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## Mapping cassava food value chains in Tanzania's smallholder farming sector: The implications of intra-household gender dynamics



Blessing Masamha<sup>a,b,c</sup>, Vusilizwe Thebe<sup>a</sup>, Veronica N.E. Uzokwe<sup>b,\*</sup>

<sup>a</sup> University of Pretoria, Department of Anthropology & Archaeology, P Bag X20, Hatfield, Pretoria, South Africa

<sup>b</sup> International Institute of Tropical Agriculture, East Africa Regional Hub, Plot No. 25, Mikochei Light Industry Area, Mwenge-Coca Cola Road, Mikochei B.P.O. Box 34441, Dar es Salaam, Tanzania

<sup>c</sup> Bindura University of Science Education, Department of Environmental Science, P. Bag 1020, Bindura, Zimbabwe

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### ABSTRACT

A gendered mapping of the structure and coordination (functioning) of traditional cassava value chains is important for marginalized groups such as women in rural development. In contrast to global high value chains, traditional food value chains and associated gender relations as well as power dynamics within households have received little attention. We conducted a cross sectional study in Kigoma, Mwanza, the coastal region, and Zanzibar Island in Tanzania. Data were collected through structured interviews conducted with 228 farmers, combined with key informant interviews, direct observations, repeated household visits, and literature review. The results of the study revealed that there are weak linkages within the cassava value chain, which is highly gendered. While production and processing nodes of the chain, which commenced from villages, were dominated by women and children, women were not well-integrated within high value nodes such as marketing in urban areas and cross-border trading, which were dominated by men. Transportation of cassava to highly lucrative markets was also dominated by men. Cassava processing was conducted at the household level as well as within small-scale cooperatives, with the major portion of this work being done by women. Supporting institutions were found to be involved in the supply of planting material, training, and the provision of processing equipment. In general, men played a prominent role in the control of resources, marketing, and income. In conclusion, the mapping of cassava value chains could help to identify avenues for understanding of poverty, enhancing food security, upgrading capacities, reducing gender inequality, and enhancing women's participation in marketing and income control in the cassava value chains.

### 1. Introduction

The impacts of agricultural growth and development on poverty reduction and the promotion of food security may be at least three times greater than the combined impacts of other economic sectors within developing countries (de Janvry and Sadoulet, 2010). As reflected in the UN Sustainable Development Goals for 2015, most contemporary discourses on global development center on issues of food security, poverty reduction, and gender inequality. For this study, we adopted a conceptual framework that brought together a gender focus at the household level with a pro-poor value chain approach to analyze, in a coordinated manner, a comprehensive range of cassava-related activities and constraints relating to input supplies, production, processing, governance, supporting infrastructure, and credit and marketing. Application of the value chain approach for examining the development of agriculture commodities has been identified as an

important strategy for enhancing efficiency and coordination. It also plays a critical role in enabling policymakers, development practitioners, donors, and academics to develop an understanding of cassava production methods, processing and marketing, and the gender and power dynamics between actors at the levels of both the household and the value chain (Kaplinsky and Morris, 2000). This is because the use of a value chain approach enables the identification of gaps and interventions that can benefit marginalized groups such as women and the poor (Coles and Mitchell, 2010). A value chain is defined as a range of activities that are required to bring a product from its conception, through its design, sourcing of raw materials and intermediate inputs, processing, marketing and distribution, to the final consumer (Kumar et al., 2011). Gender is used to describe all the socially given attributes, roles, activities, and responsibilities connected to being a male or a female in a given society. Our gender identity determines how we are perceived, and how we are expected to think and act as women and

\* Corresponding author.

E-mail addresses: [b.masamha@cgiar.org](mailto:b.masamha@cgiar.org) (B. Masamha), [Vusi.Thebe@up.ac.za](mailto:Vusi.Thebe@up.ac.za) (V. Thebe), [V.Uzokwe@cgiar.org](mailto:V.Uzokwe@cgiar.org) (V.N.E. Uzokwe).

men, because of the norms and values of the society.

Lengiso et al. (2016) asserts that to date, there is no empirical evidence available regarding the extent and market integration and related income changes affecting women's intra-household bargaining position in agriculture commodity chains. Similarly, Coles and Mitchell (2010) argue that there is a dearth of empirical evidence on women's control of productive resources and their roles in decision making and access to markets for male-dominated export and staple food crops. Njuki et al. (2016) noted that women's control over income from agricultural activities particularly the intra-household allocation of income between men and women, or the extent of women's ability to make decisions about purchases can enhance their decision-making and increase their bargaining power, which can in turn give them a voice, both within the household and at the community level. This therefore implies that there is need to investigate intra-household gender dynamics within agriculture commodity chains such as the cassava value chains. Integrating women into agricultural value chains without creating an imbalance in intra-household power relations requires a holistic, critical, and coordinated approach for understanding these value chains, with a view to identifying bottlenecks and opportunities for women to participate in the production, processing, and marketing of agricultural commodities. Nakazibwe and Pelupessy indicate that studies regarding agriculture commodity value chains have tended to focus on governance structures associated with value chains at the global scale, with only a few studies having been conducted at the national and local scales at which value chains operate. Most studies on agriculture value chains have targeted high value cash crop commodities such as organic cashew nuts, sweet potato, fresh fruits, vegetables, tomatoes, onions (Jeckoniah et al., 2013), cocoa, maize, rice, cotton, and avocado (Oduol et al., 2013). There is a paucity of empirical studies related to the mapping of traditional low value chain commodities such as cassava that have incorporated a gendered analysis at the household level. Moreover, Jeckoniah et al. (2013) have noted that the focus of most value chain studies has been on facilitating linkages of smallholder farmers to markets aimed at reducing their poverty and increasing their profits. Much less attention has been paid to the impacts of these value chains in relation to changes in the traditional roles and relations of women and men as well as other specific actors. The few studies that have considered gender have focused exclusively on modern value chains. Thus, Dolan (2001) examined how female farmers were disadvantaged within contract farming schemes in Kenya's horticultural export sector. Jeckoniah et al. (2013) also analyzed gender roles and relations along a high value onion chain in Tanzania. Barrientos et al. (2001, 2003) have reported on the exploitation of female farm workers in South Africa's deciduous fruit sector. Maertens and Swinnen (2009) have also examined the gendered consequences of modern supply chains. Specifically, they conceptualized the mechanisms whereby women were directly affected by modern supply value chains.

