VALUE ACCRUING TO ZAMBIA'S BEAN SUPPLY CHAIN PARTICIPANTS

by

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B.A.S., University of Zambia, 2004

A THESIS

Submitted in partial fulfillment of the requirements

for the degree

MASTER OF AGRIBUSINESS

Department of Agricultural Economics

College of Agriculture

KANSAS STATE UNIVERSITY

Manhattan, Kansas

2013

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ABSTRACT

The purpose of this thesis was to estimate the value accruing to Zambian bean supply chain participants with the view to showing that value at the different stages is a function of the value addition and risk incurred at those stages. The data used in the study came from two different surveys done under the Pulse Value Chain Initiative – Zambia focusing on producers and bean traders. The surveys used structured questionnaires for both producers and traders. The producers were sampled from three principal bean producing provinces in Zambia: Lundazi, Mbala and Kalomo. The traders were sampled from the largest consumer region in the country – Lusaka – and focused on traders operating in the three principal markets in the city: Soweto; Chilenje; and Mtendere. The analyses were conducted using STATA®, employing both statistical and econometric methods.

Value was defined as a function of transaction costs and value addition as well as the risks borne. In the Zambian mixed bean trade environment, where traders travel to remote locations where producers live and produce, they are seen to incur higher levels of risk and undertake higher levels of value addition – assembling the grain, bagging them and moving them from the rural areas where production occurs to the cities where customers reside. As such, it is expected that value creation and distribution would increase away from the farm. The results confirmed this expectation. The total average value created at the farm level was ZMK3,391.06/kg. However, the average value accruing to traders who only undertook wholesaling was ZMK7,405.75/kg while that accruing to traders going

further down the chain to retail was ZMK9,663.56/kg. Traders who engaged in institutional trade produced an average value of ZMK8,750.75/kg.

The share of total value produced accruing to producers in the producer-wholesaler-retailer chain was about 16.6 percent because of the higher value addition and risk that occur further downstream in the chain. The share of total value produced accruing to producers in the producer-wholesaler-institutional buyer chain was about 17.3 percent. The study showed that female producers' share was not different, statistically speaking, from male producers' value. It also showed that the average value created in thin (smaller) markets was higher than the value created in larger markets, probably because of the level of competition that occurs in the latter markets. Interestingly, the results showed that the larger the land holdings of producers, the lower the value created. This is in line with the foregoing results of size, competition and value.

The study suggests that producers' share of total value created may be enhanced by helping producers undertake specific activities that increased the value they added and reduce the risks that traders bear in their search for grain. One of such activities could be the formation of horizontal strategic alliances among producers that allowed producers to aggregate grain at particular locations in significant lots and bag them. This service would allow them to extract higher value from the exchange with traders. Any attempt to address the perceived "unfair" distribution of value along the supply chain by administrative fiat could result in higher costs to the whole supply chain and crate adverse unintended consequences for producers and the treasury.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

I would to thank the entire MAB faculty team for the support rendered to me leading to the successful completion of all the courses. Special thanks go to Dr. Vincent Amanor-Boadu who not only guided the development of this study but provided the support to complete the thesis and the course. I also grateful to Dr. Gelson Tembo and Dr. Allen Featherstone for serving on my advisory committee. The Pulse Value Chain Initiative Project provided funding for my MAB program and this research. For that, I'm grateful to the project leaders who decided to select me for funding and to the American people who paid for the project through USAID.

My tribute also goes to my course mates Lydia Mtchotsa and Sosthenes Mwansa for the companionship and support. The moments we spent together during long flights from Africa to America and back will never be forgotten.

Finally I would like to thank my wife Doreen and daughters Saliya, Natasha and Joice for enduring my long absence from home as well as time spent away from them while attending online lectures, going through the course materials and doing assignments.

CHAPTER I: INTRODUCTION

Zambia is a landlocked country endowed with abundant natural resources for agriculture. Although 58 percent of the land in Zambia (75 million hectares) is classified as having medium to high potential for agriculture, only about 14 percent of arable land is currently being cultivated. Agriculture and agro-processing are important in Zambia's economy. It accounts for more than 40 percent of gross domestic product (GDP) and contribute about 12 percent of national export earnings. It employs some 67 percent of the total labor force and supplies raw materials to agricultural industries, which account for 84 percent of manufacturing in the country, according to the World Bank (2009).

Based on the crop forecast surveys of 2009/2010 and 2010/2011, the top five mostly grown crops in Zambia in terms of area under cultivation as well as by volume, were maize, cassava, groundnuts, cotton and mixed beans. Maize is by far the most important crop and staple in the country. It accounts for about 40 percent of cultivated land and contributes about 40 percent to the country's agricultural GDP. Maize and cassava account for about 75 percent of Zambia's crop production (World Bank, 2009). Although counted among the top-five crops produced in Zambia, mixed beans are relatively small compared to maize and cassava in both volume and acreage. Yet, there are signs that given the appropriate policy environment, mixed beans may be elevated as an important cash crop in certain parts of the country to contribute significantly to poverty reduction and food security.

The majority of agricultural production in Zambia is smallholder production. According to the Crop Forecast Survey 2007/08, nearly 1.2 million households are involved in agriculture and 96 percent are classified as small-scale farmers (with holdings

of 5 hectares or less). The remaining 4 percent are medium-scale farmers (with holdings of 5-20 hectares). There are about 1,500 large-scale commercial farmers in the country. The value or benefit accruing to agri-food supply chain participants is a key motivator for all chain participants. However, information on the value created in the supply chain and its distribution among chain participants is sparse. Improved information about this value and its distribution could enhance decision making in the agri-food sector in Zambia and help policymakers identify the appropriate response to addressing any perceived inequities. The current perception in policy circles is that smallholder producers are getting the short end of the stick because of asymmetric information advantage held by the "middle men" – these are the traders who facilitate market making for the majority of smallholder producers around the country. The industry and government may also use the information on value creation and distribution to reorganize services that can direct value adding opportunities to areas where they are currently lacking, thereby increasing the underlying transactions costs which contribute to seemingly lopsided value distribution.

This study, therefore, focuses on the assessment of pecuniary value created in the bean supply chain and how the value is distributed among supply chain participants. This is done in full cognizance of the non-pecuniary value that is created in the supply chain. For example, traders provide producers with important information about market conditions by their interactions, which astute producers may utilize in extracting higher value from others in this repeated trading game with multiple participants over the course of a few months to a year. They also share information about products that may not be the focus of their current transactional exchanges, allowing producers to assess new opportunities in their future resource allocations and, hence, their income improving decisions.

The focus of this study is on the Zambian mixed bean industry because it is seen as a potential area for enhancing not only the wellbeing of smallholder producers as the government reorganizes its support for the agricultural sector, but in improving the health and nutritional status of consumers. Additionally, mixed beans have high drought tolerance in comparison to the traditional maize crop and require relatively lower levels of commercial inputs (Bebe et al., 2008; Munoz-Perea, 2006; Kawano, 2003). These qualities allow mixed beans to be an excellent food security crop in a country that is increasingly experiencing wide variability in rainfall and drought durations.

1.1 Objectives

The overall objective of this research is to assess the pecuniary value created in Zambia's bean supply chain and determine how that value is distributed among supply chain participants. The specific objectives are as follows:

1. Assess the value accruing along the mixed bean supply chain in Zambia, from mixed beans producers through wholesalers to retailers.
2. Estimate the distribution of total value created across the supply chain and assess if the values differ statistically from each other.
3. Determine the extent to which producer characteristics influenced value.

1.2 Thesis Outline

The foregoing has framed this thesis as an attempt to contribute to both public and private decision-making through the provision of information on value creation and distribution in the mixed bean' supply chain. The underscoring assumption for the research is that improved appreciation of the size and distribution of value created would provide insights into appropriate policies that may contribute to improvement in total value as well as addressing any perceived imbalances using value contribution processes instead of

administrative fiat. The next chapter presents a literature review on supply chains and the creation of value in supply chains and how the value is distributed. The data used in the research and the methods employed in their analyses are discussed in Chapter 3. The chapter also discusses the summary statistics of the smallholder producers and traders who are the focus of the research. The results from the analyses are presented in Chapter 4. They cover total value created at each stage in the supply chain and the value created by participant characteristics, such as gender and location. Chapter 5 presents the summary and conclusions of the study and provides recommendations on how policymakers in both private and public organizations may utilize the results to improve performance in the mixed beans industry. It also shows the gaps in the study and provides suggestions on how they may be addressed in future research.

