Renger Philemon Kanani

The effect of processor control on Screening Transaction Costs in farmer – food processor relationships: An investigation of antecedents and contingency factors

Molde University College
Specialized University in Logistics

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The Effect of Processor Control on Screening Transaction Costs in Farmer – Food Processor Relationships: An Investigation of Antecedents and Contingency Factors

Renger Philemon Kanani

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Preface

This scholarly work puts empahasis on the factors that moderate the effect of processor control and Screening Transaction Costs. It has been submitted to the faculty of Logistics at Molde University College; Specialized University in Logistics for the partial fulfilment of the degree of Doctor of Philosophy in Logistics.

This PhD thesis started in August 2011, and it has been supervised by Professor Arnt Buvik as the main supervisor and Professor Judith Molka Danielsen as co-supervisor. The doctoral degree including this PhD thesis were financed by the Norwegian Government through Quota scheme

The committee of three experts has evaluated this PhD thesis: (1) Associate professor Berit I. Helgheim from Molde University College; Specialized University in Logistics, Molde, Norway; Professor Sven Arne Haugland from the Norwegian School of Economics (NHH), Bergen, Norway; Professor Rodney L. Stump, Towson University, Maryland, USA.

Dedication

This PhD thesis is dedicated to my late parents Philemon and Bernadetha Kanani, for instilling me with the culture of reading books at a young age. To my beloved wife and friend Valentina Martine, for her exceptional care and love, and to my beloved daughters: Jahdiela - Bernadette and Davinia.

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Molde, 2015

Renger Kanani

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List of Abbreviations and Acronyms

ADB	Africa Development Bank
ANOVA	Analysis of Variance
AVE	Average Variance Extracted
AVS	Average Shared Squared Variance
CFA	Confirmatory Factor Analysis
CFI	Comperative Fit Index
CMV	Common Method Variance
CR	Composite reliability
EFA	Exploratory Factor Analysis
EM	Expectation Maximization
ESRF	Economic and Social Research Foundation
FAOSTAT	Food and Agricultural Organization Statistics Division
GDP	Gross Domestic Product
IBM SPSS	International Business Machine Spatistical Package for Social Sciences
IT	Information Technology
KMO	Kaiser – Mayer – Olkin
MCAR	Missing completely at random
MCT	Measurement Cost Theory
ML	Maximum Likelihood
MMR	Moderated Multiple Regression
MSME	Micro, Small and Medium Enterprises
MSV	Maximum Shared Squared Variance
MTMM	Multitrait – Multimethods
NFI	Normed Fit Index
NNFI	Non-normed Fit Index
OLS	Ordinary Least Square
PAF	Principal Axis Factoring
PC	Principal Components
PCA	Principal Component Analysis
RCT	Relational Contracting Theory
RMSEA	Root Mean Square Error of Approximation
SEM	Structural Equations Modeling
SIDO	Small Industries Development Organization
TCT	Transaction Cost Theory
TIL	Tucker – Lewis Index

URT	United Republic of Tanzania
USAID	United States Agency for International Development
VIF	Variance Inflated Factor
WB	World Bank

Abstract

Studies that focus on the issue of control in the buyer–supplier relationships have been increasing in recent years. Our interest in this issue was to investigate the factors that moderate the effect of buyer control (processor control) on Screening Transaction Costs. Specifically, our study considered four contingent factors, including the degree of perishability of transacted produce, purchase volume, the use of technological instruments for quality screening purposes, and the duration of relationships between food processors and farmers. Transaction cost theory, measurement cost theory and relational contracting theory were used as key theoretical frameworks in the analysis of the aforementioned variables.

This study used cross-sectional correlational research design, and using the self-completion questionnaire; data were collected from key informants in micro, small and medium food processors. In total 284 questionnaires comprising food processors who source their produce from farmers, retailers and wholesaler were collected, from which 239 questionnaires were considered acceptable for analysis. Since the setting of this study is the link between food processors and farmers, 137 responses were used as a source of empirical evidence for this study.

The findings from the analysis showed that the degree of perishability of transacted produce has a significant positive effect on Screening Transaction Costs, and its moderating effect on the association between processor control and screening transaction costs is significant and negative. Moreover, the empirical evidence provides support for the negative moderating effect of purchase volume. The contingent effect of the duration of relationships was found to be significantly positive meaning that it is not efficient to increase control as the relationship ages. Lastly, the analysis shows that processor control is more effective in reducing Screening Transaction Costs when it is coupled with the use of technological instruments for quality screening purposes.

By focusing on the association between processor control and screening transaction costs, this study contributes to the existing body of knowledge on control in the buyer–supplier relationships by showing empirically that processor control should be applied in a discriminatory fashion contingent on the degree of perishability of the transacted produce, purchase, the use of technological instruments for quality screening, and the duration of relationships. Methodologically, this study contributes to knowledge by providing operationalisations of the degree of perishability and Screening Transaction Costs. Additionally, the study provides managerial implications, policy implications and potential extensions for future research in this area.

CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 Introduction

Food processing firms are increasingly experiencing difficulties in selling their products due to the rise of competition and consumer demand for variety, quality and for food safety. Globalization and trade liberalization are regarded as the drivers for the growing consumer demand and increasing competition in the food industry (Kennett, Fulton, Molder and Brooks, 1998; Ortmann, 2001). Relatively high-quality products are finding their way to markets with comparatively low quality products. Thus, with increasing presence of high-quality products and consumers' demand for quality, food processors are experiencing pressure to produce high-quality products, and since most of the food processors do not farm themselves, the procurement of high quality produce for processing purposes presents one potential area for increasing their competitiveness.

Accordingly, food processors are becoming more reliant on produce suppliers to meet fast changing consumer demands. The reliance on suppliers increases further as perishability of produce increases (Rezaei and Ortt, 2011). The fundamental question in this situation is how the food processors can procure high quality produce in such a supplier reliance situation. The answer to this question lies at the level of processor control over the produce sourcing. Agri-food supply chain literature (e.g., Kennett et al., 1998) regards closer vertical coordination between suppliers and food processors as an appropriate way of ensuring high and consistent produce quality, and consequently meeting the constantly rising expectation of consumers (Kennett et al., 1998)

Nevertheless, spot market transactions remain an option for some food processors, even though it has proven to be inefficient in safeguarding processing firms against the risk of poor and inconsistent produce quality (Wilson, 1996). Kennett et al. (1998) study has related quality inconsistency of produce to Williamson's fundamental characteristic of uncertainty in transaction. When quality uncertainty of the produce is coupled with factors such as changing consumer demand and an increase in competition, ex-post transaction costs associated with using open market to source produce may increase significantly. Ex-post transaction costs associated with uncertainty are regarded as the most influential in deciding the level of control of the transaction (Frank and Henderson, 1992) and is considered as the primary motive for food processors to use non-market arrangements to vertically control sourcing of produce (Ortmann, 2001).

In recent years, there has been a surge of research on the move from the spot market to more closely coordinated transactions. In particular, most of the studies have focused on control mechanisms on closely coordinated transactions. Despite the strong research interest in this trend, hitherto, most of the studies have focused on formal contractual control using different empirical settings. Some have used empirical evidence from specific produce (e.g., Kennett et al. 1998; Strydom, Terblanche, van Zyl and Willemse, 2012; Strydom, van Zyl and Willemse, 2014), while others have considered groups of produce such as vegetables and fruit (Maruyama and Hirogaki, 2007) and agricultural produce in general (Hobbs and Young, 2000).

However, contractual arrangement is not within the reach of every food processor. In addition, it is quite common in the agri-food supply chain to have transactional exchange without any formal contracts between the parties involved (Jraisat, Gotsi and Bourlakis, 2013). Most small and medium food processors are purchasing their produce repeatedly from a few preferred suppliers without maintaining any contractual agreement for future transactions. The repeated open market transaction from the same supplier is likely to improve the quality of produce, reduce ex-post transaction costs and the likelihood of supplier opportunism; however, scant agri-food studies (e.g., Parker, Bridson and Evans, 2006) have tried to investigate control mechanisms in this context.

This research uses data from the Tanzanian food processing industry as a source of empirical evidence in examining the effect of food processor control on ex-post transaction costs in repeated open market transactions between food processors and farmers. While acknowledging that close coordination in food transactions occurs at all levels of the supply chain, from the upstream of the food processors to the downstream, this study is positioned on the relationship between farmers as the source of produce and food processors as buyers. However, this is not to ignore the effect of other supply chain's links on this relationship. Literature in agri-food supply chains (e.g., Hobbs and Young, 2000) has highlighted that the motives for close coordination between food processors and their produce suppliers in many instances are caused by the changes in other parts of the supply chain.

1.2 Research Problem

In recent years, control mechanisms have attracted considerable research interest in buyer-supplier relationships' studies. As the research interest in this issue increase, the limitations of the existing studies have also become equally apparent. Despite the limitations, it is evident that the existing studies on buyer-supplier relationships (e.g., Heide and John, 1992; Abe and Nelson, 2002; Buvik and Halskau, 2001; Ryu and Eyuboglu, 2007; Buvik and Andersen, 2011; Ju, Murray, Kotabe and Giao, 2011; Buvik, Andersen and Grønhaug, 2014) have made significant contributions to the existing body of knowledge on control mechanisms.

Nevertheless, the synthesis of the contributions of these studies on control mechanisms has indicated that the antecedents of control mechanisms, and their contingent factors have for some times attracted the attention of several researchers (e.g., Heide and John, 1992; Buvik and Halskau, 2001; Buvik et al., 2014). The widely examined antecedents and moderating variables include specific asset investments (Buvik et al, 2014; Buvik and Andersen, 2011; Buvik and Halskau, 2001; Heide and John, 1992), relationship duration (e.g. Buvik and Halskau, 2001) and relational norms (Heide and John, 1992) among others, and transaction cost theory and relational contracting theory represent the key theoretical frameworks for these studies.

Transaction cost theory mainly has been used to build arguments for the antecedents and contingent effects that are in line with Williamson's (1985) dimensions of transactions, including buyer specific investments (e.g., Heide and John, 1992; Buvik et al., 2014), supplier specific investments (Buvik et al., 2014), monitoring investment (e.g., Buvik and Andersen, 2011) and uncertainty (e.g., Ryu and Eyuboglu, 2007). On the other hand, relational contracting theory has been used widely as a theoretical framework for the antecedents and contingent effects of relational nature, including duration of the relationship (e.g., Buvik and Halskau, 2001; Li, Xie, Teo and Peng, 2010) and relational norms (e.g., Heide and John, 1992).

As indicated in the introduction, the establishment of control mechanisms is primarily motivated by the need to reduce ex-post transaction costs. Other motives concern the problem of quality uncertainty (Parker et al., 2006), a relationship's performance (Li et al., 2010) and the potential for opportunism (Ju et al., 2011). Nevertheless, only a handful of studies has examined empirically the effect of control mechanisms on such outcome variables (e.g. Ju et al., 2011; Li at al., 2010; Buvik, 2002a). Furthermore, the effects of the contingent factors that moderate the association between the control mechanisms and outcome variables such as ex-post transaction costs, opportunism and quality uncertainty are not fully documented by the extant literature. These theoretical gaps motivate the current research work; however, our focus is on the ex-post transaction costs; and thus the following research question will be answered: *what are factors that moderate the effect of control mechanisms on ex-post transaction costs?* This research question is translated into the research objective in the next section.

1.3 Objective of the Study

The purpose of this study is to examine the relationship between processor control and ex-post transaction costs in the agri-food processing industry. Specifically, the study examined the effect of processor control on Screening Transaction Costs perceived by the food processors while controlling for the level of processing investments, purchase frequency and the size of the food processor.

This study, in particular, examines whether the degree of perishability of the transacted produce and purchase volume have an effect on the association between processor control and Screening Transaction Costs. Furthermore, the study investigates whether the duration of relationships and the use of technological instruments by the food processors have an influence on the association between processor control and Screening Transaction Costs.

1.4 Contribution of the Study

The studies that have examined the relationship between governance mechanisms and transaction costs are still scant. Furthermore, most of these studies have paid limited attention to the specific components of the transaction costs (e.g., Buvik, 2002a; Buvik and Andersen, 2002). Transaction costs can be divided into several components, including search costs, screening costs, negotiation costs, transfer costs, monitoring costs and enforcement costs (Loader and Hobbs, 1996). It is generally acknowledged that the increase in control of transactions tends to reduce transaction costs (Strydom et al., 2014). However, the literature reviewed (e.g. Strydom et al., 2012) has indicated different effects of governance mechanisms on different components of transaction costs. For instance, Strydom et al. (2012) found that an increase in the control of the transaction by contracts tends to increase negotiation costs while reducing search and information costs.

These variations call for further research into the effect of different control mechanisms on different components of transaction costs. In this regard, this research contributes to the ex-post aspect of transaction costs by investigating the effect of processor control on Screening Transaction Costs. In our view, Screening Transaction Costs is significant ex-post transaction costs in agricultural transactions as food processors strive to enhance the quality of the purchased produce. Thus, by focusing on Screening Transaction Costs, this research adds more validity to transaction cost theory.

It is acknowledged by transaction cost theory (TCT) scholars that transaction costs are influenced by the structural characteristics of the transaction: the specificity level of assets supporting the transaction, behavioural uncertainty and the environmental uncertainty surrounding the transaction (Pilling, Crosby and Jackson, 1994; Heide and John, 1990; Buvik and John, 2000; Buvik2002a). Some scholars (e.g., Hobbs and Young, 2000) have noted that such structural characteristics may be associated with certain product characteristics such as the degree of perishability, product differentiation, as well as quality variability and visibility. Thus, the consideration of product characteristics is a fruitful area for advancing knowledge in TCT (Rindfleisch et al., 2010). However, researchers have paid limited attention to such characteristics (Rindfleisch et al., 2010). This study adds to knowledge about the TCT by introducing the perishability nature of produce as a contingent factor in the association between buyer control and the Screening Transaction Costs.

It is well established in the literature that the purchase volume can cause the ex-post transaction costs to increase (Buvik and Andersen, 2002; Buvik, 2002a) and this is due to the amount of economic stakes involved in a transaction. Another stream of research has consistently demonstrated the positive impact of purchase volume on buyer control (Buvik and Andersen, 2011; Buvik et al, 2014). However, there is still a theoretical gap as to whether the purchase volume may shape the effect of buyer control on ex-post transaction costs. The present study intends to add knowledge to this theoretical gap by considering the effect of buyer control on Screening Transaction Costs.

Furthermore, the discussion in literature describes buyer control (vertical control) as a unilateral control mechanism and relational based control as a bilateral control mechanism (Ryu and Eyuboglu, 2007), but whether these control mechanisms can be used as substitutes or complements remains a debatable issue. Whilst some studies (e.g., Li et al., 2010) have found unilateral and bilateral control mechanisms to be substitutes, others (e.g., Poppo and Zenger, 2002; Luo, 2002) have found them to be complementary. Furthermore, very few studies have investigated how different control mechanisms work in tandem to influence performance (e.g., Ryu, Kabadayi and Chung, 2007; Li et al., 2010). One important aspect of deploying control mechanisms in relationship management is to reduce transaction costs (Ryu et al., 2007; Ryu and Eyuboglu, 2007). Accordingly, consideration of performance variables such as transaction costs in assessing the nature of relationship between control mechanisms may add knowledge to the noted debate. Since the duration of relationships can be used as a proxy for relational control (Li et al., 2010: 341), the current study contributes to knowledge on the debate on control mechanisms by investigating the interaction effect of processor control and the duration of relationships on Screening Transaction Costs.

Transaction cost theory is a valuable framework for investigating the use of information technology (IT) in buyer supplier relationships (Cordella, 2006; Müller and Seuring, 2007). Different IT solutions can be applied to facilitate economic transactions depending on the relationship between buyer and supplier. Moreover, different IT solutions can have different impacts on transaction costs; whilst some can increase transaction costs, others can reduce transaction costs. Their level of specificity and ability to keep opportunism to a minimum are reasons for the difference in their impact (Müller and Seuring, 2007). Hitherto, most of the studies that have discussed the impact of IT on transaction costs have ignored the factors that affect transaction costs, including opportunism, uncertainty and the complexity of the transaction (Cordella, 2006). In the light of the aforementioned factors, this study contributes to transaction cost theory by examining the joint effect of technology use and buyer control (processor control) on Screening Transaction Costs.

1.5 Organization of the study

This study is organised into eight chapters. The first chapter presents an introduction to the study, research problem, objectives and contribution of the study. Chapter 2 presents the review of transaction cost theory, measurement cost theory and relational contracting theory. These three theories are used by this study as the main theoretical frameworks for analysing the relationships between variables that shed knowledge on our research objectives. Chapter 3 presents the research model and hypotheses of the study. The proposed research hypotheses are discussed in the light of the theoretical frameworks presented in chapter 2.

Chapter 4 presents the methodology of the study, which includes empirical setting, research design, questionnaire development, discussion on the population, sampling frame and sampling procedure. This chapter also covers discussion about the strategy that was used to choose respondents, questionnaire administration procedure, and common method bias. Chapter 5 is divided into two parts. The first part presents the process of measurement development and the discussion of the construct – measurement items' relationships. The second part of this covers operationalisation of the research variables.

Chapter 6 is also divided into two parts. The first part deals with data screening, which includes data entry accuracy, the assessment and handling of missing values, the assessment and handling of outliers, normality assessment, the assessment of common method variance and measurement reduction. The second part of this chapter covers confirmatory factor analysis, unidimensionality, reliability, and validity assessment of measurement items and measurement model. Chapter 7 discusses methods for estimating moderations, moderated multiple regression method and the estimation of a regression model for this study. This chapter also presents the examination of the estimated moderated multiple regression, validation of the estimated moderated multiple regression and hypotheses' testing. Finally, chapter 8 presents the summary of the study, discussion and implications of the results from the analysis in chapter 7. Specifically, chapter 8 presents, theoretical implications, methodological implications, managerial implications and policy implications. Additionally, chapter 8 presents the limitations of the study and makes suggestions for further research into this area.

CHAPTER 2

THEORETICAL FRAMEWORKS

CHAPTER 2

THEORETICAL FRAMEWORKS

2.1 Introduction

The aim of this chapter is to review the theoretical frameworks and literature that are used in the argumentations in this study. Specifically, the chapter is focusing on transaction cost theory (TCT), measurement cost theory (MCT) and relational contracting theory (RCT). Existing studies have used TCT to discuss unilateral control[1] mechanisms such as buyer control and contracts (Heide and John, 1992; Buvik et al., 2014). The consideration of the transaction dimensions including the level of specific assets and uncertainty have shed knowledge in most of the studies on the issue of control mechanisms (Heide and John, 1992; Buvik and Halskau, 2001; Buvik and Andersen, 2011) and performance in buyer – supplier relationships (Ryu and Eyuboglu, 2007; Liu, Luo and Liu, 2009).

Accordingly, TCT is reviewed in this study as a theoretical framework for analysing processor control, Screening Transaction Costs, the degree of perishability of transacted produce and purchase volume. Several other studies have used TCT as the theoretical framework for analysing the effect of the degree perishability (e.g., Hobbs and Young, 2000; Masten, 2000) and purchase volume (e.g., Buvik and Grønhaug, 2000; Buvik and Andersen, 2002) in economic transactions. Specifically, our review focuses on transaction costs, sources of transaction costs, governance problems, the issue of control, opportunism and bounded rationality. Additionally, MCT, which is regarded as a branch of TCT, is also reviewed as a theoretical explanation for a technological variable. Along with TCT and MCT, the RCT is reviewed as the theoretical framework for analysing the moderating effect of the duration of relationships. In a similar way, most of the earlier studies (e.g., Buvik, 2002a; Li et al., 2010) have also used RCT to investigate the effect of the duration of the relationships in buyer-supplier relationships.

[1] Studies used the term unilateral and formal control interchangeably. The term bilateral and informal control mechanism are also used interchangeably.

2.2 Transaction Cost Theory (TCT)

The main substantive contribution of TCT has been to relate the limitations and costs associated with organizational alternatives to the attributes of transactions in a discriminating fashion (Masten, 2000). Based on this contribution, researchers in different fields have formulated and tested various hypotheses (Buvik, 2000; Buvik, 2002a; Buvik, 2002b; Coles and Hesterly, 1998; Houston and Johnson, 2000), and the successes in testing these hypotheses empirically have made TCT a dominant and popular theoretical framework in analysing different inter-organisational related issues (Masten, 2000). The popularity of TCT has transcended the boundaries of academia, and this is highlighted by the Nobel Prize in economics awarded first to Ronald Coase in 1991 for his contribution to this theory and later to Oliver Williamson in 2009.

Studies on TCT can be classified into different streams, including research on vertical integration decisions (e.g., Dutta, Bergen, Heide and John, 1995; Anderson and Coughlan, 1987) and opportunism behaviour (Stump and Heide, 1996; Wathne and Heide, 2000; Brown, Dev and Dong-Jin, 2000; Rokkan, Heide and Wathne, 2003; Ju et al., 2011). Other research has focused on inter-firm vertical coordination and control (Heide and John, 1992; Joshi and Stump, 1999; Buvik and John, 2000; Buvik et al., 2014) and testing of the discriminating alignment hypothesis (e.g., Artz and Brush, 2000; Buvik and Andersen, 2002; Buvik, 2002a). Consistent with extant work of Commons (1934), all streams of research have maintained the transaction as the unit of analysis (Rindfleisch and Heide, 1997).

The core issue in TCT studies is the axiom that some characteristics of transactions give rise to transaction difficulties (Heide and John, 1992) or make transactions prohibitively expensive (Jones, 1987). Accordingly, the focus of the empirical studies has been to investigate how individual relationships or exchanges are organised at a particular point in time (Rindfleisch and Heide, 1997) with the objective of specifying governance mechanisms that can most efficiently handle an exchange (Jones, 1987). It is noteworthy that transaction characteristics are also termed by some studies as transaction costs' sources (Jones, 1987).

2.2.1 Transaction Cost Assumptions

Bounded Rationality. This is a cognitive assumption of TCT in which economic actors are assumed to be "intended rational but only limitedly so" (Williamson, 1985; pp. 45). That is even though economic actors often intend to act rationally, these intentions may be constrained by their limited ability to process and communicate information (Rindfleisch and Heide, 1997). It is noteworthy that bounded rationality poses a threat only to the extent that the limits of rationality are reached, and this in particular, can be the case in uncertain or complex environments (Chiles and Macmackin, 1996) in which circumstances surrounding an exchange cannot be specified exhaustively ex-ante, and performance cannot be easily verified ex-post (Rindfleisch and Heide, 1997).

Accordingly, bounded rationality relative to uncertainty/complexity is important in specifying contracts and assessing alternative governance structures, and economic actors may reduce the impact of bounded rationality in uncertain or complex environments if they can devise governance mechanisms, which reduce the level of uncertainty/complexity (Chiles and Macmackin, 1996). Some literature (e.g., Chiles and Macmackin, 1996) proposes the development of relational norms (trust) as the means of reducing the uncertainty/complexity surrounding an exchange, thus rendering bounded rationality less harmful and less important.

Opportunism. This assumption plays a pivotal role in TCT, and it is a key motive for the move towards non-market governance mechanisms (Pilling et al., 1994). Williamson (1985) viewed opportunism as self-interest seeking with guile and elaborated it to include behaviour such as lying, stealing, cheating, and calculated efforts to mislead, distort, disguise, obfuscate, or otherwise confuse. Examples of opportunism in agricultural transactions include such behaviour as hiding of immature produce among the matured produce; concealing damaged or inferior produce among the good quality produce (Grosh, 1994; Lyon, 2000); falsely over declaring of produce quality (Poulson, Forward and Kydd, 2010); withholding or reducing effort in quality, for instance, by reducing sanitary interventions (Olmos, 2010). Other opportunistic behaviors include delaying tactics such as prolonged renegotiations and delaying acceptance of produce in order to get more concessions from the trading partner, particularly in the transactions of perishable produce (Masten, 2000; Lo, 2010). The likelihood of opportunistic behaviour is aggravated by specific asset investment (Wathne and Heide, 2000; Brown et al., 2000; Cadeaux and Ng, 2012), information asymmetry (Wathne and Heide, 2000), environmental uncertainty (Cadeaux and Ng, 2012) and performance ambiguity (Stump and Heide, 1996).

The transacting party may act opportunistically either ex-ante or ex-post (Williamson, 1985) and this is more likely when it is feasible and profitable to do so (Rokkan et al., 2003). However, the propensity to behave opportunistically varies across transacting partners (Williamson, 1985), but it is difficult to distinguish ex-ante the degree to which any economic actor is inclined to the use of guile to pursue its self-interest. Therefore, it is prudent to assume that the other party to a transaction is potentially opportunistic at the start of the relationship, and this assumption is modified as relationships develop using the accumulated knowledge about the other party (Fein and Anderson, 1997).

The occurrence of opportunism in a transaction has the effect of eroding gains that would be potentially accrued to both parties in a dyadic relationship (Brown et al., 2000), and imposes costs on the trading partner (Ghosh and John, 1999). For example, Dahlstrom and Nygaard (1999) demonstrated the presence of significantly positive associations between opportunism and negotiation, monitoring and maladaption costs. Accordingly, several mechanisms can be applied to curb opportunism behaviour including both formal and informal control mechanisms (Stump and Heide, 1996; Rokkan et al., 2003; Ju et al., 2011). The formal control mechanisms are discussed in subsection 2.2.4 of this chapter, whereas the informal control mechanisms are discussed in section 2.4, which focuses on RCT.

2.2.2 Transaction Costs

The TCT acknowledges that transactions between economic actors cannot occur without friction, and this friction results in transaction costs (Williamson, 1985). By definition, transaction costs are simply the costs of developing and maintaining an exchange relationship, monitoring exchange behaviour, and guarding against opportunism in an exchange situation (Pilling et al., 1994). They can arise in any economic transaction, whether it is a spot market transaction between independent firms, contractual transactions, joint venture or stages within a vertically integrated firm (Hobbs, 1996b).

Transaction costs can be categorised in different ways depending on the stages (or phases) of the transaction. For instance, Hobbs (1996a; 1996b) and Mondelaers and Van Huylenbroeck (2008) divided transaction costs into information, negotiation and monitoring costs. Moreover, Loader and Hobbs (1996) distinguished six categories of transaction costs, including search costs, screening costs, bargaining costs, transfer costs, monitoring costs and enforcement costs. In a similar way, Liang and Huang (1998) divided transaction costs into seven groups: search costs, comparison costs, examination costs, negotiation costs, payment costs, delivery costs and post-service costs.

Furthermore, Williamson (1985) has divided all transaction costs into two broad categories: ex-ante and ex-post transaction costs. Ex-ante transaction costs are costs incurred before the agreement is established, which include costs of drafting and negotiating an agreement (Williamson, 1985), and the costs of searching for information falls under this category as well. On the other hand, ex-post transaction costs are those incurred after an agreement is established and this category includes haggling costs, monitoring costs and maladaption costs (Dahlstrom and Nygaard, 1999). Additionally, Buvik (2002a) provided a more detailed description of ex-post transaction costs as costs associated with the problems of (1) performance control (e.g. the verification of production costs), (2) performance verification costs (e.g. product quality assessment), (3) adjustment costs (e.g. change order difficulties), and (4) bargaining costs (e.g. price negotiations).

2.2.3 Sources of Transaction Costs and Governance Problems

To apply TCT to transactions in business-to-business or business-to-customer relationships, it is necessary to understand the characteristics of the transaction that leads to transaction costs (Jones 1987). The original TCT identified three sources (dimensions) of transaction costs: (1) asset specificity, (2) transaction uncertainty (environmental and behavioural uncertainty), and (3) frequency of transaction (Walker and Weber, 1984; Williamson, 1985). As TCT evolved, its application increased, and new theoretical and empirical contributions emerged; the list of the sources of transaction costs has expanded to include transaction duration (Jones, 1987), performance ambiguity (Bowen and Jones 1986; Jones, 1987), goal incongruence (Bowen and Jones 1986) and quality uncertainty (Hobbs and Young, 2000). The aforementioned sources of transaction costs are described in detail in the subsequent subsections.

Asset Specificity. This concerns the degree to which assets are tailored to a particular relationship and can hardly be moved to alternative transactions without loss of productive value (Heide and John, 1990; Heide, 1994; Buvik, 2002a). The extent to which assets lose value when moved to the alternative exchange is an indication of their level of specificity with high loss in value indicating a high level of specificity (Rindfleisch and Heide, 1997). The literature has described six main types of asset specificity: (1) site specificity, (2) physical asset specificity, (3) human asset specificity, (4) brand name capital, (5) dedicated assets, and (6) temporal specificity, also known as episodic assets (Williamson, 1991; Rindfleisch and Heide, 1997; Masten, 2000).

These specific assets are deployed in a relationship with the prospect of adding value, saving costs and/or improving performance/ quality. However, such investments transform the trading situation into a “small numbers condition” with subsequent exposure to opportunism (Buvik and Reve, 2002). Parties to a transaction do not always behave opportunistically even when conditions permit such behaviour, but when opportunism is present, it has a negative impact on performance (Rindfleisch and Heide, 1997). Therefore, it is prudent to assume that the parties to an exchange might behave opportunistically when specific investment is involved (Heide and John1990). Thus, the idiosyncratic nature of the specific asset gives rise to adaptation and safeguarding problems, in the sense that mechanisms must be designed to minimize the risk of subsequent opportunistic exploitation (Heide, 1994; Buvik 2002a).

The potential for opportunism in the specific investment setting gives rise to both ex-ante and ex-post transaction costs (Rindfleisch and Heide, 1997) and most empirical research has provided significant support in this respect. Buvik (2002a), for instance, has demonstrated that a specific asset has the significant positive impact on ex-post transaction costs. Moreover, Heide and John (1990) have found buyer specific investments to have the effect of increasing supplier verification efforts, and Artz and Brush (2000) have provided empirical evidence for the positive association between transaction specific assets and negotiation costs. Consequently, the adoption of specialized governance is justified when firms invest in specific assets because specialized governance is expected to minimize transaction costs (Joshi and Stump, 1999). However, the adoption of specialized governance is not the only way to safeguard investment in specific assets. The investing party may safeguard its investment by requiring reciprocal investments from the receiver of specific investments (Joshi and Stump, 1999). In this way, the stake of the receiver in the transaction increases and thus reduces opportunistic behaviours. Specific investment may also be secured through offsetting investments with customers (Heide and John, 1988; Heide and John, 1990).

It is noteworthy that the relevance of some types of specific assets may vary across industries as pointed out by Masten (2000: 187) and physical assets, and human assets play a less important role in agricultural transactions than in most other contexts. Even though equipment that is found in agricultural related activities, including cultivation, transportation and processing may be highly specialized, their designs are rarely transaction specific, and hence their use is not limited to a particular buyer or supplier. In the same way, the skills and knowledge necessary for growing and processing agricultural products, no matter how specialized and sophisticated, are seldom relation specific. Thus, both physical and human assets are unlikely to generate quasi-rent that would expose the transacting parties to the threat of hold ups (Masten, 2000: 187).

For different kinds of specific assets, temporal specificity and site specificity are regarded as the most relevant specific assets in the agricultural setting (Masten, 2000). Temporal specificity is more pronounced in situations where the product is perishable, and the number of alternative potential buyers is small and geographically dispersed (Koss, 1999). Owing to the aforementioned factors, both buyer and supplier have quasi-rents that can be expropriated and thus susceptible to hold up problems (Knoeber, 1983; Koss, 1999). Additionally, the large production capacity in this environment tends to increase the potential for appropriable quasi rent at the time of delivery (Koss, 1999). At the time of delivery, the buyer may engage in strategic delaying tactics to seek more concessions from the seller. In the worst-case scenario, the buyer may renege on his promise to purchase products from the supplier. In this case, the supplier may be forced to incur transaction costs to search for alternative buyers and may suffer deterioration or loss in their perishable products as a result. Similarly, supplier opportunism may increase costs to the buyer due to loss in production capacity or being forced to replace the supplier from a very thin market, which might be expensive (Knoeber, 1983). Thus, temporal specificity justifies the need for specialized governance mechanisms in the agricultural sector.

Site or location specificity is also a relevant type of specific asset in agricultural transactions because of the perishable nature and high weight to value ratio of many agricultural products. In this regards, the processing facility is expected to be located in proximity to the input source to the extent to which it reduces the weight to value ratio. Perishability is also likely to be an aggravating factor for location specificity due to the need for refrigeration and special care in transporting perishable agricultural products (Masten, 2000). Thus, site specificity may as well justify the need for specialized governance before investments are undertaken.

Transaction Uncertainty. Transaction uncertainty is defined as the inability to predict partner behaviour or changes in the external environment (Joshi and Stump, 1999). Earlier studies on TCT have described different kinds of uncertainty, including quality uncertainty (Hobbs and Young; 2000; Raynaud, Sauvée and Valceschini, 2009), technological uncertainty (Walker and Weber, 1984; Heide and John, 1990; Steenkamp and Geyskens, 2012), demand uncertainty (McNally and Griffin, 2004) and volume uncertainty (Walker and Weber, 1984; Heide and John, 1990; Steenkamp and Geyskens, 2012).

Some studies (e.g., Katsikeas, Skarmeas and Bello, 2009; Gatignon and Gatignon, 2010) have divided all uncertainties surrounding economic transactions into two broad categories: internal and external uncertainty. Whereas, internal uncertainty is defined to capture a firm's inability to assess its agent's performance by readily available output measures, external uncertainty

is used to imply the firm's inability to predict future events (Zhao, Luo and Suh, 2004). Other studies have divided transaction uncertainties into two broad categories: behavioural uncertainty and environment uncertainty (Rindfleisch and Heide, 1997; Everaert, Sarens and Rommel, 2010). Even though external uncertainty is consistently treated to be synonymous with environmental uncertainty, there are some inconsistencies in the treatment of the internal and behavioural uncertainty.

Some scholars perceive internal uncertainty as equivalent to behavioural uncertainty (Robertson and Gatignon, 1998; Stapleton and Hanna, 2002; Ivens and Pardo, 2008); others view internal uncertainty as equivalent to performance ambiguity (Katsikeas et al., 2009). Despite the inconsistencies, both behavioural uncertainty and performance ambiguity are treated as internal uncertainties stemming from within the transaction. Thus, internal uncertainty seems to be a broad concept. Behavioural uncertainty, environmental uncertainty and performance ambiguity are discussed in detail in the subsequent subsections. Additionally, we provide the description of quality uncertainty as an internal uncertainty, which is widely discussed in agri-food literature (e.g., Abebe, Bijman, Kemp, Omta and Tsegaye, 2013; Hobbs and Young, 2000)

- **Behavioural uncertainty**

In TCT, behavioural uncertainty is described as arising from the difficulties of ascertaining actual performance or adherence to contractual agreements (Rindfleisch and Heide, 1997; Jia, Cai and Xu, 2014). Because of these difficulties, transacting partners may take advantage of the situation by deliberately distorting information, shirking from their responsibilities, and engaging in other forms of dishonest behaviours (Everaert et al., 2010). Thus, behavioural uncertainty arises endogenously within the context of the transaction itself due to opportunism inclination of the transacting parties (Jia et al., 2014).

Previous studies have interpreted and conceptualised behavioural uncertainty in different ways depending on the research setting. Everaert et al. (2010) interpreted behavioural uncertainty as the difficulty in evaluating whether the accountant did the job accurately and to the best of his or her ability, and Anderson (1988; 2008) used behavioural uncertainty to imply the difficulties in evaluating sales force performance. Despite the variations in its conceptualisation, all studies have linked behavioural uncertainty to the difficulties in monitoring and assessing performance.

Moreover, behavioural uncertainty poses performance evaluation problems when bounded rationality is assumed, and this problem results in high transaction costs (Rindfleisch and Heide, 1997; Heide, 1994). Despite the widely consistent views that performance evaluation problems cause transaction costs to increase (Heide, 1994), studies that provide empirical evidence for the relationship between behavioural uncertainty and transaction costs are scarce, and most research simply assumes that such a relationship exists (Rindfleisch and Heide, 1997). However, a significant number of studies have focused on the effect of behavioural uncertainty on governance (e.g., Robertson and Gatignon, 1998; Everaert et al., 2010) and concluded that when behavioural uncertainty increases, firms tend to choose non-market governance forms to reduce the transaction costs associated with performance measurement difficulties.

- **Environmental uncertainty:**

Environmental uncertainty refers to unanticipated changes in circumstances surrounding the transactions (Andersen and Buvik, 2001). Organizations tend to perceive the environment as uncertain when relevant information is lacking or when the relevant contingencies are too numerous to be specified (Kabadayi, 2008). Unlike behavioural uncertainty, environmental uncertainty is caused by factors that are exogenous to the firm (Jia et al., 2014). Sources of this uncertainty include customers, suppliers, competitors, regulatory agencies, unions and financial institutions (Jones, Hesterly and Borgatti, 1997), and Lilly, Gray and Virick (2005) have divided sources of environmental uncertainty into three distinct components: primary, competitive and supplier uncertainty.

Primary uncertainty refers to uncertainty arising from exogenous sources such as natural events, changes in preferences, changes in regulations, standards or tariffs. Competitive uncertainty focuses on uncertainty arising from the actions of potential or actual competitors, and supplier uncertainty as uncertainty caused by the unpredictability of the actions of the suppliers (Lilly et al., 2005). The kind of environmental uncertainties that have received wide research attention include volume unpredictability (Walker and Weber, 1984; Heide and John, 1990; Heide and Stump, 1995) and technology unpredictability (Walker and Weber, 1984; Heide and John, 1990).

Unlike behavioural uncertainty, environmental uncertainty leads to the adaptation problem when bounded rationality is assumed (Rindfleisch and Heide, 1997). Environmental uncertainty forces firms to make frequent and unexpected adjustments to their business strategies and/or operations, thus leading to high transaction costs and this is because firms have to use more resources to scan the environment, process information, negotiate with

suppliers (Kim, Stump and Oh, 2009), as well as writing and enforcing contracts (Everaert et al., 2010). The literature has consistently provided empirical support for the effect of environmental uncertainty on transaction costs. For instance, Artz and Brush (2000) have found that environmental uncertainty has a significant effect on the negotiation costs. Likewise, Pilling et al. (1994) demonstrated the positive effect of environmental uncertainty on the ex-ante costs of developing an exchange relationship.

As a result, environment uncertainty may motivate firms to increase vertical coordination for efficient adaptation purposes. However, previous research has provided contradictory findings on this issue. Some studies have found a positive association between environmental uncertainty and vertical coordination (Ryu and Eyuboglu, 2007) while others have found no significant effect (Everaert et al., 2010) and still others have found both positive and negative associations (Buvik and Grønhaug, 2000). The literature has described several reasons for these variations, including the level of specific asset investment in the relationship (Buvik and Grønhaug, 2000) and the confounding of different types of environmental uncertainty in one broad construct (Heide and John, 1990). For instance, Heide and John (1990) have shown that volume unpredictability has a positive effect on the establishment of long lasting relationships, while technology unpredictability has a negative effect on the long-lasting relationship. Moreover, Buvik and Grønhaug (2000) demonstrated that environmental uncertainty has a positive effect on vertical coordination on lower levels of specific asset and a negative effect on higher levels of specific assets. Therefore, the consideration of these factors such as a specific kind of environmental uncertainty and the specific asset investment may provide more insights on the effect of environmental uncertainty on vertical coordination.

- **Quality uncertainty:**

The extant literature in agri-food industry defines quality uncertainty as the variations in quality either within a lot or across lots. It can also be viewed as variation in quality across different delivery (Wilson and Dahl, 1999). This definition is underscored by Jaffee (1992) that agricultural produce exhibit variations in quality from unit to unit and from one supply period to another. While some attributes such as appearance can easily be observed, others cannot be observed such as taste and the state of deterioration. The difficult to observe quality attributes is the source of quality uncertainty[2], and they raise the potential for opportunistic behaviour from either buyer or supplier (Tita, D'Haese, Degrande, Degrand and Van Damme, 2011).

[2] Product uncertainty is another term used to mean quality uncertainty in some studies (e.g., Dimoka, Hong & Pavlou, 2012; Dhanorkar, Donohue & Linderman, 2015).

Most-recent studies in the food sector (e.g., Passuello, Boccaletti and Soregaroli, 2015) have considered quality uncertainty as the source behavioural uncertainty. Thus, quality uncertainty tends to increase transaction costs and the need for control of the transaction.

Different studies have consistently associated quality uncertainty to the perishability nature of produce (e.g., Hobbs and Young, 2000; Heiman, Zilberman and Baylis, 2001; Tita et al., 2011; Abebe et al., 2013). Through the lenses of TCT, Hobbs and Young (2000) developed a model that showed perishability of transacted produce as one of the factors leading to the increase in quality uncertainty in the transaction. Furthermore, Tita et al. (2011) demonstrated empirically that quality uncertainty tends to be higher for highly perishable produce than for less perishable produce.

Frequency of Transaction. The review of transaction cost studies by Rindfleisch and Heide (1997) noted that in comparison to uncertainty and asset specificity, transaction frequency has received limited attention, and because of the lack of research addressing transaction frequency, some researchers (e.g., Rindfleisch and Heide, 1997; Steenkamp and Geyskens, 2012) decided to exclude it from their studies. However, the trend in major research databases such as ProQuest indicates that the number of studies focusing on transaction frequency has increased in recent years.

Transaction frequency refers to the extent to which transactions are recurring (Steenkamp and Geyskens, 2012) and researchers (e.g., Jones, 1987) have related it to both uncertainty and transaction costs and provided different views regarding the effect of transaction frequency on transaction costs. Jones (1987) argued that when the exchange is frequent, the parties to a transaction become used to dealing with one another and rely on past experience. As a result, opportunism is less likely to be a major concern, and thus transaction costs diminish. However, when transactions are infrequent, transaction costs are expected to increase due to the limited knowledge about the partner, and these transaction costs include costs such as negotiation and policing costs.