An exception to the focus on high value or modern chains is a study conducted by Andersson et al. (2016) who examined the cassava leaves value chain, focusing on how their markets were organized and who benefitted from participating in this chain and how. This study also examined the chain's structure and gendered dynamics in Mkuranga District of Tanzania. However, the study did not include other popular and important cassava products such as fresh tubers, processed cassava flour, and cassava four products like scones, biscuits, and bread and did not, therefore, provide a complete analysis of the cassava value chain. Maertens and Swinnen (2009) emphasized that most of the existing studies and discussions on agricultural commodity value chains have paid insufficient attention to gender concerns. Moreover, of the few studies that have addressed these concerns, none have investigated how the roles and relations between men and women are influenced and changed at the household level and the impacts of gender inequality resulting in skewed participation and benefit sharing within households. Most of these studies (e.g., Andersson et al., 2016) have only

examined changes in gender roles and relations at the level of the value chain, and do not, therefore, constitute exhaustive analyses of the cassava value chain. Therefore, there is a need to conduct comprehensive mapping of the traditional cassava food value chain that incorporates gender roles and relations in developing countries such as Tanzania. Mapping the behavior of men and women within the contemporary cassava value chain offers us a window for identifying gender-based constraints and opportunities for upgrading the cassava value chain. The overall objective of this study was to investigate the structure and gender dynamics of the traditional cassava food value chain. The study was organized around the following set of broad research questions: What is the structure of the gendered cassava value chain in smallholder farming systems? What are the gender dynamics of this chain? Who participates and at what points in the chain? Who has access to and control over resources in the value chain? Some of the specific questions that we investigated were: Who are the actors in the cassava value chain, and what are the roles of women and men as well as other stakeholders? How has the operation of cassava value chains transformed the roles and relations of women and men at the levels of the household and the value chain? What challenges do women, men, and other actors face through their participation in the cassava value chain?

Farnworth (2011) have reported that developing gender-focused policies will ensure higher agricultural production and productivity and generate a large number of social benefits with respect to value chains. This can also speed up the adoption of innovations, raise household incomes, and lead to improvements in child health, nutritional, and educational levels thus contributing to the Sustainable Development Goals. Investing in women farmers and increasing their effective participation in value chains, enhances the potential of value chains to become an agent of sustainable social transformation (Farnworth, 2011). Further, empirical evidence from this study provides development agencies and donors with information on where exactly to target their efforts in upgrading the cassava value chain.

## 2. Unpacking gender and the cassava value chain

### 2.1. The cassava value chain

Cassava is one of Africa's most important food crops. It is the second most important staple food crop after maize in Sub-Saharan Africa, particularly in western, central and eastern Africa. This crop is widely consumed because of its high calorific value and because it is the cheapest source of energy (Howeler et al., 2013). Following cassava's introduction into Sub-Saharan Africa in the 16th century, its high levels of resilience and adaptability to a wide range of ecological conditions have ensured its sustained production over many generations in this region (Adebayo et al., 2010). Its low input requirements make it a particularly appropriate crop that can be produced by marginalized groups with a lack of resources such as smallholder women farmers. Cassava is mostly cultivated in the humid forest zones and the sub humid savanna regions of Africa and South America, as well as in some parts of Asia. Over the last 10 years, annual yields of cassava tubers have increased by 1.18% annually, while production has increased by 0.67% annually (FAOSTAT, 2015). Cassava augments the incomes of farming households, generating employment opportunities, and can potentially benefit women as a result of reduced food prices as well as more convenience for traditional products. Nweke et al. (2002) indicated that cassava is not just a women's crop; the more commercialized it becomes, the greater men's participation in its production.

Tanzania, which has a typical African agro-based economy, was selected for the study. In this country, approximately 80% of the population depends on small-scale farming for their livelihoods and around 20% of the GDP is derived from the agricultural sector (Eskola, 2005). Cassava is mostly produced in the following regions in Tanzania: the coastal, northern, eastern, and Lake regions, as well as in Zanzibar

(Kapinga et al., 2005). The ongoing transformation of agri-food systems in Africa, including cassava, with the increasing involvement of men, necessitates the conduct of a value chain analysis with a gender focus for understanding the structure and drivers behind cassava production, processing, marketing, and governance. This is because studies have revealed that access to and control of different nodes along the cassava value chain may be highly gendered (Quisumbing et al., 2014). This also implies an unequal distribution of benefits and burdens from participation in a value chain.

Farnworth (2011) has argued that value chains may be very short, as in the case of the cassava traditional food value chain, wherein producers and consumers either live within walking distance of each other or the distances between them may be much greater, with produce being transferred between continents. Value chains are, therefore, categorized according to their associated decision-making and control mechanisms into market driven and relational chains. Market driven chains are characterized by long-term relations between the participating actors, and the key governance mechanism is the market price for produce. All of the actors compete with no specific support provided for market access. Three categories of relational chains have been identified: buyer driven, producer driven, and intermediary driven value chains (Farnworth, 2011). Transactions within all of these chains occur within the framework of the value chain approach. Consequently, incentives are established to promote desired behavior and the focus is on linking households to growing markets, so that they can earn incomes to purchase additional food. This may lead to the diversification of their diets and reduce their reliance solely on their own production for their food security.

There are many constraints hindering the efficiency of the cassava value chain, the two most important being perishability of the fresh roots and the presence of cyanogenic compounds in cassava. Because of its perishability, fresh cassava is mainly sold locally. While some processing strategies have been developed in cassava producing areas in western Africa, the resulting added value has remained low (Coulibaly et al., 2014). The strategies or processing methods that have been developed are aimed at extending the storage period of cassava tubers. Thus, their shelf life is extended after they have been dried, chipped, or converted into cassava flour, enabling their marketing over greater distances, including neighboring countries. However, because of the presence of cyanogenic compounds in cassava, it is susceptible to physiological deterioration after the roots are harvested. This means that roots that have been harvested more than 48 h previously have little market value. Consequently, the range over which fresh roots can be marketed is limited (Coulibaly et al., 2014). Studies by Coulibaly et al. (2014) and PIND et al. (2011) have also shown that the cassava value chain is dominated by men.

West African studies of cassava have revealed that it is processed into a wide range of products. Processing occurs during different stages of the chain, commencing at the farm level up to the community level. It includes peeling, boiling, steaming, slicing, grating, soaking or seeping, fermenting, pounding, roasting, pressing, drying, and milling (Coulibaly et al., 2014).

## 2.2. Gender power dynamics in agricultural commodity value chains

Within the literature, the concept of gender has been defined as the social and cultural characteristics ascribed to men in relation to their roles, responsibilities, rights and entitlements, and other privileges. In addition, gender can serve as a conceptual tool for identifying the different cultural and societal roles, responsibilities, constraints, and expectations placed on both women and men that affect their abilities and incentives to participate in agricultural value chains. This results in different levels of participation and benefit sharing among women and men. As recognized in the literature, the meanings ascribed to gender

are not static, but reveal changes over time and space that are linked to changing social, economic, cultural, and political contexts.

Women constitute about 53% of the labor force in the agricultural sector of developing countries such as Tanzania. Apata (2013) has found that as a key source of labor, women play a pivotal role in agricultural production. However, gender inequality is a significant barrier to the participation of women along successive nodes of the cassava value chain (Coles and Mitchell, 2010). Therefore, it is important to understand how each sex participates in and benefits from the cassava value chain to develop ways of overcoming this barrier. Power and hierarchy are key issues that feature in gender relations. Moreover, these relations are constituted and supported by family, culture, state and market institutions and can be cooperative, contradictory, or conflictual. A value chain approach can be used to address issues of gender inequity within households and markets. This can be achieved through an understanding of how factors such as access to assets, educational differences between males and females, and the nature and value of economic activities affect the ways in which men and women participate in and benefit from value chain activities (Coles and Mitchell, 2010; Apata, 2013; Butterworth et al., 2008).

