



**Veggies 4 Planet
& People**

PARTICIPATORY APPRAISAL REPORT FOR KENYA:

Kiambu, Murang'a, Machakos, Kisumu,
Vihiga and Kakamega Counties



Report Compiled by
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World Vegetable Center
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World Vegetable Center

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SNV



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LIST OF ABBREVIATIONS AND ACRONYMS

AVBC	African vegetable Breeding Consortium
CBO	Community Based Organization
CIDP	County Integrated Development Plan
FGD	Focus Group Discussion
GAPs	Good Agricultural Practices
IPM	Integrated Pest Management
KALRO	Kenya Agriculture and Livestock Research Organization
KES	Kenya Shillings
KEPHIS	Kenya Plant Health Inspectorate Service
Kg	Kilogram
KII	Key Informant Interview
NGO	Non-Governmental Organization
PA	Participatory Appraisal
SNV	The Netherlands Development Organization
TAV	Traditional African Vegetables
VBN	Vegetable Business Network
V4P&P	Veggies for Planet and People
WorldVeg	World Vegetable Center

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EXECUTIVE SUMMARY

The participatory appraisal study analyzed the Vegetable business networks and traditional African vegetable (TAV) value chains in six project counties (Kiambu, Murang'a, Machakos, Kisumu, Vihiga, Kakamega.). The aim of the PA was to identify challenges, weaknesses and opportunities that exist within the TAVs value chain and propose solutions that will increase effectiveness and efficiency along the value chains for increased income, employment and nutrition. Data for the study was collected using qualitative methods i.e. 6 focus group discussions with VBNs and 42 in depth interviews with main stakeholders in TAVs value chain.

The findings of the study indicate that VBNs provide an avenue for training, capacity building and follow up that has increased production through GAP, increased awareness and adoption of regenerative agriculture. The VBNs are mostly composed of Producers with women and youth actively participated in the VBNs but biased towards certain activities. The women are biased towards seed production while the youth are interested in vegetable varieties that have a quick turn over (short production cycles e.g Amaranth, Cow peas) and in technologies that reduce laborious work associated with vegetable production. There is low Low uptake in aggregation models due weak governance systems within VBNs and lack of trust within farmer organizations and traders.

The prioritized TAV in Kiambu, Murang'a, Kisumu, Vihiga and Kakamega Counties is African nightshade while Machakos county has prioritized cow pea leaves. These TAVs are preferred because they are highly marketable, culturally accepted and are well adopted to local ecological conditions. The findings on seed systems assessment indicate that seeds for TAVS are sourced from both formal and informal seed sources. The formal channels include Agrovets, seed companies, research organizations (KALRO centers). The informal sector includes (Local markets, Seed banks , Seed exchange among farmers ,Own seed (farmer saved seeds) and Village seed traders. Most of the TAVs seeds are sourced from the informal sector with a huge demand gap for the cowpea seed which is not readily available through the formal seed sector. The perceived quality of seed varies depending on the source of the seeds where seeds from the formal sources are perceived to be of better quality than those from the informal sources whose quality is relatively poor because of low germination percentages, infestation by pests, poor storage, varietal impurities, lack of skills in proper harvesting and processing techniques.

VBNs have adopted several regenerative technologies where composting, use of manure and mulching are widely adopted. IPM practices such as the use of repellent crops i.e. Mexican marigold & spring onions, botanical extracts and sticky traps have been adopted

in Kiambu, Murang'a and Vihiga counties. Key reasons for adoption of regenerative practices include lowering the cost of production, ineffective chemical pesticides and concerns about food safety. The main concerns raised in the adoption of regenerative technologies were lack of organic product differentiation in the market outlets, poor market linkages, production losses in the initial years of adoption, and poor access to biopesticides.

Producers have adopted a market-oriented approach because they are keen to only produce what they can sell in the market. The commonly used marketing channels for TAVs by the VBNs are the local spot markets and aggregators /brokers who buy at farm gate and dictate prices especially during the rainy seasons (excess production). The preferred channels are wholesalers in urban market and Retailers (supermarkets, grocery shops, hotels, Mama mbogas, hotels and eateries). However, most VBNs are not able to access the preferred markets due to seasonality in production, poor market linkages, low production volumes, strict quality standards required by some market outlets, long credit days, lack of trust or contractual agreements between producers and traders and cartels operating in the main markets. Value addition for the TAVs is limited to sorting grading and cleaning due to inadequate knowledge on Value addition technologies and markets for value added/processed products (dried vegetables). Post-harvest losses are mainly incurred at marketing level due to poor transportation and unsold produce because of lack of storage or cooling facilities in most markets. Access to loans from banks and microfinance institution is limited to traders and agro-dealers. The main source of loans for the VBNs is table banking, rotational savings and mobile money platforms like M-shwari, KCB Mpesa, Tala among others.