CHAPTER II: LITERATURE REVIEW ON BEANS

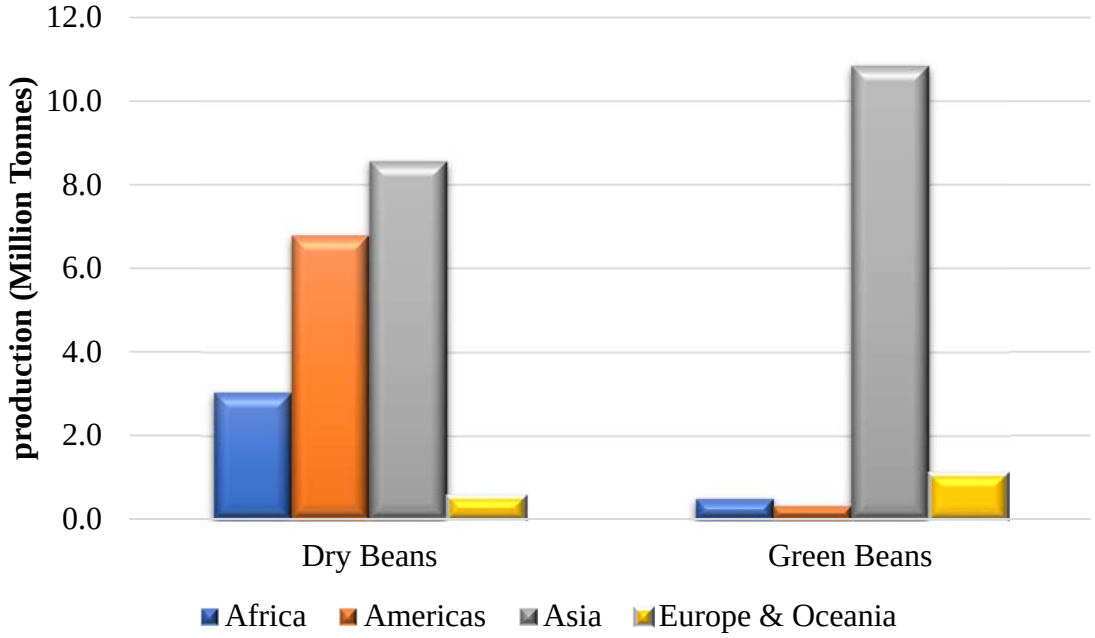
2.1 Bean origin and its production

Common beans (Phaseolus Vulgaris L.) were domesticated in the new world probably some 8,000 to 10,000 years ago from wild ancestral forms distributed in the highlands of what is now Latin America, between northern Mexico and northern Argentina (Debouck et al, 1993). Common bean is an herbaceous annual plant and is now grown worldwide for its edible bean, which is popular both as a dry grain and as a green bean. The leaf is occasionally used as a leaf vegetable, and the straw is used for fodder. Therefore, the whole plant has proven its value to consumers in different parts of the world. The commercial production of beans is also well-distributed worldwide, with countries on all continents except Antarctic included in its top producers.

Globally, about 12 million metric tons of common beans are produced annually. Latin America is the largest producer, with some 5.5 million metric tons, with Brazil and Mexico being by far the major producers (FAOStat.org). Africa is the second most important region, producing about 2.5 million metric tons, with Uganda, Kenya, Rwanda, Burundi, Tanzania, and Congo playing major roles. For example, Brazil and India are the largest producers of dry beans while China produces, by far, the largest quantity of green beans. China's average annual green bean production between 1992 and 2011 was in excess of 8.5 million tonnes, and the second highest green bean producer, Indonesia, average annual production over the same period was about 0.73 million tonnes (FAOStat.org). While Asia accounts for about 85 percent of total output, Africa is currently producing just under 4 percent of the world's total green beans. The distribution of dry beans is different even though Asia still controls global production with 45 percent and North and South America come in second with nearly 36 percent average share

between 1992 and 2011. Africa's share of global dry bean production averaged about 16 percent. India tops the dry bean production list, followed closely by Brazil, with both of them producing an average in excess of 3.5 million tonnes per annum between 1992 and 2011. The foregoing is summarized in Figure 2.1.

Figure 2.1 Global Dry and Green Bean Production



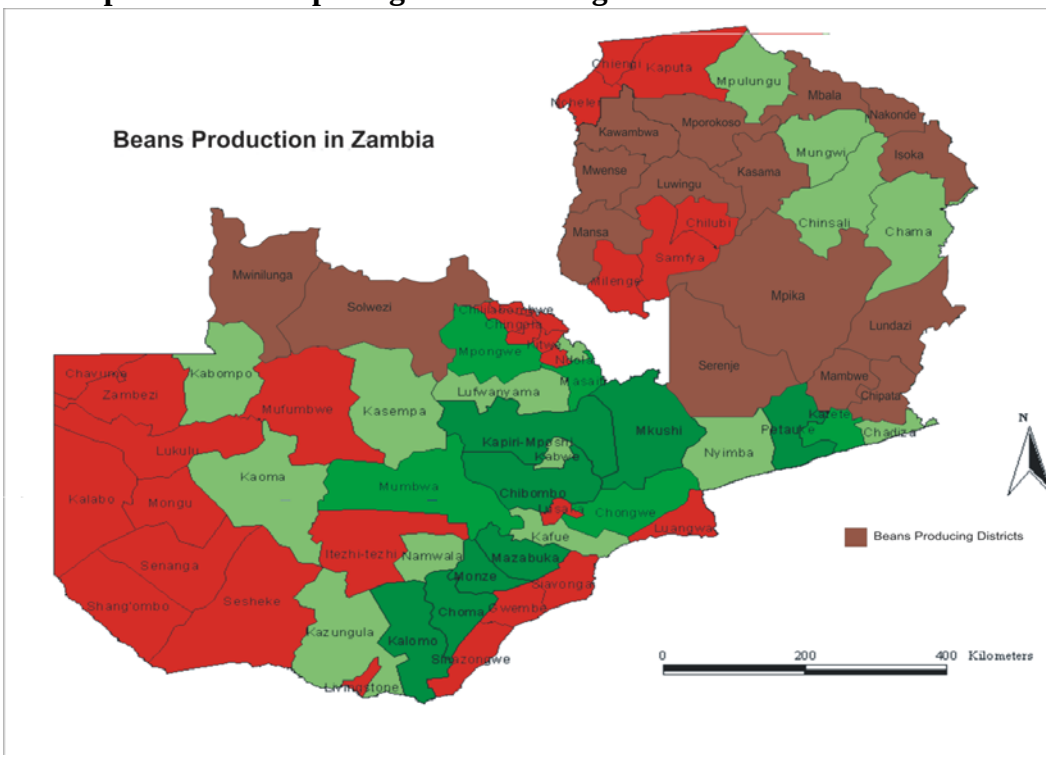
Source: FAOStat (http://faostat3.fao.org/)

2.2 Bean production in Zambia

Although beans are produced in all Zambia's provinces, they are mostly produced in Northern, North-Western, Muchinga, Eastern and Luapula Provinces of Zambia. This is as shown on the Zambian bean map on Figure 2.2. Most farmers grow local cultivars that are favored for their color and taste but have low yield potential and are susceptible to pests and diseases. Of these, the pink and speckled Kabulangeti varieties originally imported from southern Tanzania are the most popular. Average yields of local cultivars are low in the range of 0.30 to 0.50 tonnes/ha. Improved varieties with an acceptable bean size, good

color and taste, yield potential of up to 2.0 tonnes/ha and resistance to most common pests and diseases have been developed, but seed is scarce and in most cases expensive beyond the reach of most smallholder producers in Zambia. (EEOA/MAFF Information Pack)

Figure 2.2: Map of Zambia Depicting Bean Growing Districts



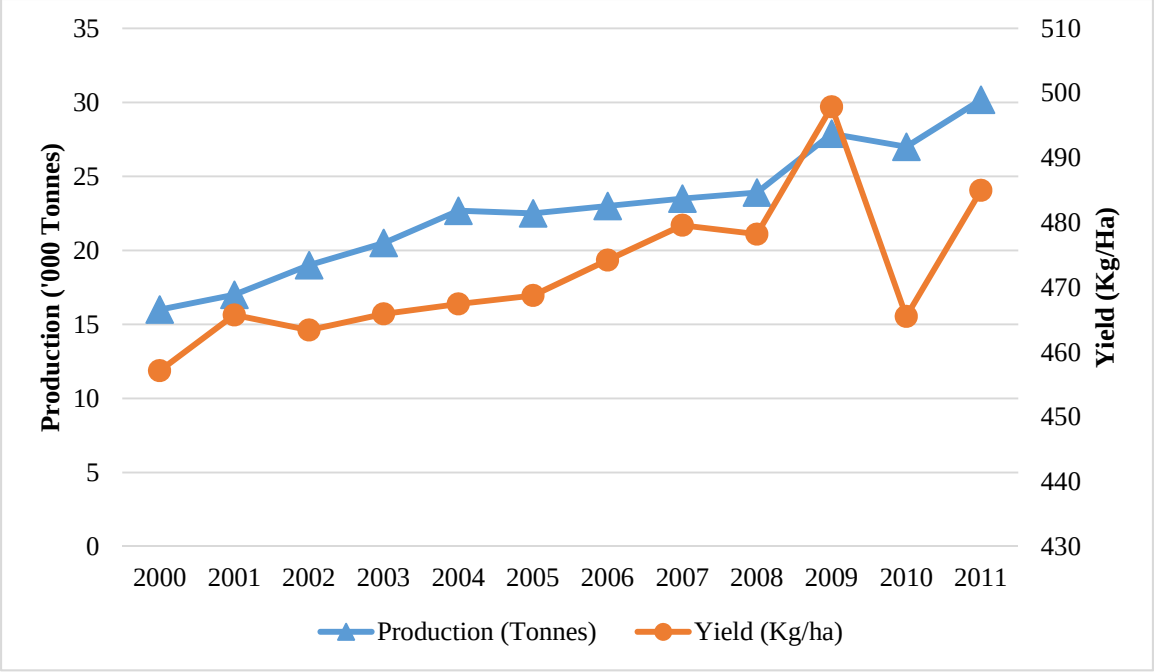
Source: Author

There are also potential marketing risks associated with producing these improved bean varieties. Producers recognize the fact that consumers are unaware and unexposed to these new bean varieties and there are no systematic promotion and marketing initiatives to enhance consumer knowledge about them. As such, they are reluctant to start growing these improved varieties because they cannot be assured of getting good market for them (EEOA/MAFF Information pack). Another challenge to low adoption rate for these improved seeds is that farmers currently do not buy seeds given that beans are self-pollinated, allowing seed to be recycled several times without significant yield losses. As

such, purchasing seed is a cultural challenge that needs to be overcome in the adoption process.