In smallholder farming contexts, women are typically positioned as producers at the bottom of the agriculture commodities value chain. There are several factors that hinder their ability to assume more profitable roles as buyers, sellers, and processors (Farnworth, 2011). Because women's productive and reproductive roles consume a considerable amount of time, they have little or no time left for processing and marketing their cassava produce. Farnworth (2011) has argued that women's lack of literacy, mobility, and numeracy skills precludes them from developing effective negotiation skills with other value chain actors. They are also hindered from using modern communication technologies such as mobile phones to support decision making and enhance their participation in, and resulting benefits from, the cassava value chain. Women involved in agriculture typically have less access to productive resources and lower incomes (CARE, 2010; PIND et al., 2011).

Gender shapes the participatory and functional behaviors of men and women at various nodes of the cassava value chain. Gender defined roles and relations within value chains, and within households, affect men's and women's access to productive resources, decision making, access to financial services, control over incomes and direct involvement in payment systems (Sebstad and Manfre, 2011). These also influence access to and use of new technologies, inputs, and services. Gender norms within society further influence the participation of individuals in social and commercial networks that enhance information flow, relationship trust, and cooperation between actors within the cassava value chain. Studies have observed that strategies to improve women's positions and functioning within value chain relationships would need to focus on ensuring that women are more visible to other value chain stakeholders, for example, by facilitating their interactions with input suppliers, processors, and other buyers, as well as through the establishment of formal agreements between buyers and women farmers (Sebstad and Manfre, 2011). In their study of a cassava leaves value chain in Mkuranga, Andersson et al. (2016) found that although the chain was dominated by women, their participation within different nodes of the chain and the distribution of benefits was highly gendered. This finding warrants an investigation of gender roles and relations along the cassava value chain. Within higher value agricultural value chains, women often participate in less visible and poorly acknowledged nodes that entail low-skilled and low-paid work. Consequently, the economic gap between women and men continues to widen (KIT et al., 2012). This study used a qualitative rapid assessment tool to map the roles of women and men, as well as those of other specific actors, in the traditional cassava value chain, and to identify entry barriers, including the lack of an enabling environment.

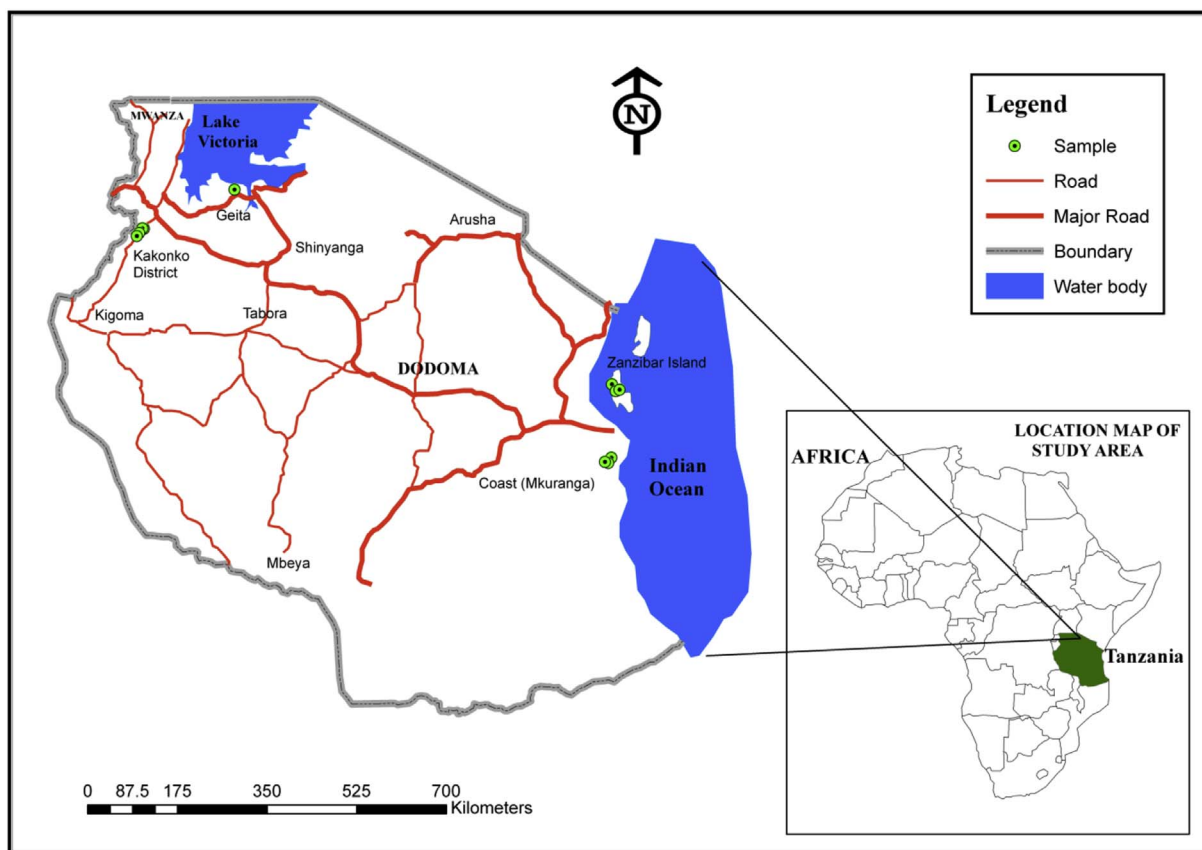


Fig. 1. A map indicating the study sites.

### 3. Methods and procedures

#### 3.1. Study areas

Fig. 1 shows the sampling sites of the study. These sites captured the diverse contexts of the cassava production system across coastal, island and dry land areas. In Kigoma, farming is the major livelihood source, with dominant crops being maize, cassava, groundnut, beans, banana, and cotton. Cassava production is predominant in the coastal region (Mkuranga) and on Unguja Island. Table 1 shows the study sites, and sampled cassava value chain actors, and their total numbers.

