ASSESSMENT OF CONSUMER ACCEPTANCE AND WILLINGNESS TO PAY FOR INDUCED QUALITY ATTRIBUTES IN PROCESSED CASSAVA LEAVES PRODUCTS IN MOROGORO MUNICIPALITY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

2013

ABSTRACT

Consumption of Indigenous vegetables (IVs) in most Sub-Sahara African countries including Tanzania is replaced by exotic varieties/species, regardless of their potential nutritional and economic values. Given this situation, among other IVs, this study was conducted with the aim of assessing consumers' acceptance and willingness to pay (WTP) for processed cassava leaves products. Sensory test together with a consumer survey of 110 randomly selected respondents was conducted in Morogoro Municipality from November to December 2012, using a structured questionnaire. Double-bounded dichotomous choice contingent valuation method (CVM) was employed to elicit consumers' WTP information. Major reasons outlined by respondents for not regularly consuming cassava leaves were: inconvenience in usage (65%) and health related risk associated with the vegetable (29%). Compared with fresh leaves, respondents rated processed cassava leaves significantly ($p=0.05$) higher for aroma, texture and general appearance attributes while dried leaves had the lowest score for colour attribute. Estimated mean WTP from restricted binary logit model were TZS 664.4/100g and 1681.4/100g for frozen and dried leaves package respectively; and TZS 289.23 for a bundle of fresh leaves. This implies that, consumers were willing to pay premiums for both dried and frozen leaves of 12% and 66.1% respectively and a discount of 3.6% for fresh leaves. The findings also show that age, income, gender, and household size significantly affected consumers' WTP for cassava leaves products. Accordingly, colour, aroma, and general appearance of the cassava leaves products statistically influenced consumers' WTP. Generally, consumers accepted the processed frozen and dried to fresh cassava leaves. Based on the study findings, opportunities for products development from cassava leaves to improve market potential through processing are available and are to be

exploited.

DECLARATION

I, Innocensia Dickson Pato, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted to any other institution.

_____ _____

Innocensia Dickson Pato Date

(MSc. Candidate)

The above declaration is confirmed

_____ _____

Dr Anna A. Temu Date

(Supervisor)

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ACKNOWLEDGEMENTS

God has been so good to me and has brought me from far and provided all that I needed to walk this journey. I praise my God, the Father of my Lord Jesus Christ for showing me favour before his eyes. This work has been a reflective process that has counted on numerous collaborators. My sincere and deepest appreciation goes to my lead supervisor Dr. Anna A. Temu, Department of Agricultural Economics and Agribusiness. I was very fortunate to have had such a wonderful supervisor. Her good guidance, invaluable contribution, and patience made it possible for the completion of this work. Thank you very much!

I would like to thank Mr. Colman Msuya and Eliya Kinshaga from SolarTunda Food Processing Plant in Morogoro for their assistance and support during the fieldwork of this research. I am grateful to the Department of Agricultural Economics and Agribusiness, starting with the Head of Department to the entire teaching staff, administration and my MSc colleagues. The Norwegian Programme for Development, Research and Education (NUFU) is highly appreciated for their financial support provided under women empowerment project in Tanzania.

Finally, I would like to acknowledge encouragement of the most important person in my life, Mr. Qambemeda Masala Nyanghura, MSc. Environmental and Natural Resources Economics student at Sokoine University of Agriculture and all other people who contributed in completing of this work.

DEDICATION

This dissertation is dedicated to my wonderful and supportive family especially my parents, my father Mr. Dickson O. Ngowo and my mother Mrs. Victoria D. O. Ngowo for their financial, spiritual support and encouragement throughout my education.

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LIST OF ABBREVIATIONS

AVRDC	Asian Vegetable Research and Development Center
CVM	Contingent Valuation Method
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
IFPRI	International Food Policy Research Institute
IVs	Indigenous Vegetables
NUFU	Norwegian Programme for Development, Research and Education
SNAL	Sokoine National Agriculture Library
SUA	Sokoine University of Agriculture
TAHA	Tanzania Horticultural Association
TZS	Tanzanian Shillings
URT	United Republic of Tanzania
USAID	United States Agency for International Development
WHO	World Health Organisation
WTP	Willingness To Pay

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Africa is a vast continent with diverse ecosystems that support a large diversity of vegetables both indigenous and exotic ones. In this study, indigenous vegetables (IVs) refer to crop species or varieties genuinely native to a region, or to crops introduced into a region where over a period of time has evolved, although the species may not be native[1]. In contrast, exotic crops are those, which have been introduced to a region from other/certain place of its origin (Weinberger and Msuya, 2004). While some indigenous vegetable varieties have limited distribution, a large number of exotic vegetables are distributed across several regions (Maundu *et al.,* 2009). Moreover these IVs are locally abundant within Sub Saharan African countries but globally rare and their current use is limited, relative to their economic potential (IFPRI, 2006).

The important role of indigenous vegetables (IVs) in Tanzanians' health, diets and as an income source is threatened through extinction of these species. Production of IVs is in the process of being replaced by exotic vegetables (Weinerberger and Swai, 2006). Such neglect is not reasonable because these underutilized crops have the potential to contribute not merely to agricultural biodiversity but also to people's livelihood Horna, (2007). Indigenous vegetables represent cheap but quality nutrition for large part of the population in both rural and urban areas. Almost all IVs are good sources of micronutrients including iron and calcium, as well as vitamins (Arnieyantie *et al.,* 2012).

[1] Hybrid varieties are excluded from this definition

Tanzania is endowed with a lot of IVs, with overall vegetable diversity of about 103 different species (Keller, 2004). A lot of these vegetables are grown at homesteads for household consumption and within city gardens for sale in the local markets (URT, 2002). Cassava leaves (*Manihot esculenta crantz*) locally known as "Kisamvu" in Swahili, is among the important domesticated IVs (Weinerberger and Swai, 2006). Like other African countries, in Tanzania cassava is considered not only as a tuber but also as leaf vegetable. Although the roots are conventionally used as the main commercial product use of the leaves is favourable nutritionally because they are rich in fibre, minerals and vitamins. The leaves are also mostly used to fill a seasonal gap in the unavailability of other vegetables due to its ability to tolerate unsuitable ecological and soil conditions in comparison with other vegetables (Nweke, 2004). However, its utilisation for human consumption is fairly low compared to other vegetables (Keller, 2004).

Problem Statement

Tanzania has potential to absorb large and expanding market of IVs produces currently within and outside the country. However, value addition functions such as assembling, processing and transportation seem to lag behind (URT, 2002). Within the little efforts taken, priority has been based mostly on few types of vegetables such as amaranths, okra, nightshade, eggplant and cowpea leaves (Weinberger and Msuya, 2004). Therefore, utilization of great majority of the potential IVs like cassava leaves found to be on decline (URT, 2002). Maundu *et al.* (2009) pointed out that, neglecting potentiality of these vegetables would lead to loss of the species and their associated values. Based upon this realization, development of range of value-added products from mainstream vegetables is

imperative. Exploiting available opportunities in underutilized IVs will be evidence for their important contribution in food security, health and income of the people.

Among strategies to promote IVs consumption is to ensure their availability in markets to enable them compete with exotic vegetables. This can be achieved through adding value to IVs via processing (Zink, 1997). Quality improvements will likely lead to stimulate consumption and increase marketability of such products (Weinberger and Msuya, 2004). Processing has been identified as an effective way to improve nutritional safety and convenient utilization of cassava leaves (Arnieyantie *et al.,* 2012). However, food processors are hesitant to convert fully to vegetable processing due to undefined market as they are not being sure whether consumers would be willing to pay for these value added products (Danso *et al.,* 2002). Therefore, this study aimed at assessing consumers' acceptability and willingness to pay for processed cassava leaves products.

Justification of the Study

Knowing cassava leaves qualities that are acceptable by consumers enable development of quality products with required end-user attributes. Results of this study provide important information to food processors to understand cassava leaves products qualities accepted in the market and thereby develop better products that cater consumers' needs. Furthermore, the study findings contribute to policy reforms especially on the agro-processing industries in the IVs sub-sector.

Objectives of the Study

Overall objective

The overall objective of the study was to find out consumers' acceptance and WTP for processed cassava leaves vegetable products.

Specific objectives

The specific objectives of this study were:

i. To identify sensory attributes in cassava leaves accepted by consumers
ii. To estimate consumers' willingness to pay for cassava leaves products
iii. To examine effects of consumers' characteristics and product attributes on consumers' WTP for cassava leaves products.

Hypotheses

i. Consumers are not willing to pay premiums for processed cassava leaves
ii. Consumers' characteristics and product attributes do not affect consumers' WTP for cassava leaves products.

Organisation of the Study

This study is organized into five chapters. After this Chapter one, Chapter two provides an extensive literature review on Tanzania Horticulture sector and marketing prospects, value addition to vegetable produces and reviews of related empirical studies on consumers' WTP. Socio-economic variables and product attributes, which influence WTP and methodological review, are discussed. In Chapter three detailed description of the study area, sampling techniques adopted for data collection and sample size used in the

study. It also includes discussion of the contingent valuation method (CVM), estimation of mean WTP and empirical discussion on the factors affecting WTP. Chapter four presents descriptive analysis from the survey data and also discusses the empirical findings of this study. Finally, Chapter five provides a summary of the research findings, conclusion and some policy recommendations.

CHAPTER TWO

LITERATURE REVIEW

Horticulture Sector in Tanzania

Agriculture is the most important sector in Tanzanian economy as it employs about 80% of the population, and contributes to about 27.1% of the country‘s Gross Domestic Products (GDP) (URT, 2013c). Inspite of its importance, horticultural industry has remained dominant for many years. This is partly due to the fact that priority was given to production of export cash crops such as coffee, cotton, cashewnuts and tobbaco (URT, 2013c). Similarly, priority was given to staple food crops including maize, beans, sorghum and cassava to small extent. Therefore little attention was given to horticultural sector. This affected the allocation of resources to research, extension and product development in this sector (Weinerberger and Lumpkin, 2005).

With the decline in terms of trade of the country’s main export crops such as coffee, cotton and sisal, one of the strategies was to promote non-traditional export such as horticultural crops. Since then, there has been a significant increase in horticulture production for both domestic consumption and export (TAHA, 2012). However, this subsector has not yet received a significant attention in terms of research and product development, as a result production and utilization of vegetables especially indigenous ones is on decline (Keller, 2004). The decline in consumption of horticultural products (mainly vegetable and fruits) give rise to an increase in the consumption of refined and exotic vegetables as observabled by Weinerberger and Swai (2006).

Vegetables are usually grown on a smallscale basis but usually generate high earning per unit area. This represents an alternative for farmers with small cultivatable land to provide adequate income from field crops (Weinerberger and Lumpkin, 2005). The study by Weinerberger and Swai, (2006) which analyzed the significance of indigenous vegetables in agricultural production and marketing showed a high degree of commercialization for some IVs in Tanzania including Amaranth and African eggplant. Other most domisticated IVs produced in Tanzania include Cowpea leaves, Nighshade, Jute mallow, Pumpkin leaves, Sweet potato leaves and Cassava leaves.

Indigeous vegetables form a part of daily diets in the form of soups and sauces accompanied by carbohydrate staples (Smith and Pablo, 2007). They help prevention and alleviation of several micronutrient deficiency diseases and malnutrition (Oluoch *et al*., 2009). Cassava leaves, in this case is rich in protein, minerals and vitamins (Fasuyi, 2005; Maundu *et al.,* 2009; Arnieyantie *et al.*, 2012). Its use as human food has been reviewed and its value as a source of protein and vitamins for supplementing predominantly starchy diets is reemphasized (Mulokozi, 2007; Arnieyantie *et al.*, 2012).

Processing of Cassava Leaves Vegetable

Among strategies to promote IVs consumption is to ensure their availability in markets to enable them compete with exotic vegetables. This can be achieved through adding value to IVs via processing (Zink, 1997). Quality improvements will likely lead to stimulate consumption and increase marketability of such products (Weinberger and Msuya, 2004). Among methods of adding value to food produces is through processing. The former transforms perishable food products such as vegetables into stable ones with

longer shelf lives (Mepba *et al.,* 2007). This helps in extending storage time, transportation and/or distribution and hence increases convenience of the product to consumers (Bosch *et al.,* 2009; Zhang *et al.,* 2010).

On the other hand, processing tremendously reduces anti-nutrients possibly present in the vegetables with minimal loss in nutrients (FAO, 1995). Cassava leaves have anti-nutrients, which can render them toxic. It has been reported to contain 15 to 20 times cyanide compared to its roots (Arnieyantie *et al.,* 2012). This therefore, exhibits fear to the vegetable consumers perhaps because of anticipated poisoning (Dada and Oworu, 2010). Processing methods such as drying/dehydration, pounding, cold storage, freezing and boiling takes care of the effects toxin of cassava leaves (Arnieyantie *et al.,* 2012). Adequate processing detoxifies the leaves with considerable nutrient retention, thus enhancing utilization of cassava leaves as a good source of leafy vegetables for human consumption (Achidi *et al.,* 2008).

Consumer Acceptance of Cassava Leaves Vegetable

The success of any new food product depends on the ability of this product to meet the needs, tastes and requirements of the target consumers (Keane and Willets, 1994). Acceptance of a food is measured in effective sensory tests with potential consumers of the product or service. Its acceptability to the intended audience is the key to success of any new product, no matter the scale of production (Keane and Willets, 1994). Assessing the market acceptance of a product at the point of purchase, the consumer forms an impression about the expected quality of the food product alternatives. It is generally acknowledged that consumer expectations about a product are based on

quality cues (Steenkamp, 1996).

Quality expectations at the point of purchase results from an integration of the quality cues that can be distinguished into intrinsic and extrinsic cues. Intrinsic cues are part of the physical product that cannot be changed without changing the physical itself. Examples of intrinsic cues include; colour, texture, presence of spots and softness for the leaves. Extrinsic cues are related to the product but are not physically part of it and these include; price, brand name, country of origin and store name (Akankwasa, 2007).

