

The Networks of Smallholder Organic Horticultural Farmer Organizations and Other Value Chain Actors for Their Change in Two Selected Regions in Tanzania

Upendo W. Mmari^{1*}, Christopher P. Mahonge¹, Emmanuel T. Malisa²

¹Department of Policy, Planning and Management, College of Social Sciences and Humanities, Sokoine University of Agriculture, Morogoro, Tanzania

²Department of Development and Strategic Studies, College of Social Sciences and Humanities, Sokoine University of Agriculture, Morogoro, Tanzania

Email: *upendo.kinyashi@gmail.com

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Abstract

With the agricultural reforms of 2000s in Sub-Saharan African countries including Tanzania that aimed to capacitate farmers in various areas including technological and marketing areas, the purpose of the study was to determine how smallholder organic horticultural farmer organizations under non-governmental organizations are contemporarily networking with other organic horticultural value chain actors for their change. The study was undertaken in Morogoro and Kilimanjaro regions of Tanzania. The study employed mixed design informed by social network analysis approach. Most smallholder organic horticultural farmer organizations under local umbrella non-governmental organizations are networking with limited capacity in disseminating, spreading and bridging technological and marketing knowledge and information, inputs and organic horticultural products to other value chain actors. These networks are concentrated on some value chain nodes and vice versa. Consequently, the weak networking has reduced their capacity to benefit from value chain in various ways including failure to cut their transaction costs, increase their bargaining power and economies of scales. This implies that more has to be done to connect remote smallholder organic horticultural farmers with numerous services. That broadly covers the services they scantily receive for those they are totally inaccessible to them. The findings call for

*Corresponding author. The past PhD student at the Department of Policy, Planning and Management, College of Social Sciences and Humanities, Sokoine University of Agriculture, P.O. Box 3035, Morogoro, Tanzania.

various actors to find different strategies to increase the applicability of functional physical and virtual distances between them. This manuscript contributes to the applicability of social network theory in smallholder organic horticultural farmer organizations under non-governmental organizations in Tanzanian context for betterment of organic horticultural sector.

Keywords

Networks, Smallholder Organic Horticultural Farmer Organizations, Umbrella Organizations, Non-Governmental Organizations, Organic Horticultural Value Chain, Organic Horticultural Value Chain Actors, Tanzania

1. Introduction

Globally, particularly in developing countries, Farmer Organizations (FOs) have always been regarded as important vehicles for smallholder farmers' development. Literature opines that establishment and strengthening of FOs are paramount for enhancing smallholder farmer's productivity and market access (Aku et al., 2018). FOs are highly advocated for smallholder farmers since they tackle most of their challenges, such as low technical knowledge, limited market information, poor market access, limited input supply, and enhanced accessibility to natural resources, and credit and advisory services in transaction cost reduction environment (Stockbridge et al., 2003; Ruvuga et al., 2007; Wennink et al., 2007; Msuta & Urassa, 2015; Aku et al., 2018). It should be noted that the significance of FOs is a widespread phenomenon seen in various kinds of agricultural production including organic horticultural production. According to International Federation of Organic Agriculture Movements (IFOAM), the emerging organic agriculture entails a production system that sustains health of soils, ecosystems and people by relying on ecological processes, biodiversity and cycles adapted to local conditions rather than the use of inputs with adverse effects (Ton, 2013). This agriculture, including horticultural production, ensures food security for increasing population while enabling smallholder farmers to obtain means of earning living and enhancing soil fertility and biodiversity (Arbenz, 2018; Willer et al., 2018).

Subsequently, the significance of FOs calls for the right institutional setting that allows them to interact with other actors for remarkable agricultural development (Wennink & Heemskerk, 2006). Thus, in enhancing productivity of organic farming, local, national and regional networks have been developed to enable organic farmer organizational networks. These networks include International Federation of Organic Agriculture Movements (IFOAM), established in 1972 for global level; IFOAM Africa, established in 2005 for Africa; National Organic Agriculture Movement of Uganda (NOGAMU), established in 2001 and Kenya Organic Agriculture Network (KOAN), in 2005 (Wagala, 2005; Arbenz, 2018; Gama & Millinga, 2019).

In this stance in Tanzania, in 2000s national umbrella organization known as Tanzania Organic Agriculture Movement (TOAM) started to mobilize and coordinate FOs, local umbrella organizations and other stakeholders in organic sector (TOAM, 2005; Shepherd, 2007; Tanzania National Organic Agriculture Forum, 2008; HODECT, 2010). Likewise, the local umbrella organizations from the private sector such as Non-Governmental Organizations (NGOs) and other organizations were formed to support government initiatives in promotion of development of organic agriculture (Mella et al., 2007; Fernandes-Stark et al., 2011; Gereffi, 2014; Dube et al., 2018). NGOs in Tanzania including Inades Tanzania, Hifadhi Mazingira (HIMA) and Kilimo Hai Tanzania (KIHATA) were amongst key actors in supporting organic agriculture development in Tanzania (Taylor, 2006). In real sense, the changing roles of NGOs in supporting reformation of SFOs were a continuation of response of Tanzania as part of Sub-Saharan African countries in 1990s during Structural Adjustment and Liberalization (SAL) epoch to embark on major agricultural sector reforms (Wennink & Heemskerk, 2006; Mella et al., 2007; Wanyama et al., 2009). The reforms in SOHFOs were inevitable for enhancing smallholder farmers' effective participation in market economy (Wanyama et al., 2009). Prior to SAL epoch, SFOs were mainly mobilized and formed by government as a part of primary cooperatives for producers (Hartmann, 1983; Msuta & Urassa, 2015).

Subsequently, since SOHFOs establishment in Tanzania in 2000s the country has been evolving in volume and area for production (for organic and inorganic horticultural products). Statistics from FAOSTAT (2019a) estimate that area harvested for fresh vegetables in Tanzania in 1994 was 130,005ha and in 2018 was 336,837ha. Yield was 850 tons in 1994 and 1,955,414 tons in 2018. Likewise, it was estimated that, area harvested for fresh fruits in Tanzania in 1994 was 31,493 ha and in 2018 was 31,837 ha. For the case of yield, in 1994 was 199,000 tons and in 2018 was 201,618 tons (FAOSTAT, 2019b). Notwithstanding such trends, empirical findings show that organic sector in Tanzania, particularly horticultural production still faces various challenges. The challenges include the inability of the horticultural sector to meet the internal and external markets (Mwasha & Leijens, 2004; URT and Kingdom of Netherlands, 2017; Mayala & Bamanyisa, 2018). This is evident whereby due to inconsistent production and low standards of horticultural products, Tanzania imports significant volumes of fruits and vegetables from neighboring countries including Kenya, Zambia and Malawi (Mayala & Bamanyisa, 2018). The above situation is accelerated by the numerous facts. First, some of identified causes include the organic sector in LDCs and particularly in East Africa are mainly done by smallholder farmers who among other things have limited place of farming and limited products. Consequently, this results in other problems such as failure to certify products, poor market and poor quality (Ton, 2013; Klang, 2010; Blanc, 2009). Second, SOHFOs and those involved in the coordination of organic agriculture value chain are faced with numerous challenges including poor coordination between local and national organizations and individual organization's weaknesses (URT, 2006, 2013; HODECT, 2010; African Union, 2015; URT

and Kingdom of Netherlands, 2017). Following these challenges, several initiatives have been emphasized so as to coordinate networking between SOHFOs and other OHVCAs (HODECT, 2010; URT, 2013; African Union, 2015; URT and Kingdom of Netherlands, 2017).

Most studies on the networking between SFOs and various actors (Wennink & Heemskerk, 2006; Ruvuga et al., 2007; Villanueva et al., 2016) have focused on the networks of Small Farmers Organizations (SFOs) in agricultural development in Tanzania generally. Few (Small and Medium Enterprise Competitiveness Facility, 2008; Mwakalinga, 2014; VSO-ICS Volunteers, 2015; Aku et al., 2018; Dube et al., 2018) have focused on Small Farmers and SFOs networks in horticultural value chain. In addition, the studies did not focus on the networking between SOHFOs under local umbrella NGOs and other OHVCAs. Furthermore, the aforementioned studies did not use social network analysis in studying the networks. Since social network analysis can measure and represent social relations accurately (Borgatti et al., 2018), there is a possibility that many useful insights have been missed in the previous studies.

1.1. Area for the Study

Using social network analysis, the present study has assessed the networks between SOHFOs under two NGOs and other OHVCAs in two selected regions (Morogoro and Kilimanjaro) in Tanzania as shown in **Figure 1**. Though there are numerous NGOs dealing with SOHFOs, the organizations were purposely selected due to their active role in facilitating networking between SOHFOs and them as local umbrella NGOs, and their strong relationship with national umbrella organization (TOAM) (Singo, 2018). In working with these SOHFOs, the organizations aim at accomplishing numerous roles including introducing and strengthening organic farming technology and boosting their economic situation. It should be noted that the study did not intend to compare the areas or organizations studied. Besides, it aimed at noting the influence of various styles of managing horticultural products from SOHFOs by local umbrella NGOs and availability of nearby OHVCAs in networks of SOHFOs. In such management, while SAT receives some horticultural products from SOHFOs, Floresta Tanzania does not receive any horticultural products from SOHFOs. Again, Floresta Tanzania's SOHFOs are surrounded by various OHVCAs that can purchase their organic products compared to SAT. Numerous SOHFOs were selected to observe the level of networking across them. It should be noted that in both NGOs, SOHFOs are dealing with other activities rather than Organic horticultural production. Other activities include crop production and animal keeping, Village Community Banks (VICOBA), soap making and bee keeping.

The intended OHVCAs are structured social systems with stable collaborations (organizations) (including other SOHFOs, other OHVCAs and NGOs). This has been done to bring into light the following issues: the patterns of horizontal networks among SOHFOs under local umbrella NGOs and the patterns of vertical

networks between SOHFOs and other OHVCAs; and the roles played by various actors towards SOHFOs in the OHVC. The study focused on SOHFOs under umbrella organizations, particularly NGOs, since NGOs have played remarkable role in introducing and strengthening organic agriculture to various kinds of FOs in the country (Taylor, 2006; Mella et al., 2007).