The study gave several recommendations to close the identified gaps in the value chain and exploit the identified opportunities. The VBNs should be trained on collective action, marketing and governance and supported to develop a marketing strategy that will be implemented to increase market access. The project should target to promote farmer seed systems through capacity building and provision of improved technologies to mechanize seed production and enable individual farmers produce, dry, store and sell quality seeds to VBNs and farmers. Farmers should also be linked to seed companies or research organizations for contractual production of TAVs seed. The project should invest in simple cost-effective technologies that could be displayed at learning sites to create awareness, ascertain their effectiveness, reduce levels of risks, and promote adoption. The project should have interventions to stimulate demand of TAVs through media campaigns while putting in place effective and reliable market linkages. Seasonality in production can be reduced through training farmers on water conservation methods and linking them to irrigation service providers whom can supply them with irrigation kits at flexible repayment terms.

1.0 INTRODUCTION

1.1 Introduction

The World Vegetable Center (WorldVeg) is an international nonprofit Research and Development Institute committed to alleviating poverty and malnutrition in the developing world through the increased production and consumption of nutritious and health-promoting vegetables. WorldVeg is currently implementing a project known as 'Veggies for Planet and People (V4P&P)' funded by the IKEA foundation (The Netherlands). The five-year project (July 2020 - June 2025) aims to create jobs and income, particularly for youth and women, in the vegetable sector in Ethiopia and Kenya, and to improve environmental and human health through safe production of vegetables. The project is being implemented in the Central and Western Kenya regions and covering 6 counties namely Murang'a, Kiambu, Machakos, Kisumu, Vihiga and Kakamega counties. The project activities in Kenya are implemented in collaboration with SNV. The Key intervention areas are;

1. Identification and strengthening of VBNs: The project has engaged 'business champions' to guide the formation of Vegetable Business Networks (VBNs) of women and youth as they pursue collective action in vegetable production and marketing in urban and peri-urban areas. The champions will facilitate their networks with access to information, business development services, input/output markets, and serve as liaisons with local governments.
2. Promotion of regenerative and circular technologies: The VBNs will be trained on regenerative, circular agriculture /agroecological technologies, business skills, and group dynamics using a gender-sensitive approach. The use of climate and pest resistant vegetable varieties, circular good agricultural practices, efficient irrigation management and IPM practices will ensure safe and sustainable vegetable production for producers, consumers and the planet. The VBNs will also provide a learning platform where technologies will be piloted and scaled.
3. The third intervention area is strengthening commercial vegetable seed systems: This will be achieved by working with existing seed companies in Kenya through African vegetable Breeding Consortium (AVBC). This will ensure that producers have timely access to quality seed which is fundamental for safe and sustainable vegetable production.
4. Awareness and demand creation for sustainable technologies, business services, seeds, other inputs, and safe vegetables and vegetable products.

The project will particularly focus on women and youth (defined as people aged 18-35 years old) by purposively selecting them as project beneficiaries while working with the VBNs. The strengthening of the VBNs will contribute to the social empowerment of youth and women and allow them to seize market opportunities within the vegetable value chain leading to sustained improvement of income and nutrition.

The aim of the participatory appraisal of the VBNs and traditional African vegetable (TAV) value chains is to enable the stakeholders to identify challenges, strengths, weaknesses and opportunities that exist within the TAVs value chain and propose solutions that will increase effectiveness and efficiency along the value chains for increased income, employment and nutrition.

1.2 Objectives of the participatory appraisal.

- i) To understand how the seed supply and distribution systems can be strengthened to enhance the availability, utilization and quality of TAVs seed for vegetable producers.
- ii) Explore the current practices being used in soil and pest management and get insights on the knowledge and perceptions of VBNs on the use of regenerative technologies/ practices in the production of TAVs.
- iii) To enable VBNs to jointly identify problems, prioritize needs, and propose solutions that will improve performance of the VBNs in the vegetable value chain.
- iv) To get insights into the gender aspects in the VBNs especially the needs, motivations, interest, opportunities and challenges facing Women and youth in the vegetables value chain.
- v) Facilitate participatory learning, experience sharing and feedback that will improve and align project interventions to the prioritized needs of the project stakeholders and beneficiary target groups.

2.0 METHODOLOGY

2.1 Materials and Methods

2.1.1 The study sites

The study was conducted in 6 major traditional vegetable producing counties (Project area) namely Kisumu, Kakamega, Vihiga, Kiambu, Murang'a and Machakos Counties. In total 6 VBNs have been sampled to take part in the participatory study, one VBN per County that are within the project areas.

2.2.2 Study approach and data sources

The participatory study was conducted using qualitative methods to get insights and understand the challenges, opportunities and proposed interventions to improve the vegetable traditional value chain. Semi structured in depth interviews were conducted with key informants including VBN coaches, officers from the Department of Agriculture, vegetable traders, aggregators, input suppliers, service providers, cooperative societies and institutions (NGOs) supporting the vegetable value chains in the project areas. Focus group discussions were conducted with the selected VBNs to understand the operations

of the VBNs and give an in-depth understanding on the vegetable value chains within the project areas.

Purposive sampling for the study was used in the selection of the VBNs and key informants . VBNs were selected based on their potential for vegetable production and their understanding of the vegetable sector which would ensure they provide data that is useful to address the objectives of the study. Key informants were selected based on having a good knowledge, in depth understanding and experience working with the actors in the vegetable value chains.