Awoyinka *et al*. (1995) in the study of nutrient content of young cassava leaves and assessment of their acceptance as green vegetable in Nigeria found that both extrinsic cues including flavour, colour, aroma, appearance of the leaves and intrinsic cues in terms of nutrient composition and health related risks associated with cassava leaves were found to influence its acceptability as a green vegetable.

A study by Umuhozariho *et al.* (2011) on utilization of cassava leaves as a vegetable in Rwanda, reported that; most consumers (80.0%) indicated that wild cassava leaves were preferred over leaves from other species. They stated good taste, easier pounding, nutritive and year-round availability as the reasons for preferring leaves from wild species. Among reasons mentioned by consumers as main constrains for not using cassava leaves vegetable regularly were hard and time consuming preparation of the leaves.

Willingness to Pay Concept and Methods of Measurement

Willingness to Pay (WTP) is the price or amount that someone is willing to give up or pay to acquire a good or service. It could also be defined as the maximum amount of money that may be contributed by an individual to equalize a utility change (Owusu, 2009). WTP is based on the principle that the maximum amount of money an individual is willing to pay for a commodity is an indicator of the value of that commodity. It is a crucial determinant of the incentives for product innovation using emerging information and an important concept for benefit cost analysis (Unnevehr *et al.,* 1999) cited by Munene (2006).

Empirical studies on consumers' WTP have taken different approaches. The stated preference method includes: choice experiment (conjoint analysis and choice modeling), and contingent valuation method. While the revealed preference method comprises: hedonic pricing, travel cost model, dose-response approaches, and averting expenditure/avoided cost approaches (Hanley *et al*., 1997; Asafu-Adjaye, 2000).

Conjoint analysis is widely applied in marketing research to investigate consumer preferences for a large number of product attributes. In conjoint analysis the explicit trade-offs between attributes that provide a more realistic approach and part-utilities produced that provide a common scale facilitating direct comparison (Murphy *et al*., 2000). It helps to quantify and predict the individual's overall judgment of a product based on its most important attributes (Steenkamp, 1987), cited by Monteiro *et al*. (2001). Despite these strengths it has the following shortcomings: Firstly difficulty involved in making interpersonal comparisons of ranking or rating data, second the difficulty of respondents to rank large number of alternatives and thirdly the fact of rating tasks in

particular involve a departure from the context of choice actually faced by consumers (Morrison *et al*., 1996), cited by Bennet and Blamey (2001). There is also difficulty in the selection of attributes to be used to describe the choice alternatives because of apparent contradictions between what policy makers regard as key factors and what really matters to respondents (Bennet and Blamey, 2001).

The other approach in eliciting WTP is hedonic pricing. This method captures the relative importance of each of the attributes of a good in determining price. Hedonic model suggests that the price consumers are willing to pay for a product is a function of its attributes such as taste, texture, colour and flavour (Akankwasa, 2007). In research studies involving food products, WTP evaluations range from basic purchase intent questions in a consumer survey to experimental auctions, with consumers bidding with real money to elicit their actual WTP (Groote *et al.,* 2006).

When investigating the viability of a new venture, production costs and consumer demand for the new product need to be considered. To determine consumer demand or WTP for such products, economists create hypothetical markets (Lusk and Hudson, 2004), typically using Contingent Valuation Methods (CVM) to ask consumers to value a new product. The values generated through use of the hypothetical market are treated as estimates of the value of the non-market good or service, contingent upon the existence of the hypothetical market. These surveys give meaningful results if they properly grounded in a consumer maximization framework (Hanemann and Kanninen, 1996). It is therefore assumed that the consumers interviewed maximize their utility subject to a budget constraint, and will therefore choose the option that gives them higher utility.

In CVM surveys, the most widely used approaches to elicit information about respondents' WTP is called dichotomous choice format. The single bound dichotomous choice format entails asking respondents whether they would be willing to pay for the product at the offered price (Boxall *et al.,* 2007; Rodríguez *et al.*, 2008; Zhang *et al.*, 2010).

Empirical Studies on Consumers' WTP Using Contingent Valuation Method

Consumer demand for niche products such as processed food has grown substantially (Dimitri and Greene, 2002). Consumers' value processed food because they perceive these products to be healthier, and more convenient (Ragaert *et al.,* 2004). This preference may translate to a WTP a premium price for these products.

In measuring quantitative WTP estimates for food quality, several authors have used Contingent Valuation Method (CVM). For example Zhang *et al*. (2010) evaluated consumers WTP for treatment induced quality attributes in Anjou pears with respect to sensory attributes, and observed that firmer and sweeter pears as a result of higher ethylene treatments increased consumers' WTP. Gil *et al.* (2000) employed contingent valuation method to value Spanish consumers' willingness to pay for organic products. Their results indicate that consumers were willing to pay higher premium for organic fruits and vegetables. In a study among Canadian consumers, Cranfield and Magnusson, (2003) used contingent valuation method (CVM) to examine consumer WTP for pesticide-free food products.

They found that consumers would be willing to pay higher premiums relative to a conventional food product. Misra *et al*. (1991) and Boccaletti and Nardella (2000) also use CVM to analyze consumer willingness to pay for pesticide-free fresh fruits and vegetables in USA and Italy respectively. Analysis by Zhang *et al.* (2010) in the study conducted in Portland indicated that treatment-induced quality losses significantly affect consumers' willingness to pay. Mean WTP for each treatment reveals that consumers prefer pears with a six-day ethylene treatment and are willing to pay a premium of $0.25/pound compared to the market price.

Based on a large-scale survey, Lin *et al*. (2006) study employed the CVM to estimate consumers' willingness to pay for biotech foods in China and to account for the effects of respondents' characteristics on the likelihood of purchasing biotech foods and WTP. Above 60% of respondents were willing to purchase biotech foods without any price discounts. However, about 20% of them would only accept non-biotech foods. Price premiums that respondents were willing to pay for non-biotech foods averaged about 23-53% for non-biotech soybean oil and 42-74% for non-biotech rice (Lin *et al*., 2006).

A study by Ngigi *et al*. (2010) in Kenya examined the willingness of the middle and high income consumers who shop specialized stores to pay for quality of leafy vegetables and drivers of willingness to pay for quality also employed contingent valuation and the payment card method in eliciting consumers' WTP. The study found that mean WTP for quality is higher among high income consumers (>60%). It also finds that; income, age of children in the household, access to information of food safety is among the significant

drivers of kale consumers' willingness to pay for quality of kales.

Boxall e*t al.* (2007) used combinations of sensory characteristics and CVM to elicit consumers WTP for convectional and organic wheat bread. The survey included a closed ended contingent valuation question to examine consumers' WTP premium for the organic bread and a trained sensory panel was used to quantify differences in the sensory characteristics of the two breads. This study therefore, combined the CVM, a stated preference technique, with sensory evaluation of cassava leaves to assess consumer acceptance and WTP for processed cassava leaves. A double-bounded; dichotomous-choice CVM was employed (Pearce *et al.*, 2002; Boxall *et al.*, 2007; Zhang *et al.*, 2010).

Since CVM is a hypothetical method, hypothetical bias[2] is one concern. To take care of the starting bid bias misconception, respondents selected were familiar with cassava leaves vegetable (Pearce *et al.*, 2002). Furthermore, the initial bid price included all costs associated with preparation until a product is placed in the market (sales point). Additional advantage obtained from using CVM was the additional information obtained from the follow-up question, which helped establish the validity of responses (Zhang *et al*., 2010).

Factors Affecting Consumers' WTP for Fruits Vegetable Products

Consumers' characteristics

Economic literature indicates that WTP for a product depends on socio-economic factors

[2] Hypothetical bias refers to situations in which WTP elicited from hypothetical formats diverges from WTP elicited from non-hypothetical formats. Most of the literature suggests hypothetical bias is in the form of an overstatement

such as gender, age, income, education, and place of residence (Goldberg and Roosen, 2005). Studies on WTP for food indicates that women, youth, high income class and educated people were willing to pay an additional premium for a product perceived to have good quality attributes (Carlos *et al*., 2005; Zhang *et al.*, 2010). Information about perceived benefits that a product delivers which includes its convenience increases consumer WTP (Ragaert *et al.*, 2004). Groote and Kimenju (2005) observed that same set of variables, prices and demographic variables, determined the demand for food genetic modified foods.

In study by Ragaert *et al.* (2004) on decision-making process towards minimally processed vegetables and packaged fruits, socio-demographic characteristics, such as age, sex, education, presence of children experience with the product category and food-health awareness were found to be significant. Also, respondents working outside the home attached more importance to shelf life (expiry date) when purchasing the produce as compared to respondents working at home, being retired, student or unemployed.

A study conducted in Kampala, Uganda by Akankwasa (2007) revealed several factors that seem to be strongly correlated with consumer purchasing behaviors and attitudes toward shopping at public markets. The study found that socio-economic characteristics including education, household size, and income significantly influenced the willingness to pay for bananas varieties under study. Furthermore, empirical results of the study by Owusu (2009) in Kumasi - Ghana shows that, age, education, income, gender, and household size significantly influence consumers' WTP for organic fruits and vegetables.

Product attributes

Numerous surveys regarding consumer behavior towards vegetables and fruits products have been conducted in the world. Sensory and cognitive variables[3] are therefore hypothesized to also influence WTP in addition to price and socio-economic factors (Boxall *et al.*, 2007; Zhang *et al.*, 2010). Based on findings from literatures, sensory attributes, perceived values on food and individual characteristics will be included in the study model since these factors are assumed to influence consumer's WTP.

In Portland, fruit and vegetable buyers consider freshness and quality as most important characteristics of fruits and vegetables during purchases (Zhang *et al.*, 2010). Consumer's decision-making process towards minimally processed vegetables and packaged fruits was studied by Ragaert *et al.* (2004), and the important motivation for purchasing related to convenience and speed, especially for consumers who bought the products during weekends. Also consumption of minimally processed vegetables depends on the consumer's high awareness of the relationship between food and health and significant attributes in relation to colour, texture and flavour. A study conducted by Owusu (2009) revealed that the characteristics Ghanaian consumers look for in assessing the quality of vegetable are: damage free, freshness, size, bright colour and hardness.

A study by Oboubie *et al*. (2006) conducted in Ghana found that consumers' considered characteristics such as freshness, colour and spotless leaves when buying vegetables. Attributes in dessert banana like taste, skin colour was found to be significantly

[3] Cognitive factors, such as beliefs, risk perception, knowledge, and trust in government, emerged as the most important factors explaining the differences between WTP

influencing the willingness to pay for these bananas by consumers in Uganda (Akankwasa, 2007). Kamga *et al.* (2013), reported that freshness, consumer preferences, and taste determines the choices consumers make about which vegetables to purchase and consume. Furthermore, the low credibility of quality claims on packaging and the higher prices of supermarkets were found to hinder sales of processed vegetables; consumers give little credibility to the "clean vegetables" labels used by supermarkets (Bridier, 2000).

Conceptual Framework

Based on theories reviewed from the literatures on willingness to pay, an idea on consumer's acceptance and willingness to pay for cassava leaves products can be conceptualised. Fig. 1 depicts the causal paths from the influencing factors to the overall acceptance and willingness to pay for cassava leaves products under study.

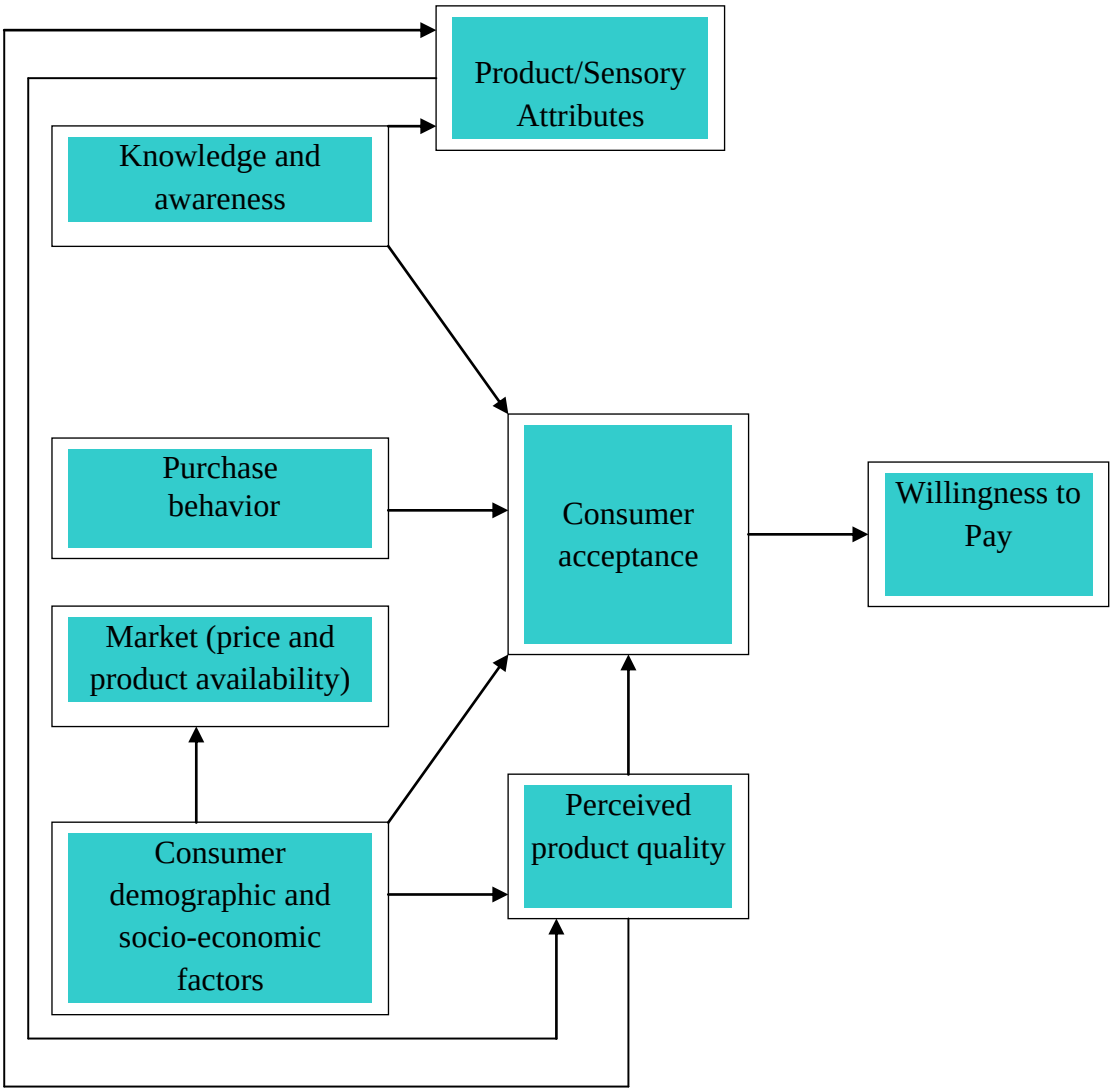

Figure 1: Conceptual framework showing factors affecting consumers' acceptance and willingness to pay for cassava leaves products