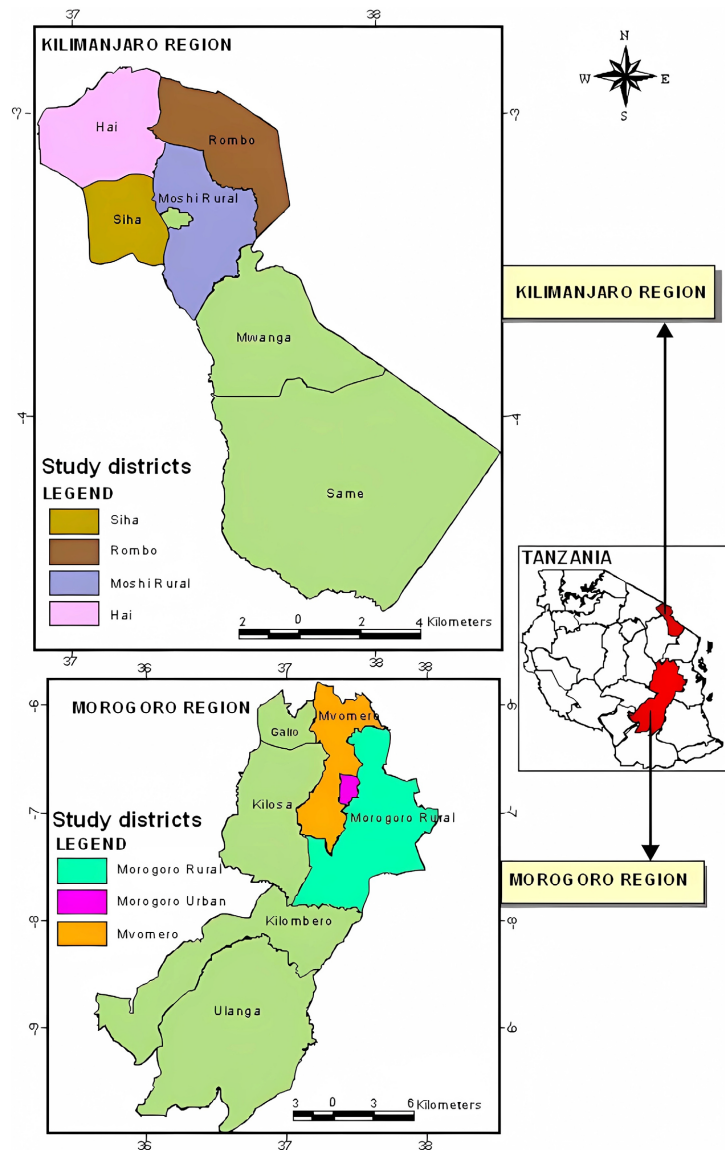


Figure 1. A map showing the area of the study (selected regions and their corresponding districts).

The patterns of interaction are very crucial in indicating the extent SOHFOs under local umbrella NGOs participate in flow of resources via OHVC (organizations) and whether the horizontal and vertical networks benefits including economies of scale and increased competitiveness are realized for enhanced horticultural organic sector in the country. Furthermore, the examination of roles of OHVCAs working with SOHFOs facilitates recognition of strong and weak actors

and nodes they cover throughout the value chains so as to uphold the OHVCAs and OHVC in selected regions as a whole. An organization in this context involves structured social system that comprises individuals who work together to meet specified goals (Greenberg & Baron, 1995).

1.2. Literature Review

1.2.1. Networking of Smallholder Organic Horticultural Farmer Organizations

Networks of various organizations (actors) for their change are well mentioned in contemporary literature. For instance, evidence indicates presence of change that has brought beneficial outcomes that have been observed in networks of agri-food organizations in China (Hao et al., 2018). This study considers innovation synonymous with change (Haveman, 1992; Tereso et al., 2012). It should be noted that these works mainly focused on technological change. However, it is plausible that the term can also mean other kinds of change. Networks of organizations entail relationship between and amongst organizations to facilitate achievement of a common goal (Provan et al., 2007; Prashantham et al., 2017). It involves meeting together of actors for the purpose of exchanging resources including experiences, knowledge, information and materials (Saint Ville et al., 2017). In relation to this study that is related to SOHFOs, literature shows that resources that are likely to flow from one actor to another in the OHVC may be knowledge and information, physical, institutional and/or financial resources for organic production (Saunders et al., 1997; Rundgen, 2006; Smith & Powell, 2007; IFOAM Organics International, 2017). Since there is limited information on how the networking amongst SOHFOs under NGOs are, we conducted this research so as to achieve the enhanced organic horticultural sector in Tanzania.

1.2.2. OHVCAs and Their Roles in the OHVC

Value chain refers to all activities and services for bringing a product from conception, various stages of production, delivery to final consumers and final disposal after use (Zamora, 2016; Odunze, 2019). Among various OHVCAs, NGOs have played observable role as local umbrella organizations (intermediaries). This is by enhancing coordination through horizontal or vertical networks of Smallholder Organic Farmer Organizations (SOFs) including Smallholder Organic Horticultural Farmer Organizations (SOHFOs) and various stakeholders in organic sector (Shepherd, 2007; Tanzania National Organic Agriculture Forum, 2008). Vertical networks (networking between SOHFOs and other noncompeting actors) in OHVC are significant for moving the product to the end market and increasing its competitiveness. Similarly, horizontal networks (networking amongst same-level actors SOHFOs) enhance access to resources, uphold economies of scale and contribute to competitiveness in the value chain (Hermann et al., 2015; Odunze, 2019). Empirical evidence from various countries of Sub-Saharan Africa including South Africa and Ethiopia has continued to show how beneficial the value chains are for various SFs and SFOs (dealing whether with crop production or animal

keeping/horticultural or non-horticultural production) (Lemma et al., 2008; Zamora, 2016; Liverpool-Tasie et al., 2020).

1.2.3. Theoretical and Conceptual Framework

This study draws insights from social network theory. The theory is also known as network theory or network analysis (Robinson, 2012). The theory has the main notion that individual actors are not as important as relationships with other actors in the network (Wasserman & Faust, 1994; Giuffre, 2013). The theory is very popular in examination of interaction patterns existing among actors, the consequences expected based on the actors involved and type of resources that flow (Wasserman & Faust, 1994; Kadushin, 2004, 2012; Knoke & Yang, 2008; Borgatti et al., 2018).

1) Independent variable of the study: networks of the SOHFOS

The networks of the SOHFOS involved in the study can be categorized as independent variable of the study. The networks study involves use of SNA, where by actors (organizations) that can be used interchangeably with the word “nodes” and their links that allow flow of network resources between them (ties) that can be used interchangeably with word “edges” (Gulati et al., 2002; Provan et al., 2007). According to Kirschbaum (2019) and Borgatti et al. (2013, 2018), the social network analysis can be done in three levels. The first is dyadic level, which deals with pairs of actors, i.e. geodesic distance and structural equivalence that focuses on the pairs of nodes vis-a-vis third parties. The second level is a node level, which deals with the particular node, i.e. network size and structural holes. The last level is group level that deals with network as a whole, i.e. network density and centrality. In a nutshell, centrality describes the position of a node in the network. Literature on social networks has continued to introduce various measures of centralities including degree, closeness, betweenness and eigenvector centralities (Borgatti et al., 2018). However, we studied the networks of SOHFOS by particularly focusing on their Normalized Closeness Centralities (NCCs) and Normalized Betweenness Centralities (NBCs).

a) Normalized Closeness Centralities (NCCs)

Closeness centrality is used to measure how close an actor is to other actors in the network and how long it will take to transfer any resource from one to other actors (Borgatti et al., 2018). Closeness centrality is a measure of independence and efficiency and is an inverse of degree centrality (Freeman, 1979). Contrary to unnormalized closeness centrality, a SOHFO or other OHVCA with higher normalized closeness centrality is said to be close to other OHVCAs (Freeman, 1979, Borgatti et al., 2018). This implies that it has high capacity to affect all other actors in the network. Resource from/to such SOHFO can quickly catch other OHVCAs and therefore spread easily. The study used Normalized Closeness Centrality, which was obtained by dividing each node’s closeness centrality score with the available highest value. This was crucial so as to allow accurate comparison of closeness centrality scores across nodes.

b) Normalized Betweenness Centralities (NBCs)

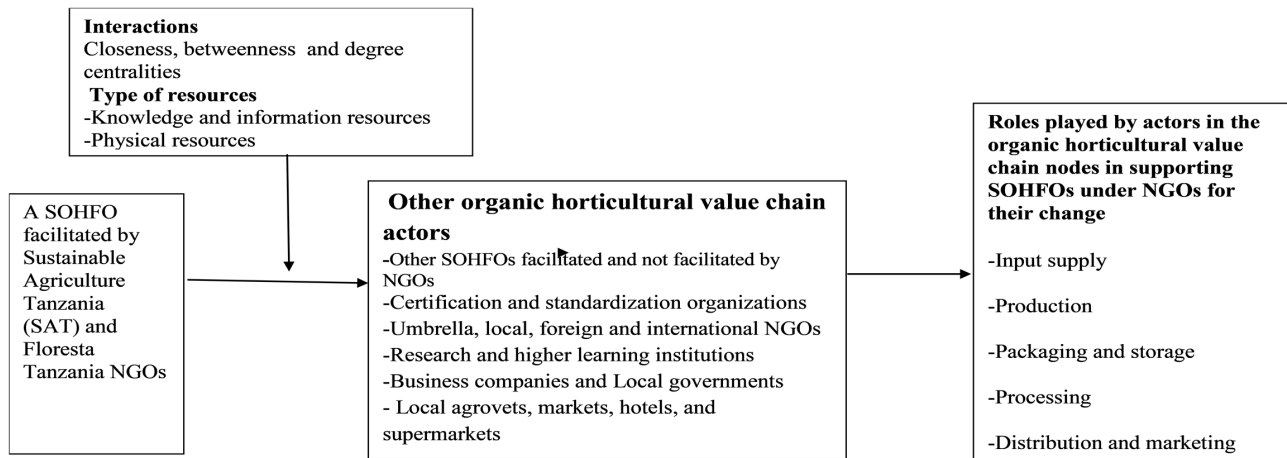
Betweenness centrality is used to measure the potential for actor to coordinate resources in the network. It shows number of times a node acts as a bridge along the shortest path in terms of number of edges in connecting two other nodes (Batool & Niazi, 2014; Borgatti et al., 2018). Betweenness centrality is the common measure of influence of the nodes in the network in joining the disconnected groups. In other words, according to Batool and Niazi (2014), betweenness centrality measures the number of times a node acts as a bridge along the shortest path in connecting two other nodes. An individual SOHFO or other OHVCA with higher normalized betweenness centrality is said to have the capacity to control flow of resources through the network (Freeman, 1979). Normalized betweenness centrality of a node is a result of a ratio between simple betweenness and its maximum value (Freeman, 1979). The use of Normalized Betweenness Centrality allowed accurate comparison of betweenness centrality scores across nodes.