The methodology used to obtain data for this study entailed a triangulation approach. Initially, secondary information was compiled

**Table 1**  
The location of study sites and sample size of cassava value chain actors considered in the study.

Location	Actors in the chain	Sample size
Kigoma (Kakonko District)	Farmers	95
	Extension agents	4
	Input suppliers	3
	Bulk traders	2
Zanzibar (Unguja Island)	Farmers	90
	Extension agents	8
	Processors	1
	Traders	5
Coast (Mkuranga District)	Farmers	43
	Extension agents	4
	Input suppliers	2
	Processors	2
	Traders	5
Mwanza (Geita)	Processors	2
	Policy makers	3

through desk research. This entailed a review of Tanzania's macro-economy and agricultural policies, reports of value chain analysis, and donor reports. This secondary information served as a starting point for eliciting the general structure of the Tanzanian agricultural system as well as some important factors that influence the functioning of the traditional cassava value chain. Primary data were collected from the Kigoma region to capture trends relating to cross border and regional trading trends within Tanzania and externally with Burundi and Rwanda. Data were also collected from Zanzibar Island and the coastal region to incorporate diverse production systems, thereby enhancing the validity of the findings. To compliment the above mentioned secondary data, primary data were collected from actors who directly participated in the value chain, including farmers, processors, marketers, and input suppliers. The following respondents (summarized in Table 1) were the key informants who were interviewed: policymakers (Ministry of Agriculture officials; Director Kizimbani Research Institute, agricultural economists); agricultural extension workers in the respective study sites, researchers (International Institute of Tropical Agriculture (IITA) and Ministry of Agriculture); NGO representatives (The Zanzibar Agricultural Research Institute (ZARI) and Alliance for a Green Revolution in Africa (AGRA) officials); and agro dealers. Primary data collection techniques used for the study included in-depth interviews, key informant interviews, focus group discussions, and extended household visits. The sampling procedure was divided into three phases. The first phase entailed purposive sampling of districts from four different regions of Tanzania. Mack et al. notes that the application of purposive sampling entails categorizing subjects in accordance with ex ante identified criteria based on the research problem which in this case was the production of cassava. Hence the sample size in this case was more of a function of objectives of the study. As way of dealing with problem stemming from sample selection bias in the respective study regions, different techniques of data collection were used as



argued by Tuckett and Stewart. Cluster sampling was then used to select villages from each district based on agronomic information of cassava production obtained from the resident agricultural extension officers. The final sampling phase entailed a random selection of households drawn from a list maintained by the local agricultural extension agent within a village. At the household level, a total of 228 household heads, comprising 117 adult women and 111 adult men were interviewed. The sampling procedures generated reliable data although its generalizability to women and men in the entire regions was to a lesser extent limited. This is because purposive sampling targeted a particular group of interest which was farmers engaged in cassava farming. Farmers who were individually interviewed were not involved in the focus group discussions. Structured interviews involved face to face interviewing of farmers (women and men) independently targeting household heads. Both *de jure* and *de facto* female headed households were considered in the study. Agricultural extension agents within each study area were recruited, trained, and supervised prior to the administration of the questionnaires. Extended household visits were used as an ethnographic way of collecting data pertaining to the household decision making, gender roles and time budgets within the household. Quantitative data were coded and captured using the SPSS Version 20 statistical program. Exploratory analysis was conducted to generate descriptive statistics for presenting the results. Qualitative data were transcribed and thematic content analysis was performed to analyze and generate important themes that emerged from focus group discussions and key informant interviews in particular.

3.2. Ethical clause

Respondents were debriefed and asked to sign consent forms prior to completing the questionnaire and participating in focus group discussions. We submitted our research protocol and instruments to the Research Ethics Committee of the University of Pretoria, and to the Tanzanian Commission of Science and Technology for ethical review, obtaining approval from both institutions.

4. Results and discussion

4.1. Cassava value chain and gender relations

The data analysis was conducted using the UNIDO conceptual framework to generate a value chain map depicting the core functions and

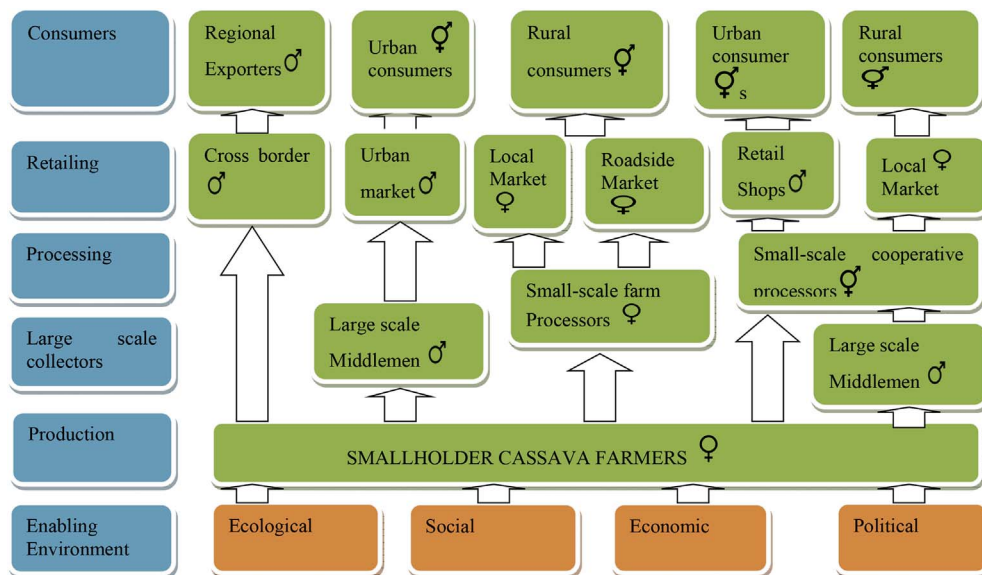


Fig. 2. Cassava value chain Map relating to smallholder farmers in Tanzania (based on empirical evidence).

actors in the cassava value chain operating in the smallholder farming sector of Tanzania (see Fig. 1). Smallholder rural households (villages) constitute the points of inception for these value chains, extending to towns like Kigoma, Zanzibar, Dar es Salaam, Mkuranga, and Mwanza, as well as to other neighboring countries such as Burundi, Rwanda, Democratic Republic of Congo, and Uganda. The flow of products in this chain is generated by small scale producers and is transmitted through middlemen, retailers, and fresh markets in Mkuranga, Zanzibar, and Dar es Salaam. While cross border trading of cassava between Kigoma and Burundi and Rwanda is potentially lucrative for farmers, the findings of this study revealed that farmers are subjected to exorbitant taxes. Moreover, middlemen buy cassava at very low prices from smallholder farmers. Factors relating to an enabling environment include ecological conditions like changing climatic conditions, socio-economic conditions relating to asset ownership, control of resources such as land, as well as gendered power dynamics within households. Politics constitute a further factor that influences policies on marketing, prices of inputs, and land allocation.