Participatory rural appraisal tools were used to collect data from key informant interviews (KII) and focus group discussions (FGD) . In total 6 FDG were conducted, one per county where the project is being implemented. The FGD consisted of a members of a producer VBN. The average number of respondents in a FGD ranged from 5 -10 and the discussion took about 60 - 90 minutes. In total, 42 semi-structured key informant interviews have been conducted, 7 per county. The key informant interviews lasted 30 - 40 minutes each.



Focus group discussion session in Murang'a county
Kisumu

A key informant interview in

The focus group guide and semi- structured in-depth interview guides captured all the areas of data collection. The Focus group discussions and KII were audio recorded, and notes were taken during the discussions. The interview guides focused on four main sections as indicated below

1. Section One: Structure and management of the VBNs.
2. Section Two: TAV seed supply and distribution networks.
3. Section Three: Regenerative vegetable production and post-harvest technologies.
4. Section Four: Market and marketing channels of TAVs.

Issues related to women and youth empowerment and participation in the VBNs and TAVs value chain were captured across all the sections.

2.2 Data analysis and reporting

The data collected from in-depth interviews were analyzed to identify, examine and interpret meaningful patterns and themes that emerged in order to address the project objectives. Data analysis followed the process of data transcription, data reduction, data display and conclusions to identify and categorize main themes emerging under the five key sections captured in the interview guides. Data transcription was done continuously throughout the data collection period.

A combination of within and cross case analysis was adopted in data analysis to identify unique patterns of each county and VBN before comparisons of cases were made. Within case analysis was done using respondent 'quotes' to illustrate identified themes. The data collected from the FGDs and KII were triangulated to compare findings from the different respondent groups.

3.0 RESULTS

The results of the Participatory appraisal will be presented under four main chapters

- a) Chapter One: Structure and management of VBNs.
- b) Chapter Two: Seed systems assessment.
- c) Chapter Three: Awareness and use of regenerative vegetable production technologies.
- d) Chapter four: Markets and marketing channels of TAVs.

3.1 Structure and management of the VBNs.

The study found that the structure and management of the farmer groups referred to as VBNs by the V4P&P project was similar across the six counties.

The VBN organizational structure generally adopted is as shown in figure 1 below.

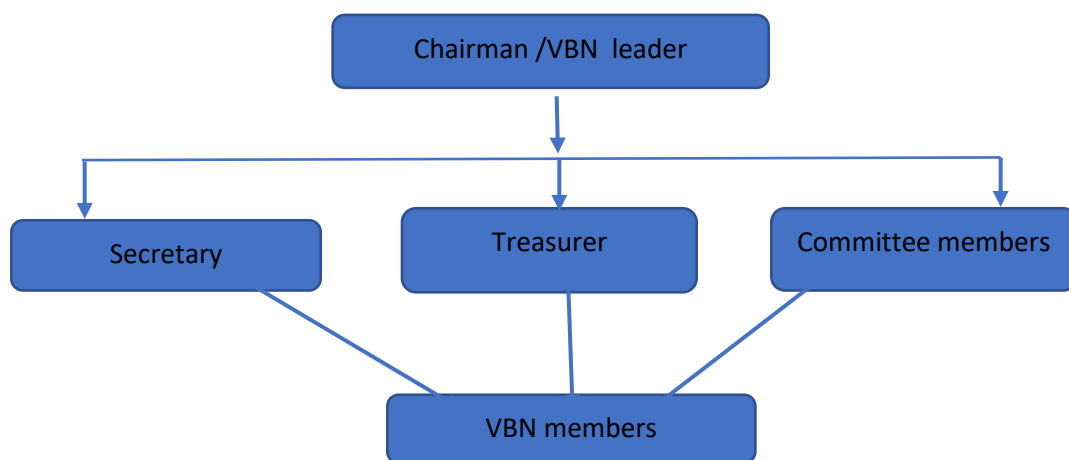


Figure 1: Organizational structure adopted by most VBNs in the project areas.

Decision making within the VBNs is democratic, where members consult each other and agree by voting. The officials of the groups are also elected democratically and serve without being paid. Apart from the chairperson or VBN leader, secretary and treasurer, the groups have an additional office for the committee members whose main aim is to represent the views of the other members in cases where decisions are made on emergency basis. Most of the VBNs have a constitution and formal group rules that guide their operations.

3.1.1 VBN activities

The VBNs are engaged in multiple activities

1. Vegetable and other crop production
2. Livestock keeping
3. Table banking or merry go rounds:- This has increased access credit for members, however, the amount of loans issued is pegged on savings making it difficult to get substantial loans that could improve production.
4. Organizing joint learning and training forums; sharing ideas, challenges and solutions :- This is the most common activity that is cross cutting among all VBNs where ,their main role is to provide an avenue for training, capacity building and follow up that has increased production through GAP and increased awareness and adoption of regenerative agriculture.
5. Sharing market information
6. Collective marketing
7. Joint purchase of inputs (manure, seeds)
8. Biopesticides preparation (Murang'a & Kiambu Counties)
9. Welfare support for members, especially during funerals and other instances as stipulated in their constitutions and rules.

Individual production models for different enterprises including TAVs have been widely adopted where the members produce at their individual level but come together for specific activities e.g trainings. However, a few VBNs have adopted a model of joint production, especially in Kisumu and Kakamega Counties, where groups have a central plot of land where they carry out communal production and sale of vegetables. In addition, members have their own individual enterprises.

