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Commercialization of indigenous vegetable value chains: a review of selected African countries

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Abstract

This paper reviews literature on the Africa Indigenous Vegetables (AIVs) value chain models in selected African countries to understand the link between the nature of the value chain and the level of commercialization. The paper also looks at the various relationships between the value chain actors and how it is affecting commercialization to come up with a clear model that suites Zimbabwe based on other countries' experiences. The value chain approach is identified as the appropriate theoretical framework for commercializing of AIVs. Coordinated and traditional chains existed in Kenya, Mozambique, Malawi, and South Africa. The traditional chains in Mozambique and Malawi had a level of commercialization of 50 percent by households who consumed 30percent of the produce and sold the rest. The players formed personal cartels to negotiate prices and access financing. In Kenya, the spot market chain governance existed with a higher level of commercialization. The transactions done between the players lacked contractual agreements. About 40 percent of farmers in Limpopo province have access to formal markets, a value chain comprised of weak linkages between the players existed.

Keywords: African Indigenous vegetables; Commercialization; Value chains; Value-added; Value chain governance.

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1. Introduction

African Indigenous Vegetables (AIVs) have been part of the food systems in Sub-Sahara African for centuries (Ngenoh et al., 2019; Richard et al., 2017) although their commercialization has been slow due to the subsistence nature of the value chains. AIVs have been used as vegetables through custom, habitat, and tradition (Kansiime et al., 2018) as well as being valued for their medicinal properties. They are common plants that have been taken from the wild and grown by households within their area of origin, or plants brought into a certain geographical location (Dube et al., 2016) and are now acknowledged as acclimatized, or those commonly picked from the wild (Ravishankar et al., 2015). Many rural households are now recognizing the potential benefits of commercializing AIVs as a source of income, for example in Kenya, almost 80% of the AIV women farmers generated an income ranging between Kshs 5000-9000 (USD 45.92 – 82.66) in season (Omulo, 2016). Agricultural commercialization refers to the process of increasing the proportion of agricultural market participation by the farmers (Tozooneyi, 2017). Commercialization of AIV requires a comprehensive understanding of the value chain to determine critical entry points, points of interventions as well as support activities. A value chain is a framework of inputs and services flow, their transformation into a product or service, and the flow of the agricultural product from the producer to the final consumer, including an understanding of the value accrued at each stage of the chain (Kimambo, 2016).

The dependency of African rural households on AIVs for sustenance spreads across Africa (Nyaruwata, 2019). Although the vegetables have been consumed for years, production has never been geared for marketing and commercialization (Kebede and Bokelmann, 2017), as AIVs are considered as food for the poor and rural people. The commonly produced and traded AIVs in Sub Sahara countries (South Africa, Benin, Senegal, Kenya, Tanzania, Corte D'vore, Malawi, Mozambique) are amaranth (Amaranthus spp.), African nightshade (Solanum scabrum, S. villosum, S. nigrum, and S. Ameri- canum), African eggplant (Solanum macrocarpon, S. aethiopicus and S. anguivi), vegetable cowpea (Vigna enguiculata), Ethiopian mustard (Brassica carinata), jute mallow (Corchorus olitorius), okra (Abelmoschus esculentus), spider plant (Cleome gynandra) and pumpkin (Cucurbita moschata) (Weinberger and Pichop, 2009; Chagomoka et al., 2013). Amaranthus hybridas is the most consumed vegetable. African nightshade, amaranth, and African eggplant were found to have a high market share in Tanzania, and this leads to their intensive production (Kimambo, 2016). In some parts of Uganda, Solanum aethiopicum and cowpea were the most preferred (Kansiime et al., 2016). In Zimbabwe, the common AIVs are Indian mustard, Pumpkin leaves, Okra, Cowpea, Spider flower, Young Jew's mallow, Amaranthus, pigweed, Black nightshade, Blackjack, Spindle weed, and Gallant soldier (Nyaruwata, 2019).

AIV production in several Sub-Saharan countries is semi-commercial in the city and peri-urban places on an average of one-quarter of a hectare or less (Weinberger and Pichop, 2009). Many farmers in the AIV production are small scale farmers, in Kenya for example, the majority of 96percent indicated that they grow AIVs on a relatively small space of fewer than two acres and a bigger acreage of three to six is done by only four percent (Weinberger and Pichop, 2009). African countries have started the introduction of programs and policies to encourage the incorporation of smallholder farmers in output and input markets through agricultural strengthening and commercialization (Ngenoh et al., 2019). Kenya, Mozambique, Malawi, and Tanzania are among the countries that have managed to commercialize AIVs value chains. Malawi for example promoted the use of indigenous vegetables as shown by its guideline to vegetable production where they aim to increase supply for both domestic demand and export (Chagomoka et al., 2014). The country also developed

in 1995 a National Horticultural Strategic Plan, in which it articulated the action plans for promoting AIVs from research strategies up to agro-processing and marketing. To action, the plan, a Horticultural Development Training and Extension Centre (HDTEC) was also established and is focused on introducing new AIV cultivars, extension services, and training on good agricultural practices (Kurgat et al., 2018). In Zimbabwe, just like in many African states, farmers are failing to supply vegetables all year round as their production is not guided by market demand (Abel et al., 2019). Rather the supply is determined by seasonal availability as presented by the spikes in shortages on the market (Okello et al., 2015).