2) Dependent variable of the study: role of other OHVCAs towards SOHFOs under NGOs

As we earlier said, value chain actors involved in this study can be elaborated as organizations (whether formal or semi-formal) with stable social collaborations. According to Pal and Sharma (2018), value chain actors involve all participants with some activities related to the product in the value chain nodes. In this study, OHVCAs include SOHFOs, NGOs, and other OHVCAs (umbrella, international, foreign and local NGOs, associations, business companies, local governments, local markets and agrovets, certification and standardization offices, supermarkets, schools, dispensaries, churches, colleges and hotels). It should be noted that, based on the empirical evidence, the OHVCAs mentioned in this study are dealing with more activities apart from those mentioned in the study and some of them are not informed of the other prevailing OHVCAs. Though value chain involves conception, final consumers and final disposal after use (Zamora, 2016; Odunze, 2019); literature admits that, the main nodes (steps for product value creation) of OHVC involve production, packaging and storage, processing, and; distribution and marketing as a result of networking (Fernandes-Stark et al., 2011; Gereffi, 2014; Dube et al., 2018). According to Coulson et al. (2018), for food crops, value chain involves activities that range from the farm to the plate. Therefore, the study only covered the aforementioned value chain nodes to observe the activities achieved by various OHVCAs to SOHFOs and available gaps.

This study aimed at assessing and mapping the patterns of interaction of all actors in the OHVC using the network theory. The Normalized Closeness Centralities (NCCs) and Normalized Betweenness Centralities (NBCs) were used to allow comparison between SOHFOs in two distinct NGOs (As intermediary organizations). This could allow observation on how differently management styles ultimately influence their experiences in flow of knowledge and information; and physical resources that are concern of the study. The measures used in this work are directed and somehow disconnected (Freeman, 1977, 1979; Borgatti & Bonacich, 1989; Wasserman & Faust, 1994). The measures were used to discern the exact direction of

flow of the resources that are concerned with the study. Though knowledge and information can have multiple meanings (Savolainen, 2017). In this paper, knowledge is regarded as advanced information that needs to be processed by individuals (Wang & Noe, 2010). The conceptual framework, which is informed by the social network theory, depicts the networks of SOHFOs and other OHVCAs (fruits and vegetables) as independent variable, and the roles of OHVCAs in enhancing the SOHFOs' involvement in the OHVC (fruits and vegetables) as dependent variable as shown in **Figure 2**.



Source: Researcher contemplation through literature review, 2019.

Figure 2. Conceptual framework for examining networks of smallholder organic horticultural farmer organizations and other actors in the organic horticultural value chain for their change in two selected regions at Tanzania.

2. Methodology

2.1. Data

Data for this work were collected between June 2019 to December 2019 employing a cross-sectional research design informed by social network analysis approach and mixed quantitative and qualitative methods. The approach allowed mapping and triangulation of data collection methods, i.e. one method complementing the other in terms of data produced (Bryman, 2006). Prior to actual data collection, pilot study was done to increase validity and reliability of the data. The pilot study was done between January 2019 to March 2019.

Network data relies on explanation about relations amongst actors, and not on individual actors. Thus, to enhance population representation of SOHFOs under the two NGOs, simple random sampling was used to select a sample of SOHFOs as a network boundary for studying networks amongst them. Again, with the interest of focusing on actor (node) level of analysis, particularly the difference in importance and influence of various SOHFOs, the chosen sample was allowed to identify the relationships they have with SOHFOs out of the sample, whether within or outside the selected NGOs. The sample for SOHFOs was determined by Yamane formula for finite population (Yamane, 1967; Israel, 2003). Yamane's formula is:

$$n = N/1 + N(e)^2$$

where: n is the sample size, and N is estimated number of SOHFOs in two selected NGOs and e = Level of estimation (0.05)².

Therefore, $n = N/1 + N(e)^2 = 286/1 + 286(0.05)^2 = 166.7638484 = 167$.

We selected a sample from a population of 79 SOHFOs and 207 SOHFOs under SAT and Floresta Tanzania respectively (Lyassa, 2018; John, 2018), making a total of 286 SOHFOs. The sample involves 46 SOHFOs from SAT (operating from the same office) and 121 SOHFOs from Floresta Tanzania that operates from diverse offices including 48 in Moshi Rural, 48 again in Siha, 13 in Hai, and 12 in Rombo Districts with the headquarters' office found in Moshi Urban District. The sample was obtained using a proportionate random sampling (Hansen et al., 1953). The formula is as follows: $a = n/N * b$ where: a is sample size for each point in the NGO, n is a total number of SOHFOs in a single point in NGOs, N is the total number of SOHFOs found in all points in NGOs and b is target (sampled) SOHFOs in all points in NGOs. In these SOHFOs, a total of 321 respondents were purposefully selected to represent their SOHFOs. The criteria for their selection were being a leader and knowledgeable on the matters of the study.

In the prior plan, the study expected to establish the network boundaries by selecting purposely 40 vertical supporters of SOHFOs under NGOs with strong inter-organizational networks that can result to their change as second-order sample (second sample selected to confirm information from first sample, particularly in networking actors). These organizations were responsible for confirming their networking with SOHFOs (as a general information on provision of services to such kind of FOs). However, the most mentioned organizations were not having any informed data on their relationships with SOHFOs. Thus, in collection of network data, advice given by Molina and Borgatti (2021) in the circumstance of missing some networking data due to some unavoidable reasons was used, in that case, they have advised on balancing between scientific research ethics and researcher decision for relevance and risks minimization. Thus, data from 167 SOHFOs on how they network amongst themselves and with other OHVCAs were collected with no confirmation of second-order sample. Instead, data from only managing organizations were used to serve the purpose by confirming the available networks. Thus, the most mentioned organizations responsible for managing (directing and controlling) SOHFOs were used instead of these other vertical organizations. The purposive selection of 10 managing organizations was done. These organizations were represented by 18 individual respondents. The organizations include 7 District councils with 14 individual respondents, SAT with 2, Floresta Tanzania with 1 and TOAM with 1 respondent.

The simplification of data collection and analysis to allow use of social network analysis was done. This was by preparation of the list of possible SOHFOS (network members) selected randomly from a sample frame given from the officers of the respective NGOs to be visited prior to the commencement of the data collection exercise (Goetz et al., 2017). Based on the nature of the study, the respondents were

told earlier via mobile phone communication to compile data on important matters of the study, i.e. networks they have built since their establishment. The study employed structured interviews and Focus Group Discussions (FGDs) for target group while semi-structured interviews were used for key informants as the main methods for data collection. Again, for the accuracy of information given, the respondents were allowed to use phone interview to contact with the knowledgeable members of their SOHFOs. These data collection methods were triangulated (Bryman, 2006, 2016) to generate comprehensive data that are credible. The structured interviews (same set of questions asked to all respondents in the same order) using interview guide attached as **Appendix** were conducted to 321 representative members of 167 SOHFOs. The criterion for their selection was experience and leadership in SOHFOs. These representatives gave the information on networks of particular SOHFOs with other SOHFOs or other SOHFOs outside their intermediary organization and with other OHVCAs. Semi-structured interviews (open-ended and close-ended questions were asked to get in-depth information) using interview guide were conducted to earlier mentioned 18 key informants from 10 organizations with vertical networks with SOHFOs in the OHVC and those managing the organic agriculture sector. In observing ethical issues, all respondents were asked for their consent before data collection exercise started and in FGD sessions on the use of an audio recorder.

Based on background and experiences on matters of the study, six FGD sessions were conducted using FGD guide and audio recorder. Except for Morogoro Urban and Mvomero District, which were combined, one FGD was conducted in each District. Combination was possible because participants in these areas seemed to have similar background and experiences. Each FGD session was composed of six to eight members making a total of 44 leaders of SOHFOs. Documentary review entailed the use of various sources including SOHFOs quarterly progress reports, books, research reports and journals to obtain information on networks of SOHFOs and other OHVCAs, and the role played by the actors to enhance change in such SOHFOs.

2.2. Measurements

In analyzing and mapping social network data, Gephi 0.9.2 software was used (Bastian et al., 2009). Amongst its peculiar attributes over some other social network analytical software is ability to produce analysed data and data visualizations; and has the capacity to handle large-size data (Jacomy et al., 2014). To ensure any weaknesses that were encountered during data collection and analysis are minimized, raw data were managed in terms of being coded and cleaned (Bryman, 2016). These relational data particularly centrality measures included co-existence of flow outcome perspective (position of a node based on the network based on structural properties) and induced outcome perspective (position of a node based on other attributes beyond structural properties). The measures used were in terms of Normalized Closeness Centrality (NCC), Normalized Betweenness Centrality (NBC) and Degree Centrality (DC). This has been done with the aim of

assessing the networks that have been made between SOHFOs under local umbrella NGOs and other OHVCAs in their various capacities and positions in the OHVC (Freeman, 1977, 1979; Borgatti & Bonasich, 1989; Wasserman & Faust 1994; Landherr et al., 2010; Eboli, 2019; Borgatti & Everreti, 2020). The results from the social network analysis, particularly the NBC scores and NCC scores were used to establish the networks between SOHFOs under local umbrella NGOs and networks between SOHFOs under local umbrella NGOs and other OHVCAs in the OHVC in Tanzania. On the other hand, the scores from DC were analysed using frequencies and percentages to establish role played by OHVCAs (organizations) towards SOHFOs under local umbrella NGOs in Tanzania. The NBC, NCC and DC scores were classified into strong and weak networks. Whereby strong networks included levels of networking of 0.5 or above and weak networks included those scores below 0.5.

Closeness centrality of a node V is calculated as:

$$C_c(V) = \sum \frac{1}{\text{Dist}(v,t)}$$

whereby Dist v and t are nodes from the graph G . According to Freeman (1979) and Wasserman and Faust (1994), the normalized closeness centrality of a node v from a graph G is calculated as $(n-1)/(|G|-1)$ where n is the number of nodes in the connected part of graph containing the node.

Betweenness centrality of a node V is calculated as:

$$C_B(V) = \sum_{s \neq v \neq t} \frac{\sigma_{st}(V)}{\sigma_{st}}$$

Whereby s = source;

t = destination;

σ_{st} = total number of shortest paths from node s to node t ;

$\sigma_{st}(V)$ = number of shortest paths between (s, t) that pass through/intersects v .

Since the network is directed and therefore asymmetrical, to obtain the normalized values the formula is divided by $(n-1)(n-2)$ where n is the number of nodes in the network (Freeman, 1977; Borgatti & Bonacich, 1989).

Normalized centralities were established by asking individual SOHFO (that fall in production node), which is also known as actor (node) in duration of establishment to the year 2018, whether it has given the resources (source), and the value chain actors that fall on production, packaging and storage, processing, distribution and marketing nodes have received the resources (target); or it has received the resources (target), and the value chain actors who fall on production, packaging and storage, processing, distribution and marketing nodes have given the resources (sources). The nodes (actors) were observed based on networks that allow flow of knowledge and information resources and physical resources. (This tool for data collection didn't show vividly the categorization of value chain actors based on their stages in the value chain. This was done further during data analysis).