Figure 2.3 shows that the production and yield of pulses in 2000 to 2011 is upward trending.[1] Production has grown at an average annual rate of about 5.2 percent over the period while the growth rate in yield has been flatter at about 4 percent per annum over the same period. This is in line with the earlier discussion about adoption of new technology and its underlying challenges and consequences. These trends suggest that the growth in the production of pulses is emanating essentially from increased area allocated to their production (Figure 2.3). Indeed, the growth in area harvested for pulses has averaged about 4.7 percent between 2000 and 2011.

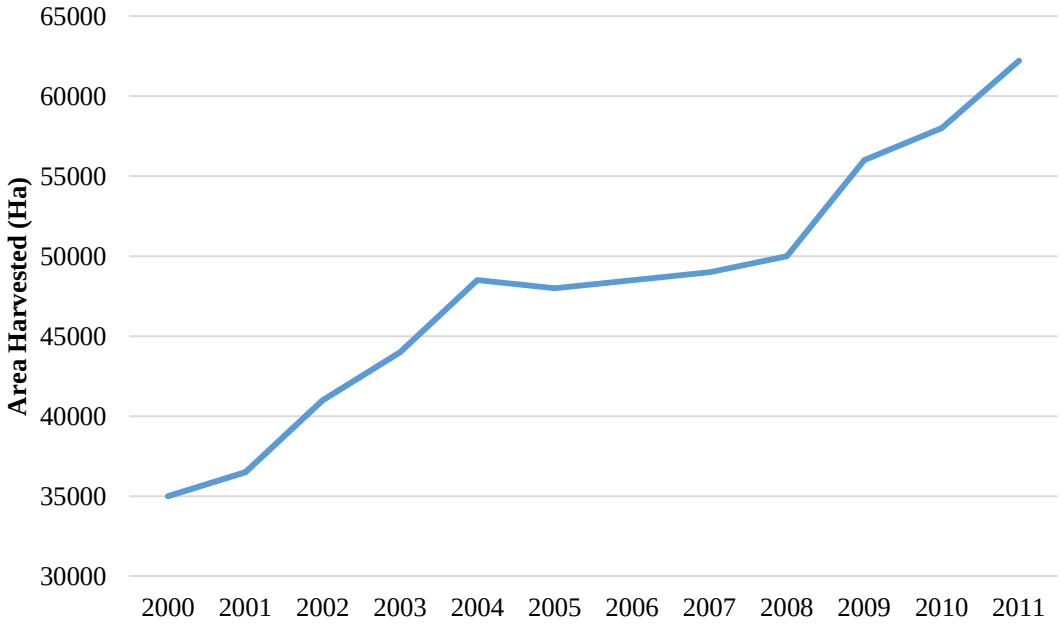
Figure 2.3: Total Annual Production and Yield of Pulses in Zambia (2000-2011)



Source: FAO (http://faostat3.fao.org/home)

[1] FAO defines pulses to encompass a broad range of grain legumes classified under *Phraseolus spp.* as well as *Vigna spp.* However, pulses are essentially mixed beans and cowpeas in Zambia.

Figure 2.4: Total Harvested Area for Pulses in Zambia (2000-2011)



Source: FAO (http://faostat3.fao.org/home)

2.3 Understanding the supply chain

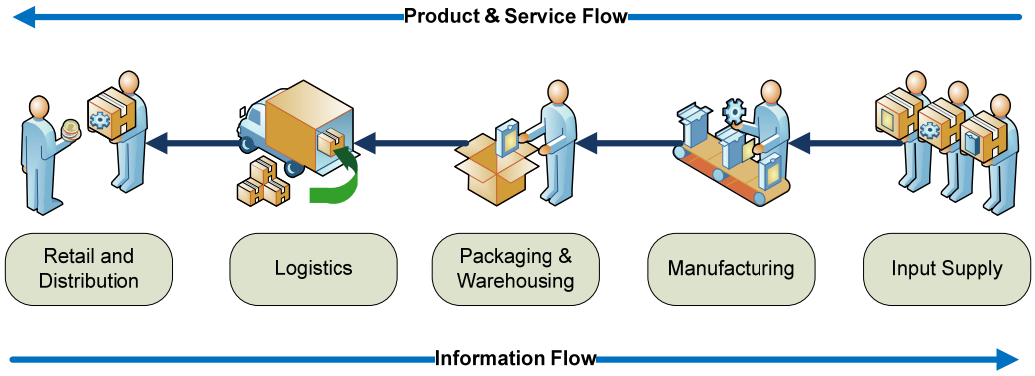
Understanding of what supply chains entail has been evolving. Beamon (1998) defined a supply chain from participating entities' perspective. For Beamon, it is as an integrated process where a number of various business entities (i.e., suppliers, manufacturers, distributors, and retailers) work together in an effort to: (1) acquire raw materials, (2) convert these raw materials into specified final products, and (3) deliver these final products to retailers. Little (1999) framed supply chains within governance structure, indicating that they combined and coordinated the flow of goods and their associated information from their origin to their final destination. But According to Chow, and Heaver (1999) perceived them from agents' or players' perspective. For them, supply chains are groups of manufacturers, suppliers, distributors, retailers, transportation, information and other logistics management service providers engaged in providing goods to consumers. Supply chains have also been conceived of from an activities' perspective

(Tecc.com.au, 2002). In this construct, a supply chain starts with raw materials and finishes with the sale of the final good or service. Bridgefield Group (2006) defines supply chains from resources and processes perspective, thus incorporating parts of the Tecc.com.au construct. For Bridgefield Group, supply chains are "a connected set of resources and processes that starts with the raw materials sourcing and expands through the delivery of finished goods to the end consumer." Pienaar (2009) defines a supply chain as "a general description" of the process the integrating process encompassing organizations transforming raw materials into finished goods and the delivery of those finished goods to end-users. Therefore, for Pienaar, supply chains are descriptive constructs.

In all these constructs, supply chains are fundamentally constructions that move products from points of production to consumers. They involve different entities, each of these entities adding value at their stage in the process of moving products to consumers at the end of the chain. When the foregoing definitions are fused and summed, it is possible to define supply chains as governance mechanisms that transform raw materials into final products and delivers them to final consumers with each stage of the chain adding real value to the transformation and transference process. They may be coordinated or uncoordinated in their behavior. When coordinated, supply chains are formal in nature and informal in nature when uncoordinated. Regardless of their structure, they involve two dynamic flows that are reflected in the definitional reviews presented above: product and service flows from production to consumption; and information flow from consumption to production (Figure 2.5). In the illustration presented in Figure 2.5, the chain is envisioned to encompass input or raw material suppliers whose outputs go into a manufacturing stage from where products are sent to packaging and warehousing. Logistics and transportation

service providers move the finished products to retailers and distributors who make them available to final consumers. There may be numerous players involved at each of these stages. For example, the logistics and transportation stage may involve services from stevedoring companies, regulators and financial services providers. While these "back-office" providers are often overlooked, they can be important and significant players in ensuring effective value creation in supply chains.

Figure 2.5: A Schematic Representation of a Supply Chain



Participants in supply chains seek to maximize their individual and collective value generation potential. This is often achieved when the supply chain is coordinated and governed so that information about downstream needs are delivered to upstream firms in a timely manner for them to take full advantage of market conditions. However, there is cost to coordination. Participants in coordinated supply chains have to invest tangible and intangible resources in building and maintain trust (Çerri, 2012) in order to benefit from the relationship's true value. As a result, not all participants are able to make such investments, leaving most supply chains to be ungoverned, uncoordinated transfer of goods from one stage in the supply-demand continuum. In this case, each agent at each stage operated independent of the rest of the chain's stages, seeking to maximize their own value

regardless of the effect on the rest of the chain. This is akin to the "win" philosophy presented originally by Covey (1989).

Gunasekaran et al. (2004) developed a framework for measuring supply chain performance that involved numerous technical metrics, such as order lead time and customer order path analysis. These performance measures provide information on the efficiency and/or effectiveness of existing systems, and/or allow existing systems to be compared with alternative systems. Performance measures also contribute to designing new systems by determining the values of the decision variables that yield the most desirable level(s) of performance. Available literature identifies a number of performance measures as important in the evaluation of supply chain effectiveness and efficiency. These measures may be categorized as either qualitative or quantitative. Qualitative measures include, but are not limited to, customer satisfaction, supply chain flexibility, information and material flow integration, effective risk management and supplier performance.

