RSM2SNF

Research Supporting African MSMEs To Provide Safe and Nutritious Food

Title: Transformation of vegetable value chains in Tanzania: Results from a rapid value-chain reconnaissance of farmer, wholesaler, and third-party logistics MSMEs in three regions

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About Research Supporting African MSMEs to Provide Safe and Nutrition Food (RSM2SNF)

The Research Supporting African MSMEs to Provide Safe and Nutritious Food (RSM2SNF) is funded by the Bill and Melinda Gates Foundation. RSM2SNF dives deep into the wholesale, logistics, processing, and retail segments of the value chains of several products, such as fish, tomato, and green leafy vegetables. The goal is to understand the midstream of these food value chains with a focus on Micro, Small and Medium Enterprises (MSMEs), and to inform policies and interventions to support MSMEs in providing safe and nutritious foods at affordable prices. This five-year project (2022–2026) is led by Michigan State University (MSU) working with partners in Nigeria and Tanzania.

Contents

Abstract

This paper presents selected main findings from a rapid reconnaissance done in August 2023 of 300 micro small and medium farms and off-farm enterprises (in wholesale and logistics) in three vegetable-producing and consuming regions of Tanzania. The study covered tomatoes and green leafy vegetables (GLV). The study showed that there has been a rapid proliferation near rivers and lakes and highways of micro and small commercial farms producing these vegetables in the past decade; their production technology features intensification with widespread use of irrigation (some of it pump-fed), chemical fertilizers, and rise of use of pesticides as dense and continuous planting is followed as usual by rise in insect and disease incidence. Farming vegetables appears to be profitable as there is a continuous stream of new entrants. The study also showed that in tandem with the spread of vegetable farming there has been a rapid spread of wholesalers buying vegetables from farmers and, in partnership with third party logistics micro enterprises, delivering vegetables to retailers in those regions as well as cross-region (such as central to eastern Tanzania). They base in wholesale markets which are very important to the functioning of vegetable supply chains in Tanzania. These off-farm actors are very important to the functioning of the vegetable supply chains criss-crossing Tanzania. The actors face challenges such rising prices of chemicals and fuel and insect and plant disease pressure.

1. Introduction

Aggregate supply of domestic FV grew rapidly over the past several decades. Tanzanian FV output in tons (per FAOSTAT data) increased 4.1-fold from 1990 to 2020. Vegetable output grew 2.3 times and fruit output, 7-fold. This rapid growth kept up with population growth (2.4-fold) for vegetables and well exceeded it for fruit. Tanzanian income per capita increased 6-fold in constant dollars over the 3 decades (per World Bank data).

Our analysis of FAOSTAT data shows that this domestic supply growth went to domestic consumption: as less than 1% of Tanzanian horticultural output is exported. The composition of vegetable output changed, with tomatoes shifting from 9% to 17%, and onions from 3% to 7%, mirroring a consumption shift toward tomatoes and onions in Tanzania as in other African countries. Tomato output leapt 4.4-fold in those three decades.

There was a rapid diffusion of FV farming (National Bureau of Statistics, 2021). In 2008, 9.5% of Tanzania farms grew FV; just 12 years later (2020) the share doubled to 21%. The fastest shift was among small-scale farmers, from 8% of farms to 20%. For medium-scale farms, the shift was from 24% to 38%, and large farms, from 16% to 26%. Overall, area under FV jumped 130% - adding 240,000 hectares in that decade. Half of that increase in area was a jump in area under tomatoes. By contrast, cereal area expanded only 27%.

While green leafy vegetables are grown throughout Tanzania in small-scale plots in rural areas or near cities, most of the other main vegetables and fruits are grown on farms clustered in specific zones with favorable climates and soils and water. Examples are citrus and bananas in the hot areas of the coast, and tomatoes in well-watered areas near highways. The combination of similar FV consumption patterns all over Tanzania with FV-growing farms (apart from green leafy vegetables) producing in spontaneous commercial SME horticulture farm clusters in specific areas has led to the formation of long supply chains criss-crossing the country.

An example is the clusters of irrigated tomato farms, such as in the center of the country (Morogoro-Dodoma), in the Southern Highlands (such as Iringa), and in the eastern region of Dar es Salaam, sending out tomatoes to cities and rural areas all over the country (Ijumba et al., 2024). These findings are similar to Zambia and Ethiopia (Reardon et al. 2024), and what was found in Nigeria for the case of tomato; Liverpool-Tasie et al., 2023). These long horticultural supply chains criss-crossing Tanzania feed an urban population that grew 4.5-fold and went from 19 to 35% of the population from 1990 to 2021. The urban share of national consumption of FV reached 60% by 2017.