Apart from establishing normalized closeness and normalized betweenness centralities of SOHFOs, degree centrality was also calculated.

Degree centrality of a node V is calculated as:

$$C_D(V) = \frac{k_v}{n-1} = \sum_{j \neq V} \frac{a_{vj}}{n-1}$$

whereby k is the degree of a node and n is the total number of the nodes.

The DC results were analysed using descriptive analysis (frequencies and percentages) to establish the role played by other actors, i.e. OHVCAs (organizations) in flow of resources towards SOHFOs for the general positive results in the OHVC in Tanzania. Data from key informants and FGDs were analyzed by content analysis through development of themes (Vaismoradi et al., 2016). In theme development, data were transcribed, coded (putting texts and phrases into relevant categories) and examined to find meaningful textual strings (relating themes) to established knowledge.

3. Results

3.1. Networks of SOHFOs under Local Umbrella NGOs with Other OHVCAs in the Organic Horticultural Value Chain

Actors positioning is paramount attribute in determining the characteristics of a network (Freeman, 1979; Borgatti, 2009; Borgatti et al., 2018; Alarcão & Sacomano Neto, 2016). Therefore, we analyzed the patterns of interaction of OHVCAs for the purpose of unveiling the way SOHFOs under local umbrella NGOs participate in the OHVC and the realization of the benefits from horizontal and vertical networks for enhanced horticultural organic sector in Tanzania. In the subsequent parts we discussed the networks patterns of various actors of SOHFOs under NGOs with other OHVCAs. The networks are particularly on dissemination of knowledge and information, and spread of physical resources to other actors in the network. As a way of managing data (numerous actors) the discussion of networks (closeness and betweenness centralities) lies on highly ranked actors using the majority rule approach as used by Niimi (2018) in large set of data in credit card transactions. Furthermore, in using the normalized centrality measures of the study, all networks in OHVCAs with 0.5 or above scores are regarded as strong networking and those below 0.5 as weak networking. Thus, discussion lies on the five highly ranked SOHFOs and five other OHVCAs with the highest scores as representatives of other actors to observe their interaction patterns and their common attributes in the OHVC. In case, two similar OHVCAs with the same role to SOHFOs (e.g. Kiziga Agrovet and Amani Agrovet) were found in high rank, only the first one with higher rank was taken as representative to observe another type of actor based on its role to SOHFOs under particular NGO.

3.1.1. Spreading Function of Resources of SOHFOs under Local Umbrella NGOs with Other OHVCAs in the Organic Horticultural Value Chain

This part discusses the networking patterns of SOHFOs in disseminating knowledge

and information and spreading physical resources. This is done with the aim of establishing how close SOHFOs are to other OHVCAs. The results in this part are from two local umbrella NGOs which are SAT and Floresta Tanzania. Since networks in this study implies exchange of resources (all initiatives made by SOHFOs to network (including exploring of markets from abroad by involving SOHFOs representatives by SAT and Floresta Tanzania NGOs) but have failed to result into exchange of resources are not part of this discussion.

To obtain the general picture of the ability of SOHFOs at SAT to transfer resources easily, i.e. to disseminate knowledge and information to other OHVCAs, we ranked them to obtain those with strong and weak networking. Results (**Table 1**) show that in dissemination of knowledge and information at SAT, the leading SOHFOs are *Twende pamoja-Kimambila*, *Upatacho-Langali*, *Tumaini Menge-Vianzi*, *Tushikamane-Kifulu* and *Lamka Mangala-Ludewa* with higher closeness centralities of 0.548, 0.548, 0.541, 0.530 and 0.530 respectively. These SOHFOs have strong networks with other OHVCAs particularly SOHFOs in disseminating required knowledge and information. For Floresta Tanzania, in dissemination of knowledge and information, out of all 178 OHVCAs only 1 (0.6%) OHCVA had strong networks and the rest 177 (99.4%) OHCVAs including all SOHFOs had weak networks. In such circumstance, the leading SOHFO is *Ufunuo-Makiwaru* with the weak networks expressed in terms of closeness centrality of 0.475.

Table 1. Leading SOHFOs and OHVCAs in terms of knowledge and information networks.

Descriptive Statistics		
Actors	Closeness Centrality	Level of Networking
Sat-Knowledge and Information Resources		
Twende Pamoja-Kimambila	0.548	1
Upatacho-Langali	0.548	1
Tumaini Menge-Vianzi	0.541	1
Tushikamane-Kifulu	0.530	1
Lamka Mangala-Ludewa	0.530	1
SAT	0.721	1
TOAM	0.442	2
Village Govt	0.417	2
SUA	0.406	2
Ward Government	0.396	2
Floresta Tanzania-Knowledge and Information Resources		
Ufunuo-Makiwaru	0.475	2
Alfa-Koboko Kaskazini	0.472	2

Continued

Mashora Da-Kware	0.469	2
Galilaya-Kisimani	0.468	2
Manso-Mashua	0.468	2
Floresta Tanzania	0.858	1
TOAM	0.334	2
Kiziga Agrovot	0.330	2
Home Veg Export Company	0.322	2
TAHA	0.320	2

NB: Level of networking is denoted by 1 = closeness degree scores of 0.5 and above = strong networks and 2 = closeness degree scores of below 0.5 = weak networks.

The findings suggest that most of SOHFOs under local umbrella NGOs have limited capacity to disseminate technological/marketing knowledge and information to other OHVCAs particularly their fellow producers (SOHFOs). Some of the methods of networks used in exchange of knowledge and information include meetings, short seminars, observations, demonstrations and farmer study tours. However, only few actors are involving themselves in enabling SOHFOs or use methods that can allow networks between SOHFOs. This consequently affects their capacity to create higher products standards and participate in the marketing campaigns initiated by themselves.

Moreover, SOHFOs which are active in disseminating technological knowledge and information to other OHVCAs are the ones with experience in virtual objects such as web platforms that are strategically employed to enhance networking between FOs. The web platforms including WhatsApp are mainly used by SOHFOs in exchanging technological knowledge and scanty on marketing information. Others are those SOHFOs established in agro-ecological settings where there is water availability and with high geographical proximity (low functional distance between SOHFOs). This is because the availability of water increases the duration for a SOHFO to work in organic horticultural production and therefore results in more networks.

Again, to obtain the general snapshot of the ability of SOHFOs at SAT to share physical resources easily, we ranked them to obtain those with strong and weak networks. Results (Table 2) indicate that SOHFOs *Umoja Mafumba-Mkuyuni*, *Nguvu Kazi-Lukonde*, *Tutugole-Kiloka*, *Vijana Bomba-Kungwe* and *Twende Pamoja-Kimambila* had closeness centrality measures of 1, 1, 1, 0.480 and 0.472 respectively. Though not all highly ranked SOHFOs had strong relationships, the aforesaid SOHFOs had higher ability to spread farm inputs (including seeds and seedlings) to other SOHFOs and mainly organic horticultural products to other OHVCAs. All these SOHFOs except *Tutugole-Kiloka* are in the WhatsApp group project. This suggests that flow of information and knowledge facilitates flow of physical resources. In

spreading of physical resources by SOHFOs at Floresta Tanzania the findings indicate that, *Siangicha-Mrimbo Uuwo*, *Kimangaro-Kimangaro*, *Nuru-Kokrie*, *Ebeneza-Lawate*, *Shalomu-Mlangoni* are among SOHFOs with higher closeness centralities of 1 each.

Table 2. Leading SOHFOs and OHVCAs in terms of physical resources networks.

Descriptive Statistics		
Actors	Closeness Centrality	Level of Interactions
Sat-Physical Resources		
Umoja Mafumba-Mkuyuni	1.000	1
Nguvu Kazi-Lukonde	1.000	1
Tutogole-Kiloka	1.000	1
Vijana Bomba-Kungwe	0.480	2
Twende Pamoja-Kimambila	0.472	2
SUA	1.000	1
Aqua alignment	1.000	1
SAT	0.808	1
Morogoro Urban Agrovet	0.339	2
Dynamo Arusha	0.324	2
Floresta-Physical Resources		
Siangicha-Mrimbo Uuwo	1.000	1
Kimangaro-Kimangaro	1.000	1
Nuru-Kokrie	1.000	1
Ebeneza-Lawate	1.000	1
Shalomu-Mlangoni	1.000	1
Home Veg Exporting Company	1.000	1
Mwika Market	1.000	1
B. Agrovet	1.000	1
Sole Proprietor Hardware	1.000	1
Floresta Tanzania	0.792	1

NB: Level of networking is denoted by 1 = closeness degree scores of 0.5 and above = strong networks and 2 = closeness degree scores of below 0.5 = weak networks.

This shows that, some SOHFOs have strong networks at Floresta Tanzania to spread physical resources including farm inputs to their fellow SOHFOs and to spread mainly organic horticultural products to other OHVCAs. The findings

suggest that generally, only some of SOHFOs under local umbrella NGOs have strong ability to spread inputs and supply implements (organic seeds, seedlings and organic matters for production of manure) to other SOHFOs and mainly market their organic horticultural products (including Chinese cabbage, sweet peppers and collard greens) to other OHVCAs. The results are in line with the FGD findings where FGD participants argued that:

“There is problem in marketing of organic horticultural products for SOHFOs under local umbrella NGOs due to minimal networking amongst us. Use of deliberate networks of SOHFOs to capture the marketing opportunity obtained by individual farmer in a single SOHFO can be amongst possible solutions” (FGD, Mvomero District, December 2019).

Moreover, most active SOHFOs in spreading physical resources (mainly organic horticultural products) to other OHVCAs are found in agro-ecological settings with water availability or experience with virtual objects such as web platforms that are strategically employed to enhance networking between them. As earlier stated, the presence of water enables SOHFOs to spend more time in production of organic horticultural products and consequently more networks.

In observing the consequences of networking amongst SOHFOs in realizing value chain benefits, participants in FGD concurred on how crucial the arranged efforts in SOHFOs under local umbrella NGOs could increase their sales and decrease their costs of production:

“In a situation whereby SOHFOs unites and interacts for exchange of information, horticultural products, farm inputs during production or marketing of their products, negotiations could be stronger due to power of collective bargaining and costs of production and marketing can decrease” (FGD, Hai District, October 2019).

The findings contend that the minimal networking between SOHFOs under local umbrella NGOs reduces their capacity to cut their transaction costs, increase their bargaining power and their economies of scale in purchase/sale of their goods and hence decrease the competitiveness of their horticultural products. The findings contrast the evidence from Iringa, in Tanzania where strong networks of SOHFOs and NGOs have enabled them to certify, purchase, process and export organic pineapples via Dabaga fruits and vegetables canning company (Temu & Marwa, 2007).