Incentives to become a member of a VBN

The VBNs have on average about 20 members of whom 70% are active members. The VBNs have a good mix of both women and youth and some have members with disabilities. The VBNs were already existing as groups before the V4P&P project started.

The key force that drew the group members together is a common objective. Perceived benefits drove VBN members to join the group, such as:

- i) Access to knowledge, skills and follow up services that would improve vegetable production and household income levels.
- ii) Improved access to markets through the VBN.
- iii) Access to small loans through table banking and merry go round.
- iv) Interest in organic farming methods.
- v) Welfare support (school fees, health safety nets, funerals, small loans)

The focus on welfare support came out as a strong incentive for some members. The strong focus on welfare issues is a key consideration that should be taken into account by the VBN and other project implementors. However, it is important to find a balance between the social welfare and business objectives of the groups. This balance can be established by promoting entrepreneurial and business principles together with overlapping social demands.

As mentioned earlier, 30% of group members were inactive even before the group was onboarded to participate in the V4P&P project. This could be attributed to the fact that the perceived benefits that the members had when joining the groups were not met thus discouraging their participation. This is supported by the findings that most VBNs are not adopting collective marketing approaches thereby not increasing bargaining power. This could be attributed to weak governance systems among current VBNs, inadequate knowledge in marketing and low production volumes that does not meet the needs of certain markets which require large quantities of produce. Some of the reasons barring collective marketing among the VBNs include:

- i) Ensuring uniform quality standards among produce from all members: The varying quality of produce from members caused low prices of the vegetables.
- ii) Unsynchronized production cycles where the members vegetables matured at different stages making it difficult to aggregate and sell. This is caused by the small number of producers within the VBNs with small land sizes making it difficult to stagger production and achieve enough quantities for continuous supply of vegetables to the market.

"Sometimes you find that my vegetables are ready for sale while another member is just planting, another one is still very young, so it forces you to sell individually" source (VBN leader, Kiambu County)

- iii) Lack of trust between members of the VBN and with the traders.

"we used to collect our vegetables and give it to one of the members to take to the market, occasionally the prices are not as good as the members would want or not all the vegetables were sold, the members would not trust or

believe the person who they had sent, this made the members to start selling individually” Source: (VBN member, Kakamega county)

- iv) Differences in VBN members preferences for different market outlets: Some prefer selling at farmgate and get slightly less in prices. Farmgate was preferred because it gives farmers more time to focus on increasing production and reduces market risks for instance not being able to sale the produce and cartels barring farmers from entering the markets. Other members prefer selling to local markets where they can get slightly higher prices.

Sharing of risks and benefits.

The VBNs have different approaches to risks and benefits. Benefits from communal production farms are invested in table banking to increase the capacity of members to borrow. Part of the monies from the enterprise are shared once a year as bonuses to the group members. Some of the benefits are also put aside in the group account to provide social support to members under special circumstances.

3.1.2 Youth and women participation in the VBNs

The VBNs have a good mix of women and youth participating actively in different crops and livestock enterprises.

Women and men have a particular bias towards some activities in vegetable production. The roles of the woman that stand out in the VBNs is seed preparation, i.e. harvesting, processing, and storing of seeds. Women also actively participate in weeding and harvesting of vegetables. Men are more involved in land preparation, gathering market information, transportation and sale of vegetables. Youth are cross cutting and are fully engaged in all the activities but are more interested in vegetable varieties that have a quick turn over (short production cycles e.g. amaranth, vegetable cowpea) and in technologies that reduce laborious work associated with vegetable production.

Challenges experienced by youth

- Lack of irrigation equipment forcing them to use bucket irrigation that makes farming laborious and discourages the youth from participating.
- Lack of access to land, and unavailability of finances to hire land for production of vegetables.
- Short time span of engagement in agribusiness as they look for other job opportunities. This limits their level of engagement as they don't see it as a long-term source of employment.
- Most of the activities done by youth are either on parent's land or on leased land. This limits their ability to use land as collateral or make major investment decisions, e.g. installation of irrigation equipment without consent from the landowners or parents.

Challenges experienced by women

- Low or unequal decision-making power in key investment decisions, e.g irrigation installation, digging of water pans and reservoirs and sometimes the sale of produce.
- Inadequate access to credit for investing in vegetables, the main source of loans for women is table banking or merry go rounds (rotational savings).
- Exploitation from traders, aggregators, and middlemen especially when sales are done at farmgate.

3.2 Traditional African Vegetables (TAVs) seed systems assessment.

3.2.1. Prioritized TAVs varieties

Traditional African Vegetables (TAVs) are vegetable crops whose natural habitat originated in Africa or were introduced and have a long history of cultivation and have been domesticated and inculcated into local food cultures (Ambrose-Oji, 2009). In Kenya, there are more than 210 TAV species that are important in traditional diets (Mwaura et al. 2014). The species are spread across different regions according to several preferences including cultural, market demand, ecological conditions among others.

