

them to fragment the old machines, for instance, single refined for a double refined one and hence efficiency decreases. Old firms may not be willing to try new innovation and technology due to financial constraints. The findings of this study conform with the findings by Le and Harvie (2010), Niringiye et al.,(2010), and Amornkitvikai (2011) on the technical efficiency of other manufacturing firms while contrasting with the study findings by Admassie and Matambalya (2002); Batra and Tan (2003); Amornkitvikai and Harvie (2011) which revealed that technical efficiency increases with age. This might be due to differences in the nature of the processing firms involved in the study.

4.3.6 Age of the Owner

The age of the owner was included to control the age difference and found to be positively and statistically significantly related to the technical inefficiency in sunflower oil processing firms. This implies that inefficiency in sunflower oil processing firms increases with the age of the owner. Thus, despite their accumulated experience through learning by doing and their greater practical problem-solving ability the performance of the firms' declines with age. This has also been justified by descriptive results of the age distribution of the owners of sunflower oil processing firms where the majority of about 66.6 % (n=146) fall at the middle active age group of 26 to 45. Few owners had higher age above 55 years of about 2.3 % (n=5) to mean that aged people are less involved in sunflower oil processing firms and thus inefficiency. This was also revealed in Table 4.21 of age group Vs technical efficiency which indicates a decreasing trend of technical efficiency of the owner up to 56 years and above which indicate a constant value.

Table 4.21: Summary of Technical Efficiency Levels Vs Age of the Owner

Age in Groups	Mean TE scores/levels
18-25	0.558
26-35	0.543
36-45	0.526
46-55	0.512
56-65	0.452
Above 65	0.452

Source: Researcher, 2016

TE levels/ scores are constant when Age at the age of 56 and above as reflected in Figure 4.1 which illustrate the result in Table 4.21 graphically.

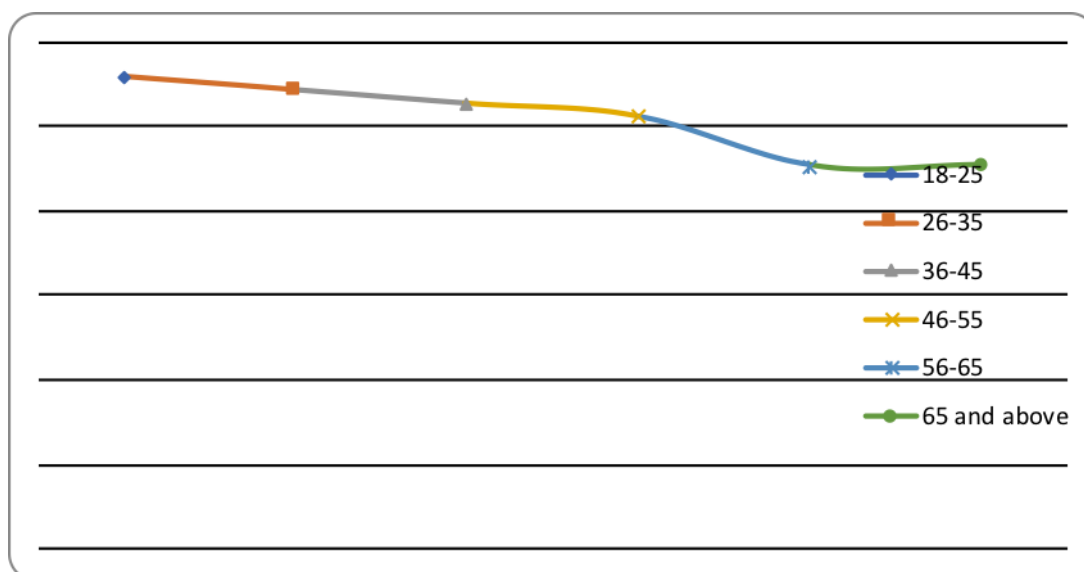


Figure 4.1: Graphical illustration of Age group Vs Technical Efficiency

Source: Researcher, 2016

Results in Table 4.21 and graphical illustration on Figure 4.1 above indicate that technical efficiency decreases with the age of the owner of the firm. It further indicates that at the age of 56 and above the efficiency level remains constant. This implies that at this stage, age does not matter in explaining performance so long as someone is aged 56 years and above.

These results are also consistent with other findings from other studies conducted in Tanzania which indicates that majority of small scale business owners are younger than 40 years (Hawassi, 2006; Isaga, 2012; Tundui, 2012). Not only that but also in line with the study findings by Levesque and Minniti (2006) which pointed out those younger business owners run businesses that perform better than old ones since they are more motivated, energetic, committed and are less risk-averse. This has also been supported by Belenzon and Zarutskie (2013) that performance of the firm drops as the owner grows older. This observation is contrary to the theoretical expected relationship and different from other subsectors as well due to the nature of the industry as it requires high mobility from material seeking, production and packaging of the products.

However, firm size, the experience of the owner and training of the employees had a negative relationship with the inefficiency effect model though not significant to imply that they are not determinants of technical efficiency but their improvement could reduce technical inefficiency in sunflower oil processing firms under the study as theoretically hypothesised.

Moreover, Staff Productivity Ratio was not included in this objective since it is not a proxy measure of technical efficiency, but rather a measure of efficiency. It thus measures how sunflower oil processing firms utilise their staff in maximising outputs for increased profit and hence financial sustainability. Recognising the role of the employees in maximising output was premised on the fact that a number of employees are considered as one of the important criteria in classifying SMEs according to their size. Thus, computed staff productivity ratios from each sunflower oil processing firm were controlled in objective two to establish the true effect of technical efficiency levels (a proxy measure of technical efficiency) on financial sustainability.

Therefore staff productivity ratio has been used in conjunction with technical efficiency levels in predicting the financial sustainability of the firms under the study as it is explained below.

4.4 The influence of Technical Efficiency on Financial Sustainability

The aim of this objective was to determine the influence of technical efficiency on the financial sustainability of sunflower oil processing firms in Tanzania. This relationship was accomplished by using Multiple Linear Regression Analysis model since both the dependent and all independent variables are continuous in nature measured as ratios. Financial self-sufficient (FSS) expressed as the ratio of revenue to expenses measured the financial sustainability while technical efficiency levels/scores and staff productivity ratios were used as measures of efficiency in explaining the financial sustainability of sunflower oil processing firms. Thus the nature of the dependent variable being continuous (ratio) best fit for Multiple Linear Regression Analysis. Other model assumptions requirements to be met prior to the analysis were also taken into consideration as indicated in section 4.4.1.

4.4.1 Dependent Variable

The dependent variable in this objective is Financial Sustainability (FS) measured by Financial Self Sufficiency (FSS) as the ratio of total revenue to total expenses for each specific sunflower oil processing firm under the study. Since FSS is measured as the ratio, then the ratio below one indicate that the firm is not able to cover its operating costs and thus financially unsustainable, if the ratio is equal to 1 indicates equal operating revenue and operating costs, to imply that the firm is operating at the break-even point and income generated is just enough to cover its operating costs without any profit. This is also further implying that the firm is retaining its working capital. Finally, if the ratio is above 1 indicates that higher revenue is generated by the firm to cover the operating costs and realising a profit as residual for the survival of the firm and hence financial sustainability of the firm.

Financial Self Sufficiency was used as the best measures of the financial sustainability of the firms since it indicates the ability of the firm to sustain itself in the business from its generated income. The ratio is computed as is indicated below.

$FSS = \text{Total Revenue} / \text{Operating expenses}$. The revenue was computed by considering the number of litres processed and sold in each sunflower oil processing firm and the price per litre in a year. Also, all expenses incurred by the firm for getting the revenue including material costs, labour costs, water and electricity costs, rent and taxes were considered in computing the FSS.

4.4.2 Descriptive Statistics

The descriptive statistics explaining the overall distribution of the variables included in the Multiple Linear Regression Analysis model for objective two is presented in Table 4.22.

Table 4.22: Descriptive Statistics

Variables	Mean	Std. Deviation	N
Financial Self Sufficiency	0.942	0.155	219
Technical Efficiency levels	0.529	0.149	219
Staff Productivity ratio	9700.278	10631.365	219

Source: Researcher, 2016

The results in the Table 4.22 above indicate that on average, sunflower oil processing firms under the study are not financially self-sufficient as their overall ratio is 0.94. This implies that most sunflower oil processing firms are operating at loss but nearly to the breakeven point since the value is around 1, thus retaining their operating capital.

Besides, the results in Table 4.22 depict that on average sunflower oil processing firms operate at a mean technical efficiency of 53%. This implies an opportunity for these firms to increase their output by 47% under the same level of inputs and technology. Likewise, the same Table 4.22 results revealed that each staff can process 9700 units on average, but sunflower oil processing firms are machine intensive rather than labour intensive and thus labour is not much required in this type of industry.

However, standard deviation on both financial self-sufficiency and on technical efficiency scores was of about 15.5% and 14.9% respectively indicating that there is variability in the performance among the sampled firms. Furthermore, the analysis in Table 4.22 of descriptive statistics was extended to disclose the number of firms under the study that operate either at loss, break-even point or at a profit as indicated in Table 4.23 as follows.

Table 4.23 Distribution of firms according to FSS performance ratio

FSS ratio	n	%
Below 1	118	53.8
1	10	4.6
Above 1	91	41.6
Total	219	100.0

Source: Researcher, 2016

Financial Self-Sufficiency (FSS) was measured as the ratio of revenue to expenses incurred to earn the same. Therefore the ratio below 1, indicate that the expenses of the firms are higher than revenue generated and thus the firm is operating at loss. In this case 53.8 % (n=118) of sunflower oil processing firms under the study operate at a loss as indicated in Table 4.23 results. This implies that these firms are unable to cover their operating expenses from their generated income and therefore could be

financially unsustainable. Also, the FSS ratio of 1 indicates that the revenue of a particular firm is equal to its expenses incurred and thus the firms are operating at the break-even point. This has been indicated in Table 4.23 results that 4.6% (n=10) of the firms under the study are operating at the break-even point. This implies that these firms are neither making profit nor loss since their generated revenue is enough to cover expenses without surplus, thus are retaining their operating capital. Moreover, the FSS ratio above 1, indicate that the firm's revenue are higher than expenses and thus operating at a profit. The results in Table 4.23 shows that 41.6% (n= 91) of sunflower oil processing firms under the study are operating at a profit since their FSS ratio is above 1 to imply that firms revenue are higher than the cost incurred and thus could be are financially sustainable.

4.4.3. Diagnostic tests for Multiple Linear Regression Model Assumptions

Multiple Linear Regression model assumptions were all tested and found to satisfy with the data used in the analysis such as Linearity, Normality, Multicollinearity, and Independence of residuals and Homoscedasticity.

4.4.3.1. Linearity assumption

Firstly, multiple linear regression models need the relationship between the independent and dependent variables to be linear in the parameter. Thus the study checked whether there is a linear relationship between the independent variables (technical efficiency scores and staff productivity ratio) and the financial sustainability, a dependent variable in our multiple linear regression models by using F-test represented in ANOVA Table 4.24.

Table 4.24: ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.994	2	1.997	338.956	.000 ^{b**}
Residual	1.272	216	0.006		
Total	5.266	218			

Source: Researcher, 2016

^{**}Significant at 5%

The linear regression's F-statistic in ANOVA Table 4.24, tests the null hypothesis that there is no linear relationship between the variables involved in the model (in other words $R^2 = 0$). This was rejected as the F-test value was large (338.96) and highly statistically significant with ($p < 0.0001$) to mean that there is a linear relationship between the dependent and independent variables involved in our model.

The results dictate further that the overall model was statistically significant and the variables technical efficiency scores and staff productivity ratios as independent variables in this objective jointly influence the financial sustainability of sunflower oil processing firms under the study.

4.4.3.2. Normality assumption

More importantly, the multiple linear regression models require that the error between observed and predicted values (i.e., the residuals of the regression) should be normally distributed. This assumption was best checked graphically by plotting standardized residual values on a histogram with a fitted normal curve or by reviewing a Q-Q-Plot or P-P-Plot in conjunction with statistical tests, skewness and kurtosis tests as well. Figure 4.2 indicates the graphical checking of normality using histogram and P-P-Plot of regression standardized residual.