In this paper we analyze value chains of vegetables (tomatoes versus green leafy vegetables, GLV) in Tanzania. We study these two vegetables for two reasons. Tomatoes and GLV are the most consumed vegetables in Tanzania Consumers mainly buy fresh tomatoes with only a small share of consumption from purchased processed tomatoes. GLVs are composed partly of indigenous greens and partly of non-indigenous greens such as spinach and cabbage and various Asian vegetables.

On the other hand, the expected market and production systems for tomatoes vs GLVs are expected to be different. Tomatoes are annual but fewer cycles, are less perishable, tend to be shipped long distance inside Tanzania in long supply chains because their production is concentrated in a few regions, but their consumption is ubiquitous over regions, and over urban versus rural, areas of Tanzania. Tomatoes are only a non-traditional vegetable in Tanzania, emerging from consumed only in small volumes even as recently as the early 1990s but now important. Tomatoes, along with onions, are key ingredients in sauces and are "flexible" in application and addition to many dishes; this has led to their rapid spread around Africa such as in Senegal (Faye et al. 2023) and Nigeria (Parkhi et al. 2023).

By contrast, GLV are annuals but if favorable conditions are present can be produced in many cycles, are very perishable (albeit with differences between less perishable GLVs like cabbage and very perishable and delicate like amaranth, the leading GLV. GLVs appear to be shipped short or medium distances only inside Tanzania because their production zones are widely distributed as is their consumption; moreover, while home production as a share of consumption is still a minority (even in rural areas), the "localness" of GLVs is more than for tomatoes. Finally, part of GLVs are "indigenous" and so traditional parts of traditional dishes.
We believe the paper makes three contributions to literature. First, the coverage of vegetables in that literature is small in comparison with vegetables importance in SSA food consumption. For instance, only 1% of the nearly 300 articles in African Journal of Agricultural and Resource Economics (AFJARE) since its founding 15 years ago have been on vegetables. By contrast, Dolislager et al. (2023) found, using LSMS data from 11 SSA countries1 that fruits and vegetables are 16% of urban, 15% of peri-urban, and 13% of rural food consumption (in value terms). These shares are more striking when compared with those of key cereals central to food debates.
Second, the coverage of domestic vegetable value chains in African agricultural economics research has been small when compared to how important vegetable purchases (from value chains) are by SSA consumers in both urban and rural areas, as noted above for the case of Tanzania. Yet the great majority of African agricultural economics articles on vegetables focus only on vegetable farming per se; very few treats vegetable wholesale, logistics, processing, and retail let alone input suppliers to vegetable farms.
There has been little attention to value chains of non-traditional vegetables (e.g., tomatoes) in SSA. The few exceptions study peri-urban irrigated agriculture in the 1980s and 1990s supplying cities (e.g., Mbaye and Moustier, 2000; Weinberger and Pichop, 2009). However, there is a relative lack of studies of longer supply chains of tomatoes and onions and other non-indigenous vegetables produced in clusters of small and medium commercial farms and then moved by medium to long value chains, which are composed of logistics providers and wholesalers, to cities, peri-urban, and rural areas around the country (such as noted for Senegal in Faye et al. (2023) and for Ethiopia by Minten et al. (2020)).
Where domestic tomato value chains have been studied the focus has been on assessing: (1) challenges based on stakeholder workshops (e.g., tomatoes in Kenya, Geoffrey et al. 2014); (2) emerging modern value chains of tomatoes for African supermarkets and intra-regional trade (e.g., Barrientos and Visser, 2013); and (3) the best design for interventions such as the reduction of post-harvest losses in tomato value chains in Nigeria (Plaisier et al. 2019).

The paper proceeds as follows. In Section 2 we describe the study sample and methodology for data collection and analysis. In Section 3 we present the findings. We focus on farmers, logistics, and wholesalers as selected results that provide the general tenor of the overall study. In Section 4 we conclude and present implications.

2. Sample, Method, and Data

To study heterogeneity of production zones as well as market contexts we undertook a rapid reconnaissance in August/September 2023 of tomato and GLV value chains in Tanzania across three regions: (1) Morogoro in the center (a key tomato production zone and an area that has seen a rapid increase in river-based irrigation); (2) Mwanza in the North (a key tomato consumption zone but also a production zone); and (3) Dar es Salaam, the capital region, in the East (a key tomato consumption zone but also a production zone).

All three of these regions produce GLVs as those are highly perishable and so (to present) have only short/medium length supply chains. GLVs play an important part in local cuisine and in local and intra-regional markets. The primary GLVs included in this study were those most consumed in Tanzania such as Amaranthus spp (green), although there are many other GLV species produced and consumed. Their short production cycle (60-80 days) and variety of species allows them to be grown in most places, at least during the rainy season. However, their production is most widespread in the well-watered areas near rivers and lakes such as in all three of our study regions.