There were declines in the consumption of African foods especially AIVs which can be traced in many African countries (Dube et al., 2016). About 75 percent of the Zimbabwean population consumes on average a kilogram of AIVs per month (Dube et al., 2016), which is way below the expected 12kg of vegetables per month as ascribed by FAO for a nutrition-sensitive diet. There are also exceptions to the general patterns which are recognized across the African region. In Kenya for example, urban and rural people consume about 73kg of vegetables per capita per year (Gido et al., 2017). The consumption of vegetables and fruits can rise if they are readily available all year round and affordable. In the past years, consumption of AIVs in Zimbabwe in the urban and peri-urban increased due to their nutritional value and medicinal properties which make many cancerous patients and HIV, and AIDs patients resort to them (Dube et al., 2016) which in turn increases demand for the vegetables. An increase in the income of middle-class consumers who are strongly aware of healthy diets (Okello et al., 2015; Ngenoh et al., 2019) has contributed to the surge in the demand for AIVs, implying wider disparities between the quantities demanded and supplied per any given period.

Despite some regional successes of commercialization of AIVs value chain in Mozambique, Malawi, Kenya, and South Africa, there are some bottlenecks that hamper effective development of the chain. As Chagomoka et al. (2013) argued, poor market infrastructure (transport, storage), a defragmented value chain system where the links among chain actors are weak are problematic. In addition, unreliable data schemes for the market, absence of a commercial approach by extension consultative services, low market bargaining power remain challenges on the marketing front, compounded by ineffective institutional and trade policies. The commercialization of AIVs has been slowed down by a lack of data on their possible input towards stability in income and availability of food (Nyaruwata, 2019). Successful commercialization could be achieved through programs and policies that are focusing on the incorporation of households at farms inefficient and effective vegetable markets, establish household start-up monetary base and enhance land tenure safety (Abel et al., 2019).

Value chain studies are anchored on several theories and methodologies as there is no unifying framework for studying the subject. These theoretical frameworks have ranged from institutional to new institutional economics. The concept of value chain analysis (VCA) originated from the commodity chain approach and was aimed at investigating the links between firms and other participants in value chains. Value chain analyses are anchored on understanding the concepts of information asymmetry and power dynamics. The VCA approach has implications on smallholder farmers in terms of the investments required to meet upgrading opportunities (Abel et al., 2019). One value chain approach is the transaction cost theory. This is an economic approach analyzing the various types of transactions along the value chains such as information sharing, coordination, and contract deals. These transaction costs arise out of uncertainty in economic decision-making between contracting parties (Ngenoh et al., 2019). The rationale is to understand relationships along the supply chain and identify ways of reducing transaction costs. The new institutional economics (NIE) examines the

motivation for the selection of particular governance structures within and among firms and includes such theories as agency theory and transaction cost economics (TCE). TCE is a theory of organizational efficiency: how should a complex transaction be governed and structured to reduce losses? The objective of efficiency calls for identifying the comparatively better organizational arrangement, the alternative that best matches the key features of the transaction. According to Chagomoka et al. (2013), the focus is more on the analysis of transactions between organizations. Transacting parties in a value chain aim at choosing the type of governance that reduces transaction costs under farmer opportunistic behavior and bounded rationality (Gido et al., 2017). Actors in the value chain then put mechanisms to mitigate rent-seeking risks such as contracts, joint investments, and monitoring. Another approach, the agency theory, defines the relationship between a principal, who delegates work to an agent, who then serves the interests of the principal also known as the principal-agent relationship. The governance solutions under agency theory range from output measurement to the measurement of behavior and processes.

The adoption of the NIE approach is increasing in producer contract development under high levels of business environment uncertainty, rent-seeking, and weak institutions (Abel et al., 2019). NIE economics defines the relationship between small, marginalized farmers and commercial value chains in terms of governance, which defines the power and politics linking the various chain actors along the AIV chain (Chowdhury, 1990). In summary, the theories of VCA show that a value chain is characterized by its governance form, network structure, bargaining power, value-added, and distribution and upgrading options. This study is therefore a review of literature and experiences on the value chain approach to the commercialization of AIVs in African countries and its implications to the Zimbabwean context. The commercialization of AIVs in Zimbabwe presents new business opportunities, creates employment, and ultimately plays a major role in reducing poverty.

The study focused on widespread literature review on value chain approaches, applications, and assessments from a few African countries that have already commercialized AIVs. In the value chain analysis model, a commodity-based analysis was used in Mozambique. This approach is defined as a quantitative analysis tool of policy and socio-economic impacts. The tool is comprised of the commodity chain analysis which assesses the effect of public policies, institutions, and investments on existing chains for agricultural commodities; it quantitatively analyses the inputs and outputs, charges, value-added, and margins of the diverse agents under different policies. This model focuses on improving value chain effectiveness with knowledgeable choice as a tool for end-market research.