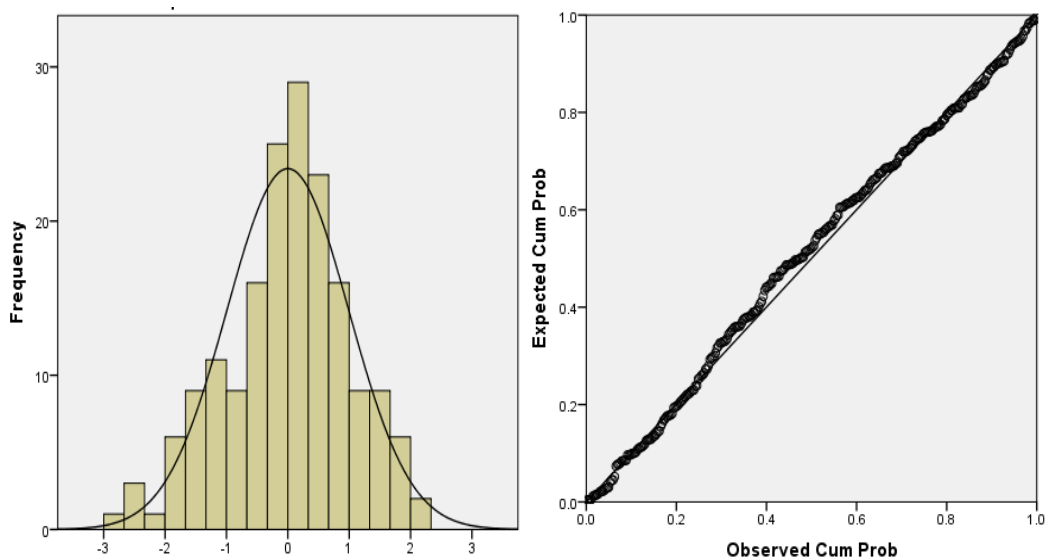


Figure 4.2: Histogram and Normal P-P Plot

The visual results in both histogram and P-P plot indicate that data concentrate on the centre but a bit skewed on the left with the scatter plot indicating a positive gradient. Normality distribution of the data has also been checked by statistical tests with a goodness of fit test by using the Kolmogorov-Smirnov test (K-S) and Shapiro Wilk test(S-W). Therefore, Table 4.25 below presents the results from two well-known tests of normality, namely the Kolmogorov-Smirnov and the Shapiro-Wilk tests for normality distribution of the study sample population. For both tests, the *p*-value is greater than 0.05 so we would accept the null hypothesis that the data come from a normally-distributed population.

Table 4.25: Statistical Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk test		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	0.063	219	0.090	0.988	219	0.142

Source: Researcher, 2016

The study also carried out normality analysis to check the distribution of data as indicated in the descriptive Table 4.26 According to Kline (2005), a distribution is said to be normal when the values of skewness and kurtosis are equal to zero. But there is a specified range for data to be approximately normal distributed to guarantee the analysis. Thus for the data to be univariate normally distributed, skewness must be less than 3 or greater than -3 and kurtosis must be less than 10.0 (ibid).

Table 4.26: Skewness and Kurtosis

n	Skewness		Kurtosis	
	Statistics	Std. Error	Statistics	Std. Error
219	-2.578	0.164	9.710	0.327

Source: Researcher, 2016

Skewness is -2.578 less within the recommended range $+_3$ and the kurtosis of 9.7 less than 10. Though lies within the recommended range of the data are a bit skewed to the left. However, the results are still valid since the sample size of the study is greater than 40, as large samples improve the distributions.

4.4.3.3. Multicollinearity Test

This assumption assumes that the independent variables are not highly correlated with each other. The study tested for multicollinearity using the VIF (Variance Inflation Factor) which quantifies the severity of multicollinearity in an ordinary least squares. It provides an index that measures how much the variance (the square of the estimate's standard deviation) of an estimated regression coefficient is increased because of collinearity.

According to Myers (1990), a VIF greater than 10 is a cause for concern. If the VIF value lies between 1-10, then there is no multicollinearity. If the VIF <1 or > 10 , then there is multicollinearity. This might cause the estimated regression coefficients to have the wrong signs and smaller t-values that might lead to wrong conclusions.

The larger the value of VIF indicates the multi-linearity existence among the variables. However, the rule of thumb, dictate that if the VIF of a variable exceeds 10, there is a multicollinearity problem (Hair et al. (2006), but in this study, all values were below 2 (1.96) in all variables to be included in the model to imply that no existence of multicollinearity in the data

Also, **Tolerance was considered** as it measures the influence of one independent variable on all other independent variables; the tolerance is calculated with an initial linear regression analysis. Tolerance is defined as $T = 1 - R^2$ for these first step regression analysis. With $T < 0.2$ there might be multicollinearity in the data and with $T < 0.01$ there certainly is. In this objective tolerance value was 0.509 and thus no multicollinearity.

4.4.3.4 Homoscedasticity assumption

This assumption requires that the variance of error terms is constant across the independent variables. The scatter plot is a good way to check whether

homoscedasticity (that is the error terms along the regression line are equal) is given. It is plotted by using the standardized residuals versus the predicted Y' values to show whether points are equally distributed across all values of the independent variables or not. In this study objective, the homoscedasticity was checked by the scatter plot of z^*_{pred} and z^*_{presid} as indicated in Figure 4.3.

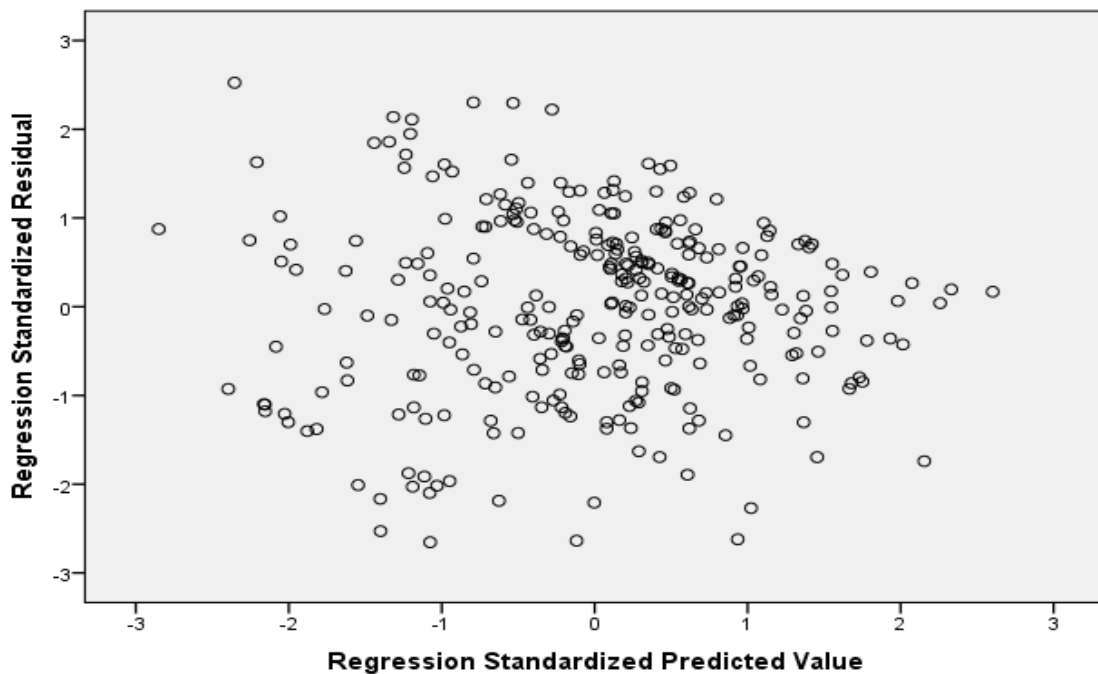


Figure 4.3 Scatter plot for Financial Self Sufficiency (FSS)

The scatter plot on Figure 4.3 indicates that the trend of residual is centred around zero but also that the variance around zero is scattered uniformly and randomly as they are concentrated on the centre of the graph thus the homogeneity of error variance assumption is satisfied.

4.4.4 The overall Model Summary

The overall model summary indicates the extent to which the predictor variable technical efficiency levels and staff productivity ratio jointly explain the financial sustainability of sunflower oil processing firms under the study as it can be seen on the model summary Table 4.27.

Table 4.27: Model Summary^b

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate	Durbin-Watson
1	.871 ^a	0.758	0.756	0.077	1.826

Source: Researcher, 2016

a. Predictors: (Constant), staff productivity ratio, technical efficiency levels

b. Dependent Variable: Financial Self- Sufficiency

The results of the overall linear regression model summary in Table 4.27 above indicate R-value of 0.871 which imply the existence of a linear relationship between the dependent variable and the explanatory variables fitted in the model. Also, the coefficient of determination, R^2 of 0.758 indicated that 75.8% of the variation in the dependent variable (FSS) was explained by the independent variables in the model.

Next is the regression coefficients indicating the joint and individual effect of the technical efficiency levels and staff productivity ratio (independent variables) to the financial sustainability (dependent variable) are indicated in Table 4.28 below respectively.

Table 4.28: Regression Coefficients

Model	Unstandardized Coefficients		Standard Coeff.	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.417	.022		18.657	0.000**		
TE levels	1.048						
Staff Prod. Ratio	-3.108E-006	0.049	1.006	21.478	0.000**	0.509	1.963
		0.000	-.213	-4.537	0.000**	0.509	1.963

Source: Researcher, 2016

**Significant at 5%

The results in Table 4.28 above indicates that both technical efficiency indicators (technical efficiency levels and staff productivity ratios) jointly predict the financial sustainability of sunflower oil processing firms in Tanzania as indicated previously by F-test as well as due to a positive intercept ($B_0 = 0.417$).

Also, both indicators are highly statistically significant determinants of the financial sustainability of sunflower oil processing firms in Tanzania at 5% level of significance with ($p = 0.0001$) though with different directions. Technical efficiency

level relates positively to the financial sustainability of the firm while staff productivity ratio relates negatively to the financial sustainability of the firms under the study.

The positive coefficients for technical efficiency levels with financial sustainability imply that when technical efficiency level of the firm increases by 1%, the financial sustainability of sunflower oil processing firms' increases by 1.048%. Keeping all other factors constant, the higher the technical efficiency level the better indication for high financial sustainability of the firm. This further means that firms input resources have been transformed to the maximum output in terms of quantity produced and sold. Maximum output produced and sold leads to high revenue and hence the financial sustainability of the firm will be attained.

However, the staff productivity ratio was measured by the ratio of unit processed to the number of staff employed to determine how sunflower oil processing firms utilise their staff to maximise their output, had a negative beta coefficient of $-3.108E006$ and strongly statistically significantly related to the financial sustainability of the firms under the study. This shows that the increase in a number of units produces per staff affected negatively the financial sustainability of sunflower oil processing firms in Tanzania. Theoretically, it would be expected that high staff productivity ratio would lead to efficient utilisation in maximising output and hence a high level of financial sustainability, but the empirical evidence suggests otherwise. The negative relationship between staff productivity and financial sustainability in this study implies that the more numbers of units produced by a staff the less financially sustainable the firm will be. That is, sunflower oil processing firm does not depend merely on staff utilisation in maximising their output; they depend on the machine (capital intensive). Therefore, from the findings revealed on the relationship between technical efficiency levels and staff productivity toward the financial sustainability, it can be profoundly said that sunflower oil processing firms are machine intensive and not labour intensive. This was also revealed by high elasticity of capital input measured in the initial cost of machines as it responds positively to the output of the firms measured in litres of oil processed. Also, the more staff you have in the firm on the relatively same task, the less productive they become.

4.5 The influence of firm-specific factors on Financial Sustainability

The aim of this objective was to determine the influence of firm-specific factors on the financial sustainability of sunflower oil processing firms in Tanzania. Since a similar set of independent variables (firm-specific factors) were used as determinants of both technical efficiency and financial sustainability of the firms under the study; thus endogeneity problem was thought to exist among the variables used. That is, the endogeneity could exist from the firm-specific factors that influence Technical Efficiency when Technical Efficiency is also used in the determinants of Financial Sustainability.

Therefore, to be sure of the non-existence of the endogeneity problem, the study started to deal with indicative measures of the problem before further steps. One of them being measurement errors among the variables involved in the study, which if not considered might cause endogeneity. Therefore to avoid this problem, the study tested and proofed for the non-existence of indicators of endogeneity problem through pairwise correlation among the variables involved and by checking the Variance Inflation Factor (VIF) for Multicollinearity. Not only that but also the study used a proper methodology by introducing technical efficiency levels and staff productivity ratios which are measures of efficiency as control variables.

From a pairwise correlation and VIF check respectively, the results indicate that the Variance Inflation Factor (VIF) of the entire variable is less than the recommended value of 10 to imply non-existence of multicollinearity problems among the variables and thus also, the tolerance values obtained were all higher than the cut-off point of 0.1, below which the multicollinearity could have been considered to be a problem according to Gujarati (2003). This is reflected in Table 4.29 of VIF results as follows.

Table 4.29: Variance Inflation Factor (VIF) for Multicollinearity Test

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	.264	.079		3.328	.001**		
Location	.022	.010	.069	2.148	.033**	.935	1.070
Firm size	-.006	.001	-.170	-4.690	.000**	.728	1.373
Firm age	.002	.003	.028	.872	.384	.925	1.081
Ownership type	.018	.011	.053	1.680	.095	.948	1.054
Education -Owner	.004	.006	.022	.673	.502	.902	1.109
Training	.001	.011	.002	.068	.945	.846	1.182
Age of the owner	.010	.004	.558	2.713	.007**	.923	1.227
Experience-owner	-.004	.002	-.050	-1.552	.122	.922	1.084
Technical Eff. levels	1.101	.052	1.056	21.107	.000**	.383	2.613
Staff product. Ratio	-4.521E-006	.000	-.309	-6.058	.000**	.368	2.714
a Mean VIF							1.4507

Source: Researcher, 2016

**Significant at 5%

The results in Table 4.29 above indicate that most of the VIF of all variables involved in the model range from 1 to 2.7 and thus fall within the recommended range of below 10 to imply the absence of multicollinearity and thus no endogeneity problem. In a similar way, the mean VIF is 1.4507 which is below 5 to mean the same.

Moreover, the results on pairwise correlations among variables as indicated in Table 4.30 below as also one of the proofs of non- existence of endogeneity problem previously thought due to measurement errors.