Source: Adapted and modified from Munene (2006) and Ulimwengu and Sanyal (2011)

CHAPTER THREE

METHODOLOGY

Description of the Study Area

The study was conducted in four wards of Mazimbu, Kihonda, Kichangani and Mbuyuni in Morogoro Municipality, Tanzania (Fig. 2). Morogoro Municipal is one of the fast growing urban towns in Tanzania with an estimated population of 315 866, of which about 48% are male and 52% are female (URT, 2013b). The Municipality is about 195 kilometers west of Dar es Salaam and is situated on the lower slopes of Uluguru Mountains whose peak is about 1600 feet above sea level. It lies at the crossings of longitudes 37.0 east of the Greenwich meridian and latitude 4.49 south of equator. Morogoro Municipality enjoys one peculiar advantage of being a hub whereby there is a highway road link to east, west, south and northern parts of the country (URT, 2013a).

Morogoro Municipality has a total land area of 531 square kilometers with 19 administrative wards including Kichangani, Mbuyuni, Mazimbu and Kihonda (URT, 2013a). This land coverage constitutes 0.8% of the total regional area. The major physical features include the famous Uluguru Mountains, which lie in the southeastern part, and Nguu Mountains, which lie in the western part. There are three main rivers with several tributaries, which form a number of alluvial flood plains. These rivers are the Morogoro, Kilakala and Bigwa. The municipality has two major seasons, the rainy and dry seasons. The rainy season experiences major rains between March and May with range from 821mm to 1505mm and the minor rains between November and December with an average of about 400mm. The average temperature ranges from 10^{o}C to 14^{o}C during cold

season (June-August) daily. During hot season (November-December) the minimum and maximum temperatures are 28^{o}C and 30^{o}C, respectively (URT, 2013a).

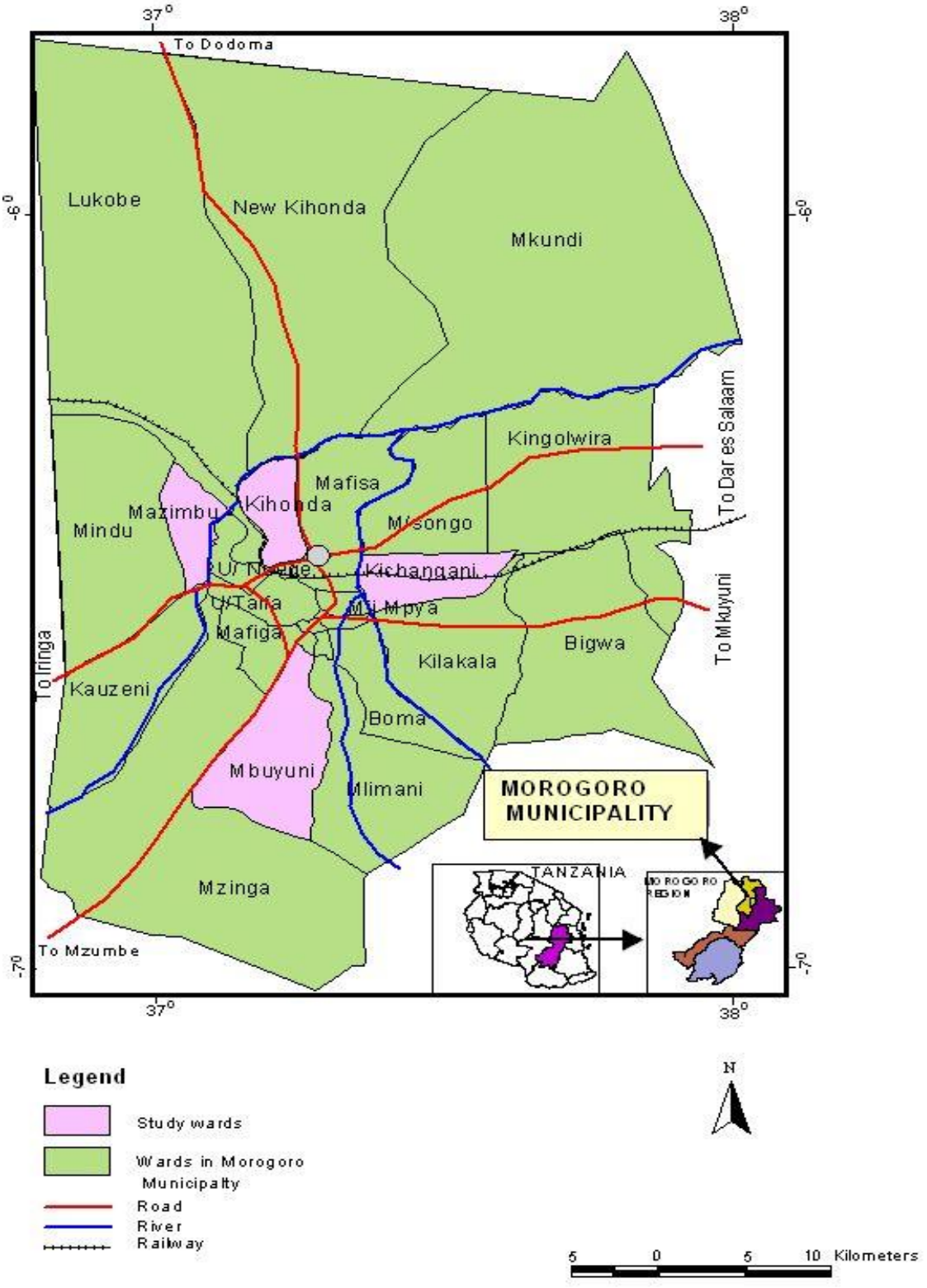
37°
38°
-6°
-7°
To Dodoma
Lukobe
New Kihonda
Mkundi
Kingolwira
To Dar es Salaam
Mafisa
Mazimbu
Kihonda
Mindu
M/songo
U/Nanne
Kichanganl
U/Taifa
Mji Mpya
Mafiga
Bigwa
To Mkuyuni
To Iringa
Kilakala
Kauzeni
Boma
Mbuyuni
Mlimani
MOROGORO
MUNICIPALITY
TANZANIA
Mzinga
To Mzumbe
Legend
Study wards
Wards in Morogoro
Municipalty
Road
River
Railway
N
5 0 5 10 Kilometers

Figure 2: Map of Morogoro Municipality showing the study area

The main economic activities in the municipal are divided into five categories: commercial undertakings wholesale and retail trading (35%), subsistence farming and livestock keeping (33%), office works (16%), employment in elementary occupations (11%) and industrial production (5%). About 75% of the working force in the Municipality engages in agricultural related activities. Farming is largely carried out in the outskirts of the town and in the neighboring district of Mvomero. The major crops cultivated include: rice, maize, sisal, banana and cassava. Fruits and vegetables are also cultivated. Fruits and vegetables processing activities are also prominent in Morogoro municipal too, because the town is having a processing plant in SUA (SolarTunda). The municipal is a major market for vegetables produced within urban and the peri- urban areas of the town (URT, 2013a).

Sample Selection and Sample Size

A multistage random sampling procedure was used to obtain respondents who participated in the study. Sample selection based on the administrative areas of Morogoro Municipality. Out of 19 wards in the municipal, four wards of Mbuyuni, Mazimbu, Kihonda, and Kichangani wards were randomly selected. Afterward, within each of the selected wards, two data collection points were also randomly selected. Respondents were randomly obtained from surrounding areas with the support from local council officials. Meilgaard *et al.* (1999), suggests that, for social science studies, standard sample size of 100 consumers for a central location test are enough to represents the studied population.

Therefore, this study selected 14 respondents randomly from each data collection point giving a total sample of 112 respondents. The valid responses obtained from the selected sample were 110. Selection of respondents was also based on their regularity in vegetable consumption and their willingness to participate in study. All respondents selected received samples of both uncooked and cooked cassava leaves products for sensory evaluation immediately after the consumer survey.

Preparation of Experimental Materials, Packaging and Pricing

Fresh cassava leaves were obtained from the vegetable garden in the vegetable processing plant (SolarTunda) in Sokoine University of Agriculture (SUA), Morogoro Municipality. The leaves were harvested at full maturity stage with a great care in selecting the leaves with appropriate qualities. Upon harvest, leaves were cleaned, sorted and pounded/grinded with addition of some food spices. A portion of the pounded leaves was subjected to a solar drying for 3 days for production of dried samples using the established process[4] and then packed in sterilized and labeled plastic packages of 100g standardized for a meal of six people. The remaining fresh pounded leaves were also packed in sterilized and labeled plastic packages of 100g and placed into refrigerators (cold storage at 3°C) to produce frozen samples. For the fresh cassava leaves, a sample of fresh whole leaf bundle was obtained from the local market. Each of the three cassava leave samples: the fresh, frozen and dried leaves were then presented to consumers for sensory testing and assessment of their willingness to pay.

Pricing of fresh cassava leaves was based on prevailing market price as the leaves were

[4] The processing ensures the end product retains the nutritional contents of the vegetable.

sold in local markets together with other fresh vegetable varieties. Processed cassava leaves products (frozen and dried leaves) were obtained from SolarTunda vegetable processing unit at SUA[5]. The conventional factor[6] of 1:1.5 and 1:6 were used for frozen to fresh and dried to fresh cassava leaves respectively. The conversion ratios were not considered in the pricing of processed leaves because SolarTunda processing plant has internalized cassava leaves production activities hence lowered costs for obtaining fresh leaves from the markets. However, this might not be the case for a plant that depends on the markets prices for obtaining fresh cassava leaves for processing. Therefore, prices were set based on unit cost associated with production and processing of a 100g package of cassava leaves in the plant. In this study, initial prices of TZS 300 for a bunch of fresh leaves, TZS 400 and TZS 1500 for 100g package of frozen and dried cassava leaves products respectively were adopted for WTP elicitation.

Data Collection and Data Types

3.4.1 Primary data

Data comprising of consumer awareness, sensory evaluation and prices consumers would be willing to pay for cassava leaves were collected from November to December 2012. Primary data was collected using a structured questionnaire (Appendix 3) administered to consumers who participated in the study. Questionnaire was designed to gather information on socio-economic characteristics of the respondents such as, age, education, sex, marital status, income, household size, and household vegetable consumption behavior. It also include sensory valuation forms for both uncooked and cooked cassava

[5] So far, it is the only food processor with value added products from cassava leaves vegetable in Tanzania.

[6] Amount of fresh cassava leaves required to produce processed cassava leaves.

leaves samples of the fresh leaves (reference product for the study), frozen and dried leaves to evaluate sensory attributes namely; colour, aroma, texture and general appearance.

After evaluating the above attributes, consumers were asked about their awareness of the cassava leaves products. Experimental samples were coded to eliminate name bias and presented to respondents and evaluation of the attributes was based on a five-point likert scale (5 = like most, 4 = like moderate, 3 = neither like nor dislike, 2 = dislike moderate, 1 = dislike most). Then respondents were asked an open ended question of how much they were willing to pay starting from the initial price set (Fredrick *et al.,* 2004) per each of the displayed uncooked sample under test. Respondents were given the chance of rearranging their ranks until they were completely satisfied that the rankings and willingness to pay values were representative of their preferences. Two trained enumerators were recruited to assist data collection and administering the tool to the respondents.

3.4.2 Secondary data

Characteristics affecting consumer behavior and vegetable attributes influencing WTP where collected from secondary data to supplement identification and selection of explanatory variables. The major sources of secondary data were Sokoine National Agriculture Library (SNAL), internet, published and unpublished dissertation and theses and other relevant literatures.

Analytical Methods

Data on socio-economic characteristics of respondents; consumer valuation and prices willing to pay for cassava leaves products summarized and descriptive statistics (mean, standard deviations, t-values, and percentages) were generated using Excel and SPSS package Version 16.0.

3.5.1 Identifying acceptable cassava leaves attributes

Data on cassava leaves attributes was ordinal in nature, and the rank values were not independently distributed. Friedman's test employed by Botelho (2012) was used. This study sought to determine sensory attributes considered by consumers when buying cassava leaves vegetable among test products. Pair wise t-test comparison was used to establish the significant difference.