The results (Table 2) also indicate some influential OHVCAs such as Floresta Tanzania to have lower closeness centrality compared to others in terms of physical resources networking. As argued by Newman (2005), the closeness centrality is emanated from the length of paths of actors that are interacting. In a circumstance that, the networks to various actors can be huge or sparingly distributed, the shortest path to those nodes must be different (Landherr et al., 2010). For instance, one of the reasons that empirically have contributed to the position of the Floresta Tanzania is its less involvement in sales and marketing of horticultural products of its SOHFOs. However, it should be noted that results at closeness

centrality measure are not directly and simply interpreted compared to degree centrality measures. The same argument is recurrently made by Freeman (1979) and Wasserman and Faust (1994) who asserted that if the node is somehow disconnected (not fully connected), its value of closeness centrality will be computed with regard to each connected part separately. This consequently will lead to numerous gauges based on the size of those specified parts.

3.1.2. Mapping the Bridging Function of SOHFOs under Local Umbrella NGOs with Other OHVCAs in the Organic Horticultural Value Chain

To present networks in diverse forms, we mapped the network of OHVCAs in SAT and Floresta Tanzania respectively. The mapping of the network of OHVCAs was done particularly by observing the bridging/coordination function in terms of betweenness centrality of the actor. Though the network maps in Figures 3-6 show the importance of the actors in terms of degree centrality (since they are very related to bridging function), they are not part of this discussion. In directed networks an actor with high betweenness centrality (bridging function) has the following attributes. The actor may receive resources from many actors who don't receive their resources from the same actor (good receiver). Otherwise, the actor may give to few actors but connect them to many actors that could be distant (good giver) (Golbeck, 2013). In understanding the actual situation, the direction of flow of resources was the key.

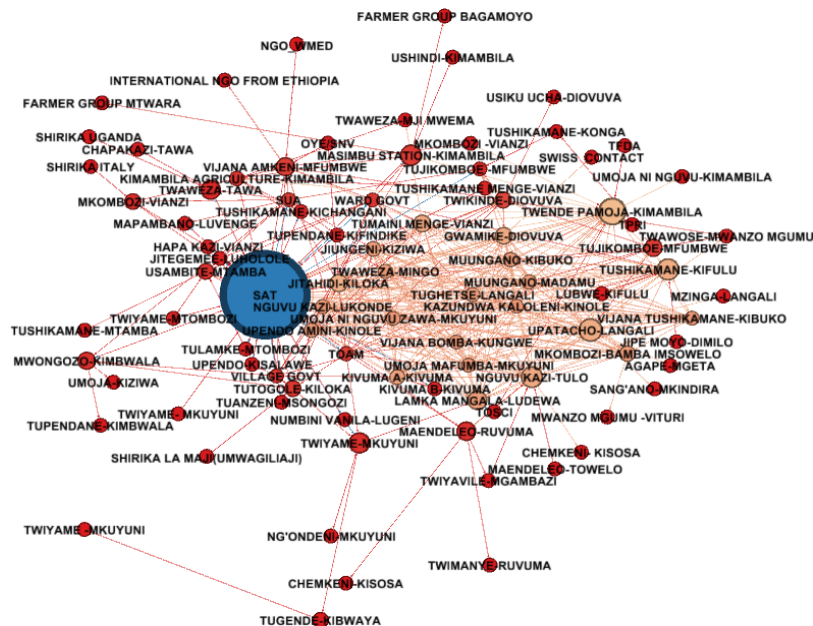


Figure 3. Sociogram of SAT knowledge and information flow among 46 SOHFOs and other OHVCAs organized using yihufan layout format with betweenness/bridging represented by node size which differs relatively and degree/importance represented by nodes colour whereby light blue represents high degree, pitch denotes medium degree and maroon represents low degree. Levels of networking are categorized into betweenness centrality scores of 0.5 or above = strong networks and betweenness centrality scores of below 0.5 = weak networks.

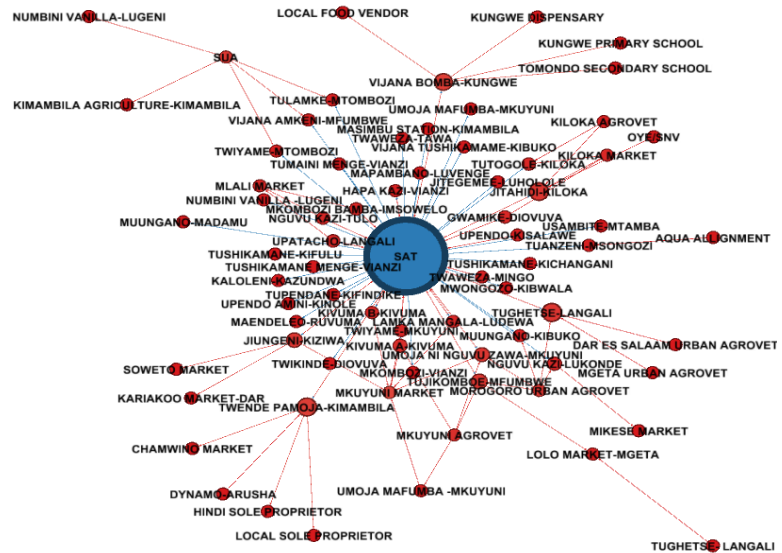


Figure 4. Sociogram of SAT physical resources flow among 46 SOHFOs and other OHVCAs organized using yi hu fan layout format with betweenness/bridging represented by node size which differs relatively and degree/importance represented by nodes colour whereby light blue represents high degree and maroon represents low degree. Levels of networking are categorized into betweenness centrality scores of 0.5 or above = strong networks and betweenness centrality scores of below 0.5 = weak networks.

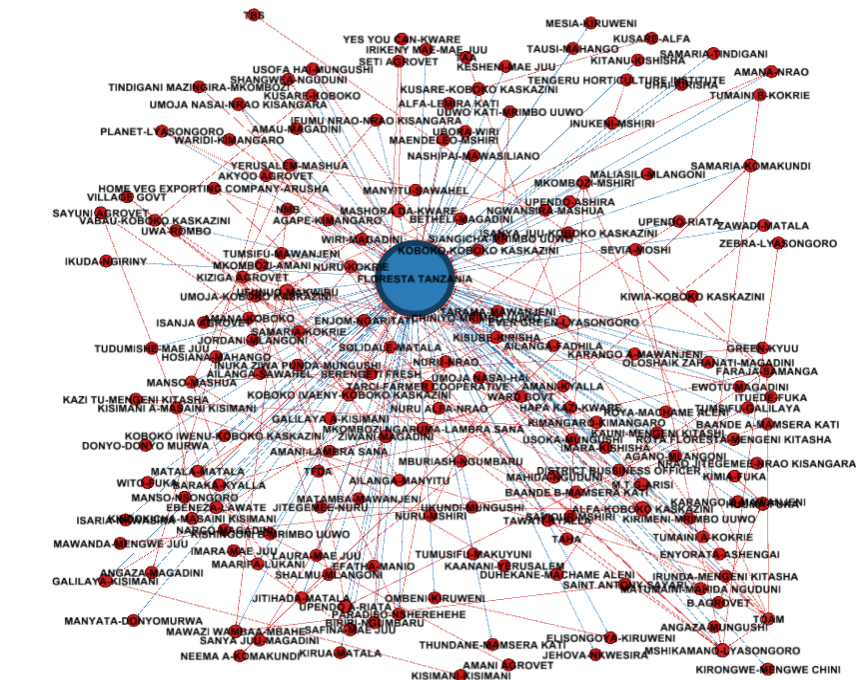


Figure 5. Sociogram of Floresta Tanzania knowledge and information flow among 121 SOHFOs and Other OHVCAs organized using yi hu fan layout format with betweenness/bridging represented by node size which differs relatively and degree/importance represented by nodes colour whereby light blue represents high degree and maroon represents low degree. Levels of networking are categorized into betweenness centrality scores of 0.5 and above = strong networks and betweenness centrality scores of below 0.5 = weak networks.

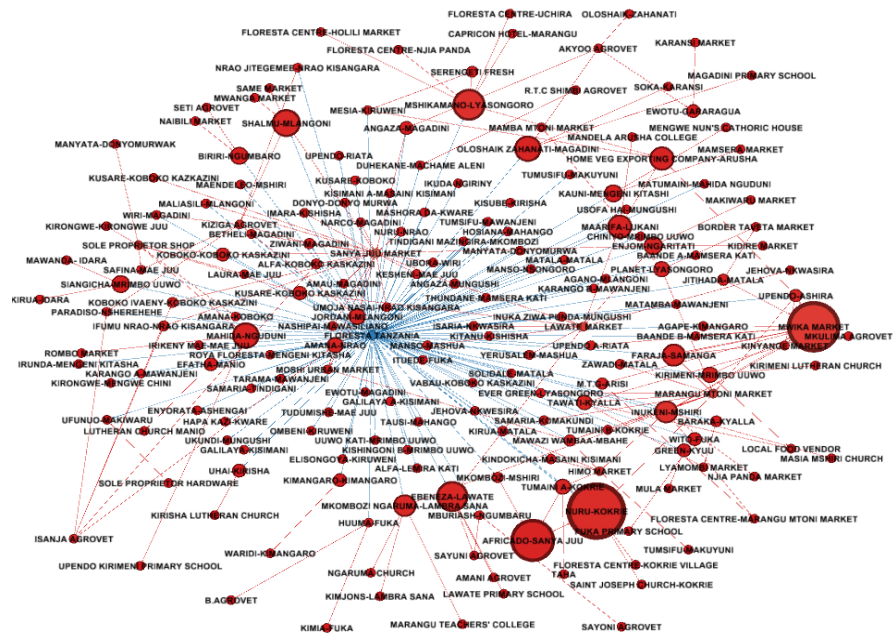


Figure 6. Sociogram of Floresta Tanzania physical resources flow among 121 SOHFOs and Other OHVCAs organized using yi hu fan layout format with betweenness/bridging represented by node size which differs relatively and degree/importance represented by nodes colour whereby light blue represents high degree and maroon represents low degree. Levels of networking are categorized into betweenness centrality scores of 0.5 and above = strong networks and betweenness centrality scores of below 0.5 = weak networks.