Table 4.30: Indicate a Pairwise Correlations Matrix among the Variables

Variable	Pearson Correlation	Loc.	Firm size	Firm age	Owner ship	Educ.	Train.	Exper.	FSS	TE Scores	Staff prod. Ratio	Age-owner
Location	P-Correlation Sig. (2-tailed)	1										
Firm Size	P-Correlation Sig. (2-tailed)	-.004 .659	1									
Firm age	P-Correlation Sig. (2-tailed)	.023 .634	.072	1								
Ownership	P-Correlation Sig. (2-tailed)	-.034 .612	.021	.147*	1							
Educ.	P-Correlation Sig. (2-tailed)	.055 .414	-.056	.066	.141*	1						
Training	P-Correlation Sig. (2-tailed)	-.038 .580	-.050	.005	.041	.186**	1					
Exper.	P-Correlation Sig. (2-tailed)	-.172* .011	-.051	-.046	-.013	.006	-.171*	1				
FSS	P-Correlation Sig. (2-tailed)	.171* .011	.036	.005	.072	-.046	.156*	-.137*	1			
TE Scores	P-Correlation Sig. (2-tailed)	.094 .165	.104	-.006	.033	-.046	.103	-.075	.857**	1		
Staff prod. ratio	P-Correlation Sig. (2-tailed)	.030 .655	-.265**	-.005	.025	-.067	-.062	-.003	.490**	.699**	1	
Age of owner	P-Correlation Sig. (2-tailed)	.038 .572	-.032	.190*	-.048	.066	-.119	.083	-.152*	-.105	-.040	1

Source: Researcher, 2016 **Significant at 5%, * Significant at 10%

Although the correlation coefficient for Financial Self- Sufficiency(FSS) and Technical Efficiency levels (TE Scores) was 0.857(greater than 0.7), but the VIF value indicated in Table 4.29 of VIF test is 2.613 which fall within the specified range of less than recommended value of 10 to imply that there is no multicollinearity problem among them. Also, the correlation level between FSS and TE is of no harm to the results and it was expected to be high as they are causality among them as shown in objective two. From this preliminary analysis on the indicative measures of endogeneity if any, it was found that there is no even the symptom of the problem.

The study went further by introducing Technical efficiency levels and staff productivity ratio as control variables, a proper methodology in avoiding endogeneity problem by employing Hierarchical Multiple Linear Regression Analysis model. But before this analysis, the variables were then considered for descriptive statistics to

explain their overall distribution before they were included in the model for objective three as presented in Table 4.31 of descriptive statistics as follows.

Table 4.31: Descriptive Statistics

Variables	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic
Location	219	0	1	.61	0.489
Firm size	219	5	28	8.54	4.437
Ownership type	219	0	1	.69	0.464
Firm age	219	3	12	4.99	1.955
Education level - owner	219	1	4	1.63	0.811
Training -employees	219	0	1	.68	0.469
Age of the owner	219	24	69	40.81	8.420
Experience of the owner	219	1	10	4.34	2.040
Technical Eff. levels	219	.03	.79	.5286	0.149
Staff productivity ratio	219	100.00	56666.67	9642.35	10600.38
Financial self Sufficiency	219	.04	1.10	.9410	0.155

Source: Researcher, 2016

The results in Table 4.31 indicate that on average, sunflower oil processing firms under the study are not financially sustainable since they're overall financially self-sufficient(FSS) ratio is below 1 (0.94). This implies that most of sunflower oil processing firms are not able to cover their operating costs as their revenue is less than the cost incurred in earning the same. In other words, they are operating nearly at the breakeven point, retaining their operating capital. Thus any improvement on the significant variables would mean profitability and hence financial sustainability of the firms. Likewise, the results in Table 4.31 portray that on average sunflower oil processing firms operate at a mean technical efficiency level of 53% implying that there is an opportunity for more improvement by 47% under the same level of inputs and improved technology.

However, most of the sunflower oil processing firms had 9 employees on average; this has been used as a proxy measure of firm size. This observation justifies that, sunflower oil processing firms are of small scale in nature since their number of employees ranges from 5 to 28 and thus fall under small scale (URT, 2003). Also on average, most of the sunflower oil processing firm in the study area has been in operation for five years since their establishment. This implies that they have no much experience in the business since they are seasonal in nature. Their seasonality nature affects their performance as they do not operate throughout the year due to lack of material during the off-season.

Moreover, the owners of sunflower oil processing firms are youth and middle-aged of around 41 years with an average of four years of industrial working experience. On average, the age of the owner reflects the fact that most of the respondents are mature, motivated and energetic whose economic reality and the survival instinct must have driven into the establishment of the businesses. Also, the high mean staff productivity ratio of 9642 litres per staff imply that, though they have few staffs on average, sunflower oil processing firms are machine intensive and not labour intensive. They only need handily support in packaging and labelling of the products for advertising and selling process.

Since the study used the proper methodology by introducing technical efficiency scores and staff productivity ratio as the control variables, thus Hierarchical Multiple Linear Regression was used to study the hypothesised relationship in order to account for endogeneity problem thought to occur when firm-specific factors and efficiency measures would have been used as among the determinants of financial sustainability of sunflower oil processing firms at the same level without hierarchy. Thus the interrelationship between firm-specific factors and the financial sustainability of sunflower oil processing firms were analysed, by controlling technical efficiency in a single analysis where two model blocks were executed with their adjusted R squares indicating the extent of the variance on how the independent variables explain the dependent variable with and without the control variable respectively.

Importantly, in applying the Hierarchical Multiple Linear Regression model, some groundwork analyses were performed to ensure that no violation of the assumptions of Multiple Linear Regressions Analysis for valid and reliable results. These include testing of a linear relationship between (a) the dependent variable and each of the independent variables, and (b) the dependent variable and the independent variables collectively. The independence of observations (residuals), homoscedasticity of data, checking of multicollinearity problem and finally the normal distribution of the residuals as indicated in section 4.4.3.

4.5.1 Firm-Specific Factors as Determinants of Financial Sustainability

A Hierarchical Multiple Linear Regression Model was used to determine the influence of firm-specific factors on the financial sustainability of sunflower oil processing firms in Tanzania when technical efficiency levels and staff productivity ratio differences, used as measures of efficiency were kept constant. This objective intended to control the effect of technical efficiency levels and staff productivity on financial sustainability observed to exist so that the extent of the true effect of firm-specific factors in explaining the financial sustainability can be clearly revealed. Technical efficiency levels were computed as the ratio of input to output factors of production.

This was also a measure of effective transformation of a set of inputs resources at given technology into maximum outputs and hence financial sustainability of the firm. Likewise, staff productivity ratio indicates how the firm uses her staff in maximising the output for high profitability and hence the financial sustainability of the firm. The results obtained from a regression model has two models listed in Model Summary from which Model 1 refers to the first block of variables (technical efficiency scores and staff productivity ratio which were entered as control variables while Model 2 includes all the variables of interest (firm-specific factors) and the controlled variables (technical efficiency levels and staff productivity ratio) which were both entered in block 2 as indicated on the model summary results in Table 4.30.

Table 4.32: Model Summary

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate	R Square Change	Change Statistics			Sig. F Change
						F Change	df1	df2	
1	0.870 ^a	0.757	0.755	0.077	0.757	336.668	2	216	0.000 ^{**}
2	0.891 ^b	0.793	0.783	0.072	0.036	4.514	8	208	0.000 ^{**}

a. Predictors: (Constant), Technical Efficiency levels, staff productivity ratio

b. Predictors: (Constant), Technical Efficiency levels, staff productivity ratio, firm age, Education level of the owner, Experience of the owner, Ownership type, Location, Age of the owner, Training of the employees, firm size

Source: Researcher, 2016

**Significant at 5%

Checking the results of R Square values in the first Model summary in Table 4.32, it was realised that the overall model explained 75.7% of the variance after the variables Technical efficiency levels and staff productivity ratio in Block 1 have been entered. After Block 2 variables which combined all variables in block 1 and firm-specific factors have also been included, the model variance as a whole raised to 79.3% in explaining the financial sustainability of sunflower oil processing firms.

Therefore, R Square change in this objective was used to tell the extent of how much of this overall variance is explained by our variables of interest (firm-specific factors). In so doing, it was found that firm-specific factors explained an additional variance of 3.6 % in predicting the financial sustainability of sunflower oil processing firms when the effects of technical efficiency levels and staff productivity ratios (measures of technical efficiency) are statistically controlled for. Also, the noted contribution of firm-specific factors on financial sustainability is statistically significant as portrayed by a highly statistically significant. F change value of (p = 0 .000).

Likewise, the ANOVA Table 4.33 shows that the model as a whole including both blocks of variables is statistically significant (F (10, 208) =79.709, p<.0005).

Table 4.33: ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.973	2	1.987	336.668	0.000^{b**}
	Residual	1.275	216	0.006		
	Total	5.248	218			
2	Regression	4.162	10	0.416	79.709	0.000^{c**}
	Residual	1.086	208	0.005		
	Total	5.248	218			

a. Dependent Variable: Financial self Sufficiency

b. Predictors: (Constant), Technical Efficiency levels, staff productivity ratio

c. Predictors: (Constant), Technical Efficiency levels, staff productivity ratio, firm age, Education level of the owner, Experience of the owner, Ownership type, Location, Age of the owner, Training of the employees, firm size

Source: Researcher, 2016

** Significant at 5%

The results in ANOVA Table 4.33 imply that though firm-specific factors contribute statistically significant in explaining the financial sustainability of sunflower oil processing firms efficiency is an important stepping stone toward the financial sustainability of the firms under the study. Furthermore, the regression Coefficient Table 4.34 below indicates important firm-specific variables influencing the financial sustainability of sunflower oil processing firms in Tanzania when technical efficiency scores and staff productivity ratio have been controlled.

Table 4.34: Regression Coefficients on Determinants of Financial Sustainability.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig. (p-values)	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.417	.022		18.650	.000**		
	Staffs prod. ratio	-3.107E-006	.000	-.212	-4.529	.000**	.512	1.953
	Technical Eff.Scores	1.048	.049	1.005	21.446	.000**	.512	1.953
2	(Constant)	.474	.039		12.291	.000**		
	Staffs prod. ratio	-4.492E-006	.000	-.307	-5.906	.000**	.368	2.714
	Technical Eff.Scores	1.113	.053	1.067	20.999	.000**	.385	2.597
	Location	.024	.010	.077	2.370	.019**	.942	1.062
	Firm size	-.006	.001	-.164	-4.444	.000**	.731	1.369
	Firm age	.002	.003	.024	.718	.474	.927	1.078
	Ownership type	.016	.011	.049	1.518	.131	.950	1.052
	Education -owner	.007	.006	.037	1.138	.256	.924	1.082
	Training -employees	.004	.011	.012	.350	.727	.854	1.171
	Experience -owner	-.003	.002	-.045	-1.358	.176	.925	1.081
	Age of the owner	-.001	.001	-.055	-1.668	.097	.922	1.084
	Mean VIF							1.516

a. Dependent Variable: Financial self Sufficiency,

** Significant. at 5% level.

Source: Researcher, 2016

The regression Coefficients results in Table 4.34 indicate that all predictors in respective models jointly made a statistically significant contribution to the financial sustainability of sunflower oil processing firms in Tanzania as reflected by statistically significant constant beta (β_0) coefficient of 0.417 ($p = 0.000$) for model 1 and 0.474 ($p = 0.000$) for model 2 respectively.

Also when technical efficiency level and staff productivity ratio differences have been controlled the location of the firm and firm size appeared to influence financial sustainability of sunflower oil processing firms statistically significant at beta coefficient of ($\beta = 0.024$, $p = 0.019$) for location and ($\beta = -0.006$, $p = 0.001$) for firm size measured by the number of employees. A positive coefficient with location implies that sunflower oil processing firms operate in Singida are financially sustainable than those in Dodoma by 0.024%.

Contrary to theory, a negative regression coefficient with firm size implies that any increase in firm size will decrease the financial sustainability of sunflower oil processing firms by 0.006%. This result further means that sunflower oil processing firms are machine intensive and not labour. The results in Table 4.34 indicating the Regression Coefficients on Determinants of Financial Sustainability, also revealed that both technical efficiency levels and staff productivity ratio are statistically significant determinants of financial sustainability of sunflower oil processing firms under both circumstances, when controlled and when not controlled. This means that though firm-specific factors are important determinants of the financial sustainability of the firm, still efficiency of the firm is necessary for more improved performance.

More on the same, by comparing the results in Table 4.32 and 4.34 when technical efficiency levels and staff productivity were not controlled and when controlled respectively. It is observed that there are low values of beta coefficients of all statistically significant variables including the constant value and high values of their significant levels (p -values) as compared to when controlled (Table 4.32). Thus, constant ($\beta = 0.264$, $p = 0.001$), location ($\beta = 0.022$, $p = 0.033$), firm size ($\beta = -0.006$, $p = 0.000$), age of the owner ($\beta = 0.010$, $p = 0.007$), technical efficiency levels ($\beta = 1.101$, $p = 0.000$) and staff productivity ($\beta = -4.521$, $p = 0.000$). When technical

efficiency levels and staff productivity were controlled (Table 4.34), beta coefficient values of all significant variables marked ** increased and their p-values decrease to mean that they are highly significant than before, with their p-value less than the conventional ($p = 0.000$). The increase in beta values and p-values are as reflected on the respective variables, constant ($\beta = 0.417$, $p = 0.000$), location ($\beta = 0.024$, $p = 0.019$), firm size ($\beta = -0.006$, $p = 0.000$), technical efficiency levels ($\beta = 1.113$, $p = 0.000$) and staff productivity ($\beta = -4.492$, $p = 0.000$). Though age of the owner appears insignificant at this point, the values of the significant variables improved than before. All these empirical evidences support that technical efficiency is important for improved financial sustainability of sunflower oil processing firms in Tanzania.