Despite their importance in revealing any challenges with the supply chain relationships, the bottom line measure of interest is value defined as what each stage participant perceives as their own share of effort. To this end, whether the supply chain is governed or not, there is interest in assessing the value generated in order to determine its effectiveness in value adding. Value may be defined as what each subsequent stage agent is willing to pay for the product or service from the preceding stage agent. This definition assumes that the "price" that emerges in the exchange at each node in the supply chain reflect the value that is embedded in the good and/or service that is exchanged as well as the relationship itself.

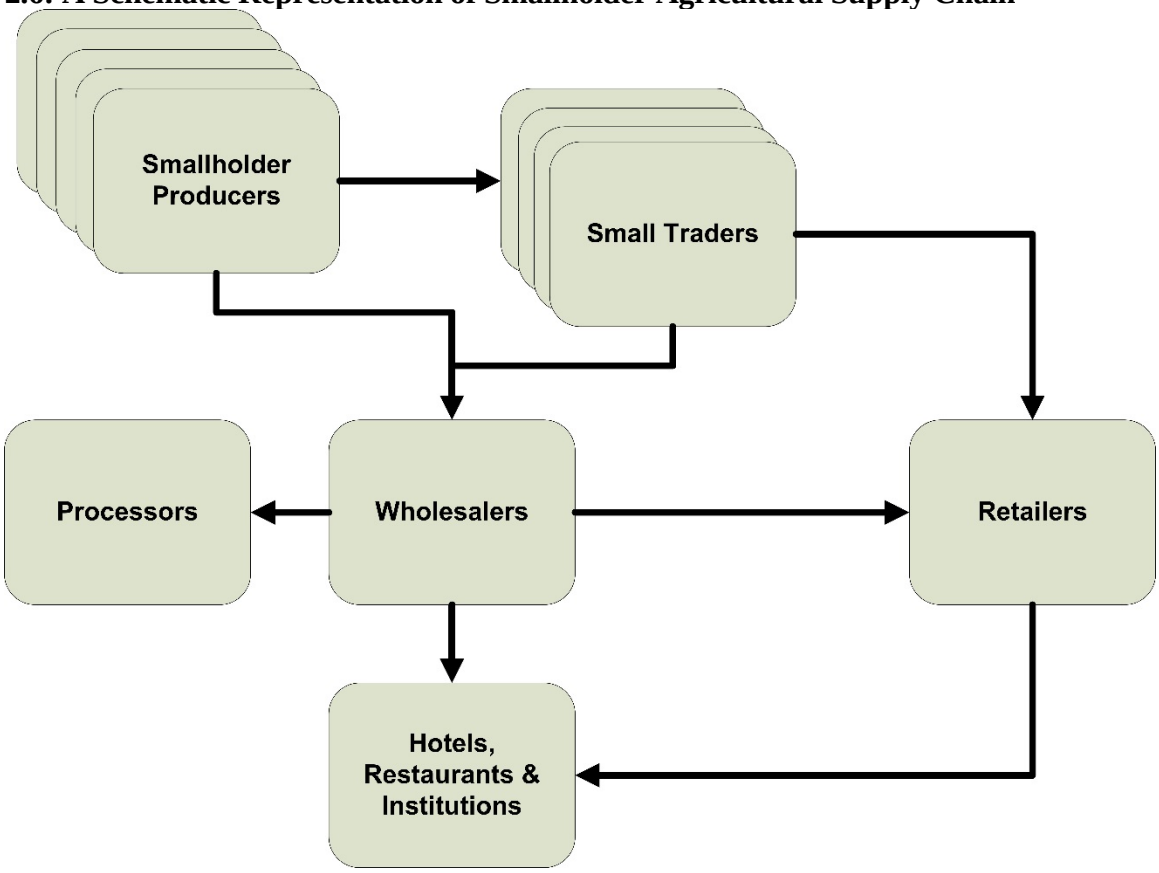
2.4 Agriculture-related supply chains in Zambia

Smallholder producers are responsible for most agricultural production in Zambia. Apart from maize, which is essentially purchased by the Government of Zambia through its Food Reserve Agency, all other crops are moved through the system by private buyers purchasing commodities from mostly smallholder producers. These buyers, like the smallholder producers with whom they deal, are mostly small scale traders who aggregate their purchases from a few to numerous producers for onward transmission to major markets for sale to traders who may be larger than themselves. The aggregation by these small scale traders is a necessary and important service in the supply chain because they facilitate the first-level economically-sound physical movement of commodity in the supply chain. Without their services, smallholder producers would have to move their small production lots to market destinations by themselves and this, by its very structure, would be uneconomical. Traders usually travel from their city locations to the rural communities where the smallholder producers are located, providing much needed logistics services for both the smallholder producers and their customers in the urban areas. These customers may be retailers, wholesalers or consumers (Figure 2.6). They may also sell to small open-market restaurants whose purchases are often not very different from those of large consumer households.

Figure 2.6 also shows that the aggregators are not the only ones who purchase commodities, such as mixed beans, from smallholder producers. Larger traders, who may be categorized as wholesalers, may also purchase directly from smallholder producers even as they purchase from small traders (aggregators) to get the volumes that provide them with the critical economic mass for their own transactions. Because of their differential volume requirements, wholesalers would traditionally purchase from relatively larger producers

than aggregators. The difference between aggregators and wholesalers is, thus, the volume of commodity they can handle at any particular time. A major determinant of whether a small trader migrates up the supply chain to become a wholesaler is principally available investment capital supporting procurement and related logistics, storage and related financing costs. These wholesalers, like the small traders, may sell to retailers who then sell to consumers. But the wholesalers also sell to larger hotels, restaurants and institutions as well as food processors. They may also be the intermediaries between international trading houses and the aggregators and/or producers. Food processors may also compete with wholesalers and aggregators purchasing directly from smallholder producers. However, their purchasing strategies are often different in that food processors would often engage a group of smallholder producers in an out grower governance system, such as purchasing contract or an input credit arrangement. These arrangements offer processors significant transactions cost advantage in that they do not incur the search and atomistic negotiation and related costs that wholesalers and aggregators incur. However, the unequal distribution of power between the processor and the smallholder producers can lead to the introduction of relationship costs, such as power abatement (Amanor-Boadu et al., 2004) and the search for anonymity (Amanor-Boadu and Starbird, 2005) to protect them from downstream risks that may be traceable to upstream suppliers for which the value from participating is not large enough to be compensating.

Figure 2.6: A Schematic Representation of Smallholder Agricultural Supply Chain



The common structure of agri-food supply chains is ungoverned and uncoordinated, with each participant seeking to extract as much as possible for their effort in the transactional exchange. In the absence of coercion, it is fair to assume that the settled exchange price at each interface is a fair estimate of the value that is embedded in the product and its related services. For example, it is plausible that farmers who organized and aggregated their produce and presented them in a central point would be perceived as having added more value than a farmer who sat in his village and the trader visited him to procure his grain. The value difference in the two exchanges would be revealed in the exchange price. This is why price is used as a measure of value in this research. It is elaborated in Chapter 3 under methods.

The sum of the value added by each of the participants in the supply chain provides the total value created by the supply chain. Under efficient conditions, the distribution of this total value created must be equal to the contributions made by each participant. However, there may be leakages that contribute to distributions differing from value contributed at any particular stage in the chain. When this happens, there often emerges the perception that some in the chain are getting more than they deserve while others are getting less than they deserve. The general perception is that these "leakages" are to the disadvantage of smallholder producers in these ungoverned supply chains that define most of smallholder agriculture. It is also perceived that the "leakages" occur in ways that puts smallholder producers at a disadvantage in the distribution of total value created by supply chain participants. The causes of this situation have been attributed to information asymmetry and lack of price transparency in these markets from the smallholder producer's perspective. As such, it has been argued that improving information available to smallholder producers could improve their position in transactions with aggregators and other traders with whom they engage (Bitzren et al., 2013). These perspectives do not recognize the value adding criteria that has been presented here as the foundation of value distribution.

Zambian smallholder producers of mixed bean generally produce without supply contracts and hope to get buyers once the product is harvested, despite some of them having long-term informal buying arrangements with traders (aggregators). These traders show up regularly to purchase their products and offer them prices that they (the farmers) perceive as adequate valuation of their contribution to the embedded value in the exchange. However, it is important to recognize that the majority of smallholder producers do not

have good storage facilities that would allow them to discriminate across time and manage any implied price risks. Therefore, they are often willing to accept prices that they may consider discounted given the value they see in their products. However, it is possible to see the "discount" as the cost of lacking storage facilities, assuming that storing the product would allow them to attain a higher price. This perception reveals a strategy for addressing the value loss by building storage facilities that would allow smallholder producers to provide storage services to traders and charge them for such services. The problem of selling at harvest is exacerbated by the fact that nearly all smallholders unleash their produce on the market at the same time – because they all lack storage facilities – making them all vulnerable to the "storage discount" reflected in lower prices at harvest time because supply exceeds demand in the market. But this storage problem may also be reflective of another problem that most smallholder producers face, i.e., cash flow problem. By the time harvest comes around, most smallholder producers are low on their cash reserves and the need for cash flow is highest. This makes the importance of concluding sales more important to get cash into the household than maximize value from effort through other strategies.