2. Value chain mapping and governance

2.1. Mozambique and Malawi

According to (Chagomoka et al., 2013), the value chain of AIVs in Mozambique and Malawi was made up of various players as shown below in Figure 1. The input suppliers were either individuals who harvested seed and then sold to others or seed companies and the government. AIVs seed constituted about seven percent of the total 37 percent vegetable seeds distributed in the two countries. The producers were linked directly to middlemen who either collected for direct resell to the consumers or transported and distributed to supermarkets which then sold to the consumers. Some transporters in Mozambique vertically integrated their

business by expanding into production, packing, and distributing on their own. Relationships between the value chain actors were built through spot markets, horizontal integration along the value chain, and persistent network relations (Chagomoka et al., 2013). A level of interaction between the AIVs marketing players was observed; players were collaborating among themselves, giving each other prices and market data, refrigeration, and logistics facility, lending and borrowing money, group purchasing of vegetables, and when supply was in the deficit, they facilitated access to produce among each other. Chagomoka et al. (2014) identified the reason to assist combined action to make sure that the chain networks for the players are strong to reduce the constrictions. Combined action and networking enable robust negotiating control and controlled goods deliveries while refining good quality standards.

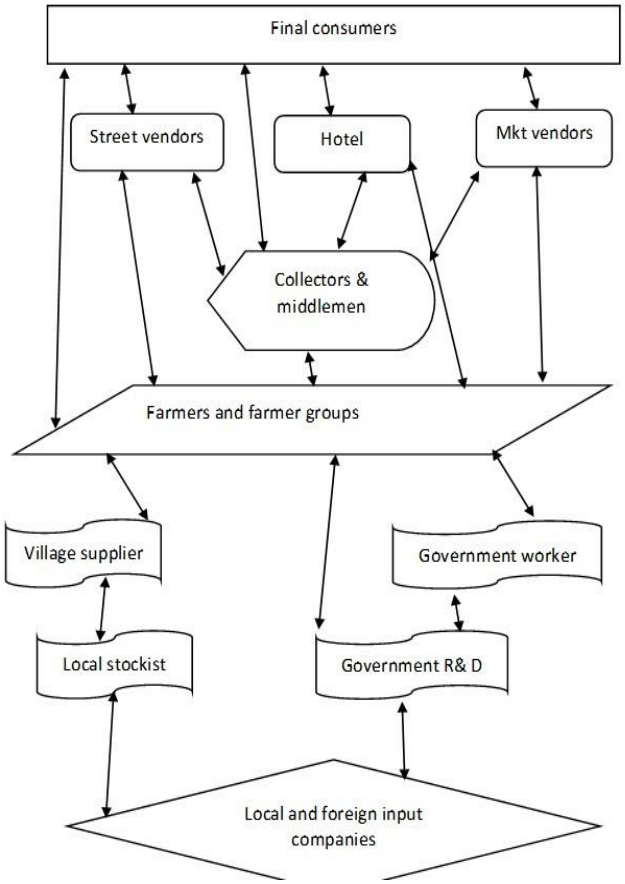

Figure 1. African Indigenous Vegetables value chain actors in Malawi and Mozambique (Chagomoka, Afari-sefa, and Pitoro, 2013)

In Malawi, from marketing vegetables, incomes obtained by the middlemen per month were approximately US$50 and the retailers were getting US$37. The sales from both middlemen and retailers in Mozambique weekly got to an average of US$28 and US$26 respectively taking into account the peak season and the season when sales were low. Farmers were consuming 30 percent on average of the vegetables they produced and sold the rest. The level of commercialization in the two countries was around 50 percent which proved to be

the best although there was a need to boost the commercialization by focusing on the producers, assistance on markets, and data delivery services for traders and brokers (Chagomoka et al., 2014).

In the two countries Malawi and Mozambique, farmers took part in the value chain as middlemen and retailers as well. In Malawi,14.3percent of the farmers were middlemen and 29.6 percent were retailers. They were involved in the collection of vegetables, owning, and managing shops, farming, and hawking. Through this channel, their sales accounted for 51-75 percent of their total income in Malawi and 86 percent in Mozambique (Chagomoka et al., 2014). In Malawi and Mozambique, 43.3 percent and 48.2 percent of the farmers took part in acting as retailers respectively and were selling their vegetables directly to the consumers. The vegetable sales in Malawi from 70 percent of the retailers accounted for 50 percent of their income. Selling through and as middlemen were of great benefit to the farmers as they maximized their returns as they had direct reach to the final consumers bypassing other players (Chagomoka et al., 2014).

The various value chain actors built their relationships upon three market transaction typologies. The first was the spot market where actors carry out transactions and all negotiations on prices and quantities at the market. The other typology was based on persistent network relations between buyer and seller, which continued when there was a chance of transacting many times as a result of trust between the players and horizontal integration along the value chain. The last typology was of a horizontal integration along the value chain, it was not a relationship as such the players involved had the same legal ownership. Several linkages between the players were spot market linkages, an exception was for the relationship among brokers and retailers which were organized and were built on long-term relationships. Figure 1 shows the value chain for Mozambique and Malawi.

In conclusion, in the value chain for Mozambique and Malawi, players are vertically linked thus the middlemen also go into the field to grow their vegetables the same way as the other buyers which makes vegetables to be available most of the time. There is an easy flow of information among the players, and everyone is made aware of what's going on and makes daily decisions well guided. The value chain model has an average level of commercialization as quantities which are 50 percent combined of the two nations pass through the chain.

2.2. Kenya

Coordinated and traditional value chains existed side by side in Kenya (Abel et al., 2019) as shown in Figure 2. Contractual arrangements, food safety, standard requirements on quality, and retail activities were used to separate traditional chains and coordinated value chains. In traditional chains, there was market sourcing where traders and producers did not set arrangements on the mode of payment, quantities to be supplied, and production levels (Abel et al., 2019). Coordinated value chains were made up of standard procurement setups where the farm decisions relied on information from supermarkets on contracts on quantities demanded, the quality expected, delivery mode, and terms of payment.