3.5.2 Estimation of mean willingness to pay

Willingness To Pay (WTP) can be assumed to have a probability density function (pdf) around a mean in the function of the price. In most literature, the logistic distribution is employed where the price enters indirectly in the argument, called the index function ν (Kimenju *et al.*, 2005, Zhang *et al.*, 2010). The most common index function is linear in the price or bid B:

$$\nu = \alpha - \rho B \quad \text{...(1)}$$

and the probability density function (pdf) of the WTP is expressed as:

$$P(WTP = B) = \exp(\nu) / (1 + \exp(\nu)) \quad \text{...(2)}$$

The logistic function has a closed form cumulative distribution function (cdf), which represents the proportion of the population whose willingness to pay, falls below a certain

value *B.*

$$G(\beta) = (WTP < B) = 1/(1+\exp(v)) \quad \text{.....(3)}$$

Consumers' who accept an offer B are those whose WTP is higher than B, so the probability of someone accepting is given by the function:

$$P(WTP > B) = \pi^{y}(B) = 1 - G(B) \quad \text{..... (4)}$$

In a double bounded contingent valuation framework, the consumer is presented with two bids, with the second bid contingent upon the response to the first bid (Kimenju *et al.*, 2005, Zhang *et al.*, 2010). If the individual responds —"yes" to the first bid, the second bid B_i^u is greater than the first bid $(B_i^u > B_i)$; if the individual responds —"no" to the first bid, the second bid, B_i^d is smaller than the first bid $(B_i^d < B_i)$.

Thus there are four possible outcomes to the questions: a "yes" to the first bid followed by a "yes" to the second bid (probability denoted by (π^{yy}), a "yes" followed by a "no" (π^{yn}), a "no" followed by a "yes" (π^{ny}) and both answers are "no" (π^{nn}). To receive information on a wider range of values, the bids differ between respondents *i* and the four probabilities can be summarized as follows; (Kimenju *et al.*, 2008);-

$$\pi^{yy}(B_i, B_i^u) = \Pr(B_i^u \leq \max WTP_i) = 1 - G(B_i^u) \quad \text{..... (5)}$$

$$\pi^{yn}(B_i, B_i^u) = \Pr(B_i \leq \max WTP_i \leq B_i^u) = G(B_i^u) - G(B_i) \quad \text{..... (6)}$$

$$\pi^{ny}(B_i, B_i^d) = \Pr(B_i^d \leq \max WTP_i \leq B_i) = G(B_i) - G(B_i^d) \quad \text{..... (7)}$$

Combining the probabilities of the four outcomes, the log-likelihood function for a sample takes the form:

$$\ln L^D(\theta) = \sum_{i=1}^{N} \{d_i^{yy} \ln \pi^{yy}(B_i, B_i^u) + d_i^{nn} \ln \pi^{nn}(B_i, B_i^d) + d_i^{yn} \ln \pi^{yn}(B_i, B_i^u) + d_i^{ny} \ln \pi^{ny}(B_i, B_i^d)\} \quad \text{..... (8)}$$

Where, d_i^{yy}, d_i^{nn}, d_i^{yn} and d_i^{ny} were binary variables with 1 denoting the occurrence of that particular outcome, and 0 otherwise. Kimenju *et al.* (2008) pointed out the parameters could be estimated by maximizing the likelihood function. Mean WTP was then evaluated as: WTP = α/ρ where, α was the coefficient of the intercept term and ρ = bid price. The estimation approach for mean WTP in this experiment was based on a random utility framework in which consumers are willing to buy processed cassava leaves when the utility of obtained from consuming cassava leaves was at least as great as consuming other vegetables (Henderson and Quandt, 1980).

3.5.3 Empirical factors affecting consumers'

Demand for products depends on an individual's perceived qualities, which are subjective implying the demand is influenced by product attributes or characteristics associated with the quality. As Kimenju *et al.* (2005) has indicated, WTP is influenced by the value that consumers attach to the product attributes, in addition to price and socio-economic factors. Moreover, consumer's WTP may be influenced by individual's tastes and preferences, income, and attributes of the product, in addition to household and socio-economic characteristics. Following Zhang *et al*. (2010) and Kimenju *et al*. (2005), a logit model is specified to examine the relationship between WTP and socio-economic variables and product characteristics. The WTP by a consumer *j* choosing a food product *i* was specified as:

$$WTP = \alpha + \rho B_{ij} + \phi Z_{ij} + \varepsilon_{ij} \quad \text{.....(9)}$$

The error term in (9) is assumed to follow a logistic distribution with zero mean and a variance of $\tau^2/3$. Formally, the logistic model explaining consumers' WTP premium for each cassava leaves products was specified as:

$$WTP = \alpha + \rho B + \phi Z + \varepsilon \quad \text{.....(10)}$$

Where;-

WTP = 1 if the consumer is willing to pay a premium for a product and 0 otherwise

B = bid price

z = a vector of explanatory (Kimenju *et al.*, 2008; Zhang *et al*., 2010)

Specifically, the logit regression explaining consumers' WTP for each of the cassava leaves product was specified as:

$$WTP_{ij} = \alpha + \rho\, Bid_{ij} + \phi_1 Age1 + \phi_2 Age2 + \phi_3 Age3 + \phi_4 Gender_{ij} + \phi_5 Hhsize_{ij} + \phi_6 Child_{ij} + \phi_7 Maristat_{ij} + \phi_8 Education_{ij} + \phi_9 Inc1 + \phi_{10} Inc2 + \phi_{11} Inc3 + \phi_{12} Colour_{ij} + \phi_{13} Aroma_{ij} + \phi_{14} Texture_{ij} + \phi_{15} General\ Appearance_{ij} + \varepsilon_{ij} \quad \text{..... (11)}$$

The detailed definitions of the variables employed in the empirical models (11) are provided in Table 1.

Table 1: List of variables and their definitions

Variable	Measure of variable	Expected sign
Bid	Bid price faced by respondent (TZS)	-
Socio-economic and demographic characteristics		
Age 1	Dummy (1≤ 25 years, 0 = otherwise)	+/-
Age 2	Dummy (1 = 25 – 55 years, 0 = otherwise)	+/-
Age 3	Dummy (1 ≥ 55 years, 0 = otherwise)	+/-
Gender (sex)	Dummy (1= female, 0 = male)	+/-
HHsize	Number of household members	-
Child	Number of children less than 18 years	+/-
Maristat	Dummy (1 = married, 0 = otherwise)	+/-
Education	Years of schooling	+

Inc1	Dummy (1≤TZS 200 000, and 0= otherwise)	-
Inc2	Dummy (1= TZS 200 000 – 500 000, and 0 = otherwise)	+
Inc3	Dummy (1≥TZS500 000, and 0 = otherwise)	+
Product characteristics		
Colour	A score for product colour	+
Aroma	A score for product aroma	+
Texture	A score for product texture	+
General appearance	A score for product general appearance	+

Key: - HHsize (household size), Maristat (marital status) and Inc (household monthly income)

A Priori Expectation

The negative sign of the bid coefficient was expected because consumers are more likely to indicate they will buy the product if it is offered at a lower price (Owusu, 2009; Zhang *et al.,* 2010). Various socio-economic and demographic variables of consumers' were predicted to influence WTP in different directions. For gender and marital status of the respondent an effect is sometimes found, although *a priori* there is no expectation on the direction of the effect. The other socio-economic variables indicated respondents' ability/inability to pay. Household monthly income (Income) and educational attainment (Education) were expected to impose positive effects on WTP hence indicate a higher ability to pay (Akankwasa, 2007; Owusu, 2009).

For household size variable, it was expected that the more number of members in the respondents household, the less willing he/she would pay due to more expenses for the household. On the other hand, age could have both positive and negative effects depending on how they value the product use. Lastly, sensory attributes of the products expected to influence WTP in a positive direction because of more appearing attribute by the respondent the higher he/she would be willing to pay for it (Akankwasa, 2007; Zhang *et al.,* 2010).

Limitation of the Study

The study encountered the following limitations.

i. Researches related to this study specifically in cassava leaves have not been carried out in Tanzania. Thus, it was difficult to access relevant materials directly related to the theme of this study.

ii. Food processing plants dealing with vegetable processing specifically in cassava leaves are very few in Tanzania. Thus, it was difficult to find enough bases for SolarTunda processed cassava leaves products quality and prices comparisons during the study.

iii. This research investigated only cassava leaves vegetable due to time and budget constraints. Therefore conclusion drawn from the study can differ if generalized to the whole set of IVs found in the country in general.

Overall, consumers' WTP for a given product is a function of knowledge and awareness on the presence of the product in the market. Demographic and socio-economic characteristics such as age, gender, income, household size also shape consumers WTP because these factors affect the product acceptance (Akankwasa, 2007). The product/sensory attributes also influence the customer's perceived quality of cassava leaves products (Ragaert *et al.,* 2004). In addition, market characteristics such as availability and prices affect purchase behavior and ultimately consumer's acceptance and WTP.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Socio-economic and Demographic Characteristics of Respondents

Characteristics of consumers such as age, household size, education level and sex are believed to have effect on product acceptance in the market because they influence consumption patterns and willingness to pay (Campiche *et al.*, 2004). Table 2 shows that, of the total (110) sampled respondents, 63 (57.3%) were females and 47 (42.7%) were males, consistent with proportion of sex ratio of the population of Morogoro Municipality reported by Tanzania census of people and housing 2012 (URT, 2013b). The mean age of respondents was 33.4 years ranging from 22 to 57 years. On average household size consist of about 4.09 people with 2 children of 18 years and below, approximately the same to national average of 4.1 members per household (URT, 2013b). As Stewart *et al*. (2004) argued, household size with large number of dependants could partly influence food choices.

The average household monthly income of respondents was found to be TZS 388 181 with a minimum of TZS 120 000 and a maximum of TZS 2 000 000. About 54% of the respondents were employed in a formal sector, 32% were self employed and the remaining 14% were students. On average studied population had attained ordinary secondary education, which was a proxy of 11 years of schooling.

Table 2: Socio-economic and demographic characteristics of respondents

Variable	Frequency (n = 110)	Percentage
Age of respondent		
Below 25 years	15	13.6
Between 25 and 50 years	83	75.5
Above 50 years	12	10.9
Gender (sex of respondent)		
Male	47	42.7
Female	63	57.3
Marital status		
Married	65	59.1
Single	33	30.0
Divorced	7	6.4
Widowed	5	4.5
Occupation (Employment Status)		
Self-employed	35	31.8
Formally employed	59	53.6
Students	16	14.6
Monthly Income level (TZS)		
Below 200 000	17	15.5
Between 200 000 and 500 000	77	70.0
Above 500 000	16	14.5
	Mean	**Standard Deviation**
Education (years)	11.0727	2.885
Household Size	4.091	2.600
Children below 18 years	1.118	1.268
Household Income per month (TZS)	388 180	298 392

Source: Author's calculations, 2013

4.2 Consumers Vegetable Consumption Rate

Respondents were asked to list vegetable varieties that account for largest share in their household daily meal for the past one week. Among varieties presented, Amaranth (mchicha) scored highest frequency (100%) followed by spinach (64%), cabbage (63%) and sweet potato leaves (tembele) (49%). Cassava leaves (kisamvu) was least used

vegetable in their household meals (10%), preceded by Collard Greens (sukumawiki) (12%), pumpkin leaves (majani ya maboga) (23%) and cowpea leaves (majani ya kunde) (27%) (see Fig. 3).

The observed low frequency of using cassava leaves in the household meals relative to other types of vegetables were pointed out to be due to its unavailability in the nearby food markets and/or inconvenience in preparation and cooking. These reasons made cassava leaves to obtain a non considerable segment in the household vegetable budget, implying that there is a need to solve problems associated with preparation and reducing cooking time of the cassava leaves (Arnieyantie *et al.*, 2012). Umuhozariho *et al.* (2011) points out that among constrains facing consumers in using cassava leaves vegetable regularly is the hard and time consuming preparation of the leaves.

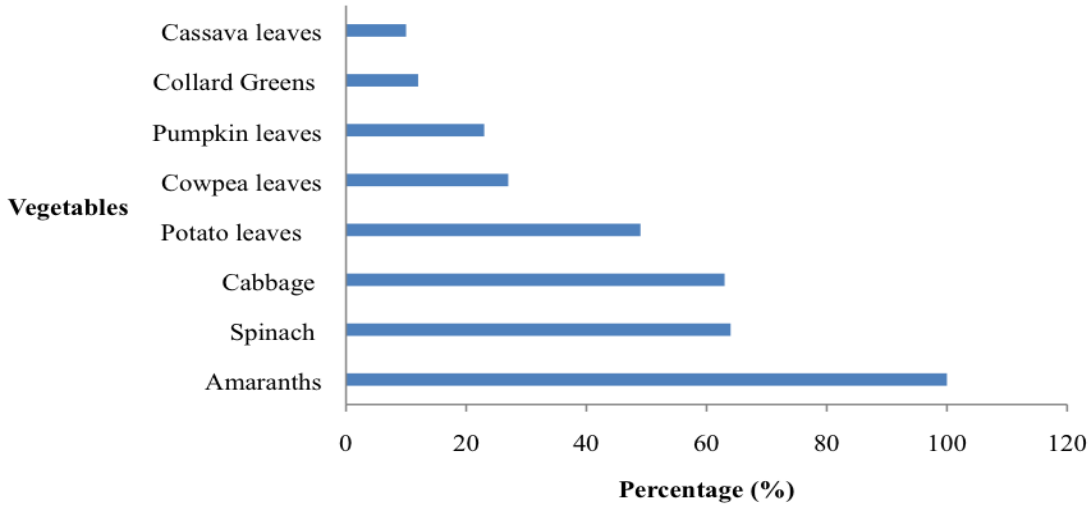

Figure 3: Vegetable varieties consumed by respondents in the past one week (n=110)

Consumers' Awareness of Processed Cassava Leaves

Fig. 4 presents respondents' awareness of the cassava leaves products. Findings indicate

that, majority of consumers (94%) were aware of the fresh whole leaves but they never came across processed cassava leaves products. This confirms that consumers did not yet know processed cassava leaves products, as they are new in the market. However minority of the respondents had seen fresh pounded cassava leaves vendored by women and some dried leaves products samples in food exhibitions (mainly on Farmers' Day - Nanenane).