However, firm age ($\beta = 0.002$, $p = 0.474$), ownership type ($\beta = 0.16$, $p = 0.131$) education level ($\beta = 0.007$, $p = 0.256$) and experience ($\beta = -0.03$, $p = 0.176$) of the owner appears to be insignificant variables, to imply that they are not important determinants of financial sustainability of sunflower oil processing firms in Tanzania.

4.6 Qualitative Findings

Following the content analysis, the replies from respondents were analyzed by using themes and sub-themes that emerged from the probed questions through interview guide. The results in Table 4.35 and Table 4.36 indicate the summary of the narrated reasons (themes) for the determinants of technical efficiency and financial sustainability respectively. The reasons indicated in these Tables have been integrated with the quantitative results in more details for enhancing the discussion of the findings in Chapter 5. This was done in each specific objective for a greater diversity of views to inform and complete understanding of the research problem at hand. On the other hand, since inefficiency effect model was used to study the determinants of technical efficiency, thus the sign of coefficients from the quantitative model has been interpreted conversely. The negative signs coefficients mean they reduce inefficiency while a positive sign means they increase inefficiency.

Since, qualitative information in this study aimed at explaining why the identified important variables under the study influence the technical efficiency and financial sustainability of sunflower oil processing firms in Tanzania, it thus identifies reasons on the observed behaviour of firm-specific factors toward technical efficiency and financial sustainability respectively. The reasons as to why some of the variables of the study converge or deviate from theoretical behaviour previously expected formed the major themes developed under a qualitative analysis to triangulate the quantitative findings. This was done by comparing theoretically expected signs with quantitative model results' signs as indicated in Table 4.35 and 4.36 respectively.

Table 4.35: Summary of the Reasons for the Behaviour of Firm-Specific Factors to Technical Efficiency

SN	Explanatory variable	Theoretically expected sign	Quantitative model sign	Qualitative Reasons (Themes)
1	Firm size	+	-	A large number of employee increases labour costs. Poor management of employees. Reduces individual accountability. Increases staff idleness.
2	Location	+	-	<p>Singida Improved infrastructure for easy material supply The firms are located near to farmers so the reduced the cost of material Also, middlemen problem is reduced.</p> <p>Dodoma 95 % of firms operate in central residential areas which increased the cost of material due to location problem. Informal location and hence no any public support.eg conformity to standards through TFDA and TBS.</p>
3	Firm Age	+	+	Inefficiency increases with increase in age Old firms perform less efficiency due to outdated technology machine used.
4	Experience of the owner	+	-	Accumulated Industrial, Managerial and entrepreneurial experience improves the performance of the firm.
5	Training of the employees	+	-	Training to employees reduces the inefficiency of the firm. Though negatively related but insignificant to mean lack of adequate industrial training. But rather, there are some instructions given during the production and hence interrupts the production.
6	Education of the owner	+	-	Inefficiency decreases with more years of schooling Education enhances the skills and capabilities to adopt technology
7	Ownership of the firm	+	-	Individual ownership is better for improved efficiency due to a one-man show in the management of the firm. full control of their business Profit retention Easily formed No accountable to any boss or supervisor
8.	Age of the owner	+	+	Inefficiency of the firm increases with the age of the owner hence they are less mobile, past their production age, low motivation in increasing their production

Source: Field interview follow-up information, 2016

Table 4.36: Summary of the Reasons for Determinants of Financial Sustainability

SN	Explanatory variable	Theoretically expected sign	Quantitative model sign	Qualitative reasons (Themes developed)
1	Technical efficiency levels	+	+	Increase in efficiency improves the financial sustainability of the firm due to maximum output. Maximum output implies large sales and hence profitability. Efficiency means cost minimisation and hence high profitability.
2	Staff productivity ratios	+	-	Increase in staff productivity ratio, reduces the financial sustainability of the firms, hence Sunflower oil processing firms are machine intensive and not labour intensive. Less labour power is required just for hand support in machines and packaging of oil.
3	Firm size	+	-	Firms with a large number of people incur high labour cost which reduces the profit of the firm. Large number results in fraud and theft.
4	Location	+	+	Most of the units produced are easily sold due to strategically location of the firms along the highways for easy customer access. Improved infrastructure for material and support services from TBS and TFDA. Reduced transport cost as most of the firms sells their oil in the processing area, bus terminals and along the highways.

Source: Field interview follow-up information, 2016

CHAPTER FIVE

DISCUSSION OF THE FINDINGS

5.1 Introduction

The chapter presents discussions of the findings obtained in Chapter 4 from each specific objective in order to address the main research problem of the study. Following the presentation of results in chapter four, this chapter discusses the findings centred in answering the key question of the study that “*what are the determinants of technical efficiency and financial sustainability for sunflower oil processing firms in Tanzania?*” The study was conducted in Dodoma and Singida regions since these two regions are considered as the central agricultural corridor and thus major producers and processors of sunflower seeds and oil respectively. Since the selected regions are large producers and processors of sunflower oil in the country, therefore the findings are representative of the other regions and thus generalised to the whole population of sunflower oil processing firms in Tanzania due to similar operating characteristics and constraints experienced by these firms across.

The prime objective of this study was to study the determinants of technical efficiency and financial sustainability of sunflower oil processing firms, where three specific objectives were developed and addressed:

- To determine the influence of firm-specific factors on technical efficiency of sunflower oil processing firms in Tanzania
- To determine the influence of technical efficiency on the financial sustainability of sunflower oil processing firms in Tanzania
- To determine the influence of firm-specific factors on the financial sustainability of sunflower oil processing firms.

The discussion in this chapter is focused to address the three objectives as follows:

5.2. Firm-Specific Factors and Technical Efficiency

The influence of firm-specific factors on the technical efficiency in this objective, involves eight independent variables which were hypothesised to explain technical efficiency of sunflower oil processing firms: These are firm age, size, location, total industrial work experience and education level of the owner, training of employees, the legal ownership of the firm and the age of the owner. Three (3) variables related negatively with technical inefficiency of the firms under the study to mean that they reduce inefficiency. These are location of the firm, ownership type and education level of the owners. Also two (2) variables, firm age and age of the owner related positively with technical inefficiency of the firm under the study to mean that their increase increases the level of inefficiency in sunflower oil processing firms. Following the negative and positive direction of both statistically significant and insignificant variables in the model, some being contrary with theory used to ground the study as well as with other empirical literature on other sub-sectors, a qualitative follow-up was considered important. This was done through in-depth interview to some of the owners of the firms, SIDO, TFDA and CEZOSOPA officers as key informants. These were purposely selected to seek out the reasons of the observed discrepancy on the behaviour of the independent variables toward the dependent variable.

The findings from content analysis are integrated with quantitative findings presented in Chapter 4 for enhanced discussions in this chapter for all firm-specific factors used in this objective, starting with statistically significant factors and then insignificant ones basing on the model results presented in chapter four. The coefficients of insignificant variables help to know the direction of the influence of the variables to the dependent if improvement could have been made on the same.

5.2.1 Firm-Specific Factors tested statistically significant Determinants of Technical Efficiency

Based on the analysis of this objective in Chapter 4, it is indicated that a negative sign on a parameter in the inefficiency effect model means that the variables improve technical efficiency, while the reverse is true for a positive sign. Thus technical efficiency of small scale sunflower oil processing firms in Tanzania is positively associated with the education level of the owner, location of the firm and ownership type and negatively related to firm age and the age of the owner as explained below:

5.2.1.1 Education level of the Owner

The education level of the owner was considered in this study to capture human capital in terms of skills and knowledge. Since most of the small scale processing firms, particularly sunflower oil are individual owned and controlled, thus education of the owners was thought of as an important determinant of technical efficiency in these firms. The variable revealed a negative and statistically significant coefficient with the inefficiency model as theoretically expected to imply that technical inefficiency in sunflower oil processing firms' decreases with the increase in the education level of the owner. In other words, one additional year of schooling enhances the technical efficiency of the sunflower oil processor to great extent.

Also from the content analysis of qualitative follow-up interview, most of the participants revealed that education of the owner enhances the skills and capabilities to adopt technology. In the same way, education level enhances the stock of human knowledge which consequently increases efficiency. Well- educated owners make rational decisions that improve efficiency in sunflower oil processing firms under the study. These imply that higher levels of educational attainment encourage better utilization of resources employed in sunflower oil processing firms processing and brings about the choice of better input combinations. Also as quoted from one of the sunflower oil processing firm owner, who is also the chairperson of their association (CEZOSOPA), through a qualitative follow-up interview:

“Generally, high level of education of the owners in sunflower oil processing, helps in identifying: Location for firm which depend on close proximity to raw materials and markets, better machines which are inexpensive and resourceful for oil extraction purposes and quality seeds with more oil content and how to increase their product quality and meeting TFDA standards to secure both local and international markets”.

These findings are in line with the study by Mushi (2016) on cost efficiency of small scale sunflower oil processors in Dodoma region which revealed that education of the owners is important tool which enable them to process efficiency overtime. It provides them with ample understanding on how firms are managed in order to maximize output and generate enough revenues for growth in the anticipatable future. Therefore technical efficiency and education of the owners are closely related in the sense that, increase in efficiency increase in any firm is largely associated with three factors such as progress of knowledge, technology and human capital. It therefore enables the owners to identify appropriate firm’s location, quality raw materials sources and even good market channels for selling their output.

Furthermore, these findings are in line with the study by Jude (2007) on technical efficiency of rice producers in Uganda which revealed that education of an individual plays a significant role in improving the efficiency of the firm by aiding adoption of requisite technologies and analysing them. The above findings are also consistent with what was found previously in some studies. For instance the study by Tingum and Ofeh (2017) on the determinants of technical efficiency of manufacturing firms in Cameroon which revealed that technical efficiency increases with the increase in educational attainment of the owner. Not only that but also with the study by Dzever et al.,(2016) on Technical Efficiency among Small and Medium Scale Entrepreneurs in High-Quality Cassava Flour in Four Geo-Political Zones of Nigeria which concluded that education influence the ability of processors to adopt improved technology used for processing and consequently improve productivity and efficiency. Others include the study by Admassie and Matambalya (2002); Zahid and Mokhtar, (2007); Amornkitvikai and Harvie (2010, 2011), Charoenrat (2012). Therefore, this implies that SME with a literate and well-trained work-force and management are thus likely to be more efficient because of their greater capacity to

absorb and effectively utilise new technology as compared to those who are not educated.

5.2.1.2. Location of the Firm

Location of the firm contributes negatively and statistically significant to the inefficiency of sunflower oil processing firms to imply that technical inefficiency decreases with the location of the firm. Since the location was captured as a dummy variable, 1 for a sunflower oil processing firm operating in Singida and 0 for those located in Dodoma, the selection of the reference category was by default since the two regions are major producers of sunflower seeds and sunflower oil processing firms have almost similar operating characteristics. Compared to the sunflower oil firms operating in Dodoma region, the negative sign with location implies that sunflower oil processing firms located in Singida are more likely to reduce inefficiency than those in Dodoma region.

This is due to the quality of inputs particularly raw materials since the region is ranked high in production of sunflower seeds across districts, thus processors choices to select materials of high quality (TAOSA, 2012). Also, through a qualitative interview with some firm owners to triangulate the findings as indicated in Table 4.33 in Chapter 4, it was revealed that the availability of sunflower seed as a raw material close to the processing firms in the area reduces the problem of middlemen costs and hence facilitates high processing of sunflower oil. Middlemen people, stand as bridges / barriers between farmers and processors, they buy raw materials from the farmers at low prices and sell to the processors at a higher price as compared to when the processors could buy directly from the farmers. Under these circumstances, sunflower oil processors cannot compromise on the quality of material to middlemen people. They could just buy regardless of quality.

Also, most of the sunflower oil processing firms under the study are located in urban/ township/municipal areas where there are improved infrastructure for easy access to materials and market opportunity. Most of the firms are located along Mwanza highway and are bit clustered around SIDO regional offices and in semi-urban centres of Manyoni, Ikungi, Iguguno, Ulemo, Kiomboi and Mkalama as compared to

those operating in Dodoma.

On the other hand, from an in-depth qualitative interview with some key informants particularly with Central Zone Sunflower Oil Processors Association (CEZOSOPA) chairperson, Tanzania Food and Drug Authority (TFDA) and Small Industrial Development Organisation (SIDO) officials and Local Investment Climate (LIC) Cluster Advisor in Dodoma region, it was revealed that 95% of the sunflower oil processors in Dodoma operate their factories within the central residential areas where there are accessibility challenges to both customers and materials. Location problem in the area brings in the issue of middlemen people who sell their raw materials to the processors at high costs since there is no specified location of sunflower oil processors in Dodoma where farmers can easily sell directly to processors. This also hinders the firms to scale-up due to uncertain location and sometimes results into failure to meet TFDA and TBS standards and hence difficult in acquiring TFDA and TBS certificates as a result only 7 sunflower oil processing firms in the area managed to conform with standards and have certificates. Furthermore, operating in their residential area resulted in collapse and difficult formation of clusters which could attract more designed location and hence easy accessibility of inputs. Finally, the firms are characterised by being tax aversion and hence no any public support like infrastructure improvement by the government toward them.