Small traders or aggregators are not very different from smallholder producers in the sense that they do not have much cash reserves and trade with little capital. Therefore, purchasing at harvest time offers them the best opportunity to maximize their returns to capital in terms of volume purchased. However, most small traders do not have storage capability, and must thus offload their purchases as quickly as possible to minimize losses. They also have cash flow constraints and are, just like the producers, in need of generating

cash flow. Therefore, they are as eager to sell their procured products as quickly as possible instead of waiting for "better prices" through adding value through storage.

The real situation, therefore, is competition between two stages of the supply chain that are both resource constrained. Without a careful appreciation of the conditions under which they operate and an assessment of the value that they are generating because of or in spite of their resource constraints, policymakers are at risk of unintended consequences when they introduce policies seeking to balance the exchange process under wrong assumptions. This is the underlying motivation for this research: contribute information to the industry and to policymakers about the value that is created in the mixed beans supply chain and how that value is distributed and the factors that may explain the logic or rationale of the distribution using mutually perceived value addition as the distribution criterion.

CHAPTER III: METHODS

The data and methods used in this research are presented and discussed in this chapter. The discussion is presented in three major steps. First, the data collection methods are presented. This is followed by a discussion of the methods used in analyzing the data. The final section provides an overview of the data so that the discussion of the results in the next chapter may be understood within the right contextual framework.

3.1 Data Collection Processes

Two different datasets were used in this study: producer data and trader data. Both were collected by the Pulse Value Chain Initiative, a research program funded by USAID under the Pulse CRSP.[2] Both surveys used structured questionnaires that were administered by trained enumerators.

Central Statistics Office (CSO) standard enumerations areas (SEAs) were used the sampling process in the survey of producers. This was done in order to ensure comparability with other national surveys using the same standard enumeration areas (SEAs) as primary sampling units. The process involved a two-stage stratified cluster sampling procedure, involving probability proportional to size (PPS) sampling of SEAs (the clusters) at the first stage and systematic sampling of households from each selected SEA at the second stage. PPS at the first stage was particularly important to ensure that high-producing areas have higher probabilities of being in the sample. The producers' sampling was limited to the three-most important mixed bean producing countries districts: Lundazi, Mbala; and Kalomo.

[2] CRSP is the Collaborative Research Support Program. These programs have been reorganized by USAID into the Innovation Laboratories.

Unlike the producer segment of the supply chain, the participants in the post-farm segments are not well identified. Therefore, target and reference sampling techniques were used to identify traders to conduct the survey. Serial convenience sampling was used to collect information from other traders by asking producers/traders who were interviewed to identify their competitors or collaborators, customers and others they do business with. These approaches allowed the PVCI to capture nearly all the traders operating in Lusaka, which was defined as the domain for the trading component of this research. This is the largest consumer market in the country and provided diversity in the types of traders to allow for the analyses. The traders identified fell into those operating at the wholesale level, retail level and both wholesale and retail levels. They also operated in one of the three local market locations: Soweto; Chilenje; and Mtendere.

3.2 Analytical Methods

Two principal approaches are employed in the research in analyzing the data: statistical; and econometric analyses. The statistical analyses provided information on simple descriptives and overall measures of value. The econometric analyses allowed for assessing the effects of particular segment characteristics on performance and testing the effect of those on difference among the segments. For example, it may be that farm size, age and gender of producers do have influence on their market participation and the value they are able to extract from the market when they participate. Similarly, gender, age and locus of operation may influence the value traders at the different nodes in the supply chain are able to extract. These are the questions that are addressed using the econometric methods approach. The econometric methods are discussed in more detail in the next section when their results are presented. Both the econometric and statistical analyses are conducted using STATA® 12.

3.2.1 Summary Statistics for Producers

Table 3.1 shows the distribution of bean producers by their districts. It shows that bean producers in the survey were almost equally distributed across the three districts, with Lundazi district accounting for the smallest share yet still above 30 percent representation. Mbala, although traditionally thought of as the bean production capital of the country, did not have statistically larger representation than Kalomo, with just about eight more producers. Of the total number of producers surveyed, only 550 were bean producers and of them, only 372 participated in the market, i.e., sold beans. The remaining are non-participants in the market because they produced beans solely for domestic or household consumption.

Table 3.1: Distribution of Producers by Districts

District	Number of producers	Percentage
Lundazi	292	31.06
Mbala	328	34.89
Kalomo	320	34.04
Total	**940**	**100**

Of the participants in the bean market, 88.2 percent are male and the remainder are female. The average education of this group of producers is six years of formal education, which is equivalent to primary school graduates. However, the average education level for females selling beans is about 4.8 years. This is not surprising since formal educational attainment in most of Africa is lower for females than males. The difference in education is statistically significant at the 5 percent level. The average age of the sample of bean market participants is about 40 years, with a standard deviation of about 14.4 years. However, the average age of female bean market participants is 46.6 years, with a standard deviation of 13.6 years. This suggests that female market participants are older than their

male counterparts and this difference is statistically significant at the 1 percent level. The average cropland allocated to beans by females participating in the bean market is 2.63 ha compared to 2.25 ha for males. The respective standard deviations are 2.40 ha and 2.60 ha. Thus, at the mean, female bean market participants have larger bean farms than their male counterparts. However, they are not statistically different from each other at even the 10 percent level.

3.2.2 Summary Statistics for Traders

Traders surveyed were all from Lusaka but they sell their products in different markets around the city. Table 3.2 shows the distribution of the 179 traders by their market of operation. It shows that over 80 percent of the trader respondents operated in Soweto Market. This is the principal food market in Zambia's capital city and hence is not surprising that it is the principal location of business for the majority of traders. The other markets, Chilenje and Mtendere, accounted for about 13% and 7% of respondents respectively. The majority (61.3 percent) of traders were female.

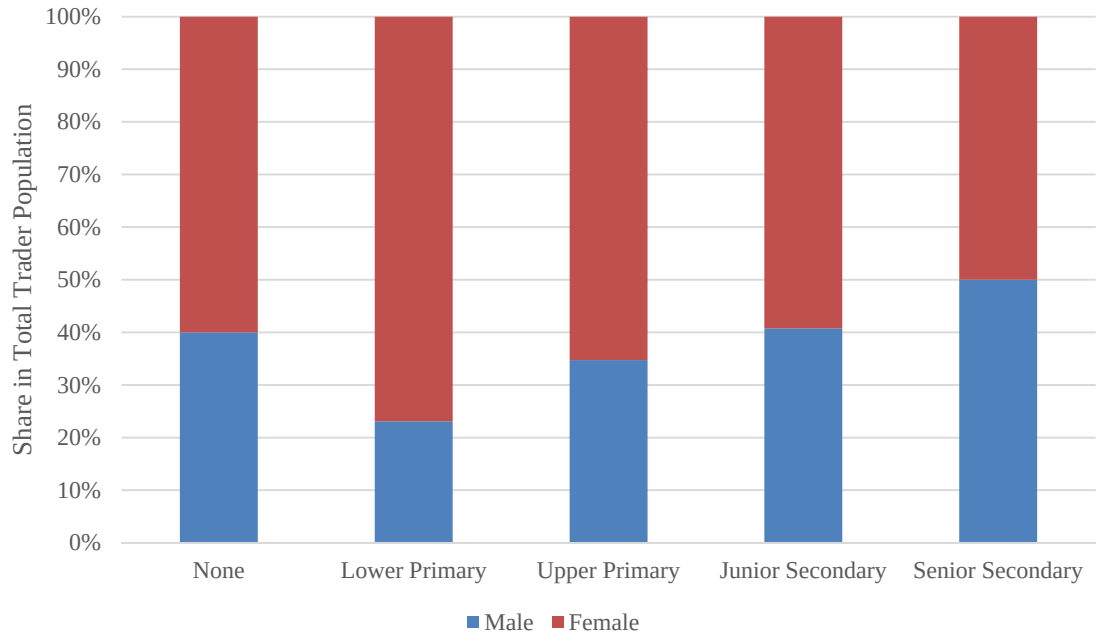
Table 3:2 Trader Distributions per Market of Operation

Market of operation	Frequency	Percent
Soweto	144	80.45
Chilenje	23	12.85
Mtendere	12	6.70
Total	179	100

The educational attainment of the traders is presented in Figure 3.1. It shows that of the 10 traders who did not have any formal education, six were female and of the 32 who had senior secondary, 50 percent of them were female. Thus, while only 14.1 percent of females had senior secondary education, nearly 23 percent of males did and 31.4 percent of males and 28.8 percent of females had junior secondary education. Thus, as seen with the

producers, the educational attainment of female traders is proportionately lower than that of their male counterparts.