It was also found that, majority of consumers usually buy vegetables in a fresh form sold in bundles (whole leaves) from street hawkers and market places. Availability of fresh cassava leaves in local markets together with other vegetable varieties can also be argued for the reason for its high level of awareness. This is similar to findings by Kamga *et al.* (2013), who observed that people of Yaoundé-Cameroon preferred to buy their vegetables mainly from street markets.

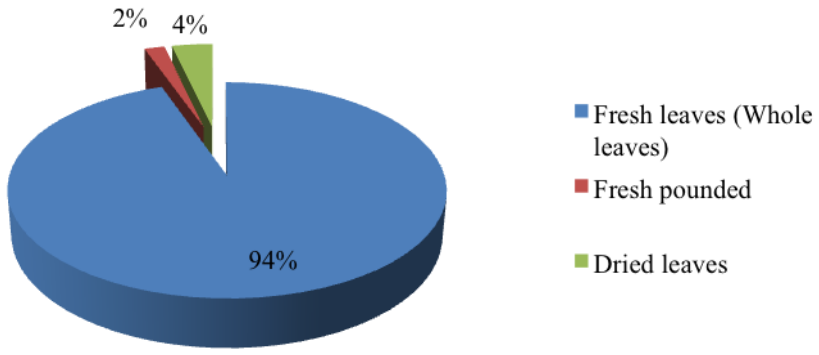

Figure 4: Responses of consumers' awareness of processed cassava leaves

Consumer Evaluation of Cassava Leaves Attributes

For consumers to accept and be willing to pay for a product, that particular product must

possess attributes that are considered most important and attractive to consumers' attention (Benedict and Steekamp, 1996). These products' quality attributes form the basis for consumer preferences and acceptance for a product. Table 3 presents summary statistics of consumers' ratings for the sensory attributes including colour, aroma, texture, and general appearance of cassava leaves products across different processing treatments.

Table 3: Consumers' rating for cassava leaves attributes[7]

Attributes	**Sample**					
		Fresh		**Frozen**		**Dried**
	Mean	**St Dev**	**Mean**	**St Dev**	**Mean**	**St Dev**
Colour	3.50b	1.07	4.39a	0.78	2.80c	0.80
Aroma	3.00c,b	1.22	4.05a	0.74	3.10b	0.69
Texture	2.28c	1.20	4.17a	0.69	3.20b	0.75
General appearance	2.90c	1.07	4.12a	0.58	3.30b	0.76

Notes: Values are ranked on a 1–5 Likert scale, with 5 denoting most liked. Lower-case letters (a, b, c) should be read by row for each variable. Differing letters denote statistically significant differences; identical letters denote no statistically significant differences.

Among the products under test, colour of the frozen cassava leaves scored highest, that is most liked followed by colour of fresh cassava leaves variety. The colour for dried cassava leaves were relatively less scored among all the cassava leaves products under test. This might be due to the fact that cassava leaves change their greenish colour to a darkish colour when dried. Most vegetable consumers less liked its colour, the situation which may influence consumer's choices. In a related study, Akankwasa (2007), identified that the initial impression and evaluation of food is based on visual assessment and found out that colour had positive implications on acceptance.

[7] For the detailed consumers' rating for cassava leaves product sensory attributes see Appendix 1 and 2

Results of consumer valuation on aroma attribute of the cassava leaves indicated that frozen leaves had relative highest score for aroma compared to others. Aroma of the dried and fresh cassava leaves was also acceptable with majority of respondents ranking it above 3.0 level of likert scale, implying that they were normally acceptable. However, there was insignificant difference between aroma of dried and that of fresh leaves. This implies that based on the aroma attribute, fresh and dried cassava leaves are perfect substitute since they are almost equally liked by consumers.

Texture of the cassava leaves indicated that frozen leaves had relative highest score compared to the rest of products under tests. This could be associated with the smoothness of the leaves pulp, which resembled the fresh pounded leaves. Texture of the dried cassava leaves was also normally acceptable because respondents ranked it above 3.0 level in likert scale. However, in fresh cassava leaves texture attribute was least liked. This is possibly because the leaves appeared in form of whole leaves hence the need for pounding in order to obtain desired texture from it.

General appearance evaluation of cassava leaves products showed that fresh leaves had relatively bad appearance and therefore less acceptable (Table 3). On average, processed cassava leaves were ranked above 3.0 level of likert scale, suggesting that their appearance was generally acceptable to consumers. However, frozen cassava leaves were noted to be more acceptable than dried cassava leaves. Moreover, consumers reported that the processed products appearance extends shelf life of cassava leave vegetable by reducing time for deterioration and hence could be good for long term storage and transportation.

Generally, among products under test, consumers ranked, frozen cassava leaves as the leading choice, followed by dried and fresh leaves respectively. The fresh cassava leaves which was familiar variety among consumers and a reference product in this study, was least liked. This is converse to findings by Zellner (1991), who argues that familiar foods were generally more liked than unfamiliar foods.

Investigating Preparation Methods for Cassava Leaves Recipes

Meanwhile in investigating consumers' acceptance and willingness to pay for cassava leaves products, this study used the chance to investigate different method preferred by consumers for each of the cassava leaves products during recipes preparation. This was done blindly following sensory evaluation of the uncooked cassava leaves product samples by same the respondents.

Consumers were randomly presented with recipes of the SolarTunda cassava leaves products (fresh, frozen and dried leaves) cooked using coconut milk and normal cooking oil. Consumers rated mostly liked all cassava leaves which were prepared using coconut milk compared to those prepared using normal cooking oil. This reveals that the outcome of spices added to the processed product had improved sensory qualities of the samples compared to the unprocessed ones. It is therefore plausible to conclude that, in preparing the cassava leaves for cooking there is a need of adding the spices to ensure that desired utility in terms of sensory attributes like aroma, texture and flavor is obtained.

Among the recipes prepared using normal cooking oil, frozen leaves sample were relatively liked compared to fresh and dried leaves samples in terms of texture and aroma

attributes. Accordingly, dried cassava leaves recipe cooked using coconut milk was marked as mostly preferred and tasty compared to the one cooked using normal cooking oil. This was shown by dislike rating by respondents of colour (very dark) (75.5%), texture (extremely rough) (68%) and aroma (67%) of the recipe cooked using normal cooking oil. Preparation of the recipe using coconut milk improved the score for aroma and colour by respondents (from 33% to 62%) allowing the dried leaves recipe to have more appealing sensory attributes compared to the evaluation of its uncooked sample by consumers (Table 3).

Generally, results of sensory evaluation of the cooked samples showed that about 78 percent of the respondents would like to prepare the recipes of dried leaves using coconut milk. For the frozen sample there was no large difference between the percent of consumers preferring its preparation with normal cooking oil (64%) and with coconut milk (62%) since all were similarly favored by consumers, confirming that SolarTunda preparation of frozen cassava leaves product add value in terms of both flavor, texture and appearance.

Consumers' WTP for Cassava Leaves Products

The distribution of consumers' willingness to pay for cassava leaves vegetable products are presented in Fig. 5 below. Among the products, 80.9% of the respondents were willing to pay for frozen leaves, followed by dried leaves (66.6%) and fresh leaves (47.2%).

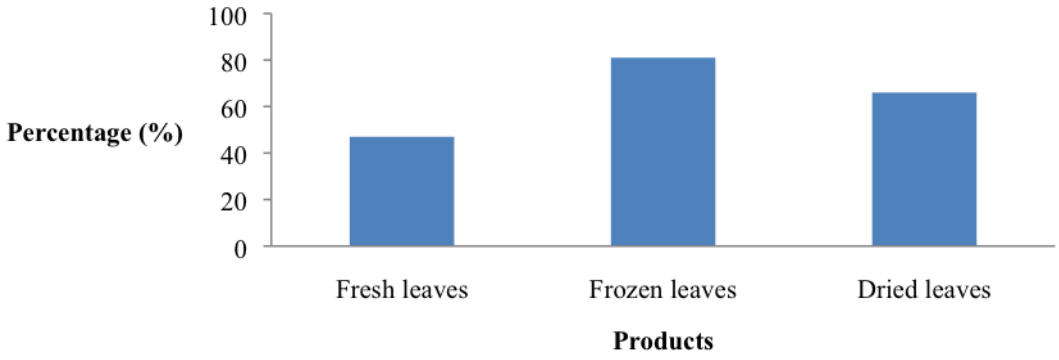

Figure 5: Distribution of respondents' WTP for cassava leaves products

In determining the motives behind observed WTP distribution for cassava leaves products under study, Table 4 summarizes respondents' responses. Sixty percent (65.5%) valued processed products because of their convenience in their usage (no need for preparations before cooking). Other reasons mentioned include the safety of processed leaves for human consumption (the harmful toxins in cassava is removed during processing) (29%); This is in line with findings of Arnieyantie *et al.* (2012), that preparation of cassava leaves through pounding and boiling was found to remove toxic content found in the fresh leaves. Furthermore, 11% of the respondents claimed that processing allows easy storage of the products without deterioration, making it more convenient to get when needed.

On the other hand, the study found that major reason given by those not-willing to pay was the presence of other vegetables in the market that may be used as substitutes for cassava leaves (50%) (Table 4). Other reasons cited, were inability of the households to afford paying for the products (39%) and 23% mentioned that, a change brought by processing cassava leaves was seen to be not significant.

Table 4: Reasons for willing and not-willing to pay for cassava leaves products

Responses from respondents	Respondents (n=110)	Percentage
Main reasons for willing to pay		
The change brought by processing is significant (makes cassava leaves more convenient for use)	72	65.5
The processed products are easy for storage	9	11
The processed products are safe for human health	24	29
Though never used the products before, I would like to use them now	92	84
Main reasons for not willing to pay		
There are many other vegetables available	56	50
My household cannot afford to buy these products	43	39
The change brought by processing is not significant	25	23

Note: Total does not add-up to 100% due to multiple responses
Source: Author's calculation, 2013

Estimating Mean WTP for Cassava Leaves Products

In determining the WTP empirically, the restricted equation (10) (without consumer characteristics) was estimated for each cassava leaves product (Owusu, 2009; Zhang *et al.*, 2010). The mean WTP was derived from the ratio - (α/ρ), where α is the coefficient of the intercept term and ρ is the coefficient of the bid (Owusu, 2009). Table 5 shows estimated mean WTP for cassava leaves products considered in the study.

Table 5: Mean WTP estimates for cassava leaves products

Variable	Fresh leaves	Frozen leaves	Dried leaves
Constant (α)	6.363	3.322	8.407
	(4.582)***	(5.190)***	(4.390)***
Bid (ρ)	-0.022	-0.005	-0.005
	(-3.723)***	(-5.000)***	(-5.010) ***
Mean WTP (TZS)	289.23	664.40	1681.40
Number of observations	110	110	110
Log- likelihood	122.617	111.590	110.340
LR chi^2 1	17.873	40.866	42.116
Pseudo R^2	0.208	0.414	0.424

Note: *** indicates significant at 1%, Figures in parentheses are z-values.

Average WTP for processed cassava leaves were TZS 664.4/100g and 1681.4/100g package of frozen and dried leaves respectively. The estimated average WTP for fresh cassava leaves was TZS 289.23 for a bunch of leaves. As shown in Table 6, percentages of premiums over prices set for the products also vary significantly. For example, observed premium for frozen and dried leaves above the set prices were 66.1% and 12.1% respectively. This finding confidently rejects the study hypothesis (p=0.05) that consumers are not willing to pay premium for processed cassava leaves, both frozen and dried leaves. For the case of fresh cassava leaves consumers were willing to pay but only at a discount of 3.6% (Table 6). However, the lower percentage premium for dried leaves could be due to high price set for 100g package (TZS 1500) compared to that of frozen leaves which was TZS 400. According to Kamga *et al.* (2013), higher prices of processed vegetables hinder sales of the products.

Table 6: Comparisons of WTP prices and set prices for cassava leaves products

Sample products	Set prices (TZS)	Mean WTP (TZS)	Premium (TZS)	Mean WTP % change over set prices
Fresh leaves	300	289.23	(10.77)	- 3.6
Frozen leaves	400	664.40	264.40	66.1
Dried leaves	1500	1681.40	181.40	12.1

Note: Figure in parenthesis is a discount

Factors Affecting Consumers' WTP for Cassava Leaves Products

Consumers' characteristics affecting WTP for cassava leaves products

Coefficient for bid price was found to be negative as expected (Table 7). The sign was expected because consumers are more likely to buy the product if it were offered at a lower price. This is consistent with the findings of Akankwasa, (2007) where prices of dessert bananas were negatively related to consumers' WTP. Similarly, Owusu (2009) found that consumers' WTP for organic fruits and vegetables in Ghana were negatively correlated to prices offered. In this study price were statistically significant in all model specifications of cassava leaves products. With the bid price negatively influencing WTP, it implies that the higher the bid, the less likely respondents are willing to pay for a cassava leaves product.

The coefficient of Age2 indicates positive correlation and statistically significant at 1% and 5% level of significance for the WTP model for processed frozen and dried cassava leaves respectively (Table 7). These imply that, young consumers (less than 25 years) relative to other age groups (middle age 25-50 years and elders above 50 years) have less WTP for processed cassava leaves. This could be due to the fact the young consumers are more energetic and possibly have more time for fresh leaves preparation compared to the older ones.