On the contrary, some scholars such as Buvik (2000) have linked transaction frequency to ordering costs and argue that transaction administration costs including expediting costs, follow up costs, and order processing costs are expected to increase with an increase in transaction frequency. From the two contradictory views described above, it is suggested that the effect of transaction frequency on transaction costs depends on the kind of transaction costs considered. Whereas, ordering costs tend to increase with an increase in transaction frequency, the cost of negotiating and policing a transaction decrease with an increase in transaction frequency.

Interestingly, research in the agri-food industry has linked the frequency of transactions to the characteristics of agricultural produce and argued that transaction frequency is the result of the perishable nature of the produce (Hobbs and Young, 2000). Perishable produce must be moved quickly to the market or processing facility to avoid deterioration, thus, leaving the seller unable to store it while waiting for favourable market conditions (Hobbs and Young, 2000). Likewise, perishability prevents buyers from holding inventories of fresh unprocessed products (Raynaud et al., 2009). Consequently, the transactions of perishable produce tend to occur more frequently than transactions of less perishable produce such as grains (Hobbs and Young, 2000).

Thus, high transaction frequency is an incentive for firms to establish administrative arrangements to provide some administrative economies of scale benefits (Buvik, 2000). However, the establishment of specialized administrative arrangement induces both administrative setup costs and efficiency problems concerning whether the volume of transactions is sufficient to utilize the specialized governance to its full capacity. In this regard, Williamson (1985) provided some assurance that under the condition of high transaction frequency, the administrative setup costs can easily be recovered.

Transaction Duration. Jones (1987) introduced transaction duration as another factor that influences transaction costs and defined it as the amount of time necessary to complete a transaction. Long transaction duration is evident in an environment in which it is very difficult for the buyer to evaluate the product offered by the supplier or in an environment in which extensive face-to-face interaction is required between the buyer and supplier. In such a situation, the transaction costs increase significantly because the buyer and supplier must exchange much information and knowledge to complete the transactions (Jones, 1987). The purchase of complex industrial products such as machinery is an example of a transaction of

this nature. Conversely, when the transaction is instantaneous or requires only a minimum involvement with the buyer/ supplier, there will be few problems in negotiating an exchange relationship, and the point of sale transaction is a good example (Jones, 1987). Industrial and office consumables fall under transactions of short transaction duration as well.

Performance Ambiguity. Performance ambiguity is defined as the difficulty of accurately measuring ex-post the exchange partner's compliance with expected output (Heide and John, 1990). Other terms that have been used by management studies to mean performance ambiguity includes measurement difficulty (e.g., Poppo and Zenger, 1998) and observability (e.g., Mayer and Salomon, 2006), and this is evident in the way these two terms have been operationalised (cf. Poppo and Zenger, 1998; Mayer and Salomon, 2006).

Several researchers have treated performance ambiguity and behavioural uncertainty as synonymous concepts, and this is demonstrated by the similarity of the definitions given to these concepts (cf. Jones, 1987; Heide and John, 1990; Rindfleisch and Heide, 1997). Nevertheless, the two concepts are not similar and their differences can be traced to their origin. Whilst performance ambiguity is caused by the characteristics of an exchanged product (Bowen and Jones 1986), behavioural uncertainty focused on the characteristics of the transacting parties.

Performance ambiguity arises when the object of exchange is complex, intangible in nature or when the quality of exchanged products is heterogeneous (Bowen and Jones 1986; Jones, 1987). In this regard, some studies have linked quality uncertainty of the exchanged object to performance ambiguity (Mahoney, 1992). On the contrary, behavioural uncertainty arises from the opportunistic behaviour of transacting parties, and such uncertainty would vanish if transacting parties were fully open and honest in their efforts to realize individual advantages. Alternatively, if full subordination, self-denial and obedience could be assumed (Williamson, 1985). However, performance ambiguity may expose the buyer to the risk of opportunism, which is the source of behavioural uncertainty (Heide and John, 1990).

Even though, it is evident that performance ambiguity is different from behavioural uncertainty, performance ambiguity is also regarded as a specific type of uncertainty (Krickx, 2000). Specifically, TCE studies view performance ambiguity as an internal uncertainty (Heide and John, 1990; Katsikeas et al., 2009). From its definition, performance ambiguity is nearly equivalent to quality uncertainty and this can be deduced from the description of these two terms in the existing literature. Whereas, performance ambiguity is consistently described by different studies as the difficulty in measuring the attributes or performance of the product (e.g.,

Biong and Silkoset, 2014; Mishra, 2013), quality uncertainty is also viewed as being caused variation in attribute of the products that are difficult to measure (Wilson and Dahl, 1999; Hobbs and Young, 2000; Tita et al., 2011).

Like behavioural uncertainty, performance ambiguity poses performance evaluation problems in connection with ascertaining whether compliance has taken place (Heide, 1994). When the buyer is faced with performance ambiguity, price is not a sufficient governance mechanism, as it does not provide sufficient information with which to evaluate the performance of the supplier (Jones, 1987). The potential for supplier opportunism is also high in this environment. Thus, both ex-ante performance verification efforts (e.g., verification of supplier competency) and ex-post performance verification efforts (e.g., inspection of products) are expected to increase (Heide and John, 1990). Consequently, performance ambiguity increases the need for more control of the transaction (Dutta et al., 1995).

2.2.4 Vertical Coordination and Control

Vertical coordination is a central issue in studying buyer-supplier relationships and supply chain management (Hobbs, 1996a). Specifically, vertical coordination is important in the quest for improving the handling of ex-post matters such as cost documentation; changes in product design; production planning, and quality control (Buvik and Andersen, 2002). Buvik and Andersen (2002:4) described vertical coordination as vertical interactions that organize the flow of activities, resources, and information between buyers and suppliers to improve value added and marketing performance.

The options for achieving vertical coordination are described as a continuum ranging from open/spot market to complete vertical integration (Peterson, Wysocki and Harsh, 2001; Hobbs, 1996a). Inbetween the continuum lies a myriad of alternative ways of coordinating economic activities, including formal contracts, strategic alliances, joint ventures and franchising agreements (Hobbs, 1996a). These forms of vertical coordination represent different levels of vertical control on the transaction with strength of control increasing from the spot market to vertical integration (Madsen, Moen and Hammervold, 2012). Accordingly, earlier studies (e.g., Heide and John, 1992) have used vertical control as a means of capturing the level of vertical coordination and the shift towards non-market vertical coordination arrangements.

The extant literature delineates two broad categories of controls in a transaction: unilateral and bilateral control, and perceive vertical control as unilateral control (Ryu and Eyuboglu, 2007). Vertical control is based on the premise that a buyer possesses the ability to impose directives on the supplier. In this regard, the buyer provides guidelines to its supplier such as quality control procedures, production processes, and quantity levels, and may be involved in close monitoring of the supplier actions to extract the desired outcomes (Ryu and Eyuboglu, 2007). On the contrary, bilateral control relies on relational norms that stimulate efforts with mutual benefits (Ryu and Eyuboglu, 2007). The bilateral control mechanisms are described in detail in relational contracting theory in subsection 2.4.

Furthermore, vertical control can be conceptualised in different ways. Some empirical studies have conceptualised vertical control as output control and process control (Ju et al., 2011). Whereas, process control puts emphasis on governing the actions of the partner, output control focuses on measuring the outcome of a partner's actions (Ju et al., 2011). Other empirical studies have not differentiated between process control and output control, instead they have used vertical control as just one construct (e.g., Heide and John, 1992; Buvik and Andersen, 2011; Buvik et al., 2014). However, close examination of operationalisation of vertical control in studies using vertical control as a single construct indicated that most of them have operationalised vertical control as process control (cf. Heide and John, 1992; Ryu and Eyuboglu, 2007; Buvik and Andersen, 2011; Buvik et al., 2014).

2.3 Measurement Cost Theory and Technology

Measurement cost theory (MCT) is a branch of TCT, and several researchers have contributed to the development of this theory (e.g., Barzel, 1982; McManus, 1975 and Ouchi, 1980). MCT is a common theoretical framework in international business studies (Hallwood, 1994a; 1994b; 1994c; 1997; Love, 1997). Other studies have used this theory to study the innovation and use of information technologies in economic transactions and argue that measurement costs, particularly those related to variability in quality play a role similar to production costs in triggering development of technologies and their use in economic transactions (Foss, 1996). However, there is still scant research that uses measurement cost theory to analyse economic transactions.

MCT primarily deals with the measurement costs of ensuring that there is a close relationship between the value of the product and its price when the variation in quality is not fully predictable (Foss, 1996). Specifically, MCT emphasizes the importance of economizing on measurement costs in the choice of governance and identifies the factors that lead to measurement costs (Hallwood, 1994b). The key element in MCT is buyer uncertainty over the attributes of goods or services exchanged, and it argues that buyers will expend resources to ensure that the values exchanged correspond to contractual agreements (Hallwood, 1997). The costs incurred by the buyer to ascertain the quantity or quality attributes of exchanged goods or services are termed as measurement costs in MCT (Hallwood, 1994a; 1994b). This includes costs for evaluating or monitoring the quantity or quality of goods or services exchanged; for instance, costs for weighing quantities and inspecting the quality of goods prior to purchase (Hallwood, 1994b). It is worth mentioning that, McManus (1975) used the term enforcement costs to mean measurement costs.

Virtually no commodity offered for sale is free from the cost of measuring its attributes (Barzel, 1982; Hallwood, 1994c), and this is due to the potential for cheating (McManus, 1975) and/or random variation in quality (Hallwood, 1994c). As variability around the true value increases, the information about the commodity attributes decreases, and it becomes costly to obtain such information, and the accuracy of measurement decreases (Barzel, 1982). Accordingly, the potential for measurement errors in assessing the attributes of the commodity increases and provides an opportunity for manipulation from the supplier and thus raises the need for safeguards (Barzel, 1982).

The literature suggests several solutions to measurement costs, including: (1) product warranties, (2) product branding, (3) suppression of information (Barzel, 1982), and (4) the use of technology (Foss, 1996). The first three solutions focus on addressing the measurement problem from the supplier's point of view whereas technology is considered as a solution to the measurement problem from a buyer's perspective. Our interest in this study is the measurement problem from the buyer's perspective; therefore, we focus our attention on the aspect of technology.

The use of information technology to facilitate economic transactions depends on the need to minimize transaction costs (Foss, 1996). Acknowledging the role of technology in reducing the measurement problem, McManus (1975) noted that the measurement costs associated with exchanged products depend not only on the nature of the product in question, but also on the availability of measurement technology. For products with high quality variability such as cherries, the application of technological solutions plays an important role in reducing measurement costs. Technologies used in measurement and sorting provide the means of reducing information costs and measurement transaction costs (Foss, 1996). Thus, based on the discussion of measurement cost theory presented here, this theory is the most relevant in building an argument for a technology construct in our study.

2.4 Relational Contracting Theory

Relational contracting theory (RCT) acknowledges the existence of contracts in all business to business exchanges (Blois, 2002; Ivens and Blois, 2004) and defines contracts in a broader perspective as simply the devices for conducting transactions, which cover both formal devices (e.g., formal contracts) and non-formal devices (e.g., norms and reputation) (Macaulay, 1963). The discussion in this study is limited to non-formal devices, which is the focus of relational contracting theory. The seminal paper written by Macaulay (1963) is credited as the foundation for the development of relational contracting theory. Macaulay observed the tendency of contracting parties to opt for relational norms in regulating transactions without any reference to existing formal contracts and concluded that formal contracts play a limited role in many business exchanges, and this conclusion is supported by Macneil (1980).

Business exchanges vary widely in the depth of relational intensity between transacting actors (Blois, 2002, Ivens and Blois, 2004). In this regard, Macneil (1983) described relational exchange as a spectrum spanning from discrete at one end to relational exchange at the other end. Discrete exchange is consistent with the underlying assumptions of neoclassical economics, including TCT, in which individual transactions are assumed to be independent of past and future relationships (Heide, 1994; Ariño, de la Torre and Ring, 2005). That is the individual parties remain autonomous and pursue strategies aimed at the attainment of their individual goals (Heide, 1994) with little or no regard for the impact of the transaction (or their behaviour in the transaction) on the future exchange (Ariño et al., 2005).

In contrast, RCT is based on a relational exchange that accounts explicitly for the historical and social context in which transactions take place and views enforcement of obligations as following from the mutuality of interest that exists between transacting parties (Heide, 1994). Furthermore, relational exchange accounts for the assumption that the transacting parties might be associated with each other in the future. The previous transactions are likely to affect the decision to undertake current exchange, and the parties will conduct themselves with an eye towards the future. In short, both past experiences and the shadow of the future constitute important elements in relational contracting theory (Ariño et al, 2005). However, it is noteworthy that both discrete and relational exchanges are viewed as norms in that they represent behavioural expectations, although their respective behavioural aspects are fundamentally different (Heide and John, 1992). Different kinds of norms in economic transactions are discussed in detail in the next subsection.

2.4.1 Relational Norms

Norms are defined across the literature as expectations about behaviour that are at least shared by the group of decision makers (Heide and John, 1992; Gundlach and Achrol, 1993), and they serve to guide, control, or regulate proper and acceptable behaviour, and set limits within which individuals may seek alternative ways to achieve their goals. Moreover, they provide a frame of reference and standards against which to evaluate appropriate behaviour in ambiguous and uncertain environment (Gundlach and Achrol, 1993). Even though Macaulay (1963) implicitly described different kinds of norms, Macneil (1980) describes explicitly nine different kinds of norms or principles of rights, a list which he later expanded by adding the tenth kind of norm (Macneil, 1983).

These norms include (1) role integrity, (2) reciprocity, (3) implementation of planning, (4) effectuation of consent, (5) flexibility (6) contractual solidarity, (7) the linking norms (restitution, reliance, and expectations), (8) creation and restraint of power, (9) propriety of means, and (10) harmonization of relational conflicts (Blois, 2002; Ivens and Blois, 2004). Even though these norms are conceptually distinguishable, they are highly interrelated and Gundlach and Achrol (1993) provide some examples of norms' interrelationships. For instance, the source of the mutuality norm is contractual solidarity, but at the same time, solidarity may not survive for long in the face of a perceived failure in the mutuality norm. Likewise, the solidarity norm presupposes role integrity, and long-term mutuality is affected by flexibility and harmonization of conflict (Gundlach and Achrol, 1993).

Furthermore, some of the above-mentioned norms are more prevalent as one moves along the spectrum towards a discrete exchange, whilst others are predominant in a relational exchange. Implementations of planning and effectuation of consent norms are common in a discrete exchange, and they enhance discreteness. In a more relational exchange, role integrity, propriety of means, contractual solidarity, flexibility and harmonization of relational conflict are greatly significant (Ivens and Blois, 2004).

2.4.2 Relational Governance and Relationship Duration

Relational governance entails the use of relational norms to control the exchange. The extant empirical literature (e.g., Gundlach and Achrol, 1993) has demonstrated that the extent of interaction is the necessary criteria for development of norms of relational nature. The exchanges with low levels of interactions are likely to possess neither the joint interactions necessary for the emergence of norms nor the requisite atmosphere of cooperation that can facilitate the development of relational norms (Gundlach and Achrol, 1993). Consequently, most business-to-business exchanges tend to rely on formal control (authority driven governance) at the early stages. As the level of interaction increases, the use of authority driven governance such as formal contracts diminishes due to the emergence of relational norms (Gundlach and Achrol, 1993). Some literature describes relational norms as soft governance mechanisms due to their self-regulating nature and non-reliance on formal control (Zhou, Zhang, Zhuang, & Zhou, 2015).

Since Macaulay's 1963 seminal paper on non-contractual relations, the efforts to operationalise relational norms started to take shape in the 1980s, and Ivens and Blois' (2004) critical review on relational exchange norms has documented Kaufmann and Stern (1988) as the first known attempt to operationalise relational exchange norms. Since then, several studies have operationalised and empirically tested the effect of relational norms in business-to-business exchanges, with the field of marketing leading the way (e.g., Heide and John, 1992; Heide and Miner, 1992; Lusch and Brown, 1996; Gundlach, Achrol and Mentzer, 1995; Rokkan et al., 2003). Nevertheless, most of the operationalisation and empirical efforts have focused on norms of flexibility, solidarity and mutuality, and very few studies are found on the norms of role integrity, implementation of planning, effectuation of consent, and the creation and restraint of power (Ivens and Blois, 2004).

Earlier studies have used different research strategies in investigating the effect of relational norms, including experiment (Gundlach and Achrol, 1993; Gundlach et al., 1995) and survey (Heide and John, 1992). Moreover, some studies have investigated relational norms as antecedent variables (e.g., Donada and Nogatchewsky, 2009; Gundlach et al., 1995), but most of these studies have considered relational norms as moderating variables and combined them with variables from other theories, particularly TCT (Heide and John, 1992; Artz and Brush, 2000; Rokkan et al., 2003). Despite the differences in perspectives and research strategies, these studies have consistently demonstrated the ability of relational norms to govern business-to-business exchanges.

Heide and John's (1992) work is an example of an investigation of the relational norm as a moderator variable, and this study found that in the presence of the relational norm, a buyer's specific investments increase rather than decrease buyer control. In a similar manner, Rokkan et al. (2003) investigated among others the influence of the solidarity norm in the effect of specific investment on a receiver's opportunism and found that buyer specific investments tend to increase the potential of opportunism (expropriation) for a lower level of solidarity norms, but the effect turns negative for a higher level of solidarity norms (bonding effect). Moreover, Gundlach et al. (1995) found that a high level of relational norms tends to mitigate opportunism. Lastly, Artz and Brush (2000) investigated collaboration, continuity expectations and communication norms and found that when the level of relational norms is low, transaction specific investment and environmental uncertainty increase negotiation costs, but the effect decreased for a high level of relational norms.

Furthermore, several empirical studies have used duration of relationship as a proxy for relational norms and investigated the extent to which the duration of a relationship controls economic exchanges (e.g., Buvik and Halskau, 2001; Buvik, 2002a; Fryxell, Dooley and Vryza, 2002). For instance, Buvik and Halskau (2001) noted that in a transaction with moderate to high levels of investment, the increase in the duration of the relationship reduces the need for extensive buyer control in the transaction. Buvik (2002a) concluded that as the duration of buyer-supplier relationship ages, ex-post transaction costs, including coordination, negotiation and controlling costs tended to decrease.

To sum up, most of the earlier empirical research on relational norms has shown that relational norms are able to govern business-to-business exchanges and are highly effective in ambiguous (Heide, 1994) and uncertain environments (Noordewier, John and Nevin, 1990; Heide, 1994). However, whether they can replace or complete formal control mechanisms is still a contentious issue (Heide and John, 1992). Whereas, some studies (e.g., Li et al., 2010) view relational control and formal control as substitutes, others view them as complementary (e.g., Ryu et al., 2007).

2.5 Exposition of Purchase volume

Purchase volume concentration is described as combining separate purchase agreements for the same supplier into a single, large volume agreement or eliminating multiple suppliers of a common item by establishing a single source (Monczka, Trent and Callahan, 1993). It can also be described as the purchase of a large portion of supply from one supplier (Cai, Yang and Hu, 2010) or reducing the number of suppliers in the supply base and allocating large purchase volume to a few suppliers (Choi and Krause, 2006). Purchase volume concentration has the potential of influencing both transaction costs and relational norms (Cai et al, 2010). In this regard, the research on the issue of purchase volume concentration has drawn from both transaction cost theory and relational contracting theory in analysing its impact on buyer-supplier relationships.

Most of the extant studies have used TCT to analyse the impact of purchase volume concentration (cf. Stump, 1995; Buvik and John, 2000; Buvik and Andersen, 2002; Buvik et al., 2014), and this theory is viewed in the literature (e.g., Stump, 1995) as a promising theoretical framework in analysing the issue of purchase volume concentration. TCT follows an efficiency line of reasoning in analysing the impact of purchase volume concentration (Stump, 1995). The scholars of TCT have used two perspectives in the analysis of the impact of purchase volume in economic transactions: (1) overall supply base perspective (e.g., Choi and Krause, 2006), and (2) individual buyer-supplier relationships (e.g., Buvik and John, 2000 Andersen and Buvik, 2001; Buvik and Andersen, 2002; Cai et al. 2010).

From the perspective of supply base, purchase volume concentration is seen to be a result of supply base reduction, that is the buyer purchases large portions of its supply from a single or few suppliers (Cai et al., 2010). The source of transaction costs in the supply base is its complexity, which is a function of the number of suppliers, degree of differentiation and the level of interaction. However, the number of suppliers in the supply base is a primary source of transaction costs. As the number of suppliers increases, the costs of haggling, and the level of effort required to manage multiple suppliers and to control the potential for opportunism increase (Choi and Krause, 2006). In the same way, Handfield and Nichols (cited in Choi and Krause, 2006) emphasised that using multiple suppliers for the same product increases the level of coordination needed to improve the efficiency of operations. Thus, Choi and Krause (2006) propose that the reduction of the number of suppliers in the supply base and a concentration of the purchase volume to a few suppliers is the way forward in reducing transaction costs in the overall supply base.

From the perspective of the individual buyer–supplier relationship, purchase volume concentration reflects the importance of inter-firm transaction (Buvik and John, 2000; Cai et al., 2010). Research (e.g., Buvik and Andersen, 2002; Buvik and Andersen, 2011) has elaborated the importance of the transaction in terms of the economic stakes involved in a transaction. Thus, the literature has concluded that purchase volume concentration on the individual buyer–supplier relationship results in high ex-post transaction costs (Buvik and John, 2000; Buvik and Andersen, 2002); and thus, influences positively the level of vertical coordination and control in a transaction (e.g., Andersen and Buvik, 2001; Buvik et al, 2014).

In relational contracting reasoning, the concentration of purchase volume to one or a few suppliers is regarded as an indication of a relational approach and a shift to a more intermediate form of governance (Stump, 1995). Cai et al. (2010) emphasised this reasoning by claiming that volume concentration implies recurrent business transactions between parties, which facilitates inter-firm relationships. In this view, volume concentration may serve as a governance mechanism, as it promotes cooperative norms and coordination between trading partners (Cai et al. 2010), and loyalty of the supplier (Goffin, Szwejczewski and New, 1997). This study follows an efficiency path and uses transaction cost theory to analyse the moderating effect of purchase volume on the association between processor control and Screening Transaction Costs.

2.6 Chapter Summary

This chapter has presented the theoretical frameworks for this study. Mainly our review in this chapter has focused on TCT, MCT and RCT. The TCT provides useful insights on transaction costs, the characteristics of transactions that give rise to transaction costs, different governance problems and different ways of alignment of transactions with the characteristics of transaction. The TCT has been used in our study as the theoretical framework for analysis of the processor control, Screening Transaction Costs, perishability variable and purchase volume. On the other hand, MCT is used as a theoretical framework for analysing the way the use of technological instrument in examining the quality of produce affects the association between the processor's control and Screening Transaction Costs. Lastly, RCT has been reviewed to shed knowledge on informal control mechanisms (soft control mechanism). Our study used duration of a relationship as a proxy for relational norms, thus RCT is used as a theory for analysing the way the duration of a relationship moderates the effect of processor control on Screening Transaction Costs. The next chapter focuses on the conceptual model and hypotheses.

CHAPTER 3

CONCEPTUAL MODEL AND HYPOTHESES

CHAPTER 3

CONCEPTUAL MODEL AND HYPOTHESES

3.1. Introduction

Building on the theoretical frameworks presented in chapter two, this chapter presents the research model and hypotheses developed to capture the research objectives introduced in chapter one. The chapter starts by introducing the research model, and in the subsequent sections, the rationales for the proposed hypotheses are presented, and finally we conclude by giving an overall summary of this chapter.

3.2 Research Model

The research model and hypotheses proposed in this study were informed by transaction cost theory (TCT), measurement cost theory (MCT) and relational contracting theory (RCT), which are presented in chapter two. Conceptually, the research model posits that the level of processor control (PROCON) has an influence on the Screening Transaction Costs (SCOST) incurred by the food processors. However, the influence of processor control is contingent on the degree of perishability of the transacted produce (PER), purchase volume (PURCH), the use of technological instruments for quality screening purposes (TECHUSE) and the duration of the relationship between the food processor and the farmer (DURAT).

The degree of perishability was introduced as an antecedent of Screening Transaction Costs and as a moderating variable for the association between processor control and Screening Transaction Costs, and this is because of its connection to quality uncertainty (performance ambiguity) as described on page 22 to 23. That is as the degree of perishability increases, quality uncertainty (performance ambiguity) is expected to increase (Hobbs and Young, 2000; Tita et al., 2011). Moreover, the extant literature has concluded that the amount of economic stakes involved in a transaction increase transaction difficulties (Buvik and Andersen, 2002). Accordingly, purchase volume was also introduced as a moderating variable to capture the effect of the economic stakes involved in a transaction.

Additionally, the use of technological instruments and the duration of relationship were introduced as contingent variables to capture the processor's control mechanisms. Previous studies have described the use of technology as a possible quality control mechanism when processing firms are faced with measurement difficulties, particularly in the transaction of agricultural produce such as fruit and vegetables (Foss, 1996). Moreover, the literature has also demonstrated empirically the capacity of the duration of a relationship to act as an alternative control mechanism to buyer control (unilateral control) (Buvik and Halskau, 2001) and its capacity to reduce ex-post transaction costs (Buvik, 2002a).

To avoid spurious associations between variables and to make the model more complete: the level of processing investments, purchase frequency and the size of food processor were introduced as relevant control variables. The increase in the level of investment in processing activities is expected to act as a motive for the food processors to increase their effort in screening the quality of produce before they purchase. Moreover, large food processors are expected to expend more extensive screening effort than the small food processors, and the annual sales volume was used to capture a processor's size. Lastly, the frequency of transaction is expected to have a negative effect on Screening Transaction Costs. The research hypotheses and control variables are summarized in the conceptual framework in figure 3.1 below:

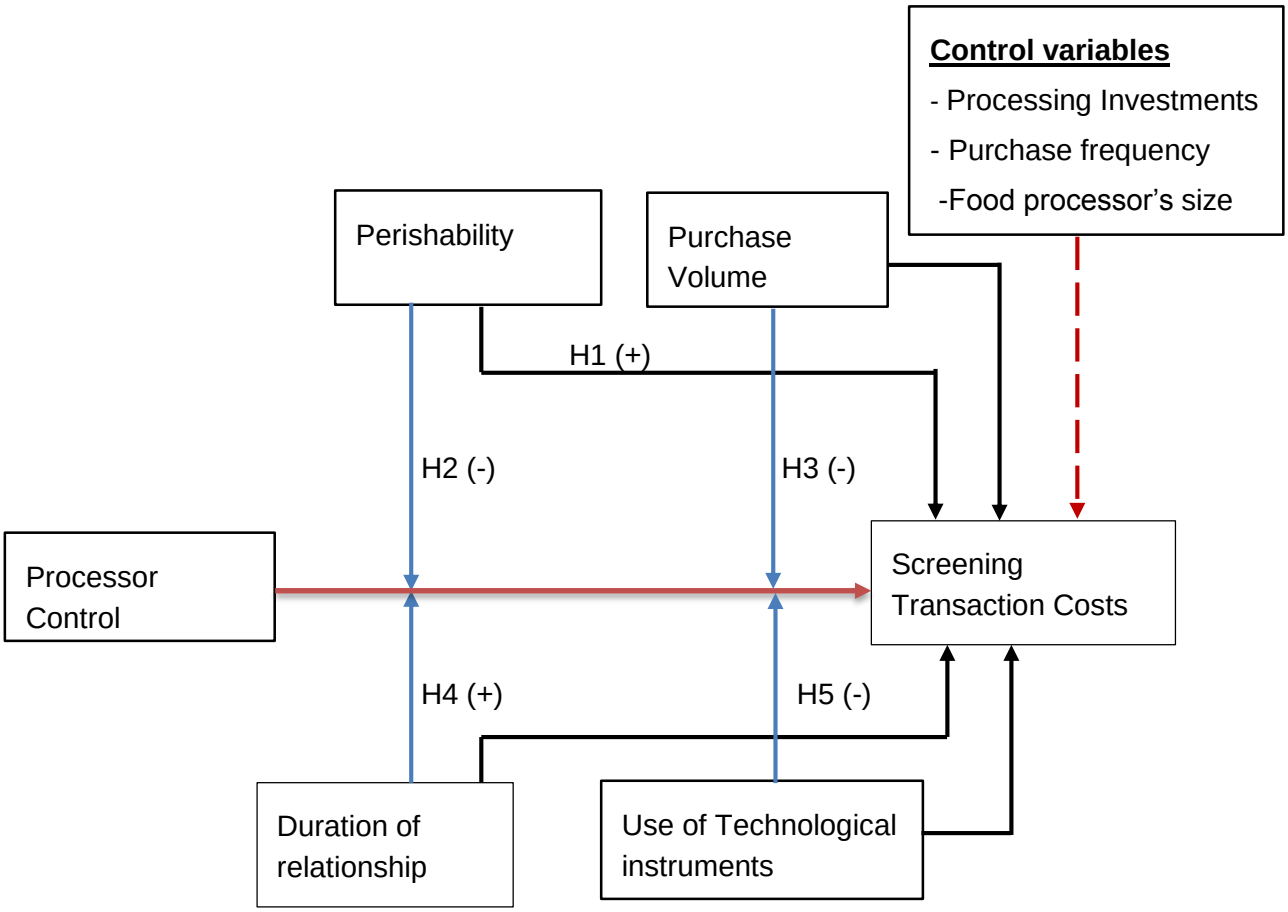

Figure 3.2: Conceptual model and research Hypotheses

3.3 Research Hypotheses

3.3.1 The Main Effect of Perishability

Perishability is a phenomenon that exists in many industries, including electronics, fashion, food and petroleum, and it is evident in different ways (Lian, Liu and Zhao, 2009; Panda, Saha and Basu, 2009; Byun and Sternquist, 2012). Because of its wide application to various industries, it is a rather complex concept, and many researchers have described it differently depending on the industry in which the study is positioned. Literature in the food and agricultural industry has described perishability in terms of shelf life, respiration rate, softness of tissue, level of moisture and vulnerability of the produce to the risk of damage (Masten, 2000; Clements, Lazo and Martin, 2008; Blackburn and Scudder, 2009; Parfitt, Barthel and Macnaughton, 2010).

Furthermore, perishability is a stand out characteristic of agricultural produce that distinguishes them from most of the industrial products (Siskos, Matsatsinis and Baourakis, 2001), and it distinguishes different products within the category of agricultural produce. Some agricultural produce such as grains have a longer shelf life than other produce including fruit and vegetables (Shukla and Jharkharia, 2013) (see table 3.1). Likewise, the quality of fruit and vegetables is more fragile than that of grains. Thus, fruit and vegetables are regarded as more perishable than grains. However, quality vulnerability and shelf life vary across produce with some produce being more perishable and fragile than others (Clements et al., 2008). The variations are also evident across units of the same produce and from one supply period to another (Jaffee, 1992).The variation can be in terms of several attributes, including moisture content, sugar content, size, level of damage, taste, colour, variety and time of delivery (Grosh, 1994).

Table 3.1 Shelf life and vulnerability of few selected produce

	Shelf life and vulnerability	
Produce	**Shelf life**	**Quality Vulnerability**
Hard grains	Several years	Less vulnerable
Green bananas	5 – 7 days (USAID, 2011)	Vulnerable
Ripe bananas	Up to 3 days (USAID, 2011) Up to 5 days (Ahmad et al., 2006)	Vulnerable
Ripe mangoes	4 – 8 days (Abbasi, 2009) Up to 12 days (Ullah et al., 2010)	Vulnerable
Green tomatoes	15 days (Moneruzzaman et al., 2008)	
Half ripe tomatoes	13 days (Moneruzzaman et al., 2008)	Vulnerable
Full ripe tomatoes	9 days (Moneruzzaman et al., 2008)	

Accordingly, some researchers have consistently described perishability as the source of quality variability (Jensen, Kehrberg and Thomas, 1962) and uncertainty (Hobbs and Young, 2000; Simangunsong, Hendry and Stevenson, 2012; Tita et al, 2011). In Hobbs and Young's (2000) view, the perishability of agricultural produce tends to create quality uncertainty for the buyers concerning product quality and trustworthiness of the supplier due to the difficulties in determining the state of deterioration of the produce at the time of purchase. Tita et al. (2011) provided empirical evidence that quality uncertainty is higher for perishable than less perishable produce. Furthermore, Martino (2013) noted the heterogeneity of intrinsic attributes and time variability of produce as the cause of quality uncertainty. In a similar way, Johnson, Wilson and Diersen (2001) emphasised quality variability of agricultural produce as the source of quality uncertainty.

Moreover, from the discussion of quality uncertainty on page 22 and performance ambiguity on page 25 in the theoretical review chapter, this study regards these two concepts to be equivalent. Quality uncertainty (performance ambiguity) is among the main causes of transaction costs (Bowen and Jones, 1986; Jones, 1987). When the quality uncertainty (performance ambiguity) is low, buyers face little difficulty in evaluating the quality of the produce they buy, and under this condition, transaction costs faced by the buyer are minimal (Bowen and Jones, 1986). This is typically the case in the purchase of homogenous products and less perishable produce.

On the contrary, when quality uncertainty (performance ambiguity) increases, the potential for opportunism increases. Thus, the buyer faces more difficulties in evaluating and accurately measuring the quality of the product they want to purchase. Consequently, transaction costs are considerable in this situation because of the buyer's quest for more information before completing the transaction (Bowen and Jones, 1986) and this is typically the case in the transactions of perishable produce. Some of these transaction costs include costs of inspection and sorting (Hobbs and Young, 2000; Tita et al., 2011). Our study conceptualises these transaction costs as Screening Transaction Costs, and these are expected to increase with an increase in the level of perishability. Thus, based on the on the arguments presented above, we propose the following hypothesis:

H1: There is a positive association between perishability and Screening Transaction Costs.

3.3.2 Moderating Effect of perishability

Perishability is a variable loaded with risks. Perishable produce tends to be at high risk of quality loss after harvest, vulnerable to long transportation time (Zuurbier, 1999) and can easily be damaged (Casson, 1986; Clements et al., 2008). Consequently, perishability poses logistics and quality management challenges (Zuurbier, 1999). Similarly, Jaffee (1992) explained perishability as a factor that enhances the risk of produce loss or value decline during transportation and storage. Thus, the fundamental question here is whether the difference in the perishability level of different produce can moderate the effect of processor control on the Screening Transaction Costs incurred by the food processors. The answer to this question lies in the understanding of the factors that influence the quality of agricultural produce.

Trienekens and Zuurbier (2008) used a chain approach to illustrate the variety of factors that influence the quality of fruit from the planting stage through the processing stage and up to the retail stage. However, the interest of this study is on factors that influence the quality of produce from the harvesting stage and before the processing stage. During the harvest and transportation stages, the quality of produce can be affected by the harvesting method, hygienic picking conditions, choice of clean fruit, and protection of produce from sun and insects. Other factors are loading and unloading conditions and packaging conditions (Trienekens and Zuurbier, 2008).The factors delineated by Trienekens and Zuurbier (2008) are more pronounced in perishable produce than in less perishable produce, and this is underscored by Casson (1986) who points out that perishable produce are difficult to transport, and their handling requires special expertise and care. In a similar way, Masten (2000) explained perishability as a factor that calls for great care during the transportation of agricultural produce. In addition, the quality of perishable produce is also affected by delays in shipments (Casson, 1986). Generally, the aforementioned factors contribute to the increase in quality variability of agricultural produce particularly, for perishable produce.

Accordingly, to enhance quality and to control the abovementioned factors, buyers (processors) have often reached back to the beginning of the distribution channel (Siskos et al. 2001). The control of produce from the farm can ensure a steady supply of suitable produce for processing (Knoeber, 1983). Similarly, Blackburn and Scudder (2009) argue that the actions taken to control activities in the early stages of the supply chain can ensure the quality and value of produce. Accordingly, when the food processor increases control of factors that affect quality, it may benefit by economising on Screening transaction Costs due to the reduction in quality uncertainty (performance ambiguity) of transacted produce.

However, literature (e.g., Casson, 1986; Zuurbier, 1999) regard the perishability of agricultural produce as the main concern for buyers in controlling quality of agricultural produce and this may be due to quality uncertainty, which tends to be high for perishable produce as described in chapter two. Thus, control is considered important for perishable produce compared to less perishable produce (Sporleder, 1992; Zuurbier, 1999). In the first hypothesis (H1), we argued that perishability increases Screening Transaction Costs incurred by the processing firms because of its influence on quality uncertainty (performance ambiguity). We follow up this line of reasoning by arguing that the increase in control of the factors that affect the quality of produce is expected to decrease Screening Transaction Costs incurred by the food processors more in the transactions involving produce with the high degree of perishability than in the transactions involving produce with the low degree of perishability.

Despite the efficiency potential for processor control in reducing Screening Transaction Costs, achieving vertical control in a transaction that involves two independent firms is not straightforward (Heide and John, 1992). It requires the firm that seeks to exercise vertical control to have an ability to do so. As it has been pointed out in the above discussion, perishability provides an incentive for the food processor to increase control of the transaction. We further argue that perishability may also endow the food processor with the ability to exercise control due to its temporal specificity nature.

> *"Temporal specificity may arise because…or because the product is perishable, as is the case, of course, with agricultural commodities" (Masten, 2000: 180).*

Masten, Meehan and Snyder's (1991) study is credited with introducing the term temporal specificity. This kind of specific asset is more pronounced when there are fewer alternative potential buyers, when the produce is perishable and when the alternative buyers are geographically dispersed (Koss, 1999). Most agricultural produce faces few processors in any

given locality; therefore, given the temporal specificity of perishable produce, farmers face uncertainty as to whether there will be an outlet for their produce irrespective of price (Mueller and Collins, 1957; Hobbs and Young, 2000). Consequently, market uncertainty forces farmers to relinquish control to the food processor in return for market assurance. In this regard, perishability offers not only a motive but also the ability to the food processor to exercise control. From the discussion above, we posit the following hypothesis:

H2: The association between processor control and Screening Transaction Costs becomes more negatively shaped when the level of perishability increases.

3.3.3 Moderating Effect of Purchase Volume

From a TCT perspective, economic transactions cannot occur without transaction costs (Stanford, 1999; Lu Trienekens, Omta and Feng, 2008). These costs include costs of developing and maintaining an exchange, monitoring exchange behaviours, safeguarding against opportunism in an exchange (Pilling et al., 1994), administrative costs and communication costs (Cai et al., 2010). Transaction costs tend to increase with an increase in the number of suppliers and the extent of the suppliers' differentiation in factors such as geographical dispersion, different operational procedures, culture and technical capability. Consequently, most firms that seek to reduce transaction costs focus primarily on reducing the number of suppliers before considering other factors (Choi and Krause, 2006). Researchers have observed this tendency in large companies in different industries, including automobile, technology and aerospace (Choi and Krause, 2006). The outcomes associated with reducing the number of suppliers include lower transaction costs due to fewer negotiations and communication channels; better tracing of problems, and reduction in the potential for frictions (Choi and Krause, 2006).

However, as the number of suppliers decreases, the concentration of purchases from few supplier increases and the literature (e.g., Choi and Krause, 2006) has identified an increased reliance on a few suppliers as the natural consequence of the decrease in the number of suppliers. Furthermore, Cai et al's (2010) study highlighted purchase volume consolidation as one major outcome of supply base reduction. That is a buyer purchasing a considerable volume of products from one supplier. This situation increases the dependence of a buyer's success on one or a limited number of suppliers. Nevertheless, the effect of supply base reduction on the individual buyer–supplier relationship has received limited attention (Cai et al., 2010). It is therefore critical to study the effect of volume concentration on the individual buyer-supplier relationship.

Most previous studies (e.g. Heide and Stump, 1995; Buvik and Grønhaug, 2000; Buvik and Haugland, 2005; Buvik and Andersen, 2011; Buvik et al., 2014) have paid scant attention to purchase volume and used it as a control variable in investigating various buyer-supplier relationship issues. For instance, Heide and Stump (1995) study used purchase volume as the control variable in investigating the performance implication of buyer-supplier relationships in industrial markets, whereas, Buvik et al. (2014) used purchase volume as the control variable in examining the development of bilateral governance and complexity of inter-firm governance. Even though most of the earlier studies have not used purchase volume as one of their main focuses, still, purchase volume has proved to have significant effect on various investigated variables, including ex-post transaction costs (Buvik and John, 2000; Buvik, 2002a), buyer control (Buvik and Andersen, 2011; Buvik et al., 2014) and buyer-supplier relationship performance (Heide and Stump, 1995). Therefore, it is worthwhile studying purchase volume as a main research variable rather than a control variable. In particular, this study pays attention to the interaction effect of purchase volume and processor control on Screening Transaction Costs.

In the buyer–supplier relationship, purchase volume reflects the amount of economic stakes involved in a transaction. The TCT posits that the parties to a high stake exchange will face high exposure to opportunism and high transaction costs when the terms of trade are to be realigned (Buvik and Andersen, 2002; Buvik et al., 2014). Likewise, purchase volume involves high transaction costs when the relationship between transacting parties is adversarial due the potential for opportunism (González-Benito, Suárez-González and Spring, 2000). Thus, as food processors purchase produce in large volumes, the farmers' opportunistic behaviours described in chapter two including hiding immature produce among the matured produce, damaged or inferior produce among good produce (Grosh, 1994; Lyon, 2000), and false over declaring of produce quality (Poulton, Dorward and Kydd, 2010) are likely to increase. This is due to the increase in the difficulty in evaluating quality of produce.

Taking into account economic stake consideration, a food processor buying large amounts of produce from one supplier is likely to increase screening efforts to reduce the probability of buying produce of poor quality and this is because the consequence of poor quality may be higher for large purchase volume compared to small purchase volume. However, when a food processor increase control of factors that affect the quality of produce, the extensive screening efforts are expected to be attenuated, and therefore, leading to a reduction in Screening Transaction Costs. The decrease in Screening Transaction Costs is expected to be higher for

the transaction involving large purchase volume. From the above discussion, we propose the following hypothesis.