The results, as shown in **Figure 3** and **Figure 4** indicate that in bridging flow of knowledge and information; and physical resources at SAT, there is no SOHFO with high betweenness centrality of more than 0.5. Despite the fact that all SOHFOs have low betweenness centrality, SOHFOs or other OHVCAs at SAT with leading betweenness centrality in flow of knowledge and information are *Twende Pamoja-Kimambila*, *Upatacho-Langali*, *Tushikamane-Kifulu*, *Nguvu Kazi-Tulo* and *Masimbu Station-Kimambila*. For physical resources flow, the SOHFOs with leading betweenness centrality are *Tughetse-Langali*, *Twende Pamoja-Kimambila*, *Jitahidi-Kiloka*, *Vijana Bomba-Kungwe* and *Tujikomboe-Mfumbwe*. Again, the SOHFOs using virtual objects are the ones with the leading betweenness centrality in both knowledge and information resources and physical resources. For the case of other OHVCAs, SAT is the organization with the highest betweenness centrality in flow of knowledge and information resources and physical resources.

In SOHFOs at Floresta Tanzania, results (**Figure 5** and **Figure 6**) show that in bridging flow of knowledge and information; and physical resources there are no SOHFOs with high betweenness centrality of more than 0.5. Furthermore, the leading SOHFOs with higher betweenness centrality in flow of knowledge and information include *Ufunuo-Makiwaru*, *Alfa-Koboko*, *Mshikamano-Lyasongoro*, *Faraja-Samanga* and *Mashora Da-Kware*. In bridging flow of physical resources, SOHFOs with leading betweenness centrality includes *Nuru-Kokrie*, *Ebeneza-Lawate*, *Shalomu-Mlangoni* and *Mahida-Nguduni*. Amongst OHVCAs, Floresta-

Tanzania has high betweenness centrality in flow of knowledge and information. For the case of flow of physical resources, again there are no OHVCAs with high betweenness centrality. However, *Mwika Market*, *Africado-Sanya Juu* and *Oloshaik-Magadini dispensary* are OHVCAs with higher betweenness centrality.

The findings (from **Figures 3-6**) indicate that SOHFOs under local umbrella NGOs allow passage of knowledge and information, and physical resources. However, there is no SOHFO with strong networks in terms of bridging function in flow of knowledge and information; and physical resources to other OHVCAs. This may be caused by the fact that though both NGOs have done great job to promote networks of SOHFOs, there are no institutionalized methods established by NGOs or SOHFOs themselves that allows strategic networks amongst SOHFOs; and between SOHFOs and other OHVCAs for intended flows of network resources. In comparison between capacity to spread physical resources, disseminate knowledge and information and bridging (controlling) physical and knowledge and information resources, SOHFOs under NGOs have weaker networking capacity in bridging (controlling) resources rather than in spread physical resources and disseminate knowledge and information. This indicates somehow evenly distribution of resources within the SOHFOs under NGOs which leads on structural equivalence in flow of resources among various SOHFOs. At the same time, it shows failure of NGOs to build capacity of SOHFOs to recognize, invest and share peculiar opportunities they can have. For instance, some of the SOHFOs were networking with companies that could buy their organic horticultural products that is Africado-Sanyajuu, Seeds of Expertise for the Vegetable Sector of Africa (SEVIA)-Moshi, Home Veg Exporting Company-Arusha. Furthermore, other SOHFOs are nearer to the market places, or networking with remarkable actors in input supply (opportunities that are not known or available to other SOHFOs). The presence of mechanisms that could allow shift of these opportunities is paramount. In actual sense, in the first place the mechanisms will create structural holes (presence of SOHFOs with strong networks in controlling resources in the network, however in a long run the resources will be evenly distributed again. This is the case if social capital, which refers to the capacity to receive resources is built among SOHFOs).

SOHFOs with water availability in their agro-ecological settings or involved in WhatsApp group project portray more ability in coordination/bridging function. Despite the fact that the results promote the use of virtual aids, particularly WhatsApp groups that are strategically deployed as means of communication; it should be noted that the use of the virtual aids without working on emerging challenges in the system may bring unintended effects. This was raised by FGD findings, where FGD participants argued that:

“Use of WhatsApp groups has enhanced the knowledge of SOHFOs’ members on fighting against crop diseases, raise awareness on organic practices and sometimes realizing possible markets for their crops. However, the method can face a number of challenges like failure to use smart phones properly by some of members

of other SOHFOs, poor networks that sometimes is caused by type of phone or line used and false pictures especially in environment where the officer is calling the SOHFO member and ask him/her to send a picture of their products while he/she is far from the farm. It is better to blend the WhatsApp groups with effective physical officers' visitations which is also currently used by NGOs can help as a way of solving the issue" (FGD, Mvomero District, December 2019).

The study findings are in line with those of [Lemma et al. \(2008\)](#) who did their study on Ethiopian smallholder dairy value chain for innovation system. They argued on importance of intensifying Information and Computer Technology (ICT) infrastructures for enhancing inter-organizational networks in the value chain. Despite the fact that value chains for various products are different, it is plausible that their findings can apply to SOHFOs under NGOs and their OHVC in Tanzania. Other OHVCAs which portray more ability in coordination/bridging function include local agrovets, business companies, i.e. Dynamo-Arusha (that deals with vegetable and fruits drying machine), Africado-Sanya Juu (for purchasing avocado) and local markets.

3.1.3. Networks of SOHFOs from Local Umbrella NGOs Perspective

When focusing on various discrepancies found between the two NGOs so as to get more insights on context variability, a number of issues can be raised. Results ([Table 1](#) and [Table 2](#)) show that in overall comparison amongst OHVCAs, SAT and Floresta Tanzania, have higher closeness centrality measures of 0.721 and 0.858 respectively in flow of information and knowledge. Again, in flow of physical resources, similarly SAT and Floresta Tanzania have higher closeness centrality measures of 0.808 and 0.792 respectively amongst all OHVCAs. The findings suggest that, amongst OHVCAs, local umbrella NGOs which act as intermediary organizations are close to SOHFOs and therefore are key actors in disseminating various kinds of knowledge and information and spread numerous physical resources to SOHFOs. This indicates a need for various OHVCAs who can strengthen inputs supply, production, packaging storage, processing distribution and marketing. The findings concur with those of [Phuong \(2018\)](#) who asserts that, NGOs were key actors in Thailand to support local farmers in adopting organic farming practices and employing standards and certification systems.

When observing the little discrepancy between local umbrella NGOs in flow of knowledge and information resources; and physical resources, in flow of knowledge and information resources the closeness centrality of SAT was lower compared to that of Floresta Tanzania. This is due to SAT having more organizations including FOs, local and international NGOs which while they give their knowledge and information resources to SOHFOs at SAT, they did not receive any of such resources. On the other hand, Floresta Tanzania has lower closeness centrality in flow of physical resources compared to that of SAT. Again, this was consequently brought by Floresta Tanzania giving physical resources to SOHFOs but not receiving any from those SOHFOs.

In spreading physical resources at SOHFOs of local umbrella NGOs, results

(Table 1 and Table 2) show that at SAT in the networks of SOHFOs with other OHVCAs, most of OHVCAs including SOHFOs had weak networks. In Floresta Tanzania, in spreading of physical resources between SOHFOs and other OHVCAs the findings (Table 1 and Table 2) show that for OHVCAs including SOHFOs, comparatively to SAT most of them had strong networks. Based on the findings, at Floresta Tanzania more SOHFOs have strong ability to spread inputs and implements supply (whether hoes, watering facilities, organic seeds and organic matters for production of manure) and marketing of organic horticultural products (including Chinese cabbage, sweet peppers, carrots and collard greens) to other OHVCAs than at SAT. One reason for such discrepancy is different ways of handling physical resources in the said NGOs. While both NGOs were involved in providing farm inputs to their SOHFOs, Floresta Tanzania had not been purchasing the organic horticultural products from SOHFOs. This consequently has influenced the nature of SOHFOs at Floresta Tanzania in aggressiveness if seeking markets for their products. For the case of SAT, SAT purchases directly some of the organic horticultural products from SOHFOs. Consequently, this resulted into SOHFOs at Floresta Tanzania increasing their networks with other actors who could purchase their products. The findings suggest that when local umbrella NGOs strengthen SOHFOs to sell their products to other OHVCAs, they can produce many networks and thus resulting into better positioning of SOHFOs in the OHVC. Another factor that has helped SOHFOs at Floresta Tanzania to market their organic horticultural products is availability of private business companies including Seeds of Expertise for the Vegetable Sector of Africa (SEVIA)-Moshi, Home Veg Exporting Company-Arusha, Africado-Sanya Juu and Serengeti Fresh. This shows the importance of various stakeholders to create conducive environment for SOHFOs that allows them to access various OHVCAs for remarkable results.

3.2. Role Played by Other OHVCAs towards SOHFOs in the Organic Horticultural Value Chain in Enhancing Organic Horticultural Sector in Tanzania

The actors mentioned to work with SOHFOs are identified and the role they play while participating in flow of knowledge and information; and physical resources is well articulated. Networks amongst SOHFOs are not covered here, since they were largely discussed in previous parts. Furthermore, in flow of physical resources, some of the activities of value chain nodes (for example distribution) are not well covered in networks. This is due to the fact that, though SOHFOs members are transporting their organic horticultural products, they are not aware of any transport agent who is commonly used to distribute their products except for local umbrella NGOs.

The results (Table 3) indicate that there was a flow of knowledge and information between SOHFOs under NGOs and other OHVCAs, including higher learning and research institutions; local governments; local, international and foreign NGOs, associations, business companies; and local agrovets. However, most of the other OHVCAs including certification and standardization organizations (on participatory

guarantee system as locally developed certification system), particularly TOAM, have managed to interact with below 50% of the SOHFOs under NGOs. Only local umbrella NGOs were able to interact with all SOHFOs. Furthermore, most organizations have disseminated the knowledge and information on organic practices to SOHFOs that mainly fall under production as shown in **Table 3**. Few were focusing on inputs supply, processing and marketing information and none was disseminating knowledge and information on distribution, packaging and storage of organic horticultural products produced in SOHFOs. This makes the activities found in node 5 related to marketing and distribution of the OHVC to be fulfilled partially, whereby information is disseminated on marketing and not on distribution. The findings imply that other OHVCAs, particularly local umbrella NGOs are the key actors with strong networks with all SOHFOs. Furthermore, most of the knowledge and information on organic practices disseminated to SOHFOs is mainly focused on production. This is revealed by the knowledge found in SOHFOs on how to practice organic production and introduction of new types of vegetables and fruits that were not present prior to NGOs interventions. The fact that there is scant information that is disseminated on inputs supply, processing and marketing and none on distribution, packaging and storage, connote limited potentiality for growth of SOHFOs in such areas.

Table 3. Role played by OHVCAs in the OHVC in flow of knowledge and information resources to SOHFOs.