The value chain of AIVs is divided into two main categories, which are rural and peri-urban actors (Abel et al., 2019). Key players in the value chain were input distributors, farmer groups, wholesalers, middlemen, supermarkets, and retail shops. Input suppliers comprised NGOs, agro-vets, farmers, and local seed retail traders (Abel et al., 2019). Farmers in the rural areas used retained seed (Abukutsa-Onyango, 2010); NGOs and agro-vets supplied certified seed on credit in peri-urban areas. Agro-vets in peri-urban areas went a step

further in supplying other inputs and extension services (Ngenoh et al., 2019). Farmer decision-making had a dual approach, as either individuals or as groups. Farmers who belonged to groups were slow in decision-making compared to individuals. Furthermore, the peri-urban farmers worked more as individuals and groups only came into place in joint transportation of vegetables to the markets and proportionate sharing of transportation costs (Mutonyi, 2016). The other costs shared were market fees. In the rural areas, farmers depended on middlemen all year round for the transportation of their produce. The next node in the value chain was managed by wholesalers who bought vegetables from the middlemen. These wholesalers were found in and around Nairobi and their role was to assess market demands and set prices which were communicated to the middlemen and retailers.

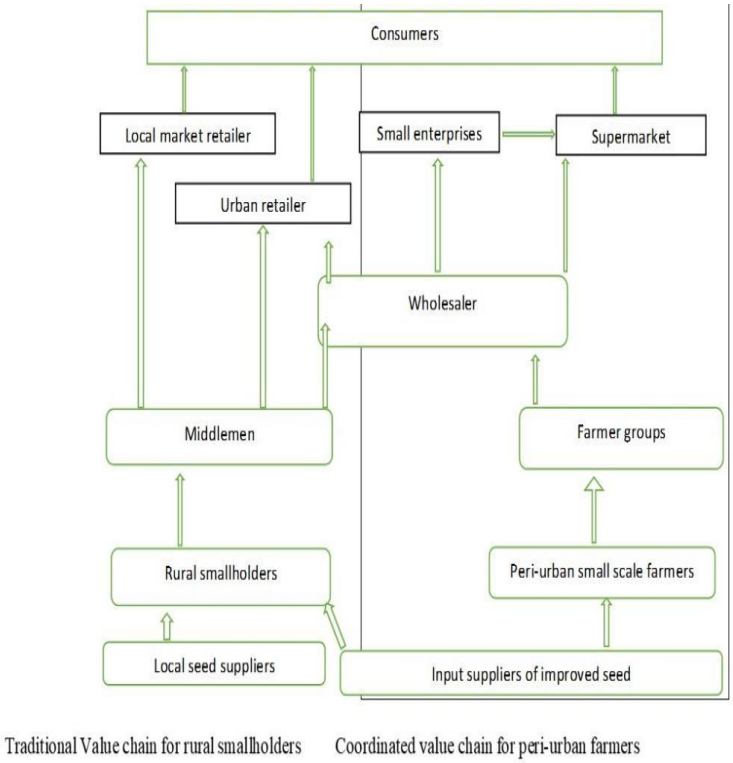

Figure 2. Kenya African Indigenous Vegetables value chain (Abel et al., 2019)

Farmers and market brokers had both formal and informal relations with other players in the value chain. At the production level, farmers aligned their marketing and production activities to group collective decisions (Mutonyi, 2016). In the rural areas, there was no group procurement of inputs and produce marketing unlike in the urban areas and irrigation schemes. The peri-urban farmers used improved seed and fertilizers to produce their vegetables indicating some level of commercial farming approach (Kang et al., 2017). This approach was however mostly defined at farm level and not at group level. Peri-urban farmers would grow their vegetables in nurseries and later transplant them because they had a chance to sell seedlings as well to fellow farmers unlike in rural areas where they practiced direct seeding. At the distribution and assembly point, brokers from the peri-urban had casual welfare relations grounded in the local markets. Middlemen had committees that represented them in negotiating and securing markets with lower access fees. The middlemen

who supplied schools and hospitals and supermarkets were not organized into associations. At the marketing level, trader associations operate cartel-like informal associations presenting entry barriers into the business. Wholesalers justified these cartels as a way of stabilizing prices (Abel et al., 2019). Under traditional value chains, arm's length spot market chain governance which did not vertically coordinate smallholders and buyers dominated the chain (Muhanji et al., 2011). Retailers had flexible agreements with selected groups of farmers in coordinated value chains. Informal contracts were common in Kenya; for instance, supermarkets did not offer financial or technical support to farmers, and in turn, farmers were not obliged to deliver all standing orders from supermarkets.

In traditional value chains, there was asymmetrical access to information among the actors (Abel et al., 2019). Information about markets came from the wholesalers implying that they were the ones who controlled information. They had information about market demand because they had relations with supermarkets and product quantity availability from their backward relations with farmers and middlemen. Wholesalers advised middlemen of the daily prices who then used it to their advantage to negotiate for lower prices with farmers.