These study findings are in line with the study by Tran et al. (2008), Le and Harvie (2010) and Charoenrat (2012) which revealed a negative relationship between location and technical inefficiency of the firm to mean that strategic industrial location improves technical efficiency of the firm.

5.2.1.3. Legal Ownership of the Firm

Likewise, the legal ownership of the firm was captured as dummy representing two major types of ownership 1 for sole proprietorship and 2 for partnership form of ownership. Partnership type of ownership was set as reference base, thus as compared to partnership, a sole proprietorship type of ownership revealed a negative and statistically significant relationship with technical inefficiency of sunflower oil

processing firms under the study to imply that sunflower oil processing firms under sole proprietorship type of ownership are more efficient compared to partnership form of ownership. Importantly the sole proprietorship form of ownership was revealed descriptively to dominate in this sub-sector indicating one-man show in the management of the firm, while the partnership was revealed to few firms being formed among family members. In view of this, it can be concluded that there is a tendency in this sector to confine ownership of the firm to the family only.

Through an in-depth interview with some sunflower processing firm owners, it was revealed that individual owned businesses are easy to be formed and the owners are the bosses of their businesses i.e. they are not accountable to any boss or supervisor, possesses all of the authority to make decisions on behalf of the company, keep all the profits i.e. are the sole owners of their businesses and do not split profits with other owners, have maximum privacy, can easily change their legal structure as well as can easily wind up their businesses when the need arises. Also in this type of business, there are no specific business taxes paid by the firm. The owner pays taxes on income from the business as part of his or her personal income tax payments. All these help the business firm to accumulate enough working capital for acquiring inputs and hence output maximisation.

On the other hand, during the qualitative interview with key informants, it was evidenced that in a partnership form of ownership, there is a risk of disagreements and friction between partners and management. Also, each partner is an agent of the partnership and is liable for actions by other partners. Additionally, if partners join or leave, there are possibilities of valuing all the partnership assets. This may increase inefficiency of the firm in the sense that the partners may have different interest and thus goal congruence in maximising output might be a problem. The findings are in line with the findings from previous studies on manufacturing SMEs which revealed that most of the firms are owner managed which fall under sole proprietorship (Admassie & Matambalya, 2002; Isaga, 2012).

However, the findings contradict with the study by Hawassi (2006) in the analysis of processing, marketing and demand for processing fruits and vegetables in Tanzania where it was revealed that many firms were under the partnership, which is mainly formed by family members. Conversely, Dzever et al. (2016) revealed that the type of ownership structure does not have any significant influence on the technical efficiency level of high-quality cassava processors in Nigeria.

5.2.1.4 Firm Age

Firm age in this study was measured by the number of years in operation since the firm establishment. It was found that age of the firm is positively and highly significantly related to the technical inefficiency in sunflower oil processing firms under the study. The positive direction implies that the inefficiency of sunflower oil processing firms increases with age. From an in-depth qualitative interview with SIDO officials, it was revealed that more aged firms are less efficient compared to the newly established firm regardless of the accumulated experience through learning by doing and high investment capital over time as this can be off-set by out-dated production technology and machines.

Therefore, contrary to other firms, firm age in sunflower oil processing firms has been ascertained with the use the obsolete technology with little or no technological change and that is why inefficiency increases with increase in firm age. The greater indifference observed was through possession of older machinery as most of them own single refined machines rather than double refined ones. It becomes too expensive and difficult for them to fragment the old machines, for instance, single refined for a double refined one due to their low capital according to their nature and hence efficiency decreases. In addition, old firms may not be willing to try new innovation and technology due to financial constraints and thus inefficiency.

Theoretically, firm age is associated with the learning by doing would be expected to increase efficiency. This could also imply that processing firms with more years of experience will have better knowledge of machine operation, better knowledge of efficient allocation of resources and are expected to run a more efficient and profitable firm.

However, these findings contrast to that of Admassie and Matambalya (2002); Batra and Tan (2003); Amornkitvikai and Harvie (2010, 2011) reported that firm age has a statistically positive impact upon a firm's technical efficiency. Likewise, the findings of this study are against with the recent study by Tingum and Ofeh (2017) which revealed that firm age is a major determinant of the technical inefficiency of manufacturing firms in Cameroon as it reduces the inefficiency of the firms. The source of differences on the findings between these studies and sunflower firms under the study could be the nature of the sub-sectors involved, context and environmental, cultural and technological differences in which the studies were conducted particularly from developed and developing countries.

5.2.1.5 The Age of the Owners

The age of the owner was used as one of the variables of interest since the majority of sunflower oil processing firms are individually owned, thus characteristics of the owner including age could not be excluded as one of the factors in explaining the performance of their firm. The variable was found to be positively and significantly related to the technical inefficiency of sunflower oil processing firms under the study. This implies that inefficiency in sunflower oil processing firms increases with age of the owner. The descriptive results in Table 4.3 of the age distribution of the respondents in Chapter 4 also revealed that majority of the players in this subsector of about 66.6% (n =146) are of active age, ranging between 26 to 45 years. Few of about 24.3 % (n = 53) had more than 55 years. The optimal production age of sunflower oil processors under the study is 40 years on average.

By conducting a qualitative interview with the key informants, it was revealed that the decrease in technical efficiency due to the age of the owner has been attributed to poor mobility and low production motives despite their greater practical problem-solving ability. In other words, inefficiency of the firm under the study increases as the owners grow older and get past of their productive age of 40 years. Also, their flexibility and willingness to make a fundamental strategic change of business directions diminishes with age. These results are also consistent with previous studies in other manufacturing sub-sectors conducted in Tanzania (Hawassi, 2006; Isaga, 2012; Tundui, 2012).

5.2.2 Firm-Specific Factors that Appears Statistically Insignificant

Only three (3) firm-specific factors out of eight (8) included in the inefficiency model: firm size, the experience of the owner and training of the employees revealed a negative correlation with inefficiency model to imply that they reduce inefficiency in sunflower oil processing firms though they were not statistically significant as explained below:

5.2.2.1 Experience of the Owner

Though the total industrial experience of the owner appears to be insignificant determinant of technical efficiency of sunflower oil processing firms under the study, a negative coefficient revealed in Table 4.14 of MLE results implies that industrial experience reduces firm inefficiency due to accumulated management practices and learning by doing by the owners. This is due to add up experience and thus more likely to accept innovations and might have more chances of reducing inefficiency than their counterpart. Descriptive statistics in Table 4. 8 revealed that most of the owners, about 85.4% (n=187) had less than 5 years of industrial working experience which is hard to be reflected on the performance of sunflower oil processing firms. This observed behaviour is due to the seasonality nature of the business and newness of the industry in the area revealed through a detailed qualitative follow-up with the key informants. It was further evidenced that sunflower oil processing firms do not operate throughout the year due to limited materials during the off-season. This may not results in intensive industrial experience of the owner due to seasonal production and thus may not have much role to contribute in reducing technical inefficiency of the firms under the study.

This observation is contrary to the literature in other subsectors other than in sunflower oil processing firms like the study by Katozai (2005) and Nsubuga, (2009) which revealed that experience of the owner influences the performance of the firms. Thus owners with high working experience perform better than the ones with low/no working experience something which is not applicable to sunflower oil processing firms. As one acquires more work experience, s/he acquires more skills, techniques and methods that improve performance capabilities (Katozai, 2005; Nsubuga, 2009). This means that an increase in work experience results in higher job knowledge and

task performance. Literature also reports that the performance of individuals differs from culture to culture and country to country depending upon the knowledge and experience of the firm owner (ibid). However, the findings align with the fact that sunflower oil processing firms are capital (machine) intensive and thus the industrial experience of the owner may not have a significant impact on the technical efficiency.

5.2.2.2 Firm Size

With regard to inefficiency model, though not significant, firm size also revealed a negative relationship with inefficiency model for sunflower oil processing firm to imply that it reduces the technical inefficiency of sunflower oil processing firm but not an insignificant determinant. In this study, the number of employees in the firms under the study was considered as a proxy measure of firm size. Since, the numbers of employees are used as one of the criteria in classifying the firms according to their size apart from capital (URT, 2003). The number of employees for the firms under the study ranges from 5 to 29 to mean that sunflower oil processing firms under the study are of small scale as they fall under 5 to 49 employees (ibid). The variable does not matter in determining the technical efficiency level of the firms under the study.

This observation is linked with the findings that sunflower oil processing firms are machine intensive and not labour intensive due positive highly elastic and significant value of capital in the production frontier model.

The findings on this study contrast with the number of empirical studies conducted in various countries including Thailand (Lundvall & Battese, 2000; Batra & Tan, 2003; Charoenrat, 2013); in Vietnam (Amornkitvikai & Harvie, 2011) in Tanzania (Admassie& Matambalya, 2002; Niringiye et al., 2010) and in Malaysia (Zahid & Morkhtar, 2007) respectively, which found that the firm size has a significant and positive relationship with SMEs' technical efficiency. Therefore, due to contradictory findings, it can be concluded that the literature on the effect of firm size on efficiency of the firms is still ambiguous depending on how the variable was measured, countries in which the study was conducted and sectors analysed.

Though the role of firm size, measured in a number of employees is not reflected directly from stochastic frontier and inefficiency model, they should not be ignored

completely. This is due to the fact that sunflower oil processing firms need few employees to support the machines during the extraction of oil, labelling and packaging output for marketing purpose and thus this study considered the inclusion of staff productivity to measure efficiency utilisation of staff in these firms for their improved financial sustainability as reflected in objective two of the study.

5.2.2.3 Training of the Employees

Though training of employees revealed a negative sign to the inefficiency model, it was not significant. This suggests that training of the employees in the study is not a determinant of technical efficiency in this sub-sector. Though the variable is not among the significant determinant of technical efficiency in sunflower oil processing firms under the study, a negative coefficient with the inefficiency model implies that inefficiency of the firm can be reduced by trained employees of the firm as compared to the firm whose employees are not trained at all. Therefore, the results necessitated exploring the reasons as to why training of the employees was not significant as theoretically expected.

Through an in-depth qualitative interview made with the owners and some officials from the organisation dealing with these firms like SIDO, TFDA and CEZOSOPA as key informants, it was noted that majority of the sunflower oil processing does not provide intensive industrial training to enhance the skills and capabilities of the employees. Though from the descriptive statistics in Table 4.9, it was revealed that 67.6 % (n=148) of the firm owners offer training to their employees in their firms. But through an in-depth qualitative interview, it was revealed that the kind of training offered is not adequate. They give mere instructions which are not scheduled as they are given during oil extraction process which sometimes interferes with the production of the firms. Thus most of employees' use their own initiatives and experience gained for a prolonged involvement in this business in different similar firms. This is due to the fact that most of the employees are casual labour with few being permanent employed. Well trained personnel could have the capacity to understand and adopt improved technology that would shift the production frontier upwards. These findings contrast with the study by Admassie and Matambalya,

(2002); Zahid and Mokhtar, (2007); Amornkitvikai and Harvie, (2010, 2011); Charoenrat (2012) which revealed that industrial training of the employees is significantly related with the firm's efficiency.

5.3 The Influence of Technical Efficiency on Financial Sustainability

In this objective, the influence of technical efficiency on financial sustainability of sunflower oil processing firms was measured by technical efficiency levels while controlling for staff productivity. Staff productivity is a measure of efficiency as revealed by the study by Nyamsogoro (2010) and Thela (2012) on Microfinance Institutions. Its inclusion on this objective was deemed important as a measure of efficiency in explaining the financial sustainability of the firms under the study. Technical efficiency levels estimated from Stochastic Frontier Analysis (SFA) formed a column of continuous variables with scores from each specific firm while the staff productivity ratio was used to determine the extent to which sunflower oil processing firms utilise their staff in maximising the output. This was estimated as the ratio of total quantity processed and sold in litres with the number of staff employed in each firm. The use of these two indicators measured from two different approaches was to investigate the influence of a combined measure of efficiency, from both advanced models and traditional ratio approach on the financial sustainability of sunflower oil processing firms in Tanzania. The econometric results revealed a strong and highly statistically significant relationship between technical efficiency levels and the financial sustainability of firms under the study to mean that technical efficiency is necessary for the financial sustainability of sunflower oil processing firms as further explained below.

Technical efficiency levels revealed a positive and a significant relationship while staff productivity ratio revealed a negative relationship with the financial sustainability of sunflower oil processing firms respectively. In this sense, the positive relationship of technical efficiency levels with financial sustainability implies that increase in technical efficiency level in sunflower oil processing firms, increases the profitability of the firm and hence financial sustainability is attained. This can be met if the existing resources of the firm will be used efficiently with

either minimal cost or income maximisation at a given level of operation thus will have a persistent positive impact on the financial sustainability of the firm. Technical efficiency level indicates the extent to which firms transformed their input factors of production to Maximise output under a given technology (machine). When that is done, its effect is on improved financial sustainability of the firms.

Moreover, technical efficiency levels were computed from the input-output relationship of capital, labour and material to the litres of oil processed as output. In this capital and materials contribute significantly to the output though with different directions, positively with capital while negatively related with materials of production. The negative relation with material implies that the output of the firm declines with an increase in materials. This is due to low quality of raw materials used in the production, purchased at high time / during harvest season without much quality compromise to avoid shortage during off- season due to seasonality nature of the sunflower seeds. The seeds are not available to processors throughout the year and if available through the middlemen will be sold at high cost regardless of their quality and thus result into low production.