H3: The association between processor control and Screening Transaction Costs becomes more negatively enforced when the purchase volume increases

3.3.4 Moderating Effect of Relationship Duration

Transacting without any formal contract between two parties is quite common in the agri-food supply chain (Fearne, 1998; Parker et al., 2006) and this condition fosters opportunistic behaviour (Jraisat et al., 2013). In agricultural produce transactions, such behaviour is more evident when the quality of the produce is highly variable, produce is perishable and some attributes are difficult to evaluate, such as taste, maturity and moisture content and the state of deterioration of produce.

Suppliers (farmers) are more likely to behave opportunistically in one-off transactions (Quinn and Anh, 2008) and in the early stages of the relationship due to lack of cooperation, and low level of personal relationship and expectation for continuity. Furthermore, the level of information asymmetry in the early stages is high, which in turn induces suspicion of opportunism, as there is less history to draw upon to explain behaviour of the transacting partner (Tong and Crosno, 2015). Therefore, in the early stages of the relationship, the buyers (food processors) are motivated to exercise control to curb supplier (farmer) opportunism (Buvik et al., 2014), thereby economising on search and Screening Transaction Costs (Fafchamps, 2001).

Accordingly, the prior length of the relationship is an important element in understanding buyer control (Buvik et al., 2014), and is closely related to trust (Li et al., 2010; Talay and Akdeniz, 2014; Vanneste, Puranam and Kretschmer, 2014) and relational norms (Li et al., 2010). Research contributions from different studies (e.g., Buvik and Halskau, 2001; Buvik, 2002a) have emphasized the benefits of long-term buyer-supplier relationships. A study by Buvik (2002a) has demonstrated the capacity of relationship duration in reducing ex-post transaction costs. Moreover, Buvik and Halskau's (2001) study has shown the capacity of the relationship duration to protect specific asset investment. In this regard, relationship duration can act as a control mechanism. Nevertheless, whether prior history of a relationship can reduce the need for buyer control remains a contentious issue.

Concerning informal and formal control, the literature has highlighted two competing views: the substitution view and the complementary view. The subscribers of the substitution view believe that the length of relationship may diminish the need for formal control (Xin and Pearce, 1996). Whilst the subscribers of the complementary view believe that, the length of relationship sets the foundation for the use of unilateral control (formal control) (Li et al., 2010). That is the use of unilateral control increases with an increase in the length of the relationship. Several factors appear to be the cause of this ongoing debate, including differences in empirical setting (Li et al, 2010; Cao and Lumineau, 2015), focus on different functions of the formal governance such as coordination, control and adaptation (Huber, Fischer, Dibbern and Hirschheim, 2014; Cao and Lumineau, 2015) and measurement error (Cao and Lumineau, 2015). These variations in the findings of the existing research signal the need for further research on complementarity and substitutability of control mechanism.

This research extends knowledge in the ongoing debate by focusing on the interaction effect of the length of relationship and processor control on Screening Transaction Costs. The most-recent review by Schepker, Oh, Martynov and Poppo (2014) emphasised the need for knowledge on the issue of how and when informal control in our case, “relationship length” obviates the need for substituting or partially substituting formal control, which in our case is processor control. The consideration of a specific function of formal governance such as control may increase an understanding of the relationship between control mechanisms (Schepker et al., 2014), and is underscored by Cao and Lumineau (2015) as a way forward for further research on the joint effect of formal and informal control. Our study seeks to contribute to this area through the analysis of agricultural produce transactions.

The purchase of produce for production is different from the purchase of capital goods. The former involves higher purchase frequency than the latter. Therefore, as the food processor continues to purchase produce from the same source every time, a relationship is likely to emerge. As this relationship develops over time, experience about a supplier performance builds up and creates quality assurance for the food processor while providing marketing assurance for farmers. Trust, relational norms and personal relationships may also emerge from successful completion of the past transactions and satisfaction with supplier performance (Buvik and Andersen, 2002; Buvik and Halskau, 2001). Relational norms and trust are expected to reduce exchange hazards associated with uncertainty (Cao and Lumineau, 2015) and opportunism (Buvik and Andersen, 2002; Cao and Lumineau, 2015) and thereby reduce transaction costs (Zaheer and Venkatraman, 1995; Buvik and Andersen, 2002). Increasing control in this environment where relational norms and trust have been established would be inefficient or even counterproductive. That is, as the relationships between food processors and farmers continue to evolve, the effect of processor control on reducing transaction costs in this case Screening Transaction Costs is expected to diminish. From the above discussion, we propose the following hypothesis.

H4: The association between processor control and Screening Transaction Costs is less negatively shaped as the relationship ages.

3.3.5 Moderating Effect of Screening Technology

One of the challenging aspects of most processed food products is the strong heterogeneity of agricultural produce (Raynaud et al., 2009). The effort to ensure quality consistency in this context is likely to increase Screening Transaction Costs significantly since food processors are forced to inspect produce quality thoroughly before purchase. In the preceding hypotheses, we have argued that the increase in processor control is likely to decrease these Screening Transaction Costs significantly contingent on the duration of the relationship between the food processor and farmer (H4). We further argue that the efficiency of processor control in reducing Screening Transaction Costs is contingent on the processor's use of technological instruments for quality screening purposes and examined whether the use of technological instruments enhances the efficiency of the processor's control, and a dummy variable was used to capture whether the processor owns technological instruments for quality screening.

Several research studies (e.g., Foss, 1996; Patel, Kar, Jha and Khan, 2012) have highlighted the role of technology in evaluating the quality of agricultural produce. Quality evaluation has traditionally been performed manually by assessing each product or a sample of produce for factors such as colour, size, shape, texture and aroma. Despite the best efforts by the food processors to evaluate the quality of produce before they purchase, manual evaluation is very subjective. It always varies from one quality inspector to another and/or from one day to the other, and therefore, always poses the risk of procuring inferior produce in the environment with high-quality variability (Patel et al., 2012). Moreover, manual evaluation is difficult and costly in terms of both time and labour (Patel et al., 2012), and therefore, gives rise to high Screening Transaction Costs. Interestingly, the transaction costs related to variability in quality or performance play a significant role in triggering the use of information technology and the measurement cost branch of transaction cost theory provides a theoretical argument in this respect (Foss, 1996).

Furthermore, the difficulties in measuring quality and related measurement costs increase when moving from search to experience and to credence attributes (Bougherara, Grolleau and Mzoughi, 2009). However, some studies (e.g., Patel et al., 2012) have shown that in the situation where the food processor evaluates the quality of produce manually, the transaction costs are likely to be high even for search attributes because agricultural produce are, by their nature, characterised by variability. The increase in processor control in this context is likely to reduce Screening Transaction Costs by reducing the need for extensive screening, even though it is unlikely to provide sufficient assurance for quality attributes that are difficult to detect such as the moisture level of produce. Technological instruments can be introduced into this situation to enforce the ability of the processor control to screen quality attributes that are difficult to detect. Technological instruments can also be used to assess colour, size, shape and chemical composition of produce (Jaffee, 1992).

Several technologies that involve full automation of produce screening have been discussed in the literature including machine vision technologies (Patel et al., 2012), and there is much evidence of the wide adoption of these technologies in quality screening of fruit, vegetables and grains before processing. Moreover, full automation technologies are credited for their quality screening speed, consistency, objectivity, cost-effectiveness and their ease of use (Patel et al., 2012). Despite the benefits of full automation technologies, processors involved in this study were using simple technological instruments such as moisture meters. These instruments screen produce quality based on samples and consequently; they are unlikely to eliminate the need to control activities that may affect quality, including harvest practices, loading, offloading and packing among others. Instead, the food processor couples technological instruments and control. This combination is likely to attenuate the screening efforts used by the food processor and consequently, reduces Screening Transaction Costs. Following the above discussion, we propose the following hypothesis.

H5: The association between processor control and Screening Transaction Costs becomes more negatively shaped when the food processor uses technological instruments for quality screening than when the food processor does not use technological instruments for quality screening.

3.4 Chapter Summary

This chapter has presented the conceptual model, which suggest the way the association between processor control and the Screening Transaction Costs is moderated by the perishability of the transacted produce, the purchase volume, the food processor's use of technological instruments for screening the quality of the produce and the duration of the relationship between the food processor and the farmer. For the developed conceptual model, we have developed and discussed five hypotheses of which one focused on the main effect of perishability on the Screening Transaction Costs, and the remaining four focused on the moderating effects. The conceptual model and the research hypotheses were informed by TCT, MCT and RCT, and in order to make our model more robust in examining the effects of our variable interest, we added three control variables, including processing investments, purchase frequency from the main source and the size of the processing firm. In the next chapter, the research methodology is discussed.

CHAPTER 4

RESEARCH METHODOLOGY

CHAPTER 4

METHODOLOGY

4.1 Introduction

This chapter presents the systematic process followed in conducting this research. Science insists on following systematic methodological rules for gathering empirical evidence and in this way, the number of errors in the process of knowing are reduced or controlled, and the findings can be scientifically trustworthy and replicated by other scientists (Ruane, 2005). The chapter starts with the presentation of an overview of the empirical setting, and proceeds with a discussion of the research design used in this study and data collection process from the development of the questionnaire up to its administration. Furthermore, the chapter presents the discussion of common method variance.

4.2 Empirical Setting

4.2.1 Agriculture Status in Tanzania Economy

The growth of the gross domestic product (GDP) of the Tanzanian economy fluctuates between 5.1 and 8.8 percent. However, the contribution of the agricultural sector has continued to increase from 27 percent in 2007 to 32 percent in 2013 (WB, 2015) and employs nearly 80 percent of the population (ADB, 2011: 2). Whereas cash crops contribute only 10 percent of the agricultural GDP contribution, food crops contribute about 65 percent with maize being the major contributor accounting for 20 percent of the agricultural GDP contribution. However, the export of cash crops grows at a higher pace (6 percent) than food crops (4 percent). Moreover, agriculture is more important in the rural areas contributing about 70 percent of the rural income (URT, 2013:2).

Despite the vital role of agriculture in the economy, post-harvest loss is still a major problem. The statistics indicate that postharvest loss may be as high as 40 percent for fruit and vegetables (ESRF, 2009: 70). Moreover, there are a number of other challenges facing the agricultural sector in Tanzania including (1) limited capital and access to financial services, (2) inadequate agricultural technical support services, (3) poor rural infrastructure, (4) weak producer organizations, and (5) land insecurity due to the lack of legal property rights. Other challenges are the low productivity of land, labour and production inputs (URT, 2013:3).

4.2.2 Agricultural Produce Cultivated

Farmers in Tanzania cultivate a variety of produce ranging from fruit, vegetables and grains to root crops and spices. The 2013 agricultural production statistics from the Food and Agriculture Organization of the United Nations (FAOSTAT, 2013) show that grains are widely produced at approximately 12 million tonnes a year, followed by root crops (10 million tonnes), fruit (approximately 6 million tonnes), sugarcane (approximately 3 million tonnes), vegetables (approximately 2.2 million tonnes), and oil seeds (approximately 2.1 million tonnes). These quantities of production are illustrated in the bar chart in figure 4.1 below:

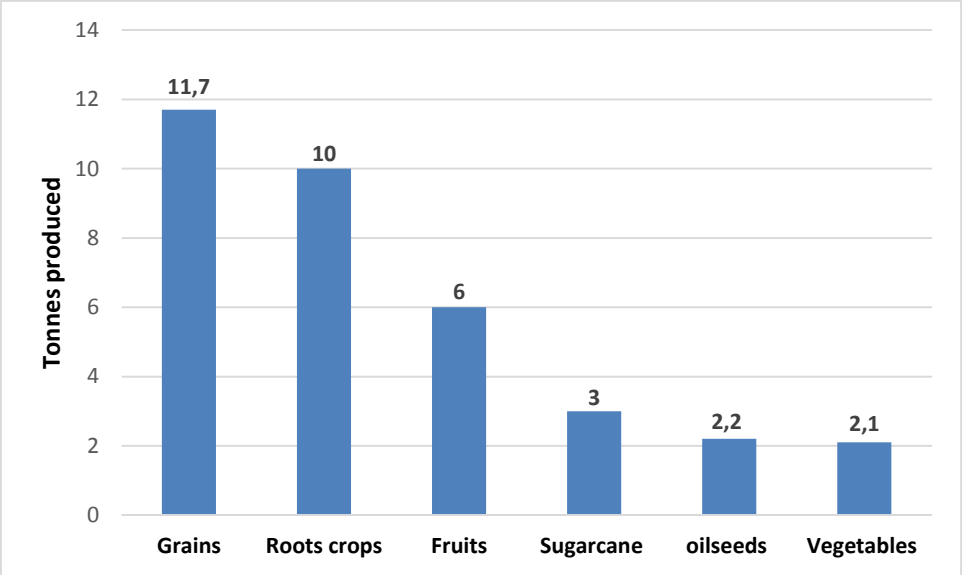

Figure 4.1 Average agricultural production per year (in millions)

Source: Constructed from FAO agricultural production statistics of 2013 (FAOSTAT, 2013)

Furthermore, FAOSTAT (2013) shows that maize is a widely produced grain at approximately 5 million tonnes per year, followed by rice (2 million tonnes), dry beans (1 million tonnes), sorghum (0.83 million tonnes), groundnuts (0.79 million tonnes) and millet (0.32 million tonnes). Cassava, sweet potatoes and potatoes are leading produce in the category of root crops with approximately 5, 3.5 and 2 millions of tonnes produced per year respectively. Moreover, banana is by far the largest produced fruit at approximately 3 million tonnes. Other widely produced fruit includes plantains (0.74 million tonnes), coconut (0.53 million), mangoes and guava (0.45 million tonnes), tomatoes (0.42 million tonnes), oranges (0.36 million tonnes) and pineapple (0.36 million tonnes). Additionally, grass produce, particularly sugarcane is the fourth largest product at approximately 3 million tonnes a year. The bar charts in appendix 1A illustrate the leading produce in quantity produced per year for different produce categories.

4.2.3 Food Processing Industry Profile

The food processing industry accounts for nearly 40 percent of all manufacturing value added in Africa (Dietz, Matee and Ssali, 2000). Nevertheless, the food processing industry in Tanzania is still in its infancy even by the standards of a developing country (Makombe, 2006). Despite its infancy, it is still one of the largest industries and employs between 12 and 31.5% in both rural and urban areas (Makombe, 2006), and it accounts for 56% of total employment in the manufacturing sector (Sutton and Olomi, 2012). Moreover, the United States of America commercial guide for US companies in 2011 listed agribusiness and food processing as among the best prospect sector in Tanzania.

The sizes of food processing firms in Tanzania range from micro to large and nearly 51.2 percent are located in urban areas in major towns such as Dar es Salaam and Arusha (Makombe, 2006). The industry is dominated by macro and small enterprises, which account for 74 percent of the total food processors, most of which are owned and run by women (Mushobozi, 2010: Shylers, 2010). Large and medium food processors account for only 10.9 and 15 percent respectively (URT, 2006). While large and medium food processors operate in the formal sector, most of the micro and small food processors do not feature in any statistics (Dietz et al., 2000).

Tanzanian food processors produce a variety of products, which include tomato paste, pickles, maize flour, cassava flour, nutritious flour[3], peanut butter, vegetable oil, different kinds of fruit juices, banana wines, orange wine, pineapple wine, grape wine, rosella wine and dried vegetables among others. Although small food processors are faced with financial constraints, they tend to produce multiple products most of which are unrelated. For instance, some of the enterprises visited during the course of this study were processing pickles and wines, dried vegetables and wine or pickles and nutritious flour at the same time.

[3] Nutritious floor is a flour made by mixing different produce such as maize, finger millet, soya beans, and groundnuts

Unlike medium and large food processors, which use improved and modern technologies, micro and small food processors are highly labour intensive and use poor technology. Apart from the aforementioned constraints, there are a number of other constraints facing micro and small food processors, including poor equipment, low processing skills, little publicity, inadequate packaging materials, and a limited market due to limited habits in consuming processed fruit and vegetables (Makombe, 2006). Other constraints include limited access to finance, poor technical and management skills, poor quality raw materials and poor production facilities (Dietz et al., 2000).

Access to finance and high financing costs are the major constraints facing micro and small enterprises in the food processing industry. Demand for collateral and high interest rates limits the small food processors seeking to expand their businesses, consequently leading to other constraints such as poor working equipment, production facilities, packaging materials and technology (Dietz et al., 2000). Most micro and small food processors visited during the course of this study have tried and failed to secure loans in different banks. As a result, most of them end up conducting their production activities in a small facility at home in the backyards under poor hygienic conditions, which affect the quality of the final products and consequently, their competitiveness.

Lack of business knowledge, skilled labour, limited food processing knowledge and proper advice are also described as constraints facing micro and small businesses. For example, the majority of enterprises produce several products at the same time with little regard to demand even though they face budget constraints. Moreover, most of the micro and small food processors keep limited financial records, and the boundary between an owner's personal income and business income is too fluid. Dietz et al's (2000) study noted that the majority of food processors have limited knowledge of consumer needs' analysis, market segmentation, products pricing and financial planning. Our preliminary study, which was conducted using focus group discussions and interviews with food processors, confirmed some findings of Dietz et al. (2000).

4.2.4 Supply Chain of Processed Food in Tanzania

The supply chain of processed foods in micro, small, medium and large food processors in Tanzania is very complex and encompasses a number of interacting supply chain members both in the upstream and downstream of the processing firm. Some of the small food processors purchase their raw materials from the retailers in open-air markets. Open-air markets are outdoor public places where farmers and vendors sell food and merchandise. They are very common in developing countries in Africa and Asia. Other food processors buy their produce directly from farmers at the farm level. Most of the medium food processors buy their produce either from wholesalers or directly from the farmers at the farm level and transport them to their processing facilities.

After the processing stage, different channels are used to reach customers, and different food processors use different channels depending on their scale of operation and access to target customers. The sales and distribution of large and medium scale food processors such as brewers, millers, bakers and oil processors tend to cover a very large area. Using their own transport, large firms transport their products to depots and sell from depots to wholesalers, retailers, market stalls and street vendors. Some wholesalers distribute the produce to local shops in rural areas and market stalls in market places. In urban areas, large food processors also sell directly to wholesalers, retailers and local shops. Additionally, some street vendors, local shops and market stalls in urban areas purchase their products from the retailers (Dietz et al., 2000). The use of depots and wholesalers allows large firms to access multiple channels while allowing small delivery to be managed locally by depots and wholesalers (Shylers, 2010).

On the other hand, most of the macro and small food processors struggle to distribute their products to end customers. They manage their distribution channels directly without the use of any intermediaries, and most of these food processors sell directly from the production facility to consumers in the nearby areas, street vendors, market stalls and local shops. Some small food processors have managed to establish links with retail chains and mini-supermarkets in which they supply periodically depending on the inventory turnover. Low levels of production seem to be a factor that inhibits small food processors from using intermediaries to distribute their products (Dietz et al., 2000). The figure 4.2 below provides the simplified supply chain of processed foods from the main sources of produce through the focal firm to final customers.

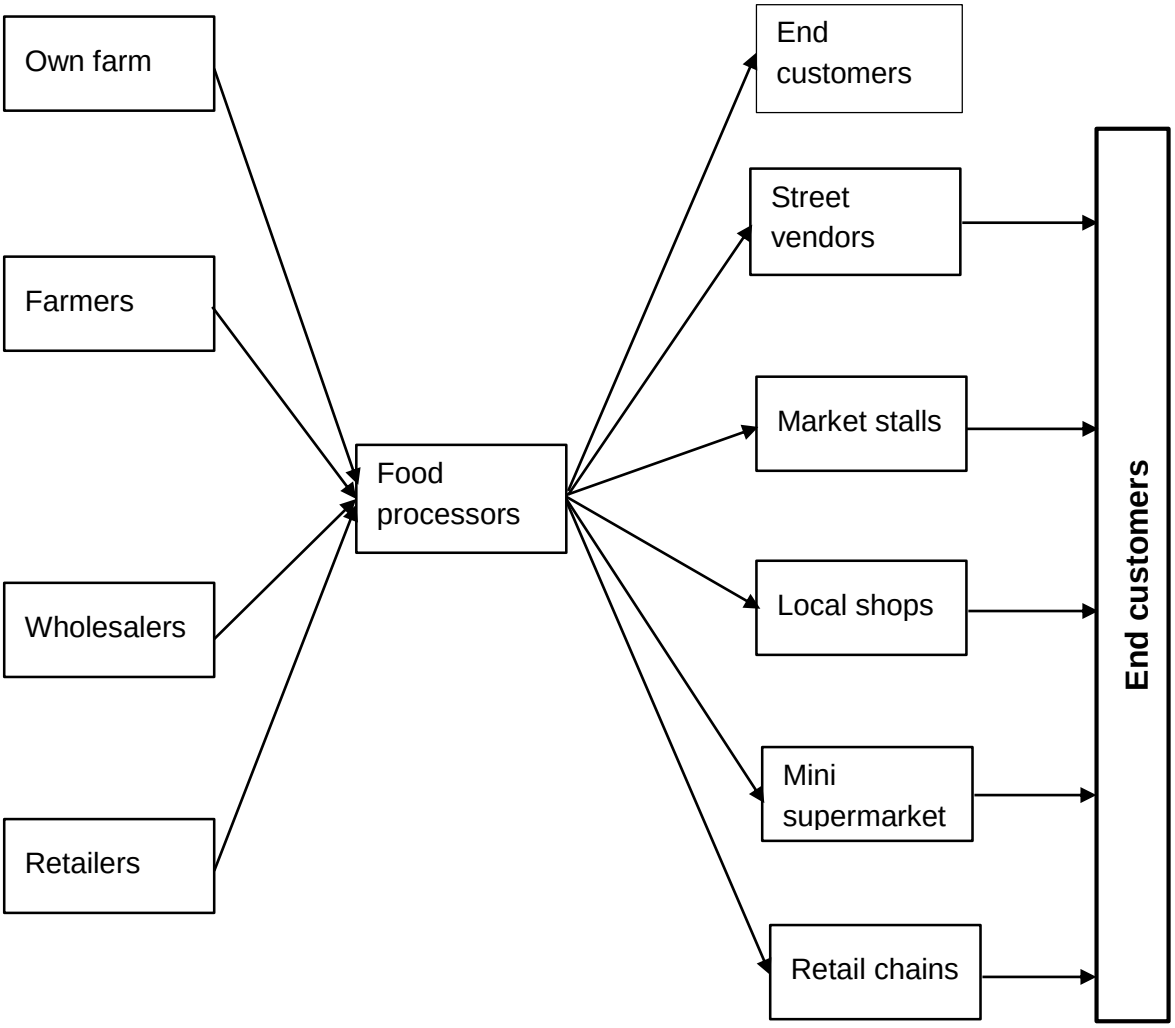

Figure 4.2 Supply chain of processed foods

4.3 Research Design

Research design is a general plan of the stages to be followed in addressing the research question (Saunders, Lewis and Thornhill, 2009). It can also be viewed as a framework that guides research in the collection and analyses of data (Churchill and Brown, 2004). Research design is important in insuring the quality of the research and the trustworthiness of the research conclusions (Ruane, 2005). Accordingly, the researcher must strive to develop the best possible research design that may fulfil the research purpose within the constraints of time and money (Saunders et al., 2009).

Among other classifications described in various literature (e.g., Robson, 2002; Creswell, 2009; Frankfort-Nachmias and Nachmias, 2008), research designs may be classified into five broad categories: (1) experimental design, (2) cross-sectional or social survey design, (3) longitudinal design, (4) case study design, and (5) comparative design (Bryman and Bell, 2011). The choice of the research design depends on the nature of the research question that a study is seeking to address (Robson, 2002). In turn, the research question(s) informs the choice of the research strategy, data collection techniques, analysis procedures, and the time horizon over which the research will be undertaken (Saunders et al., 2009). Therefore, the understanding of the research question(s) or the objective of the research is essential in deciding on the appropriate research design (Robson, 2002).

Accordingly, data for empirical evidence in this study were collected from key informants in the food processing industry at the same time using a structured questionnaire. This way of collecting data is consistent with the cross-sectional research design. Furthermore, the observations of the variables in the self-completion questionnaire were made across a large number of key informants with the aim of establishing the patterns and associations between variables without any use of control groups. The literature terms this kind of cross-sectional design that focuses on establishing relationships between variables as correlational design (Ruane, 2005). Therefore, the research design for this study can specifically be described as cross-sectional correlational research design.

However, the use of cross-sectional correlational research design raises a number of concerns. These include (1) the inability to establish causal relationship (Rindfleisch, Malter, Ganesan and Moorman, 2008), (2) difficulties in isolating the effect of other variables (Antonakis, Bendahan, Jacquart and Lavile, 2010), and (3) common method variance (CMV) (Rindfleisch et al., 2008). Despite these concerns, cross-sectional correlational research design remains a widely used design among researchers focusing on theory testing, particularly in the social sciences (Robson, 2002; Frankfort-Nachmias and Nachmias, 2008). The first two aforementioned concerns are discussed in the next subsection with reference to experimental research design, and the CMV concern is discussed at the end of this chapter and at the stage of data screening and validation in chapter six.

4.3.1 Key Issues in Cross-Sectional Correlational Research Design

The main objective in cross-sectional correlational design is not to make the causal inference, rather to establish the association between variables. However, this is not to ignore the conditions for causal inference. The extant literature points out three necessary conditions for causal inference, which may be used to discuss and address the limitations of cross-sectional correlational research design. These are (1) temporal ordering, (2) association or covariation, and (3) nonspuriousness or isolation (Ruane, 2005; Frankfort-Nachmias and Nachmias, 2008 Bryman and Bell, 2011).

- **Temporal ordering**

Temporal ordering is also known as temporal sequence (Bryman and Bell, 2011), time order (Frankfort-Nachmias and Nachmias, 2008) or temporal precedence (Kraemer, Kiernan, Essex and Kupfer, 2008; Kraemer, 2012 and for this condition to be met, the causal event must precede the effect in time (Ruane, 2005). The notion of independent and dependent variables presupposes temporal ordering (Bryman and Bell, 2011). Therefore, the research must demonstrate that the assumed cause occurs prior to the assumed effect (Frankfort-Nachmias and Nachmias, 2008). Fixed variables such as gender and age are always assumed to precede the effect (Ruane, 2005). However, as we depart from such fixed variables, cross-sectional design faces difficulties in establishing time order between variables. In experimental research design, the presence of a control group can clarify independent – dependent relationship (Bryman and Bell, 2011). The control group does not exist in cross-sectional design and in addition, data for independent and dependent variables are collected at the same time.

The literature recommends that in the situation where temporal order is not apparent, the researcher must make a case for the order they endorse (Ruane, 2005). In this study, we treated processor control as an independent variable and Screening Transaction Costs as a dependent variable. As highlighted in chapter two, processor control can be associated to vertical coordination. Several studies on TCT (e.g., Buvik and John, 2000; Buvik, 2002a; Buvik and Andersen, 2002) have treated vertical coordination as temporally preceding ex-post transaction costs. Based on the empirical evidence from the abovementioned studies, this study regards processor control as temporally preceding Screening Transaction Costs. This way of using logical reasoning and empirical evidence from other studies is recommended as a means of providing justification for temporal precedence (Kraemer, Stice, kazdin, Offord, Kupfer, 2001; Ruane, 2005), particularly in cross-sectional studies.

Even though buyer-supplier relationship studies use the statistical criterion of the significance of the interaction effect to demonstrate the presence of moderation, temporal precedence is also an important criterion (cf. Kraemer et al., 2001; Kraemer et al., 2008; Farmer, 2012; kraemer, 2012). It allows the researcher to identify which variable is a moderator and which is the independent (Farmer, 2012). Kraemer et al. (2008) termed temporal precedence as an eligibility criterion of moderation along with the association criterion. Additionally, these criteria are also termed as theoretical criteria for moderation (Farmer, 2012).

The variable is theoretically considered a moderator when it temporally precedes the independent variable (Kraemer et al., 2008; Kraemer and Gibbsons, 2009). Thus, as a prerequisite of moderation, the researcher should provide theoretical justification regarding the temporal precedence of the moderator (Farmer, 2012). In this study, four variables, including the degree of perishability, purchase volume, the use of technological instruments for quality screening and the duration of relationship between food processor and the farmer are considered as the moderators of the association between the processor control and Screening Transaction Costs.

From TCT perspective, the degree of perishability can be regarded as temporally preceding processor control due to its impact on quality uncertainty (performance ambiguity) and opportunism. As described in chapter two, perishability increases quality uncertainty and the potential for opportunism in economic transactions, thus motivating food processor to increase control. Several previous studies (e.g., Lo, 2010; Tita et al. 2011) have also described perishability as a factor that influences control in agri-food transactions. Similarly, as purchase volume increases, the amount of economic stakes in a transaction increase, thus motivating food processor to increase control of produce from the farmer. Based on this reasoning, several studies (e.g., Buvik and Andersen, 2011; Buvik and Andersen, 2015) have considered purchase volume to be an antecedent of buyer control. Accordingly, this study regards purchase volume as temporally preceding buyer control.

Moreover, several empirical research on buyer-supplier relationships (e.g., Buvik and Andersen, 2011; Buvik and Andersen, 2015; Buvik, Andersen and Halskau, 2015) have consistently found the duration of relationship to be an important antecedent of buyer control due to it positive influence on relational norms. In line with this stream of research, our study considers the duration of relationship as temporally preceding processor control. Lastly, the use of technological instrument for quality screening which is a dichotomy variable is regarded in this study as temporally preceding processor control. That is, processor control is expected to change depending on whether food processor use or does not use technological instruments for quality screening. Often (but not always) grouping variables are considered to temporally precede independent variable, and thus candidate for moderation (Farmer, 2012). The criterion of association between the moderators and the independent variable is discussed in the next subsection.

- **Association**

Two variables are said to be associated if they move together in a patterned way (Ruane, 2005) and the correlation measures are used to make inference for independent – dependent relationships (Frankfort-Nachmias and Nachmias, 2008). Whilst cross-sectional correlational design faces difficulties in establishing temporal ordering, it is very strong and well equipped to meet the condition of association (Ruane, 2005).

Even though the conditions of experimental design are lacking in cross-sectional correlational design, this study used statistical techniques to examine the covariation between variables. However, the use of statistical techniques to assess covariation requires the presence of adequate variance in the sample, but in research of a cross-sectional nature, it is difficult to manipulate independent variables in order to assess variations in the dependent variable. Thus, to achieve enough variance to examine association, we followed the recommendation of Bryman and Bell (2008) and used extreme measures (Likert scale) to solicit quantitative responses from a large number of respondents.

In the moderation perspective, the association (correlation) between variables is regarded to be an important criterion in qualifying the variable as the candidate for moderation. In addition to temporal precedence, the variable is considered a potential moderator when it is not correlated with the variable it moderates (independent variable) (Baron and Kenny, 1986). However, it is very unlikely for two variables to be completely uncorrelated. Therefore, the researcher needs to decide what degree of association is acceptable (Farmer, 2012).

Earlier studies (e.g., Kraemer, 2008; Kraemer et al., 2008) have recommended correlation coefficient threshold of 0.2. In this study, the correlation coefficients of the use of technological instruments for quality screening and purchase volume with processor control were below 0.2, whereas the correlation coefficients of the degree of perishability and the duration of relationship with processor control were between 0.2 and 0.3 (see Table 7.1 on page 126). Even though only two variables seem to meet the recommended threshold, some researchers (e.g., Arnold et al., 2010) have considered the correlation coefficients of less than 0.5 as acceptable for the variable to be considered a potential moderator. In this regard, all four variables are potential moderators for the effect of processor control on Screening Transaction Costs. The significance of these potential moderators is examined by using the moderated multiple regression technique in chapter seven.

- **Spuriousness**

Spuriousness or isolation is the most salient threat to internal validity in cross-sectional research design (Frankfort-Nachmias and Nachmias, 2008), and it has to do with the correlation between presumed cause (x) and omitted or un-modelled causes (Antonakis et al., 2010). Nonspurious relationships can be claimed if the study is able to rule out all plausible explanations of the relationship between independent and dependent variables (Kline, 2011). Otherwise, if the independent–dependent relationship is explained, in part, by other variables, then the relationship is spurious and the true coefficient of independent variable could be either higher, lower or even bear the opposite sign (Antonakis et al., 2010).

Ideally, cross-sectional correlation research design does not involve randomly assigned experimental and control groups. Consequently, it is difficult to exclude conclusively the rival explanations of the independent – dependent variable relationship. Still this problem can be limited by introducing relevant control variables' while maintaining the original relationships between variables (Frankfort-Nachmias and Nachmias, 2008). Accordingly, we did a thorough literature review and critically thought of other variables that might explain the independent–dependent variables relationships, which were of interest to us. Several variables, including size of the food processor measured by sales volume, purchase frequency and the level of investment in food processing activities were identified as rival explanations for our independent-dependent variable relationships. The survey questions capturing these variables were constructed and added along with other variables in the questionnaire for data collection and were subsequently included in the estimation of the moderated regression model as control variables. It is noteworthy that the elimination of the rival explanations in cross-sectional correlational design depends on how thoughtful and diligent the researcher is in including questions about rival explanations in a questionnaire (Ruane, 2005).

4.4 Questionnaire Development

4.4.1 Specification of the Questionnaire's Information

The focus at this stage was to translate the research variables into survey questions, the answers to which were used to test the hypotheses proposed in chapter three. To start with, a thorough literature review was conducted to get an in-depth understanding of the research variables and to determine whether there are any other studies that have investigated our research variables and the measurement used by those studies. This process enriched our understanding of the research variables. It also revealed a number of studies that have investigated our main research variables, including buyer control (e.g., Heide and John, 1992; Buvik and Halskau, 2001; Ryu and Eyuboglu, 2007; Buvik et al. 2014), Screening Transaction Costs (e.g., Loader and Hobbs, 1996; Ruben, Boselie and Lu, 2007), perishability (e.g., Amorim, Meyr, Almeder and lmada-lobo, 2013; Lievens and Moenaert, 2001; Cloninger and Oviatt, 2006), purchase volume (e.g., Buvik and John, 2000; Buvik and Andersen, 2002), frequency of transaction (e.g., Jones, 1987; Buvik, 2000; Hobbs and Young, 2000) and the duration of relationship (e.g. Buvik, 2002a; Li et al., 2010).

Based on the literature review, a preliminary questionnaire was developed. Some of the questions were new while others were adapted from other studies. The use of the survey questions that have been used and validated by other studies is highly recommended as a way of improving the quality of a questionnaire (Bryman and Bell, 2011). Moreover, measurement items for latent variables were structured as close-ended questions with a seven-point Likert scale. The rationale for opting for Likert scaled close-ended questions was to enhance comparability of answers, which in turn make it easier to show the relationship between variables and to make comparisons between respondents or types of responses. Furthermore, Likert scale close-ended questions are quicker to respond, and reduces the response burden on the respondents, thus the response rate is enhanced (Bryman and Bell, 2011).

However, before proceeding with the pretesting and piloting of the questionnaire, interviews and focus group discussion were conducted. For these purposes, an open-ended questionnaire cum interview guide covering relevant issues in the food processing industry, including produce and product flows, perishability concept, quality issues, specific investments, supplier development activities, as well as contractual and pricing issues was developed. This interview guide was used to conduct five face-to-face interviews and one telephone interview with agri-food processors in the Dar es Salaam region in August 2012. It is noteworthy that other new issues that emerged during the interviews were discussed further with the interviewees. The practice of starting with open questions before developing closed questions is recommended as a way of tapping the knowledge and understanding of the respondents (Bryman and Bell, 2011). The response freedom offered by open-ended questions means that the respondents might report information that the researcher would never have thought of including in a close-ended set of questions (Ruane, 2005).

Additionally, to enrich our understanding of various issues in the food processing industry, the interviews were followed by focus group discussion with 11 agri-food processors forming the Morogoro food cluster in the Morogoro region, Tanzania in August 2012. Based on the findings from the interviews and focus group discussion, the preliminary self-completed questionnaire with close-ended questions was improved and some adapted survey questions were adjusted to fit our research setting and the purpose of this research.

4.4.2 Pretesting of the Questionnaire

In survey research, measurement errors can occur if respondents misunderstand the survey questions or key concepts, do not know or cannot recall required information, hide some information or provide socially desirable answers (Campanelli, 1997). Therefore, pre-testing is advisable as the better way to find out what potential respondents think about the questionnaire (Ruane, 2005). This study used the "think loud" technique, which is arguably an effective pretesting technique (Ruane, 2005: 141; Campanelli, 1997:7) and this technique is implemented by asking what others think about each of the questions included in the questionnaire (Ruane, 2005).

Initially, four academicians, one of which had an education background in agribusiness were asked to comment on the questionnaire instructions, and each of the questions included in the questionnaire. From this stage, several comments were obtained regarding the structure of the questionnaire, clarity of instructions and questions, choice of words, length of the questions, as well as ambiguity and relevance of the questions and these comments were used to improve the questionnaire. Additionally, the improved version was discussed with one expert from Sokoine University of Agriculture in Tanzania who worked in both academia and the food processing industry, and the feedback obtained was used to improve further our questionnaire before the pilot study.

4.4.3 Pilot study and the Final Questionnaire

The main objective for conducting the pilot study is to assess the performance of the questionnaire in actual conditions of data collection (Churchill and Brown, 2004). A pilot study is critical for research based on a self-completed questionnaire since the interviewer may not be present to clear up any misunderstandings and confusion during the data collection stage (Bryman and Bell, 2011). It is worth mentioning that before undertaking the pilot study, the questionnaire was translated into Swahili, the national language of Tanzania. The literature suggests two different methods for questionnaire translation, including back translation and parallel or double translation (Douglas and Craig, 2007).

This study used parallel translation in which a questionnaire was translated by the researcher as well as by one expert in both English and Swahili. The two translated questionnaires were compared for differences and comparability, and the improved translated questionnaire was developed. Additionally, to improve the reliability of the translated questionnaire, both the Swahili and English questionnaires were given to an expert in the food processing industry who was fluent in both languages to check for the similarity of the meaning of questions across the two languages. Moreover, the expert was also asked to check whether the terms used were common to agri-food processors. The expert's feedback was used to improve further the translated questionnaire before the pilot study took place.

The research methodology literature recommends 10 responses as the minimum number for a pilot study. However, for large studies, the response between 100 and 200 is usual (Saunders et al., 2012). In our case, the questionnaire was administered to 72 food processors as part of the pilot study, out of which 33 were from the Morogoro region, 16 from the Tanga region and 23 from the Dar es Salaam region. In Dar es Salaam, agri-food processors were visited in their production facilities, whereas in the Tanga and Morogoro regions, they were invited to meet in one location. Since the pilot study provided the last chance to assess the questionnaire, a thorough data analysis was conducted including descriptive statistics, exploratory factor analysis, correlation analysis, validation of constructs and regression analysis.

Based on the pilot study analysis, some measurement items were dropped; new ones were introduced, and the wordings of some measurement items were revised, and the final questionnaire was developed (see appendix 1B). Nevertheless, before the main data collection, the final questionnaire was also subjected to parallel translation in which two experts in both Swahili and English, and one expert in food processing were employed for this purpose, and their comments were used to improve the final translated questionnaire (see appendix 1C).

4.5 Population, Sampling Frame and Sampling Procedure

A definition of the target population is the first necessary condition in developing the sampling frame (Churchill and Brown, 2004). The clarity of the population definition may enable the researcher to identify specific groups the sample needs to represent and hence enhance the researcher's ability to assemble or find a good sampling frame (Ruane, 2005). The target population for this study was micro, small and medium (MSME) agri-food processors operating in Tanzania, and because of poor record keeping and the informal nature of most food processors, there was neither a database nor records of agro-food processors operating in the country. Likewise, the sampling frames were also unavailable. However, this is not surprising as in practice sampling frames are rarely available. Consequently, researchers have to use substitute lists that contain the same information, as the sampling frame but that may not be comprehensive (Frankfort-Nachmias and Nachmias, 2008).

Accordingly, the study used the lists of firms that have benefited from business development services offered by the Small Industries Development Organization (SIDO). This is parastatal organisation, which was established in 1973 and has a presence in 21 regions. SIDO provides different services to small firms, including training in entrepreneurship, business management, manufacturing of different products and marketing. In addition, the organisation provides training to both food and non-food entrepreneurs. Since its establishment, SIDO has enabled the creation of 100,351 enterprises, and for a year 2011 to 2014, it conducted 2,082 training sessions out of which 1,311 focused on food processing and technical skills with 9,653 entrepreneurs benefiting from these training sessions (SIDO, 2014).

Despite its successes, SIDO is characterised by poor record keeping and organisation of data. This is indicated by outdated information on its website (only 221 food processors are listed) and poor organisation of the list of food processing firms. For instance, non-food enterprises such as blacksmiths, soap and leather product manufacturers were listed under the category of food processors, and some contacts and the types of food products produced by some food processors were not listed. Therefore, we decided to visit the SIDO offices, and with help of business development officers from SIDO, the lists of food processors were developed and used as sampling frames for our study.

In spite of the efforts put into creating sampling frames, they were still incomplete, and this is because SIDO's regional offices did not keep a full list of all beneficiaries. Furthermore, not all food processors operating in Tanzania are beneficiaries of SIDO services. In this kind of situation, it is advisable to use supplementary lists (Frankfort-Nachmias and Nachmias, 2008: 166). Thus, to make our sampling frames more inclusive and comprehensive, sampling frames created from SIDO beneficiaries were supplemented with beneficiaries of the FEED THE FUTURE initiatives of the USAID through the Tuboreshe chakula (Let's Improve Food) project. In total, 271 agri-food processors from SIDO and 333 agri-food processors from the "Let's Improve Food" project were included in the sampling frame.

The purposive sampling procedure was used to choose elements for inclusion in our sample. Following this procedure, elements are chosen because they can offer the information needed by the researcher (Churchill and Brown, 2004). Thus, the researcher must set the criteria for inclusion and exclusion of elements in the sample (Bryman and Bell, 2011). Consequently, 224 agri-food processors from the "Let's improve Food" project that were only in the business of renting processing facilities (toll food processors) were excluded from the sample. Moreover, the sample included only agri-food processors who had been in operation for at least one year.