In all three regions we studied MSMEs (micro, small, and medium enterprises) in urban, peri-urban, and rural areas, and farms in rural and peri-urban areas. We studied MSMEs in all segments of the value chains, including farm input suppliers, farmers, rural wholesalers, urban wholesalers, logistics firms such as truckers for long distance trade and small vehicles for short distances, and retailers.

We use data and qualitative insights from our "rapid reconnaissance" of actors in the above segments of tomato and GLV value chains in those regions. In August and September 2023, we interviewed individually for each of the two products 150 respondents, with around 50 per region in each of the three regions), distributed over value chain segments, and firm and farm size scale strata. The interviews included questions about the firm or farm's assets, input procurement, value added activities and services provided, and marketing method and patterns. We asked what they do now and a decade ago, and their reasons for their actions and choices, as well as the constraints they face.

For the size strata we use used the classification of the Tanzania government, with MSMEs being "nano" if they employ 1-2 persons, micro, 3-9 persons, small, 10-49 persons, and medium, 50-199 persons. The great majority of the enterprises we sampled were nano, micro, and small scale; this probably reflects the size distribution in reality but we cannot verify that as there is no census of informal sector enterprises. We tried to find medium-scale firms and farms for these products could not as they appear to be scarce. Sampling from the three strata was done using the "snowball" technique as there are no official sampling frames due to lack of census data. Our limited sample and method of sampling mean that we cannot say whether our findings are statistically robust or necessarily representative. The findings are broadly indicative and not meant to be used for statistical tests.

3. Findings for the tomato farm segment

3.1. Overview of tomato farming and farmers

First, tomato farms are increasing in numbers. There have been a lot of recent entrants: e.g., in Mwanza, 40% of the farms have been there for a decade, 40% less than a decade, and 40% less than 10 years, and only 15% for more than 20 years.
Second, they are emerging in clusters in rural and peri-urban areas such as in Dumila and Mlali in Morogoro. The number of farms increased a lot over the past decade (corroborating the census and FAO data). The clusters appear to be mainly spontaneous, not set up by government or NGO or large company projects or programs.

3.2. Tomato Farming: land use and access

First, tomato farm size distribution is reported in the rapid reconnaissance as being a strong dominance of small farms, in general. However, farm size distribution different over zones because of land markets and water access. As in the case of GLV, Morogoro has "bigger" small tomato farms because of abundant water (with many farms irrigated) and proximity to highways. Most tomato farms in Morogoro have 1 hectare and some have 2-3 ha. Some of the individual farms include a group of farmers farming a larger-small farm (such as 4ha farm) with several owners, such as teachers in the town. This appears to be common in Dumila and Mlali in Morogoro. Moreover, Morogoro tomato farmers tend to farm tomatoes as a main activity of their household.
By contrast, in Mwanza, as with GLVs, 90% of the tomato farms operate less than 1 acre. This is partly from constraints to irrigation water available along the lake near Mwanza. Also, in Mwanza many tomato farmers do not pursue tomato production as their main activity. This is the situation as well in Dar es Salaam where tomato farms are small because of less land available near water sources and water constraints.
Second, land rental markets are important to tomato farming. Many or even most tomato growers in all three regions rent their tomato land. They rent from several sources: (1) from long-term landowners, Dumila/Morogoro; (2) from farmland owners like paddy farmers in Dumila/Morogoro and lakeside farmers in Mwanza.

3.3. Tomato Farming: water access

First, the emergence of the tomato farms was found to be highly conditioned by water access, when crossed with highway access. All the tomato zones studied (and, it appears, all the tomato clusters in Tanzania as a hypothesis) are near lakes (like Mwanza, with low water tables around them), and rivers (other zones). These water-rich areas were either already the basis of irrigated farming (like paddy farming in Dumila), or part of the geography of urban settlements that then supported water-using horticulture (all the other zones) as urban demand grew and induced commercial tomato clusters.
Second, there is an uneven diffusion of pump irrigation (as a shift from traditional bucket use). In Morogoro, as with GLV there, tomato farmers tended to start with buckets, and then many shifted to pumps/pipes to irrigate from rivers/lakes. They also shifted tomato cultivation from

one to two seasons, and from a tiny scale to a bigger area as they irrigated more. The irrigation investments appear to be self-financed investments based on reinvesting retained earnings from tomato farming.
By contrast, in Mwanza, there is much less pump irrigation; 60% still use buckets to get water from the big lake. They reported that a pump is expensive and only farmers with a lot of water accessible use a pump. They report that a pump is a big investment in the face of price risk and water access constraints because water is from boreholes near the lake and the "water draws down quickly".