4.2. Supply of inputs

The 2013 Tanzanian National Agriculture Policy stated that the government was to support farmers in accessing modern inputs and agro-chemicals together with increased private sector participation because it had noted low utilization of modern inputs and agro-chemicals. The input suppliers are responsible for procuring inputs from manufacturers and research institutions and then selling these locally to farmers. This cassava value chain node is upstream (Fig. 2) at the bottom of the value chain. Such inputs include fertilizers, seed, herbicides, improved cuttings and implements such as ploughs, hoes and knap sack sprays. Reports from key informants (agriculture extension officers) revealed that planting material and fertilizer are the major inputs that determine cassava productivity in Tanzania. Farming inputs such as herbicides, insecticides, fertilizers, and spraying equipment are supplied by small local shops located in business centers. These shops are mostly operated by men. Varieties of cassava are cultivated mainly from local cultivars, although a major program to improve cassava varieties has been implemented by IITA. This finding is similar to that of Coulibaly et al. (2014) who reported for the planting of local varieties of cassava in western African countries such as Sierra Leone, a local or informal seed system is predominant which involves farmers producing, disseminating and accessing seed directly from their own

harvest or through exchange and barter trading among friends, neighbors and relatives. This finding is also in line with Me-Nsope and Larkins who found that in the Malawian pigeon pea value chain an informal seed system was predominant. Similar results were reported in the plantain value chain mapping in South West Nigeria and in the sweet potato value chain in Tanzania. An agricultural extension officer for Kigoma explained the access and distribution of cassava cuttings:

*“Smallholder farmers share cassava cuttings within their neighborhood and close friends as a way of enhancing their relations. This also happens with other crops such as groundnuts, maize, beans and banana. The cassava varieties exchanged are predominantly local varieties”*

The agro dealers are not highly involved in the sourcing and distribution of cassava cuttings (germplasm). Farmers trade local varieties of cassava among themselves during the planting season, with one bundle costing between TZSH2000 (US\$2). Other organizations such as the IITA are responsible for propagating the germplasm that is distributed to farmers for planting. The supply of inputs is dominated by men who are able to travel long distances. Cultural and gender-related constraints limit women's movements, thereby reducing their potential to engage in the supply of inputs. Approximately one-third of farmers can directly purchase improved cassava cuttings from their own villages. The majority have to travel to neighboring villages, or to the central district, to access the cuttings. Those village level sellers of cuttings are individual farmers and not agro-dealers. Because cassava requires few inputs, fertilizers and chemicals are rarely applied.

### 4.3. Cassava production

Cassava production is labor intensive, entailing a variety of activities such as land clearing, and tillage, planting, weeding, harvesting, and processing. About 80% of land preparation for cultivating cassava is done by the men within a household. Smallholder farmers characterize Tanzanian agriculture. The average size of land cultivated varies between less than 1 ha–3 ha of land. In Kigoma, 1.59 ha of land (Table 2) on average, is allocated for cassava, whilst in Zanzibar, an average of 1.58 (Table 2) hectares of land are planted with cassava. The smallest area planted with cassava by women was recorded in Mkuranga (1.55 ha). Relative to the area planted by women, the cassava area planted by men across all the study sites was significantly higher (Table 2). The planting system was predominantly intercropping (70%), where cassava was intercropped with groundnuts (60%) and beans (40%) in Kigoma. Despite the dominance of the intercropping technique, sole cropping was also practiced by a minority of households (30%). In Zanzibar, intercropping of cassava involved crops such as cowpeas and coconut trees although sole cropping was mostly dominant (80%).

All land in Tanzania is public land vested in the president as trustee on behalf of all citizens. This therefore implies that all citizens in smallholder farming communities have user rights but do not own land. Within households, ‘land ownership’ reflects a patriarchal system which is skewed towards men. In all sites men hold rights to land ownership including land that is used by women. Land is allocated through the parents of a grown up young man as soon as he gets married. Women can only get access to land ownership rights through their husband when he passes on. In this study ownership of land was solely the

**Table 2**  
Average cassava land area planted in the different study sites.

District	Women		Men	
	Area (Ha)	Quantity (Tons)	Area (Ha)	Quantity (Tons)
Kigoma	1.59	712	2.331	2077
Zanzibar	1.58	2151	1.90	2233
Mkuranga	1.55	1386	1.84	1453

responsibility of men about 95% across all study sites although decision making with regards to use of land is sometimes jointly made with the man and woman within a household. Despite the land ownership dynamics, household decisions on land use were sometimes jointly made, with women playing a major part in cassava related activities. Women were reportedly found active in preparing cassava cuttings (80%), planting (75%), weeding (90%) of cassava and the general disease scouting (80%) management as well as general supervision of cassava plots. According to Mmasa, women's access to land had been through usufruct rights through their husband's lineage family group. However, the Government of Tanzania through the National Agriculture Policy of 2013 committed itself to the promotion of equitable land tenure governance and endeavors to eliminate discriminatory or exclusionary laws. The Government of Tanzania also instituted the Land and Village Land Act of 1999 to allow for equal distribution of land and eradicate gender inequality in land ownership at the community level. This also has enabled women headed households to have access to land and ownership rights as well.

However, even if women perform the major roles in cassava cultivation, men are responsible for the major cassava cultivation decisions at the household level across all study sites. This is similar to the situation described by Me-Nsope and Larkins in Malawi where men were responsible for pigeon pea cultivation decisions at the farm level. These production arrangements are highlighted in an excerpt from an interview with a female farmer in Zanzibar:

*“Although I perform most of the cassava cultivation responsibilities, my husband owns the land and he is the one who allocates the size of land for the different crops. Although he consults me in some circumstances I will only gain control of the land when my husband is late”.*

Planting and weeding is done jointly by women and men as well as by children. Key findings from the study indicated that the participation of women (70%) and children (20%) was largely confined to low value nodes, whereas men were more active in the marketing (80%) of produce. These results depart from those reported by Shayo in a study on gender difference in earnings (wage gap) in the cassava value chain in Tanzania. Notable findings by Me-Nsope and Larkins from the pigeon pea value chain in Malawi postulated that women are more likely to be in charge of seed selection, seed storage, harvesting and processing as discovered from our study of the cassava value chain as well. This finding is supported by those of other studies that have shown that within agricultural value chains, women often participate in less visible nodes that receive little attention, performing low skilled and low paid work, while men, by contrast, are often engaged in marketing and other high value activities (Mayoux and Mackie, 2008). The findings of a study on the avocado value chain conducted by Oduol et al. (2013) revealed that while women dominated the production phase, men tended to own the fields and control revenues, making decisions on the sales of premium quality (grade 1) fruit. Local cassava varieties such as Zamani, Kisasa, Manyenzi and Ugonjwa were more common among farmers in Kigoma and were reported to be producing good yields and were traditionally preferred by farmers. Local varieties made up about 90% of cassava grown in Kigoma, but improved varieties were mostly planted in Zanzibar. Most of these improved varieties (80%) were sourced from the Kizimbani Agriculture Research Institute where demonstration plots have been established in collaboration with IITA. Major challenges reported by farmers were diseases such as cassava brown streak virus disease, cassava mosaic disease, and cassava white fly. IITA has made efforts to generate cultivars that are resistant to such diseases. The use of improved varieties has also been promoted, but issues of access and affordability have posed a challenge for women farmers.