Since capital comprised of initial cost of production machines which are available to all firms, thus it contributed positively with high elasticity to imply that, it is the most contributing input factor of production to sunflower oil processing firms' production capacity. The findings are in line with the study by Essmuis et al. (2013) and Ngeh (2014) respectively which also found that technical efficiency influence financial sustainability of the manufacturing firms.

Moreover, from in-depth qualitative follow-up interview with the respondents and the key informants, the study revealed the following key facts related to capital, materials and marketing challenges which impede maximum output and financial sustainability of the firms under the study.

Lack of Capital

During the interview, it was clearly observed that sunflower oil processing firms under the study are constrained with limited capital which results in low productivity. Sunflower oil plants require double refined machines which are much expensive for

high-quality products to meet the market requirement. This was the most prominent challenge perceived to be the most burning issue to most of the sunflower oil processing firms as quoted from one of the sunflower oil processing firm owner:

“The big issue is capital; if you have money everything will be possible. Money is needed to pay for high-quality machinery- a double refined, meet unpredicted expenditures such as machine repairs, afford high-quality raw material all year round, advertising, TBS, packaging, to upgrade and comply with regulations, to pay for transport to markets and electricity”

Also, it was further revealed that the nature of sunflower oilseed required for high-quality oil is expensive and hard to obtain. The available seeds provide 18 to 20 litres of oil from one bag of 70kg, different from high-quality seeds which give 22 to 23 litres of oil per 70kg.

Thus fail to operate all the year round due to the low capacity of stocking quality seed resulting from lack of adequate investment and working capital. Therefore, insufficient financial resources were mentioned as a major constraint to sunflower oil processing firms in Tanzania, particularly modern machines for the double refined product.

Availability of Quality Raw Materials

Insufficient supply of quality raw material needed for sunflower oil processing firms mainly due to seasonality nature of the business was another challenge to achieve maximum technical efficiency for financial sustainability. This creates uncertainties for processing enterprises relying on seasonal sunflower seeds as they are not able to operate all the year round and thus low capacity utilisation of their machines. This also results in the inadequate output to cater for the high demand due to increased population and improved life standard to both rural and urban dwellers. They only operate for six to eight months within a year as they do not have enough raw materials for processing all the year round to utilise fully the capacity of their processing machines.

Like most agricultural produce, sunflower seeds are mainly available at the end of the harvest season. Since most small farmers do not have enough storage facilities, they prefer selling their produce during the season to avoid storage costs and waste, and it

is left to the processor to balance the purchase of sunflower seeds, process them to oil, and meet the regular demand of the consumer markets. While the crushing equipment is a relative of small investment, the processor has to spend much money on buying and storing the sunflower grains to enable him to meet demand continuously. For example, a processor has installed a crushing capacity of about 50 bags per day; he would need to purchase about 10,000 bags if he wanted his machine to be active for 200 days. The purchase requires a capital of about Tsh. 300 million which is far in excess of the machinery investment costs (RLDC, 2008). At the same time, sunflower oil processors are sometimes not able to buy sufficient quantities of sunflower seeds at going prices as it was stated by one of the owners:

“Availability and quality of raw material is a problem because the price is really high in low seasons. The price can be twice as high compared to harvesting season. Now it’s around 60, 000, but in high season it can be as low as around 30, 000 Tsh.”.

Therefore, seasonality nature of the material is a challenge in the sense that it causes a rise in price with uncertainty and inconsistent quality and thus affects the financial sustainability of sunflower oil processing firms in the area.

Marketing Constrains of their Produce.

Majority of sunflower oil processing firms under the study remarked that their market distribution network of their produce is still concentrated mostly around the same area they are located, with few sales made in the distant domestic markets and to the neighbouring countries like Kenya, Rwanda and Burundi. Small local retailing enterprises and direct consumers are major customers of firms’ products.

Also, a difficult compliance standard from Tanzania Bureau of Standards (TBS) and Tanzania Food and Drug Authority (TFDA) to qualify for international markets was observed as a major problem to most of the sunflower oil processors. This is due to product quality problems as most of sunflower oil processing firms do not have required certifications, as a result, many remain to sell their produce informally in the local market at the same time striving to qualify for the certificates. High-quality products which conform to standard would help to increase the acceptability of their product(s) in the market both locally and globally. Despite the competitive

advantages that come with TBS-certification however, only a few firms produced TBS-certified sunflower oil. Surprisingly, all respondents were familiar with the regulations and requirements of this certification and most seemed to be aware of what they were missing. As one of the sunflower oil processors' responded:

I don't have TBS because of a lot of standard issues required; you need to have good machinery and enough packages for the products. You also need the special machine to seal the product. A lot of qualifications are needed therefore it is hard for people like me with small capital to qualify for TBS.

In addition, the interviews with owner-managers of the sunflower oil processing firms revealed further that, their oil faces unfairly strong competition in the market from edible oil locally manufactured from imported palm crude oil material. It is duty-free and used to produce cheap oil like Korie which out-competes local sunflower oil made from locally produced oil seeds and thus the demand for locally produced oil and the total revenues falls as well. This is due to the fact that, consumers preferred cheap oil without thinking of their health effect.

However, the issue of double refined machines was a cry for the majority as it improves the quality of their produce particularly the sunflower oil processors. Thus, few processors with double refined machines sell their produce at a high price as compared to single refined.

Importantly, the use of staff productivity ratio in this study as one of the measures of efficiency on the financial sustainability was particularly to find out how sunflower oil processing firms utilise their staff to maximise their output for high profitability and hence financial sustainability. Contrary to the theory, staff productivity ratio related negatively to the financial sustainability of sunflower oil processing firms. This implies that the increase in staff productivity ratio decreases the financial sustainability. This implies that firms with less number of staff are relatively less profitable. Theoretically, it would be expected that high staff productivity ratio would lead to lower cost of labour and hence a high profit to attain financial sustainability, but the empirical evidence suggests otherwise.

A detailed qualitative follow-up was necessary to understand the key reasons for the observed behaviour. Through an in-depth interview with owner and key informants, it was revealed that firms the nature of Sunflower oil is that only profitable firms do employ. Also sunflower oil processing firms are basically family businesses, thus firms with few staff end up having higher staff productivity (all things being equal). This could trigger higher profitability; however this is not going hand in hand with with increase in sales which is being influenced with the quality of output. Thus what matters is the quality of materials used in the production.

In addition, the interview with the key informants revealed that, despite their high staff productivity, most of the employees are not well trained in processing, packaging, overall hygiene and material handling to avoid waste. In the same vein, it was revealed that since most of sunflower oil processing firms are family businesses, so large portion of their consumptions are drawn from the business and thus decline in financial sustainability. Though from a different context, a negative relationship between staff productivity and financial sustainability of the firms was also observed in the study by Nyamsogoro (2010) on the financial sustainability of rural microfinance in Tanzania.

Therefore, by using a combined measure of efficiency in studying the determinants of financial sustainability of sunflower oil processing firm, it was observed that technical efficiency level from a transformed set of inputs, particularly capital and materials under a given technology matters a lot in improving the financial sustainability of the firms under the study. Also, though staff utilisation efficiency is negatively related with financial sustainability of the firm, their role should not be ignored completely.

5.4. The Influence of Firm- Specific Factors on the Financial Sustainability

The contribution of firm-specific factors to the financial sustainability of sunflower oil processing firms was revealed when technical efficiency levels and staff productivity ratios (measures of efficiency) were controlled under Hierarchical Multiple Linear Regression analysis model. This was done to establish the true effect of firm-specific factors on financial sustainability of the firms under the study. By

controlling technical efficiency levels and staff productivity ratio differences, the location of the firm and firm size contributed statistically significantly at 5% level to the financial sustainability of sunflower oil processing firms in Tanzania.

Location of the firm revealed a strong and positive relationship toward the financial sustainability to mean that, the strategic industrial location of the firms do matter a lot in predicting the financial sustainability of sunflower oil processing firms in Tanzania.

Through a qualitative follow-up, it was revealed that most of the sunflower oil processing firms in Singida regions are located in urban/ township/municipal areas, mostly along the high way where there is improved infrastructure for easy access to the market. Most of their customers are passengers travelling from coastal to lake and northern zones and vice versa, as well as to the neighbouring countries like Rwanda, Burundi, and Kenya. Furthermore, sunflower oil processing firms located along Mwanza and Arusha highways are bit clustered around SIDO regional office and in semi-urban centres of Manyoni, Ikungi, Iguguno, Ulemo, Kiomboi and Mkalama as compared to those operating in Dodoma region. Thus access to the market is not a problem for sale of the processed oil through their open market to both wholesalers and retailers and thus increase revenue for financial sustainability.

However, through an in-depth interview with the key informants in Dodoma region, it was revealed that 95% of the sunflower oil processing firms are located in the residential areas which bring chaos to customers for they cannot easily access the products for consumptions. These also result in transport cost by the firm to search for open and accessible market by customers in bus terminals and along Dar-es-salaam high way which reduces the profitability of the firm and hence financial unsustainability.

In the same vein, some sunflower oil processors have decided to hide their factories in their backyards with no proper registration and identification and thus difficult to conform to standards. Most of the firms don't get support from TBS and TFDA and thus their product does not meet their international standard to be sold at high prices. They are termed as low standard produce sold locally to retailers and supermarkets for home consumptions.

On the other hand, firm size revealed a negatively statistically significant relationship with financial sustainability of the firm. Increase in firm size, measured in a number of employees reduces the financial sustainability of sunflower oil processing firms in Tanzania. This implies that sunflower oil processing firms are machine intensive and do not require much labour power. Increases in labour result in the high cost of hired labour as well as large firms experience management and supervision problems and hence low productivity.

Also through an in-depth interview on the reasons as to why firm size is negatively related to the financial sustainability, most of the sunflower oil processing firms owners claimed that they only employed few permanent workers and hired many temporary workers during high season when there was a sharp increase in workload and thus cost of production increases. Sometimes they work night shifts which need double payment of the wages and thus decrease the profit of the firm and hence financially unsustainable.

More so, seasonality nature of the business does not favour permanent employees which might be idle most of the time particularly off-season, accompanied by the high cost of payment to affect the profit of the firm. Also according to Dzever et al.(2016), large firm size may constitute a drain on resources of the processors thus decrease technical efficiency and hence financial sustainability is reduced. Thus a minimal number of employees should be observed to minimise the cost of wages for higher performance.

Importantly, a strongly and statistically significant influence of controlled technical efficiency levels and staff productivity ratios suggests that firm-specific factors work better under technical efficiency environment for more improved financial sustainability in sunflower oil processing firms under the study. This was also revealed by a small R square change from 75.7% to 79.3% after introducing the control variable. Therefore it can be evidenced that technical efficiency of the firm can be considered as an important stepping stone toward the financial sustainability of sunflower oil processing firms.

This studied relationship is scanty found in the literature as the past empirical studies (Cull et al., 2007; Nyamsogoro, 2010 and Kipesha, 2013) though concentrated on Microfinance institution, they did not consider technical efficiency as a control variable. This gap guaranteed empirical settings in sunflower oil processing firms in Tanzania.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

6.1 Introduction

This chapter presents a summary of the major findings of the study, conclusions with reference to study objectives and implication of the findings to policy and practice by suggesting possible policy measures and interventions for improved Technical Efficiency and Financial Sustainability of sunflower oil processing firms in Tanzania. The chapter also highlights some limitations of the study which worth acknowledging and providing possible areas for further studies. Finally, it ends up by indicating key knowledge contribution made by this study.

6.2 Summary

The major aim of this study was to examine the determinants of Technical Efficiency and Financial Sustainability of Sunflower oil processing firms in Dodoma and Singida regions in Tanzania. This was achieved by firstly developing a comprehensive conceptual model reflecting the causal- effect relationship of study objectives, grounded by Resource-Based and Profitability Theories as indicated in chapter two. This formed the research model that examined the determinants of technical efficiency and the financial sustainability of sunflower oil processing firms (SOPFs) in Tanzania from a developing country perspective. To achieve the purpose, the study used data collected purposely from 219 firm owners and 9 key informants using questionnaire and interview guide respectively. Data collected were analysed using One Stage Stochastic Frontier Analysis (SFA), Standard and Hierarchical Multiple Linear Regression models respectively, to simultaneously estimate technical efficiency levels and their determinants, determine the influence of TE on FS and the influence of firm-specific factors on the FS of sunflower oil processing firms based on the requirement of each specific objective as summarised in the following sections.

6.2.1 The influence of Firm-Specific Factors on Technical Efficiency

In this objective, technical efficiency levels (a measure of technical efficiency) and their determinants (firm-specific factors) were simultaneously estimated using One Stage Stochastic Frontier Approach (SFA) with inefficiency effect model, based on Cob-Douglas production function under Maximum Likelihood Estimate method (MLE) as proposed by Battese and Collie (1995). Eight (8) firm-specific factors were considered in the model as the determinants which include firm age, size, and location, ownership type, training of employees, experience, education level and age of the owner. Since the inefficiency model was used, thus a negative sign on a parameter that is explaining inefficiencies means that the variables improve technical efficiency, while the reverse is true for a positive sign.

It was found that technical inefficiency of sunflower oil processing firms is significantly and negatively related to location, ownership type, and education level of the owner, except for the age of the owner and age of the firm which were positively related. The variables contribute to a mean technical efficiency level of 53% jointly with capital and material input resources. This implies that on average, 47% technical potentialities are not achieved due to inefficiency, which means an opportunity that the level of output in sunflower oil can be improved under a better utilisation of the given set of inputs resources and technology.