4.6 Sample size

Sample size is one of the important decisions to be made when designing a sample for a study, and the literature recommends that the decision on minimum sample size be made prior to data collection in order to achieve the desired statistical power of significance testing, and to avoid collecting too little or too much data than required (McQuitty, 2004). However, making this decision is not straightforward as it depends on several factors, including heterogeneity of the population, complexity of the research model or number of variables included in the model (Robson, 2002; Bryman and Bell, 2011) as well as the statistical technique and procedure used (Robson, 2002; Kline, 2011). Other factors are the non-response (Bryman and Bell, 2011) and time and cost implications (Bryman and Bell, 2011; Ruane, 2005).

This study used a moderated multiple regression procedure to test the hypotheses that involved eight independent variables and one dependent variable. Thus, based on our statistical technique and the number of independent variables, there are different ways of deciding the minimum sample size. Hair, Black, Babin and Anderson (2010) suggested 15 to 20 observations for each independent variable in multiple regression analysis. In a different way, Tabachnick and Fidell (2007) provided the rule of thumb in terms of formulas as $N \geq 50 + 8m$ for multiple predictors and $N \geq 104 + m$ for testing individual predictors, where "N" is a sample size, and "m" is the number of independent variables. From Hair et al's (2010) perspective, the adequate minimum sample size for this study is 120 observations (8*15), whereas following Tabachnick and Fidell's (2007) recommendation, the minimum sample size is 114 observations (50 + 8 * 8). Given the risk of non-response, we adapted a pessimistic view and treated 120 observations as our target for minimum sample size.

4.7 Strategy of Choosing Respondents

The key informant strategy was used by this study to collect primary data from the agri-food processors. Even though this strategy is traditionally used to collect qualitative data in ethnographic studies, Campbell (1955) noted that it could successfully be used to collect quantitative data and produce valid findings. Accordingly, studies on buyer-supplier relationships have widely and successfully used this strategy to solicit quantitative data on various dyadic issues (e.g., Buvik and Reve, 2002; Heide and John, 1990; Buvik and John, 2000; Heide and Stump, 1995). Despite its popularity, some researchers still cast doubts on key informant strategy. For instance, Seidler (1974) raised concerns on the effectiveness of key informant strategy on data collection in large organizations. In the same way, Phillips (1981) criticized key informant strategy in that it is hard to find a respondent who is reliable in all issues. Furthermore, Phillips (1981) pointed out that using key informants from one side of the dyad does not afford the valid tests for dyadic relationships. Despite the criticisms, researchers (e.g., John and Reve, 1982) have emphasized that when appropriate selection procedures are followed carefully in conjunction with the internally consistent multi-item scales, the key informant strategy can provide valid and reliable information in a variety of buyer-supplier relationship settings.

The earlier studies have suggested several criteria to consider during the selection of reliable informants. These include (1) the key informants should occupy the roles that make them knowledgeable about the issues being investigated, (2) willingness and ability of the key informant to communicate with the researcher (Campbell, 1955), (3) the size of the organization (Phillips, 1981; John and Reve,1982), (4) the extent to which the key informant participated in the decision making on the issues being investigated, and (5) the length of time the informant has been in the organization (Phillips, 1981).

Concerning the above-mentioned criteria, managers and employees who were involved in day-to-day activities of the firm were chosen as the key informants. Given the small size of food processing firms, managers were assumed to be acquainted with all aspects of their companies. In the same way, employees who were involved in day-to-day activities and in making decisions were expected to be conversant with all aspects of the business. In this regard, we believe the information obtained from both managers and employees was valid and reliable.

4.8 Questionnaire Administration and Response rate

This study used personal delivery mode to administer questionnaires to managers and employees involved in day-to-day operations in the agri-food processing firms. Despite our decision to use personal delivery mode, several other modes can be used to administer self-completion questionnaires. These include email, web survey and fax and postal administration (Synodinos, 2003; Bryman and Bell, 2011), and among these modes, email and postal questionnaire are the most prominent (Bryman and Bell, 2011). Nevertheless, there is no questionnaire administration mode that is superior to the others in all circumstances, and the mode that is appropriate in one country may be inappropriate in another (Synodinos, 2003). Thus, our choice of personal delivery mode was based on the types of questions, nature of the target group and its geographical dispersion and availability of resources as suggested by Synodinos (2003). Furthermore, the status of communication infrastructures in our research setting was also considered.

Tanzania, like many developing countries, is characterised by poor quality, expensive and/or low penetration rates of communication services. The Internet penetration rate stood at around 15 percent in 2014 (Internet World Stat, 2014), and the average speed of downloading and uploading files is poor (Net Index Explorer, 2014). As such, using the email mode was ruled out due to concerns regarding low response rates and limited access to food processors. Likewise, the postal administration mode was dropped because of the same concerns as for the email mode, as most people in Tanzania do not have postal addresses. Despite the state of advancement of communication in any country, most of the studies that have used email and postal questionnaire administration modes have reported low response rates.

In spite of the costs and time challenges associated with the personal delivery mode, it was the only feasible mode in our research setting. Using this mode, data were collected between February and May 2014. The exercise of data collection started with telephoning food processors to secure appointments. This was followed by delivering questionnaires to key informants in a location of their convenience. Some completed questionnaires were collected at the same time, and others were collected later at the respondent's convenience. Because of the limited time for data collection, travelling costs and geographical dispersion, five research assistants were recruited four of whom were business development officers from SIDO and one was a small and medium enterprise advisor from the "Let's Improve Food" project.

It is worth mentioning that the decision to use research assistants might affect data quality. Thus, to curb any potential negative consequences of this decision, research assistants were carefully chosen based on the criteria of education level, area of specialization, work experience, and recommendations from other researchers in the same field. They were then trained in different aspects of the questionnaire before data collection started. Since the chosen research assistants were working directly with food processors and knew their locations, the response rate increased significantly.

Out of 358 distributed questionnaires, 284 were returned, which represents a response rate of 79 percent. Before proceeding with data analysis, the returned questionnaires were examined to check that they were fit for analysis. In this process, we noted that some of the respondents did not mention the produce on which they based their responses, and others responded with reference to produce that was outside the focus of the study. Additionally, some questionnaires were incomplete while others indicated respondents' disengagement. From this examination, 45 of the returned questionnaires were dropped, which represents around 16 percent of the returned questionnaires, and the responses from the remaining 239 questionnaires were considered acceptable for analysis.

Out of 239 acceptable questionnaires, 137 questionnaires were filled by the food processors who were mainly sourcing their produce from the farmers, and 102 questionnaires were filled by the food processors who were mainly sourcing their produce through intermediaries. Since this study is positioned on the link between food processors and farmers, 137 questionnaires were used as the source of empirical evidence for the proposed hypotheses in chapter three. The key question at this point is whether the number observations on the link between food processors and farmers are sufficient for testing the posited hypotheses. There are different criteria that can be used to address this question, including the number of independent variable included in the model, and the number of measurement items used to capture the constructs of interest. In estimation of multiple regression model, the sample size of 137 observations is sufficient as discussed in subsection 4.6, on page 72.

Before the estimation of the regression model, the measurement model needs to be estimated and validated using confirmatory factor analysis (CFA). Literature in structural equation modeling (SEM) suggests various criteria that can be used to decide the adequacy of sample size. Some literature (e.g., Kline, 2011) have proposed an absolute sample size of 200 observations, and it may go to as low as 150 observations (Wang and Wang, 2012); other literature has proposed the measurement items' criterion and recommended the minimum size of five observations per measurement item (Wang and Wang, 2012). Our study has four latent variables: processor control, perishability, Screening Transaction Costs and processing investment, and 38 measurement items in total were used to capture these latent variables as indicated in the questionnaire (see appendix 1B). This means that in order to use CFA, at least 190 observations (38*5) are required.

However, large number of measurement items per construct may compensate for small sample size. For the model with 6 to 12 measurement items per construct, the sample size of at least 50 observations is considered to be adequate, whereas for the model with 3 to 4 measurement items per construct, the sample size should be at least 100 observations. Moreover, for the model with only two indicators per construct, the sample size should be at least 400 (Wang and Wang, 2012). Since all of our constructs have at least six measurement items per construct, the sample size of 137 is enough to perform a CFA.

4.9 Concern for Common Method Biases

As explained in the above sections, the questionnaire used by this study was designed for self-completion using a seven-point Likert scale and the data for all variables in the questionnaire were solicited from the same responded. This method of collecting data raised concern regarding common variance (CMV), which is the amount of covariance shared among variables because of the common method used in data collection (Malhotra, Kim and Patel, 2006), and it poses a major potential validity problem in social science research (Sharma, Yetton and Crawford, 2009). For instance, Cote and Buckley (1987) reviewed 70 studies from different fields and found that 26.3% of variance in the measurement items were due to method variance and only 41.7% was due to trait variance.

The literature has described the sources of CMV into four groups, including (1) common rater effects, (2) item characteristics effects, (3) item context effects, and (4) measurement context effects. It is possible for several of these sources of CMV to be operative in one study (Podsakoff, Mackenzie and Podsakoff, 2003). Additionally, the problem of CMV is likely to be severe in a situation in which data for predictors and criterion variables are obtained from the same person, in the same measurement context, using the same item characteristics (Podsakoff et al., 2003).

Most of the causes of CMV can be minimised or eliminated at the design stage of the study. Thus, following the recommendations from various studies (e.g., Podsakoff et al., 2003; Chang, Van Witteloostuijn and Eden 2010), a number of procedural techniques were used at the questionnaire design stage to limit this problem in our study. First, enough time and care were put into the development of measurement items to avoid problems such as ambiguous questions, double barrel question and the use of terms that were not understood by the respondents. Second, the interviews and focus group discussions were conducted prior to questionnaire development with the aim of getting more information about the industry and avoiding the use of terms that were not known to the respondents. Third, the questionnaire was discussed with the practitioners in the food processing industry and academicians. Fourth, independent variables and dependent variables were spaced by the set measurement items of other constructs, and this was done to reduce the possibility of the respondents using prior responses to answer the subsequent set of questions. Fifth, the key informants were used as a source of data and their anonymity was emphasised.

4.10 Chapter Summary

This chapter has discussed in detail the methodology followed by this study. The cross-sectional correctional design, which is the chosen design for this study was presented, and its weaknesses were discussed. Since this study used a survey research strategy with a structured questionnaire, this chapter has presented a discussion of the questionnaire development process, population, sampling frame and sampling procedure. It has also discussed the criteria used to decide on minimum sample size, strategy for choosing respondents, questionnaire administration procedure and response rate. Moreover, the chapter has presented the procedural techniques that were used to address the concern for common method bias. The next chapter focuses on the operationalisation of the variables used in this study.

CHAPTER 5

MEASUREMENT OF VARIABLES

CHAPTER 5

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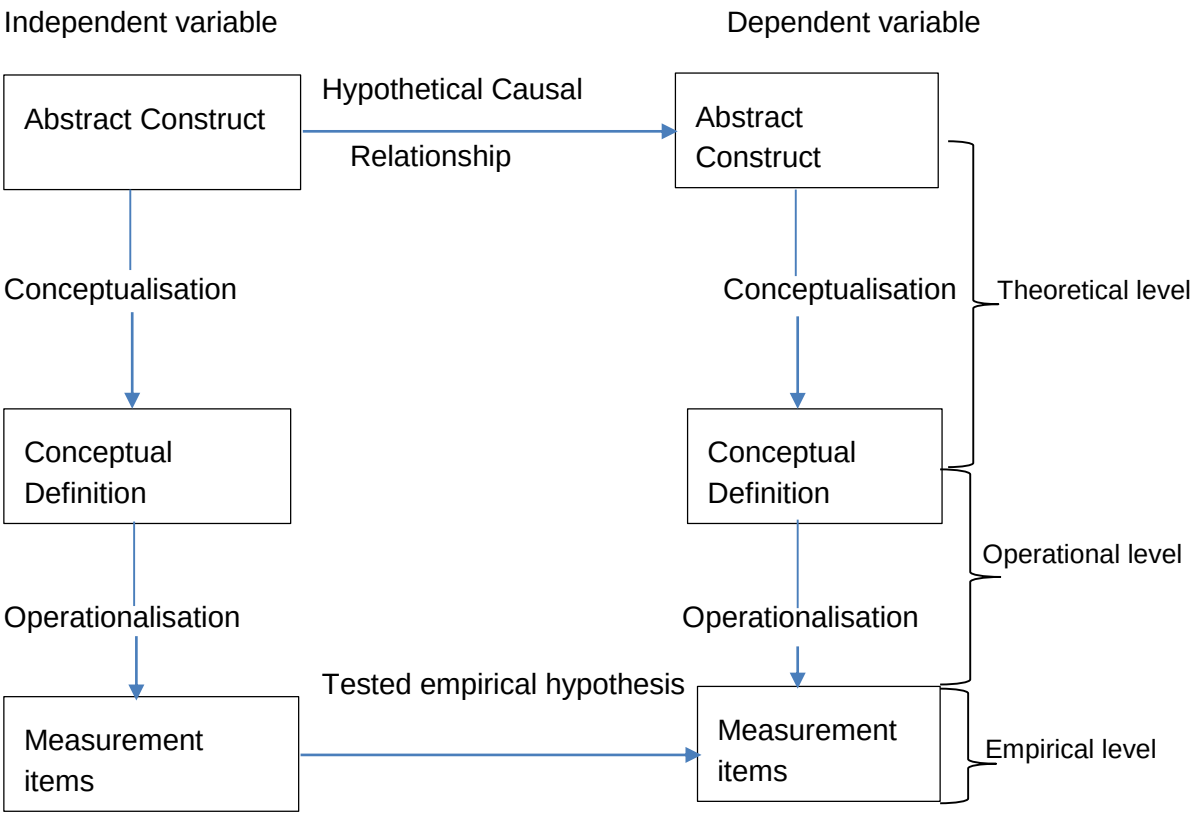
5.1 Introduction

The variables used in our hypotheses in chapter three are latent, and therefore, they cannot be used for data collection purposes. Thus, to seek empirical evidence for our proposed hypotheses, the constructs in our conceptual model were translated into measurable terms so that data could be collected. This chapter presents the measurement development process, which includes conceptualisation, operationalisation and a discussion on the relationships between constructs and measurement items. Finally, the chapter presents the measurement of research constructs and variables.

5.2 The process of developing Measurement Items

Measurement of latent variables (constructs) is a challenging undertaking for researchers, and the ability to identify correctly the significant associations between variables depends on the adequacy of the measurement. Large amount of random or specific errors in measurement can lead to the wrong conclusion (O'Leary-Kelly and Vokurka, 1998). Therefore, the fundamental objective of researchers in the measurement of constructs is to produce observed scores that are as close as possible to the true scores for a stronger theory (Churchill, 1979).

There are two important aspects to consider in the process of developing measurement items: (1) conceptual specification of constructs and (2) operational definition of constructs (Neuman, 2002; Bisbe, Bastia-Foguet and Chenhall, 2007). The ability of measurement items to capture the concept of interest depends on the clarity of the conceptual definition. The model proposed by Neuman (2002) in figure 5.1 below provides the depiction of the process of moving from constructs to measurable terms and testing the hypotheses. Further description of this process is provided in the subsequent sections.



Source: Neuman (2002)

Figure 5.1: Measurement development process

5.2.1 Conceptualisation

Conceptualisation is the process of thinking through the meaning of the construct and states exactly the theoretical properties through which the construct is manifested or by which it is constituted (Bisbe et al., 2007). In stating the exact conceptual definition, it is advisable to specify its boundaries by stating exactly what is included and what is excluded (Segars, 1997; Neuman 2002). This task is complex due to differences in terminology used by different researchers, disciplinary orientations and underlying assumptions (Venkatraman, 1989). Nevertheless, the researcher can manage to state the conceptual definition through a literature review to identify what others have said about the concept, consult with other knowledgeable people in the research area, interviews, observing the subject of interest and focus group discussions (Neuman 2002).

One construct can have several definitions, and different studies may disagree over definitions, and the way conceptual definitions are linked to conceptual frameworks. However, it is recommended to state explicitly which definition is used by the study (Neuman, 2002). Moreover, the conceptual definition should be clear and unambiguous. Failure to define a construct adequately can lead to a number of problems, including: (1) contamination of the measurement items by unrelated factors, (2) difficulties in specifying correctly how the construct relates to its measurement items, and (3) weak theoretical rationale for why constructs are related. These problems are likely to lead to low validity of constructs, low internal validity and eventually severely flawed conclusions regarding the existence, magnitude and directions of relationships between constructs (Mackenzie, 2003; Bisbe et al., 2007). Therefore, clarity of conceptual definition is important. After the conceptual definition is laid down, the researcher can proceed to the operationalisation stage.

5.2.2 Operationalisation

This is a stage in which the conceptual definitions of constructs are translated into operational variables (indicators) that measure the variability associated with constructs (Bisbe et al., 2007), and many researchers refer to operational variables as operational definitions (Neuman, 2002; Churchill and Brown, 2004). Usually, most of the constructs can be operationalised in multiple ways, whereas some are better and more practical compared to their alternatives. Nonetheless, the important issue is to choose the operational definitions that fit the conceptual definitions. If the operational definitions are well linked to the conceptual definitions, they can adequately capture the empirical world and relate it to the conceptual world (Neuman, 2002), otherwise, the content validity of the measures would be endangered (Bisbe et al., 2007). Furthermore, in operationalisation of conceptual definitions, the researcher can choose to develop new measures or adapt the measures that have been used and validated by other researchers (Neuman, 2002). As in the conceptualisation process, a researcher may take advantage of interviews and focus group discussions in the development of measurement items (Churchill, 1979).

The literature (e.g., Singh, 2006) suggests three approaches that can be used to operationalise a construct, including: (1) operationalisation in terms of operations that must be performed to cause a construct, (2) operationalisation in terms of how a particular construct operates. That is, what it does or what constitutes its dynamic properties and is most useful for behavioural constructs, and (3) operationalisation in terms of what a construct being defined looks like. That is what constitutes its static properties. This operationalisation uses observable structural properties of the construct. It describes qualities, traits or characteristics of the construct. The next subsection discusses the relationships between operational items (indicators) and their respective constructs.

5.2.3 The relationships between contracts and measurement items

In studies that are geared to testing substantive theory, the specification of the relationships between constructs and measurement items (indicators) is equally important as the development of measurement items. Such relationships can be specified as either a reflective or a formative scale, and are known in the literature as epistemic relationships or rules of correspondence (Hulland, 1999). In the case of the reflective scale, the measurement items are believed to reflect the unobserved construct. That is, the observed variations in the measurement items are caused by the underlying construct. In contrast, in the formative scale, the measurement items are believed to cause the construct. That is, the construct is completely determined by a linear combination of its measurement items (Hulland, 1999; Bisbe et al., 2007).

Most of the studies in social sciences assume a reflective scale. The decision on whether to treat measurement items as reflective or formative is not a simple one to make; even experienced researchers often make the wrong decision (Jarvis, Mackenzie and Podsakoff, 2003). Nearly 29 percent of the epistemic relationships in the top four marketing journals, including the Journal of Consumer Research (JCR), Journal of Marketing (JM), Journal of Marketing Research (JMR), and Marketing Science (MS) for the period from 1977 to 2000 were found to be incorrectly modelled (Jarvis et al., 2003). Such miss-specification can lead to inaccurate conclusions about the structural relationships between constructs (Law and Wong, 1999). The literature proposes four criteria that can help researchers to determine the appropriate relationship between measurement items and their constructs: (1) direction of causality, (2) interchangeability of measurement items, (3) covariation among indicators, and (4) nomological net of the construct's measurement items (Jarvis et al., 2003). Table 6.1 below describe these criteria in detail.

Table 5.1: Decision Rules for Determining Whether a Construct is Formative or Reflective

		Formative Model	Reflective Model
i)	Are the indicators defining (a) characteristics or (b) Manifestations of the construct?	Indicators are defining characteristics of the construct	Indicators are manifestations of the construct
ii)	Would changes in the indicators/ items cause changes in the construct?	Yes	No
iii)	Would change in the construct cause changes in the indicators?	No	Yes
iv)	Should the indicators have the same or similar content/ share common theme?	Not necessary	Yes
vi)	Would dropping one of the indicators alter the conceptual domain of the construct?	Yes	No
vii)	Should change in one of the indicators be associated with changes in the other indicators?	Not necessary	Yes
viii)	Are the indicators expected to have the same antecedents and consequences?	Not required	Required

Source: Modified from Jarvis et al. (2003)

The set of criteria in table 5.1 above are recommended to be used in combination (Jarvis et al., 2003). Despite the significant contribution made by Jarvis et al. (2003), researchers need to be aware that these criteria are not straight forward, as some seem to overlap. For instance, as it is in the reflective measurement items, correlation among measurement items is also possible in the formative scale (Wilcox, Howell and Breivik, 2008). The literature highlighted further complication in that the same set of measurement items can be modelled as formative with respect to one construct and reflective with respect to another depending on the wording of constructs, measurement items and presentation of general instructions (Bollen and Ting, 2000; Wilcox et al., 2008). Additionally, the wording of measurement items may also affect the modelling of a construct (Baxter, 2009). Nevertheless, the use of combination of criteria proposed by Jarvis et al. (2002) and Coltman, Devinney, Midgley and Venaik (2008), and the insights from other studies (e.g., Wilcox et al., 2008) seem to be a promising way forward for

appropriate modelling of formative and reflective scale. Jarvis el al. (2003) Study used this approach and managed to classify reliably 98 percent of constructs in the top four marketing journals. Thus in this study, we used a combination of criteria in reaching the decision to model our latent constructs as reflective.

5.3 Measurement of Research Variables

5.3.1 Screening Transaction Costs

Screening Transaction Costs was the focal dependent variable in this study. Several studies, particularly in the agricultural sector, have described screening costs as one type of transaction cost (Loader and Hobbs, 1996; Ruben et al., 2007). However, the conceptual definition of Screening Transaction Costs varies across different research. Loader and Hobbs (1996) defined screening costs as costs caused by uncertainty about the reliability of a potential buyer/supplier, or uncertainty about the actual quality of the goods or services delivered, and Ruben et al. (2007) described Screening Transaction Costs as costs of inspecting produce either at delivery or at the farm. Furthermore, Beil (2010) described Screening Transaction Costs involved in verifying suppliers' competence prior to award of contracts, and this includes the costs of following up potential supplier's references, financial status, the indicators of supplier quality competence and ability to meet specifications. Similarly, Tadesse and Shively (2013) referred to screening costs as the costs incurred in an attempt to identify a trustworthy partner when one member buyer/seller wants to engage in a repeated transaction.

From the definitions of Screening Transaction Costs above, it is evident that Screening Transaction Costs can be described in terms of verifying the competence and trustworthiness of a partner or in terms of evaluating the quality of the goods or service offered. This study follows a product perspective in the conceptualisation of Screening Transaction Costs and describes transaction costs as the costs incurred by the food processor in an attempt to secure produce of good quality for processing purposes. The causes of these costs are uncertainty concerning the quality of the product (Loader and Hobbs, 1996), perishability and quality variability of produce (Jaffee, 1992). Examples of costs that fall into this type of transaction cost include sorting costs (Loader and Hobbs, 1996), inspection at delivery, and inspection at the farm (Ruben et al, 2007).

In line with our conceptual definition of Screening Transaction Costs, eight measurement items were developed as listed below. Because of the lack of operationalisation of Screening Transaction Costs in existing studies, our measurement items were developed from the definition of screening costs, causes of Screening Transaction Costs and example of Screening Transaction Costs identified in the literature. Moreover, focus group discussions and interviews conducted at the preliminary stages of this study provided more input into the operationalisation of Screening Transaction Costs.

SCOST1: We spend a lot of time in inspecting the texture of this produce from this seller / farmer

SCOST2: We spend a lot of time in inspecting the colour of this produce from this seller / farmer

SCOST3: We spend a lot of time in inspecting shape and size of this produce from this seller / farmer

SCOST4: We spend a lot of time in evaluating the aroma of this produce from this seller / farmer

SCOST5: We spend a lot of time in sorting damaged produce when we buy from this seller / farmer

SCOST5: We spend a lot of time in sorting produce of the required degree of maturity for processing when we buy from this seller / farmer

SCOST6: We spend a lot of time in sorting suitable varieties of produce for processing when we buy from this seller / farmer

SCOST7: We spend a lot of time in sorting spoiled produce when we buy from this seller / farmer

SCOST8: We spend a lot of time in evaluating the tenderness of this produce from this seller / farmer

From the measurement items above, the Screening Transaction Costs are expected to be manifested in the time spent in inspecting, evaluating and sorting produce. Accordingly, all measurement items shared common theme “time spent” and they are expected to be highly correlated. Moreover, dropping of some indicators is not expected to change conceptual definition of Screening Transaction Costs. Thus, the Screening Transaction Costs construct was modelled in this study as reflective construct using seven-point Likert scale from “strongly disagree” to “strongly agree.”

5.3.2 Processor Control

Processor control (buyer control) was the main independent variable in this study. The conceptualisation and operationalisation of vertical control have several precedents in the existing literature (e.g., Heide and John, 1992; Buvik and Halskau, 2001; Madsen et al, 2012; Buvik et al, 2014). Nevertheless, most of the existing conceptualisation and operationalisation are founded on the study of Heide and John (1992). Heide and John (1992) defined buyer control as a buyer’s authority and control over supplier decision making. In the same way, Buvik and Halskau (2001) defined buyer control as a buyer’s influence on supplier decisions concerning quality assurance, product control, selection of sub-suppliers, tools and production equipment. Furthermore, Madsen et al. (2012) viewed control in terms of buyer responsibilities in the transaction and conceptualised it as the extent to which a buyer is responsible for the activities and decisions of the suppliers.

Consistent with the definitions of buyer control in existing studies, this study conceptualises processor control as the extent of a processor’s control and authority over farmer decisions and activities. As described in chapter three, Trienekens and Zuurbier (2008) delineated several factors that may have an effect on the quality of produce from the planting stage to the processing stage. However, our conceptual definition is limited to the control of factors that affect quality at the harvest and transportation stage and this includes harvest methods, hygiene picking conditions, choice of appropriate produce and protection of harvested produce. Other activities are packing, loading and offloading activities. Furthermore, following Mueller and Collins’s (1957) definition of processor control, the conceptual definition of processor control in this study also includes processor’s decisions on when to harvest, the quality or maturity of the produce to harvest and the rate of delivery. From our conceptual definition, the measurement items delineated below were developed.

PROCON1: Our firm always decides how this produce should be harvested when we buy from this seller / farmer

PROCON2: Our firm completely decides the harvest time of this produce when we buy from this seller / farmer

PROCON3: Our firm has complete control of the storage conditions of this produce after harvest when we buy from this seller / farmer

PROCON4: Our firm has complete control on the loading and offloading activities of this produce from the farm when we buy from this seller / farmer

PROCON5: Our firm always decides the type of transport used to transport this produce from the farm when we buy from this seller / farmer

PROCON6: Our firm always decides which transporter to use to transport this produce from the farm when we buy from this seller / farmer

PROCON7: Our firm always decides when this produce should be transported from the farm when we buy from this seller / farmer

PROCON8: Our firm always decides how this produce should be packed during transportation from the farm when we buy from this seller / farmer

PROCON9: Our firm has complete control of the time spent during transportation of this produce from the farm when we buy from this seller / farmer

From the measurement items above, it is evident that the construct of processor control was operationalised such that the measurement items share a common theme. That is, the extent to which processing firm makes decision concerning different aspects of the transaction that affect the quality of produce. In the empirical context, these measurement items are expected to be highly correlated. Accordingly, the processor control was modelled as reflective scale using seven-point Likert scale from “strongly disagree” to “strongly agree.”

5.3.3 Perishability

This variable is a significant characteristic of agricultural produce such as fruit and vegetables and is of less significance in grains, and it has attracted research interests from different fields for more than half a century. Hitherto, there is no universally accepted definition of this concept. The differences in definitions of this concept may be traced to differences in research objectives and research settings. Most previous studies on the perishability concept focused on its role in inventory management, and they have defined perishability as the number of units of product that outdate or perish over time (Ghare and Schrader, 1963).

As the perishability concept evolved and interest in this issue continued to grow, its definition has expanded to consider loss in value of a produce stored or delivered late (Weiss, 1982; Hurter and Van Buer, 1996; Varadarajan and Yadev, 2002; Cloninger and Oviatt, 2006). Other recent studies (e.g., Byun and Sternquist, 2012) have conceptualised perishability in terms of life span and product desirability, and defined perishable products as those with a fixed useful life or whose desirability fade out over time such as fashionable products. Wang and Li (2012) conceptualised perishability from the quality perspective and define perishable goods as those whose quality can be considered to be of a dynamic state that decreases continuously until the product is no longer fit for processing.

The definitions of the concept of perishability are not limited to the conceptualisations delineated above, the more expansive definitions are provided by Wee (1993) and Amorim et al. (2013). Wee (1993) defined perishability as decay, damage, spoilage, evaporation, obsolescence, pilferage, loss of utility, or loss of marginal value of a commodity that results in decreasing usefulness of the original commodity. On the other hand, Amorim et al. (2013) defined perishable products as those which meet at least one of the following conditions: (1) its physical status worsen noticeably by either spoilage, decay or depletion among others, and/ or (2) its value decreases in the perception of customers and/or (3) its useful life is limited by authority due to the danger of future reduced functionality.

Accordingly, the conceptualisation of the concept of perishability in various studies shows clearly that perishability is a complex concept, and that it is caused by different factors and evident in different forms. Perishability may be concerned with the physical characteristics of the product such as being easily damaged, spoiled or declining in quality. It may also be due to product sensitivity to time in that quality or value of the product declines with time. Moreover, perishability can be induced by the perception of customers such as in fashionable and electronic products. Additionally, perishability may also be due to the limitations imposed by the authority on the product such as “best before date” in processed food and medicine.

In this study, a synthesis of these definitions is used; perishability is conceptualised as the decline in quality of the produce over time due to delays and temperature conditions. Furthermore, our conceptualisation includes the extent to which a produce can be damaged due to various conditions, including rough loading and offloading, poor packaging during transportation, vibrations during transportations and abrasion between produce units. This conceptualisation of perishability is limited to the physical characteristics of the produce.

Accordingly, our conceptual definition of perishability was operationalised using eleven measurement items as listed below. Some of the measurement items were adapted with adjustments from existing studies; others were developed from the literature review, focus group discussion and interviews with a few selected food processors. Moreover, the measurement items were designed such that they share a common theme. That is the vulnerability of the quality of the produce to delays and damage. Likewise, empirically, the measurement items of the degree of perishability are expected to be highly associated with each other. Thus, they were modelled in this study as reflective scale using a seven points Likert scale from “strongly disagree” to “strongly agree.”

PER1: It is very difficult to store this produce for later processing (adapted with adjustment from Lievens and Moenaert, 2001; Cloninger and Oviatt, 2006)

PER2: The quality of this produce is significantly affected by spending a long time between the farm and the processing facility

PER3: This produce is easily damaged by overloading vehicles during transportation from the farm to the processing facility

PER4: This produce is easily damaged by the use of improper packaging material during transportation from the farm to the processing facilities

PER5: This produce is easily damaged by rough loading and offloading practices

PER6: The quality of this produce is significantly affected by transportation delays from the farm to the processing facility (adapted with adjustment from Cloninger and Oviatt, 2006).

PER7: The taste of this produce is significantly affected by processing delays (adapted with adjustment from Cloninger and Oviatt, 2006)

PER8: This produce becomes stale quickly (adjusted from Wansink, 1994)

PER9: The quality of this produce is significantly affected by variations in temperature

PER10: Vibrations easily damage this produce during transportation

PER11: This produce is easily damaged by abrasion between produce units during transportation

5.3.4 Purchase volume

As discussed in chapter three, the purchase volume reflects the economic stake involved in a transaction, and therefore, influences the transaction costs and the governance structure in buyer-supplier relationships. Purchase volume was introduced in this study as a moderating variable. Previous studies have operationalised purchase volume in different ways. Some studies (e.g., Heide, 2003) have operationalised it in terms of the value of purchase from the particular supplier in the previous year. Cai et al. (2010) on the other hand, have operationalised purchase volume as the percentage of products purchased from a particular supplier in dollar value. Furthermore, other studies (e.g., Buvik and John, 2000; Andersen and Buvik, 2001; Buvik et al., 2014) have operationalised purchase volume as the buyer's average annual dollar purchase from a focal supplier. Consistent with some existing studies (e.g., Buvik and John, 2000; Buvik et al., 2014) we have operationalised purchase volume in terms of average annual purchase in dollar value from a focal supplier. The purchase volume was later transformed using the natural logarithm before the estimation of the moderated regression model. We performed this transformation because we assumed the effect of purchase volume is not linear, and it diminishes at higher values.

5.3.5 Duration of relationship

The length of time that the buyer and supplier have worked together is a key determinant for relational governance (Poppo and Zenger, 2002). It affects the behaviour and attitudes of members in an exchange relationship (Liu, Liu and Li, 2014). Supplier certainty of supplying to a buyer for an extended period promotes commitment to the quality level expected by the buyer. This perceived supplier certainty reduces the chances of moral hazard that can arise when suppliers skimp on quality assurance and improvement efforts (Zu and Kaynak, 2012). Thus, the duration of the relationship was introduced in this study as a contingent variable as explained in chapter three.

Consistent with previous studies (e.g., Ryu et al., 2007; Li et al., 2010; Liu et al., 2014), the relationship duration was operationalised as the number of years that the food processor had been buying produce from the major supplier. It is important to note that the experience of the buyer and supplier in the transaction accumulates at a decreasing rate. That is, the duration of the relationship has diminishing effect at higher values. Thus, a nonlinear transformation of the duration of the relationship is necessary (Heide and Miner, 1992; Zu and Kaynak, 2012; Buvik et al., 2014). Therefore, the duration of the relationship was transformed using the natural logarithm.

5.3.6 The use of Technological instruments

Technology was considered as a moderating variable in this study, and it was operationalised as a dichotomy variable with zero representing food processors who use technological instruments to screen the quality of produce before they purchase, whereas one represents food processors who do not use technological instruments.

5.3.7 Control variables:

To make our model more complete and robust, three variables were introduced as control variables, including the level of investment made by the food processor in processing activities, frequency of purchase from the main source of produce and the size of the food processor. The operationalisation of these variables are presented in the subsections below.

Processing investment. As in many other industries, the agricultural industry has both specific assets and general assets. As described in chapter 2, location, dedication and temporal specificity are viewed as the most relevant specific assets in agriculture; physical and human assets play a less important role than they do in other industries (Masten, 2000). Most of the equipment, facilities used for cultivation, processing, transportation may be highly specialised, but they are rarely specific to a particular transaction (Masten, 2000; Mishra, Harris, Erickson, Hallahan & Detre, 2012), and this is also the case for human skills applied in cultivation, processing and transporting agricultural produce (Masten, 2000). In this regard, this study focuses on general assets and introduces investment in processing activities made by the food processor as a control variable. That is, the food processing firm with a large investment in processing activities has more incentives to increase control because in the case of business failure they have more to lose.

Based on the literature review, focus group discussion and interview with food processors, processing investment was conceptualised to include investment in time and resources in the construction of production and storage facilities, processing equipment and knowledge, designing and making packaging materials, as well as certification standards. This construct was modelled as reflective scale using a seven-point Likert scale from “strongly disagree” to “strongly agree,” and operationalised using the measurement items listed below.

PINVEST1: Our firm has invested a lot of time and resources in the construction of a processing facility for this produce

PINVEST2: Our firm has invested a lot of time and resources in the construction of a storage facility for this produce while waiting to be processed

PINVEST3: Our firm has invested a lot of time and resources in the construction of storage facilities for the processed products from this produce

PINVEST4: We have invested a lot of time and resources in learning about aspects of processing this produce

PINVEST5: We have invested a lot of resources in equipment for processing this produce

PINVEST6: Our firm has committed a lot of time and resources in designing and making packaging materials for the processed products from this produce

PINVEST7: Our firm has committed a lot of time and resources in designing labels for the processed products from this produce

PINVEST8: Our firm has used a lot of time and resources to acquire Tanzania Bureau of Standards certification (TBS) for the processed products from this produce

PINVEST9: Our firm has used a lot of time and resources to acquire Tanzania Food and Drugs Authority (TFDA) Certification for the processed products from this produce

Purchase frequency. Purchase frequency from the focal supplier is an important factor in the development of relational norms. As a food processor purchases its produce frequently from the focal farmer, relational norms are expected to emerge and limit the potential for opportunistic behaviour. Accordingly, Screening Transaction Costs incurred by the food processor are expected to diminish. In this regard, purchase frequency was introduced as a control variable in this study. Some studies have operationalised purchase frequency in terms of the monthly number of orders (e.g., Buvik and Reve, 2002; Buvik and Haugland, 2005). Other studies have operationalised purchase frequency in terms of an annual number of orders (Buvik, 2000). These operationalisations of purchase frequency seem to be similar with one being the multiple of the other. Therefore, this study operationalised purchase frequency as a single item ratio scale using the annual number of orders from the focal farmer (focal supplier).

Size of the firm. The existing studies in buyer-supplier relationships have suggested that transaction costs might vary by size of the firm (Buvik and John, 2000). Therefore, the size of the firm was also introduced as a control variable in this study. Researchers have operationalised the size of the firm differently. Buvik and John (2000) used sales volume and total purchase volume to capture the size of the firm. Andersen and Buvik (2001) used only the purchase volume as a proxy for firm size. Furthermore, other studies (e.g., Rokkan et al., 2003) have used sales volume and number of employees to capture the size of the firm. An observation worth noting is that most of the studies have operationalised firm size differently by using either purchase volume, sales volume or number of employees, and very few studies (e.g. Buvik and John, 2000; Rokkan et al., 2003) have used more than one proxy to capture firm size. In line with existing studies that have operationalised firm size, this study used natural logarithm of average annual sales volume as a proxy for a processor's size.

5.4 Chapter Summary

This chapter has focused on the measurement development process and epistemic relationships. Furthermore, the chapter presents the review of earlier studies on the conceptualised and operationalised of some of our research variables. Moreover, the chapter has presented the conceptualisation of operationalisation of our research variables, including Screening Transaction Costs, processor control, perishability, purchase volume, duration of relationship and the use of technical instruments for quality screening. Finally, the chapter has presented operationalisation of control variables, including investment in processing activities, purchase frequency and the size of the firm. In the next chapter, data screening and validation of multi-items' variables is presented.

CHAPTER 6

DATA SCREENING AND VALIDATION

CHAPTER 6

DATA SCREENING AND VALIDATION

6.1 Introduction

The previous chapter has presented the methodology for this study. This chapter focuses on the examination of data used as a source of empirical evidence for the hypotheses proposed in chapter three. Moreover, this chapter is divided into two main sections: the data screening stage and the validation of measurement items. The data screening stage involves an assessment of data entry accuracy, missing data, outliers and the underlying assumption of normality, and the data validation stage involves measurements' reduction, unidimensionality analysis, reliability and validity assessment.

6.2 Data Screening

Data screening is an integral part of any multivariate data analysis. Thus, consideration of issues such as data entry accuracy, missing data, outliers and multivariate assumptions is necessary to ensure the validity and accuracy of the results obtained. This study used IBM SPSS 22 to screen data for the aforementioned issues. The subsequent subsections provide the steps and details of the data screening process.

6.2.1 Accuracy of Data file

The assessment of data entry accuracy was the first step of data screening in this study, and this was conducted by comparing each response in each questionnaire with the corresponding entry in the computerised data file. The proof reading of data entered into the computer before conducting further analysis is highly recommended in literature, particularly when the data set is small (Tabachnick and Fidell, 2007). The proofreading process enabled us to notice some problems in some of the cases, and the noted problems were corrected before any further assessment of data accuracy was made. Furthermore, the assessment of data entry accuracy was conducted by running descriptive statistics from which maximum and minimum values were examined, in which no variable was found to have a value out of the range used to solicit responses. After ensuring the accuracy of the data entry, the missing values' analysis followed.

6.2.2 Missing values

The problem of missing values is common in research and is caused by several factors, including data entry error, questionnaire malfunction and a respondent's refusal to answer some questions (Hair et al., 2010). Since the dataset was assessed for data entry accuracy prior to missing value analysis, the data entry error was ruled out as the possible cause of missing values. Thus, our analysis of missing values proceeded by focusing on the pattern and the extent of missing values. For Likert scale responses, no variable was found to have more than a 2% level of missing values, whereas for non-Likert scaled variables included in the study no variable had more than a 4% level of missing values. It is recommended in the literature to ignore the amount of missing values of less than 5% in a single variable, if they are missing in a non-systematic fashion (Kline, 2011). On the other hand, ignoring the non-random missing values may have serious consequence to the generalizability of the findings, regardless of the size of the missing values (Hair et al., 2010). Therefore, it is important to examine the patterns of missing values even when the extent of those missing is small. The literature (e.g. Hair et al. 2010) regards the amount of missing values as a secondary issue in the choice of appropriate technique for handling missing data.

Little's MCAR test was used to test the pattern of all measures with missing values. This is a chi-square test (X^2 test), which tests the null hypothesis stating that the data are missing completely at random. This test showed the X^2 value of 1973.103 (df = 1445, $p < 0.001$) which indicates that the data are missing in a non-random way. To get a clearer picture of the missing values, the multiple imputation function in IBM SPSS version 22 was used to examine their patterns and concentration. The findings showed that 34 cases out of 239 cases (14.23%) had missing values in 48 (69.58%) variables, which indicates a concentration of missing values in few cases. The deletion of cases with missing values is one of the techniques that can be used to handle missing data. Nonetheless, this technique may cause biased results if the values are missing in a non-random way. Therefore, the decision was taken to impute the missing values by using expectation maximisation technique (EM), which is arguably the best technique to apply when the data are missing non-randomly (Hair et al., 2010). Moreover, imputation of missing values was considered an appropriate choice because of the small sample size of this study.