### 4.4. Cassava harvesting and processing

Harvesting of cassava in a piece meal manner is the normal practice

**Table 3**  
Percentage of people involved in the harvesting of cassava at household level.

Region	Men	Women	Children	Hired men	Hired women	Total
Zanzibar	41.1% (N = 53)	38.8% (N = 50)	13.2% (N = 17)	6.2% (N = 8)	0.78% (N = 7)	100%
Kigoma	31.4% (N = 55)	32% (N = 56)	6.9% (N = 12)	22.9% (N = 40)	6.9% (N = 12)	100%
Mkuranga	53.5% (N = 23)	30.2% (N = 13)	16.3% (N = 7)	0% (N = 0)	0% (N = 0)	100%

of small-scale cassava farmers in Tanzania due a lack of processing skills and equipment, poor storage facilities and the lack of a ready market. Harvesting small amounts of cassava allowed them to manage the process using kitchen knives to peel off the outer layer and cut the root into pieces. However, the longer the cassava tubers stay in the field after maturity, the more chance there is for pest and disease infestation, which cause high post-harvest losses. An agriculture policy brief reported that women in Tanzania take charge of weeding, harvesting, processing and storing food crops; they also contribute significantly to these tasks for cash crops, though men tend to help more with agricultural tasks for cash crops. This is consistent with Osuji et al. who reported planting, weeding and harvesting as being done by men and women jointly in Kigoma and Zanzibar (Table 3), whereas in Mkuranga, men were predominantly involved in the harvesting of cassava (Table 3). Root tubers are mostly harvested and are processed within 2–3 days of harvesting because of their high perishability. This finding is consistent with those of Coulibaly et al. (2014), who reported that cassava root tubers were popular in Sierra Leone. After harvesting, farmers incur post-harvest losses of cassava produce for several reasons; these are presented in Fig. 3.

What emerged from the study is that both men and women in Kigoma and Zanzibar were jointly responsible for harvesting cassava as highlighted in Table 3. In Zanzibar 41% of the men were involved in the harvesting of cassava compared to 38.8% women. This means that both men and women in Zanzibar jointly harvested cassava which was almost the similar case in Kigoma with men and women involvement being 31.4% and 32% respectively. The notable difference was the relatively high percentage of hired labor of men (22.9%) in Kigoma compared to none in Mkuranga and 6.9% in Zanzibar. The situation was different in Mkuranga, where men were predominantly involved in the

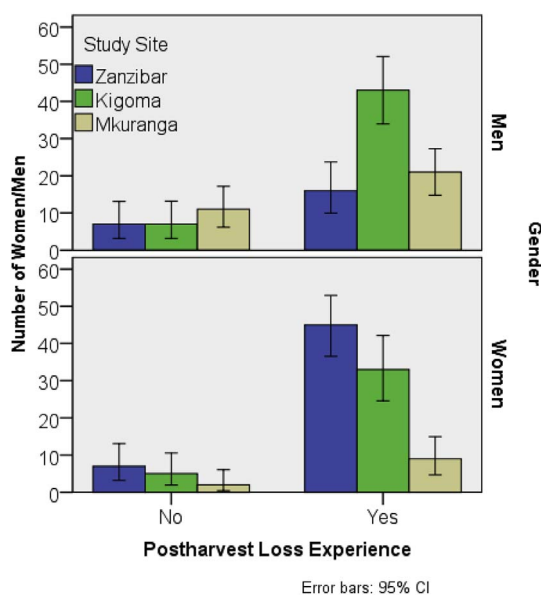
harvesting of cassava (Table 3). This is probably because men in Mkuranga had limited off farm employment unlike in Zanzibar hence the harvesting and subsequent marketing of cassava on the road side and nearby Mkuranga town and Dar es Salaam city made men to be more involved in harvesting of cassava for immediate disposable income. Root tubers are mostly harvested and are processed within 2 or 3 days of harvesting because of their high perishability. This finding is consistent with those of Coulibaly et al. (2014), who reported that cassava root tubers were popularly harvested in Sierra Leone.

An agriculture policy brief reported that women in Tanzania take charge of weeding, harvesting, processing and storing food crops; they also contribute significantly to these tasks for cash crops, though men tend to help more with agricultural tasks for cash crops. This is consistent with Osuji et al. who reported planting, weeding and harvesting as being done predominantly by women in South east Nigeria. After harvesting, farmers incur post harvest losses of cassava produce due to reasons presented in Table 5. Farmers loose approximately 30% of their produce as post harvest losses due to rotting if there is no enough labor to process the root tubers within the required 2–3 days after harvesting. Information from the review of a policy brief indicated that agro-processing in this country is constrained by limited supply of rural energy; inadequate raw materials; inappropriate machinery and technology; and limited skills. Fig. 5 depicts the percentages of women and men who experience post harvest losses in the respective study sites.

Basing on the findings presented in Fig. 3, 81% of the farmers experienced post-harvest cassava losses compared with only 19% who reported that they did not experience post-harvest losses. Among the farmers experiencing post-harvest losses, 52.1% of them were women, and fewer women reported no post-harvest losses. Men were relatively more involved than women (Table 3) at harvesting hence more losses were attributed to men. Cassava losses owing to bruises during harvesting were higher for men, perhaps because of their handling not being as gentle as that of women. More women may be involved in the handling of cassava in the storage and processing stages where they face serious challenges for food losses as depicted in Fig. 3. The most prevalent form of post-harvest loss is the deterioration of cassava root tubers whilst in the field (Fig. 3). This is commonly caused by pests and diseases and women are mostly affected. If cassava post-harvest management interventions are to be sustainable and effective, they should include women (see Table 4).

The deterioration of cassava tubers in the field was more prominent across the three study sites with women having recorded the highest experiences (see Table 5) The losses attributed to the bruising of tubers during harvesting were also common across the study sites and more prominent among women as well. However, losses that were attributed to deterioration of cassava during storage and peeling were reported only in Kigoma with 33.8% and 5.1% for women and men respectively for peeling. This is because women are predominantly involved in cassava processing hence much losses being attributed to them.

The processing of cassava root tubers entails a series of procedures that include peeling, washing, grating, pressing, drying, and finally grinding into flour. Cassava flour is used to prepare *mandazi*, cakes, biscuits and *chapatti*. Raw cassava is also processed into chips and spaghetti that are used in cooking. Cassava leaves are harvested and consumed either as relish or, after being dried and pounded, as porridge. Women and children are mostly involved in the processing of cassava and in the culinary preparation of products for sale. The processing of cassava is done at the household level, and in some areas like Geita and Zanzibar, small-scale processing cooperatives have been established. These small-scale cooperatives are formed by women and men. The allocation of responsibilities within these groups is highly gendered, with women involved primarily in planting and processing. Men are more involved in land clearing, packaging, transportation, and marketing. The establishment of the cooperatives had led to several advantages for women, as highlighted by one of our informants. The chairman of Mkombozi small scale cassava processing cooperative gave



**Fig. 3.** Number of women and men experiencing cassava post-harvest losses disaggregated by gender and study regions.

**Table 4**  
Types of cassava post-harvest losses experienced by men and women in the respective study sites of Tanzania.