Figure 3.1: Trader Education by Gender



3.3: Method of Value Estimation

Both producers and traders sell and buy products at different times during the year. The average price obtained by each producer and trader is used as the representative price for that particular market participants. Because of embedded measurement challenges, value is defined as the estimated average price from the different transactions identified by the specific market participants. Therefore, for each producer, i, participating in the market, the value, Vi, attained in the transaction is defined as the ratio of total revenue, Ri, accruing from all sales to total quantity sold, Qi. That is:

$$V_i = R_i / Q_i \qquad (1)$$

The value, V_i, is the profit, π_i, attained plus the cost, C_i, associated with the transactions, including the relevant production costs. That is:

$$V_i = \pi_i + C_i \tag{2}$$

The methodological advantage of this approach to measuring value is that it eliminate the subjective components of value if it is measured as profit from the transaction, making interpersonal comparability of value difficult because of size and other characteristic differences. It also allows for the sum of the individual estimates of value across each stage in the supply chain to evaluate the average value generated at that level. That is, the average value accruing to market participants at each stage, *j*, is defined as follows:

$$V_j = \frac{\sum_{i=1}^{N} V_i}{N_j} \tag{3}$$

where N is the number of participants at supply chain stage *j* and all other variables are as defined above. The total value, *V*, generated across the supply chain with *J* stages is, thus,

$$V = \sum_{j=1}^{J} V_j \tag{4}$$

Thus, each stage's relative share of total value created will be a function of both the average value accruing to each individual and the number of players involved at each stage. For example, while the total value accruing to a particular stage may be relatively large, the accompanying large number of players at that stage could lead to the average value at that stage being relatively smaller when viewed within the context of another stage with a fewer number of participating players. This is an important theoretical observation because it will be possible to provide some explanation to some of the challenges that underscore the perceptual power relationships in agricultural product supply chains in most African countries.

This analytical approach also allows for an assessment of the effect of individual participants' characteristics on their share of their stage share of total value. Unfortunately, neither producers nor traders can isolate the quantities they sold to particular downstream counterparties. Therefore, it is impossible to isolate particular transactions costs related to particular channels, which could be informative in designing market participation decisions in the supply chain. Trader activities are evaluated in terms of their channels of operations – wholesale, retail and institutional sales. Figure 3.2 shows these channels and the number of traders operating in them. The figure shows that 154 of the 180 traders were involved in extracting value from wholesale activities while 127 extracted value from retail activities. Only 37 traders extracted any value from the institutional end of the market. Obviously, the foregoing suggests the nature of the business and the fact that traders are opportunistic in their operations, entering and exiting different channels when they present opportunities to do so.

The majority (80.1 percent) of traders operate in the largest market in Lusaka, i.e., Soweto. By self-identification, about 52 percent of traders operate in only retail end of the chain while 30 percent operate at the wholesale end. The remaining 18 percent operate in both wholesale and retail (Figure 3.3). Their distribution across the three markets is presented in Figure 3.3. All the traders in Mtendere are retailers while 91 percent of those operating in Chilenje are retail and the remainder are both retailers and wholesalers. Soweto has the widest diversity of operators – mainly because of its size.

Figure 3.2: Bean Supply Chain Emanating from the Research

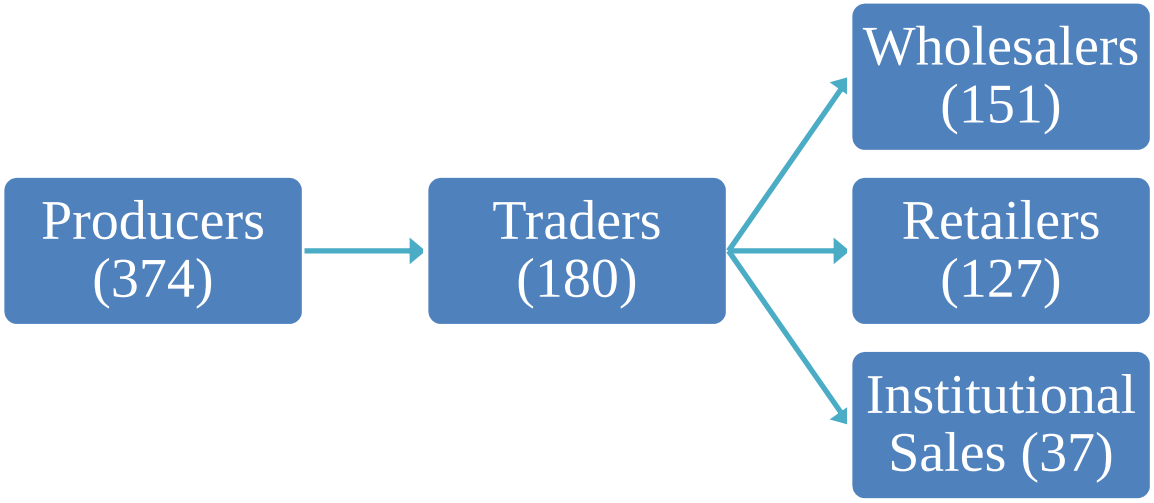
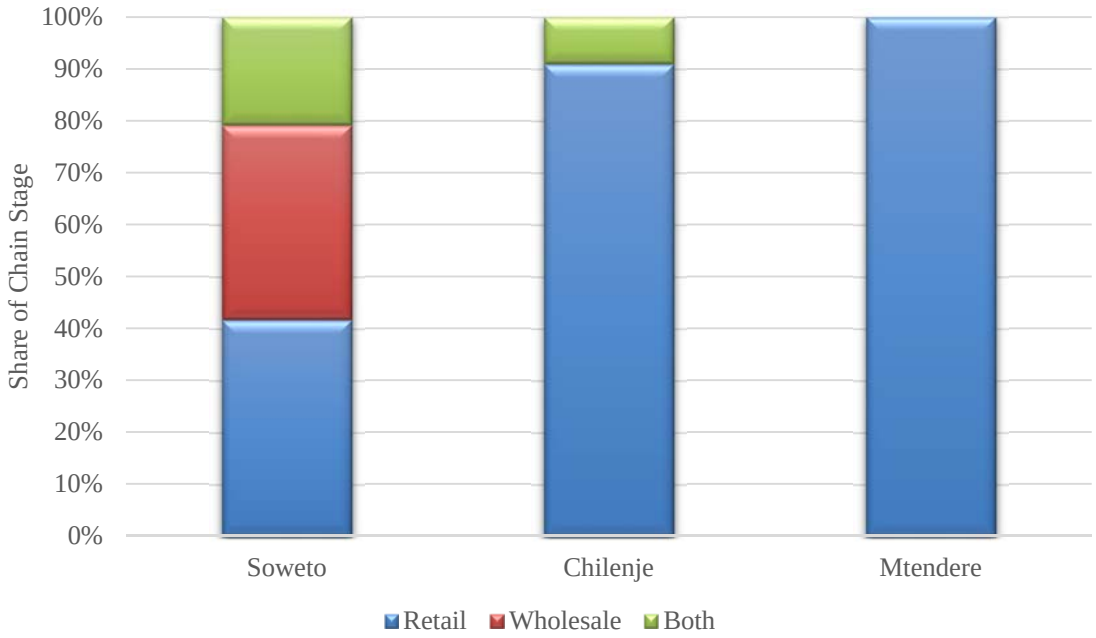


Figure 3.3: Distribution of Traders by Bean Supply Chain Stage by Market



CHAPTER IV: RESULTS AND ANALYSIS

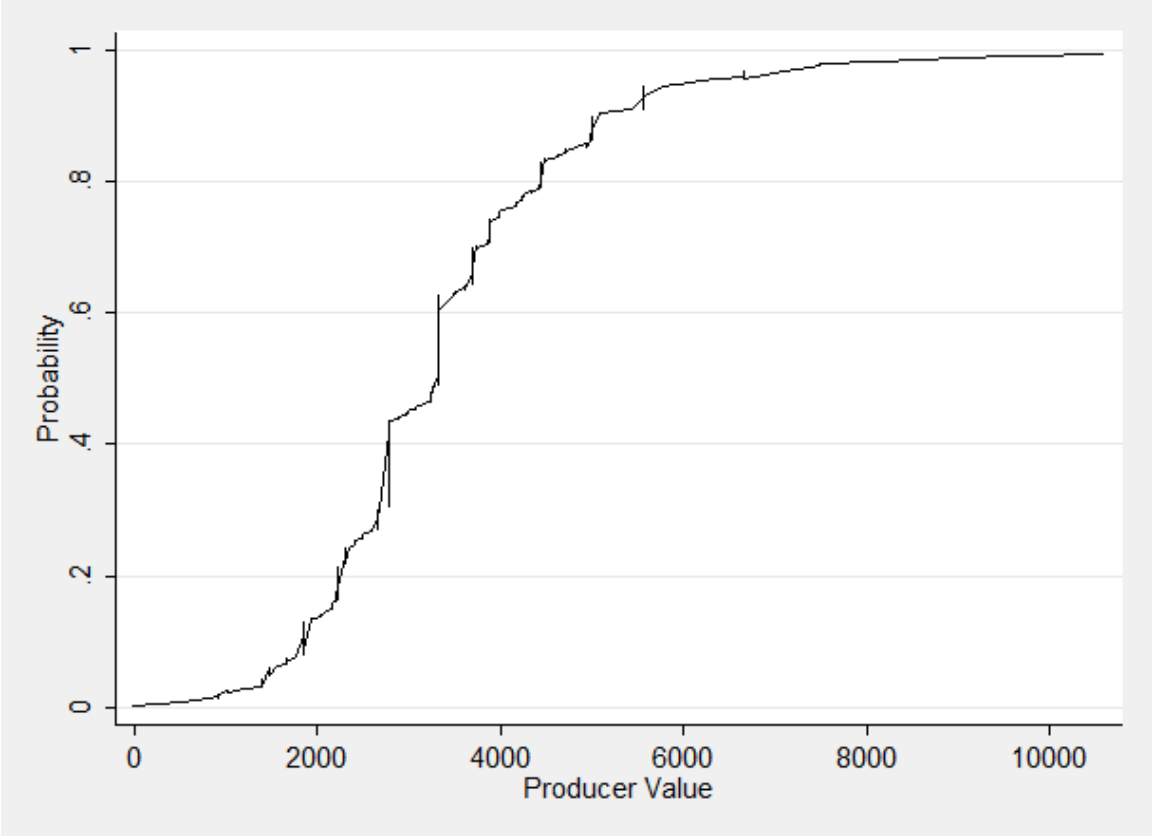
The results from the estimation analyses are presented in this chapter. The chapter is divided into three distinct subsections. The first covers provider value estimates. The second covers trader value estimates, and the third presents that analyses of the distribution of value across the supply chain.