3.4. Tomato farmers use of traditional vs hybrid seeds

Regardless of scale, tomato growers have shifted rapidly over the past decade from traditional to hybrid tomato seeds. The rapid diffusion was reported to have been encouraged by: (1) agro-dealers (seed, fertilizer, pesticide), supported by manufacturers sending representatives to the villages; (2) extension agents; and (3) farmer to farmer contacts.

3.5. Tomato farmers' use of tractors

Most farmers use hand-hoes and hired labor to prepare the land in the rainy season. However, in Morogoro, in the dry season, a substantial share of farmers uses tractors. As expected from the smaller farms, there is far less tractor use in Mwanza and Dar es Salaam.

3.6. Tomato farmers use of chemicals

First, there has been a spread of the use of pesticides over the past decade, from 30% to 55% of the farmers using pesticides. This has been induced by spread of to 55% using (as insects & disease spread over the decade). Mwanza and Dar es Salaam respondents reported using more than recommended doses because they believe the recommended rates were not enough to control pests.
Second, respondents reported that use of fertilizer and manure is widespread regardless of farm scale. Some reported increasing use because of "tired soils" from intensive cultivation. Fertilizers are mainly sourced from agro-dealers and some from government subsidized supply. Mwanza respondents noted a sharp jump in fertilizer prices over the decade, and that small farms there use below the minimum volume to be able to access subsidized fertilizer, so they buy from agro-dealers in small amounts. Morogoro respondents noted government subsidized fertilizer is on offer on 1-2 times per year. They have to register and the association informs them, but often do not get it and thus mainly buy from agro-dealers.

3.7. Tomato farmers' harvesting and marketing

Farmers are not processing their tomatoes. Nearly all is sold fresh to traders. Moreover, most farmers report selling to wholesalers, for example from the local city, say Morogoro, but some sell to wholesalers based in Dar es Salaam.

3.8. Main challenges reported by tomato farmers

Tomato growers noted three challenges. Growing intensively and densely with a climate of heat and humidity have combined to bring more disease and pests. They apply pesticides but over time those lose their potency so they have to apply more (even while the price of those inputs rises). The cost squeeze is exacerbated by the increase of prices of irrigation pipes and tractor services. At the same time tomato prices were erratic and season. But the farmers appeared to be making profits as they were reinvesting and newcomers were spilling into the sector.

4. GLV Farming Segment

4.1. Overview of farming and farmers

First, GLV farms are proliferating. They tend to locate spontaneously in clusters near water (rivers and lakes to feed irrigation directly or via the water table) and highways. They are in peri-urban areas and urban areas or rural areas near the towns: the clusters are near rural towns such as Dumila near Morogoro and along lakes (as in Mwanza), and in urban areas (such as in watered-areas inside Morogoro city). The clusters are not set up by NGO or company projects or government programs; they are formed by local "grass roots" individual entry into areas where production is favored by water and marketing by roads.

Second, the informants noted that the origin of the growers is usually not that of an incumbent grain farmer who added or switched to GLVs, as vegetable growers mainly rent from incumbent farmers or rent in new areas.

Third, the respondents noted that relative to local incomes the start-up costs are high but after starting the returns are high. Water pumps and land rent are important items in the start-up costs (but these outlays are modest compared to eventual gross returns from GLV farming). The farmers started mainly with their own funds from prior activities and self-funded from prior activities, and self-funded expansion as earned from GLV farming. GLV farming appears to have substantially higher (roughly two or three times) gross returns per hectare than paddy and much more per day than farmworkers earn.

Fourth, the data from the respondents revealed that growers are mainly male but there are some women. Note that GLV growing in rural households for home-consumption has traditionally been (and now is still) a "woman's job" (to supply ingredients for sauces), using tiny plots near the home as subsistence home gardens. But commercial farmers (including the micro and small farmers that were the near totality of these clusters) of GLVs are mainly male. The reason for this male bias given by the respondents is that land rental and input outlays are threshold investments which are more feasible for men than for women. However, the rapid reconnaissance found that some women grow commercially, but as their main employment.

4.2. GLV farming: land use and access

First, GLV farm sizes range from tiny to small: (1) in Morogoro, they are small, around 2 acres; (2) they are "micro" (less than 1 acre) in Mwanza and Dar es Salaam. The size distribution differs over the regions because of land markets and water access. Morogoro has "bigger" small farms because of abundant water in areas near highways (as seen in the cluster of farms in Dumila) with paddy farmers renting land to GLV growers. By contrast, in Mwanza and Dar