Post Harvest Loss	Zanzibar Women (N = 45)	Men (N = 16)	Kigoma Women (N = 33)	Men (N = 43)	Mkuranga Women (N = 9)	Men (N = 21)
1.Deterioration of tubers in the field	48.3%	19.1%	26.9%	28.4%	19%	33%
2.Bruising tubers during harvest	17.2%	10.3%	33.8%	6.4%	3%	18%
3.Harvest of immature tubers	3.4%	0%	0%	0%	3%	21%
4.Deterioration of roots after processing	0%	0%	22.6%	6.4%	0%	0%
5.Deterioration of cassava during drying	1.7%	0%	33.8%	6.4%	0%	3%
6.Deterioration of quality during storage	0%	0%	11.3%	5.1%	0%	0%
7.Losses during peeling	0%	0%	33.8%	5.1%	0%	0%
<b>Total</b>	<b>70.6%</b>	<b>29.4%</b>	<b>42.2%</b>	<b>57.8%</b>	<b>25%</b>	<b>75%</b>

insights above the advantages of processing cassava collectively rather than at individual households:

*“Processing our cassava cooperatively has enabled us to reduce processing costs since requirements like fuel, labour and equipment are collectively made. It has also enabled us to increase our bargaining power and access to lucrative markets such as retailers in Sengerema and even as far as Mwanza town.”*

Similar findings involving cassava leaves processing were reported by Andersson et al. (2016) where drying of leaves was done predominantly by women in a farmers' cooperative called the District Cassava Farmers Organization (DCFO) in Mkuranga. The main problem identified by Sewando et al. (2011) is a lack of appropriate processing technologies for adding value to cassava. A further challenge relates to the availability of drying equipment, especially during seasons when day light is limited. Farmers also experience post-harvest losses resulting from the problem of storing root tubers, which are highly perishable. These challenges are faced particularly by women at the household level, as they are mostly involved in the harvesting and processing of cassava.

**4.5. Cassava transportation and marketing**

Agricultural product markets are crucial for the development of agricultural commodities and stimulating agricultural production. Furthermore, a set of supportive infrastructure from production, transportation, storage and processing is vital in enhancing agricultural marketing. Men were predominantly involved in the transportation of cassava to distant and more profitable markets. They used bicycles and motorcycles to transport cassava locally and hired vehicles to transport cassava products to distant urban markets. Bicycles were the most common form of transport used in ferrying cassava to distant markets unlike in Zanzibar and Mkuranga where motor vehicles were more prominent (Fig. 4) Some farmers face challenges in transporting their produce to distant markets. This issue was reported mostly by women whose mobility was limited as a result of cultural norms. Farmers also faced constraints related to modes of transport, with most farmers (Fig. 4) using bicycles to transport their produce. This was because 71.5% of the farmers owned bicycles and 44.7% were owned by women, hence the bicycles were the most common mode of transporting their produce. Only 8.9% of the farmers in this study owned motorcycles, and of these only 40% of them were owned by women. These motorcycles were reportedly used for transporting their planting material and cassava produce for marketing. Similar findings were reported from the pigeon pea value chain in Malawi by Me-Nsope and Larkins with women facing mobility restrictions, unequal gender divisions of labor in reproductive and household chores as well as limited access to transportation assets.

The marketing of cassava is conducted at the household level, with fellow farmers coming to buy produce from each other's fields even before harvesting. A farmer in Kigoma made the following remark:

*“Cassava is even sold whilst still in the field before the crop is ready for*

*harvest. The farmer (buyer) will then come and harvest [it] once the crop is mature and ready for harvest.”*

Sales are also conducted at roadsides to passing motorists, as well as at weekly local markets and at nearby town markets. A small proportion of sales are made by women (10%) and children (20%) at roadsides and local markets, whereas most of the urban marketing and middleman operations involve men (70%).

Marketing of cassava was dominated by middlemen in all the three study sites (Fig. 5) who were involved in the collecting of large quantities of cassava from farmers, which they then sell in urban areas and in neighboring countries such as Rwanda, Uganda, and the Democratic Republic of Congo (DRC). Sewando et al. (2011) similarly found that lack of access to urban markets was mainly attributed to small volumes of produce. This was exacerbated by a lack of collective marketing and the inability of farmers to maintain stable supplies and quality standards for cassava products as a result of the crop's seasonality and the use of inadequate processing methods. As an agricultural extension officer in the Kakonko District of Kigoma observed:

*“Large scale middlemen move around households buying cassava at very low prices and they transport their product to either nearby town of Kigoma or across the border to Burundi or even Rwanda. The middlemen try as much as possible to bypass the border control authorities to evade exorbitant export taxes that restrict them from trading with neighboring countries.”*

Smallholder cassava farmers, mostly women, obtain very low returns from raw cassava or from traditionally processed cassava chips

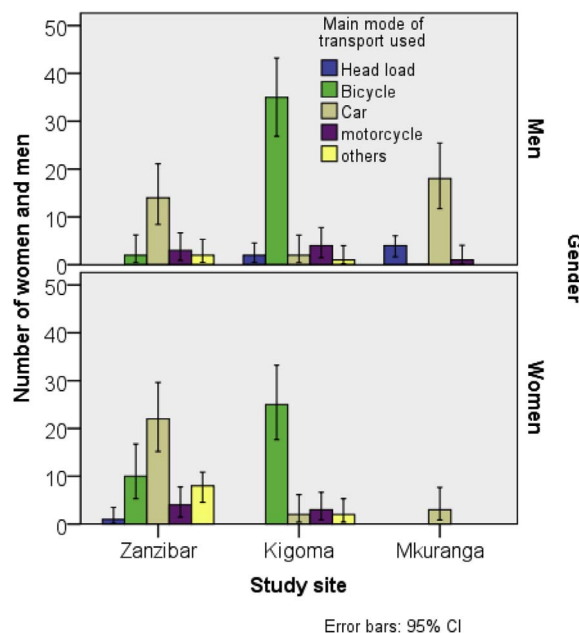


Fig. 4. Mode of transportation of cassava to the market by men and women in Tanzania.



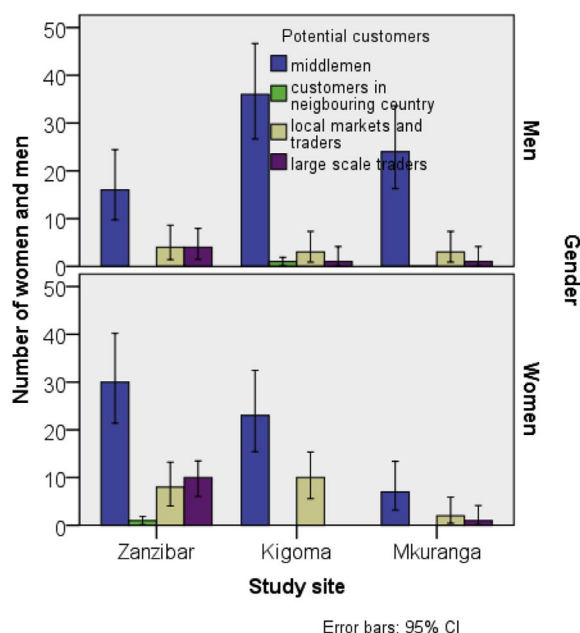


Fig. 5. Number of potential cassava customers disaggregated by gender in Tanzania.