The average quantities of bean sold by producers was 165.85 kg per producer, ranging from 1 kg and to 1944 kg. The 374 producers who sold beans were distributed thus: 24 from Kalomo district; 106 from Lundazi district; and 237 from Mbala district. Average quantities sold per producer for Kalomo, Lundazi and Mbala districts were 71 kg, 93 kg and 209 kg respectively. Thus, Mbala district was distinctly the highest in average quantity sold per producer and also had the largest number of producers who sold beans.

4.1: Producer Value

The average producer value emanating from participating in the bean market is estimated at ZMK3,391.06, with a standard deviation of ZMK1,440.82 and a range of ZMK227.78 to ZMK10, 597.83. The cumulative density function of producer value emanating from market participation is presented in Figure 4.1. Although there are a few outliers, the distribution is nearly vertical, as illustrated in the figure, indicating that a large proportion of producers – nearly all producers – fall within a very small value window. The 95 percent confidence interval for the distribution is ZMK3,243.96 to ZMK3,538.15.

Figure 4.1: Cumulative Density Graph of Producer Value



The effect of location on the producer value is presented in Table 4.1. The table shows that the average producer value ranged from ZMK3,097.64/kg in Mbala to ZMK4,752.51/kg in Kalomo. As indicated in the theoretical determination of value, the district with the largest number of producers posted the lowest average producer value as well as the smallest standard deviation of producer value (ZMK1,118.41/kg) and the district with the lowest number of producers posted the highest average producer value with the highest dispersion (ZMK1,530.59/kg). The difference between Lundazi and Mbala's producer value (ZMK693.85/kg) is statistically significant at the 1 percent level with t = 4.19. On the other hand, the wide standard deviation of the value in Kalomo caused the difference between Kalomo and Mbala to be statistically significant only at the

10 percent level, with t = 1.90. There was no statistical difference between Lundazi and Kalomo in terms of producer value emanating from market participation in those districts.

Table 4.1: Value Accruing to Producers Based On District of Operation

District	Number of producers	Average Producer Value (ZMK/kg)	Minimum Producer Value (ZMK/kg)	Maximum Producer Value (ZMK/kg)
Kalomo	23	4,752.51	694/44	16,666.67
Lundazi	106	3,791.49	500.00	9,722.22
Mbala	236	3,097.64	277.78	10,597.83

The lower competition from fewer producers in Kalomo may have contributed to the higher average it posted even though its total share of value created by producers is smaller just as higher competition among the larger number of producers in Mbala might have contributed to the lower average value accruing to producers in that district.

The producer value by gender showed the average for males and females was ZMK3,367.75/kg and ZMK3,534.32/kg respectively. The standard deviation was smaller for males at ZMK81.67/kg compared to females'' at ZMK182.29/kg. However, the difference between producer values by gender was not statistically significant even at the 10 percent level. This implies that male and female producers participating in the bean market fared about the same on average, statistically speaking. Therefore, it is safe to conclude that males do not have higher value extraction or rent-seeking capability than females in the bean market in Zambia.

What other production characteristics may explain the value that producers extract from their transactions in the bean market? To address this question, average value is modeled as a function of certain producer characteristics:

$$V_j = f(\mathrm{A}, G, \mathrm{M}, E, \mathrm{F}, L, D, B) \tag{5}$$

where A,G, M, E, L, D, F, and B are respectively age, gender, marital status, educational attainment, the producer is a full-time farmer, total land asset, district and the proportion of land allocated to bean production.

The results (Table 4.2) show that while the overall model is statistically significant at the 1 percent level, the coefficient of variation is relatively low, just about 10 percent. Additionally, the only statistically significant variables are total cropland owned by the producers and whether the producer is located in Mbala. A 10 ha increase in owned cropland leads to a decrease of about ZMK0.02/kg in value accruing to the producer. Thus, farmers, according to this model, perform slightly lower, but statistically significant at the 5 percent level, with increasing cropland or size of operations. Producers in Mbala make about ZMK0.14/kg less than producers in Lundazi, and the coefficient is significant at the 1 percent level.

Table 4.2: Value Accruing to Producers Based On District of Operation

Producer Value	**Coefficient**	**Std. Err.**	**t-value**	**P>t**	**[95% Conf. Interval]**	
Age	-0.001	0.001	-1.130	0.261	-0.003	0.001
Married	-0.046	0.057	-0.820	0.415	-0.159	0.066
Farmer	0.094	0.057	1.650	0.101	-0.019	0.207
Cropland	-0.002**	0.001	-3.030	0.003	-0.004	-0.001
Education	0.006	0.004	1.390	0.165	-0.003	0.015
District (Reference = Lundazi)						
Mbala	-0.136***	0.034	-4.000	0.000	-0.204	-0.069
Kaloma	-0.010	0.089	-0.110	0.912	-0.185	0.165
Bean Share	0.043	0.071	0.600	0.552	-0.098	0.183
Gender	0.031	0.062	0.500	0.619	-0.091	0.152
Intercept	0.591	0.114	5.160	0.000	0.365	0.816
F(9, 185)	5.050		**Prob > F**	0.000		
R^2	0.100					

4.2: Trader Value

The average trader values by channel are presented in Table 4.3. The table shows that the average value extracted by traders operating in the wholesale channel is ZMK7,405.75/kg compared with ZMK8,750.75/kg and ZMK9,663.56/kg in the institutional and retail channels respectively. The standard deviations increase as one moves closer to the ultimate consumer, i.e., from wholesale to retail through institutional channels. The value extracted in the wholesale channel is statistically different from that extracted in the retail channel at the 1 percent level. Similarly, the wholesale and institutional values are statistically different at the 1 percent level too. However, the difference between value extracted in the retail channel and that extracted in the institutional channel is not statistically different.

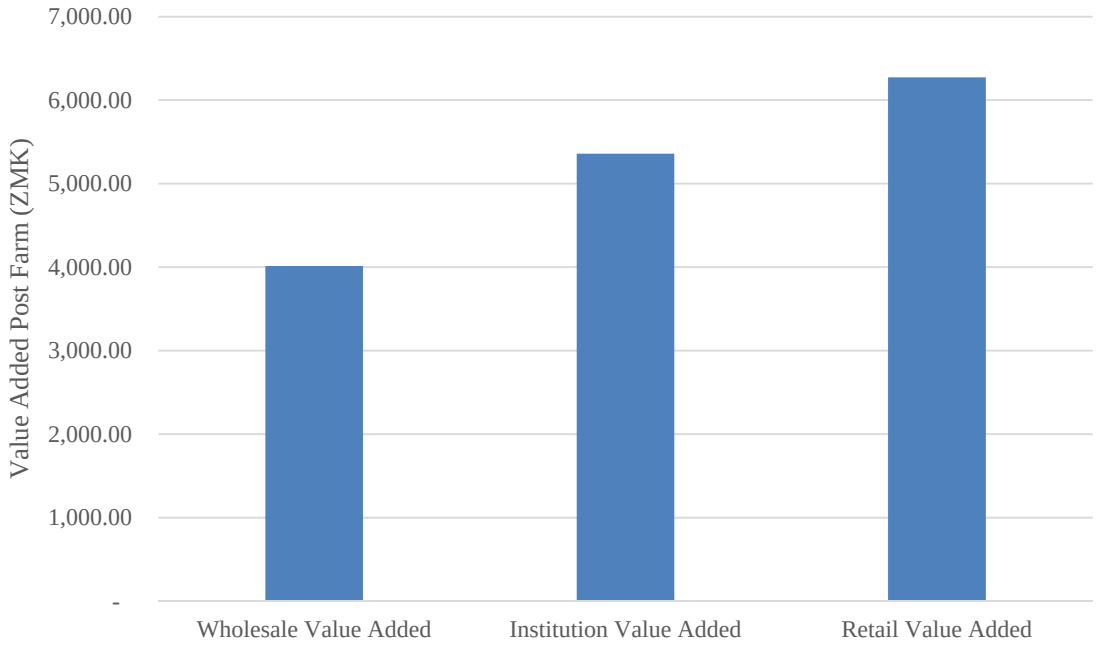
Table 4.3: Value Accruing to Traders by Channel

Channel	N	Mean (ZMK/kg)	Std. Dev. (ZMK/kg)	Minimum (ZMK/kg)	Maximum (ZMK/kg)
Wholesale	151	7,405.75	1,729.82	1,851.85	13,888.89
Institutional	37	8,750.75	2,148.28	5,555.56	13,333.33
Retail	125	9,663.56	3,189.19	2,222.22	21,111.11

The value added between the farm level and the different channel levels is captured by the difference between the value extracted by producers and the value extracted by the different channels. Figure 4.2 shows the value added that occurred in the different channels based on the average value extracted at the producer level. It shows that, as expected, value addition at the wholesale level is lower than at the institutional level and value at the institutional level is lower than at the retail level. Indeed, the analysis shows that the value added at the institutional level in the channel is about 33.5 percent more than was added at the wholesale level while the value added at the retail level is 56.2 percent of what prevailed at the wholesale level. This makes perfect sense as traders operating closer to the

end of the chain incur higher levels of risks over longer durations than those operating closer to the beginning of the chain once the production risks are accounted for.