es Salaam there are smaller farms because of less land available near water sources and water constraints.
Second, land rental markets are very important to GLV farming. Many if not most GLV farmers in all three zones rent their GLV land, although in particular in Morogoro and Mwanza rental is dominant while in Dar es Salaam owning still dominant. The informants noted that there are cases where growers started by renting land then owning.
The farmers rent from a surprising array of sources: (1) collectively owned "schemes" in areas designated as GLV near water (Dar/Ilala); (2) institutions (government and religious institutions in Dar es Salaam (but not in Dumila); (3) some from schools and religious institutions in Pwani near Dar es Salaam); (4) farmland owners like paddy farmers in Dumila/Morogoro and lakeside farmers in Mwanza).
Third, land rental costs (per hectare per time unit) differ a lot intra-zone and inter-zone. Where land access is constrained (such as in Morogoro city and along the lake in Mwanza), land and water are costly and hard to get/rent. Where land access is less constrained (e.g. in Dumila (town/village near Morogoro city) where a lot of paddy farmers rent out land), land and water costs are lower. But entry in those areas has been rapid so the land market is tightening.
Fourth, some farms are expanding. For example in Morogoro, some grew from 2 to 5 plots (urban Morogoro) and from 1 to more hectares (Dumila). Some acquired land by buying or more usually renting from other farmers in their cluster who drop out or drop plots. Some acquired additional land in other clusters where the land rental cost is less (including newer areas) so diffusion is over clusters.

4.3. GLV farming: water access

First, water access including via de facto water markets is important (especially when crossed with highway access). All the GLV zones we studied (and, it appears, all the GLV clusters in Tanzania as a hypothesis) are near lakes (like Mwanza, with low water tables around them), and rivers (other study zones). These water-rich areas were either already the basis of irrigated farming (like paddy farming in Dumila), or part of the geography of urban settlements that then supported water-using horticulture (all the other zones) as urban demand grew and induced commercial GLV clusters).
Second, there has been uneven diffusion of pump irrigation. This has featured a shift from traditional bucket use. Small-scale GLV farmers tended to start with buckets. Those unable to afford (or have the incentive) to obtain a pump just stayed with buckets. The shift to pumps was earliest and fastest in Morogoro. There they are bought or rented. The pumps are imported Chinese pumps. They have been adopted by "larger" small farmers from retained earnings from vegetable farming (or sometimes from outside income). Many farmers rent pumps from others at a cost similar to their land rental outlay for one season. By contrast, in Dar es Salaam (Ilala), tiny farms just use buckets, although Pwani (near Dar es Salaam), has incipient pump use
Pump use saves a lot of labor as buckets are labor-intensive (if one imputes wages to labor costs the bucket option can be expensive). However, the net cost of pump over time may be not much higher than buckets when one figures equipment plus labor plus fuel, but up-front costs are much higher for pumps.

Third, irrigation (buckets or pumps) allows off-season GLV farming with continuous production either with one species of GLV planted over and over or different species staggered. The result is that there are repeated harvests over different plots each of which is on about a 3-week cycle (planting to harvesting).
Fourth, there is a link between water access and seasonality. In Dumila/Morogoro, some farmers rent land for a year but during December-May (rainy season) the farms grow paddy (flooded), then grow vegetables in the dry season (with irrigation). However, our findings show that two-thirds of farmers sell in both high and low seasons but just grow more in the dry season. In Dar es Salaam and Pwani, the respondents noted that with irrigation there is no seasonality of vegetable production.

4.4. GLV species concentration & diversification

The main commercialized GLV species have increased from 3 to 7 over the past decade (but of course are a subset of the number of GLV species consumed as there are many wild or only home garden species that are home consumed). Farms grow GLVs with high consumption market demand, in particular, amaranth, Chinese cabbage, black nightshade, Ethiopian mustard, and spinach.

4.5. GLV Farmers' use of traditional vs hybrid seeds

Regardless of farm scale, growers use hybrid GLV seeds as there are no traditional seeds for important exotics (Chinese cabbage, spinach, Ethiopian mustard, kale). Even where there are traditional seeds/crops, farmers shifted from traditional to hybrids for better yields.
However, some farmers still use traditional seeds/cuttings for indigenous GLV (cowpea leaves, wild amaranth, sweet potato leaves). There are no improved varieties of indigenous species.

4.6. GLV farmers' use of tractors and chemicals

Only about a third of farmers use tractors; the rest prepare the land by hand. Tractor use is negatively correlated with farm size. By contrast, inorganic fertilizer use is widespread regardless of farm scale; the informants reported that this has been the case over the past decade. More than half of the growers use herbicides; this has not changed over the life of the enterprises studied. Pesticide application is widespread. The survey received varying responses on when the growers stop using pesticides before the moment of harvest.
The informants noted that they buy inputs on a cash basis, not on credit.

4.7. GLV farmers' harvesting and marketing practices

First, extremely little of the GLV output is processed; nearly all is sold fresh.
Second, most farmers harvest "in bulk" (say once) and sell to wholesalers, rather than harvest little by little. Most farmers reported selling to wholesalers from the local city, say Morogoro. But it is common for Dumila (rural town near Morogoro) farmers to sell to wholesalers who deliver them inter-zone to Dar es Salaam markets. A reason given is that flooding in Dar es Salaam in the rainy season induces wholesalers to buy from Morogoro in the rainy season where there is relatively less flooding.