The relationship from the farmer to the retailers was based on spot markets, no prior arrangements about price and quantity were made. This is a disadvantage to the sellers as they were forced to take any price presented because of the perishability of the crop. The flow of information to and fro the rural farmers was unidirectional, there were no clear flow wholesalers would come with their information the same was happening with the middlemen and retailers (Abel et al., 2019). The middlemen who bought vegetables from the rural farmers supplied the wholesalers and their value chain governance was relational. This is because the power asymmetry degree and explicit coordination are not strong as the farmers did not have contact with the supermarkets (Abel et al., 2019). The farmers had low bargaining power as they are not organized into marketing groups. The value chain had mutual information flow among all players. The peri-urban model had efficiencies in how they operated as there was a clear flow of information between the players unlike in the rural value chain where information flow is unidirectional. Formal coordination channels were used through explicit contractual arrangements at each level of actor engagements, from input suppliers to retailers (Mutonyi, 2016; Abel et al., 2019). The urban value chain governance was characterized as modular, implying there are links involving specialized suppliers who finance part of production on behalf of the buyer (Mutonyi, 2016), as they will be paid by the buyers to supply the farmers and the channel acted as a contract of some sort where the farmers will be expected to sell to the buyers who are linked to the suppliers.

Value addition was in cooperated to preserve the vegetables and also makes them available off-season. Methods included drying, blanching them, and sun drying. These vegetables are exported to the diaspora from Northern Nakuru county (Marson et al., 2019). Cowpeas in Kenya were value-added through sun-drying, freeing, and freeze-drying (Okello et al., 2015). Farmers grew their vegetables under irrigation and also as rain-fed and they sold through different channels earning different incomes (Marson et al., 2019). Vegetables were either grown under irrigation or rain-fed by different farmers and they sold them through different channels which made their earnings to be different. The channel of supplying an irrigated crop to supermarkets through other actors resulted in the farmer getting 39 percent of the retail share price, traders got 23 percent and retailers earned 29 percent. The farmers who grew a rain-fed crop and sold through traders to retailers earned 44 percent of retail share price and the traders' got 40 percent with the retailers getting a minimum of 11 percent (Marson et al., 2019). Farmers who sold their produce without intermediaries to the supermarkets got a retail share of 52 percent and retailers got 29 percent. Commercial farmers who sold directly to wholesalers

at a wholesale price got a price share of 82 percent. The share which farmers got by selling through many actors was very low compared to the benefits they reap from selling directly to the retailer. Farmers ended up going through the middlemen in trying to avoid extra costs in transporting as the markets were distant so the middlemen had ready markets which they were supplying and would come to farms to aggregate and transport on their own (Wasike et al., 2018).

The number of vegetables sold in green groceries and supermarkets where the higher and middle social classes buy groceries increased. Between 2003 and 2006 after the promotion of consumption of AIVs, sales in peri-urban markets rose from 31tonnes to 600tonnes per month (Lans et al., 2012). From 2009 to 2014 the area under production of amaranth increased by 23.2 percent which was relatively low compared to spider plant which was 25 percent and also the yields for the two vegetables increased respectively by 36.5 percent and 44 percent (Kebede and Bokelmann, 2017). Muhanji et al. (2011), found out that with three seasons, farmers producing IVs had close to a trebled area devoted to production from an average of 0.09 acres to 0.25 acres. The annual gross margins were estimated at USD5,274 per acre, compared to USD1,213 for exotic vegetables, constituting an effective 335 percentage increase in margins, which is phenomenal (Muhanji et al., 2011). About 95 percent of the farmers in Kiambu and Thika counties were selling their AIVs at spot markets (Marson et al., 2019). More than 60 percent of the vegetables in Kenya passed through the value chain (level of commercialization) because of various nutritional campaigns done and feeding programs carried out and also the increase in the demand for AIVs in the country.

2.3. South Africa

The AIVs value chain in Limpopo Province in South Africa is underdeveloped. It is made up of the following key actors; input suppliers, subsistence farmers, traders, and consumers (Senyolo et al., 2018) as illustrated in Figure 3. The farmers channel their products to either traders or direct to consumers and only 42 percent of the farmers have access to the formal markets. These traders are retailers, middlemen, wholesalers, and street vendors. Apart from that, the other network started from farmers to the retailer and final customer. The producers control the value chain as they are the price setters in Limpopo province. Producers enjoy higher gross margins which are above 50 percent although the margins start to fall as the number of producers increase (Senyolo et al., 2018). About 44 percent of smallholder farmers sold their vegetables at the farm gate to eliminate transport costs. Many farmers in South Africa, Limpopo province are not part of the farmers' organizations which hinders them from accessing technical production services and certified seeds. There is an absence of relations among farmers and the processors, traders, and foreign markets (Senyolo et al., 2018). An establishment of the three missing relations by coming up with public and private processing, and traders who buy in bulk and finding international markets, rural farmers present a benefit to the value chain.

Some supermarkets in the Limpopo province have a straight relation with the small-scale producers. Retail markets near rural areas buy vegetables from farmers and sell them (Shonhai, 2016; Mahlangu et al., 2020). The majority of the retailers did business with local producers without formal contractual agreements, if the product is of good quality they didn't hesitate to buy. In the value chain of AIVs, loopholes were on the processing and packaging of the vegetables. The absence of the two has led to a loss in quality and quantity of vegetables supplied to the consumers and also to low returns to the farmer (Senyolo et al., 2018). The middlemen in the chain exploited the farmers which on a disincentive on the producer.