6.2.3 Outliers Assessment

Outliers are cases with extreme values on a single variable (univariate outlier) or extreme values on a combination of two or more variables (multivariate outlier) (Tabachnick and Fidell, 2007). There are several possible causes of outliers in the data set, including incorrect data entry and misspecification of missing values. Furthermore, the cases may appear as outliers in the analysis when they have more extreme values than the normal distribution (Tabachnick and Fidell, 2007). Most of the statistical procedures such as regression analysis, factor analysis and structural equation modelling are sensitive to the presence of outliers in the dataset. Therefore, it is necessary to examine the data set for outliers and take corrective actions before any further analysis.

The assessment of data entry accuracy, which was conducted before this stage, ruled out data entry errors as the possible causes of outliers. Thus, we focused on the standardised scores (z-scores) of the individual variables, from which the cases with large z-score values were considered as outliers. However, the cut-off point to designate a case as an outlier is unclear. Tabachnick and Fidell (2007: 128) proposed a z-score value of 3.3 as a cut-off point for a sample size below 1000 observations, while other scholars (e.g., Hair et al., 2010) proposed a z-score value of 2.5 for a sample with at most 80 observations. Moreover, Weinberg and Abramowitz (2008) suggested z-core value of 2.0 as an appropriate cut-off point to designate a case as an outlier. Despite these inconsistencies, the literature agrees that the extreme values of z-scores are likely to happen in large samples. Thus, the small z-core value can be used as a cut-off point for small samples (80 or fewer observations) (Hair et al., 2010).

Using Hair et al's (2010) threshold for a small sample, the size of the sample in this study can be regarded as large (239 cases), thus we used a z-score value of 3.3 suggested by Tabachnick and Fidell (2007) as a cut-off point to designate a case as an outlier. The z-scores for every variable included in our study were computed automatically using IBM SPSS version 22, and the descriptive command was used to identify maximum and minimum z-scores in every variable. With an exception to two measures of processing investments, PINV1 and PINV5, z-scores in all other variables were less than a z-core value of 3.3. To identify cases with extreme values, z-scores of PINV1 and PINV5 were arranged in ascending order for examination of extreme negative z-scores, and in descending order for examination of extreme positive z-scores.

The result of the above procedure indicated that two cases had more than 3.3 z-score values in both PINV1 and PINV5, two cases had extreme values in PINV1, and one case had extreme value in PINV5. In total, five cases were identified as outliers, which represent 2% of all cases. Some Literature (e.g., Pallant, 2011) recommends the deletion of outliers as a remedy in large sample sizes. Other researchers (e.g. Hair et al., 2010) have cautioned that opting for this technique runs a risk of improving multivariate analysis at the expense of generalizability. Thus, to avoid this, we opted to retain outlying cases by reducing their distortion to subsequent analysis, and this was done by replacing the extreme values with the values that are one unit larger than the next extreme scores in the distribution, which is within an acceptable z-score value. This method is highly recommended as a means of reducing the influence of outlying cases for arbitrary responses (Tabachnick and Fidell, 2007; Kline, 2011).

6.2.4 Normality Assessment

Normality is the most fundamental assumption in multivariate statistical methods. It refers to the correspondence of the shape of the data distribution of individual metric variables to the normal distribution. If the distribution of an individual variable is greatly departing from the normal distribution, the resulting statistical conclusions are deemed invalid, because the normality is required to use F and t-test. The detrimental effect of normality violation tends to decrease with the increase in sample size (200 observations or more). Nevertheless, it is advisable to examine normality violation even when the sample size is large. This is because the non-normality of data may lead to violation of the homoscedasticity assumption, which also has an impact on statistical analysis and conclusions (Hair et al., 2010).

The assumption of normality was examined by considering both individual variables (univariate normality) and a combination of variables (multivariate normality). The latter assumes that each individual variable and all linear combinations of variables are normally distributed. Thus, the assumption of multivariate normality may partially be addressed by examining and addressing the violation of the normality assumption of individual variables (Tabachnick and Fidell, 2007) and in this study, we used skewness and kurtosis statistics for this purpose. The positively skewed distribution indicates the presence of a large concentration of cases on the left tail, and the right tail is too long. On the contrary, the negatively skewed distribution indicates the presence of a large concentration of cases to the right tail, and the left tail is too long. Such concentration of cases on one side of the distribution is an indication of normality violation, and the skewness statistic is often used to capture these patterns in the distribution of variables (Tabachnick and Fidell, 2007; Hair et al., 2010; Pallant, 2011). Additionally, kurtosis statistics are used to assess peakedness and flatness of the distributions of variables compared to normal distribution.

Perfectly normal distribution has skewness and kurtosis values of zero (Tabachnick and Fidell, 2007; Field, 2009; Hair et al., 2010; Pallant, 2011; Kline, 2011). Any value, which is above or below zero, indicates a departure from normality (Hair et al., 2010). Thus, the fundamental question in this regard is how far the value of the skewness and kurtosis statistics can depart from zero before the variable is deemed to violate the normality assumption. For skewness, the variable with a skewness statistic value outside the range of ±1 is regarded as highly skewed (Balmer, 1979; Hair et al., 2010), whilst for the kurtosis statistic any value outside ±3 is regarded as highly peaked or too flat (Balmer, 1979).

Accordingly, the skewness statistic values of all variables in this study ranged from 0.074 to 1.628, and the kurtosis statistic values ranged from 0.257 to 2.821 (see appendix 2A). Seven variables with skewness statistic value above one; including PER1, PINV1, PINV4, PINV5, PCONT1, PCONT2 and STCOST4 raised doubts of normality violation. Nonetheless, the large skewness statistic values are likely to happen in large samples. In this regard, Kline (2011) recommended that the skewness statistic with a value greater than 3 is an extreme value that suggests the presence of a normality problem. Following Kline's (2011) recommendation, the aforementioned variables with skewness statistic values above one were not considered an extreme violation of the normality assumption. Thus, they were used in the further analysis without any remedy for normality violation.

6.2.5 Assessment of Common Method Variance

As explained in chapter five, CMV poses a validity threat in social science research. Therefore, most of the sources of CMV were addressed during the questionnaire design. Nonetheless, before proceeding with the formation of constructs for subsequent use in the regression model estimation, the measurement model was assessed for common method variance. For this purpose, several statistical methods are proposed in the extant literature, including (1) traditional multitraits – multimethod procedure (traditional MTMM), (2) modern multitraits – multimethod procedure (modern MTMM), (3) Harman's single factor test, and (4) the marker-variable technique (Malhotra et al. 2006; Podsakoff et al., 2003).

The traditional MTMM procedure requires a researcher to measure each variable using multiple methods and use the data collected to create correlation matrices, one involving single method and multiple traits (MH) and the other involving multiple traits and multiple methods (HH). The CMV problem is said to exist when the average of the MH correlation is considerably higher than the average of HH correlations. The major limitation of the traditional MTMM procedure is its inability to assess the extent of the CMV problem. Accordingly, modern MTMM uses the CFA that allows a researcher to assess the extent of the CMV problem by expressing true variance due to measurement trait, variance due to method effect and random error (Malhotra et al. 2006). Nonetheless, since a single method was used to collect data for all variables in our questionnaire, none of the MTMM methods was viable for this study.

Furthermore, a single unmeasured latent construct method proved to be inapplicable in this study due to the problem of identification. However, this is not surprising as this problem is highlighted in the literature (e.g., Podsakoff et al., 2003) as likely when using this method for the assessment of CMV. In this regard, we opted for Harman's single factor test, which is the most widely used method in addressing the CMV. This method was implemented by introducing measurement items of all constructs of interest in the EFA, and the resulted unrotated factor solution was examined for the number of factors that are required to account for the variance in the measurement items. The CMV problem is said to be substantial when (1) a single factor that accounts for all variance, or (2) a factor that accounts for the majority of the variance in the measurement items emerges (Podsakoff et al., 2003; Malhotra et al. 2006).

The principal components (PC), principal axis factoring (PAF) and maximum likelihood (ML) extraction methods were used for factor analysis of the measurement items of perishability construct, Screening Transaction Costs, processing investments and processor control. The unrotated factor solution using the PC extraction method revealed eight factors with eigenvalues greater than one, from which the first factor accounted for 34% of the total variance and the cumulative variance of the remaining seven factors was 47.23% (see table 6.1 below). The unrotated factor solutions using both PAF and ML extraction methods resulted in six factors with eigenvalues greater than one, out of which the largest variance, accounted for by one factor in the two extraction methods were 33.4% and 27.78% respectively (see table 6.1 below). Since the factors that accounted for the highest variance in all three extraction methods were less than the 50% threshold recommended in the literature (e.g., Cowin, Johnson, Wilson and Borgese, 2013), CMV does not seem to be a serious problem in our study.

Table 6.1: Percentage of Variance for Factors with Eigenvalues Greater than One

Factors	**Extraction Methods**		
	PCA	**PAF**	**ML**
Factor 1	33,999	33,403	10,455
Factor 2	17,781	17,399	16,255
Factor 3	9,429	8,720	27,778
Factor 4	5,689	5,205	8,527
Factor 5	4,389	3,699	4,326
Factor 6	3,806	3,222	3,637
Factor 7	3,170	-	-
Factor 8	2,965		

6.2.6 Measurements Reduction

Measurement reduction can be performed by either principal component analysis (PCA) or exploratory factor analysis (EFA). The choice of either of these statistical techniques depends on two criteria: (1) the objective of the factor analysis, and (2) the amount of prior knowledge about the variance in the variables (Hair et al. 2010). The researcher may choose PCA when the goal is to reduce the measured variables to a smaller set of composite components that capture as much information as possible in the measured variables with as little information as possible (Fabrigar, Wegener, MacCallum and Straham, 1999; Park, Dailey and Lemus, 2002). On the other hand, EFA is a technique of choice when the goal is to find the latent structure of observed variables by uncovering common factors that influence the measured variables (Fabrigar et al. 1999; Park et al, 2002).

Moreover, the difference in goals of PCA and EFA is reflected in the way they analyse the variations in the measured variables. EFA focuses on the shared variance among the variables by separating common variance from unique variance. In contrast, PCA does not distinguish between common and shared variances because it focuses on the total variation among the variables and defines each variable as a linear function of principal components, with no separate presentation of unique variance (Fabrigar et al., 1999; Park et al., 2002). However, the two data reduction methods may essentially produce similar solutions when the number of variables exceeds 30 or the commonalities exceed 0.6 for most of the variables (Hair et al., 2010).

For the purpose of this study, the goal is to establish a latent structure of measurement items for processor control, Screening Transaction Costs, the degree of perishability and processing investments, which in turn will be used as a base for developing composite variables (constructs) for subsequent use in the testing of theory. In this regard, the EFA is an appropriate data reduction technique for our purpose. Our choice is reinforced by Brown's (2009) study, which described EFA as an appropriate reduction technique when researchers are working from a theory drawn from previous research about the relationships among variables, and therefore, want to include only the variance that is accounted for in an analysis (excluding unique and error variance) in order to see what is going on in the covariance, or common variance.

The EFA technique is usually performed in the early stages of the research to provide insights into the interrelationships among variables and the underlying data structure (Tabachnick and Fidell, 2007). Such insights create the basis for developing the smaller set of composite variables that incorporate the characteristics and nature of the original observed variable (Hair et al., 2010). Since the composite variables are fewer than the original observed variables, the parsimony is enhanced considerably (Tabachnick and Fidell, 2007) and the variable inter-correlation is reduced significantly (Hair et al, 2010). Moreover, the composite variables are more reliable than individual observed variables (Tabachnick and Fidell, 2007).

Even though our main goal for data reduction justifies the use of EFA, the sample size must also be satisfactory to warrant the use of this reduction technique. In this study, the sample size is 137 observations, which is above the threshold suggested by Hair et al. (2010: p. 108) for appropriateness of EFA. Before performing the EFA, the correlation matrix of measurement items of the degree of perishability, Screening Transaction Costs, processing investments and processor control was developed and examined for the presence of sufficient correlations among measurement items to provide further justification for factor analysis. Visual inspection revealed a substantial number of correlations greater than the recommended cut-off point of 0.3 (see Tabachnick and Fidell, 2007; Hair et al., 2010). Additionally, an examination of the correlation matrix showed the clusters of measurement items with high correlations among themselves and low correlations with measurement items in other clusters. These patterns of measurement items are suggested in the literature (e.g. Hair et al., 2010) as an indication of the presence of common factors in the correction matrix.

Moreover, statistical tests, including Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) were used to assess the appropriateness of the factor analysis on the correction matrix. The KMO index is recommended, in particular, when the case-to-variable ratio is less than 5:1 as is the case in this study (4:1) (Williams, Onsman and Brown, 2010). The findings of both the Bartlett test of sphericity and KMO index corroborate the findings from the visual inspection of the correlation matrix. The Bartlett test of sphericity for the correlation matrix was significant ($X^2 = 10610.294$; $df = 703$; $p < 0.001$), indicating the presence of some significant correlations among some of the measurements and hence strengthening the case for the suitability of factor analysis to our data set.

Similarly, the KMO measure of sampling adequacy was 0.916 demonstrating the presence of a sufficient degree of inter-correlation among variables. The literature regards the application of factor analysis in a correlation matrix with a KMO value below 0.5 as inappropriate (De Vaus, 2007; Hair et al., 2010). Generally, the application of factor analysis requires the correlation matrix to have a KMO value of at least 0.7 (De Vaus, 2007). Other literature (e.g., Tabachnick and Fidell, 2007; Pallant, 2011) recommends 0.6 as minimum KMO value for good factor analysis. The KMO value for our data, which is 0.916, is above the recommended threshold. Therefore, both the Bartlett test of sphericity and KMO index indicate that EFA is appropriate for the data used by this study.

Accordingly, the pool of measurement items was subjected to exploratory factor analysis. Since our data meet the normality assumption, the ML extracted method was used. Scholars (e.g., DeCoster, 1998; Costello and Osborne, 2005) regard this method as the best when data meet the assumption of multivariate normality. Further support for our choice is found in Fabrigar et al's (1999) study, which emphasized ML as the appropriate extraction method in EFA when skewness and kurtosis are less than 2 and 7 respectively, the condition which is met by our variables (see table A in appendix 2). However, prior to the use of the ML extracted method, the principal component (PC) extraction method was used to develop an initial rotated solution as suggested in the literature (e.g., Williams et al., 2010). Together with these extraction methods, the variance maximisation (varimax) rotation method was chosen with the objective of producing an orthogonal factor solution. Contrary to the oblique rotation, which allows factors to be correlated, in the orthogonal rotation, the factors are constrained so as to be uncorrelated (Fabrigar et al., 1999). In this way, the interpretation of the final factor solution is simplified by allowing variables that correlate highly with a factor to have high loadings in a particular factor, while those with low correlations receive values close to zero in that factor (Hair et al., 2010).

At this stage, a decision was made concerning the number of factors to extract. Several techniques can be used for this purpose, including the Kaiser criterion, scree plot and parallel analysis. Among these techniques, there is no one, which is more reliable than the other. Therefore, several studies (e.g., Williams et al., 2010; Fabrigar et al, 1999) have recommended the use of multiple techniques to decide the number of factors to extract. In this study, we opted for the Kaiser Criterion and scree plot. Conceptually, we expected one construct for each set of measurement items, but the Kaiser criterion suggested eight factors with eigenvalues greater than one, whereas, the scree plot suggested six factors. When the techniques used to decide the number of factors to retain suggest different numbers of factors from those expected, it is advisable to run the EFA with a different number of factors and chooses the one with significant factor loadings, no or few item cross-loadings, no fewer than three items (Costello and Osborne, 2005), and is conceptually meaningful (Williams et al., 2010). Even though the Kaiser criterion has the weakness of overstating the number of factors, we opted to start with eight factors to avoid the problem of under extraction of factors.

Multiple criteria were used to improve the interpretability of the initial rotated solution for measurement items of the degree of perishability, Screening Transaction Costs, processing investments and processor control. To start with, the factors with less than three significant factor loadings were deleted one at a time. For the sample with 100 to 199 cases, the loadings of around 0.5 and above are considered to be significant (Field, 2009). The rotated solution was further improved by deleting variables with insignificant factor loadings (loadings < 0.5) one at a time. In the same way, variables with high cross loading (loadings ≥ 0.5) were also deleted (Hair et al., 2010; Field, 2009).

Likewise, variables with significant loadings in theoretically different factors were deleted as well. The final factor solutions from the PC and ML extraction methods are presented in appendix 2B and C. It is worth mentioning that the three measurement items (PINV 6, PINV7 and PCON4), which were significant in the final factor solution using the PC extraction method, turned out to be insignificant in the final factor solution using the ML extraction method, and therefore, were dropped. This is not surprising since the PC extraction method tends to inflate factor loadings (Fabrigar et al, 1999). The EFA solution with the ML extraction method was subjected to further validation using confirmatory factor analysis (CFA) before formation of composite scores for a model estimation.

6.3 Validation of Measurement Model

In this stage, the EFA solution was subjected to confirmatory factor analysis (CFA) using IBM Amos version 22 to test whether the measurement model fits the data adequately. Unlike the EFA, CFA provides a stricter, objective and more accurate assessment of the measurement model (Segars, 1997; O'Leary-Kelly and Volkurka, 1998). Usually, CFA is performed prior to a reliability and validity assessment, and it often produces different conclusions from the EFA about the unidimensionality of the measurement items (O'Leary-Kelly and Volkurka, 1998).

6.3.1 Confirmatory Factor Analysis (CFA)

In CFA, each measurement item is restricted to its hypothesised latent construct, and all constructs in the measurement model are allowed to correlate. Following the recommendations from different scholars (e.g., Hair et al., 2010; Byrne, 2010; Kline, 2011) and consistent with existing studies (e.g., Palmatier, Dant, and Grewal, 2007; Brown et al, 2000), we used multiple fit indices to assess the fit of the estimated measurement model. Specifically, this study used Chi-square, Root Mean Square Error of Approximation index (RMSEA), Tucker-Lewis (TLI) index and Comparative Fit Index (CFI). Additionally, the measurement model was assessed with respect to the size of the factor loadings and their significance. Hair et al. (2010) recommended standardised loading of at least 0.5 for a well-fitting model.

Concerning the above-mentioned criteria, the overall fit of the initial measurement model to the data was poor (see figure D in appendix 2) and some problems were noted, including lower standardised loadings than the recommended value of 0.5, insignificant loadings and high levels of standardised residuals. Data analysis literature regards the standardized residual values greater than 2.58 (Byrne, 2010) or 2.5 (Hair et al., 2010) in the matrix of standardized residual covariances as an indication of problems with measurement items, and for small sample size this value can be 2.0 (Keith, 2015). It is noteworthy that in real research, it is often difficult to achieve well-fitting model when the measurement model has a large number of measurement items per factor, and this is because many error terms are likely to be correlated (Wang and Wang, 2012). Accordingly, the initial measurement model was re-specified by dropping measurement items with insignificant loading, low standardised loadings and standardised residuals greater than 2.0. The final measurement model demonstrated an adequate fit to the data, and the figure E in appendix 2 shows the measurement items of the final model. The fit indices of the final measurement model are discussed in the subsections below:

- **Chi Square (x^2)**

Chi square (X^2) is the most fundamental and commonly used fit index in model evaluation (Hoe, 2008; Hair et al., 2010). X^2 tests the null hypothesis stating that there is no difference between the observed and estimated covariance matrix (Hair et al., 2010). In the X^2 fit index, the researcher looks for small X^2 value and large p – value, which indicate that there is no significant difference between two matrices, therefore, providing some evidence for the model fit to the observed data (Hair et al., 2010). The p-value is required to exceed the value of 0.1 before non-significance is confirmed (Hoe, 2008). The X^2 goodness of fit test for the measurement model in this study was significant (X^2 =158.146; df = 71; p < 0.001), which indicates that there is significant difference between the observed and estimated covariance matrix. This finding is not surprising as it is often the case in large samples (Heide, Wathne and Rokkan, 2007). That is, in large samples, the X^2 test tends to reject the model even though it fits the data reasonably well (Lei and Wu, 2007).

Additionally, the ratio of Chi-square to the degree of freedom is suggested as an alternative evaluation criterion. The model is considered to be of satisfactory fit when the ratio of X^2 to df is less than 2 or 3 as recommended by Schreiber, Nora, Stage, Barlow and King (2006). In this study, the ratio of X^2 to df was 2.23, which is within the recommended threshold for a well-fitting model. Together with X^2 tests, other fit indices were also used to assess our measurement model. These include a root mean square error of approximation, Tucker-Lewis and comparative fit index.

- **Root Mean Square Error of Approximation (RMSEA)**

RMSEA is arguably the most informative index in covariance structure modelling (Hoe, 2008; Byrne, 2010). It examines how well the estimated model fits not only a sample but also the population covariance matrix if it is available (Hair et al., 2010; Byrne, 2010). The calculation of the RMSEA uses X^2 value of the estimated measurement model, together with the sample size and the correction for model complexity (degree of freedom) to ensure that these factors do not affect the decision to accept or reject the model (Shevlin, Miles and Lewis, 2000). RMSEA is scaled as a badness of fit test in the sense that high value is an indication of poor fit (Kline, 2011). The RMSEA value between 0 and 0.05 to 0.08 indicates an acceptably fitting model (Schreiber et al., 2006; Schumacker and Lomax, 2010) and the value between 0.08 and 0.1 indicates mediocre fit (Hooper, Coughlan and Mullen, 2008; Byrne, 2010). Moreover, when the value of RMSEA is 0.1 and above, it signals a serious problem in the measurement model

fit (Kline, 2011). RMSEA for the measurement model in this study was 0.072, which according to Hoe (2008) indicates a reasonably fitting model.

- **Tucker – Lewis Fit Index (TLI)**

TLI also known as a non-normed fit index (NNFI) in that its value may go beyond the value of one. TLI is an incremental fit index that compares the estimated model fit to the null model. It was designed to rectify the normed fit index's (NFI) weakness of inflating fit index values for complex models. TLI compares the normed X^2 values of the null and estimated model (Hair et al., 2010). A value close to 0.9 or 0.95 indicates a better fitting model (Schumacker and Lomax, 2010). The value of the TLI index for the estimated measurement model in this study was 0.961, which demonstrates a good fitting model.

- **Comparative Fit Index (CFI)**

CFI is also an improved version of NFI. Contrary to TLI where it is possible to have the values above 1 or below 0, CFI values range between 0 and 1 with a value close to one indicating better fitting model. CFI is one of the good indexes for estimating the model fit even for small samples (Tabachnick and Fidell, 2007). The threshold of 0.9 or above is advisable to avoid accepting a miss-specified model (Hoe, 2008; Hair et al., 2010). The estimated measurement model in this study yields an estimated CFI value of 0.97, which demonstrates a well-fitting model.

Generally, the fit indices from different families of indices were used to test the well-fitting hypothesis for our measurement model, and the results of all fit indices presented above are summarised in table 6.2 below. After our measurement demonstrated satisfactory fit to the data, it was further assessed for validity before the formation of composite scores. However, it is noteworthy that fit indices are guidelines for an acceptable model fit and not rules that guarantee a correct model. Thus, no specific value on any index can separate the models into those that are acceptable and those that are unacceptable. In this regard, the use of several guidelines together can assist in determining the acceptability of the model fit (Hair et al., 2010). The consistence in conclusion from different families of indices may indicate a well-fitting model. Still the exclusive reliance on model fit indices is unacceptable as it is possible for an incorrectly unspecified model to have a good fit. Therefore, the evaluation of a model must not only be based on statistical considerations, but also on theoretical considerations (Byrne, 2010).

Table 6.2: Measurement Model Fit indices

Absolute fit Indices :

Model:	Index
	RMSEA
Estimated Model	0.072
Null Model	0.364
Threshold:	RMSEA≤0.08

Incremental Fit Indices:

	Indices			
Model:	NFI	IFI	TLI	CFI
Estimated Model	0.947	0.970	0.961	.970
Saturated model	1.000	1.000		1.000
Null Model	0.000	0.000	0.000	.000
Threshold:			TLI ≥ 0.90	CFI ≥ 0.9

NB: Saturated model is a model whereby each variable relates to every variable in the model, whereas a null model is the one in which no variables are related.

By observing the original number of measurement items of the degree of perishability, Screening Transaction Costs, processor control and processing investment from the questionnaire, and the final measurement model, it is evident that the adequate fit was achieved after dropping significant number of measurement items. As a result, the concerns may be raised that, attrition of a large number of measurement items destroys the breadth of the constructs being measured and can introduce inaccuracies. In the situation where the measurement items are highly correlated, and the constructs demonstrated high level of reliability with Cronbach alpha of at least 0.9; no measurement item is indispensable, and the removal of indicators may have only minor effects on the overall reliability (Bollen and Lennox, 1991).

Thus, with an exception to the processing investment, which has a Cronbach alpha of 0.824, the Cronbach alphas of the degree of perishability, Screening Transaction Costs, processor control involving their original number of measurement items were 0.975, 0.939 and 0.951 respectively. In this regard, the significant attrition experienced during the estimation of the measurement model is not expected to introduce inaccuracies in estimating the regression model for testing our hypotheses. The Cronbach alpha lower than 0.9 for processing investment is due to poor internal consistency.

6.3.2 Reliability and Validity Assessment

This section focuses on the examination of the extent to which the constructs fit together in the overall measurement model. Specifically, we considered the unidimensionality, reliability, convergent validity and the discriminant validity. The unidimensionality was examined by using the item to total correlations and comparison of the fits between an unconstrained and constrained model. The reliability of constructs was examined by using the squared standardised loadings and the composite reliability (CR). The convergent validity of constructs was evaluated by using factor loading – standard error ratios and average variance extracted (AVE). Furthermore, the discriminant validity was examined by using AVE and average shared squared variance (ASV). Additionally, maximum shared squared variance (MSV), squared root of AVE and inter-constructs correlations were considered as well in a discriminant validity assessment.

- **Unidimensionality**

The assessment of unidimensionality is a necessary condition for both reliability and validity assessments (Segars, 1997). It is concerned with an assessment of whether there exists one latent trait or construct for a given set of measurement items, and it is viewed as one of the most critical and basic assumptions in measurement theory (Hattie, 1985), particularly when more than two constructs are involved (Hair et al., 2010). Composite scores are meaningless when items are not unidimensional (Segars, 1997). Earlier studies have identified two necessary conditions for unidimensionality: internal consistency and external consistency (Anderson and Gerbing, 1982; Gerbing and Anderson, 1988; Segars, 1997). This study used item-to-total correlations to examine the unidimensionality of measurement items and results indicated that all item-to-total correlation values were ranging from 0.58 to 0.92 (see table 6.3 below). These values are above the recommended threshold of 0.5 for unidimensionality (Hair et al., 2010).

Even though the items demonstrated acceptable item-to-total correlation values, this measure of unidimensionality does not account for external consistency. That is it does not discriminate sets of items representing different constructs (Gerbing and Anderson, 1988; Segars, 1997; O'Leary-Kelly and Vokurka, 1998). In this regard, the measurement items that lack external consistency create false associations between constructs, thus, compromising the findings of the study (O'Leary-Kelly and Vokurka, 1998). To examine external consistency several additional measurement models were estimated by constraining each pair of constructs to one and comparing the fit of the resulting model to the unconstrained model as suggested by Segars and Grover (1993). Our model demonstrated better fit than the estimated constrained models, thus providing evidence for external consistency.

Table 6.3: Correlated Item-Total Correlation

Construct	Item-Total Correlation	Minimum Item-total Correlation	Maximum Item-total Correlation
Perishability (PER)	PER1: 0.92 PER2: 0.92 PER6: 0.90 PER7: 0.85	0.85	0.92
Screening Transaction Costs (SCOST)	SCOST1: 0.81 SCOST2: 0.84 SCOST3: 0.73 SCOST5: 0.58	0.58	0.84
Processing Investment (PINVEST)	PINVEST1: 0.67 PINVEST2: 0.83 PINVEST3: 0.80	0.67	0.83
Processor Control (PROCON)	PROCON1: 0.83 PROCON2: 0.85 PROCON3: 0.64	0.64	0.85

- **Reliability**

The unidimensionality of a construct is not a sufficient condition to ensure the usefulness of measurement items (Gerbing and Anderson, 1988). The examination of reliability is needed in order to determine the extent to which the measurement items are consistent and free from error. Thus, paying attention to reliability is likely to reduce the chance of rejecting the true relationship masked by poor measurement items (Venkatraman and Grant, 1986). The literature recommends that a reliability assessment should be performed prior to a validity assessment (Hair et al., 2010).

This study used the squared standardised loadings to examine the reliability of individual measurement items and composite reliability (CR) to examine the reliability of the constructs. The measurement items with squared standardised values above 0.5 are regarded as reliable (Segars, 1997). With an exception of squared standardised loadings of two items (PCONT3 and STCOST5) that were below 0.5, one squared standardised loading was approximately 0.5 and the remaining squared standardised loadings ranged from 0.64 to 0.93. The items with squared standardised loadings above 5 demonstrated that more variances in the individual measurement items are explained by the constructs rather than by the error terms (see table 6.4). Further, an assessment of reliability with CR showed that the CR values of all constructs ranged from 0.899 to 0.959 (see Table 6.5), which is above the recommended threshold of 0.7 for satisfactory composite reliability (Segars, 1997). Consequently, the two items with lower than 0.5 squared standardised loadings were retained because of satisfactory composite reliability and for the purpose of model identification.

- **Convergent Validity**

When multiple measurement items are used to capture a construct, a researcher should be concerned with convergent validity (Hulland, 1999). This psychometric property refers to the extent to which the measurement items of the same construct converge or share a high proportion of variance (Hair et al., 2010). Even though we have discussed the reliability and convergent validity separately, construct reliability is subsumed in convergent validity in the sense that it indicates convergent validity (Venkatraman and Grant, 1986; Hair et al., 2010). Drawing on contributions from different scholars (Fornell and Larcker, 1981; Hair et al., 2010; Segars, 1997), this study used the factor loading – standard error ratios and the average variance extracted (AVE) to examine the convergent validity. All factor loading – standard error ratios were large and significant with t-values greater than the |2.00| threshold suggested by Segars (1997) for acceptable convergence validity (see table 6.4). Furthermore, the AVE values ranged from 0.666 to 0.853 (see table 6.5), which is above the 0.5 threshold proposed by Fornell and Larcker (1981) and Hair et al. (2010) for convergent validity.

Table 6.4: Unstandardized loadings, Squared standardised loadings and t-values

Construct	Items	Unstandardized Loadings	Standard error	t-values	Standardized loadings	Squared standardised loadings
PER	PER1	1			0.953	0.91
	PER2	0.96	0.03	32.02	0.948	0.90
	PER6	0.92	0.03	27.89	0.919	0.84
	PER7	0.84	0.04	23.16	0.872	0.76
SCOST	SCOST1	1			0.89	0.79
	SCOST2	0.99	0.05	19.89	0.92	0.84
	SCOST3	0.85	0.05	15.78	0.80	0.64
	SCOST5	0.67	0.06	10.81	0.62	0.39
PINVEST	PINVEST1	1			0.70	0.49
	PINVEST2	1.78	0.15	12.28	0.93	0.87
	PINVEST3	1.71	0.14	12.36	0.87	0.76
PROCON	PROCON1	1			0.95	0.90
	PROCON2	0.999	0.04	25.55	0.96	0.93
	PROCON3	0.83	0.07	12.36	0.66	0.43

- **Discriminant Validity**

Discriminant validity is the extent to which the construct is distinct from other constructs in the model (Hair et al., 2010). The rationale for discriminant validity is the need to address the problem of multicollinearity; it is a precondition for structural equation modelling (SEM), and regression models' estimations (Shiu, Pervan, Bove and Beatty, 2011). Consistent with the previous studies (e.g., Fornell and Larcker, 1981; Hair et al., 2010; Segars, 1997), we used average variance extracted (AVE); average shared squared variance (ASV); maximum shared squared variance (MSV); square root of AVE, and the correlations of constructs to examine discriminant validity. The AVE values of all constructs in this study were greater than their corresponding ASV and MSV values, thus providing evidence for discriminant validity (see table 6.5 below).

Moreover, the evidence for discriminant validity was demonstrated by comparing the square root of AVE of each construct as indicated along the diagonal in table 6.5 below, with the bivariate correlations of all other constructs (off-diagonal values). Our measurement model passed this test, as the square roots of all AVE values were higher than the bivariate correlations between constructs. Despite the wide application and the strength of AVE in examining discriminant validity, it has weaknesses in the sense that a pair of constructs may pass a discriminant validity test even when the inter-construct correlation suggests that they are, in fact, not distinct. In this regard, Kline (2005) recommended that the constructs are discriminately valid when all inter-construct correlations are below 0.85. In this study, the highest inter-construct correlation was 0.658 (see the off-diagonal values in table 6.5), which is lower than the maximum cut-off point recommended by Kline (2005).

Table 6.5[4]: Composite reliability (CR), Average variance extracted (AVE), Average shared squared variance (ASV), Maximum shared squared variance (MSV) and correlations

	CR	AVE	MSV	ASV	PINVEST	PER	SCOST	PROCON
PINVEST	0.877	0.706	0.044	0.029	**0.840**			
PER	0.959	0.853	0.433	0.203	-0.209	**0.924**		
SCOST	0.887	0.666	0.433	0.156	-0.125	0.658	**0.816**	
PROCON	0.899	0.754	0.132	0.059	0.168	0.363	0.136	**0.868**

[4] The figures in bold along the diagonal represent the square roots of average variance extracted (AVE) of each construct, and the shaded off-diagonal figures represent inter-construct correlations

6.4 Chapter Summary

This chapter has delineated the different procedures followed to ensure the accuracy of the data, including proofreading of the data file and descriptive statistics for examining the maximum and minimum values for Likert scale responses. The chapter has also described the methods used to handle missing values, outliers and examine the normality of variables. EFA for measurement reduction is also presented in this chapter. Moreover, this chapter has delineated clearly different methods and criteria used to validate both measurement items and constructs. The next chapter is concerned with the estimation of a moderated regression model, and the testing of the research hypotheses presented in chapter three.

CHAPTER 7

MODEL ESTIMATION AND HYPOTHESES TESTING

CHAPTER 7

MODEL ESTIMATION AND HYPOTHESES TESTING

7.1 Introduction

The previous chapter focused on data screening and the validation of measurement. This chapter follows on from the previous chapter by presenting the estimated moderated multiple regression model, which was subsequently used for testing the hypotheses proposed in chapter three. In addition, this chapter describes different methods that can be used to estimate the moderating effects and follows this discussion with a brief presentation of the moderated multiple regression procedure.

7.2 Methods for Estimating Moderations

This study used a moderated multiple regression method (MMR) to estimate the moderating effects of the degree of perishability, purchase volume, quality-screening technology and the duration of relationships on the association between processor control and Screening Transaction Costs. There are several other methods that can be used to study the moderating effects, including the sub-group analysis (Fynes and Voss, 2002; Rajagopal and Rajagopal, 2009) and the indicant product analysis (Stephenson, Holbert and Zimmerman, 2006). Ping (1995) grouped the aforementioned methods into the three major approaches used to investigate moderating effects. However, the MMR method is a widely used method in the supply chain and buyer-supplier relationship research (Simpson, Power and Samson, 2007; Zsidisin and Wagner, 2010), and is arguably to be the method of choice in detecting the moderating effects in field research and is seen as superior to other methods such as sub-group analysis (Dawson and Richter, 2006).

The subgroup analysis method involves dividing the sample into subgroups using the variable that is considered to moderate the relationship between the independent and dependent variables (Fynes and Voss, 2002). In this method, the chow test may be used to test whether or not the subgroups are significantly different across different levels of moderating variables (Fynes and Voss, 2002). The Chi-square test may also be used when the structural equation modelling approach (SEM) is employed to test the moderating effects. That is, the magnitude of difference in X^2 between the unconstrained and constrained models may determine the presence of an interaction effect and its strength. Nevertheless, the SEM is complicated for continuous moderating variables (Ro, 2012). Additionally, the analysis of variance approach (ANOVA) is also described in the literature as a subgroup analysis method that can be used to test moderating effects, particularly, in the situation in which both independent and moderating variables are categorical (Ro, 2012).

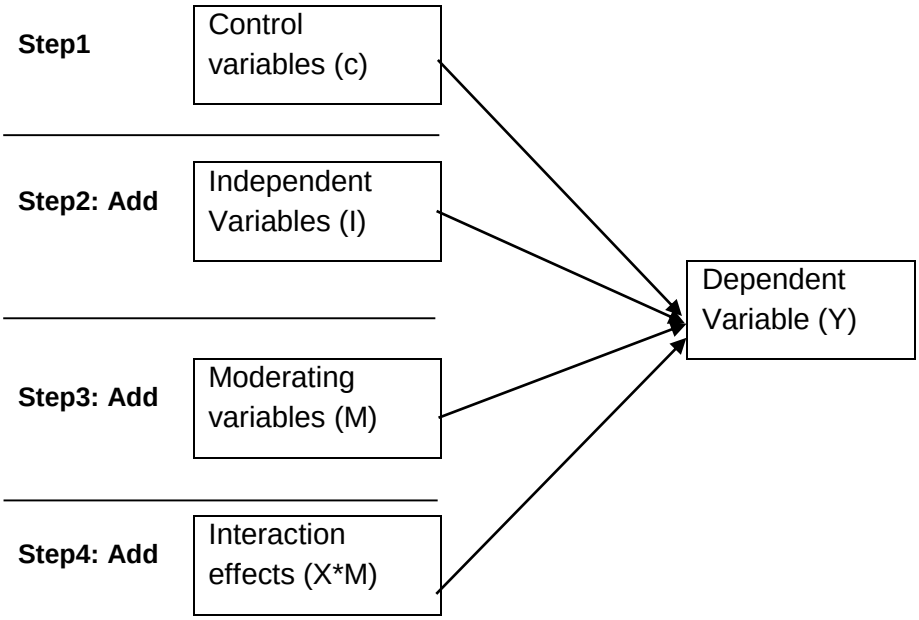
The extant literature has pointed out several limitations associated with methods of sub-group analysis: first, artificial transformation of a continuous variable into a categorical one results in the loss of information (Narasimhan, Swink and Kim, 2005; Dawson and Richter, 2006). Second, splitting of a sample causes a reduction in power, which may lead to the false disconfirmation of theory (Ping, 1995; Dawson and Richter, 2006). Third, methods of subgroup analysis do not allow for a comparative test of slopes that do exist across the barriers of subgroups. That is, the subgroups are treated as if they are separate samples. Thus, the subgroup analysis methods are restricted to the assessment of slope differences within a subgroup (Dawson and Richter, 2006).

From the discussion above, we can infer that the nature of the moderating variable may determine the choice of method for testing the interaction effects, and Ro (2012) provides support for this inference. The MMR is the most preferred method for examining moderating effects when the predictor and moderator are continuous variables or when the predictor is continuous and the moderator is categorical (Villa, Howell, Dorfman and Daniel, 2003). Three moderating variables in this study were continuous, while one was dichotomous. The independent and dependent variables were both continuous. Therefore, the MMR was selected as an appropriate method for this study. Several studies (e.g., Liakhovitski, Stone-Romeo and Jaccard, 2008) regard MMR as the most appropriate technique for detecting moderating effects.

Despite the MMR being widely regarded by researchers as the method of choice, a considerable number of studies, which used this method have failed to detect the moderating effects even in empirical studies in which such effects are strongly expected (Paunonen and Jackson, 1988). This situation has caused some scholars (e.g., De Vries, Roe and Taillieu, 2002) to claim that MMR lacks the statistical power to detect moderating effects, particularly in field studies. Nonetheless, research has provided sufficient evidence that MMR has the enough statistical power to detect the presence of moderation (Paunonen and Jackson, 1988). Furthermore, research has pointed out that the difficulties experienced by the researchers in detecting hypothesized contingent effects are not caused by the MMR method but rather by the methodological factors that decrease statistical power. This includes the small sample size, unequal subgroup sizes, scale coarseness and measurement errors in the predictor variables that make up the interaction terms (Jaccard, Wan and Turrisi, 1990; Villa et al., 2003). To the extent that analyses of the interaction effects lack statistical power, the presence of an interaction effect is more likely to go undetected. However, most of these factors can be rectified in the design stage of the research (Jaccard et al., 1990).

7.3 Moderated Multiple Regression Method (MMR)

The MMR method follows the ordinary least square (OLS) hierarchical procedure, whereby separate terms are added to a least squares prediction equation and are evaluated for incremental effects in accounting for a dependent variable (Paunonen and Jackson, 1988). This method begins by identifying and entering the variable(s) to be controlled for as a block in the regression model. The inspection of t and F test values of the control variables will indicate whether they provide significant effects to be accounted for in the analysis of predictors. The predictors and moderators are added in the second and third stage respectively in the model containing control variables. The coefficients of predictors and moderators at these stages capture their effects on the dependent variable after accounting for the control variables. In the final stage of the MMR method, the interaction terms are added as a block. The four steps of the MMR method are shown in figure 7.1 below. It is noteworthy that some studies (e.g., Ro, 2012) suggest that the MMR method can be performed in three steps, whereby moderators and predictors are entered together as one block.



Source: constructed from literature review

Figure 7.1: Moderated Multiple Regression (MMR) Method

In the MMR method, the interaction effects are captured by the product terms of the predictors and moderators that are entered in the regression equation already containing the variables from which the terms are formed (Jaccard and Turrisi, 2003). In so doing, the main effects of predictors and moderators are linearly partialled from the product term, and the coefficient of product terms represent their unique contributions to the amount of variance in the dependent variable (Paunonen and Jackson, 1988; Villa et al., 2003). If the interaction effects are present, then the difference in R^2 values after and before adding product terms should be statistically significant (Jaccard et al., 1990; Jaccard and Turrisi, 2003). Likewise, the coefficients of the product terms should be statistically significant (Jaccard and Turrisi, 2003). Nonetheless, it is noteworthy that even if the predictors and moderators are not significant, they must remain in the model to enable proper partialling of the interaction effects (Irwin and McClelland, 2001). In contrast, when the interaction effects are insignificant while the predictors and moderators are not, the researcher should consider dropping the product terms, unless there are strong theoretical reasons for expecting interaction effects (Ro, 2012).