4.8. Main challenges reported by GLV farmers

First, weather and planting density and continuity have been correlated with a lot more disease/pests over the past decade. Farmers report that agrochemicals have waned in effectiveness.
Second, input prices (for chemicals and fuel) have been increasing while input (seeds, pesticides) quality is sometimes poor. Output prices are volatile, in particular sharply seasonal.
Third, farmers reported a lack of reliable extension on input use.
Fourth, in some areas land rents are high, especially when near main markets and where there is competition for land. In some places there are constraints on land, such as in Dumila where growers can just rent in the dry season because land owners grow paddy in the rainy season; growers would like to rent land for longer (not just yearly and much less do they want just in dry season) to plan ahead.
Fifth, the competition to access water pumps is rising. There is a general constraint of water access in the dry season; farmers increasingly have to dig wells.

4.9 Findings for the tomato post-farmgate segments: wholesale

4.10 Key findings on characteristics & changes

The respondents noted a large increase in the number of tomato wholesalers over time from the establishment period from 1990s to now. This correlated with the spread of tomato farming in Morogoro and Mwanza and with rise in consumption of tomato in Dar es Salaam and other regions.
Second, informants reported various paths people have taken to become traders: (1) some were farmers then into wholesale; (2) some started as retailers; (3) some had nonfarm enterprises; (4) some just graduated from school; (5) some were unemployed.
Third, the share of men is about 60% and women, 40% in the set of traders. Women tend to be semi-wholesalers buying from wholesalers and selling on to retailers. Many traders (especially females) are wholesalers and retailers too (depending on the volume wanted by a customer). Moreover, in the high season when tomatoes in the production areas are abundant, some retailers also sometimes become wholesalers.
Fourth, the traders cluster in wholesale markets (rather than are dispersed in the production areas). They tend to operate in both high and low seasons all year (but with highest profit rate in low season).
Fifth, Morogoro and Mwanza (mainly production zones) traders buy direct from farmers and from distant traders; Dar es Salaam traders buy from production zone traders and from local farmers as there is a big local market.
Sixth, trade is done nearly all in cash; few traders use digital payment to farmers. Some traders advance inputs to farmers; but even those who do, they advance inputs to just a small share (just a few) of the farmers supplying them.
Seventh, the traders tend to use informal repeats (regular buying from a farmer) versus just spot market differs by season. In the high season, there is lots of supply, so traders just buy from their regular farmers; and farmers are keen to sell or face losses so there is "easy access" to farmers. in the high season even retailers go direct to farmers. In the low season, there is more competition for the small supply available; traders use both the spot market and buy from their

regular farmers. In Mwanza and Dar, traders also buy from other traders coming with tomatoes from other zones such as Morogoro.
Eighth, there has been a large increase in wholesalers' use of 3PLS (third party logistics) over the decade. Wholesalers own vehicles or hire 3PLS but "most" traders use 3PLS in all the zones. The motorcycle and tricycle 3PLS operators go to farms to fetch tomatoes. Some farmers transport their own tomatoes but 3PLS hired by farmers is more common now. Traders either ask farmers to arrange 3PLS or bring the tomatoes, or arrange 3PLS to go to farm to fetch the tomatoes.

4.11 Challenges of tomato wholesalers

Tomato traders complained of volatile prices - although that can benefit them too. They reported what they feel are high tax charges (CESS) in wholesale markets. They noted that there is poor market infrastructure (on the open ground, leading to loss).