Figure 4.2: Post Farm Value Added in the Supply Chain



The level of competition has a direct effect on the value that market participants can extract from their transactions. Soweto market, being the largest in Lusaka, also has the largest number of trader participants, operating in all three channels from there. It is observed from Table 4.4 that the value accruing to wholesale operators was lower at Soweto than Chilenje and Mtendere. Similarly, retailers in the smaller markets are able to extract higher value on average than those in bigger markets because of the nature of competition and the number of players operating in the market. Thus, while retailers in Mtendere and Chilenje were able to extract an average of about ZMK11,629.63/kg and ZMK13,819.44/kg respectively, Soweto retailers only managed to extract ZMK8,820.99/kg.

Table 4.4: Value Accruing to Traders by Channel and by Market Location

Variable	N	Mean (ZMK/kg)	Std. Dev. (ZMK/kg)	Minimum (ZMK/kg)	Maximum (ZMK/kg)
		Soweto Market			
Wholesale	124	7,126.12	1,646.99	1,851.85	13,888.89
Institutional	37	8,750.75	2,148.28	5,555.56	13,333.33
Retail	99	8,820.99	2,432.36	2,222.22	15,740.74
		Chilenje Market			
Wholesale	17	8,834.42	1,624.68	6,481.48	11,111.11
Retail	16	13,819.44	3,512.91	6,666.67	21,111.11
		Mtendere Market			
Wholesale	9	8,518.52	1,469.86	6,666.67	11,111.11
Retail	9	11,629.63	3,779.41	7,777.78	20,000.00

4.3: Value Distribution

The distribution of total value created in each supply chain may be estimated by focusing on the channel paths associated with the supply chain. Suppose that there are two distinct supply chains from the farm to consumers:

1. Producers to wholesalers to retailers; and
2. Producers to wholesalers to institutions

Then the total value created in each supply chain is the sum of the average value created at each stage in the chain. Based on the foregoing analyses, the total value in the first supply chain described above is ZMK20,460.37 and the second one has a total value of ZMK19,547.56. The value difference illustrates the proximity of the penultimate transaction to the final consumer. Thus, while retailers sell directly to final consumers (even if they are small restaurants, etc.), institutions are final customers and exhibit larger market power than individual consumers do in the exchange process. Producers capture 17.3 percent of the total value in the producer-wholesaler-institution chain while wholesalers capture 37.9 percent and institutions capture 44.8 percent (Figure 4.3). For the

producer-wholesale-retail chain, the distribution is as follows: 16.6 percent for producers; 36.2 percent for wholesalers; and 47.2 percent for retailers (Figure 4.4). As indicated earlier, the extra value addition undertaken by the retailer in getting the atomistic distribution of the product completed in the chain explains the higher share captured by retailers compared to institutional seller despite the length of the chain being the same in terms of number of participants.

Figure 4.3: Distribution of Total Chain Value in the Producer-Wholesaler-Institution Supply Chain

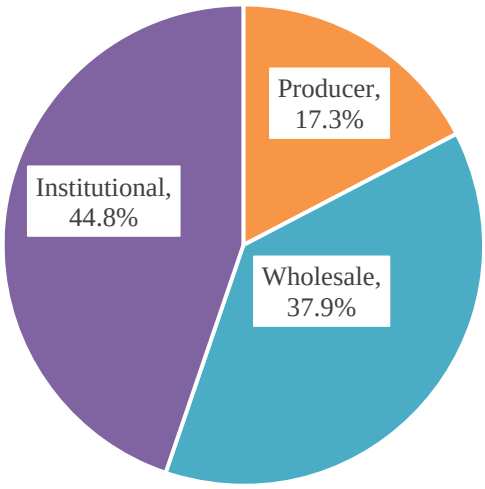
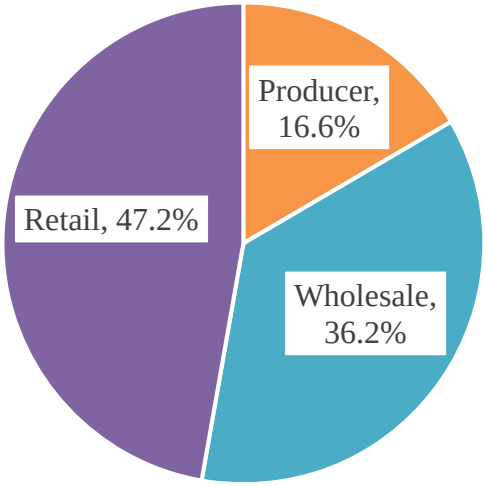


Figure 4.4: Distribution of Total Chain Value in the Producer-Wholesaler-Retailer Supply Chain



CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS

The overriding objective of this research was to estimate the pecuniary value created in the Zambian mixed bean industry and determine how that value is distributed along the supply chain. It also sought to identify any differentiating factors that explained how much producers were able to extract from their exchange transactions with traders in the bean value chain. The study used primary data collected from both producers and traders. The traders operated in the largest consumer market in Zambia—Lusaka – and in three food markets in the city: Soweto; Chilenje; and Mtendere. Producers was sampled from three districts known as the principal bean producing districts in the country: Mbala; Kalomo; and Lundazi.

The results show that value is a function of perceived value addition at each stage as well as the embedded risks. Thus, the closer the exchange occurred to the consumer, the higher the value that the seller was able to extract in the exchange. For example, wholesalers' average value was ZMK7,405.75/kg compared to retailers' average value of ZMK9,663.56/kg. The average value for institutional merchants was estimated at ZMK8,750.75. These values were all higher than the average farm level value of ZMK3,391.06/kg. It is important to note that included in the post-farm value are transaction and logistics costs that reflect the risks and value addition that occur in the downstream stages of the supply chain. For this reason, it is extremely difficult to argue that these downstream players are taking advantage of producers because of asymmetric price information because there is real value addition and risks that are borne by downstream players.

The relative competition in the market was found to influence the resulting value that is extracted. The results showed that markets with a lot of sellers often had lower

value extraction capacity even as market with few sellers relative to buyers created the opposite effect. Thus, the average producer value in the smaller mixed bean producing regions was higher than in the larger region. Similarly, the trader value in the smaller markets was higher than in the larger markets. The results also showed that gender, education, and similar producer characteristics had no influence on value extracted by producers. The only characteristic that mattered was available land to the producer, and it was shown to have a negative and significant effect on value. This is probably because larger farmers make up the lost unit value with savings in transactions costs achieved through volume.

The distribution of total value created was consistent with the value addition and risk exposure argument presented above. Thus, despite being about the same length in terms of the number of participants, the terminal players – retailers versus institutional vendors – received different shares of the total value created in their supply chains. Retailers, being closer to the final consumer and bearing more risks of completing the final atomistic distribution of the product was found to get a few percentage points higher of than the institutional vendor, who could sell in higher volumes.

The foregoing research provides empirical evidence that value addition and risks bearing define the share of value that is attained in the mixed bean supply chains. Policymakers must, thus, see the value that traders make in the supply chain before imposing economic costs on them that would not only adversely affect their performance but hurt the very cause that they seek to achieve, i.e., improve the financial wellbeing of smallholder producers. A more effective policy than attempts to target traders is to help producers increase the value they add to the chain. For example, by organizing horizontal

alliances to reduce the search and gathering/aggregation costs incurred by traders, producers would be able to share in the transaction cost savings that are experienced by the traders. Once they are able to do that, it becomes a lot easier to organize themselves into increasing the value they add by moving products from their villages or aggregation points to central locations that make it easier for traders to deal with them. What this value addition strategy does is also concentrate the bargaining power of producers by reducing the level of atomicity and competition as seen in the estimates. Indeed, they may even be able to learn from their successes and begin investing in integrating downstream toward the consumer in the cities, and thus capturing the majority of the value in the supply chain by incurring the related risks. Policymakers have a role in providing the infrastructural and knowledge support to facilitate these developments in the mixed bean industry in Zambia.

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