The selection criteria used to prioritize vegetable types during the FGD were:

- Market potential and demand
- Taste preferred by the market (bitter, sweet, soft)
- Yield and productivity
- Size of the leaves
- Tolerance to diseases and pests
- Drought tolerance and adaptation to the local environment
- Longevity of harvesting

The prioritized types of TAVs vary across different project counties as listed in table 1 below.

Table 1: Ranking of prioritized types of TAVs in the project counties.

County	Ranking of prioritized TAVS		
	1 st	2 nd	3 rd
Kiambu	African nightshade	amaranth	Ethiopian kale(Kanzira)
Murang'a	African nightshade	amaranth	cowpea
Machakos	cowpea	amaranth	African nightshade
Kisumu	African nightshade	spider plant	cowpea
Vihiga	African nightshade	spider plant	cowpea
Kakamega	African nightshade	spider plant	cowpea

The TAVs above are preferred because of their marketability, cultural reasons, local consumers or household consumption and ecological adaptation. The market demand is a key criterion used by the farmers to prioritize the crops grown because the demand for the vegetables in the urban centers is growing thereby dictating what the producers grow.

"For me market demand is key, I produce what the market demands so that I have an easy time when it comes to selling the vegetables. Source (FGD-Kiambu County -VBN member,)"

VBN members also tend to grow what is culturally accepted and consumed by the surrounding community as well as in their own households. Despite the overarching criteria of market demand being important in selection of the crops to be grown, ecological conditions also play a big role in selection of vegetables to be grown.

"The climatic conditions also dictate what we can plant, this area is very cold and spider plant (saget) despite having a big market demand cannot withstand the cold and does not do well in this region" Source (FGD - Kiambu County -VBN member,)"

African nightshade was prioritized across all the counties and was preferred both in terms of household consumption and market demand.

Challenges with preferred vegetables

African nightshade is highly susceptible to powdery mildew disease in cold areas like Kiambu (Kimende) and aphids attacks after two to three harvests which reduces the profit margins of the producers.

"There are several varieties of African nightshade, not all of them are affected by powdery mildew, can you help us identify a variety that is indigenous to the place and is no susceptible to mildew" source (VBN member, FGD- Kiambu County-Kimende)"

3.2.2 Seed sources and availability of seed

The study assessed the sources of seed for TAVs and challenges in accessing good quality seeds. The producers indicated that they accessed several sources of seed which could be categorized as formal and informal seed sources.

3.2.2.1. Formal seed systems

The formal seed sources are licensed to either produce or and sell certified seeds, being:

- i) Agro-dealers or agrovets. they stock a wide range of agricultural inputs including seeds. They are used as a distribution channel for seed companies.

- ii) Seed companies
- iii) KALRO

The most common seed sources for the prioritized seeds sourced from the agrovets is African nightshade and amaranth. However, the farmers in Kiambu County raised a concern that the seed variety stocked in the agrovets for amaranth is wide leafed one which is not preferred by the consumers in the market.

The initial seed is bough from the agrovet, but many farmers then use these seeds to prepare their own seed for several cycles before buying new seed from agrovets. Others buy seed at each planting cycle because they lack the skills to prepare their own seeds. Seeds were mostly sourced from agrovets when farmers perceived that the quality of their seeds had reduced (seed replacement) or when they wanted to try new varieties.

Gaps/challenges in the formal seed sector

- i) High prices of seed
- ii) Low germination percentage (especially for African nightshade)
- iii) Stocking varieties that are not preferred by farmers e.g (For crotalaria, farmers in Western prefer the narrow leafed bitter variety while the one stocked in most agrovets is the wide leafed variety which was described as being soft)
- iv) Some types of TAVs are not stocked in most agrovets (cowpea)
- v) Wrong packaging of seeds (not true to type)
 - "In the past people have bought well packed seeds with good pictures that were certified but turned out to be a totally different thing"* Source (FGD -Machakos County - VBN member)
- vi) Lack of trust because of past experiences e.g. selling expired seeds
- vii) Unavailability of seeds especially during the planting seasons
 - "Sometimes we lack seeds to plant because the supply is unreliable, they give you good quality once and when you want to buy the next season, they are not available, there is no point in giving me seed this year and it does very well and then next year you are missing in action"* source (KII Murang'a County -VBN leader)
- viii)Diverse and fragmented seed demands which makes it difficult for the seed companies to supply demand.

3.2.2.2 Informal seed systems

Informal seed systems are traditional systems whereby individual farmers or groups are producing seeds for their own use or for sale to other farmers in their locality. The informal seed systems include:

- Farmer saved seed
- Local market
- Seed exchange among farmers

- Seed banks
- Village seed traders

Majority of the farmers obtained seed from informal sources with most farmers using their own saved seed or from other farmers. The reason for using their own seed was that it was readily available during planting, the quality was better than that sourced in the market and it was cheap. The market was a last resort when either the farmer did not produce their own seed due to disease infestation or low yields, or did not have money to buy seed from the agrovet.

The producers indicated that saving seeds takes time and effort and producers have to trade-off between time and costs regarding saving seed and buying seed.