4.12 Findings for the GLV post-farmgate segments: wholesale

4.12.1 Key findings on characteristics & changes of GLV wholesalers/brokers

First, there has been a big increase in the number of GLV wholesalers over time. They tend to cluster in wholesale markets. They operate in both high and low seasons. A number of the traders reported large increases in their own volumes over time. The general picture is of trading profitability (manifested in its drawing in entrants) despite the traders' facing various challenges. An example of entrants drawn to trading profitability reported was of paddy farmers in origin. such as from Tabora in Western Tanzania (NW of Dodoma), coming to Morogoro to start GLV farming and become wholesalers in Morogoro.
Second, the GLV traders are mainly male and operate at a nano/micro scale. Some are also farmers. Some have their own vehicles but many use 3PLS operators of bicycles or motorcycles or bajaji (motorized three wheelers). 3PLS firms using trucks are mainly to ship GLV to more distant markets like Dar es Salaam. For example, in Dumila traders buy Chinese cabbage in bulk and transport it to Dar es Salaam using hired 3PLS (buying from collection points in Dumila).
Third, the GLV traders mainly buy direct from farmers in Morogoro area and buy via brokers/agents for those further away. Nearly all the GLV trade is in cash; few traders use digital payment to farmers.
Fourth, the traders buy with criteria of quality traits: fresh, size, green, no blemished, not over matured, and some traders said they also ask whether farmers report a safe period observed (pesticide). Wholesalers noted that customers want fresh GLV (at most one day) and that GLV not sold after 1 day is normally sold to livestock/chicken farmers. However, there is no quality differentiation (in sorting or differentiated payment for grades) at the point of purchase from farmers as they just buy what farmers have that is fresh and ready that they can sell immediately.
Fifth, traders sell to retailers, food service firms (like street vendors of food), and boarding schools (these two increased over time) in most zones. In Dar es Salaam some sell to big offices for lunch service.
Sixth, they are selling mainly on a cash basis not on credit, except for some credit to food service firms. The same goes for how traders buy GLV, mainly just buying on cash not credit. There has been an increase in use of mobile phones for confirmation of delivery and payment.

4.12.2 Challenges of GLV wholesalers

On the roads, GLV wholesalers report high fuel costs and breakdowns of trucks and trucks being held back as government demands tax payment. In the markets, traders reported high tax charges, lack of permanent stalls, and poor conditions (dirty and hot in open areas), as well as inadequate storage

4.13 Findings for the tomato post-farmgate segments: logistics

4.13.1 Characteristics and trends of tomato transporters

First, there has been a lot of growth in the number of transporters and some growth of vehicle scale over the past decade. This has mirrored the growth in the value chain. The flip side of this growth is that transporters feel rising competition driving declining profits.
Second, transport (third party logistics) shows a mix of scales and modes adapted to the local situation. For example, in Mwanza there is a mix of: (1) large trucks small trucks, tricycles, motorbikes, bicycles, wheelbarrow; (2) small boats on Lake Victoria (<3 tons cargo, 5-person crew).
Vehicle size linked to transport function: (1) Small vehicles (tricycles, bicycles, motorcycles) to collect tomatoes from rural areas & remote areas; (2) Motorcycles and trucks for longer distance (from Morogoro fanning out over the country); (3) In Mwanza some reported shifting from a smaller to a larger vehicle, a small to a larger boat, but also more boats entering has meant less cargo per boat (competition).
Third, most of the MSMEs are male-owned and nano scale; a quarter are small scale. In Mwanza, 75% operate in peri-urban areas or in town and mostly within the markets, and 25% in rural areas. Some vehicles are owned, some rented (a common theme of emerging equipment and land rental markets). For example, in Mwana, two-thirds own and one-third rent the vehicle.
Fourth, their main clients are diverse: farmers, wholesalers, and retailers. These pay 3PLS after selling their tomatoes.

4.14 Findings for the GLV post-farmgate segments: logistics

4.14.1. Characteristics and trends

There has been rapid growth in the number of transporters and transport-clients over time, with the number of motorcycles growing very rapidly in the past 2-3 years. Most are male operated at the nano scale. The owners have often built up from just hand-carrying/walking, to bicycle, to tricycle/motorcycle. Most own their vehicle or rent it.
Moreover, transporters sometimes double as wholesalers. Their clients are wholesalers and farmers. Most operate short distance, locally within their region.

4.14.2 GLV Transporters' reported challenges

They report high fuel and vehicle maintenance costs (rising), theft, poor roads, poor condition of boats, and easy entry which then creates lots of competition for business.

4.15 Conclusions & policy implications

4.15.1 Overview of findings

First, domestic tomato and GLV value chains are important. They are growing quickly and transforming dynamically. Factor markets are important to that growth: rental markets in land and equipment are helping them, and services like transporters are helping farmers and wholesalers to build value chains in local regions (especially for GLV) and across regions (for tomatoes).
However, tomato and GLV value chains are also challenged: (1) by climate change magnified by the usual problems of intensification/densification of vegetable production (disease); (2) by poor roads and road theft; (3) by expensive farm inputs and other value chain equipment.

4.15.2 Policy implications

We found that a crucial segment in these value chains is wholesalers, who are primarily based in produce wholesale markets within cities and peri-urban areas. As these traders rely heavily on third party logistics services (3PLS), there is a clear need for more information on this understudied segment of the value chain, and policy attention to building and upgrading wholesale markets and minding road quality and transport policy.
Moreover, while these vegetable value chains have grown quickly, becoming massive in volume and number of actors, each segment faces vulnerabilities to high costs and shocks such as of climate, gender inclusion, food safety, and environmental issues.
The emerging policy implications center on the need for government investment in the basic infrastructure underpinning these value chains – including wholesale markets, storage facilities, roads and good transport policies, electricity grids, and governance. Likewise, investment in soft infrastructure, in particular a reduction of road officials' corruption, food safety education, and women's capital building would also aid in the efficiency and inclusiveness of the value chains

References

Barrientos, S. and Visser, M., 2013. South African horticulture: opportunities and challenges for economic and social upgrading in value chains. Available at SSRN 2209718.