Table 7: Logit estimates on consumers' WTP for cassava leaves products

Variable	Sample		
	Fresh	**Frozen**	**Dried**
Constant	3.164	3.690	10.648
	(2.954)***	(1.878)**	(3.995)***
Bid (TZS)	-0.023	-0.008	-0.009
	(-2.510)***	(-3.980)***	(-4.010)***
Consumer characteristics			
Age 1	0.052	-8.960	-9.718
	(0.042)	(-2.731)***	(-2.174)**
Age 2	1.782	-2.373	0.181
	(2.139)**	(-1.555)	(0.162)
Gender	0.748	0.227	-2.715
	(0.680)	(0.161)	(1.896)*
Hhsize	-0.191	-0.775	0.534
	(-0.965)	(-1.932)*	(1.713)*
Child	-0.262	-0.899	-2.666
	(-0.740)	(-1.407)	(-2.836)***
Maristat	-0.122	3.805	8.632
	(-0.111)	(2.263)**	(3.395)***
Edu	-0.100	-0.045	0.008
	(-0.862)	(-0.274)	(0.049)
Inc2	-0.412	5.440	6.958
	(-0.267)	(2.258)**	(2.295)**
Inc1	1.160	4.443	5.330
	(1.750)*	(1.481)	(1.411)
Product attributes			
Colour	0.819	0.921	-1.192
	(1.869)*	(1.914)*	(-2.489)***
Aroma	-0.019	2.654	0.026
	(-0.062)	(3.346)**	(0.043)
Texture	-0.278	0.431	-0.159
	(-1.324)	(0.911)	(-0.324)
General appearance	-0.276	1.906	1.722
	(-0.857)	(1.832)*	(1.923)*
Number of observations	110	110	110
Log - likelihood	117.188	100.964	92.723
Chi-square	23.303	51.492	59.733
Pseudo R^2	0.265	0.374	0.419

Note: ***, **, * indicates significant at 1%, 5% and 10% respectively, figures in parentheses are z-values

Gender of respondent was found to have a significant effect (p= 0.1) on WTP for dried cassava leaves only. The direction of influence was negative implying that female consumers were willing to pay less for dried cassava leaves. This proves that, female

respondents preferred the freshness form of vegetables that was found in fresh and frozen products compared to the male respondents. This is because women are mostly responsible for household food purchases (USAID, 2012). It was also found that women were more aware of the fresh vegetable because it is the form of cassava leaves vegetable available, mostly in the local markets.

Household size variable had a significant negative relationship with WTP for frozen leaves at 1% level of significance (Table 7). The direction of influence was similar to expectation. The model results showed that consumer's willingness to pay for frozen cassava leaves decreases as the number of household members increases. Thus, justifies relative higher WTP by small sized household. This suggests that, for large sized households the packages of frozen leaves were seen not enough to prepare a meal for the whole household. Contrary to expectation, significant positive relationship between the household size and WTP for dried cassava leaves was noted. These results could be due to the fact that dried leaves absorb water and bulge (increase in size) when soaked during and before cooking relatively to the frozen leaves hence enough to satisfy the meal requirement for a large sized family.

Number of children in the household was negatively related to consumers' WTP for cassava leaves vegetable and significant (1% significance) for dried leaves. The direction of influence was similar to expectation. The empirical results indicate that consumers with children (less than 18 years) are less likely to pay for dried cassava leaves products. The findings are in line with that of Govindasamy and Italia (1998) who concluded that, larger numbers of children in a household are likely to have a negative correlation with

consumers' WTP. This is because households with a larger number of children may have less money to spend per child, and cannot afford to pay premiums for the products.

Marital status of respondent was also found to have a positive and significant relationship with WTP for processed cassava leaves. This may be because, respondents who are married are mostly likely to consume home prepared meals they purchase fresh vegetables. However, in the case of cassava leaves, the study found that married people would like to purchase processed cassava leaves. The reasons could be as shown in Table 4, that preparation of cassava leaves is time consuming and cumbersome compared to other fresh vegetables.

Income was found to have a positive effect on consumer's WTP for cassava leaves products as expected. Estimated positive coefficients of consumers in the high income groups for the processed leaves indicate that consumers in the middle and higher income groups (TZS 200 000 - 500 000, and above TZS 500 000 respectively) were more willing to pay for the processed cassava leaves products ($p=0.05$). This could be due to the fact that, high income earners have more disposable income and thus would probably desire to test new products. Also, high income people are much more interested with variety and/or quality of products consumed (Owusu, 2009). Accordingly, positive and significant coefficient of low level income earners (below 200 000 TZS/month) for fresh leaves implies that consumers with low income levels exhibit higher WTP for fresh leaves product. This could be reasoned by the perception that processed food products are relatively expensive (Kamga *et al.*, 2013).

Education level was also an important factor in predicting consumer willingness to pay for cassava leaves products. Though the variable was not significant, its coefficients for fresh and frozen cassava leaves were negative, suggesting that respondents with higher education level were willing to pay less for these products. Probably this could be due to relatively higher costs associated with handling of fresh and frozen cassava leaves especially in the absence of the cooling facilities such as refrigerators. This is not the case in dried cassava leaves. Therefore, the observed positive relationship of education level to WTP of dried cassava leaves suggests that highly educated consumers were willing to pay more for dried cassava leaves.

Product attributes influencing consumers WTP for cassava leaves

Expectedly, Table 7 shows that colour had positive and significant (10%) relationship with WTP for fresh and frozen cassava leaves. This indicates that vegetable consumers attach more importance to its colour. For the dried leaves, colour was observed to influence WTP at $p = 0.01$ with negative correlation unexpectedly, implying that, the colour of dried leaves was not acceptable to consumers. Unexpected negative relationship can be due to the fact that, drying processes change the actual green colour of the leaves making them not attractive to vegetable consumers. This is also shown in the ratings of the attribute where dried leaves were least liked (Table 3).

The estimated coefficient for vegetable aroma was also positive and significant at $p = 0.05$ for frozen leaves. This suggests that, frozen cassava leaves had a typical aroma of cassava leaves, an attribute that was acceptable to consumers. The coefficients for aroma for dried

cassava leaves though not significant was also found to be positive related to WTP as expected. General explanation for such positive relation in processed cassava leaves and negative in fresh cassava leaves is the addition of spices during preparation of the processed leaves such as garlic that improves the aroma.

General appearance attribute that represent the form of the product showed a positive significant relationship for WTP for both frozen and dried cassava leaves. Fresh cassava leaves were insignificant and negatively correlated to WTP (Table 7). Though insignificant, the negative coefficient indicates that consumers who pay more attention to the convenience of cassava leaves are less likely to prefer fresh leaves. The form at which the product appears is observed to influence its acceptance and utilization (Akankwasa, 2007). This is consistent with reasons pointed out by consumers for not eating cassava leaves regularly in their meals, among them being difficultness in preparing the leaves to a form that is easy for cooking (Table 4).

Coefficients for texture were not significant in determining WTP. However, positive correlation observed for frozen leaves indicates that consumers would be WTP for higher price premium for frozen leaves because it meets their texture preference. This could be associated with the smoothness of the leaves pulp due to addition of the food species such as garlic, which improved both the aroma and texture of the leaves. Negative correlation between texture and WTP for fresh and dried cassava leaves suggests that the whole-leaf form and the dryness of the leaves respectively are relatively undesirable to cassava leaves consumers.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

About 94% of the respondents acknowledged their unawareness of the processed vegetables. This is because they have never seen these products. Fresh leaves form is the most common form found in general public markets. However, 65.5% of the respondents commented that processing added a significant value to the fresh leaves; this implies that consumers have spotted the importance of processing cassava leaves.

Consumers' decision on vegetables purchase was found to base on some of attributes of which they attach values. Respondents had positive WTP for cassava leaves products with accepted attributes including colour, aroma, texture and appearance. High score rating for colour in fresh and frozen leaves showed that, the greenish and freshness appearance of the vegetable is an important attribute to consumers. Aroma, which was the actual smell of the vegetable, was also found important with lowest scores in fresh leaves and higher ratings in frozen and dried leaves. Texture of the leaves obtained relative lower scores in both fresh and dried leaves compared to the frozen leaves indicating its roughness. Finally, consumers rated higher the appearance of processed leaves compared to fresh leaves. They also appreciate the convenience in use due to less time required for preparation. Other reasons revealed were safety of the processed leaves for human consumption and the possibility for longer storage time of the products for future use.

Consumers' WTP for cassava leaves products was also assessed. Respondents' were willing to pay for processed cassava leaves products though the variations in percentage

were high. About 81% were willing to pay for frozen leaves', 66.6% were willing to pay for dried leaves followed by 47.2 % for fresh leaves. The estimated mean WTP for these products were 289.23, 664.40 and 1681.40 TZS for fresh, frozen and dried cassava leaves respectively. This is equal to 66.1% and 12% premium for frozen and dried cassava leaves respectively; and 3.6% discount for fresh cassava leaves. The findings showed a large market potential for frozen and dried leaves compared to the fresh leaves in the study area.

The study found out that socio-economic factors including age, income, gender, and household size significantly influence consumers' WTP for cassava leaves products. It was also found that, sensory attributes including colour, aroma and general appearance were statistically significant. Therefore, the study findings concluded that acceptance and WTP for cassava leaves vegetable products depends on both consumers' and product sensory attributes.

Recommendations

Based on the study findings, the following recommendations are geared towards improving market potential for cassava leaves products.

i. In view of the fact that consumers accepted and are willing to pay for the processed cassava leaves, efforts to ensure availability of these products in markets needs to be done. This could be through supporting establishment of processing units that will also provide job opportunities for many especially youth and women. It will also help cassava leaves growers/farmers fetch good prices for their fresh cassava leaves produce. This will address constrains faced by

horticulture processing industry in Tanzania.

ii. Standardization and grading of processed cassava leaves products to ensure credible quality, better packaging and labeling needs to be emphasized. Moreover, better technology is strongly recommended to provide uniform texture since the use of wooded traditional processing tools may not work in the commercial market.

iii. To improve aroma of the processed cassava leaves, addition of spices in frozen products will add value to consumer's preference. However, various spices combination could be tested to make frozen products more attractive. Also possibility of having the same in dried products should be sought out as these attributes are important during recipes preparations.

iv. Investment in financial support to the processing units: providing capital to entrepreneurs who would like to establish themselves in the vegetable processing industry. This will enable them to acquire required technology, hence reduce high preparation costs faced by present vegetable processing units in order to set competitive prices for the products with other vegetable varieties found in markets, especially for dried leaves.

Suggestions for Future Research

Future studies should consider WTP for other IVs products. Since only Morogoro Municipality was examined, similar studies should be replicated in other parts of the country to determine the overall acceptance and consumers' WTP for processed cassava

leaves products. This is because consumer behavior and characteristics varies with location, though the study assumed a mixed urban population with people from different places. However, the study give clues of what could be happening if processing of cassava leaves is carried out throughout the country. Therefore it is recommended that similar studies should be conducted in other areas for building a database and for comparison purposes.

Furthermore, some of the variables tested in the WTP model were unexpectedly not statistically significant probably due to the small sample size. To address this statistical limitation, future studies should consider a larger sample size in order to increase the degree of freedom. It is also suggested that, comprehensive innovations should be done on product development within frozen and dried cassava leaves and more on recipes lines for sensory evaluation. Finally, future studies should focus on commercialization potentials of new Agribusiness products in the IVs subsector could be explored.

REFERENCES

Achidi, A. U., Ajayi, O. A., Maziya-Dixon, B. and Bokanga, M. (2008). The effect of processing on the nutrient content of cassava (Manihot Esculenta Crantz) leaves. *Journal of Food Processing and Preservation* 32(3): 486 – 502.

Akankwasa, K. (2007). Consumer acceptability and willingness to pay for introduced dessert bananas. Dissertation for Award of MSc Degree in Agribusiness Management at Makerere University, Uganda, 71pp.

Alphonce, R. and Alfnes, F. (2012). Consumer willingness to pay for food safety in Tanzania: An incentive aligned conjoint analysis. *International Journal of Consumer Studies* 36(4): 394 – 400.

Amegbeto, N. K., Manyong, V. M., Coulibaly, O. and Asiedu, R. (2008). Estimating market demand for fresh yam characteristics using contingent valuation: Implications for crop breeding and production choices. *Journal of Agricultural Economics* 39: 349 – 363.

Ara, S. (2003). Consumers' WTP for multiple attributes of organic rice: A case study in

the Philippines. In: *25th International Conference of Agricultural Economists*, Durban, South Africa, 16 – 22 August, 2003. pp. 1 – 15.

Arnieyantie, A. H., Rafidah, R., Aida, M., Fadhlina, M., Norfezah, H., Nuru, H. and Anderson, N. (2012). Cassava (Mahinot esculanta crantz) Leaves Floss a Potential Protein Source. In: *UMT 11th International Annual Symposium on Sustainability Science and Management, Terengganu, Malaysia*, 9-11 July, 2012 pp. 606-610.

Asafu-Adjaje, J. (2000). *Environmental Economics for Non-economists*. World Scientific Publishing Company Ltd., New Jersey, USA. 130pp.

Awoyinka, A. F. Abegunde, V. O. and Adewusi, S. R. A (1995). Nutrient content of young cassava leaves and assessment of their acceptance as a green vegetable in Nigeria. *Plant Foods for Human Nutrition* 47: 21 – 28.

Benedict, J. and Steekamp, E. M. (1996). Quality guidance: A consumer based approach to food quality improvement using partial least squares. *European Review of Agricultural Economics* 23: 195 – 215.

Bennett, J. and Blamey, R. (2001). *The Choice Modeling Approach to Environmental Valuation.* Edward Elgar Publisher Ltd., London, UK. 69pp.

Boccalletti, S. and Nardella, M. (2000). Consumer willingness to pay for pesticide-free fresh Fruit and vegetables in Italy. *International Food and Agribusiness Management Review* 3: 297 – 310.

Bosch, C. H., Borus, D. J. and Siemonsoma, J. S. (Eds.) (2009). *Vegetables of Tropical Africa.* Conclusions and Recommendations Based on PROTA 2. (2nd Ed.), PROTA Foundation, Wageningen, Netherlands. 28pp.