Community seed banks

Two seed banks were identified during the participatory appraisal, the Vihiga Community Seed Bank in Vihiga county and the Nyando Community Seed Bank in Kisumu County. The seed banks have preserved a range of TAVs and other crops such as beans. The main aim of the establishment of these seed banks was to conserve seeds to prevent extinction. These seed banks also act as learning centers for the community by providing capacity building in:

- Seed production and management
- Urban farming technologies
- Good agronomic practices
- Use of biopesticides

The establishment of these seed banks has been largely supported by Bioversity International who co-funded the infrastructure of the seed banks, built capacity to operationalize, sourced and characterized seeds.

The seed banks are not allowed to sell seed by law but have a network of custodian farmers who have been trained in quality seed production. These custodian farmers are given seed from the seed bank, they bulk the seed and sell it to other farmers and bring back the borrowed seed to the seed bank after harvesting.

The main challenge in the community seed banks is to ensuring sustainability of the seed banks. Since they are not allowed by law to sell seed, they don't have a model for generating income. They are run by community volunteers who may not be permanently stationed in the communities. Some of the interventions proposed to ensure sustainability of the seed banks include:

- Support in the acquiring of value addition machineries and capacity building in value addition to use the seeds that are in excess in the production of highly nutritious flours and other products that can generate income for the seed banks.

- Lobbying for adapted regulations of KEPHIS to enable the seed banks go through a certification process to brand and sell quality seeds to farmers.
- Linkage of the seed custodians who work with the seed banks to research institutions and seed companies for contractual multiplication of TAVs seeds.



Vihiga community seed bank in Vihiga County.

3.2.3 Quality of seeds

The perceived quality of seed varies depending on the source of the seeds. The seeds from the formal sources are perceived to be of better quality than those from the informal sources, however some farmers prefer using their own seeds stating that the quality of their seed is better than those from the agrovets and the local market.

The quality of seeds from the informal system is perceived as poor because of low germination percentages, infestation by pests, poor storage, varietal impurities, lack of skills in proper harvesting and processing techniques. Seeds sourced from formal sources could be compromised in quality because of sales beyond expiry dates.

The criteria used by producers to select seed are:

- Germination percentage
- Yield
- Longevity of harvesting
- Price of seed
- Adaptation to the agroecological zone
- Market and consumer preferences (taste, color, size of leaves)

Criteria to select seed also vary depending on:

- a) Age of farmers: - *"Older farmers i.e above 55 years are not so keen on the source of seed, to them, seed is seed"* source (KII -Vihiga County -Agricultural extension officer)
- b) Purpose of production: *"When producing for domestic consumption only, farmers are not keen on quality of seed, but when producing to sell/commercial, farmers will*

buy quality certified seed to ensure good production because they are sure of getting back their money". Source (KII -Kisumu County -VBN coach)

c) Level of capacity building or training received by the producers:

"Those farmers who have been trained and know the importance of quality seed or certified seed will tend to avoid local seeds and go for certified seed from the agrovets" Source (KII Kiambu County - Seed company field officer)

The price of seed plays a key role in seed selection; farmers will often prefer seeds from the informal sources because they are cheaper. Agro-dealers indicated that when the price of seeds from different seed companies vary, most farmers would go for the cheaper seeds, however there is an exception of a few commercial farmers who will go for quality rather than price.

3.2.4 Challenges in the informal seed system

- i) Low and inconsistent supply of seeds due to small scale production of seed.
- ii) Diminished seed quality due to seed recycling over time .
- iii) Damage by pests especially in cowpea.



cowpea seeds which are heavily infested by pests

- iv) Lack of technical knowledge on seed production (harvesting time, extraction, storage, pest control).
- v) Low varietal purity (different varieties combined, inert materials).
- vi) Inefficient and labor intensive seed extraction methods.
- vii) Lack of differentiation between seeds for consumption or planting (cowpea, grain amaranth).
- viii) Policy restrictions: farmers don't have a legal status to produce and sell seed unless they are contracted by seed companies or any other accredited institutions that are certified to produce and sell seed.

3.2.5 Opportunities in seed systems

- i) Increasing demand for TAVs thereby increasing the demand for good quality seeds from farmers which will drive the sector.
- ii) Existing partners willing to collaborate in strengthening the seed systems (WorldVeg, KALRO, KEPHIS, Bioversity, other research institutes)
- iii) Availability of individual community seed producers and traders willing to increase production
- iv) Availability of local seed banks with well-established networks for seed production and bulking (custodian farmers) in Vihiga, Nyakach, Machakos.

3.2.6 Proposed Interventions to improve quality, access, and utilization of quality TAV seeds.

The following interventions were proposed by the participants during the PA

1. Promote farmer seed systems through training or capacity building in seed production, harvesting time, processing, storage and quality assurance to enable individual farmers produce and sell quality seeds to VBNs and farmers.
2. Identifying individual farmers and VBNs interested in commercial seed production, building their capacity and linking them to seed companies or research organizations for contractual production of TAVs seed.
3. Working together with seed companies to establish demonstration sites within the VBNs to create awareness on the importance of good quality seed, performance of different seed varieties and availability of these seeds from the formal sector.
4. Increasing access of seeds through recruitment of more distributors including local farmer agents during the long and short rainy periods when there is high demand.
5. Creating awareness on the importance of buying seeds from the recommended agrovets to avoid cases of buying counterfeits and the use of scratch codes that can be used to ascertain seed quality.
6. Mechanization in seed production especially fabricating small shellers for cowpea, seed extractors in amaranth and identifying better drying and storage technologies.
"currently we are using maize shellers to extract cowpea seeds, these cause a lot of breakages and losses in terms of seed"
Source: (KII- Kakamega County -Research Institution)
7. Identifying germplasms suitable to different agro-ecological conditions.
8. Lobbying for policy change to empower community seed banks to produce and sell good quality seed to farmers.