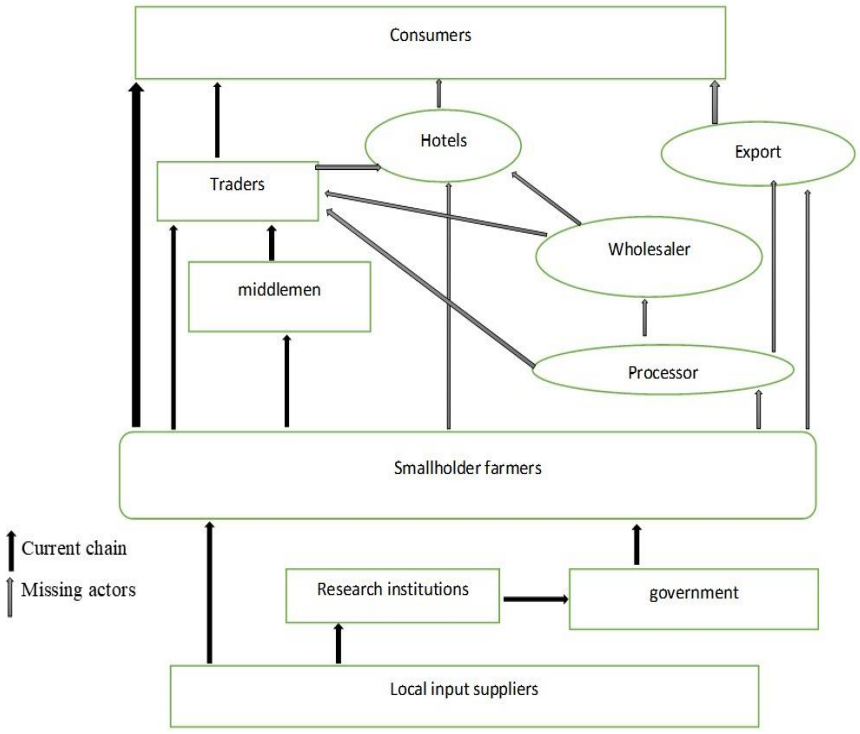

Figure 3. African Indigenous Vegetables value chain in Limpopo South Africa (Senyolo, Wale and Ortmann, 2018)

The value chain of AIVs comprises of different stages and at each stage value is either added or subtracted and this attracts an extra cost on the final product. Grains from amaranth plants are used as a food ingredient for several dishes (Senyolo et al, 2018). They are prepared as cereal, baby foods, toasted, popped as popcorns, sprouted, ground into flour, and used as a thickening agent for stews. The processing of AIVs in Limpopo is something that hasn't been fully tapped into as there was an absence of direct linkages between the farmers and the processors. Retailers in Limpopo paid R8 to the producers for a bundle of vegetables and sold it to the final consumer at R10 after washing the vegetables and packing them (Senyolo et al., 2018). The producers sold to middlemen at R7.2 and retailers at R8, with the farmer earning 50 percent of the gross margin ratio, middlemen getting six percent, and retailers having 15percent.

Absence of relations existed among producers, processors, retailers, and foreign markets (Lekunze, 2014). The farmers were directly linked to the middlemen and a few supermarkets buying directly from them (Mahlangu et al., 2020). A few farmers had access to better formal markets for their vegetables, entailing a relatively lower level of commercialization. Efficient and formal linkages from the farmers to the last consumer will help improve the level of commercialization in the area (Mahlangu et al., 2020).

From the above synthesis, the literature shows that a commodity-based approach was implemented in Mozambique and Malawi, which provided better insights into the organizational structures and strategies of different actors engaged in traditional vegetable chains. This chain does not typically have well-structured markets to exhibit global commodity value chains characteristics. There are no contractual agreements in the operations of the farmers and the buyers. The other players practiced horizontal and vertical integration. The

linkages were based on spot market relationships between the farmers and the buyers. The link between the supermarket and retailer was more organized and coordinated based on persistent relationships.

In Kenya, the study by Abel et al. (2019), provided little information about the structure of the value chain. A coordinated and traditional chain existed side by side in Kenya. These chains were made up of peri-urban and rural regions that comprised of segments and actors who were the same. Differences in the structure and dynamics of the chain-like rural and peri-urban perspectives provided a diversity of marketing outlets within the same value chain. Participation in coordinated value chains provided greater income security due to low price volatility. Contractual agreements were absent. The relationship between middlemen and wholesalers was characterized by relational arrangements, a modular relationship existed between the farmers and supermarkets under coordinated value chains and vertical linkages were limited to suppliers meeting procurement conditions only.

In South Africa, there were no processors and wholesalers. Supermarkets have contracts with established suppliers who can supply to them all year round and who can meet quality standards. The chain is coordinated, and the spot market relationship existed between the players. From the four countries which have commercialized value chains of AIVs, it shows that in Mozambique and Malawi main focus was on the establishment of modes and types of buyer-farmer linkages and their corresponding marketing outlets. Zimbabwe can learn from the different countries on how to come up with an efficient value chain for AIVs. Mozambique and Malawi provided insight on organizational structure and strategies of the different actors; this is something that is useful for Zimbabwe to implement. The AIV markets are not well structured Across All Nations but can be perfected over time. horizontal and vertical integration helps the continuous flow of produce along the chain which is a good trait. Having persistent relationships helps to organize and coordinate links between markets. From Kenya, the key takes ways which Zimbabwe can benefit from the separation of the VC, having a traditional and coordinated chain which helps to provide diversity of markets.