Actors	Stakeholders Involved	Role in the OHVC	Contacted SOHFOs
Local Umbrella NGOs/intermediary NGOs	Sustainable Agriculture Tanzania (SAT) and Floresta Tanzania have disseminated the knowledge and information on organic practices to SOHFOs on use of soil nutrient management practices, i.e. mulching and composting, crop rotation, intercropping, making, usage and storage of organic pesticides, making, usage and storage of organic manures, preparing nurseries, planting new types of fruits and vegetables to establish in their areas and preparing local irrigation systems. Few SOHFOs have received information on processing and marketing of their products where by, they have learnt to locally produce jam and fruits juice and dry fruits and vegetables.	2, 4 and 5	167 (100%)
Certification and standardization organizations	Tanzania Organic Agriculture Movement (TOAM), Tanzania Food and Drugs Authority (TFDA), Tanzania Bureau of Standards (TBS) have visited the SOHFOs, disseminate the knowledge and information on organic practices and approve the SOHFOs by using Participatory Guarantee System (PGS).	2	26 (15.6%)
Higher learning and research institutions	Sokoine University of Agriculture (SUA) Tropical Pesticides Research Institute (TPRI), Tanzania Official Seed Certification Institute (TOSCI), Tengeru Horticulture Institute have done some research on seeds, diseases facing vegetables and fruits and work with SOHFOs to eradicate them; and drying vegetables.	1, 2, 4	17 (10.2%)
Local governments	Village governments, Ward Government and District Business Officer have disseminated the knowledge and information on group development and entrepreneurial skills.	2, 5	24 (14.4%)

Continued

Local NGOs	NGO_WMED, Water and Irrigation organization have shared with SOHFOS on how to irrigate and use of various organic practices.	2	2 (1.2%)
International NGOs	OYE/SNV have disseminated the knowledge and information on organic practices including use of greenhouse to SOHFOS at SAT.	2	2 (1.2%)
Foreign NGOs	Organizations from Uganda, Italy and Swiss Contact have shared with SOHFOS on various organic practices.	2	3 (1.8%)
Associations	Tanzania Horticultural Association (TAHA), Tarci Farmer Cooperative, Tanzania Airport Authority (TAA) have mainly shared with SOHFOS on various organic practices and their marketing.	2, 5	3 (1.8%)
Business Companies	Seeds of Expertise for the Vegetable Sector of Africa (SEVIA)-Moshi, Home Veg Exporting Company-Arusha, Serengeti Fresh have disseminated the knowledge and information on organic practices to SOHFOS at Floresta Tanzania. They also introduced new horticultural products including baby corns (Serengeti Fresh) and peas (Home Veg Exporting Company-Arusha).	1, 2, 5	3 (1.8%)
Local agrovets	Many of them are owned via sole proprietorship. They have mainly shared with SOHFOS on various organic practices including the handling of seeds and seedlings.	1, 2	17 (10.2%)
Banks and financial institutions	NMB has disseminated the knowledge and information on group development and financial literacy particularly importance of savings for enhanced organic production to 1 SOHFO at Floresta Tanzania.	2	1 (0.6%)

The subsequent numbers denote the type of knowledge and information provided by the OHVCAs particularly the fruits and vegetables and the role they play in supporting SOHFOS in terms of 1 = inputs supply; 2 = production; 3 = packaging and storage; 4 = processing and 5 = distribution and marketing. Key for networking = above 50% networking = Strong networks, below 50% networking = weak networks.

The findings concur with the results of interview made to DCDO in Rombo District who said that:

“Floresta Tanzania is familiar to me, its leaders came and introduced themselves to me, they have been giving written reports. For effective results, I recommend relationships via meetings and special platform to harmonize availability of various knowledge and information; and physical resources for SOHFOS. Mobilization of efforts between District Council, Floresta Tanzania and other actors in the sector is important. The relationships provide a chance of diversity and avoiding duplication. One advantage of the platform is to seek markets for SOHFOS” (KII, Rombo, October 2019).

This continues to indicate that, there was poor value chain coordination due to lack of a platform that can harmonize the flow of knowledge and information; and physical resources flow between SOHFOS and other OHVCAs in OHVC. Again, the study findings concur with those of [Lemma et al. \(2008\)](#) who did their study on Ethiopian smallholder dairy value chain for innovation system. They authors argued on weak networks in terms of poor organization between local dairy producers and other vertically coordinated value chain actors which hampers more progress in the sector.

Nevertheless, some few concerns were evident in production information disseminated, including presence of reject fruits and vegetables. For instance, in an interview with one SOHFO member, it was revealed that, out of 700kgs of avocados that were to be sold by that SOHFO, 200kgs were rejected. The findings are in line with the study by [VSO-ICS Volunteers \(2015\)](#) which shows that smallholder farmers on horticultural value chain in Zanzibar face challenges of unreliable information on marketing, prices uncertainty and access to low-priced way to transport their products to the markets. With these findings, it is plausible for SOHFOs in the similar value chain to come across the same challenges. The challenges of timely and more relevant information on marketing consequently affect their capacity in various ways including provision of quality and marketable products. This is also argued by [Liverpool-Tasie et al. \(2020\)](#) and [Saarelainen and Sievers \(2012\)](#) who assert that SFOs' operations in developing countries including Sub-Saharan Africa countries have continued to be affected by various matters including capacity constraints in terms of technical knowledge, poor participation in the value chain, high transaction costs, financial constraints, and buyers' market power. As earlier observed, most of the said challenges in SFOs are perpetuated by information asymmetry and poor access to the reliable market. Again, this is expected to be so for the SOHFOs under NGOs in Tanzania.

In flow of physical resources ([Table 4](#)) (including giving inputs, i.e. hoes, watering facilities, organic seeds and purchasing of organic products, i.e. Chinese cabbage, sweet peppers, carrots and collard greens), the results show that while local umbrella NGOs interact with all SOHFOs, most OHVCAs including local markets, local agrovets, learning institutions, international NGOs, associations, business companies, sole proprietors, secondary and primary schools, dispensaries, local food vendors and religious institutions have received or given physical resources to less than 50% of the SOHFOs. With regard to OHVC activities in flow of physical resources as shown in [Table 4](#), most of OHVCAs have focused on inputs supply, production and marketing. Few have dealt with processing and distribution and no organization has dealt with packaging and storage.

The study findings show that in flow of physical resources, local umbrella NGOs are key actors in interacting with SOHFOs followed by local markets and local agrovets. This implies that, SOHFOs under NGOs receive or give physical resources that were mainly focusing on production, inputs supply (including hoes, watering facilities, seeds) and marketing (organic horticultural products). Furthermore, the results indicate scant services by OHVCAs which are available for SOHFOs on processing and distribution of their horticultural products. In the same vein, there is lack of services and facilities by OHVCAs dealing with packaging and storage of horticultural products. The findings concur with those of [Temu and Marwa \(2007\)](#) who compiled evidence on changes in governance of global value chains of horticultural products in Sub-Saharan Africa countries and argued that challenges on availability of facilities, equipments and other infrastructures for horticultural

production affect the participation of smallholder farmers in the global value chain. With these findings it is plausible for the challenges to happen to SOHFOs in the OHVC whether for countries' internal or external markets of organic horticultural products. Again, similar findings in other way are insisted by [Liverpool-Tasie et al. \(2020\)](#), who argued about persistence of problems such as high transaction costs, buyer's market power, poor involvement of SFOs in the value chain is accelerated by lack of reliable facilities, equipments and infrastructures.

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Table 4. Role played by OHVCAs in the OHVC in flow of physical resources to SOHFOs.

Actors	Type of Physical Resources Flow to SOHFOs	Role in the OHVC	Contacted Organizations
Local umbrella NGOs/ intermediary NGOs	SAT and Floresta Tanzania have provided farm inputs for organic horticultural production including irrigation equipment and seeds to SOHFOs. SAT also buys from SOHFOs fruits and vegetables and sometimes involved in distribution.	1, 2, 4, 5	167 (100%)
Local markets	Mkuyuni, Kiroka, Mlali, Lolo, Chamwino, Soweto and Kariakoo markets for SAT, and Sanya Juu, Mwika, Moshi Urban, Lawate, Himo, Mamba Mtoni, Border Taveta and Njia panda markets and others act as important centres for SOHFO to sell their vegetables and fruits.	5	58 (34.7%)
Local agrovets	Morogoro Urban, Dar es Salaam city, Kiloka, Mgeta agrovets Kiziga, Isanja, Akyoo, Sayuni, Seti, Amani, Sayuni, Sayoni agrovets and others have provided farm inputs for organic horticultural production including farming equipment and seeds to SOHFOs.	1	41 (24.6%)
Learning institutions	SUA enhance SOHFOs members access to seeds and have conducted Land survey and doing analysis/measurements on various soil types in some SOHFOs at SAT, Marangu Teaching Training College purchases the vegetables from SOHFOs.	1, 5	6 (3.6%)
International NGOs	OYE/SNV have provided irrigation equipments and greenhouse to 1 SOHFO.	1	1 (0.6%)
Associations	Tanzania Horticultural Association (TAHA) buys vegetables from SOHFOs.	5	1 (0.6%)

Continued

Business companies	Aqua Alignment company for water pump, Dynamo-Arusha for vegetables and fruits drying machines, Home Veg Exporting Company-Arusha, Africado-Sanya Juu and Serengeti Fresh have provided farm inputs for organic horticultural production including seeds to SOHFOs. They also buy from SOHFOs fruits and vegetables.	1, 5	8 (4.8%)
Sole proprietors	Hindi Sole Proprietor and Local Sole Proprietor shops and hardwares.	5	11 (6.6%)
Secondary and primary schools	Tomondo Secondary School and Kungwe Primary School for SAT, Magadini Primary School, Fuka Primary School, Lawate Primary School, Upendo Kirimeni Primary Schools buy vegetables from SOHFOs.	5	6 (3.6%)
Dispensaries	Kungwe and Oloshaik-Magadini Dispensaries buy vegetables from SOHFOs.	5	2 (1.2%)
Local food vendors	They are present in SAT and Floresta Tanzania and they buy vegetables from SOHFOs.	5	3 (1.8%)
Religious institutions	Kirimeni Lutheran Church, Masia Mshiri Church, Ngaruma Church, Kirisha Lutheran Church, Saint Joseph church-Kokrie, Mengwe Nun's Catholic House and others buy vegetables from SOHFOs.	5	7 (4.2%)
Hotels	Capricon Hotels-Marangu buys vegetables from SOHFOs.	5	1 (0.6%)

The subsequent numbers denote the type of knowledge and information provided by the OHVCAs, particularly the fruits and vegetables and the role they play in supporting SOHFOs in terms of 1 = inputs supply; 2 = production; 3 = packaging and storage; 4 = processing and 5 = distribution and marketing. Key for networking = above 50% networking = strong networks Below 50% networking = weak networks.