3.3 Regenerative vegetable production technologies

3.3.1 Awareness and use of regenerative practices

Regenerative agriculture is a way of farming that increases biodiversity, enriches soils, improves watersheds, enhances natural resources and farm communities (modified from definitions listed in Burgess et al., 2019).

Farmers in this study are aware of and have adopted different regenerative practices related to soil and water management and IPM.

a) Improve and maintain soil fertility

- Manure from cows, chicken, goats: the price of a 90 kg bag of manure ranges from 250 - 400 Ksh depending on the type of livestock, season and availability of the manure.
- Use of rabbit urine; adopted across all project counties
- Composting using both pits and above ground piles
- Bioslurry
- Vermicomposting from red worms and black soldier flies: largely practiced in all counties but little in Machakos.



A VBN coach in Kisumu county practicing vermicompost

b) Water conservation

- Cover crops
- Mulching
- Raised beds
- Rainwater harvesting (surface run off) using water pans
- Roof catchment using tanks

Access to water for irrigation

The irrigation practices being used by most VBNs consists of fetching water manually with buckets. This is very labour intensive and limits the size of land that is cultivated through irrigation.

"You only plant the size of the farm that you can carry water and irrigate"

Source (FGD -Kakamega County- VBN member)

However, majority of the VBNs in Kiambu and Murang'a counties have invested in irrigation equipment i.e. submersible pumps and drip irrigation kits. Their main concern is security of the equipment because of high levels of theft targeting this irrigation equipment. Farmers also plant vegetables near riverbanks and seasonal rivers. have dug shallow wells.

Sources of water for irrigation



A)



B)



C)



D)

- A) A dry water pan in Machakos County during the dry season.
- B) Roof catchment using a water pans/dams in Kisumu County
- C) Roof catchment using Tanks in Kakamega County
- D) A shallow well in Vihiga County

One of the challenges that has led to low adoption levels of irrigation was the high cost of irrigation equipment and poor access to credit facilities. During the study, the participants proposed that use of solar irrigation pump kits could be increased through creation of linkages with service providers. The repayment terms should be flexible, and the kits should be portable so that members of VBNs can use them on a rotational basis.

c) Integrated pest management

- Repellent crops i.e Mexican marigold & spring onions
- Sprinkling ash
- Botanical extracts in Murang'a, Kiambu and Vihiga Counties
- Use of disease and pest tolerant varieties
- Push pull technology
- Fly traps, used mostly in fruit trees i.e. avocados in Murang'a County and mangoes in Machakos County
- Yellow and blue sticky traps, especially in the central region
- Crop rotation
- Uprooting heavily infested plants



A)

B)

A) The author inspecting a fly trap used in controlling fruit flies in avocado at a learning site in Murang'a county.

B) Blue sticky trap at a learning site in Machakos County.

Other regenerative agriculture practices adopted include

- Agroforestry (Vihiga)
- Minimum tillage (direct sowing in Machakos County)
- Soil conservation structures like ridging in Kisumu County

3.3.2 Reasons for adopting regenerative practices

1. Lowers the cost of production: the plants used for pest management are readily available in some places.
2. Ineffective pesticides from the agrovets
"The drugs from the agrovets are expensive and sometimes they don't work"
Source (FGD Kisumu County - VBN member). IPM practices are sometimes perceived as a last resort that may or may not work, when the other methods have failed.
3. Concerns about food safety. *"If we could have access to drugs or bio pesticides that are safe for consumption and are affordable, then we would adopt them because we also consume these vegetables"*. Source (FGD- Murang'a -VBN Member)
4. Benefits associated to regenerative agriculture such as human health and soil fertility improvement.

3.3.4 Concerns about regenerative agricultural practices

The producers were willing to adopt and continue utilizing regenerative technologies but raised a few concerns that should be addressed to enhance use of regenerative agriculture. These include:

1. Lack of organic product differentiation in the market outlets used by most farmers.
"How can we differentiate ourselves as being organic, as a group that does not use chemicals when the vegetables get to the market" Source (VBN Coach -Kiambu County)
2. Lack of market linkages for organic produce.
The TAVs segment for certified organic produce is still in the formative stages with few market outlets. They have stringent requirements that most small-scale farmers are not able to meet. There is a need for awareness creation among consumers on the benefits of consuming organic produce to stimulate market demand. Small-scale farmers have challenges accessing these high-end organic markets because they have not acquired organic certification status.
There are no incentives for adoption of regenerative practices; The lack of product differentiation in the market makes it difficult to charge a premium price for organic vegetables.
"If we can we get a market that gives a good price for organic products, this will motivate the farmers to adopt regenerative practices and even increase production"
Source (VBN coach - Vihiga County)
3. Production losses in the initial years i.e. long timespan required for production to increase.
"The timespan is too long for me start seeing the benefits, you see I need to eat, the shamba is limiting in size, I guess it can work over a long period so that we do it in small parts of the shamba" Source (FGD -Kiambu County, VBN member)

4. Poor perception of regenerative technologies especially IPM practices (slow acting, non- effective)

"Some pests and diseases are stubborn, the regenerative practices seem ineffective in dealing with these pests e.g Tuta absoluta, they are not 100% effective" source (FGD Machakos County -VBN member)
5. Poor access to some regenerative technologies e.g biopesticides.