The studies were limited in terms of looking at who controls the various linkages and who has power. The chains were characterized by poor contractual agreements between the farmers and the markets. The governance of the chain was not fully analyzed. The value chain governance study in Kenya looked at the main governing structure of the chain. The commercialization of the AIV value chains has not been comprehensively analyzed, to consider relations, governance, power relations value-added, and the benefits of selling through the chain.

3. The demand for AIV in Africa

There is a general observed increase in the number of vegetables handled by supermarkets and greengrocery stores in Kenya, (Abukutsa-Onyango, 2010). Despite this, vegetables like African nightshades, amaranth, and spider plant were readily available in the local markets mainly in the rainy season but demand was unsatisfied to a greater extent (Ngenoh et al., 2019; Magogo et al., 2020). Between 2001 and 2007, an increase from four percent to 10 percent was noted in the contribution of IVs in the domestic market (Abukutsa-Onyango, 2010). A survey done on socio-economic factors of AIVs in the central, eastern and western parts of Africa showed that the demand for vegetables in and around big and small cities was increasing therefore forcing many to grow them in and around cities to meet the increasing market demands (Abukutsa-Onyango, 2010). In Kenya, high market returns motivated small-scale farmers to commercialize AIVs (Gido et al., 2017).

In Nairobi, markets for AIVs were developed and people are now aware of their benefits therefore now including them as part of their diets at both rural and urban levels thus their demand is increasing (Kebede and Bokelmann, 2017). Improved awareness of the benefits of consuming AIVs in Tanzania resulted in increased demand for processed AIV (Richard et al., 2017). There is an increase in demand for AIVs in Zimbabwe by cancerous and people with notifiable diseases as they are after the nutritive benefits to boost their immune system (Abel et al., 2019). There is an unmet demand in South Africa in terms of quality and quantity available for consumption (Senyolo et al., 2018). The increase in the rate of urbanization presents a great market potential for vegetables (Richard et al., 2017). There is low consumption of meat products in the urban and rural populations of Mozambique and Malawi due to their low per capita income and this led to an increase in demand for AIVs (Chagomoka et al., 2014). The demand for AIVs outweighs the supply because of serious customer awareness campaigns which lead to continuous promotion and production of indigenous vegetables, which still satisfy below 60 percent of existing demand (Muhanji et al., 2011).

4. Supply of AIV in Africa

Production of AIVs has been constrained by poor marketing and infrastructure which results in low commercialization of the vegetables. The major constraints of marketing included the abundance of vegetables during the rainy season, exploitation of traders due to lack of market information, lack of adequate market and transport infrastructure. This calls for the identification and creation of markets for indigenous vegetables and possibly linking farmers and farmer groups to appropriate markets (Wachuka et al., 2019).

AIVs markets are disorganized, and the vegetables supplied are failing to meet the market demand (Nyaruwata, 2019). To meet the rise in demand, farmers in Eastern Africa have started to grow AIVs at a large scale in peri-urban farms (Omulo, 2016), to ensure the availability of the vegetables all year round. Additionally, in Kenya, the land apportioned for AIV production increased between 2009 and 2014 (Ngenoh et al., 2019). Despite the improvement, a discrepancy in the supply of AIVs exists (Richard et al., 2017; Ngenoh et al., 2019) and market demand is not being met in the dry season (Senyolo et al., 2018). There is an abundant supply of vegetables in the rainy season and the first two to three months just after the rains (Mpala et al., 2015; Richard et al., 2017), as the vegetables are mainly cultivated during that time and in the dry season there are shortages in the market. Farmers in Kenya are motivated by high market returns which pushed them to the commercialization of AIVs (Senyolo et al., 2018). Nevertheless, in Nakuru county, the growth of black nightshade and leaf amaranths is relatively low as shown by a negligible three percent contribution to total farm output and production area allocated (Marson et al., 2019). The output per acre of black nightshade and leaf amaranths are nonetheless higher than 26 and 36 tonnes respectively, and the area for growing AIVs in Nakuru rose between 2015 and 2016 season from 602 to 1135 hectares (Marson and Vaggi, 2019).

Chagomoka et al. (2014), found out that the extremely short shelf life of AIVs is a severe problem in the selling and delivery of vegetables. The level of the perishability of AIVs makes the quality deteriorate over a short period between harvesting and consumption. The absence of refrigeration services is among the limitations that affect the selling of AIVs. This forces many supermarkets to procure vegetables in reduced quantities. Unavailability of appropriate vendor shades to openly sell the produce impacts on quality, which results in lesser values and sales. Market demand is not being met because many smallholder producers have small portions of land which mean that the harvest will not be enough to meet the demand, which causes the

supply deficit. If small-scale producers start and manage group action in supplying AIVs, the challenges of inadequate and poor quality supply could be solved (Senyolo et al., 2018).

Smallholder farmers are excluded in the procurement models used by large well-established supermarkets like Pick and Pay and Shoprite who prefer to deal with large scale farmers who are established, unlike small scale farmers who they term to be risky and costly (Senyolo et al., 2018). They deal with smallholder farmers on a spot market basis without contractual agreements (Abel et al., 2019). Small-scale farmers are thereby exploited by middlemen along the way. Supermarkets incur high transaction costs in dealing with small-scale farmers which are worsened by low production, poor physical structure, bad communication systems, low education levels, and low density of economic activity in the poor rural areas (Senyolo et al., 2018).