7.4 Estimation of Regression Model

Statistically, our hypotheses specify that the effect of processor control on Screening Transaction Costs is contingent on the degree of perishability of the transacted produce, purchase volume, the use of technology for quality screening and duration of relationship between food processors and the farmers. The overall regression model can be expressed as:

$$SCOST = b_0 + b_1\,FREQ + b_2\,PINVEST + b_3 SALESVOL + b_4 PROCON + b_5\,PER + b_6 PURCH + b_7\,TECHUSE + b_8\,DURAT + b_9 PER \times PROCON + b_{10}\,PURCH \times PROCON + b_{11}\,TECHUSE \times PROCON + b_{12}\,DURAT \times PROCON + \varepsilon_1$$

Where: SCOST = Screening Transaction Costs

FREQ = annual purchase frequency

PINVEST = the level of processing investments

SALESVOL = annual sales volume

PROCON = the level of processor control

PER = the degree of perishability of transacted produce

PURCH = annual purchase volume

TECHUSE = the use of technological instrument for quality screening (TECHUSE = 1; TECHUSE = 0)

DURAT = Duration of relationship between food processor and the main supplier (farmer).

Note that the values of the constructs in the regression model are based on the means of their respective measurement items from the final measurement model presented in appendix 2D. That is, SCOST values are computed as the mean of three measurement items: SCOST1, SCOST2, SCOST3 and SCOST5; PINVEST values as the mean of PINVEST1, PINVEST2 and PINVEST3; PROCON values as the mean of PROCON1, PROCON2 and PROCON3, and PER values as the mean of PER1, PER2, PER6 and PER7.

In the estimation of multiple regression models, coming to the proper solution is unlikely when there is a high level of collinearity between exogenous variables. Particularly when the correlations among exogenous variables are greater than 0.9 (Grewal, Cote and Baumgartner, 2004). Thus, before estimating the MMR model, we ran the bivariate correlation analysis of the model variables. This analysis provided us with an opportunity to assess the significance of correlations between model variables prior to the estimation of MMR model. It also allowed us to check whether there is a multicollinearity problem among our research variables (Grewal et al, 2004; Hair et al., 2010). With an exception of a bivariate correlation between the purchase volume and sales volume, which was around 0.8, the bivariate correlations of all other exogenous variables were below 0.6 (see table 7.1 below). This means that multicollinearity is not a serious problem for the variables in our model. It is worth mentioning that the variables forming product terms were mean centered before forming interaction terms to avoid potential problems of multicollinearity.

Table 7.1: Means, Standard Deviations and Pearson Correlations

	CONSTRUCTS												
CONSTRUCTS	**FR**	**IN**	**SV**	**SC**	**PR**	**PE**	**PU**	**TE**	**DU**	**PP**	**PUP**	**TP**	**DP**
FRIQ (**FR**)	1												
PINVEST (**IN**)	-,24**	1											
SALESVOL (**SV**)	,04	,37**	1										
SCOST (**SC**)	-,15	-,14	-,16	1									
PROCON (**PR**)	-,13	,11	-,01	,08	1								
PER (**PE**)	-,01	-,26**	-,37**	,66**	,26**	1							
PURCH (**PU**)	,05	,42**	,82**	-,19*	-,01	-,43**	1						
TECHUSE (**TE**)	-,14	,25**	,39**	-,02	,10	-,07	,37**	1					
DURAT (**DU**)	-,13	,16	,03	-,02	,24**	,08	,02	,32**	1				
PER X PROCON (**PP**)	-,03	,06	-,08	-,13	,46**	,12	-,15	,05	,14	1			
PURCH X PROCON (**PUP**)	-,04	-,12	-,12	-,15	-,39**	-,20*	-,13	-,01	-,06	-,52**	1		
TECHUSE X PROCON (**TP**)	,09	,03	-,02	-,10	,50**	,16	-,01	,06	,09	,24**	,001	1	
DURAT X PROCON (**DP**)	-,15	,03	-,06	,15	,39**	,17	-,06	-,02	-,03	,30**	-,091	,36**	1
Mean	**3,07**	**5,19**	**16,70**	**3,19**	**-,17**	**-,08**	**,01**	**,21**	**-,02**	**,71**	**-,02**	**,02**	**,22**
SD	**1,05**	**1,38**	**1,32**	**1,47**	**1,41**	**1,91**	**1,51**	**,41**	**,65**	**3,32**	**2,02**	**,70**	**,95**

***** $p < 0.05$ (two tailed)

****** $p < 0.01$ (two tailed)

After examination of the correlation between variables, the model was estimated using the MMR approach as discussed in the preceding sections of this chapter. The MMR model can be estimated in either four steps or three steps. However, the MMR model in this study was estimated in three steps as described by Ro (2012) and the final moderated regression model is presented in table 7.2 below.

Table 7.2: The Final Estimated Moderated Regression Model for Screening Transaction Costs (SCOST)

	Variables and Estimates			
Models	**Variables**	**Coefficients (B)**	**T-Values**	**VIF**
Model 1: Control Variables only	(Constant)	6,637	4,090***	
R^2 adj = 0.039	Freq[e]	-,244	-1,974*	1,082
F(3, 131) = 2.817*	Pinvest	-,148	-1,461[a]	1,253
	Salesvol[e]	-,115	-1,120	1,183
Model 2: Independent and Moderating	(Constant)	3,299	1,535[a]	
variables added	Freq[e]	-,247	-2,602**	1,125
R^2 adj = 0.457	Pinvest	-,016	-,205	1,386
R^2 change = 0.429	Salesvol[e]	,045	,361	3,119
F change (5,126) =21.166***	Procon	-,124	-1,731*	1,174
	Per	,581	10,117***	1,382
	Purch[e]	,118	1,037	3,391
	Durat[e]	-,151	-,947	1,205
	Techuse[d]	-,055	-,203	1,385
Model 3: Product terms added	(Constant)	2,789	1,369[a]	
R^2 adj = 0.517	Freq[e]	-,170	-1,824*	1,222
R^2 change = 0.07	Pinvest	-,004	-,052	1,403
F change (4,122) = 4.884***	Salesvol[e]	,059	,498	3,134
	Procon	-,010	-,117	2,034
	Per	,535	9,294***	1,556
	Purch[e]	,008	,071	3,762
	Techuse[d]	,106	,409	1,428
	Durat[e]	-,106	-,695	1,236
	Per X Procon	-,119	-3,253***	1,891
	Purch[e] X Procon	-,103	-1,708*	1,920
	Durat[e] X Procon	,229	2,111*	1,349
	Techuse[d] X Procon	-,368	-2,297*	1,599

[a] Significant at P< 0.1 (1-tailed test); * Significant at P< 0.05 (1-tailed test); ** Significant at P< 0.01 (1-tailed test); *** Significant at P< 0.001 (1-tailed test); [d] Dichotomy variable; [e] natural logarithmically transformed

In the first step, model 1 was estimated by regressing the Screening Transaction Costs variable (SCOST) on three control variables: the food processor's frequency of purchase from the main source (FREQ), processing investments (PINVEST) and the size of the food processor, which was measured by using annual sales volume (SALESVOL). The findings of this model indicated that FREQ and PINVEST are significantly associated with SCOST, and the cumulative effect of control variables explained significantly 3.9% of the variance in SCOST (R^2 adj = 0.039; $p < 0.05$). These results provided support for the effect of selected control variables on Screening Transaction Costs.

In the second step, model 2 was estimated by adding independent and moderating variables, including processor control (PROCON), perishability (PER), purchase volume (PURCH), the use of quality screening technology (TECHUSE), and the duration of the relationship (DURAT). The addition of these variables increased the explanatory power of the model significantly (R^2 adj = 0.457; R^2 change = 0.429 $p < 0.001$). Despite the increase in explanatory power, the effect of three variables, including PURCH, TECHUSE and DURAT were insignificant ($p<0.1$). Nonetheless, they were retained for subsequent use in the analysis of interaction effects as recommended by Hayes (2013).

Finally, in the third stage, the moderated multiple regression model was estimated by adding product terms to the third model as one block. It is noteworthy that when the product terms are added to the main effects' model (model 2), the coefficient of the predictor (PROCON) becomes the conditional effect on the dependent variable (SCOST). That is it reflects the influence of PROCON on SCOST when the value of the moderator it interacts with is zero. Nevertheless, in this study the value of zero is meaningful only for the dichotomy moderator, TECHUSE. For other moderating variables, including PERISH, PURCH and DURAT, the value of zero is outside their range of values collected from the field survey. Therefore, for the meaningful zero value, these variables were mean centered by subtracting the mean values from their respective variable values. This procedure transformed zero values of variables into mean values, which are meaningful.

Accordingly, the product terms were constructed from the mean centered variables and entered in model 2 to form model 3. The addition of product terms in the model explained significantly 7% of the variance in the Screening Transaction Costs, and this is captured by the change in a squared multiple correlation coefficient (R^2 change) from model 2 to model 3 (R^2 change = 0.07; $p<0.001$). Generally, the overall model explained about 51.7% of the variance in Screening Transaction Costs (R^2 adj = 0.517; $p< 0.001$). Nonetheless, before using the estimated regression model for testing the proposed hypotheses, it was examined for conformance with multiple regression assumptions.

7.5 Examination of the estimated MMR Model

The conformance to multiple regression assumptions is essential to ensure that the results obtained are the best results possible (Hair et al., 2010). Therefore, the estimated MMR model was examined for the assumption of linearity, normality, homoscedasticity and multicollinearity. The following subsections discuss these assumptions.

7.5.1 Linearity Assessment

Regression analysis is built on the assumption that the independent variables are linearly associated with dependent variables. That is the change in the dependent variable for every one-unit change in the independent variables is constant across the range of values of independent variables (Hair et al, 2010). The regression analysis does not capture the substantial nonlinear association between variables (Tabachnick and Fidell, 2007). Therefore, once the assumption of linearity is violated, it jeopardizes the meaningfulness of the interpretation of the regression coefficients (Hayes, 2013). This assumption was examined by visual inspection of the residuals' scatter plot of the regression of standardized residual (ZRESID) on y-axis and the regression standardized predicted value (ZPRED) on x-axis (see appendix 3A). The scatter plot of residuals did not indicate any systematic nonlinear pattern between x and y, which means that our model meets the assumption of linearity.

7.5.2 Normality Assessment

This assumption concerns the degree to which the distribution of data is consistent with normal distribution. It is the least important assumption in linear regression analysis. A number of studies (e.g. Hayes, 1996) have shown that only the most severe violations of the normality assumptions affect substantially the validity of statistical inferences if the sample is large (Hayes, 2013). The normality assumption can be examined by either statistical or graphical methods. In this study, we used both graphical and statistical methods.

Concerning the graphical methods, the normal probability plot (normal P-P plot), which is arguably the most reliable graphical approach, was chosen (Hair et al., 2010). In a normal probability plot, the normal distribution forms a diagonal line and the cumulative distribution of observed data must fall closely along the diagonal if the data are normally distributed. The visual inspection of the normal probability plot revealed this pattern with minor deviations to the left and right tails (see appendix 3B). Moreover, the skewness statistic was used to provide further support for the normality assumption. With an exception to the interaction effect of the use of quality screening technology and processor control (TECHUSE X PROCON), which had the skewness statistic value of 2.99, all other variables in our regression model had the skewness statistic values ranging from 0.416 to 1.183 (see table 7.3 below). These skewness values are within the recommended maximum threshold of 3 (Kline, 2011). Therefore, we can conclude that our MMR model meets the condition of normality.

Table 7.3: Descriptive Statistics and Heteroscedasticity Assessment

	Statistics				
Variables	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Skewness**
SCOST	1,00	7,00	3,186	1,470	,716
FREQ	,00	4,56	3,071	1,047	-1,116
PINVEST	1,67	7,00	5,186	1,378	-,636
SALESVOL	13,89	20,39	16,895	1,324	,480
PROCON	-1,70	4,30	-,173	1,414	1,384
PER	-2,44	3,56	-,078	1,915	,607
PURCH	-4,22	3,81	,005	1,517	,462
TECHUSE	,00	1,00	,207	,407	1,460
DURAT	-1,06	1,58	-,016	,646	,416
PER X PROCON	-6,04	14,22	,711	3,322	1,411
PURCH X PROCON	-7,93	7,17	-,024	2,020	-,684
DURAT X PROCON	-2,12	4,40	,223	,946	1,183
TECHUSE X PROCON	-1,70	3,97	,021	,696	2,990

7.5.3 Homoscedasticity Assessment

The estimated regression model is said to meet the assumption of homoscedasticity when the variance of the residuals in the prediction of dependent variable scores is the same for all predicted scores (Pallant, 2011). When this assumption is not met, the relationship between the independent and dependent variables is termed as heteroscedastic, and the presence of this problem in the regression model affects the validity of inference, standard error, and it reduces the statistical power of hypotheses tests (Hayes, 2013). In this study, the problem of heteroscedasticity was examined by visual inspection of the scatter plot of the standardized residual versus standardized predicted value, which showed a low level of homoscedasticity violation (see appendix 3A). However, a moderate violation of homoscedasticity assumption is not a serious threat to multiple regression analysis (Hayes, 1996). Additionally, the most common source of heteroscedasticity is the skewed distribution of variables (Hair et al., 2010). The skewness statistic's values of all variables in our MMR model were within the recommended maximum threshold of three as shown in the normality assessment in table 7.3 above. In this regard, heteroscedasticity is not a serious problem in our estimated model. Thus, we proceeded with an assessment of the multicollinearity assumption.

7.5.4 Multicollinearity

Multicollinearity is the situation where one independent variable is highly correlated with other independent variable(s) (Hair et al., 2010). When independent variables are highly correlated among themselves, the unique contribution of each independent variable is difficult to assess, and this is because of the shared variance between independent variables (Ho, 2006). Consequently, multicollinearity tends to reduce the predictive ability of the regression model. It may also affect the estimation of the regression coefficients and their statistical significance tests, and in some situations, it may lead to an incorrect sign of the effect of independent variables (Hair et al., 2010).

The problem of multicollinearity occurs because what appear to be separate variables in the model are actually measuring the same concept (Kline, 2011). Another possible cause of this problem is the inclusion of product terms and their constituent variables in the same model. Concerning product terms, the variables forming product terms were mean centered to curb the potential threat of multicollinearity (Aiken and West, 1991; Rokkan et al., 2003). In addition, the possible presence of a multicollinearity problem in the overall model was examined using a variance inflation factor (VIF) as indicated in the MMR model in table 7.2. The literature (e.g., Ho, 2006; Hair et al., 2010; Pallant, 2011; Kline, 2011) suggests that a VIF greater than 10 always indicates a problem of multicollinearity. With an exception to sales volume and purchase volume, which had VIFs of 3.13 and 3.76 respectively, the VIF of the remaining terms in the estimated MMR model (model 3) ranged from 1.22 to 1.92. From these findings, we can conclude that the multicollinearity is not seemed to be a problem in our model.

7.6 Validation of the Estimated MMR Model

The objective of validation at this stage is to examine how well the estimated MMR predicts Screening Transaction Costs or the extent to which it is less sample specific. The estimated regression model can be validated by examining the extent to which it matches the existing theoretical models or set of previous validated results on the same issue. However, in many instances the prior theories or results are rarely available (Hair el., 2010). Thus, in the study, we used empirical validation. The literature has proposed different empirical validation approaches, including (1) additional or split samples, (2) leave-one-approach, and (3) comparison of the predictive power of different regression models (Hair et al., 2010).

The additional sample approach involves a collection of the new sample, estimating the new regression model and comparing it to the original regression model in terms of signs, size, and relative importance of variables and predictive accuracy. In many instances, collection of a new sample is difficult due to cost, time pressure and availability of respondents. Alternatively, the available sample can be divided into two samples, whereby one sample is used to estimate the regression model, and the remaining sample is used to validate the estimated regression model (Hair et al., 2010). The additional sample approach was impossible in this study due to cost implications, difficulties in locating respondents and time constraints. Similarly, the split sample approach was ruled out due to sample size (N=137).

Accordingly, we opted for a comparison of the predictive power of the MMR model estimated from the full sample with MMR models estimated from two randomly selected subsamples as suggested by Hair et al. (2010). Following the recommendation of Field (2009), each validation sub-sample was drawn to represent 80% of the sample. In this approach, when the powers of the MMR models estimated from the validation subsamples change significantly, the accuracy of the MMR model estimated from the full sample is questionable, and it cannot be generalized (Field, 2009). The results of the analysis showed that the difference between the adjusted R^2 value of the full sample model and validation sub-sample one was 0.009, whereas for the validation of the second sub-sample was 0.043 (see table 7.4 below). These differences are within the 5% variation recommended as a threshold in the literature (e.g., Tsai Eliasziw and Chen, 2012) for a valid model. In this regard, we concluded that our estimated MMR model can satisfactorily predict the variation in Screening Transaction Costs, and therefore, can be used to test the hypotheses proposed in chapter 3.

Table 7.4: Overall Model fits of the full sample and validation samples

Statistic	**Samples**		
	Full sample	**Validation Subsample 1**	**Validation Subsample 2**
Multiple R	0.748	0.749	0.731
Coefficient of determination (R^2)	0.56	0.561	0.535
Adjusted R^2	0.517	0.508	0.474
Standard error of estimation	1.022	1.037	1.026
$F_{\text{full sample}}(12, 122) = 12.935$; $p < 0.001$			
$F_{\text{subsample 1}}(12, 99) = 10.556$; $p < 0.001$			
$F_{\text{subsample 2}}(12, 92) = 8.804$; $p < 0.001$			

7.7 Hypotheses testing

The regression analysis tests the null hypothesis that the coefficient of the independent variable is equal to zero (H0: $b_i = 0$). The rejection of this hypothesis provides support for the research hypothesis. In this regard, the final estimated multiple regression model in table 7.2 above was used to test the proposed hypotheses in chapter three. The first hypothesis (H1) was tested by using the main effect model (Model 2) and the moderated hypotheses (H2, H3, H4 and H5) were tested by using the moderate regression model (Model 3).

7.7.1 Hypothesis one (H1)

This hypothesis states that there is a positive association between the degree of perishability and Screening Transaction Costs. The objective of this hypothesis was to examine whether the degree of perishability of produce affects the Screening Transaction Costs incurred by the food processor. The results indicate the presence of a significant positive association between the degree of perishability of produce and Screening Transaction Costs incurred by the food processor ($b= 0.581$, $t = 10.117$, $p < 0.001$), which provides strong support for the proposed hypothesis.

7.7.2 Hypothesis two (H2)

The objective of this hypothesis was to examine whether the perishability of produce moderates the effect of the processor control on Screening Transaction Costs and the nature of its moderating effect. The statistical results indicate the presence of a negative effect of the interaction of the degree of perishability and processor control (PER x PROCON) on Screening Transaction Costs (SCOST) ($b = - 0.119$, $t = -3.253$, $p < 0.001$). This means that the increase in the level of processor control decreases Screening Transaction Costs significantly when the level of perishability increases.

To achieve a clear visualization of this interaction effect, we did the analysis of the coefficient of processor control (PROCON) from the moderated regression (model 3 in table 7.2) at different levels of perishability as recommended by Hayes (2013). This analysis was implemented by performing a partial derivative of the moderated regression equation (model 3), and the resulting model was graphed as shown in figure 7.2 below. The graph demonstrates the negative trend in the association between processor control and Screening Transaction Costs ($\partial SCOST/\partial PROCON$) when the level of perishability increases (PER).

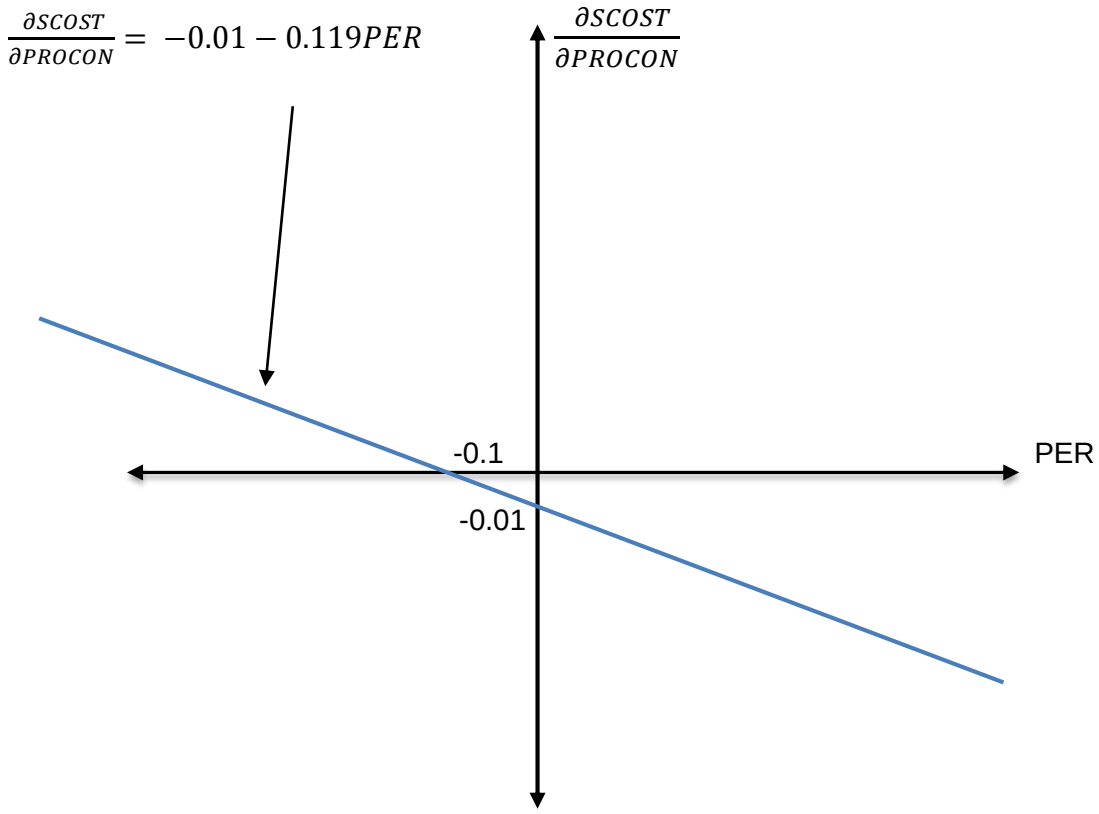


Figure 7.2: The association between processor control and Screening Transaction Costs for different levels of perishability

The interaction effect was further probed by examining the nature of the relationship between the processor control and the Screening Transaction Costs as the degree of perishability increases from 2 standard deviation below its mean to 2 standard deviation above its mean as indicated in table 7.5 below.

Table 7.5: Slope Analysis with degree of Perishability (PER) as a moderator

$\frac{\partial SCOST}{\partial PROCON} = -0.01 - 0.119PER$	Degree of perishability				
	Very low (-2σ)	Low (-σ)	Medium (mean)	High (+1σ)	Very high (+2σ)
Effect of processor control (PROCON) (b)	0.46	0.23	-0.001	-0.23	-0.46
(t-values)	(t=2.58)**	(t=1.80)*	(t=-0.01)ns	(t=-2.61)**	(t=-3.78)***

* indicates significant at p < 0.05; **significant at p <0.01; *** significant at p<0.001; ns indicates not significant; σ is standard deviation

From the trend in table 7.5 above, the effect of processor control on Screening Transaction Costs becomes more negative as you move from a very low degree of perishability (2 σ below the mean) to a very high degree of perishability (2 σ above the mean). Moreover, it appears that the effect is strongly negative at a very high degree of perishability ($b = -0.47$, $t = -3.8$, $p < 0.001$). In general, the analysis provides strong support for our hypothesis as originally proposed and demonstrates that the increase in the degree of perishability enforces the negative effect of processor control on Screening Transaction Costs.

7.7.3 Hypothesis Three (H3)

In this hypothesis, it was posited that the association between processor control and Screening Transaction Costs is more negatively enforced when the purchase volume increases. The objective of this hypothesis was to examine whether the effect of processor control (PROCON) on Screening Transaction Costs (SCOST) is contingent on the food processor's volume of purchase (PURCH). This hypothesis was captured by the coefficient of the interaction between processor control and Screening Transaction Costs (PURCH x PROCON), which was negative and significant ($b = -0.103$, $t = -1.708$, $p < 0.05$). This significant negative coefficient means the effect of processor control on Screening Transaction Costs is more negative when the transaction involves large purchase volume. This effect is elaborated further by the graph in figure 7.3 below, which was constructed from the partial derivative of the moderated regression equation (model 3 in table 7.2) with respect to processor control while holding all other variables in the model constant.

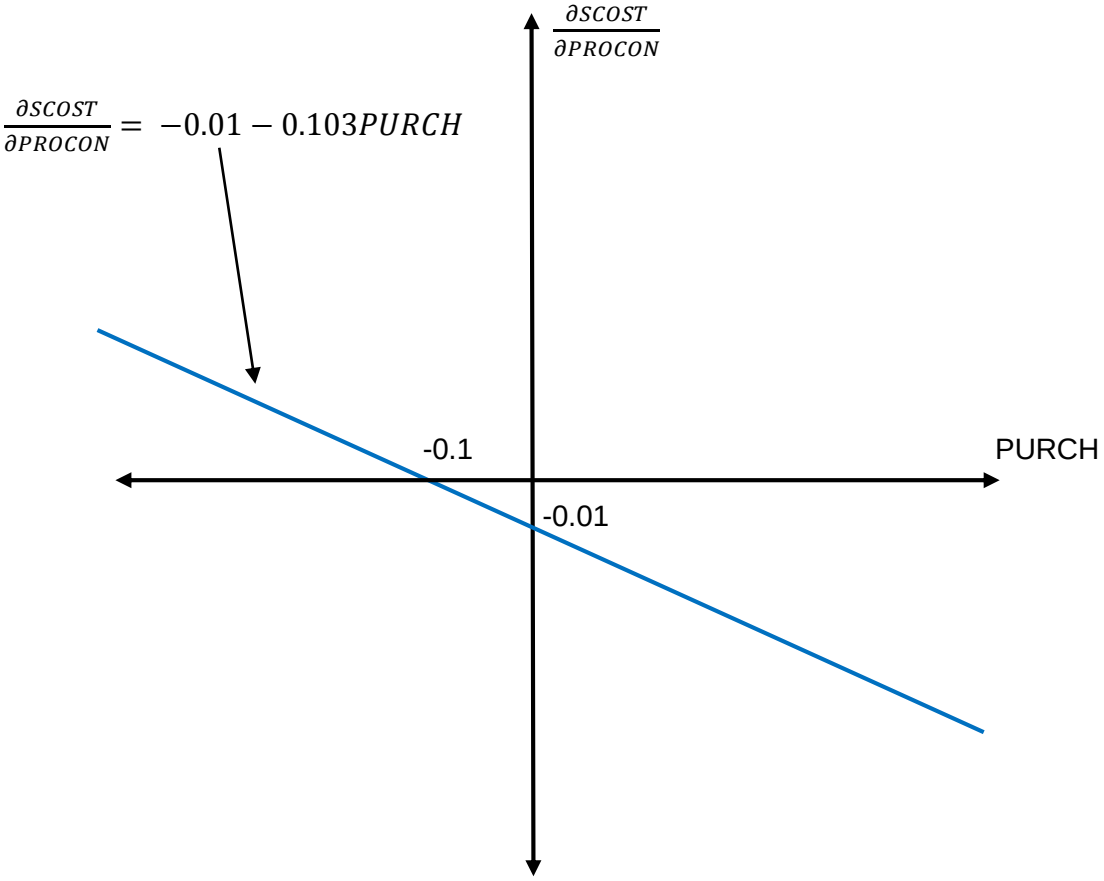


Figure 7.3: The association between processor control and Screening Transaction Costs for different levels of purchase volume.

The interaction effect of processor control and purchase volume on Screening Transaction Costs was further probed by using a "picking a point strategy" in which the values of purchase volume deviating by +/- 1-2 standard deviations from the mean were plugged into the partial regression equation used to construct the graph in figure 7.3 above. The results indicated that the association between processor control and Screening Transaction Costs ($\partial SCOST/\partial PROCON$) becomes more negative as the purchase volume increases (see table 7.6 below). Nonetheless, even though the overall moderating effect of purchase volume was significant (b = - 0.103, t = - 1.708, $p < 0.05$), it appears that its effect is weak and noticeable at very low or high purchase volumes (+/- 2 standard deviations).

Table 7.6: Slope analysis with purchase volume (PURCH) as a moderator

$\frac{\partial SCOST}{\partial PROCON} = -0.01 - 0.103PURCH$	Levels of purchase volume				
	Very low (-2 σ)	Low (-σ)	Medium (mean)	High (+1σ)	Very high (+2 σ)
Effect of processor control (PROCON) (b)	0.30	0.15	-0.01	-0.17	-0.32
(t-values)	(t=1.54)$^{+}$	(t=1.23)^{ns}	(t= -0.12)^{ns}	(t= -1.17)^{ns}	(t=-1.43)$^{+}$

$^{+}$ indicates significance at $p < 0.1$; ns indicates not significant; σ is standard deviation

7.7.4 Hypothesis Four (H4)

This hypothesis posited that the association between processor control (PROCON) and Screening Transaction Costs (SCOST) is less negatively shaped as the relationship ages, and the objective of this hypothesis was to assess if the length of the relationship between food processors and farmers influences the effect of processor control on Screening Transaction Costs. The statistical results indicated that the interaction of processor control and the duration of the relationship between food processor and farmer is positively associated with Screening Transaction Costs ($b = 0.229$, $t = 2.111$, $p < 0.05$). This means that in a relationship with a long history, the processor is better off by decreasing the level of control. This interaction effect is depicted graphically in figure 7.4 below which was constructed from the partial derivative of the moderated regression equation (model 3 in table 7.2) with respect to processor control while holding all other variables in the model constant.

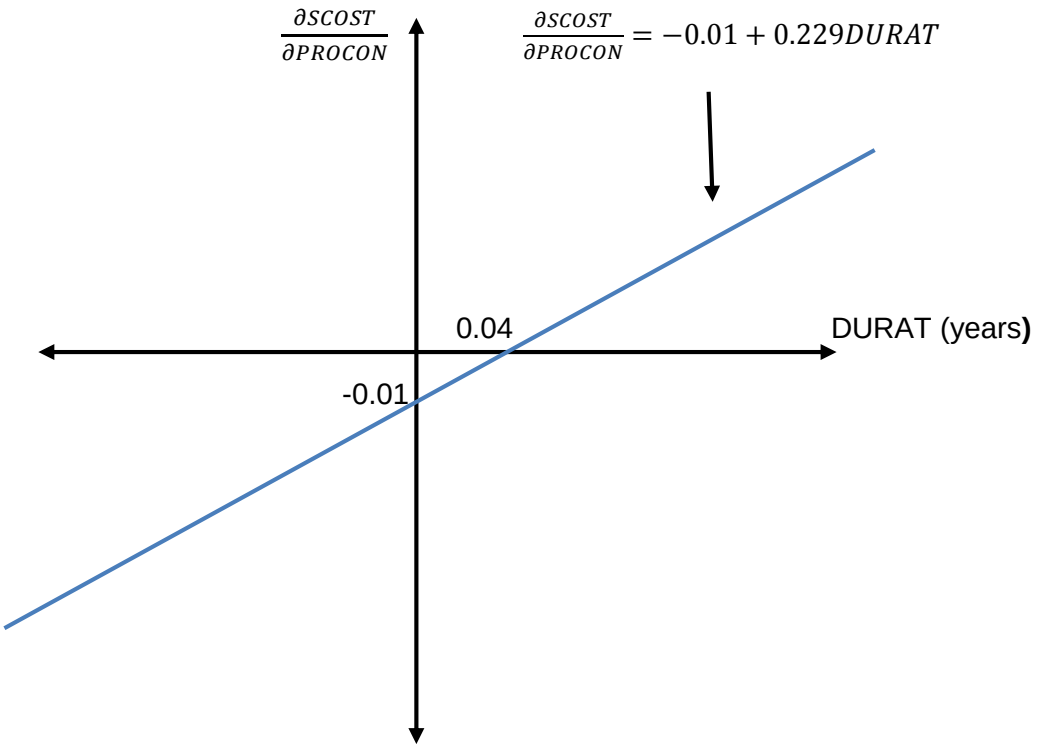


Figure 7.4: The association between processor control and Screening Transaction Costs for different levels of relationship duration

The interaction effect of processor control and the duration of relationship (DURAT X PROCON) on Screening Transaction Costs was further probed by plugging the values equal to +/- 1-2 standard deviation around the mean of the relationship duration into the equation used to construct the graph in figure 7.4 above. The aim of this procedure was to examine the pattern of the effect of processor control (PROCON) on Screening Transaction Costs (SCOST) when the duration of the relationship between food processors and farmers decreases below or increases beyond its mean value. The empirical findings demonstrated that the effect of processor control on Screening Transaction Costs ($\partial SCOST/\partial PROCON$) is less negatively shaped as the duration of relationship increases (see table 7.7 below), and for a relationship with a long history (2σ above the mean), the effect is more positive (b = 0.29, t = 1.89, p < 0.05).

Table 7.7: Slope analysis with duration of relationship (DURAT) as a moderator

$\frac{\partial SCOST}{\partial PROCON} = -0.01 + 0.229DURAT$	Levels of relationship duration				
	Very low (-2σ)	Low (-σ)	Medium (mean)	High (+1σ)	Very high (+2σ)
Effect of processor control (PROCON)(b) (t-values)	-0.31 (t=-1.69)*	-0.16 (t=-1.28)+	-0.01 (t= -0.15)ns	0.13 (t= 1.33)+	0.28 (t=1.89)*

* significant at p < 0.05; + significant at p < 0.1; "ns" means not significant; σ is standard deviation

7.7.5 Hypothesis five (H5)

This hypothesis focused on the moderating effect of the use of quality screening technology and posited that the association between processor control and Screening Transaction Costs is more negatively shaped when the food processor uses quality screening technology than when the food processor does not use quality screening technology. The objective of this hypothesis was to examine whether the use of technology for screening the quality of produce does affect the impact of processor control on Screening Transaction Costs. The empirical findings from the estimated moderated multiple regression model (see model 3 in table 7.2) demonstrated a significant coefficient of the interaction between the use of quality screening technology and processor control (TECHUSE x PCONT) (b = -0.368, t = - 2.297, p < 0.05). Thus, there is a significant difference in the effect of processor control on Screening Transaction Costs among food processors that use technological instruments for quality screening and those, which do not use technological instruments for quality screening. The moderating effect of technology is depicted in figure 7.5 below.

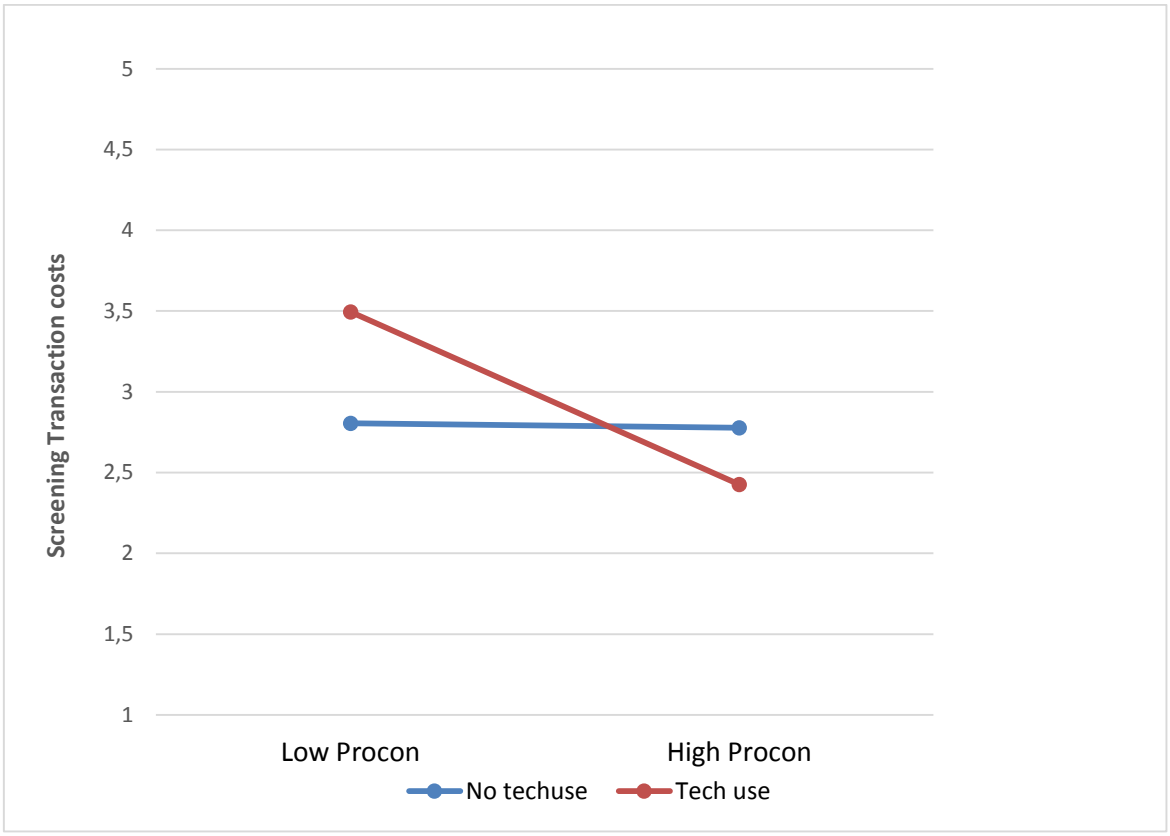


Figure 7.5: The association between processor control and Screening Transaction Costs for users and non-users of technological instruments for quality screening.

The contingent effect of the use of technological instruments was further probed by examining the effect of processor control on Screening Transaction Costs among the group of food processors who use technological instruments for quality screening purposes and those that do not use technological instruments (see table 7.8). The empirical findings from this analysis indicated that the effect of processor control on Screening Transaction Costs is more negative and significantly enforced for food processors who use technological instruments for quality screening than for those which do not use technological instruments ($b = -0.379$, $t = -2.603$ $p < 0.01$).

Table 7.8: Slope analysis with quality screening technology (TECHUSE) as a moderator

$\frac{\partial SCOST}{\partial PRCONT} = -0.01 - 0.368TECHUSE$	Firm's technology use status	
	Do not use = 0	Use = 1
Effect of processor control (PROCON) (b) (t-values)	-0.01 (t = - 0.117)^{ns}	-0.379 (t = - 2.603)**

** significant at p < 0.01; "ns" means not significant

7.7.6 The findings of the control variables

In the first step of regression model estimation, the effect of processing investments on Screening Transaction Costs was negative and significant (b= -0.148, t = -1.461; p < 0.1). Similarly, the frequency of transaction was significantly negatively associated with Screening Transaction Costs (b= -0.244, t = -1.974; p < 0.05). However, in the moderated multiple regression model (Model 3), only the frequency of transaction was significantly associated with Screening Transaction costs (b= -0.17, t = -1.824; p < 0.05). This means that as the frequency of transactions between the food processor and the main farmer increases, the Screening Transaction Costs decrease.

7.8 Chapter summary

The main objective of this chapter was the estimation of model and hypotheses testing. Accordingly, the chapter has presented the estimation of the model using the moderated multiple regression method (MMR model). In addition, the chapter has presented the techniques, which were used to assess the estimated MMR model for conformance with multiple regression assumptions. The subsequent section and subsections of this chapter focused on testing the hypotheses presented in chapter three, and the findings demonstrated strong support for our hypotheses. Furthermore, the chapter provides the elaboration of the moderating hypotheses (H2, H3, H4 and H5) using a graphical method and "picking a point strategy". The next chapter focuses on the discussion of the findings from this chapter.

CHAPTER 8

DISCUSSION AND IMPLICATIONS

CHAPTER 8

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8.1 Introduction

This study has investigated the moderators of the effect of processor control on Screening Transaction Costs. Four moderating variables were considered, including the degree of produce perishability, purchase volume, the duration of relationships between food processors and farmers and the use of technology for quality screening. In addition, this study paid attention to the main effect of the degree of perishability on Screening Transaction Costs. Thus, this chapter presents the discussion of the findings of the hypotheses tested in chapter seven. Specifically, this chapter presents the theoretical implications of our findings, methodological implications, managerial implications, policy implications, limitations to the study and areas for further research.

8.2 Summary of the Study

Before proceeding with a discussion of the findings, it is worth reflecting on the main research question, objectives and the main findings of the study. This research was guided by the following research question: *What factors moderate the effect of control mechanisms on ex-post transaction costs?* and the main objective was to investigate factors that moderate the effect of processor control on Screening Transaction Costs. The specific objectives involved examining:

- The effect of the degree of perishability of transacted produce on Screening Transaction Costs.
- The effect of the degree of perishability of transacted produce on the association between processor control and Screening Transaction Costs.
- The effect of the purchase volume on the association between processor control and Screening Transaction Costs.
- The effect of the duration of the relationship between the food processor and farmer on the association between processor control and Screening Transaction Costs.
- The effect of the use of technological instruments for quality screening on the association between processor control and Screening Transaction Costs.

Each of the specific research objectives above was translated into a research hypothesis. The first hypothesis (H1) focused on the main effect of the degree of perishability on Screening Transaction Costs consistent with the first specific objective. The remaining four hypotheses (H2, H3, H4 and H5) focused on the moderating effect of the degree of perishability, purchase volume, the duration of the relationship between food processors and the farmers, and the use of technological instruments for quality screening on the association between processor control and Screening Transaction Costs. The degree of perishability was hypothesised to have a positive main effect on Screening Transaction Costs, whereas its moderating effect was hypothesised to be negative. The moderating effects of the purchase volume and the use of technological instruments for quality screening were hypothesized as negative, whereas, the moderating effect of the duration of the relationship was hypothesised as positive, and all five hypotheses received significant empirical support. The table below summarises the findings of our hypotheses.