sold in local spot markets and at roadsides at low prices. This skewed resource ownership negatively affects women's disposable income within households. These findings concur with those of Donovan et al. (2011) and Shackleton et al. (2011) and tended to be concentrated in lower paid, fragmented, and insecure employment centering on productive activities and informal retail in the cassava value chains in Mozambique. By contrast, men are predominant within the more lucrative nodes of wholesale, storage, transportation, and milling. Similar findings have been reported for cassava value chains in Mozambique (Donovan et al., 2011) and gum arabic value chains in Burkina Faso (Shackleton et al., 2011). Farmers face challenges in transporting their produce to distant markets. This issue was reported mostly by women whose mobility is limited as a result of cultural norms. Farmers also face constraints relating to modes of transport, with most farmers using bicycles to transport their produce. About 34% of the farmers in our study owned motorcycles that they used for transporting their planting material and produce.

### 5. Supporting institutions

Farmers' organizations in the form of smallholder farmer associations, cooperatives and groups are important vehicles for farmers to lobby for policy changes that may help to improve their bargaining power in the input and output markets. Farmer groups also provide an avenue for cost reduction of various services such as cost effective delivery of loans, inputs, extension services and market information. However, these institutions are weak in managerial skills and are not member-based. The National Agriculture Policy of 2013 categorically states that The Government of Tanzania shall strengthen financial institutions and financial intermediaries such as rural or community banks, and Savings and Credit Cooperative Organization (SACCOS) to make them responsive to agricultural development financial needs. The 2013 policy also reports that the Government in collaboration with other actors shall facilitate accessibility of finance to farmers and other actors in the agricultural sector focusing on the financial needs of women and youths to foster social equity.

Limited external support in the form of market information, financial support, research and extension farmer linkages, and access to infrastructural support such as transport as well as communication services provided by institutions and organizations has had negative consequences for women's participation in high value chain nodes, as well as for their generation of income. This is consistent with findings by Andersson et al. (2016) who also reported limited support by the enabling institutions that surround the cassava leaves value chains. They further report that little attention has been paid to cassava by researchers, development agencies, academics as well as policy makers to increase the knowledge and awareness of its contribution to food security and poverty alleviation in Tanzania. This scenario is not only evident with regards to cassava, but it is also a general problem facing the Tanzanian food system.

Table 5 illustrates the number of women and men who had access to various services with regards to ownership of bank accounts, access to credit farming, membership to a local farmer cooperative as well as participation in SACCOS. About 91.5% of the farmers had no bank accounts and 13.5% of the farmers reported having accessed money from lending financial institutions for farming purposes. Of the 18 farmers that reported having bank accounts, 67% were men indicating some disadvantage to women with regards to monetary issues. However, out of the total number of 36 farmers who had membership to SACCOS (Table 5), about 67% were women. This can be attributed to the Government's initiative of improving financial intermediaries such as SACCOS for communities through the 2013 National Agriculture

Table 5  
Farmers who received services from various organizations disaggregated by gender and study site.

Study Site		Zanzibar		Kigoma		Mkuranga	
Service	Gender	Yes	No	Yes	No	Yes	No
	Own Bank Account	10% (N = 6)	90% (N = 53)	0% (N = 0)	100% (N = 39)	0% (N = 0)	100% (N = 10)
Used credit	Women	29% (N = 6)	71% (N = 18)	10% (N = 5)	90% (N = 44)	3% (N = 1)	97% (N = 29)
	Men	29% (N = 7)	71% (N = 17)	0% (N = 0)	100% (N = 38)	14% (N = 1)	86% (N = 6)
Cooperative Membership	Women	29% (N = 7)	71% (N = 17)	2% (N = 1)	98% (N = 48)	6% (N = 1)	94% (N = 17)
	Men	44% (N = 28)	56% (N = 36)	2.3% (N = 1)	97.7% (N = 41)	0% (N = 0)	100% (N = 11)
Extension Support	Women	35% (N = 9)	65% (N = 17)	2% (N = 1)	98% (N = 51)	0% (N = 0)	100% (N = 32)
	Men	66% (N = 33)	34% (N = 17)	32% (N = 10)	68% (N = 21)	33% (N = 1)	67% (N = 3)
		55% (N = 12)	45% (N = 10)	45% (N = 19)	55% (N = 22)	22% (N = 4)	78% (N = 14)

Policy. Direct observations from the field show that these were mostly reported in Zanzibar where women reported more community participation. Similar observations were made with regards to farmers' co-operatives where 39 farmers (Table 5) reported membership in co-operatives.

This is because as cassava crop becomes more commercialized, it attracts the attention of men who controls resources and eventually the income thereof. Consequently, there is a need for organizations that can champion women's rights and interests. There are a number of institutions, mostly non-governmental, that support smallholder farmers through extension as well as the provision of agronomic training, germplasm, and processing equipment. In Zanzibar, ZARI, IITA, and Farm Concern International have been involved in programs to train farmers in the use and repair of processing machinery, as well as the use of solar driers, through the Participatory Agricultural Development Empowerment Program funded by AGRA. These organizations have no specific gender integration programs and they have been dominated by men. This was revealed in an interview with a ZARI official who said:

*“As ZARI we engage in collaborative cassava initiatives with various organizations especially in production of improved cassava varieties. We partner with IITA to set up demonstration plots which we use to develop high yielding varieties that are resistant to diseases. We then upscale the varieties by distributing to local farmers through our extension staff.”*

Sewando et al. (2011) have similarly reported that poor organization and coordination of farmers makes it difficult for them to access lucrative urban markets. Consequently, women only have access to unreliable and unprofitable markets for their unprocessed or locally processed cassava products.

## 6. Conclusions

The gender-focused mapping of the cassava value chain, which has its inception point in the villages, has shown that intra-household gender power dynamics influence the structure and functioning of the chain. The major actors within this chain are input suppliers, smallholder farmers, middlemen, traders, small-scale processors, and retailers. The study revealed that women participated more in the chain's production and processing nodes, with high value nodes such as packaging, marketing, and transportation being dominated by men. Women were also more engaged in sales at local and roadside markets than men, who had access to high income urban markets. These findings suggest that there is need to strengthen women's participation in high value nodes of the cassava value chain. The study's findings also show that there is a need to provide farmers with cassava processing equipment to reduce post-harvest losses. Policy options need to be explored to empower women in relation to their ownership of productive resources and decision making, as well as their participation in the transportation and marketing of cassava. Policymakers also need to consider the taxation framework to enable farmers to engage in cross border cassava trading with buyers in neighboring countries. Further studies could conduct cassava value stream mapping to explore the potential use of cassava in industrial processing, for example, in the production of ethanol. Researchers could also incorporate the gender component into investigations of post-harvest treatment methods.

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## Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.jrurstud.2017.12.011>.

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