5. Marketing of AIVs in Africa

Market information is very crucial to the participation behavior in the market of any community. Information on markets helps farmers to make sound decisions that are in line with supplying needs, searching for potential buyers, negotiating, and enforcing contracts. Information source is of great importance as it determines the level of accuracy of the information. Most farmers in Kenya and Mozambique rely on informal networks that include friends, relatives, and traders (Chagomoka et al., 2014; Abel et al., 2019). Relying on these informal sources exposes farmers to the risk of opportunistic behavior of the more informed group which will have presented the information like the traders (Ngenoh et al., 2019). The traders condemn farmer produce on the notion that they are of low-quality forcing farmers to accept low prices (Magogo, 2015). A good reputation and trustworthiness of traders in Ethiopia helped to increase the commitment of farmers to supplying these traders and this reduces the opportunistic behavior (Hailu, 2016). Sound market information systems enable farmers to strengthen their bargaining power on the market to increase their market share (Weinberger and Pichop, 2009).

Market participation by farmers is based on institutional economies and organizational theory and their main focus are on coming up with the relationship between transaction costs and the choice of the channel. The transactional cost theory assumes that for the farmer to take part in a particular market they are driven by comparative institutional efficiency which means the transaction cost minimizing condition (Abel et al., 2019). However, access to high-value markets is more than a question of mere fulfilment of production volume requirements and minimizing transaction costs; it is more about how farmers embed themselves into the networks of value chain lead actors (Kilelu et al., 2017).

6. Conclusion and policy implications

Relationships between the value chain actors were built through spot markets, horizontal integration along the value chain, and persistent network relations. In the four countries reviewed in the literature, distribution channels of products differ or went through three different channels thus from producer to consumer; producer through middlemen and then consumer, and finally from the producer; middlemen, wholesalers, retailers, and finally consumers. Suppliers and retailers were the main players in traditional value chains and the coordinated value chains. In the traditional chain, the spot market system was commonly used where the players met at random to come up with prices for every transaction. In Kenya, the relationship between

middlemen and wholesalers was made of a relational governance system. The level of trust between middlemen and wholesalers was high because of long-term trade relationships to a point that some transactions were done over the phone. In coordinated chains, a modular relationship was between farmers and supermarkets, there was a limit in the vertical linkages to suppliers meeting procurement conditions. Farmers in Mozambique and Malawi had minimum bargaining influence and were pushed to sell at the cost presented to them by superstores. There were multiple governance arrangements in the traditional system, whereby farmers' transactions to middlemen were spot markets, becoming relational among brokers and wholesalers and then spot on among middlemen and supermarkets or retailers. The value chain systems are commercialized as a percentage of vegetables are sold through the system and in South Africa, the commercialization of the system is poor because there are poor linkages between the players which makes it impossible for the product to move from the producer to the retailer up to the final consumer.

The above synthesis of AIV value chains for Mozambique, Malawi, Kenya, and South Africa, showed that the value chains are different from country to country. The chains are made up of different players who have their committees and associations to which they belong for different reasons which include the ability to bargain prices, access to financing, and access to low market entry costs. Spot markets dominated the governance in all four countries. In many instances, there was the absence of written contracts and binding agreements. The value chain map of Mozambique and Malawi has proved to be the best followed by the one of Kenya with South Africa being the least, in terms of the level of linkages between players and how information and product flow across the chain. However, the value chain model for Mozambique has its loopholes of lack of collective action between the various players. Each player is independent in their deals which makes them not enjoy the benefits of bargaining in numbers. The outstanding feature of the South African model is that the farmers are the price setters, so they are the ones who control the chain.

Other nations can follow the value chain of Kenya in managing the commercialization of AIVs. The value chain of Kenya is made up of traditional and coordinated value chains. Separating the two chains gives room for one farmer to participate in a chain where they are not exploited. In Kenya, the farmers and traders had both informal and formal relationships. Under formal relationships, they managed to have clear contracts and under informal, the farmers were not obliged to deliver to anyone. Middlemen had associations that represented them in negotiating and securing lower market fees. Wholesalers had forward and backward linkages with farmers and retailers which gave them flexibility in their operations.

Commercialization of AIV is slow and this is due to several reasons across nations. Commercialization is influenced by internal and external factors and these external factors are beyond the farmers' control (Leavy and Poulton, 2007). According to Wachuka et al. (2019), the rate of commercialization was slow in Kenya because the majority of the population still depended on exotic vegetables, the value of AIVs is not fully appreciated therefore lower percentages are sold on the market. There is a lack of government policy in several countries that attempts to promote the production of AIVs (Reinten and Coetzee, 2002; Chagomoka et al., 2014; Wachuka et al., 2019). Lack of contractual agreements between the players is affecting smallholder farmers attain high gross margins and their intention to take part in the mainstream markets (Senyolo et al., 2018). Supermarkets make contractual agreements with farmers which are more inhibiting to achieving integration of smallholder farmers whereby farmers are exploited in the terms of payment presented to them, they are paid once the product has been sold and are updated about unsold orders which they will have to collect (Abel et al., 2019).

Policy interventions are required in the promotion of processing AIVs for value addition, provision of cold storage facilities nearer to the smallholder farmers in rural areas and nearer to the urban consumers, and to encourage continuation of production by stabilizing farm gate prices. There is need to support female headed families through the various policy interventions and initiatives and also improve their market participation decisions. Market participation can also be improved through strengthening supportive institutions such as access to credit at favorable terms and extension contact.

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