The study findings show that in flow of physical resources, local umbrella NGOs are key actors in interacting with SOHFOs followed by local markets and local agrovets. This implies that, SOHFOs under NGOs receive or give physical resources that were mainly focusing on production, inputs supply (including hoes, watering facilities, seeds) and marketing (organic horticultural products). Furthermore, the results indicate scant services by OHVCAs which are available for SOHFOs on processing and distribution of their horticultural products. In the same vein, there is lack of services and facilities by OHVCAs dealing with packaging and storage of horticultural products. The findings concur with those of [Temu and Marwa \(2007\)](#) who compiled evidence on changes in governance of global value chains of horticultural products in Sub-Saharan Africa countries and argued that challenges on availability of facilities, equipments and other infrastructures for horticultural production affect the participation of smallholder farmers in the global value chain. With these findings it is plausible for the challenges to happen to SOHFOs in the OHVC whether for countries' internal or external markets of organic horticultural products. Again, similar findings in other way are insisted by [Liverpool-Tasie et al. \(2020\)](#), who argued about persistence of problems such as high transaction costs, buyer's market power, poor involvement of SFOs in the value chain

is accelerated by lack of reliable facilities, equipments and infrastructures.

4. Summary and Concluding Remarks

The findings show that most SOHFOs under NGOs are interacting with limited capacity in disseminating technological and marketing knowledge and information, spreading inputs to other SOHFOs, marketing their organic horticultural products and bridging the resources to other OHVCAs. This has reduced the capacity of SOHFOs to benefit from value chain in terms of failure to cut their transaction costs, increase their bargaining power and their economies of scales in purchase/sale of their goods. Furthermore, based on contextual variability, SOHFOs using virtual boundary objects such as web platforms that are strategically employed, established in areas with water availability and high geographical proximity (low functional distance between SOHFOs) are in better position in networks and participation in the OHVC compared to their counterparts. Again, local umbrella NGOs that strengthen SOHFOs in selling their products to other OHVCAs enable the SOHFOs to position better in the OHVC. It is also concluded that creating enabling environment via presence of OHVCAs in areas surrounding SOHFOs is paramount for remarkable results of SOHFOs. This may involve clustering of various actors to simplify service provision to SOHFOs.

This study is built up on social network theory. The theory argues on importance of networks between actors over attributes of individuals in consequences obtained. It is important to point out that, generally, the findings concur with the theory. This is because the areas in the OHVCAs where SOHFOs under NGOs have strong networks, whether in disseminating knowledge and information, spreading physical resources or bridging flow of knowledge and information and physical resources, have experienced some observable benefits from the value chain (mainly input supply and production, and marketing). Again, the areas in the OHVCAs where SOHFOs have weak networks (processing, distribution, packaging and storage) have remained dormant. This again has reduced the capacity of SOHFOs to cut their transaction costs, increase their bargaining power and their economies of scales in purchase/sale of their goods, and hence increase competitiveness of their organic horticultural products. This is revealed by failure of SOHFOs to obtain proper organic seeds, reliable markets, proper market structures (including decentralized, cleaning, grading and cold rooms), inadequate processing and packaging and reliable transport of organic horticultural products.

The study also adds knowledge on the social network theory, whereby it suggests that when local umbrella (in this case, NGOs) strengthens SOHFOs to sell their products to other OHVCAs, they can produce many networks and thus resulting in better positioning of SOHFOs in the OHVC. Creation of enabling environment via presence and clustering of various OHVCAs in areas surrounding SOHFOs is paramount for remarkable results of SOHFOs participation in OHVC. This could allow observation on how different management styles ultimately influence their experiences in flow of knowledge and information, and physical

resources that are concerned with the study.

We call for various actors (public and private sector actors) to provide room and strengthen ability of SOHFOs to disseminate knowledge and information amongst themselves and market their organic products to other OHVCAs. The actors are also needed to support processing and distribution and establish packaging and storage facilities of SOHFOs' horticultural products. There is a need for policy-makers and implementers to re-evaluate knowledge and information, and physical resources provided to SOHFOs. Again, this includes thorough assessment of the capacity of SOHFOs to receive such resources and reasons behind the current networking (whether poor or strong networks). This can be accomplished with the aim of establishing and strengthening linkages amongst SOHFOs and between SOHFOs under NGOs and other actors in the organic horticultural sector in Tanzania. This is so crucial to SOHFOs and other OHVCAs for realization of value chain benefits. This study focused on SOHFOs under NGOs to see how they interact with other actors in the OHVC. Further studies can be done by focusing on networks of SOHFOs with other OHVCAs with perspective of extent/intensity of networks. Other studies can observe available potential marketers, processors, distributors and consumers to see their interests, dynamics and challenges and the way they can interact with SOHFOs under NGOs in provision of knowledge and information, and physical resources.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Interview Schedule for Leaders of Farmer Organizations on Assessment of Inter-Organizational Networks of Smallholder Organic Horticultural Farmer Organizations under Local Umbrella NGOs and Their Change in Two Selected Regions in Tanzania

This tool was used for collection of data. The first part is intended to collect data on characteristics of various Small-holder Organic Horticultural Farmer Organizations under local umbrella NGOs. The second part and the last was expected to collect data on inter-organizational networking. The difference of the tables in part two lies in type of re-source that flow, direction of flow and whether the flow was amongst Smallholder Organic Horticultural Farmer Organizations under local umbrella NGOs or between Smallholder Organic Horticultural Farmer Organizations under local umbrella NGOs and other organizations. This aimed at observing horizontal as well as vertical patterns of networking. The inclusion of the nodes(actors) of the horticultural (fruits and vegetables) value chain is not seen in the tool. Otherwise, demarcations between various actors in the value chain were established during data analysis.

Enumerator's name _____

Date of interview _____

1.0 Farmer Organization Characteristics

1.1	Respondent's identity	
1.2	Respondent's Sex	
1.3	Title of the respondent	
1.4	Farmer organization name	
1.5	Year of establishment of farmer organization	1 = Within SAT/FLORESTA TANZANIA 2 = Without SAT/FLORESTA TANZANIA
1.6	Number of members in farmer organization	1. Male = 2. Female = 3. Total =
1.7	Status of registration of farmer organization	1 = Registered 2 = Not registered

2.0 Networks of Smallholder Organic Farmer Organizations under Local Umbrella NGOs in Tanzania

2.1 Among various farmer organizations, tell the ones your farmer organization is getting knowledge and information on issues related to organic agriculture.

Farmer organization	Mention type of information and knowledge you are getting	Mention the frequency of getting knowledge and information since establishment of your organization to 2018	Mention means of information exchange: 1 = Informal meetings; 2 = Formal meetings; 3 = Training (short course, seminar/workshop); 4 = Demonstration plots/trails; 5 = Farmer to farmer extension; 6 = Observation; 7 = Farmers study tours and exchange; 8 = Others (specify)
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2.2 Among various farmer organizations, tell the ones your farmer organization is giving knowledge and information on issues related to organic agriculture.

Farmer organization	Mention type of information and knowledge you are getting	Mention the frequency of getting knowledge and information since establishment of your organization to 2018	Mention means of information exchange: 1 = Informal meetings; 2 = Formal meetings; 3 = Training (short course, seminar/workshop); 4 = Demonstration plots/trails; 5 = Farmer to farmer extension; 6 = Observation; 7 = Farmers study tours and exchange ;8= Others (specify)
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2.3 Indicate relationship you have with the organizations indicated below in getting knowledge and information about organic agriculture between year of establishment to 2018.

Organization	Mention type information and knowledge you are getting	Mention the frequency of getting knowledge and information since establishment of your organization to 2018	Mention means of information exchange
TOAM			
SAT			
Floresta Tanzania			

Continued

Researchers/research institutes
(specify)

Training institutions
(specify)

LGAs through extension agents
(specify)

Farmer cooperatives
(specify)

Village government office

Ward government office

International NGOs (specify)

Local NGOs (specify)

Research Centres (specify)

Others (specify)

2.4 Indicate relationship you have with the organizations indicated below in giving Knowledge and information about organic agriculture between year of establishment to 2018.

Organization	Mention type information and knowledge you are giving	Mention the frequency of giving knowledge and information since establishment of your organization to 2018	Mention means of information exchange
TOAM			
SAT			
Floresta Tanzania			
Researchers/research institutes (specify)			
Training institutions (specify)			
LGA through extension agents (specify)			

Continued

- Farmer cooperatives
(specify)
 - Village government office
 - Ward government office
 - International NGOs (specify)
 - Local NGOs (specify)
 - Research centres (specify)
 - Others (specify)
-

2.5 Among various farmer organizations, tell the ones you are getting physical resources such as seeds, seedlings, organic manure, land and water for organic agriculture.

Farmer organization	Mention physical resources you are getting	Mention the frequency of getting physical resources since establishment of your organization to 2018
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2.6 Among various farmer organizations, tell the ones you are giving physical resources such as seeds, seedlings, organic manure, land and water for organic agriculture.

Farmer organization	Mention physical resources you are giving	Mention the frequency of giving physical resources since establishment of your organization to 2018
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2.7 Indicate how you relate with the organizations indicated below in terms of getting organic agriculture physical resources between the year of establishment to 2018.

Organization	Mention type of physical resources you are getting	Mention the frequency of getting physical resources since establishment of your organization to 2018
TOAM		
SAT		
Floresta Tanzania		
Training institutions (specify)		
LGA through extension agents (specify)		
Farmer cooperatives (specify)		
Village government office		
Ward government office		
International NGOs (specify)		
Local NGOs (specify)		
Bank (specify)		
Savings and credit societies (VICOBA, SACCOS, VSLA) (specify)		
Supermarkets (specify)		
Organic shops (specify)		
Hotels and restaurants (specify)		
Responsible body for preparation of organic seeds in Tanzania		
Others (specify)		

2.8 Indicate how you relate with the organizations indicated below in terms of giving organic agriculture physical resources between the year of establishment to 2018.

Organization	Mention type of physical resources you are giving	Mention the frequency of giving physical resources since establishment of your organization to 2018
TOAM		
SAT		
Floresta Tanzania		
Training institutions (specify)		
LGA through extension agents (specify)		
Farmer cooperatives (specify)		
Village government office		
Ward government office		
International NGOs (specify)		
Local NGOs (specify)		
Bank (specify)		
Savings and credit societies (VICOBA, SACCOS, VSLA) (specify)		
Supermarkets (specify)		
Organic shops (specify)		
Hotels and restaurants (specify)		
Responsible body for preparation of organic seeds in Tanzania (TOSCI)		
Others (specify)		

Thank you for your cooperation.