Botelho, G. (2012). *Sensory Analysis*. Functional foods: Science, engineering and Myths. lifelong learning programme (IP). Erasmus Intensive Programmes, Tokat, Turkey. 22pp.

Boxall, P., Cash, S., Wismer, W. V., Muralidharan, V. and Annett, L. E. (2007). *The Role of Sensory Experiences and Information on the Willingness to Pay for Organic Wheat Bread.* Research Project No. 7. Edmonton, Canada. 23pp.

Bridier, B. E. (2000). *Etude de la Perception de la Qualité des Légumes Par Les Consommateurs de Cas Particulier de la Qualité Sanitaire*. Développement agricole tropical. Option: Valorisation des production. Montpellier, CNEARC: Hanoi, Vietnam. 149pp.

Campiche, J., Holcomb, R. B. and Ward, C. E. (2004). *Impacts of Consumer Characteristics and Perceptions on Willingness to Pay for Natural Beef in the Southern Plains.* Food and Agricultural Products Research and Technology Center. Oklahoma State University, Oklahoma. 16pp.

Carlos, D., Mayen, S. and Marshal, L. M. (2005). Consumer preference of fresh–cut

melon product: A potential value added product for modern growers. Indiana Melon Growers. [http://www.ifama.org/conferences/1140_Paper_Final.pdf] site visited on 15/4/2012.

Caswell, M. F., Fuglie, K. O. and Klotz, C. A. (1994). *Agricultural Biotechnology: An Economic Perspective Agricultural Economic*. Report No. 687. United States Department of Agriculture, Washington, DC. 14pp.

Cranfield, J. A. L. and Magnusson, E. (2003). Consumer‘s willingness to pay for pesticides free food products: An ordered probit analysis. *International Food and Agribusiness Management Review* 6(4): 13 – 30.

Dada, O. A. and Oworu, O. O. (2010). Mineral and nutrient leaf composition of two cassava (*Manihot esculenta Crantz*) cultivars defoliated at varying phenological phases. *Notulae Scientia Biologicae* 2(4): 44 – 48.

Danso, G., Drechsel, P. and Fialor, S. C. (2002). Perceptions of organic agriculture by urban vegetable farmers and consumers in Ghana. *Urban Agriculture-Magazine* 6: 23 – 24.

Dimitri, C. and Greene, C. (2002). *Recent Growth Patterns in the Organic Foods Industry*. Department of Agriculture Economic Research Service. Bulletin No. 777. Agriculture Information, US. 42pp.

FAO (1995). *Fruit and Vegetable Processing:* Agricultural services Bulletin No. 119.

Rome, Italy. 249pp.

Fasuyi, A. O. (2005). Nutrient composition and processing effects on cassava leaf *(Manihot esculenta, Crantz)* anti-nutrients. *Pakistan Journal of Nutrition* 4(1): 37 – 42.

Fredrick, C., Kohlin, G. and Mekonnen, B. (2004). *Contingent Valuation of Community Plantations.* In: A look into Value elicitation formats and intra-household resource allocation decision. Working Papers No. 151. Addis Ababa, Ethiopia. 18pp.

Gil, J. M., Gracia, A. and Sanchez, M. (2000). Market segmentation and willingness to pay for organic products in Spain. *International Food and Agribusiness Management Review* 3: 207 – 226.

Goldberg, I. and Roosen, J. (2005). Measuring Consumer Willingness to Pay For Health Risk Reduction of Salmonellosis and Campylobacteriosis. *Paper Presented at the 11th Congress of EAAE. The Future of Rural Europe in the Global Agri-Food System.* Denmark, 24 – 27 August 2005. 6pp.

Gonzalez, M. J. and Loomis, B. J. (2006). *Testing Welfare Measurement Gains of Combining Stated and Revealed Preferences Method Using count Data Models.* In: American Agricultural Economist Association annual meeting, Long beach, California. 20pp.

Govindasamy, R. and Italia, J. (1998). Predicting the influence of demographic characteristics on the willingness to pay for fresh fruits and vegetables. *Journal of Food Products Marketing* 4(4): 25 – 38.

Groote, D. H., Kimenju, S. C. and Morawetz, B. U. (2006). Comparing accuracy and costs of revealed and stated preferences*: The Case of Consumer Acceptance of Yellow Maize in East Africa. In: International Association of Agricultural Economists Conference,* 12 – 18 August 2006, Gold Coast, Australia. 18pp.

Groote, H. and Kimenju, S. C. (2005). Consumers' willingness to pay for genetically modified foods in Kenya: *Paper Prepared for Presentation at the 11th International Congress of the European Association of Agricultural Economists*, 24 – 27 August, 2005, Copenhagen, Denmark. 16pp.

Grunert, K. G. (2002). Current issues in the understanding of consumer food choice. *Trends in Food Science and Technology* 13: 275 – 285.

Grunert, K. G., Hartving-Larsen, H., Madsen,T. K. and Baadsgaard, A. (2006). *Market Orientation in Food and Agriculture*. Boston. 283pp.

Hanemann, W. M. and Kanninen, B. (1996). *The Statistical Analysis of Discrete-response CV Data.* Working Paper No. 798. Department of Agricultural and Resource Economics and Policy. University of California, USA. 123pp.

Hanley, N., Shogren, F. and White, B. (1997). *Environmental Economics in Theory and*

Practice. Palgrave Macmillan Publishers, New York. 418pp.

Henderson, J. M. and Quandt, R. E. (1980). *Microeconomic Theory, A Mathematical Approach*. (3rd Ed.), McGraw-Hill, Inc., New York. 370pp.

Horna, D., Timpo, S. and Gruère, G. (2007). *Marketing Underutilized Crops: The Case of the African Garden Egg (solanum aethiopicum) in Ghana.* Global Facilitation Unit for underutilized species, Rome, Italy. 24pp.

Ho-Shui, L., Houston, J. E., Wang. S. and Lee, H. (2000). Factors affecting consumer preferences for fish in Taiwan. [http://oregonstate.edu/Dept/IIFET/2000/ papers/houstonli2.pdf] site visited on 5/7/2012.

IFPRI (2002). *Vietnam's Fruit and Vegetable Sector:* Raising rural incomes by improving post-harvest activities. Executive summary, Washington, DC, USA. 21pp.

IFPRI (2006). *Marketing Underutilized Plant Species for the Benefit of the Poor:* A conceptual framework. EPT Discussion Paper No. 154. Washington, DC, USA. 24pp.

Kamga, R., Kouamé, C. and Akyeampong, E. (2013). Vegetable consumption patterns in Yaoundé, Cameroon. *African Journal of Food, Agriculture, Nutrition and Development* 13(12): 7399 – 7414.

Keane, A. and Willets, A. (1994). Factor that affect food choice. *Journal of Nutrition of*

Food Science 94(4): 15 – 17.

Keane, A. and Willets, A. (1994). Factor that Affect Food Choice. *Nutrition of Food Science* 94(4): 15 – 17.

Keding, G., Weinberger, K., Swai, I. and Mndiga, H. (2007). *Diversity, Traits and Use of Traditional Vegetables in Tanzania.* Technical Bulletin No. 40. Shanhua, Taiwan. 53pp.

Keller, G. B. (2004). *African Nightshade, Eggplant, Spider Flower and Others, Production and Consumption of Traditional Vegetables in Tanzania from the Farmer's Point of View*. Masterarbeit im wissenschaftlichen Studiengang Agrarwissenschaften an der Georg-August, Universität Göttingen. 251pp.

Kendall, P., DiPersio, P. and Sofos, J. (2010). *Drying Vegetables.* Fact Sheet No. 9. State University Extension Ltd., Colorado. 308pp.

Kimenju, S. C. and Hugo, D. G. (2005). Consumer's willingness to pay for genetically modified foods in Kenya. In: *11th International Congress of the European Association of Agricultural Economists, the Future of Rural Europe in the Global Agri-Food System,* Copenhagen, Denmark, 24 – 27 August 2005. 16pp.

Kimenju, S. C. and Hugo, D. G. (2008). Consumer willingness to pay for genetically modified food in Kenya. *Agricultural Economics* 38: 35 – 46.

Kovacic, D., Radman, M. and Kolega, A. (2002). Behaviour of fruit and vegetable buyers on the city markets in Croatia. *Paper Prepared for Presentation at the 13th International Farm Management Congress,* Wageningen, The Netherlands. 7 - 12 July, 2002. 14pp.

Lin, W., Somwaru, A., Tuan, F., Huang, J. and Bai, J. (2006). Consumers' willingness to pay for biotech foods in China: A contingent valuation approach. *AgBioForum* 9 (3):166 – 179.

Lusk, J. L., and Hudson, D. (2004). Willingness-to-pay estimates and their relevance to agribusiness decision making. *Review of Agricultural Economics* 26(2): 152 – 169.

Maundu, P., Achigan-Dako, E. and Marimoto, Y. (2009). Biodiversity of African vegetables. In: *African Indigenous Vegetables in Urban Agriculture*. (*Edited by Shackleton, C.M., Pasquini, M.W. and Drescher, A. W.*), Earthscan, London. pp. 65 – 101.

Meilgaard, M., Civille, G. V. and Carr, B. T. (1999). *Sensory Evaluation Techniques*. (3rd Ed.), FL CRC Press, Boca Raton. 387pp.

Mepba, H. D., Eboh, L. and Banigo, D. E. B. (2007). Effects of processing treatments on the nutritive composition and consumer acceptance of some Nigerian edible

leafy vegetables. *African Journal of Food, Agriculture, Nutrition and Development* 7: 1 – 18.

Misra, S., Chung, L., Huang, M. and Stephen, L. O. (1991). Consumers willingness to pay for pesticide-free fresh produce. *Western Journal of Agricultural Economics*. 16(2): 218 – 227.

Monteiro, M. S. D. and Lucas, M. R. V. (2001). Conjoint measurement of preferences for traditional cheeses in Lisbon. *British Food Journal* 103(6): 414 – 424.

Mulokozi, G., Mugyabuso, J. and Modaha, F. (2007). Potential of cassava and sweet potato leaves to contribute to the vitamin A requirements. *Proceedings of the 13th ISTRC Symposium*, Dar es Salaam, Tanzania. pp. 755 – 762.

Munene, C. N. (2006). Analysis of Consumer Attitudes and Their Willingness To Pay For Functional Foods. Dissertation for Award of MSc Degree at Louisiana State University, USA, 157pp.

Murphy, M., Cowan, C., Henchion, M. and O'Reilly, S. (2000). Irish consumer preferences for honey: A conjoint approach. *British Food Journal* 102(8): 585 – 598.

Ngigi, M. W., Okello, J., Lagarkvist, C., Karanja, N. and Mburu, J. (2010). *Assessment of Developing-country Urban Consumers' Willingness to Pay for Quality of Leafy Vegetables:* The case of middle and high income consumers in Nairobi, Kenya.

16pp.

Nweke, F. (2004). New challenges in the cassava transformation in Nigeria and Ghana. *Proceedings of the Conference Successes in African Agriculture,* 1-3 December, 2003, Pretoria. pp. 6 – 11.

Obuobie, E., Keraita, B., Danso, G., Amoah, P., Cofie, O. O., Rachid-Sally, L. and Drechsel, P. (2006). *Irrigated Urban Vegetable Production in Ghana:* Characteristics, benefits and risks, Accra, Ghana. 98pp.

Oluoch, M. E., Germain, N. P., Silue, D., Abukutsa-Onyango, M. O., Diouf, M. and Shackleton, C. M. (2009). Production and harvesting systems in African indigenous vegetables. In: *African Indigenous Vegetables in Urban Agriculture.* (*Edited by Shackleton, C. M., Pasquini, M. W. and Drescher, A. W.*), Earthscan, London. 169pp.

Owusu, M. A. (2009). The assessment of market potential and marketing prospects of organic fruits and vegetables in Kumasi Metropolis of Ghana. Thesis for Award of PhD Degree at Kwame Nkrumah University, Ghana, 97pp.

Pearce, D. and O¨zdemiroglu, E. *(*2002). *Economic Valuation with Stated Preference Techniques:* Summary guide. Queen's printer and controller of her Majesty's stationery office, London. 94pp.

Piyasiri, A. G. S. A. and Ariyawardana, A. (2002). Market potentials and willingness to

pay for selected organic vegetables in Kandy-Sri Lanka. *Sri Lankan Journal of Agricultural Economics* 4(1): 107 – 119.

Quagrainie, K. (2006). IQF Catfish retail: A study of consumers' WTP. *International Food and Agribusiness Management Review* 9(2): 453 – 467.

Ragaert. P., Verbeke, W., Devlieghere, F. and Debevere. J. (2004). Consumer perception and choice of minimally processed vegetables and packaged fruits. *Food Quality and Preference* 15: 259 – 270.

Rao, A. R. and Monoroe, K.B. (1989). The effects of price, brand name and store name on buyer's perceptions of product quality: an integrative review. *Journal of Marketing Research* 26: 351 – 357.

Riccarda, M., Raffaelli, R. and Thilmany-McFadden, D. (2011). Consumer preferences for fruit and vegetables with credence-based attributes: *International Food and Agribusiness Management Review* 14(2): 121 – 142.

Rodríguez, E., Lacaze, V. and Lupín, B. (2008). *Contingent Valuation of Consumers' Willingness-to-pay for Organic Food in Argentina*. 12th Congress of the European Association of Agricultural Economists, Argentina. 10pp.

Sebasigiri, K. (1996). Characteristics of exotic bananas to determine their fruit utilization according to food habits in East Africa. *Fruits* 4: 253 – 260.

Sloof, M., Tijskens, L. M. and Wilkinson, E. C. (1996). Concepts for modeling the quality of perishable products. *Trends in Food Science and Technology* 7: 169 – 171.