6.2.2 The influence of Technical Efficiency on Financial Sustainability

In this objective, the influence of technical efficiency on financial sustainability was measured through technical efficiency levels and staff productivity ratios by using a Multiple Linear Regression Analysis model since all variables (dependent and independent variables) were continuous in nature. It was found that both efficiency indicators were statistically significant at 5% level in explaining the financial sustainability of the firms under the study though with different directions. Technical efficiency level was positively related with the financial sustainability to imply that financial sustainability increases with increase in technical efficiency level while staff productivity ratio was negatively related with financial sustainability of sunflower oil processing firms in Tanzania to imply that increase in staff productivity ratio decreases the financial sustainability of the firm.

6.2.3 The influence of Firm-Specific Factors on Financial Sustainability

Importantly, Hierarchical Multiple Linear Regression analysis model was employed to analyse the effect of firm-specific factors on the financial sustainability of sunflower oil processing firms in Tanzania when technical efficiency levels and staff productivity ratios were controlled. This was done to control the effect of technical efficiency on the financial sustainability revealed on objective two so that the study can establish the true effect of firm-specific factors on the financial sustainability of sunflower oil processing firms. The model depicted a highly statistical and significant relationship between both the controlled variables and firm-specific factors to the financial sustainability of sunflower oil processing firms under the study. The inclusion of firm-specific factors on the model raised the value of R square from 75.7% to 79.3% which implies that firm-specific factors are also important determinants of financial sustainability of the firms under the study. Specifically, location of the firm and firm size were the only firm-specific factors appeared significant determinants of financial sustainability of sunflower oil processing firms in Tanzania apart from technical efficiency level and staff productivity ratio.

6.3 Conclusions

The main objective of this study was to examine the determinants of technical efficiency and financial sustainability of sunflower oil processing firms in Tanzania. Specifically, the influence of firm-specific factors on technical efficiency, Technical efficiency on financial sustainability and firm-specific factors on financial sustainability of sunflower oil processing firms were studied. Besides, specific research questions were used to test these relationships. The conclusions are therefore made basing on the empirical evidences of the statistically significant variables from each objective as provides the following sections.

6.3.1 Firm-Specific Factors influencing Technical Efficiency of SOPFs in Tanzania

Based on the empirical evidence from the econometric analysis provided in Chapter 4, triangulated by qualitative follow-up interview on the reasons for the observed behaviour of independent variables toward the dependent, we conclude that location of the firm, education level of the owners, ownership type, firm age and age of the

owner are significant determinants of technical efficiency in sunflower oil processing firms in Tanzania. Also, SOPFs operate at the mean technical efficiency level of about 53% with capital and materials inputs contributing significantly to the output. This suggests an opportunity of about 47% for more output improvement can be obtained through a better use of a given set of inputs resources and technology. Thus, the efficient use of input resources is an issue which needs to be addressed in sunflower oil processing firms particularly on the availability of quality materials and adequate capital to upgrade their machines for improved technical efficiency.

Sunflower oil processing firms are constrained by the input resources of production particularly capital (improved machines) and quality materials and thus technically inefficiency by being operating under capacity. Most of the firms use single refined machines which is regarded as the used of out-dated technology and thus inefficiency. Also, the seasonality nature of business due to limited materials all the year around contributed to their technical inefficiency and financial unsustainability, since most of the processors sometimes purchase sunflower seeds during off-season at higher costs through middle-men who collected then direct from farmers without quality compromise as they even order them before harvesting period. The direct link of processors with the suppliers (farmers) for raw material will have greater implication to output processed in terms of quantity, quality and cost saving and hence improved technical efficiency and financial sustainability of sunflower oil processing firms.

6.3.2 The influence of Technical Efficiency on Financial Sustainability of SOPFs in Tanzania

Based on empirical findings provided in chapter 4, we conclude that technical efficiency level and staff productivity ratio are significant determinants of financial sustainability of small scale sunflower oil processing firms. Also, on average, sunflower oil processing firms are operating at a level which is not sustainable since their mean financial sustainability is 94% which is just below 100%, indicating that costs are higher than revenue. Therefore, efficiency improvement is necessary for the enhanced financial sustainability of small scale sunflower oil processing firms in Tanzania.

6.3.3 Firm-Specific Factors influencing Financial Sustainability of SOPFs in Tanzania

Based on the empirical evidence from the econometric analysis provided in Chapter 4, we conclude that location of the firm and firm size are significant determinants of financial sustainability of sunflower oil processing firms apart from technical efficiency and staff productivity. Also, small R square change of firm-specific factors in explaining the financial sustainability when technical efficiency levels and staff productivity were controlled indicate that much of the overall variance is explained by controlled variables in explaining the financial sustainability of sunflower oil processing firms. This further stresses that efficiency is an important stepping stone toward the financial sustainability of the firms under the study.

Generally, the findings of this study are also in tandem with theories used to ground the study, as they established focus, limit and relationships of the study variables. Resource-based theory in particular, which perceives the organisation as a bundle of resources and capabilities that can be combined in the best way for a superior performance of the firms. This performance cannot be achieved unless the resources are valuable, inimitable, non-substitutable and non-transferable (Barney, 1991). This means that differences in the performance of sunflower oil processing firms under the study in terms of their technical efficiency and financial sustainability are the result of their distinct resources utilisation and capabilities possessed by specific firms. Likewise, the profitability theory which considers the profitability of the firm as the residual in the sense that most of the sunflower oil processing firms under the study were not financially sustainable since their operating costs are higher than revenue and thus no residual/profit for financial sustainability. Therefore technical efficiency is a necessary condition for financial sustainability of the firm since it informs on whether existing company resources have been used efficiently through cost minimisation or income maximisation at a given level of operation and hence financial sustainability of the firm.

Although this study is confined to the determinants of technical efficiency and financial sustainability of sunflower oil processing firms in Dodoma and Singida regions, the results have been generalised to include other parts of the country dealing with sunflower oil processing due to similar operating characteristics of the firms under the study. Also the sample used is representative since the regions selected as the study area, represent the central sunflower agricultural corridor where sunflower seeds are largely grown.

6.4 Implications of the Findings

6.4.1 Theoretical Implication

Though there have been many studies trying to contribute to the theories and empirical understanding of the determinants of technical efficiency and financial sustainability of the firms worldwide, such studies are very limited to other sub-sectors other than sunflower oil processing firms in developing countries and Tanzania in particular. This study, therefore, attempts to add to the theoretical understanding of the determinants of technical efficiency and financial sustainability for sunflower oil processing firms from resource-based and profitability theories point of view. The study has provided a theoretical review of the role of firm-specific factors on the technical efficiency and financial sustainability of sunflower oil processing firms. It attempted to explain different theoretical reasons as to why sunflower oil processing firms are technically inefficiency and financially unsustainable.

Moreover, a single theory does not widely cover all relevant variables grounding the major concepts of the study (technical efficiency and financial sustainability) by establishing focus, limit and their relationship in addressing the major research question. Therefore, the results of combining resource-based and profitability theories have helped to construct and test a comprehensive theoretical model which has focused on a different way of measuring and explaining the determinants of technical efficiency and financial sustainability of sunflower oil processing firms as reflected on the conceptual framework in Chapter two. The established relationships basing on firm-specific factors as the determinants of technical efficiency and financial

sustainability as well as regarding technical efficiency the determinants of financial sustainability were derived from resource-based and profitability theories. Although important variables of the study came from these theories, other variables studied like staff productivity were borrowed from previous empirical literature; this also added another significance of this study. Therefore, theoretical framework grounded by two theories and literature review provides a holistic approach to examine the determinants of both technical efficiency and financial sustainability of the firms under the study. This implies that either of the theories (resource-based or profitability) could not have been used as stand-alone theory to suffice in explaining the intended relationship.

Furthermore, the variables of the study have been captured in different ways compared to previous studies which form a new theoretical paradigm. For instance, the study used litres processed as a proxy measure of output in estimating technical efficiency levels, since unit processed has a direct link with technical efficiency as it is input-output relationship i.e. transformation of input to maximum output at a given technology. The levels of technical efficiency of sunflower oil processing firms anticipated indicated that there are losses in oil production that could be attributed to inefficiencies due to differences in firm specific factors. Previous studies in other manufacturing sub-sectors used sales turnover as a proxy measure of input, which is the function of many factors like price, advertisement and other marketing issue, thus it is not direct related with the technical efficiency of the firm.

More clearly, the theoretical framework offered an opportunity to examine the preliminary estimation of technical efficiency levels and the contribution of various input factors of productions like capital, labour and material to the output of the firm and their determinants in a single stage. One stage SFA is a parametric model which decomposes its error term into measurement errors out of the control of the firm (noise and other random shocks) and errors due to inefficient factors within the control of the firm. It was from this theoretical ground that the study was able to reveal empirically that sunflower oil processing firms are machine (capital) and not labour intensive. This also emphasize that, though labour is less required, their role

should be considered important, particularly in supporting the machines during oil extraction, packaging, advertisement and marketing issues.

The research model also linked the technical efficiency with the financial sustainability of sunflower oil processing firms and revealed that technical efficiency is necessary for the financial sustainability of the firm. This framework is potentially suitable for testing similar phenomena in the other similar nature of the problem from both a developing and developed country perspective.

6.4.2 Methodological Implication

The study stands under the positivism research paradigm, since all three specific objectives of the study measured causal- effect relationship and thus quantitative in nature. However, the objective nature of quantitative findings does not provide deeper understanding of the reasons as to why some factors were contrary to theory in explaining important determinants of Technical Efficiency and Financial Sustainability of sunflower oil processing firms in Tanzania. Therefore, being an explanatory study, the study was able to contribute on the existing body of knowledge by identifying various reasons on the behaviour of the independent variables toward the dependent variable through a qualitative follow-up to supplement the quantitative findings as a means of triangulation for more diversity and complete understanding of the research problem. The approach was also supported by Webb et al.(1966) through the assertion *that “once a proposition has been confirmed by two or more independent measurement processes, the uncertainty of its interpretation is greatly reduced”*.

A measure of efficiency in explaining the financial sustainability of the firms under the study using two indicators computed from two different approaches is another methodological contribution which was scanty found on the existing empirical literature. Thus, technical efficiency level from advanced model SFA indicating the effective transformation of inputs to maximum output under a given technology and staff productivity ratio from the traditional ratio approach indicating the extent to which the firms under the study utilises the staff in maximising output for enhanced financial sustainability. Introducing staff productivity ratio in the study we were able

to reveal that staff has no much role to play in maximising the output of the firms under the study. Sunflower oil processing firms should keep a minimal number of employees as they can for enriched efficiency and improved financial sustainability. This is because their main driver in maximising output is processing machine and not human capital.

Likewise using both technical efficiency levels and staff productivity ratio in predicting the financial sustainability in objective two, the findings stress more on the positive contribution of technical efficiency levels and negativity of staff productivity ratio toward the financial sustainability of the firms under the study. The findings imply that technical efficiency levels from estimated from a parametric SFA model matter a lot in influencing the financial sustainability of sunflower oil processing firms rather than staff productivity ratio from a traditional ratio approach. Therefore, using more than efficiency indicators in measuring the performance of the firms under the study gave more understanding of the firm specific factors responsible for the technical efficiency and financial sustainability from sunflower oil processing empirical settings.

Besides, using Hierarchical Multiple Linear Regression (HMLR), to establish the true effect of firm-specific factors on financial sustainability of SOPFs when the interfering effect of technical efficiency levels and staff productivity ratios (measures of efficiency) are controlled, is another prominent methodological contribution since there are patchy empirical studies which employed the same approach. Previous studies did not use technical efficiency scores and staff productivity ratios as control variables when assessing the influence of firm specific factors on financial sustainability, thus its contribution is scanty found. This evidence sensitized that efficiency of the firm is necessary condition for more improved financial sustainability of the firms under the study. This has also been supported by Kuhn (1996) and Nyamsogoro (2010) respectively by the assertion that “*devising new approaches and methodologies lead to the discovery of new knowledge*”

6.4.3 Implication of the Findings to Policy and Practices

With regards to the empirical results revealed in this study, important policy interventions and practices to various stakeholders like government and other agencies in the sub-sector may be considered for improved technical efficiency and financial sustainability of sunflower oil processing firms in Tanzania. The only means of ensuring that sunflower oil processing firms operate technically efficiently and achieve their financial sustainability is only if the enabling and constraining firm-specific factors identified significant in the study are considered for improvement. This will, therefore, make sunflower oil processing firm becoming a business venture to attract other new and retain many processing firms in place as well as sunflower seeds' small-holder farmers to improve the quality of raw materials produced for a sustained reliable market.

Profoundly, sunflower oil processing firms in Tanzania have a potential opportunity to operate technically efficiently and contribute greatly to their financial sustainability as most of the firms are new to the industry eagerly and motivated to learn and adopt new technology. Thus various industrial specific measures and interventions suggested can give a series of options which can act as an effort to help sunflower oil processing firms reach their full potential in terms of the maximum output and hence profitability for their financial sustainability as follows:

Affordable, clustered and strategic industrial location may be designed by the government to help firms to easy accessibility and support services from TFDA, SIDO and TBS. The central location of industrial areas will also enable clustering of sunflower oil processing firms according to their size for easy accessibility of materials and support services like improved infrastructure, standard conformity through TFDA and TBS through regular visits and environmental protection. Specifically, emphasis should be given to the sunflower oil processing firms operating in Dodoma region to shift their factories from residential places to designed industrial area, since the location of the firm is among of the important determinants of both technical efficiency and financial sustainability of sunflower oil processing firms in Tanzania. Also, entrepreneurial awareness and skills may be natured from primary to higher level curricular for the young and middle-aged group since

technical efficiency decreases with the age of the owner. The middle-aged is considered as an optimal production age group / potential investment group due to high mobility factor and production motives. Not only that but also they are motivated, energetic, committed and flexible in adapting change in technology for the high profitability of the firm and hence financial sustainability.