Table 8.1: Summary of hypotheses and findings

Type of hypothesis	**Hypotheses**	**Hypothesised Effect**	**Findings**	**Significance**
Main effect	H1	Positive	Supported	$p < 0.001$
Interaction effects	H2	Negative	Supported	$p < 0.001$
	H3	Negative	Supported	$p < 0.05$
	H4	Positive	Supported	$p < 0.05$
	H5	Negative	Supported	$p < 0.05$

8.2 Theoretical implications

Perishability is underscored in literature as one of the key product characteristics that poses challenges to the management of the supply chain (Clement et al., 2008), and it has attracted research interest from different fields of research, including supply chain management (Blackburn and Scudder, 2009) and inventory management (Lian et al., 2009). It has also received attention in marketing (Byun and Sternquist, 2012) and finance research (Lievens and Moenaert, 2001). In recent years, the number of studies focusing entirely on the concept of perishability has started to emerge (Amorim et al., 2013). Such a surge of research on the concept of perishability highlights an increasing appreciation of the role this concept plays in management and strategic decisions.

Accordingly, seeking to add knowledge to the earlier research on the concept of perishability and transaction cost theory, this study focused on the effect of the degree of produce perishability on the Screening Transaction Costs, an area that has received limited attention by researchers. Following on the effect of perishability on quality uncertainty (performance ambiguity) discussed in chapter two, we used the uncertainty dimension of TCT to build arguments for a positive association between the degree of produce perishability and Screening Transaction Costs incurred by the food processor. Our findings provided significantly positive support for this association.

This means that the characteristics of a transacted produce play a significant role in the transaction cost analysis, and in particular, the degree of perishability. As highlighted in chapter two that the increase in the degree of perishability of transacted produce tends to increase quality uncertainty (performance ambiguity) faced by the buyer (food processor) (c.f. Hobbs and Young, 2000; Tita et al., 2011). Thus, as the degree of perishability increases, the Screening Transaction Costs in terms of inspection and sorting are expected to increase. This finding is consistent with earlier studies (e.g., Jangwe, 2011) which suggested that transaction costs are higher for produce with a high degree of perishability than for produce with a low degree of perishability. However, it differs from the existing studies by investigating this relationship from the buyer's (food processor) perspective and conceptualising transaction costs in this perspective.

In this study, we acknowledge the TCT premise that the transaction costs are caused by uncertainty surrounding the transaction among other dimensions of transaction suggested in the literature (e.g., Williamson, 1985; Kabadayi, 2011). However, we extended knowledge on this premise by showing that the transaction costs may also be caused by the characteristics of the transacted product. This finding is important, particularly because it underscores the fact that sources of transaction costs are not limited to well-established dimensions of transaction such as uncertainty. Therefore, it is worthwhile investigating other sources of transaction costs, including the characteristics of the transacted produce/products by taking advantage of their links with the established dimensions of transactions.

The core of TCT is the axiom that characteristics of the transaction give rise to transaction difficulties, and that buyer control can be used to minimize the resulted transaction costs. Buyer control is regarded in the literature as a specialized governance structure, which is required under particular conditions of transactions (Heide and John, 1992). This view emphasizes that even though buyer control can decrease transaction costs, its use is contingent on the characteristics of the transaction environment. This reasoning is termed by Williamson as the discriminating alignment hypothesis (see Williamson, 2008).

Accordingly, by using the degree of perishability as a contingent factor, the empirical analysis in this study provides significantly strong support for the discriminating alignment hypothesis and demonstrates that an increase in buyer control reduces Screening Transaction Costs significantly when a transaction involves produce with a high degree of perishability. For instance, in the transaction of produce such as tomatoes, a food processor can reduce Screening Transaction Costs significantly by increasing control of a farmer's activities, compared to transactions of less perishable produce such as grains, including finger millet and maize. This interaction effect of processor control and the degree of perishability has extended our knowledge of the discriminating alignment reasoning by considering characteristics of the transacted produce as a contingent factor on the effect of control and Screening Transaction Costs. Additionally, our findings concerning the degree of perishability of a transacted produce have added more validity to Rindfleisch et al's (2010) idea that consideration of a contextual variable such as the characteristics of goods and services being transacted is one area for advancing knowledge on TCT. In the same way, our findings emphasis Masten's (2000) argument that agriculture is a rich area for advancing knowledge of TCT.

Furthermore, our study has demonstrated the importance of purchase volume in buyer control decisions in a unique way. Traditionally, most studies have paid limited attention to the role of purchase volume in the organisation of economic transactions and treated it as a control variable (e.g. Buvik and Andersen, 2002; Buvik et al., 2014). Despite the limited attention, purchase volume has consistently been shown to have a positive and significant effect on ex-post transaction costs (Buvik and John, 2000; Buvik and Andersen, 2002; Buvik, 2002b). Other studies (e.g., Cai et al., 2010) have tried to build an argument for the negative effect of purchase volume concentration on transaction costs in dealing with an individual supplier, but have failed to provide significant empirical support. This failure has helped to strengthen the case for the positive effect of the purchase volume on the transaction costs. Additionally, other studies (e.g. Buvik and Andersen, 2011; Buvik et al, 2014) have provided evidence for the positive impact of the purchase volume on buyer control. That is, purchase volume is likely to increase the need for buyer control. Thus, following on from the aforementioned studies, we view purchase volume as an important variable that deserves more attention in control decisions.

Accordingly, the key contribution of this study regarding purchase volume resides in demonstrating its contingent effect on the association between buyer control (processor control) and Screening Transaction Costs. The concentration of purchase volume in a single supplier relationship tends to raise the economic stake of the buyer, and therefore, reflects the importance of the transaction (Andersen and Buvik, 2001). Nonetheless, purchase volume concentration does not automatically imply superior supplier performance. That is a supplier may not necessarily improve its performance because the buyer is purchasing in large quantities, and the literature (e.g., Cai, et al., 2010) has indicated that such a situation is rare. Thus, for quality assurance, food processors are motivated to increase their control of the aspects of transaction that are likely to affect the quality of the produce, including the decision regarding the time of harvest, harvest practice, packaging, loading and offloading conditions. This practice is likely to reduce the Screening Transaction Costs involved in quality assurance activities, including inspection and sorting activities, and the decrease in Screening Transaction Costs is likely to be high in transactions involving large purchase volume. Our empirical evidence provides significant support for this reasoning and emphasizes the moderating role of purchase volume on the influence of buyer control on Screening Transaction Costs.

The duration of the relationship between food processors and farmers was also considered in this study as a key issue in buyer control decisions that requires research attention. The duration of buyer-supplier relationships has attracted the interest of researchers for some time (Buvik and Halskau, 2001; Buvik, 2002a; Yen and Barnes, 2011) and the knowledge about this issue has continued to grow in recent years (Talay and Akdeniz, 2014). Much of the research interest has been on the way the duration of a relationship influences transaction costs (Buvik, 2002a; Buvik and John, 2000) and buyer control (Buvik et al., 2014). Another stream of research has treated the duration of a relationship as a dependent variable and focused on the way relational choices are influenced over time by variables such as buyer performance and environmental uncertainty (Fink, James and Hatten, 2008).

Accordingly, this study contributes to the knowledge on relationship duration by treating the duration of relationships as a decisive contingent factor for the association between processor control and Screening Transaction Costs. Even though our empirical findings have indicated that the duration of relationships has no significant main effect on Screening Transaction Costs, its interaction effect with processor control on Screening Transaction Costs was significantly positive. That is, as the duration of a relationship develops, the increase in processor control may cause Screening Transaction Costs to increase. Thus, it is not beneficial for the food processor to increase control in transactions with a long history of relationships.

That is, in the early stages of the relationship, transactions are characterized by a low level of expectation for continuity (Cao and Lumineau, 2015), a low level of trust, a high level of uncertainty (Fink et al., 2008) and a high probability for opportunism. Accordingly, suppliers (farmers) are more likely to focus on short-term gains at the expense of long-term gains such as market assurance. Therefore, buyers (food processors) are less willing to rely on suppliers in the early stages since their behaviour is unpredictable and their performance is uncertain, and for quality assurance purposes, food processors are motivated to engage in controlling farmers' decisions and screening the quality of the produce.

As transactions between food processors and farmers repeat over time, farmers' (suppliers) demonstration of trustworthy behaviour in previous transactions provide a rationale for the food processors to believe that the farmers would hardly deviate from this behavioural pattern. In this regard, the quality uncertainty surrounding the transaction and the food processor's perception of opportunism diminish. As a result, the food processor should reduce control and delegate it to its supplier (Ryu, Lim and Hong, 2009). In the same way, Screening Transaction Costs, including sorting and inspection costs are expected to decrease. Thus, the duration of a relationship may serve as a governance mechanism and reduce the need for processor control.

Lastly, this study has paid attention to the moderating effect of quality screening technology on the association between processor control and Screening Transaction Costs. The application of information technology (IT) on economic transactions is well-documented (Clemons, Reddi and Row, 1993; Müller and Seuring, 2007; Cordella, 2006) and the general hypothesis is that the use of information technology reduces transaction costs (Müller and Seuring, 2007). However, the aforementioned hypothesis is viewed as too simplistic (Müller and Seuring, 2007). That is, IT does not always reduce transaction costs (Cordella, 2006). In some situations, it may increase transaction costs depending on its level of specificity and its influence on opportunism (Müller and Seuring, 2007).

Earlier studies on the impact of IT on transaction costs demonstrated that the reduction in transaction costs, including information search, exchange and processing costs can be achieved by making use of IT in economic transactions (Clemons, Reddi and Row, 1993). However, the reduction in such costs can be experienced in both market transactions and within organizations (hierarchies). Accordingly, these transaction costs can hardly explain the influence of IT on the choice of vertical coordination forms. Thus, approaching the impact of the IT use in buyer-supplier relationships from the perspective of TCT related variables, including opportunism, specificity and uncertainty can provide clear explanations for its impact on transaction costs and the choice of vertical coordination, and may provide an avenue for theoretical contributions (Müller and Seuring, 2007).

Our study used arguments of uncertainty and opportunism to examine the influence of the use of technological instruments such as moisture meters on the association between processor control and Screening Transaction Costs. The empirical evidence has demonstrated that the ability of processor control to reduce Screening Transaction Costs is significantly enforced when technological instruments are introduced as complementing control mechanism. That is, while food processors can reduce Screening Transaction Costs by increasing control of the aspects of the transaction that affect quality, the Screening Transaction Costs can be reduced further by introducing technological instruments because of their ability to examine both hidden and unhidden quality characteristics of produce. It follows that technological instruments can reduce the quality uncertainty and the potential for supplier opportunism significantly, and consequently food processors incur low Screening Transaction Costs.

8.3 Methodological implications

The main methodological contribution of this study concerns the operationalisation of the perishability and Screening Transaction Costs constructs. Even though a number of studies (e.g., Hobbs and Young, 2000), have conceptually emphasized the effect of perishability on transaction costs, little effort has been put on its operationalisation. Some earlier studies (e.g., Apte, 2010) have operationalised perishability as a dichotomy variable and categorised produce into two groups: perishable and non-perishable produce. Other studies from the service industry (e.g., Lievens and Moenaert, 2001; Cloninger and Oviatt, 2006) and food industry (e.g., Wansink, 1994) have tried to operationalise the perishability concept using multiple items. However, the operationalisation of this concept in the service industry is not entirely applicable to the manufacturing industry. Consequently, borrowing a leaf from existing studies in the service and food industry, the present study has conceptualised perishability as a multi-item construct and developed a rather comprehensive scale for measuring it. Even though our operationalisation still needs further validation, it has set a stage for future studies on this concept.

Most of the transaction cost theory studies have operationalised ex-post transaction costs as a single construct (e.g., Buvik, 2002a; Buvik and Andersen, 2002) and very few studies (e.g., Dahlstrom and Nygaard, 1999; Artz and Brush, 2000) have considered the components of ex-post transaction costs. For instance, Artz and Brush (2000) focused on renegotiation costs, and Dahlstrom and Nygaard (1999) focused on negotiation costs, monitoring costs and maladaption costs. Our study has focused on the Screening Transaction Costs. This component of ex-post transaction costs is not new (see Ruben et al., 2007; Loader and Hobbs, 1996); nevertheless, to the best of our knowledge, its operationalisation is still lacking. Therefore, this study has contributed to the existing studies by developing measurement items of Screening Transaction Costs in the agricultural industry context. Thus, future studies may consider using these measurement items.

8.4 Managerial implications

As described in chapter one, competition is one of the challenges facing food processing firms today. As the liberalization of markets gains ground, local food processors in most countries are losing some of the protection they used to have from foreign competitors (Dietz et al., 2000). For example, a study conducted by Kinabo (2004) indicated that 80% of food sold in the supermarkets in Tanzania was imported and only 20% was locally manufactured. However, the competition is not only between imported and locally manufactured products, but also among local manufacturers, and in the worst-case scenario, some poorly performing food processors are pushed out of business (Ruteri and Xu, 2009).

Thus, increasing control between food processors and suppliers of produce is seen as a means of improving competitiveness and quality of purchased produce (Ortmann, 2001). However, the practitioners in the food processing industry need to apply control in a discriminatory fashion. Our study has underscored this issue by showing that the effect of processor control on Screening Transaction Costs is contingent on several factors, including the degree of perishability of the transacted produce, purchase volume, the use of technological instruments and the duration of the relationship.

Perishable produce has a short shelf life, soft tissue, high vulnerability, and a high level of moisture (Parfitt et al., 2010). In this regard, the quality of perishable produce is easily affected by transportation delays, processing delays, poor harvest practice, improper packing and handling practice. Moreover, perishability tend to raise the risk of contamination. Thus, quality assurance efforts such as inspection and sorting for damaged produce in perishable produce transactions tend to increase the Screening Transaction Costs (Jaffee, 1992). Therefore, food processors should increase control of aspects of the transaction that may affect quality. This includes harvest time, harvest practice, loading and offloading practices, and transportation. In this way, quality uncertainty (performance ambiguity) may be reduced and consequently so do the Screening Transaction Costs.

Several examples that are in line with the managerial implication of the degree of perishability suggested above can be found in existing literature. Foss (1996) described the perishability characteristics of fruit and vegetables as a source transaction cost due to its impact on variability and recommended that the food processor should increase control in this case to reduce quality variability. Likewise, Lo's (2010) study concluded that perishability is a key motive for close vertical coordination in the transactions of fruit and vegetables because of its influence on opportunism. Furthermore, Masten (2000) described perishability as a factor influencing tuna processors to enter into exclusive contracts with tuna captains to reduce wasteful inspection and sorting.

Despite the ability of the processor control to reduce Screening Transaction Costs, the increase in control adds costs to food processors. In this regard, increasing control without considering the characteristics of the transacted produce may add unnecessary costs. Therefore, the association between processor control and Screening Transaction Costs can be viewed as a cost efficiency problem. That is, food processors need to consider the trade-off between costs of control and Screening Transaction Costs, and increase control if the costs associated with it are justified by the decrease in Screening Transaction Costs, and this is likely to happen in the transaction of perishable produce due to their quality vulnerability and variability.

The managerial implications of the moderating effect of purchase volume can be seen by viewing the findings concerning this variable through the lenses of supply base literature in which the increase in the purchase volume allocated to one supplier can be related to supply base reduction (Cai et al., 2010). The supply base reduction and concentration of purchase to a few suppliers has several benefits, including (1) a limited number of contacts with suppliers, (2) quantity discounts, (3) reduced logistical costs, (4) improved buyer-supplier relationships, (5) improved trust, and (6) high quality performance (Goffin et al., 1997; Chen and Paulraj, 2004). Accordingly, purchase volume concentration on a few suppliers may acts as a governance mechanism when we consider its ability to promote quality performance, and norms of trust and cooperation (Cai et al., 2010).

Nevertheless, food processors need to be aware that the practice of purchasing a large amount of produce from one supplier (farmer) increases the economic stake in a transaction (see Buvik and Andersen, 2002; Buvik and Andersen, 2011). Additionally, there is no guarantee that the allocation of a large purchase volume to one supplier would improve performance (Cai et al., 2010) and shield the buyer (food processor) from a supplier's opportunistic behaviour. Moreover, in the case of poor quality delivery and opportunistic behaviour, food processors with large purchase volume may suffer severe loss. As such, food processors must engage in controlling farmers' activities that can affect the quality in the early stages of the relationship. In so doing, they may reduce the probability of opportunism, as well as reducing quality uncertainty and Screening Transaction Costs.

Moreover, the managerial implications of the duration of a relationship are discussed with reference to sport market transactions. These kinds of transactions are common in the agricultural industry, but it is important for practitioners to understand that these transactions are characterised by high levels of uncertainty. Likewise, suppliers are likely to behave opportunistically in one-off transactions and in early stages of a relationship due to lack of trust and low expectations of continuity. For example, the study by Fafchamps (2001) noted that in the transactions that lack trust, the purchase and sale of commodities open the door to all kinds of abuse – from deficient quality to incorrect quantity. In this kind of environment, the food processors engaged in one-off relationships with farmers may incur high Screening Transaction Costs. Therefore, it is important for food processors to purchase repeatedly from farmers who have a reputation for offering produce of good quality. In this way, the farmers' expectation for relationship continuity and relational norms will develop, which in turn will limit the potential for opportunism, reduce the problem of quality uncertainty faced by the food processor, and hence reduce the Screening Transaction Costs and the need for a high degree of processor control.

Even in the situation where farmers are not performing well in the early stages of the transaction, it is important for the food processors not to change the supplier immediately. Instead, food processors should allow trust and an expectation of continuity to develop and apply more control on the aspects of the transaction that may affect quality. In this way, the food processor may receive produce of good quality while experiencing low levels of Screening Transaction Costs. Similar reasoning is found in Tadesse and Shively's (2013: 1173) study in transactions of grains, which recommended repeated transactions even when the buyer is not judged to be trustworthy in the first encounter due to a number of reasons, including (1) avoiding the costs of searching and screening a new trade partner, (2) the need to establish long term mutual trustworthiness. Thus, long-term relationships are essential for a successful buyer-supplier relationship.

Furthermore, the finding regarding the application of information technology such as moisture meters is beneficial to practitioners in the food processing industry. The negative effect of processor control on Screening Transaction Costs seems to differ significantly between food processors who use, and who do not use technological instruments for quality screening. This means when technological instruments are incorporated in the processor control, the effectiveness of transaction governance increases significantly and this in turn reduces Screening Transaction Costs incurred by the food processor. Therefore, food processors should supplement the control of farm activities with the use of technological instruments. In this way, they can enhance the quality of purchased produce and reduce Screening Transaction Costs.

Even though our study emphasised that food processors should seek to increase control to curb Screening Transaction Costs in the transactions involving large purchase volume, perishable produce and short relationship duration, the control cannot be easily achieved between independent firms. That is, the food processor may not realise control of the factors that affect the quality of produce without the supplier (farmer) relinquishing control of those factors in the same way as the zero sum game. Thus, there is a number of factors that can enable the buyer (food processor) to achieve control of produce from the supplier, and this include relational norms, expert power and the need for market assurance by the farmer.

The relational norms have the potential of limiting opportunistic behaviour. Thus, in the environment where the relational norms such as the norm of solidarity and information sharing have been established, the farmers (suppliers) are expected to have confidence that relinquishing control will not expose them to buyer's opportunistic behaviour. Therefore, the food processor (buyer) may be able to increase control in this environment. This argument is underscored by Heide and John (1992) that relational norms enable the buyer to extract the safeguard of vertical control (p. 36). Accordingly, the food processor should focus on the behaviour that enhances relational norms such as joint problem solving and sharing of information with the supplier concerning quality of produce.

Expert power is based on the perception that the other party has special knowledge or expertise (Graham, 2014). When the food processor offers to farmers some technical advice in aspects such as the type of seeds to use, application of fertilizers, best planting and harvest practices and storage methods, the farmer may perceive the food processor as attaching high value in the relationship and that the relationship is expected to continue into the foreseeable future. In this environment, the farmer may have confidence that the food processor is not likely to abuse control. Therefore, we recommend food processors to take initiatives to enhance their knowledge in the farming of produce they process and use that knowledge to provide technical advices to farmers. In that way, they may enhance their ability to achieve control in the transaction.

In the transaction of perishable produce, the farmers' need for market assurance may also give the food processor an ability exercise control in the transaction. Perishable produce by their nature have to be harvested and consumed or processed immediately to avoid quality degradation, and such a short time window needed to preserve quality has an implication on transaction costs. That is, the farmers involved in perishable produce marketing may be forced to expend considerable resources to search for the buyer so as to avoid the eventual losses in case the transaction failed to occur in the limited time (Jangwe, 2011). Thus, the farmer my let food processor take control of transaction as a strategic move for market assurance.

To sum up, even though factors such as the high degree of perishability and purchase volume may motivate food processor to increase control in order to reduce Screening Transaction Costs. The ability to achieve control may be enhanced by factors such as the relational norms that has developed between the food processor and the farmer. Other factors include expert power possessed by the food processor and the farmer's need for market assurance.

8.5 Policy Implications

The food processing industry is recognized in Tanzanian development policies as an area with huge potential for accelerating industrial development. However, food processors are facing several challenges, including high transaction costs, access to quality raw materials, poorly developed extension services and/or lack of access to extensions (URT, 2001). Other challenges are limited availability of supporting services such as entrepreneurial training, marketing training, finance, and organizational development skills (Dietz et al., 2000; URT, 2009). To address these challenges and enhance the competitiveness of food processing firms, the government have taken a number of initiatives, with the most significant being the establishment of a parastatal organisation (SIDO) to provide support services to small and medium firms, including food processing firms.

Among the services offered by the government through SIDO are facilitating technology access and technical services to small and medium firms, business skills development services, facilitating market access and information, access to finance and enhancing the operational capacity of small and medium firms (SIDO, 2014). The findings of this study provide a significant input to these initiatives by highlighting the way control of farm activities enables food processors to reduce transaction costs. Additionally, the study emphasizes the need to consider the perishable nature of produce and the volume of purchase in making control decisions. Furthermore, the study has described clearly the essence of developing a long-term relationship with the supplier of produce, and using technology to screen produce for quality. Accordingly, the knowledge introduced by this study may be used by government in developing policies geared towards improving the competitiveness of food processing firms.

8.6 Limitations and Potential Extensions

This study has a number of limitations that need to be addressed in future research. First, the findings from this study have demonstrated that the characteristics of a transacted product present a promising research direction in buyer-supplier relationships. The consideration of the characteristics of a transacted product such as the degree of perishability can provide a rich contribution to knowledge in this area. Whilst this study has investigated perishability as an antecedent of Screening Transaction Costs and as a moderator for the association between buyer control and Screening Transaction Costs, further study may consider it as an antecedent of other relationship constructs such as opportunism and behavioural uncertainty. Our suggestion emphasised the call of Rindfleisch et al's (2010) study that consideration of the contextual variables is a possible research area for advancing knowledge on opportunism.

Second, the perishability construct is not limited to the food industry; it exists in other industries, including the financial services industry (Lievens, Moenaert and S'jegers, 1999; Lievens, Moenaert, 2001), fashion industry (Byun and Sternquist, 2012) and electronics industry (Voss and Seiders, 2003). The investigation of how this construct affects outcome variables such as opportunism, uncertainty and different kinds of transaction costs in other industries may enrich our knowledge concerning the perishability construct and take us a step closer to a generalization of its effects. Furthermore, research on this construct in other industries may consider whether the degree of perishability affects control decisions in buyer-supplier relationships.

Third, the present study has focused on four contingent variables that may modify the effect of buyer control (processor control) on Screening Transaction Costs. However, the contingent variables investigated by this study are not exhaustive. Therefore, researchers may consider other factors that may be of interest in control decisions, including quality uncertainty, information asymmetry and trust among others. Researching these factors may shed more light on buyer control issues. Alternatively, research may use different outcome variables such as opportunism and uncertainty to study the contingent variables investigated in this study.

Fourth, there is a wide range of factors that can affect the quality of agricultural produce, including planting, growing, harvesting, transportation, sorting and processing factors (Trienekens, Zuurbier, 2008). However, our study considered the control of factors that may affect the quality of produce at the farm level, including harvesting condition, time of harvest and storage conditions. Therefore, future studies may consider processor control in a much wider perspective, including the control of input at the farm, and the control of transportation activities between the farm and the processing facility.

Fifth, this study has considered the duration of the relationship between food processors and farmers as one of the important moderating variables in studying the effect of buyer control on Screening Transaction Costs, but the data used in this study are cross-sectional and thus cannot fully capture the effect of this variable. Therefore, future studies may consider using longitudinal data to investigate the moderating effect of the duration of a relationship. Additionally, the duration of a relationship is regarded in the literature (e.g., Li et al., 2010) as a proxy for relational control. However, the use of proxy may limit our understanding of the effects of different types of relational norms. Therefore, to add more validity to our findings, future studies may consider different relational norms as a contingency factor for the association between processor control and transaction costs.

Lastly, this study used the amount of purchase volume from a particular supplier (farmer) to capture the purchase volume concentration into a particular buyer-supplier relationship. More understanding of the purchase volume concentration may be obtained by examining the proportion of the produce allocated to a particular farmer. Therefore, future studies on the effect of purchase volume on the association between the buyer control and transaction costs may consider operationalising purchase volume using the proportion of produce sourced from a particular supplier.

Moreover, this study is limited to two-way interactions between processor control and contextual factors, namely the degree of perishability and purchase volume. In addition to the aforementioned contextual factors, the future studies may consider the factors that enhance the ability of processor control to achieve control in buyer-supplier relationships, such as relational norms, trust and expert power and focus on three-way interaction effects. That is, the interaction effects comprised of the processor control, contextual factors and factors that enable the food processor to achieve control on Screening Transaction Costs.

8.7 Conclusion

The objective of this study was to investigate factors that moderate the effect of processor control on transaction costs, particularly Screening Transaction Costs. Four moderating variables were considered in this analysis, including: (1) the degree of perishability of the transacted produce (2) purchase volume involved in a transaction (3) the use of technological instruments for quality screening, and (4) the duration of the relationships between food processors and the farmers. Transaction cost theory, measurement cost theory and relational contracting theory were used as the main frameworks.

Data collected from the food processing industry in Tanzania were used as a source of empirical evidence and a moderated regression model was used to test the proposed associations between variables. Accordingly, the study has demonstrated that the effect of processor control on Screening Transaction Costs is contingent on the aforementioned factors. The findings from the analysis indicated that the degree of perishability of the transacted produce has a negative moderating effect on the association between processor control and Screening Transaction Costs. Additionally, the main effect of the degree of perishability of transacted produce on Screening Transaction Costs was also examined, and it demonstrated a significantly positive effect.

Moreover, the purchase volume, the use of technological instruments for quality screening and the duration of relationships demonstrated significantly negative moderation effects on the association between processor control and Screening Transaction Costs. These findings have both theoretical and managerial implications in the sense that processor control needs to be applied in a discriminatory fashion contingent on the aforementioned factors. However, the contingent factors included in this study are not exhaustive; therefore, future studies may consider other contingent factors such as opportunism, behavioural uncertainty and relational norms.

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APPENDICES

Appendix 1

A: Production Quantity of Different Produce

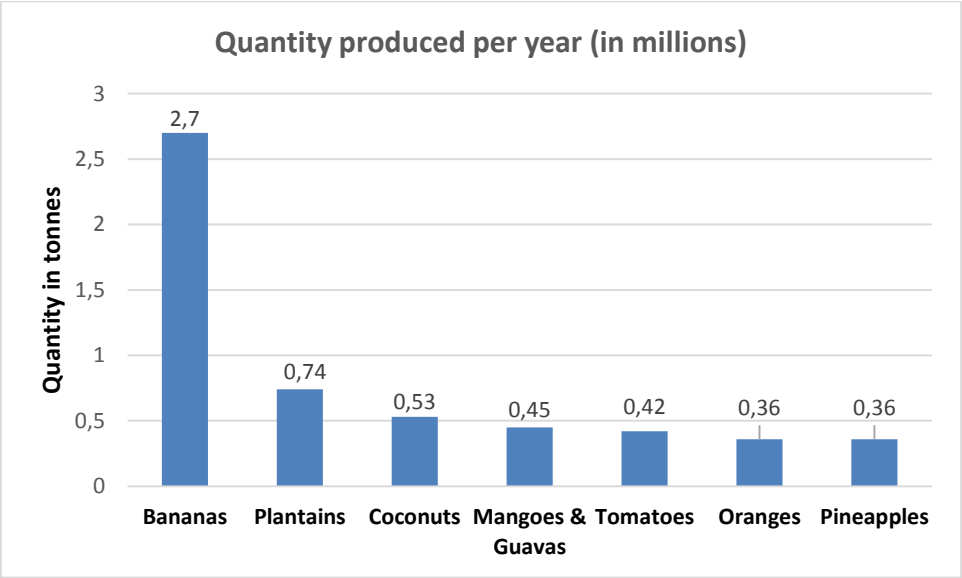


Figure A1: Leading fruit in production quantities in 2013

Source: Constructed from FAO agricultural production statistics (FAOSTAT, 2013)

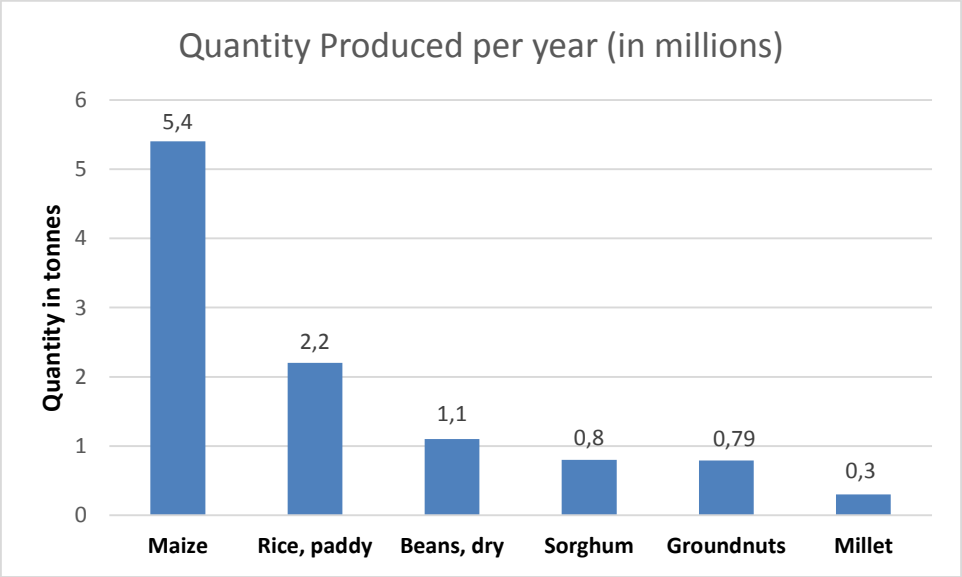


Figure A2: Leading grains in production quantities in 2013

Source: Constructed from FAO agricultural production statistics (FAOSTAT, 2013)

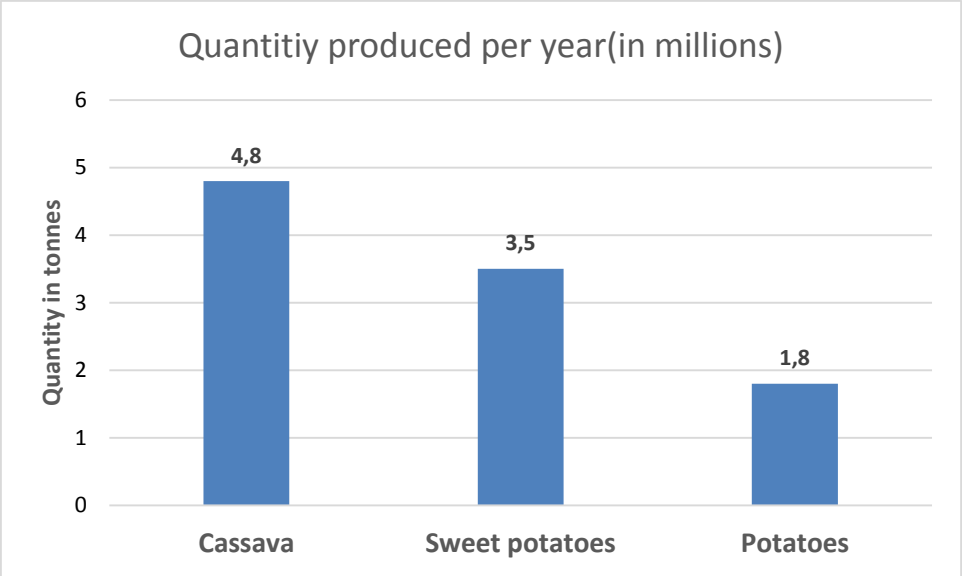


Figure A3: Leading root crops in production quantities in 2013

Source: Constructed from FAO agricultural production statistics (FAOSTAT, 2013)

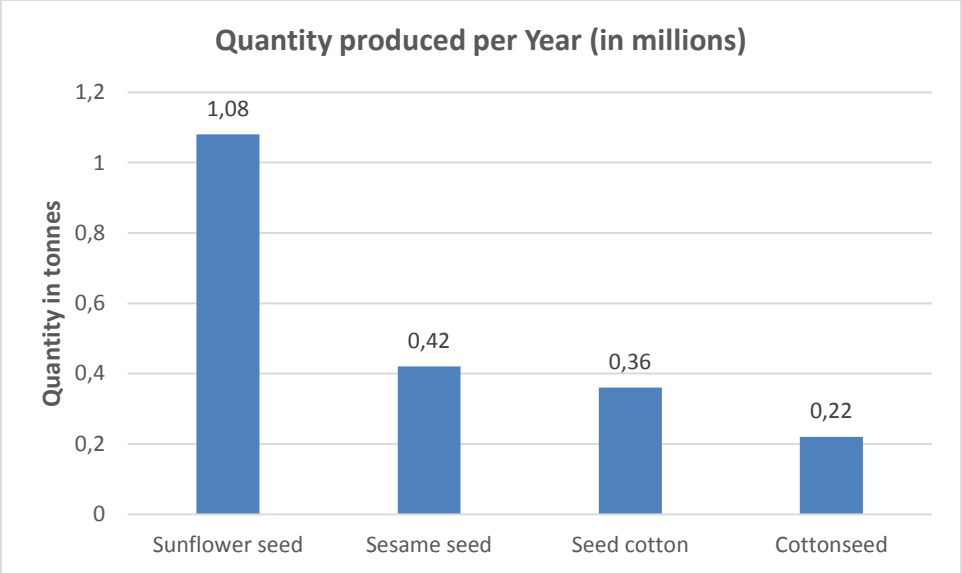


Figure A4: Leading seed crops in production quantity in 2013

Source: Constructed from FAO agricultural production statistics (FAOSTAT, 2013)

Appendix 1

B: Questionnaire (English Language)

Molde University College
Specialized University in Logistics

Department of Economics,
Informatics and Social Sciences

Tanzania Food Processing Firms' Survey 2014

Questionnaire #

NAME OF THE FIRM:_____

_____ _____

Region ***District***

Address of the firm _____

_____

Phone: _____

Researcher:	
Name and Signature	
Visit 1:	Date:
Visit2:	Date:

Researcher Assistant:	
Name and Signature	
Visit 1:	Date:
Visit2:	Date:

1. What category of produce is most important in your processing activities? [ ]

   a. Vegetable b. Fruits c. Grains

2. With reference to your answer in question one above, write the name of the produce that accounts for the largest portion of your processing activities in the space provided below :

   _____

3. What is your most important source of this produce? [ ]

   a. Farmers b. Wholesalers c. Retailers b. Others:_____

4. Write the name of the region and the district where the seller / farmer that accounts for the largest proportion of your purchase for the produce you have mentioned in question two is located

   Region: _____ District: _____

With reference to the produce you have mentioned in question two (2) above, respond to each of the statements in the tables below by circling the number that best describes the extent to which you agree with each of the statements (Please circle once for every statement)

A	**Perishability**	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
5.1	It is very difficult to store this produce for later processing	1	2	3	4	5	6	7
5.2	The quality of this produce is significantly affected by spending long time from the farm to the processing facility	1	2	3	4	5	6	7
5.3	This produce is easily damaged by overloading of vehicles during transportation from the farm to the processing facility	1	2	3	4	5	6	7
5.4	This produce is easily damaged by the use of improper packaging material during transportation from the farm to the processing facility	1	2	3	4	5	6	7
5.5	This produce is easily damaged by rough loading and offloading practices	1	2	3	4	5	6	7
5.6	The quality of this produce is significantly affected by transport delays from the farm to the processing facility	1	2	3	4	5	6	7

A	Perishability	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
5.7	The taste of this produce is significantly affected by processing delays	1	2	3	4	5	6	7
5.8	This produce become stale quickly	1	2	3	4	5	6	7
5.9	The quality of this produce is significantly affected by variations in temperature	1	2	3	4	5	6	7
5.10	This produce is easily damaged by vibrations during transportation	1	2	3	4	5	6	7
5.11	This produce is easily damaged by abrasion between produce units during transportation	1	2	3	4	5	6	7

With reference to the farmer / seller that accounts for the largest proportion of your purchase for the produce you have mentioned in question two (2) above, respond to each of the statements in the tables below by circling the number that best represents your views about this produce from the farmer / seller you have chosen

B	Quality uncertainty	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
6.1	It is difficult to know the freshness of this produce from this seller / farmer	1	2	3	4	5	6	7
6.2	There is a high chance of buying stale produce from this seller / farmer	1	2	3	4	5	6	7
6.3	There is a high chance of buying produce of poor taste from this seller /farmer	1	2	3	4	5	6	7
6.4	There is a high chance that the taste of the produce we buy from this seller / farmer may be different from what we expected	1	2	3	4	5	6	7
6.5	The taste of the produce we buy from this seller / farmer often varies	1	2	3	4	5	6	7
6.6	There is a high chance of buying produce of unsuitable maturity for processing from this seller / farmer	1	2	3	4	5	6	7

B	**Quality uncertainty**	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
6.7	There is a high chance of buying produce of unsuitable taste for processing from this seller / farmer	1	2	3	4	5	6	7
6.8	It is difficult to get produce of the same taste from this seller / farmer	1	2	3	4	5	6	7
6.9	There is a high chance of buying damaged produce from this seller / farmer	1	2	3	4	5	6	7

C	**Quality Performance**	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
7.1	Buying this produce from this seller / farmer increase significantly the quality performance of our processed products	1	2	3	4	5	6	7
7.2	Buying this produce from this seller / farmer reduce significantly the quantity of unsuitable produce for processing	1	2	3	4	5	6	7
7.3	Buying this produce from this seller / farmer reduce significantly the quantity of produce with unsuitable taste for processing	1	2	3	4	5	6	7
7.4	Buying this produce from this seller / farmer reduce significantly the quantity of produce with unsuitable maturity for processing	1	2	3	4	5	6	7
7.5	Buying this produce from this seller / farmer reduce significantly the quantity of produce with poor taste	1	2	3	4	5	6	7

D	Screening transaction cost	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
8.1	We spend a lot of time in inspecting the texture of this produce from this seller / farmer	1	2	3	4	5	6	7
8.2	We spend a lot of time in inspecting the colour of this produce from this seller / farmer	1	2	3	4	5	6	7
8.3	We spend a lot of time in inspecting shape and size of this produce from this seller / farmer	1	2	3	4	5	6	7
8.4	We spend a lot of time in evaluating the aroma of this produce from this seller / farmer	1	2	3	4	5	6	7
8.5	We spend a lot of time in sorting damaged produce when we buy from this seller / farmer	1	2	3	4	5	6	7
8.6	We spend a lot of time in sorting produce of required degree of maturity for processing when we buy from this seller / farmer	1	2	3	4	5	6	7
8.7	We spend a lot of time in sorting suitable variety of produce for processing when we buy from this seller / farmer	1	2	3	4	5	6	7
8.8	We spend a lot of time in sorting spoiled produce when we buy from this seller / farmer	1	2	3	4	5	6	7
8.9	We spend a lot of time in evaluating the tenderness of this produce from this seller / farmer	1	2	3	4	5	6	7

Please indicate your level of agreement with each of the statements in the table below by circling the number that best describes the amount of investment you have committed in processing activities of the produce you have mentioned in this questionnaire

E	Processing Investment	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
9.1	Our firm has invested a lot of time and resources in construction of processing facility for this produce	1	2	3	4	5	6	7
9.2	Our firm has invested a lot of time and resources in construction of storage facility for this produce while waiting to be processed	1	2	3	4	5	6	7

E	Processing Investment	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
9.3	Our firm has invested a lot of time and resources in construction of storage facilities for the processed products from this produce	1	2	3	4	5	6	7
9.4	We have invested a lot of time and resources to learn processing aspects of this produce	1	2	3	4	5	6	7
9.5	We have invested a lot of resources in equipment for processing this produce	1	2	3	4	5	6	7
9.6	Our firm has committed a lot of time and resources in designing and making packaging materials for the processed products from this produce	1	2	3	4	5	6	7
9.7	Our firm has committed a lot of time and resources in designing labels for the processed products from this produce	1	2	3	4	5	6	7
9.8	Our firm has used a lot of time and resources to acquire Tanzania Bureau of Standards certification (TBS) for the processed products from this produce	1	2	3	4	5	6	7
9.9	Our firm has used a lot of time and resources to acquire Tanzania Food and Drugs Authority (TFDA) Certification for the processed products from this produce	1	2	3	4	5	6	7

please indicate your level of agreement with each of the statements in the table below by circling the number that best describes your views about the seller / farmer that account for the largest portion of your purchase for the produce you have mentioned in this questionnaire (Please circle once for every statement)

F	Information Asymmetry	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
10.1	This seller / farmer has more correct information than we do on the time elapsed since the harvest of this produce	1	2	3	4	5	6	7
10.2	This seller / farmer has more correct information than we do on the methods used to harvest this produce	1	2	3	4	5	6	7

F	Information Asymmetry	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
10.3	This seller / farmer has more correct information than we do on the storage condition of this produce after harvest while waiting to be transported	1	2	3	4	5	6	7
10.4	It is difficult to get correct information from this seller / farmer about the time taken to transport this produce from the farm	1	2	3	4	5	6	7
10.5	This seller / farmer has more correct information than we do on the way this produce was packed during transportation from the farm	1	2	3	4	5	6	7
10.6	It is difficult to get correct information about the quality of this produce from this seller / farmer	1	2	3	4	5	6	7
10.7	This seller / farmer has more correct information than we do about the loading and offloading practices on this produce from the farm	1	2	3	4	5	6	7
10. 8	This seller / farmer has more correct information than we do as to whether the vehicle was overloaded during transportation of this produce from the farm	1	2	3	4	5	6	7

Please indicate your level of agreement with each of the statements in the table below by circling the number that best describes your views about the seller / farmer that account for the largest portion of your purchase for the produce you have mentioned in this questionnaire (Please circle once for every statement)

G	Processor Control	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
11.1	Our firm always decides how this produce should be harvested when we buy from this seller / farmer	1	2	3	4	5	6	7
11.2	Our firm completely decides the harvest time of this produce when we buy from this seller / farmer	1	2	3	4	5	6	7
11.3	Our firm has complete control on the storage conditions of this produce after harvest when we buy from this seller / farmer	1	2	3	4	5	6	7
11.4	Our firm has complete control on the loading and offloading activities on this produce from the farm when we buy from this seller / farmer	1	2	3	4	5	6	7

G	Processor Control	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
11.5	Our firm always decides the type of transport used to transport this produce from the farm when we buy from this seller / farmer	1	2	3	4	5	6	7
11.6	Our firm always decides which transporter to use to transport this produce from the farm when we buy from this seller / farmer	1	2	3	4	5	6	7
11.7	Our firm always decides when this produce should be transported from the farm when we buy from this seller / farmer	1	2	3	4	5	6	7
11.8	Our firm always decides how this produce should be packed during transportation from the farm when we buy from this seller / farmer	1	2	3	4	5	6	7
11.9	Our firm has complete control on the time spent during transportation of this produce from the farm when we buy from this seller / farmer	1	2	3	4	5	6	7

Please indicate the extent to which you agree with each of the statements in the table below by circling the number that best describes your views about the seller / farmer that account for the largest portion of your purchase for the produce you have mentioned in this questionnaire (Please circle once for every statement)

H	Processor's Fear of Opportunism	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
12.1	We are susceptible to deceitfulness about the quality of this produce when we buy from this seller / farmer	1	2	3	4	5	6	7
12.2	Sometimes this seller / farmer sells to us produce of poor taste	1	2	3	4	5	6	7
12.3	Sometimes this seller / farmer sells to us spoiled produce	1	2	3	4	5	6	7
12.4	Sometimes this seller / farmer sells to us the produce of inappropriate maturity for processing purpose	1	2	3	4	5	6	7
12.5	Sometimes this seller / farmer provides us with false information about suitability of this produce for processing purpose	1	2	3	4	5	6	7
12.6	Sometimes this seller / farmer lies about quality of this produce for his/her interest	1	2	3	4	5	6	7

H	Processor's Fear of Opportunism	Strongly disagree	Disagree	Somewhat Disagree	Neither agree Nor disagree	Somewhat agree	Agree	Strongly agree
12.7	Sometimes this seller / farmer does everything within his/her means to gain more from the sale of this produce	1	2	3	4	5	6	7
12.8	Sometimes this seller / farmer exaggerates the quality of this produce in order to gain more from the sale of this produce	1	2	3	4	5	6	7
12.9	This seller / farmer is not always sincere about the quality this produce	1	2	3	4	5	6	7

1.0 RESPONDENT PROFILE

1.01 Gender [ ]

a. Male
b. Female

1.02 Which group best describes your age in years? [ ]

a. 20 - 30
b. 31 – 40
c. 41 - 50
d. 51 - 60
e. Above 60

1.03 What is your education level? [ ]

a. Primary education
b. Secondary education
c. College certificate
d. Degree
e. Others:_____

1.04 What is your position in this firm? [ ]

a. Manager
b. Ordinary employee
d. Others:_____

1.05 What is your employment status in this firm? [ ]

a. Full time
b. Part time

1.06 How long have you been working in the food processing?

Years:_____

1.07 Do you have knowledge on traceability of produce? [ ]

a. Yes
b. No

1.08 Have you attended any course on traceability of produce? [ ]

a. Yes
b. No

1.09 If you were to be given a chance to attend a course, which course would you prefer to attend? [____ _____ _____ ____ _____]

a. Strategies of procuring raw materials
b. Food processing
c. Marketing strategies and market access
d. Packaging strategies
e. Traceability of produce

2.0 FIRM PROFILE

2.01 What is the age of this firm?

Years_____

2.02 How many employees are working this firm?

a. Full time: [ ]
b. Part time: [ ]

2.0 FIRM PROFILE

2.03 Do you buy this produce from other seller / farmers? [ ]

a. Yes
b. No

2.04 What percentage of the produce you have mentioned in this questionnaire do you buy from the seller / farmer that account for the largest portion of your purchase?