Smith, I. F. and Pablo, E. (2007). African leafy vegetables: The role in the World Health Organisation Global fruit and vegetables initiative. *African Journal of Food Agriculture, Nutrition and Development* 7(3): 345 – 365.

Smith, T. A., Lin, B.H. and Huang, C. L. (2008). Organic premiums of U.S. fresh produce. In: *Proceedings of the Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management*, St. Louis, MO. 17pp.

Ssemwanga, J. K. and Thopson, A. K. (1994). Investigation of post harvest and eating qualities likely to influence acceptability of Matooke banana cultivars to be introduced in Uganda. Stone, H.and Sidel (eds.). *Aspects of Applied Biology* 39: 207 – 213.

Steenkamp, E. M. and Van TriJp, H. C. M. (1996). Quality Guidance: A consumer Based Approach to food quality improvement Using a partial Least squares.

Stewart, H., Haris J. M. and Guthrie, J. (2004). *What Determines the Variety of a Household's Purchases?* Bulletin No. 792. Agricultural Information, United States 3pp.

TAHA (2012). *Position Paper Key Policy Issues Affecting Tanzania's.* Horticultural Industry, Arusha, Tanzania. 10pp.

Ulimwengu, J. and Sanyal, P. (2011). *Joint Estimation of Farmers to Pay for Agricultural Services.* Discussion Paper 1070. IFPRI, Stated Willingness. 28pp.

Umuhozariho, M.G, Shayo, N. B. Msuya, J. M. and Sallah, P. Y. K (2011). Utilization of cassava leaves as a vegetable in Rwanda. *Rwanda Journal of Agricultural Sciences* 24: 15 – 27.

URT (2013a). Morogoro Municipal Council profile: [http://www.morogoromc.go.tz/about_us/economic.php] site visited on 20/5/2013.

URT (2013b). *Population and Housing Census*. Population distribution by administrative areas. Key findings, Dar es Salaam, Tanzania. 244pp.

URT (2013c). Tanzania economy profile. [http://www.indexmundi.com/tanzania/economy_ profile.html] site visited on 20/5/2013.

URT (2002). *Study on the Horticulture Development in Tanzania.* Ministry of Agriculture and Food Security, Dar es Salaam, Tanzania. 86pp.

USAID (2012). Food Security and Gender. USAID Fact Sheet. [http://pdf.usaid.gov/pdf_docs/PNADR706.pdf] site visited on 10/09/2013.

Van der Pol, M. and Ryan, M. (1996). Using conjoint analysis to establish consumer preferences for fruit and vegetables. *British Food Journal* 98(8): 5 – 12.

Weinberger, K. and Lumpkin, T. A. (2005). *Horticulture for Poverty Alleviation*. The Unfunded Revolution. Working Paper No. 15. AVRDC The World Vegetable Center, Shanhua. 20pp.

Weinberger, K. and Msuya, J. (2004). Indigenous vegetables in Tanzania: Significance and prospects. Shanhua, Taiwan: AVRDC. *Technical Bulletin* 31: 14 – 33.

Weinberger, K. and Swai, I. (2006). Consumption of traditional vegetables in central and North-Eastern Tanzania. *Ecology of Food and Nutrition* 45(2): 87 – 103.

Wessells, C., Roheim and Anderson, J. G. (1993). Consumer willingness to pay for sea food safety assurances: Implications for sea food labeling and public policy. In: *Aquaculture and Seafood Markets: Public Policy, Consumer Behavior and Industry Relationships*. (Edited by Toroko, S. J.), University of Rhode Island. 25pp.

Zellner, D. A. (1991). *How Foods Get to be Liked, Some General Mechanics and Special Cases.* In: Hedonics of taste (Ed.Rc.Bolles), Lawrence Erlbaum, Hillsdale, New Jersey, USA. 217pp.

Zhang, H. R., Gallardo, K., McCluskey, J. J. and Kupferman, E. M. (2010). Consumers' willingness to pay for treatment-induced quality attributes in Anjou pear. *Journal of Agricultural and Resource Economics* 35(1): 105 – 117.

Zink, D. L. (2007). The impact of consumer demands and trends on food processing. Glendale, California, USA. *Emerging Infectious Diseases* 468: 3 – 4.

APPENDICES

Appendix 1: Descriptive statistics of cassava leaves products sensory attributes

Attributes	Sample	N	Mean	Std. Deviation
Colour	sample A	110	4.3909	.77927
	sample B	110	2.8273	.79976
	sample C	110	3.5455	1.07205
Aroma	sample A	110	4.0455	.74669
	sample B	110	3.1364	.69701
	sample C	110	2.9909	1.21531
Texture	sample A	110	4.1727	.68882
	sample B	110	3.2091	.75535
	sample C	110	2.2818	1.19734
General appearance	sample A	110	4.1182	.58626
	sample B	110	3.3818	.76604
	sample C	110	2.9182	1.06772

Appendix 2: Consumers' rating for cassava leaves product sensory attributes

Sample attributes	Pairs of test	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Colour	Sample A - sample B	1.56364	.77255	.07366	1.41765	1.70963	21.228	109	.000
	Sample A - sample C	.84545	1.63217	.15562	.53702	1.15389	5.433	109	.000
	Sample B - sample C	-.71818	1.53331	.14620	-1.00794	-.42843	-4.912	109	.000
Aroma	Sample A – sample B	.90909	1.20050	.11446	.68223	1.13595	7.942	109	.000
	Sample A – sample C	1.05455	1.60753	.15327	.75077	1.35833	6.880	109	.000
	Sample B – sample C	.14545	1.58454	.15108	-.15398	.44489	.963	109	.338
Texture	Sample A - sample B	.96364	.82314	.07848	.80808	1.11919	12.278	109	.000
	Sample A - sample C	1.89091	1.28038	.12208	1.64895	2.13287	15.489	109	.000
	Sample B - sample C	.92727	1.49439	.14248	.64487	1.20967	6.508	109	.000
General Appearance	Sample A - sample B	.73636	.89522	.08536	.56719	.90554	8.627	109	.000
	Sample A - sample C	1.20000	1.21005	.11537	.97133	1.42867	10.401	109	.000
	Sample B - sample C	.46364	1.62366	.15481	.15681	.77047	2.995	109	.003

Key: A-Frozen cassava leaves, B- Dried cassava leaves, C- Fresh cassava leaves

Appendix 3 : Consumer survey questionnaire

MEASURING CONSUMERS' WILLINGNESS TO PAY FOR INDUCED QUALITY ATTRIBUTES IN PROCESSED CASSAVA LEAVES IN MOROGORO MUNICIPALITY

INTERVIEWER NUMBER [……..]

DATE (DD/MM/YY)……/……/2012

WARD: …..……....

INTRODUCTION

I am Innocensia D. Pato, MSc. Agricultural Economics student from Sokoine University of Agriculture. I kindly request about 30 minutes of your time to ask you few questions concerning vegetable consumption and attributes considered during purchase. This is a survey is about consumers' acceptance and willingness to pay for processed cassava leaves products (Kisamvu). The questionnaire has three parts: **Part A** consists of questions on the socio-demographic characteristics of the interviewee. **Part B** consists of questions on vegetable purchasing and consumption. **Part C** consists of questions on cassava leaves sensory valuation and **Part D** consists of questions on WTP for cassava leaves products.

PART A: SOCIO-DEMOGRAPHIC CHARACTERISTICS

1.0 Personal information

1.1. Sex of respondent □ Male □ Female

1.2. Marital status □ Married □ Single □ Divorced □ Widowed

□ other (specify)……..

1.3. Age…….. (Years)

1.4. House hold size ……. (Number of people)

1.5. Number of HH members below 18 years.....

1.6. Educational level of respondent □ No formal education □ Primary education

□ Secondary education □ Graduate □ others (specify)…….

2.0. **Occupation and income**

Occupation		Income per month (TZS)
Major		
Minor (if any)		
Total income per month (TZS)		

PART B: VEGETABLE PURCHASING AND CONSUMPTION

4.0 Vegetable consumption behavior

4.1 Have you eaten vegetables for the past week? □ Yes □ No

(if yes, continue with 4.2)

4.2. List the type of vegetable eaten within the last week and their frequency

Type of vegetable e.g. Amaranth (Mchicha), Cassava leaves (Kisamvu) etc.	Frequency/week

4.3 If no cassava leaves (Kisamvu) in 4.2, why?

…….....

.....

.....

4.4 If cassava leaves in 4.2, where do you normally eat? □ Home □ Restaurant

□ Food vendors □ Others (specify)……

4.5 Where do you get your supply of cassava leaves?

□ Farm gate □ Market vegetable retailer □ Street hawkers □ Supermarkets□ Home

□ Others (specify)…….

4.6 In which form do you usually buy cassava leaves? □ Whole leaves

□ dried □ fresh pounded □ frozen pounded □ others (specify)……

5.0 Awareness of processed vegetable (Cassava leaves)

5.1 Have you ever seen processed cassava leaves products (e.g. dried or frozen)?

□ Yes (if yes, continue 5.3) □ No

5.2 Where did you see it?

□ Home □ Food exhibition □ food vendors □ Local gloceries □ supermaket □ friends place/family members □Others (specify)……

5.3 Have you ever bought processed cassava leaves? □ Yes □ No

5.4 If yes, in 5.3 why did you buy processed cassava leaves and not unprocessed one? □ safe (not poisonous) □ very convenient in use □ not very expensive □ available □ others (specify).....

5.6 If no **5.3** Why?

□ Not safe (chemicals and poisonus) □ very expensive □ not available □ other reasons.....

PART C: SENSORY VALUATION OF CASSAVA LEAVES PRODUCTS

1.0 Descriptive profile of uncooked Cassava leaves (<u>Kisamvu)</u>

Sex …… Age: …….

Date:…… Time:……..…..... Location:……..…….

Please evaluate each of the three (3) coded samples from left to right indicate how much you like or dislike each sample by checking the appropriate sample attribute and indicate your preference (1 – 5) in column against each attribute. Put tick against each attribute.

Key:

5. Like most 4. Like moderate 3. Neither like nor dislike 2. Dislike moderate 1. Dislike most

Attribute	**Sample codes**		
	A	**B**	**C**
Colour			
Aroma			
Texture			

General Appearance			
Overall Acceptability			

.

Comments based on the sample code(s)

……

….....

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2.0 Descriptive profile of cooked Cassava leaves (<u>Kisamvu)</u>

Please evaluate each of the six (6) coded samples from left to right indicate how much you like or dislike each sample by checking the appropriate sample attribute and indicate your preference (1 – 5) in column against each attribute. Put tick against each attribute.

No	Attribute	Rating scale	Sample code					
			U	V	W	X	Y	Z
1	**Aroma Intensity** Typical Kisamvu aroma	1 = Extremely weak						
		2. = Slightly weak)						
		3. = Fairly weak						
		4. = Slightly intense						
		5. = Extremely intense						
2	**Taste / flavour**	1 = Dislike extremely						
		2. = Dislike slightly						
		3. = Dislike moderate						
		4. = Like slightly						
		5. = Like extremely						
3	**Colour** The impression of appearance that you see on the product	1 = Extremely dark						
		2. = Slightly dark						
		3. = Moderate dark						
		4. = Slightly green						
		5. = Extremely green						
4	**Texture** Amount of connective fibre (The chewiness of Kisamvu)	1 =Extremely abundant						
		2. = Slightly abundant						
		3. = Moderate						
		4. = Practically none						
		5. = None						
5	**Overall apperance**	1 = Dislike extremely						
		2. = Dislike slightly						
		3. = Dislike moderate						
		4. = Like slightly						
		5. = Like extremely						

Comments

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PART D: QUESTIONS ON "WILLINGNESS TO PAY"

I am about to ask you if you would purchase a processed cassava leaves product at a certain price. Previous surveys of this nature find that the amount of money people SAY they are willing to pay is sometimes higher than the amount they would ACTUALLY pay for this product. For this reason, as you read the following question, please imagine that you would ACTUALLY have to pay this amount keeping in mind what you normally pay for groceries for you and your family.

1.0 Consider carefully the following options. Suppose these were the only options available, which one would, you choose? A Status quo (unprocessed cassava leaves), Frozen leaves and Dried leaves (the price is varied randomly across the sample).

1.1 Would you pay 300 TZS for a package of 100 grams of fresh cassava leaves at the purchasing store as seen in the samples?

If YES: would you pay 400TZS? (If Yes rise price by interval of 100 TZS till NO)

If NO: would you pay 200 TZS? (If No lower price by interval of 100 TZS till YES)

1.2 Would you pay 400 TZS for a package of 100 grams of frozen cassava leaves at the purchasing store as seen in the samples?

If YES: would you pay 500TZS? (If Yes rise price by interval of 100 TZS till NO)

If NO: would you pay 300 TZS? (If No lower price by interval of 100 TZS till YES)

1.3 Would you pay 1500 TZS for a package of 100 grams of dried cassava leaves at the purchasing store as seen in the samples?

If YES: would you pay 1600 TZS? (If Yes rise price by interval of 100 TZS till NO)

If NO: would you pay 1400 TZS? (If No lower price by interval of 100 TZS till YES)

2.0 WTP Follow-Up Questions

Follow up questions, will be asked to the respondents for helping to clarify the motives for and validity of responses, they are also needed to test the credibility of the scenario above. Please tick where the response is valid (√) and cross (×) where otherwise.

2.1 Possible reasons for unwillingness to pay

My household cannot afford to pay □

The change due to processing is too small to be of importance □

I am not interested with cassava leaves □

There are many other similar vegetables around □

2.2 Possible reasons for willingness to pay

I think problems of inconvenience of cassava leaves is critical □

I am are very interested in these products □

Clarify the reasons why? .....

Although I do not use it now, I might use the products in the future □

I will not really have to pay any extra amount □

THANK YOU