In addition, improvement of the capability and skills of owners through seminars and industrial training may be considered by the government, given the level of education they possess. This is due to the fact that performance of the firms under the study increases with increase in years of schooling and most of the owners have a primary level education.

Nevertheless, sole proprietorship form of ownership may be encouraged through individuals' credit empowerment. Availability of credit facilities will encourage one man control of the business and decision making since it will address some of their investment needs according to their size, such as easy and affordable loan condition to small scale sunflower oil processing firms due to collateral issues.

Moreover, a minimal number of employees in sunflower oil processing firms may be observed by owners for improved performance since efficiency utilisation of staff and financial sustainability of sunflower oil processing firms' decreases with firm size. A large number of employees undertaking relatively similar assignment leads to idle time, difficult in management and increased labour costs.

Furthermore, government interventions to emphasize on the replacement of the existing capital in more aged firms as one of the market forces for improved production are important to firm owners. That is, the processing machines in more aged firms should be improved from single to double refined for the best use of the current technology. This is due to the fact that the main driver and catalyst of the production in sunflower oil processing firms are machines and not human capital (staff) as compared to other sub-sectors of manufacturing. This was evidenced by high elasticity of capital toward the output of the firms to imply that they are machine intensive.

These interventions on technical efficiency and financial sustainability-enhancing measures would, in turn, create enabling environment for sunflower oil processing firms' improved efficiency and hence financial sustainability as the way forward to realise their full potentials in a long run.

6.5. Contribution of the Study to Knowledge

The study makes the following key contributions to knowledge:

First, to the general literature on agro-processing firms, this study contributes toward narrowing the knowledge gap on the determinants of Technical Efficiency and Financial Sustainability of Sunflower oil processing firms in particular. The study provided evidences that location of the firm is important for enhanced Technical Efficiency and Financial Sustainability of sunflower oil processing firms in Tanzania. Also the study established that Technical Efficiency is a pre-requisite for Financial Sustainability of sunflower oil Processing Firms.

Second, the study also provides a comparative mirror on the performance of sunflower oil processing firms in the country in which firm owners can benchmark the performance of their firm in terms of their technical efficiency and financial sustainability with other firms operating in the industry.

Third, the findings of the study are useful to government, policy makers, regulatory bodies and all agencies in Tanzania responsible for creating enabling environment for improved performance as they create awareness of efficiency and financial sustainability indicators of these firms and areas which needs more support for improved technical efficiency and financial sustainability like considering strategic and clustered industrial locations, empowering individual through credit, enhancing capacity of the firm owners through seminars and workshop.

Fourth, to the researchers and other institutions like universities, the study portrays the performance of small scale agro-processing firms in Tanzania context, in terms of Technical Efficiency and Financial Sustainability and hence providing benchmarking ground to other scholars worldwide.

Fifth, to the firm owners, the study revealed that capital is one of the key input resources in maximizing output of the firm, since SOPFs are machine intensive. Thus owners should consider improving their machines from single to double refines ones.

Not only that but also fully staff utilization in both productivity and sales results into increased profit and hence financial sustainability since there is prevalence state, which indicate the big difference between unit produced and sold. SOPFs with fewer number of staff, seems to be fully utilizing them in productivity which increases the stock rather than in sales. This is associated with fewer sales compared to the firms with many staff as they can produce less and sell it all. This is a figure relationship on staff productivity ratio.

Sixth, the study developed a comprehensive theoretical framework by integrating Resource Based and Profitability theories which gave a new holistic analytical way of examining the determinants of technical efficiency and financial sustainability of sunflower oil processing firms in Tanzanian context. The model which might be suitable for testing similar phenomena in large firms from both developing and developed country perspective.

Seventh, methodologically, a combined measure of efficiency on financial sustainability using technical efficiency levels while controlling staff productivity by introducing a frontier model as an improved advanced measure to a widely-used conventional (ratio) accounting model to measure firm's performance gives a reflection that sunflower oil processing firms are machine intensive rather than labour intensive but the role of human capital should not be ignored for improved efficiency and financial sustainability. Thus by devising *new approaches and methodologies lead to the discovery of new knowledge* (Kuhn, 1996; Nyamsogoro, 2010).

Eighth, on average sunflower oil processing firms are not financially sustainable and thus unable to cover their operating expenses from income generated internally. They depend on loan as a major source of capital to sustain their business.

6.6 Limitations of the Study and Areas for Further Research

While the researcher considers that, this study is fairly robust, detailed and empirical; there are some limitations which are worth acknowledging.

Firstly, was lack of secondary data due to small scale nature of the firms under the study and thus data were collected from primary sources. Sunflower oil processing firms do not have formal financial records, however, they have some documentaries in their books for their references and thus helped on data recalling during data collection exercise. They could easily refer and memorize the quantity of processed oil daily in litres and the price per litre, the number of workers and their daily wages and the price per bag of raw materials used in processing oil.

To overcome this challenge the study was thus a cross-sectional, where data were collected from primary sources at one point in time unable to capture variations in study variables over time. In addition, data was validated by triangulation approach where a qualitative follow-up interview from key informants was made to supplement the quantitative results with the reasons on the behaviour of the explanatory variables toward the outcome variables. Since this a cross-sectional study, therefore longitudinal (time series) data can be considered for further studies so as to capture the influence of these factors with respect to the changes of these variables over time.

Also, this study was confined to only internal firm-specific factors as the important determinants of technical efficiency and financial sustainability of sunflower oil processing firms, thus, the research problem addressed was problematized and philosophised from a demand-side philosophical lens point of view. It specifically addresses what sunflower oil processing firms can do internally from what they possess in terms of resources and capabilities to attain high levels of technical efficiency and financial sustainability. Therefore future studies can consider addressing the problem from a supply- side philosophical lens point of view to account for external factors as determinants of technical efficiency and financial sustainability of sunflower oil processing firms. That is the role of supporting institutions like Microfinance for credit availability to these firms and other external factors like competition, inflation and interest rates in studying the determinant of technical efficiency and financial sustainability of sunflower oil processing firms in Tanzania.

Additionally, this study was limited to only financial sustainability measured by financial self-sufficient indicator as the key dimension and a measure of the firm sustainability to mean institutional sustainability as used in other sub-sectors (Nyamsogoro, 2010; Thela, 2012; Kipesha 2013). Therefore, other measures of the firm sustainability can also be considered for future studies like mission sustainability, marketing sustainability and human resource sustainability.

Not only that but also Operating Self- Sufficient (OSS) as another financial sustainability indicator can also be considered for future study, to study the firm sustainability on a subsidized base.

Besides, the study at hand was conducted on small scale sunflower oil processing firms as part of manufacturing (agro-processing firms), therefore similar study linking technical efficiency and financial sustainability may be conducted on other sectors like in service organizations.

Nevertheless, an ideographic study can be conducted in Dodoma region to see the influence of government city and municipal council on sunflower oil processing firms industrialization move toward the middle economy.

Moreover, a different study with similar methodology can be conducted on perishable crops like grapes since sunflower oil is of long shelf product to establish the extent of applicability of the findings of this study.

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APPENDICES

Appendix 1: A questionnaire for Surveyed Sunflower oil Processing Firms

Questionnaire for sunflower oil firm Owners

Dear Respondent,

I am a PhD candidate at Mzumbe University (MU) in Morogoro. Currently undertaking a research on Determinants of Technical Efficiency and Financial Sustainability of Sunflower oil processing firms in Tanzania as requirements for the fulfilment of the award of PhD. As the owner of this firm, you are kindly requested to provide some important information on key problems under investigation meant to improve firms' performance in terms of their technical efficiency and financial sustainability.

You have been selected in this survey because of your potentiality to provide the required information. I am aware that you are very busy, but I would be grateful if you could take time to answer this questionnaire. Every information given will be treated with strict confidentiality and it will solely be used for academic purpose.

Thank you very much for your cooperation and valuable response.

Your participation is highly appreciated for the success of this research.

Yours sincerely,

Anastasia R. Njiku

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Part One: General Information about the business and Owner-Manager

Fill in the blank with appropriate answers and Tick (√) where appropriate.

P1.1 Questionnaire Number.....

P1.2 What is the name of your business?

P1.3. Your Phone Number.....

P1.4. Where your business is firm located?

1. Dodoma []
2. Singida []

P1.5. What is an exact total number of employees in your business firm?.....

P1.6. What is your role in the business?

1. Owner []
2. Owner-Manager []

P1.7. What is your Sex?

1. Male []
2. Female []

P1.8. What is your age in years?.....

Part Two: Information on Capital, Labour and Material costs used in the production

P2.1. What is the amount of your business operating capital annually in Tsh...

P2.2. What is the source of your operating capital in the business?

1. Internally generated fund []
2. Loan from Bank []
3. Loan from NGOs(SACCOS) []
4. Contribution from friends and relatives []
5. Others (Specify).....

P2.3 (a). Indicate the costs of raw materials you used in your processing firm annually.

Quantity in bags	2013	2014	2015
Total bags purchased			
Cost per bag			
The average size of the bag(Kgs)			
Average Litres per bag			

P2.3 (b) Indicate the costs of the following items you used in processing activities annually.

Item	Total estimated costs annually in Tsh.		
	2013	2014	2015
Fuel/Car hire			
Water bill			
Electricity bill			
Wages and Salaries			
Cost of repair of equipment and machinery			
Premise rent			
Machine cost/ rent			
Tax(property)			
Others(specify)			

P2.4 Indicate the units of output produced and sold for the past three years

Quantity in units	2013	2014	2015
Total Unit produced			
Total unit sold			
The average price per unit(Litre)			

P2. 5 Indicate the number of staff engaged in the production for the past three years

Item	Years		
	2013	2014	2015
Number of staff			
Average payment			

P2.6 (a) What capacity utilisation do you think that you are producing at?

1. Minimum []
2. Average []
3. Maximum []

P2.6 (b) Indicate the specific amount of output you are able to produce at your capacity annually in litres.....

Part Three: Information on Firm-Specific Factors

P3.1. When was your business firm established?.....

P3.2 What is the type of business ownership?

- 1. Sole Proprietor []
- 2. Partnership []
- 3. Government owned []
- 4. Other (Please specify).....

P3.3. What is your highest level of formal education?

- 1. Primary education []
- 2. Secondary education []
- 3. Certificate / Diploma []
- 4. Bachelor degree/ Masters []

P3.4. Do you provide any industrial training to improve employee’s skills?

- 1. Yes []
- 2. No []

P3.5. How many years have you owned or managed a firm?.....

P3.6 (a) Have you been running any other business operation of your own prior to this?

- 1. Yes []
- 2. No []

P3.7 (b) If yes, for how long.....

P3.8 (c) If yes, explain how the accumulated experience helps you in managing your current business.....

.....

Part Four: Information on the Financial sustainability of the business

P4.1. Provide the information on current assets you own in your business for the last three years in monetary terms.

Type of asset	Total number	Estimated value		
		2013	2014	2015
Cash				
Inventory				
Processing Machine				
Debtors/receivables				
Others(Specify)				

P4.2. Provide the information on current liability you owed in your business for the last three years in monetary terms.

Type of liabilities	Total number	Estimated value		
		2012	2013	2014
Short-term loan				
Payables/creditors				
Interest				
Others(Specify)				

P 4.3. Please provide information about the sales of the processed food for the last three years.

Who do you mostly sell to?	b) Where do you usually sell?	c) Mode of selling	d) At what Time of the year when prices are very high?
1.Retail consumers	1.Open market	1=cash	1=Holiday Season
2.Wholesales	2.Order market	2=credit	2=Harvesting Season
3.Both	3.Both	3=both	3=Throughout the year
			4=After harvesting Season
			5.Before harvesting season

P4.4. How would you rate your overall financial performance in terms of profit over the past three years?

1. Increasing by.....Tsh. []
2. Decreasing byTsh. []
3. It is constant ofTsh. []

Thank you for your Cooperation.

Appendix 2: Interview Guide

- Q1. Why labour input does not matter in maximizing the output of your firm?
- Q2. Why only materials and capital contribute greatly to the output of your firm?
- Q3. Which factor is the most crucial among capital, material and labour as input factors of production in maximizing the output? Why?
- Q4. What can you say about the quality of material in relation to the output of the firm?
- Q5. What can you say about the availability and accessibility of materials through out of the year? Why?
- Q6. Why training of employees does not matter to your firms? How do you conduct it to your employees?
- Q7. Why is an industrial experience not influencing technical efficiency and financial sustainability of the firms?
- Q8. Why does location of the firm important in enhancing your production and profitability of your firm?
- Q9. What can you say about the quantity of litres of oil processed in relation to the income generated by your firm?
- Q10. What can you say about the number of employees you have in your firm, in relation to productivity of the firm? How do they contribute to the profitability of the firm?

Note: Additional follow-up and probing questions were asked, as appropriate, with each key informant.