Percentage:_____

2.05 How often do you buy the produce you have mention in this question?

Per month:_____
Per Year: _____

2.06 How often do you buy the produce you have mentioned in this questionnaire from the seller / farmer that accounts for the largest proportion of your purchase?

Per month:_____
Per Year: _____

2.07 How much of the produce you have mentioned in this questionnaire do you buy on average?

Per Month:_____ Tsh
Per Year: _____ Tsh

2.08 How much of the produce you have mentioned in this questionnaire do you buy on average from the seller / farmer that account for larger portion of your purchase?

Per Month:_____ Tsh
Per Year: _____ Tsh

2.09 How long have you been buying this produce from this seller / farmer?

Years:_____

2.10 How far is the seller / farmer of this produce from your processing facility?

Km:_____

2.11 How many types of produce do you process? [ ]

2.12 How much processed products do you sale on average

Per Week:_____ Tsh
Per Moth:_____ Tsh

2.13 Which channel do you use to sell most of the products you are processing from the produce you have mentioned in this questionnaire? [ ]

a. Final consumers
b. Shops
c. Mini supermarkets
d. Supermarkets
e. Others:_____

2.14 Is your firm registered by BRELA? [ ]

a. Yes
b. No

2.15 Are your processed products from this produce certified by Tanzania Bureau of Standards (TBS)? [ ]

a. Yes
b. No

2.16 Are your processed products from this produce certified by Tanzania Food and Drugs Authority (TFDA)? [ ]

a. Yes
b. No

2.17 How long have you been processing the produce you have mentioned in this questionnaire?

Years:_____

2.18 Do you use any technology to assess the quality of produce before you purchase? [ ]

a. Yes
b. No

2.19 Do you buy from the market during the season of this produce? [ ]

a. Yes
b. No

Appendix 1

C: Questionnaire (Swahili Language)

Molde University College
Specialized University in Logistics

Utafiti wa Kampuni Zinazosindika Chakula Tanzania, 2014

Namba ya Dodoso

JINA LA KAMPUNI: _____

_____ _____
Mkoa ***Wilaya***

Anwani ya Kampuni: _____

_____

Namba ya Simu: _____

Mtafiti:	
Jina na Sahihi	
Mara ya 1:	Tarehe:
Mara ya 2:	Tarehe:

Mtafiti Msaidizi:	
Jina na Sahihi	
Mara ya 1:	Tarehe:
Mara ya 2:	Tarehe:

1. Ni kundi lipi la mazao unalosindika kwa kiasi kikubwa? [ ]

   a. Mboga za majani b. Matunda c. Nafaka

2. Kwa kuzingatia jibu lako katika swali la kwanza (1) hapo juu, andika jina la zao unalosindika kwa kiasi kikubwa?

   _____

3. Je, ni kipi chanzo chako kikuu cha zao hili? [ ]

   a. Wakulima b. Wauzaji wa jumla c. Wauzaji wa rejareja c. Nyinginezo:_____

4. Andika jina la mkoa na wilaya anakopatikana muuzaji / mkulima anayekuuzia kiasi kikubwa cha zao ulilolitaja katika dodoso hili

   Mkoa: _____ Wilaya:_____

Kwa kuzingatia zao ulilotaja katika swali la pili (2) hapo juu, jibu kila kauli iliyoainishwa katika jedwali lifuatalo kwa kuzungushia namba inayoelezea kiwango unachokubaliana na kila kauli (Tafadhali zungushia mara mmoja kwa kila kauli)

A	**Kupoteza Ubora Upesi**	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubalina	Nakubaliana kabisa
5.1	Ni vigumu sana kuhifadhi zao hili kwa usindikaji wa baadaye	1	2	3	4	5	6	7
5.2	Ubora wa zao hili huathiriwa kwa kiasi kikubwa na utumiaji wa muda mrefu kutoka shambani hadi kwenye kituo cha kusindikia	1	2	3	4	5	6	7
5.3	Ni rahisi sana zao hili kuharibika kutokana na ujazaji wa magari kupita kiasi wakati wa kusafirisha kutoka shambani hadi kwenye kituo cha kusindikia	1	2	3	4	5	6	7
5.4	Ni rahisi sana zao hili kuharibika kutokana na kutumia vifungashio visivyofaa wakati wa kusafirisha kutoka shambani hadi kwenye kituo cha kusindikia	1	2	3	4	5	6	7
5.5	Ni rahisi sana zao hili kuharibika kutokana na upakiaji na upakuaji usiofaa (Usio wa makini)	1	2	3	4	5	6	7
5.6	Ubora wa zao hili huathiriwa kwa kiasi kikubwa na ucheleweshaji wa kusafirisha kutoka shambani kwenda kwenye kituo cha kusindikia	1	2	3	4	5	6	7

A	**Kupoteza Ubora Upesi**	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubalina	Nakubaliana kabisa
5.7	Ladha ya zao hili huathiriwa kwa kiasi kikubwa na uchelewaji wa kusindika	1	2	3	4	5	6	7
5.8	Zao hili huharibika (huchakaa) haraka	1	2	3	4	5	6	7
5.9	Ubora wa zao hili huathiriwa kwa kiasi kikubwa na mabadiliko ya hali ya joto	1	2	3	4	5	6	7
5.10	Ni rahisi sana zao hili kuharibiwa na mitikisiko wakati wa usafirishaji	1	2	3	4	5	6	7
5.11	Ni rahisi sana zao hili kuharibika kutoka na msuguano wa mazao wakati wa usafirishaji	1	2	3	4	5	6	7

Kwa kuzingatia muuzaji / mkulima anayekuuzia kiasi kikubwa cha zao ulilotaja katika swali la pili (2) hapo juu, jibu kila kauli iliyoainishwa katika majedwali yafuatayo kwa kuzungushia namba inayoelezea maoni yako juu ya zao hili kutoka kwa muuzaji / mkulima uliyemchagua

B	**Ubora wenye mashaka**	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubaliana	Nakubaliana kabisa
6.1	Ni vigumu kujua upya wa zao hili kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
6.2	Kuna uwezekano mkubwa wa kununua zao lililochoka (chakaa) kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
6.3	Kuna uwezekano mkubwa wa kununua zao lenye ladha duni (hafifu) kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
6.4	Kuna uwezekano mkubwa wa ladha ya zao tunalonunua kutoka kwa muuzaji / mkulima huyu kuwa tofauti na matarajio yetu	1	2	3	4	5	6	7
6.5	Ladha ya zao tunalonunua kutoka kwa muuzaji / mkulima huyu mara nyingi hutofautiana	1	2	3	4	5	6	7
6.6	Kuna uwezekano mkubwa wa kununua zao lenye ukomavu usiofaa kwa kusindika kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
6.7	Kuna uwezekano mkubwa wa kununua zao lenye ladha isiyofaa kwa kusindika kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7

B	**Ubora wenye mashaka**	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubaliana	Nakubaliana kabisa
6.8	Ni vigumu kupata zao lenye ladha ileile tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
6.9	Kuna uwezekano mkubwa wa kununua zao lililoharibika kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7

C	**Ubora wa Mazao**	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubalina	Nakubaliana kabisa
7.1	Ununuzi wa zao hili kutoka kwa muuzaji / mkulima huyu uongeza kwa kiasi kikubwa ubora wa bidhaa zetu	1	2	3	4	5	6	7
7.2	Ununuzi wa zao hili kutoka kwa muuzaji / mkulima huyu upunguza sana kiasi cha mazao yasiyofaa kwa usindikaji	1	2	3	4	5	6	7
7.3	Ununuzi wa zao hili kutoka kwa muuzaji / mkulima huyu upunguza sana kiasi cha mazao yenye ladha isiyofaa kwa usindikaji	1	2	3	4	5	6	7
7.4	Ununuzi wa zao hili kutoka kwa muuzaji / mkulima huyu upunguza sana kiasi cha mazao yenye ukomavu usiofaa kwa usindikaji	1	2	3	4	5	6	7
7.5	Ununuzi wa zao hili kutoka kwa muuzaji / mkulima huyu upunguza sana kiasi cha mazao yenye ladha duni / hafifu	1	2	3	4	5	6	7

D	**Uchunguzi wa Zao**	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubali ana kiasi	Nakubaliana	Nakubaliana kabisa
8.1	Tunatumia muda mwingi kukagua muonekano asili (mikwaruzo) wa zao hili kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
8.2	Tunatumia muda mwingi kukagua rangi ya zao hili kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
8.3	Tunatumia muda mwingi kukagua umbo na ukubwa wa zao hili kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7

D	Uchunguzi wa Zao	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubali ana kiasi	Nakubaliana	Nakubaliana kabisa
8.4	Tunatumia muda mwingi kutathmini harufu ya zao hili kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
8.5	Tunatumia muda mwingi kuchambua mazao yaliyoharibika wakati wa kununua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
8.6	Tunatumia muda mwingi kuchambua zao lenye ukomavu unaofaa kwa kusindika tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
8.7	Tunatumia muda mwingi kuchambua aina ya zao hili inayofaa kwa kusindika tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
8.8	Tunatumia muda mwingi kuchambua zao lililooza tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
8.9	Tunatumia muda mwingi kutathmini ulaini (kupondeka) wa zao hili kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7

Tafadhali onyesha ni kwa kiasi gani unakubaliana na kila kauli katika jedwali lifuatalo kwa kuzungushia namba inayowakilisha maoni yako kuhusu kiasi cha uwekezaji ulichofanya katika usindikaji wa zao ulilolitaja katika dodoso hili

E	Uwekezaji Kwenye Usindikaji	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubaliana	Nakubaliana kabisa
9.1	Kampuni yetu imewekeza muda na fedha nyingi kutengeneza sehemu ya kusindikia zao hili	1	2	3	4	5	6	7
9.2	Kampuni yetu imewekeza muda na fedha nyingi kutengeneza sehemu ya kuhifadhia zao hili kabla halijasindikwa	1	2	3	4	5	6	7
9.3	Kampuni yetu imewekeza muda na fedha nyingi katika ujenzi wa sehemu ya kuhifadhia bidhaa zitokanazo na usindikaji wa zao hili	1	2	3	4	5	6	7
9.4	Tumewekeza muda na fedha nyingi kujifunza namna ya kusindika zao hili	1	2	3	4	5	6	7

E	**Uwekezaji Kwenye Usindikaji**	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubaliana	Nakubaliana kabisa
9.5	Tumewekeza fedha nyingi katika vifaa vya kusindikia zao hili	1	2	3	4	5	6	7
9.6	Kampuni yetu imetumia muda na fedha nyingi kubuni na kutengeneza vifungashio vya bidhaa zitokanazo na usindikaji zao hili	1	2	3	4	5	6	7
9.7	Kampuni yetu imetumia muda na fedha nyingi kubuni nembo (lebo) ya bidhaa zitokanazo na usindikaji wa zao hili	1	2	3	4	5	6	7
9.8	Kampuni yetu imetumia muda na fedha nyingi kupata cheti cha ubora kutoka shirika la viwango la Tanzania (TBS) kwa bidhaa zinazosindikwa kutokana na zao hili	1	2	3	4	5	6	7
9.9	Kampuni yetu imetumia muda na fedha nyingi kupata cheti cha uthibitisho kutoka mamlaka ya chakula na dawa ya Tanzania (TFDA) kwa bidhaa zinazosindikwa kutokana na zao hili	1	2	3	4	5	6	7

Tafadhali onyesha ni kwa kiasi gani unakubaliana na kila kauli katika jedwali lifuatalo kwa kuzungushia namba inayowakilisha maoni yako kuhusu muuzaji / mkulima anayekuuzia kiasi kikubwa cha zao ulilolitaja katika dodoso hili (Tafadhali zungushia mara moja kwa kila kauli)

F	**Taarifa Zisizowiana**	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubaliana	Nakubaliana kabisa
10.1	Muuzaji / Mkulima huyu anataarifa sahihi zaidi yetu kuhusu muda uliopita tangu zao hili lilipovunwa	1	2	3	4	5	6	7
10.2	Muuzaji / Mkulima huyu anataarifa sahihi zaidi yetu kuhusu mbinu (njia) zilizotumika kuvuna zao hili	1	2	3	4	5	6	7
10.3	Muuzaji / Mkulima huyu anataarifa sahihi zaidi yetu kuhusu jinsi zao hili lilivyohifadhiwa baada ya kuvunwa wakati likisubiri kusafirishwa	1	2	3	4	5	6	7
10.4	Ni vigumu kupata taarifa sahihi kutoka kwa muuzaji / mkulima huyu kuhusu muda uliotumika kusafirisha zao hili kutoka shambani	1	2	3	4	5	6	7

F	Taarifa Zisizowiana	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubaliana	Nakubaliana kabisa
10.5	Muuzaji / Mkulima huyu anataarifa sahihi zaidi yetu kuhusu namna zao hili lilivyohifadhiwa (lilivyofungashwa) wakati wa kusafirishwa kutoka shambani	1	2	3	4	5	6	7
10.6	Ni vigumu kupata taarifa sahihi kuhusu ubora wa zao hili kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
10.7	Muuzaji / Mkulima huyu anataarifa sahihi zaidi yetu kuhusu namna zao hili lilivyopakiwa na kupakuliwa kutokea shambani	1	2	3	4	5	6	7
10.8	Muuzaji / Mkulima huyu anataarifa sahihi zaidi yetu kama gari lilijazwa mizigo kupita kiasi wakati wa kusafirisha zao hili kutoka shambani	1	2	3	4	5	6	7

Tafadhali onyesha ni kwa kiasi gani unakubaliana na kila kauli katika jedwali lifuatalo kwa kuzungushia namba inayowakilisha maoni yako kuhusu muuzaji / mkulima anayekuuzia kiasi kikubwa cha zao ulilolitaja katika dodoso hili (Tafadhali zungushia mara moja kwa kila kauli)

G	Udhibiti wa Msindikaji	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubaliana	Nakubaliana kabisa
11.1	Mara nyingi kampuni yetu huamua namna ya kuvuna zao hili tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
11.2	Mara zote kampuni yetu huamua muda wa kuvuna zao hili tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
11.3	Kampuni yetu inaudhibiti wa kutosha wa mazingira ya kuhifadhia zao hili baada ya kuvunwa tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
11.4	Kampuni yetu inaudhibiti wa kutosha wa shughuli za upakiaji na upakuaji wa zao hili kutoka shambani tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
11.5	Mara nyingi kampuni yetu huamua aina ya usafiri unaotumika kusafirisha zao hili kutoka shambani tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7

G	Udhibiti wa Msindikaji	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubaliana	Nakubaliana kabisa
11.6	Mara nyingi kampuni yetu huamua ni msafirishaji yupi asafirishe zao hili kutoka shambani tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
11.7	Mara nyingi kampuni yetu huamua ni lini zao hili lisafirishwe kutoka shambani tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
11.8	Mara nyingi kampuni yetu huamua jinsi ya kufungasha (kupaki) zao hili wakati wa kusafirishwa kutoka shambani tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
11.9	Kampuni yetu inaudhibiti wa kutosha wa muda unaotumika kusafirisha zao hili kutoka shambani tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7

Tafadhali onyesha ni kwa kiasi gani unakubaliana na kila kauli katika jedwali lifuatalo kwa kuzungushia namba inayowakilisha maoni yako kuhusu muuzaji / mkulima anayekuuzia kiasi kikubwa cha zao ulilolitaja katika dodoso hili (zungushia mara moja kwa kila kauli)

H	Hofu ya kudanganywa/Kunyonywa	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubaliana	Nakubaliana kabisa
12.1	Kuna uwezekano mkubwa wa kudanganywa kuhusu ubora wa zao hili tunaponunua kutoka kwa muuzaji / mkulima huyu	1	2	3	4	5	6	7
12.2	Wakati mwingine muuzaji / mkulima huyu hutuuzia zao lisilokua na ladha nzuri	1	2	3	4	5	6	7
12.3	Wakati mwingine muuzaji / mkulima huyu hutuuzia zao lililoharibika (lililooza)	1	2	3	4	5	6	7
12.4	Wakati mwingine muuzaji / mkulima huyu hutuuzia zao lenye ukomavu usiofaa kwa malengo ya kusindika	1	2	3	4	5	6	7
12.5	Wakati mwingine muuzaji / mkulima huyu hutupatia taarifa zisizo sahihi kuhusu ufaaji wa zao hili kwa usindikaji	1	2	3	4	5	6	7
12.6	Wakati mwingine muuzaji / mkulima huyu hudanganya kuhusu ubora wa zao hili kwa maslahi yake binafsi	1	2	3	4	5	6	7

H	Hofu ya kudanganywa/Kunyonywa	Sikubaliani kabisa	Sikubaliani	Sikubaliani kiasi	Sikubaliani na upande wowote	Nakubaliana kiasi	Nakubaliana	Nakubaliana kabisa
12.7	Wakati mwingine muuzaji / mkulima huyu hufanya vyovyote awezavyo ili afaidike zaidi kutokana na mauzo ya zao hili	1	2	3	4	5	6	7
12.8	Wakati mwingine muuzaji / mkulima huyu anaukuza ubora wa zao hili ili afaidike zaidi kutokana na mauzo yake	1	2	3	4	5	6	7
12.9	Mara zote muuzaji / mkulima huyu sio mkweli kuhusu ubora wa zao hili	1	2	3	4	5	6	7

1.0 WASIFU WA MHOJIWA

1.01 Jinsia [ ]

b. Mme
b. Mke

1.02 Ni kundi lipi kati ya haya linaeleza kwa ufasaha umri wako katika miaka? [ ]

b. 20 - 30
b. 31 – 40
c. 41 - 50
d. 51 - 60
e. Zaidi ya 60

1.03 Una kiwango gani cha elimu? [ ]

a. Elimu ya msingi
b Elimu ya sekondari
c Diploma
d. Shahada
e. Nyinginezo_____

1.04 Unanafasi gani katika kampuni hii? [ ]

a. Meneja / Mkurugenzi
b. Mfanyakazi wa kawaida
c. Nyinginezo:_____ _

1.05 Je, una ajira ya aina gani katika kampuni hii? [ ]

a. Ajira ya kudumu
b. Ajira ya muda

1.06 Ni kwa muda gani umekua ukijishughulisha na usindikaji?

Years:_____

1.07 Unaufahamu kuhusu ufuatiliaji wa mazao? [ ]

a. Ndiyo
b. Hapana

1.08 Umewahi kuhudhuria mafunzo yeyote kuhusu ufuatiliaji wa mazao? [ ]

a. Ndiyo
b. Hapana

1.09 Kama ungepewa nafasi ya kuhudhuria mafunzo, ni mafunzo gani ungependelea zaidi? [____ ____]

f. Mbinu za manunuzi ya malighafi
g. Usindikaji wa vyakula
h. Mbinu za kuuza bidhaa na mbinu za kuingiza bidhaa sokoni
i. Mbinu za kufungasha bidhaa
j. Ufuatiliaji wa mazao

2.0 SIFA ZA KAMPUNI

2.01 kampuni yako ina umri gani?

Miaka: _____

2.02 Una wafanyakazi wangapi katika kampuni yako?

a. Ajira ya kudumu [ ]
b. Ajira ya muda [ ]

2.0 SIFA ZA KAMPUNI

2.03 Je, huwa unanunua zao hili kutoka kwa wauzaji / wakulima wengine? [ ]

a. Ndiyo
b. Hapana

2.04 Je, ni asilimia ngapi ya zao ulilolitaja katika dodoso hili unanunua kutoka kwa muuzaji / mkulima anayekuuzi kiasi kikubwa?

Asilimia:_____

2.05 Je, ni mara ngapi unanunua zao ulilolitaja katika dodoso hili?

Kwa Mwezi:_____
Kwa Mwaka:_____

2.06 Je, ni mara ngani unanunua zao ulilolitaja katika dodoso hili kutoka kwa muuzaji / mkulma anayekuuzia kiasi kikubwa cha mazao?

Kwa mwezi:_____
Kwa Mwaka:_____

2.07 Kwa wastani unanunua kiasi gani cha zao ulilolitaja katika dodoso hili?

Kwa Mwezi:_____ Tsh
Kwa Mwaka:_____ Tsh

2.08 Kwa wastani unanunua kiasi gani cha zao ulilolitaja katika dodoso hili kutoka kwa muuzaji / mkulima nayekuuzia kiasi kikubwa cha zao hili?

Kwa Mwezi:_____ Tsh
Kwa Mwaka:_____ Tsh

2.09 Ni kwa muda gani umekua ukinunua zao hili kutoka kwa muuzaji / mkulima huyu?

Miaka:_____

2.10 Je, muuzaji / mkulima wa zao hili yuko umbali gani kutoka kwenye kituo chako cha kusindikia?

Kilometa:_____

2.11 Ni aina ngapi za mazao unasindika? [ ]

2.12 Kwa wastani unauza bidhaa zenye thamani gani ?

Kwa wiki:_____ Tsh
Kwa mwezi_____ Tsh

2.13 Ni njia ipi unayoitumia kuuza kiasi kikubwa cha bidhaa unazosindika kutokana na zao ulilolitaja katika dodoso hili? [ ]

a. Watumiaji wa mwisho
b. Maduka/ Vioski
c. Maduka ya saizi ya kati (Supamaketi ya saizi ya kati)
d. Maduka makubwa (Supamaketi)
e. Nyinginezo:_____

2.14 Je, Kampuni yako imesajiliwa na BRELA? [ ]

a. Ndiyo
b. Hapana

2.15 Je, bidhaa unazosindika kutokana na zao hili zimethibitishwa na shirika la viwango la Tanzania (TBS)? [ ]

a. Ndiyo
b. Hapana

2.16 Je, bidhaa unazosindika kutokana na zao hili zimethibitishwa na Mamlaka ya chukula na Dawa ya Tanzania (TFDA)? [ ]

a. Ndiyo
b. Hapana

2.17 Ni kwa muda gani umekuwa ukijishugulisha na usindikaji wa zao ulilolitaja katika dodoso hili?

Miaka:_____

2.18 Je, kuna teknolojia yoyote unayotumia kutathmini ubora wa zao hili kabla ya kununua? [ ]

a. Ndiyo
b. Hapana

2.19 Je, Unanunua kutoka sokoni wakati wa msimu wa zao hili? [ ]

a. Ndiyo
b. Hapana

Appendix 2

A: Descriptive Statistics and Normality Assessment

Variables	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Skewness Statistic	Kurtosis Statistic
PER1	1	7	3,31	2,173	,555	-1,343
PER2	1	7	3,44	2,095	,507	-1,356
PER3	1	7	3,21	2,086	,726	-1,033
PER4	1	7	3,49	2,080	,457	-1,375
PER5	1	7	3,55	2,063	,520	-1,311
PER6	1	7	3,42	2,076	,539	-1,321
PER7	1	7	3,59	1,995	,374	-1,295
PER8	1	7	3,17	2,058	,699	-1,089
PER9	1	7	3,89	2,030	,155	-1,508
PER10	1	7	2,74	1,896	1,032	-,257
PER11	1	7	2,98	2,108	,811	-,873
SCOST1	1	7	3,32	1,815	,467	-1,052
SCOST2	1	7	3,23	1,741	,571	-,809
SCOST3	1	7	3,08	1,718	,787	-,432
SCOST4	1	7	2,62	1,627	1,185	,654
SCOST5	1	7	3,54	1,738	,400	-1,034
SCOST6	1	7	3,53	1,743	,441	-,930
SCOST7	1	7	3,54	1,814	,358	-1,038
SCOST8	1	7	3,37	1,661	,712	-,505
SCOST9	1	7	3,14	1,892	,682	-,824
PINVEST1	2	7	5,65	1,211	-1,238	1,578
PINVEST2	1	7	5,05	1,614	-,637	-,666
PINVEST3	1	7	4,98	1,668	-,549	-,895
PINVEST4	1	7	5,27	1,532	-1,150	,461
PINVEST5	2	7	5,83	1,084	-1,409	2,821
PINVEST6	1	7	5,07	1,582	-,767	-,290
PINVEST7	1	7	4,98	1,706	-,684	-,568
PINVEST8	1	7	3,23	1,821	,746	-,544
PINVEST9	1	7	3,80	1,916	,074	-1,256
PROCON1	1	7	2,49	1,642	1,506	1,224
PROCON2	1	7	2,43	1,620	1,628	1,640
PROCON3	1	7	3,18	1,988	,646	-1,083
PROCON4	1	7	3,36	2,091	,541	-1,314
PROCON5	1	7	3,50	2,110	,428	-1,444
PROCON6	1	7	3,48	2,088	,453	-1,432
PROCON7	1	7	3,52	2,118	,375	-1,500

A: Descriptive Statistics and Normality Assessment

Variables	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Skewness Statistic	Kurtosis Statistic
PROCON8	1	7	3,50	2,084	,386	-1,456
PROCON9	1	7	3,47	2,090	,451	-1,392
Valid observations 137						

B: Exploratory factor solution using principle components extraction methods

	FACTORS			
Measurement items	**PER**	**SCOST**	**PINVEST**	**PROCON**
PER1	,882	,297	-,108	,142
PER6	,875	,250	-,112	,098
PER2	,867	,356	-,094	,116
PER8	,865	,357	-,113	,019
PER3	,810	,393	-,022	,076
PER11	,802	,388	-,021	,039
PER7	,782	,319	-,189	,126
PER9	,731	,131	-,103	,169
SCOST5	,161	,796	-,058	-,004
SCOST6	,249	,779	-,082	,039
SCOST2	,365	,769	,007	-,086
SCOST1	,370	,741	-,043	-,136
SCOST3	,302	,734	,089	,033
SCOST4	,289	,718	,054	,048
SCOST8	,323	,667	,031	,142
PINVEST3	-,147	-,050	,855	,164
PINVEST2	-,213	-,088	,803	,120
PINVEST1	-,067	,013	,775	-,161
PINVEST5	,017	-,096	,754	-,008
PINVEST6	-,102	,038	,651	,119
PINVEST7	-,008	,142	,649	,128
PROCON2	,171	,077	-,038	,891
PROCON1	,199	,083	-,082	,880
PROCON3	,042	,036	,253	,774
PROCON4	,066	-,143	,226	,561

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

C: Exploratory factor solution using principle components extraction methods

	FACTORS			
Measurement items	**PER**	**SCOST**	**PINVEST**	**PROCON**
PER1	,890	,298	-,121	,144
PER2	,876	,348	-,097	,120
PER6	,857	,257	-,105	,114
PER8	,840	,377	-,114	,046
PER3	,789	,404	-,081	,061
PER7	,788	,292	-,147	,132
PER11	,729	,453	-,079	,070
PER9	,615	,252	-,097	,173
SCOST2	,291	,858	-,037	-,030
SCOST3	,230	,810	,023	,124
SCOST1	,315	,794	-,056	-,093
SCOST4	,281	,653	,006	,062
SCOST6	,355	,579	-,073	,035
SCOST5	,287	,564	-,050	,002
SCOST8	,402	,511	,061	,088
PINVEST2	-,201	-,066	,892	,113
PINVEST3	-,151	-,012	,873	,139
PINVEST1	-,111	,074	,713	-,102
PINVEST5	,017	-,087	,678	,056
PROCON2	,163	,051	-,015	,973
PROCON1	,233	,017	-,040	,876
PROCON3	,043	,026	,210	,604

Extraction Method: Maximum Likelihood.

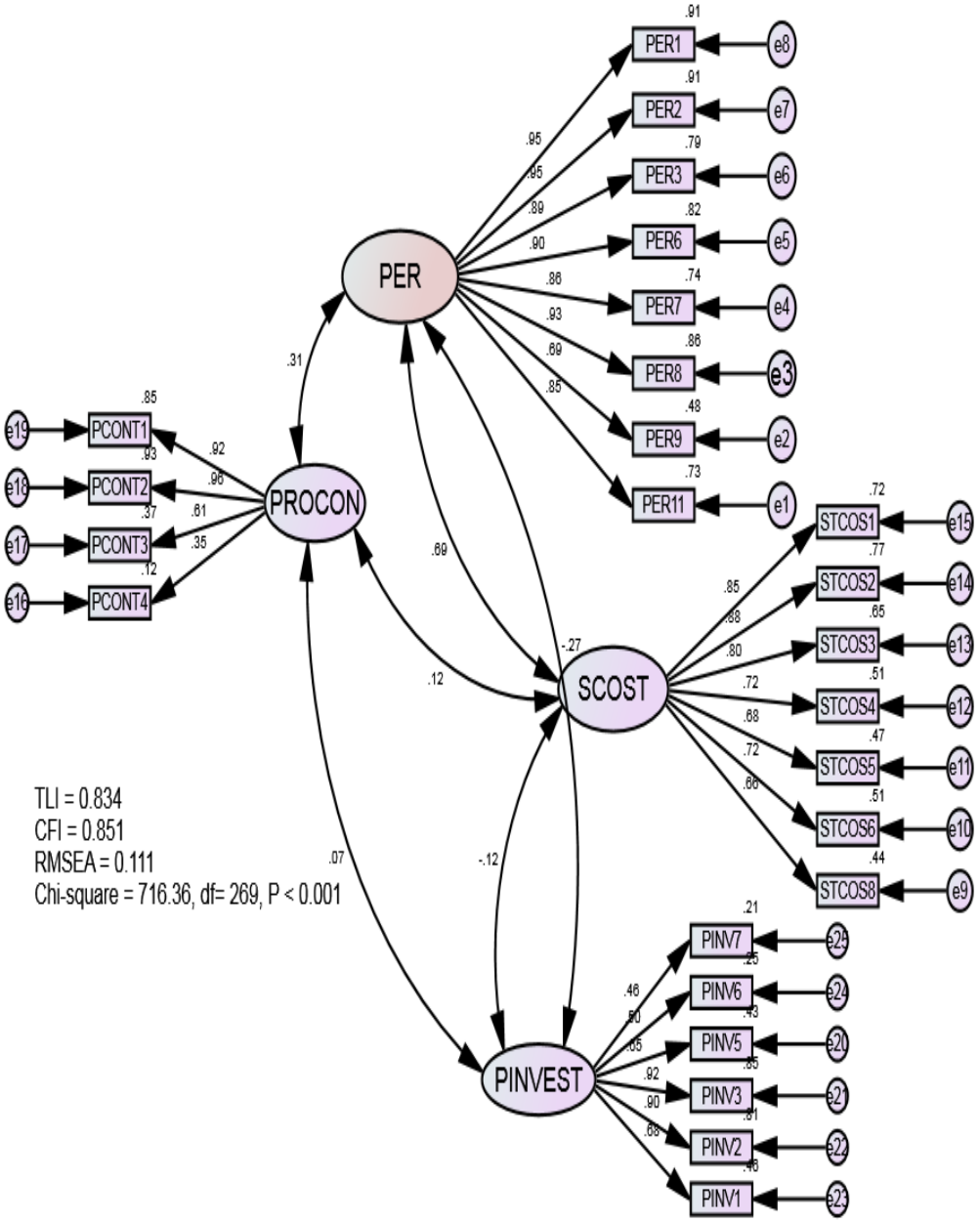
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

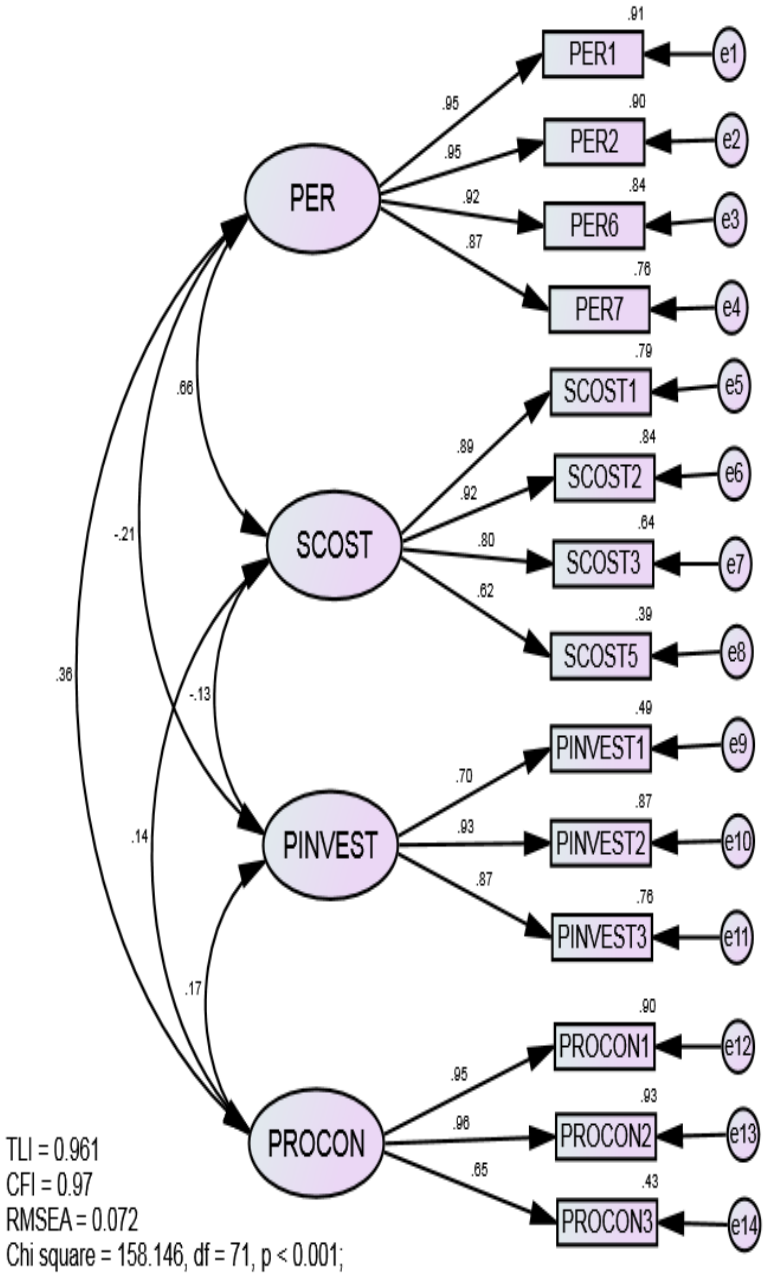
Key:

The first factor concerns the produce perishability (PERIS), the second factors concerns the Screening Transaction Costs (SCOST), and the third and the forth factors concerns the level of processing investment (PINVEST) and the level of processor control (PROCON) respectively

D: Initial measurement model

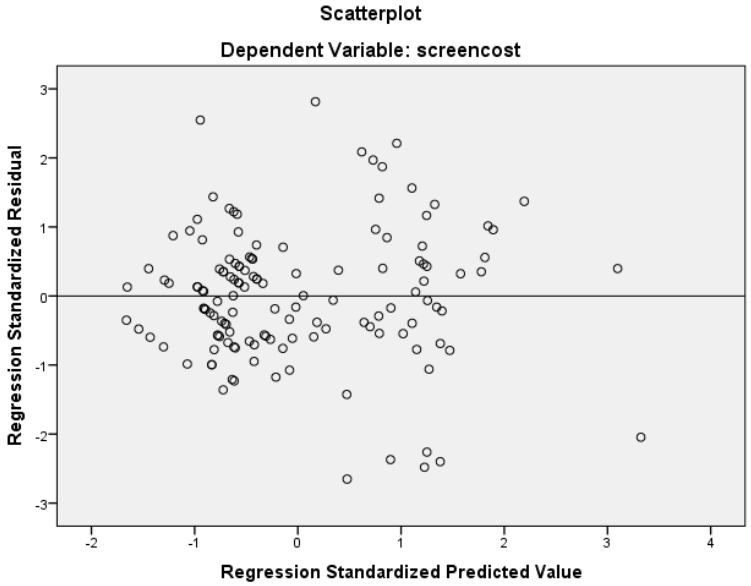


E: Final measurement model

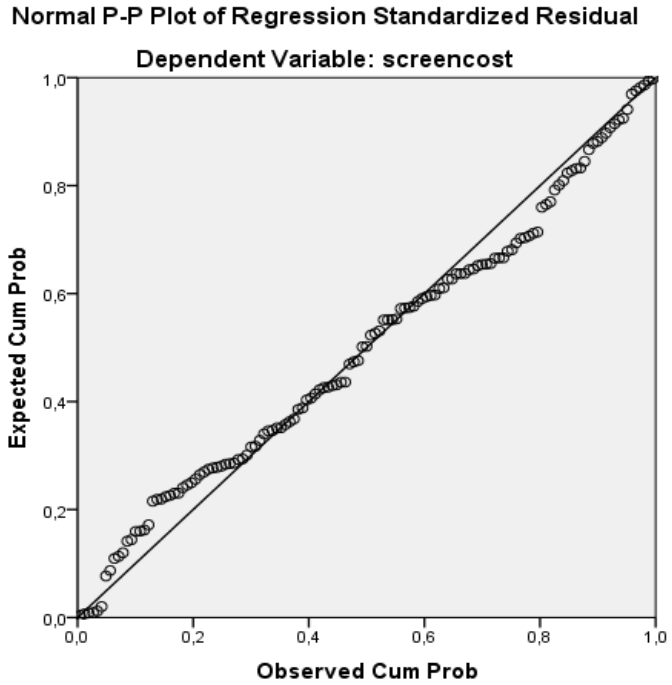


Appendix 3

A: Scatter plot of regression standardized residual (ZRESID) vs regression standardized predicted value (ZPRED)



B: Normal probability plot (Normal P-P plot)



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