Dolislager, M. J., C. Holleman, L. S. O. Liverpool-Tasie, and T. Reardon. 2023. Evidence and Analysis of Food Demand and Supply across the Rural–Urban Continuum for Selected Countries in Africa." In Background paper for The State of Food Security and Nutrition in the World 2023. Rome: FAO Agricultural Development Economics Technical Study.

Faye, N.F., T. Fall, T. Reardon, V. Theriault, Y. Ngom, M.B. Barry, M.R. Sy. 2023. Consumption of fruits and vegetables by types and sources across urban and rural Senegal. Journal of Agribusiness in Developing and Emerging Economies. Published online March11. https://doi.org/10.1108/JADEE-05-2022-0090

Geoffrey, S.K., N.K. Hillary, M.A. Kibe, M. Mwangi, M.C. Mutai. 2014 Challenges and Strategies to Improve Tomato Competitiveness along the Tomato Value Chain in Kenya. International journal of business and management. 9(9): 205-212. http://dx.doi.org/10.5539/ijbm.v9n9p205

Ijumba, C., E. Domonko, E. Lazaro, S. Ahmad, T. Reardon, A. Wineman, M. Maredia, D. Nyange, L.S.O. Liverpool-Tasie, and D. Tschirley. 2024. Tomato Wholesale Markets across Tanzania: Survey Findings & Policy Implications. East Lansing, Michigan: Department of Agricultural, Food, and Resource Economics, Michigan State University.

Liverpool-Tasie, L. S. O., R. I. Yau, A. Ibrahim, A. Y. Bashir, V. Olunmogun, O. Oyediji, I. E. Martins, et al. 2023. Transformation in Vegetable Value Chains in Nigeria: Rapid Reconnaissance. East Lansing: Michigan State University: RSM2SNF Project Working Paper November.

Mbaye, A. and Moustier, P. 2000. "Market-oriented urban agricultural production in Dakar", in Bakker, N., Dubbeling, M., Guendel, S. and Sabel-Koschella, U. (Eds), Growing Cities, Growing Food: Urban Agriculture on the Policy Agenda. A Reader on Urban Agriculture, Deutsche Stiftung Fuer Internationale Entwicklung, Feldafing, pp. 235-256, Zentralstelle fuer Ernaehrung und Landwirtschaft. https://agritrop.cirad.fr/477612/1/ID477612.pdf

Minten, B., B. Mohammed, S. Tamru. 2020. Emerging Medium-Scale Tenant Farming, Gig Economies, and the COVID-19 Disruption: The Case of Commercial Vegetable Clusters in Ethiopia. The European Journal of Development Research. 32: 1402-1429.

National Bureau of Statistics. 2021. "National Sample Census of Agriculture 2019/2020." Tanzanian National Bureau of Statistics https://www.nbs.go.tz/index.php/en/census-surveys/agriculture-statistics/661-2019-20-national-sample-census-of-agriculture-main-report.

Parkhi, C. M., L. S. O. Liverpool-Tasie, T. Reardon, and M. Dolislager. 2023. Heterogeneous Consumption Patterns of Fruits and Vegetables in Nigeria: A Panel Data Analysis. Policy Research Brief 2. Feed the Future Nigeria Agricultural Policy Activity. East Lansing: Michigan

State University
https://www.canr.msu.edu/fsg/publications/Nigeria_Policy%20Brief_Fruits_Vegetable%20Consumption%201.pdf

Plaisier, C., Sibomana, M., Van der Waal, J., Clercx, L., Van Wagenberg, C.P. and Dijkxhoorn, Y., 2019. Approach for designing context-specific, locally owned interventions to reduce postharvest losses: Case study on tomato value chains in Nigeria. Sustainability. 11: 247.,doi:10.3390/su1101

Reardon, T., L.S.O. Liverpool-Tasie, B. Belton, M. Dolislager, B. Minten, B. Popkin, R. Vos. 2024. African domestic supply booms in value chains of fruits, vegetables, and animal products fueled by spontaneous clusters of SMEs. Applied Economic Perspectives and Policy. Published "early view" April. http://doi.org/10.1002/aepp.13436

Weinberger, K. and Pichop, G.N., 2009. Marketing of African indigenous vegetables along urban and peri-urban supply chains in sub-Saharan Africa. Chapter 7 in C.M. Shackleton, M.W. Pasquini, A.W. Drescher (editors). African indigenous vegetables in urban agriculture, London: Earthscan: 225-44.