Most agrovets have not stocked biopesticides because of low demand that could be associated to lack of awareness about their use and the costs.
6. High cost of biopesticides as compared to the synthetic pesticides.

3.3.5 Drivers to adoption of regenerative technologies

- i) Knowledge and awareness on the technology.
- ii) Relevance and compatibility of the technology to the enterprise.
- iii) Benefits of the technology in terms of increased income, health, better yields, cost reduction and water retention.
- iv) Access to the technology and availability of raw materials (biopesticides, botanical extracts, repellent crops).
- v) Risks and uncertainties. The VBNs were reluctant to spend money to try out a new technology because it seemed like a big risk to them. They require someone else to take the risk of testing the technology for them to establish its effectiveness before they can adopt or invest in the technology.

"Most of us are Thomases, and there is nothing wrong with being a Thomas, once we see that the technology works then we will adopt and promote it"
Source (FGD -Machakos County -VBN member)

The implication of this to the project implementation is that the project should consider providing starter packs of these technologies to be displayed at the learning sites for the farmers to learn and see their effectiveness..

- vi) Ease of use of the technology or practice.

Technologies that are labour intensive and require high levels of technical expertise may not be adopted widely as opposed to those that are simple to understand and require minimal levels of inputs or labour.

"Si hiyo ni kazi mingi sana, wamama wataweza kuifanya kweli? itabidi walipe mtu afanye" when translated to English this states
"That is too much work, will the women manage to do all that, it will force them to hire labour to assist in doing the work"

This was a remark made by a VBN member about raised beds when we took a tour through one of the learning sites in Machakos county.

vii) Food safety and health benefits associated to consuming organic products.

"The food is safe, it's a healthier way of production, at the end of the day, the production systems adopted reflect on my health, forget about the general population" source (KII Kakamega County - VBN coach)

3.3.6 Barriers to adopting Regenerative technologies

- i) High cost of some technologies especially biopesticides, worms for vermicomposting, and drip irrigation kits.
- ii) Time consuming, takes a longer span for results to start showing
- iii) Fear of yield loss
- iv) Labour intensive
- v) Lack of incentives to produce organic products (lack of market linkages, no price premiums, product certification)
- vi) Fear of lack of follow up

"During the process of adoption, the users may encounter a problem or a challenge that they may need assistance with. If there is no proper follow up to help them along the way to solve these challenges they may abandon the technology" Source (KII Kisumu County - Agricultural extension staff)

- vii) Poor perception of regenerative agriculture. The importance and effectiveness of regenerative technologies in improving soil fertility are accepted widely, however the effectiveness of regenerative practices in managing pests and diseases are not well understood and farmers perceptions is that they work slowly, gradually, and sometimes are not effective at all.

3.3.7 Use of conventional methods

Conventional methods especially use of pesticides are still being used in the production of TAVs. However, inorganic fertilizer is not widely used in TAVs as producers have adopted the use of manure and compost to reduce the costs. Some TAV farmers who have leased multiple small plots of land use a combination of compost, manure and inorganic fertilizers and pesticides.

3.3.8 Proposed interventions from the participatory appraisal to promote adoption of regenerative technologies

1. Creating awareness on the availability, use and effectiveness of regenerative technologies through training while stimulating demand for organic products through media and campaigns.
2. Reduce risks and uncertainties related to the use of the technology by supporting demonstrations on the use and effectiveness of the technologies through learning sites.
3. Ensure frequent follow up on the use of technologies to support users .
4. Improve access to raw materials for preparation of botanical extracts and sensitize agrovets in stocking of biopesticides.

5. Promote low-cost technologies that are easy to understand and use.
6. Create market linkages for organic produce with premium prices.
7. Facilitate organic certification process for producers and other actors.

3.4 Markets and marketing channels of TAVs

Several actors were identified in the TAVs value chain namely producers, aggregators, wholesalers, retailers and consumers. Most of the producers sell their vegetables at farmgate to aggregators, or middlemen, and sometimes directly to consumers within their locality. The producers who sell their vegetables beyond the farmgate level are categorized into two; i) those selling to wholesalers and retailers in urban and local markets, ii) those selling in local markets directly to consumers. Most producers preferred selling at farmgate although at slightly lower prices to reduce transport costs, get time to concentrate on production related activities, and reduce the risks and uncertainties of urban markets, e.g. losses from not selling all the vegetables taken to the market. Few producers who preferred to take their produce to the markets indicated that they wanted to benefit from higher prices as compared to farmgate prices. Figure 2 below shows the marketing channels in the TAV value chain.

Marketing channels of TAVs

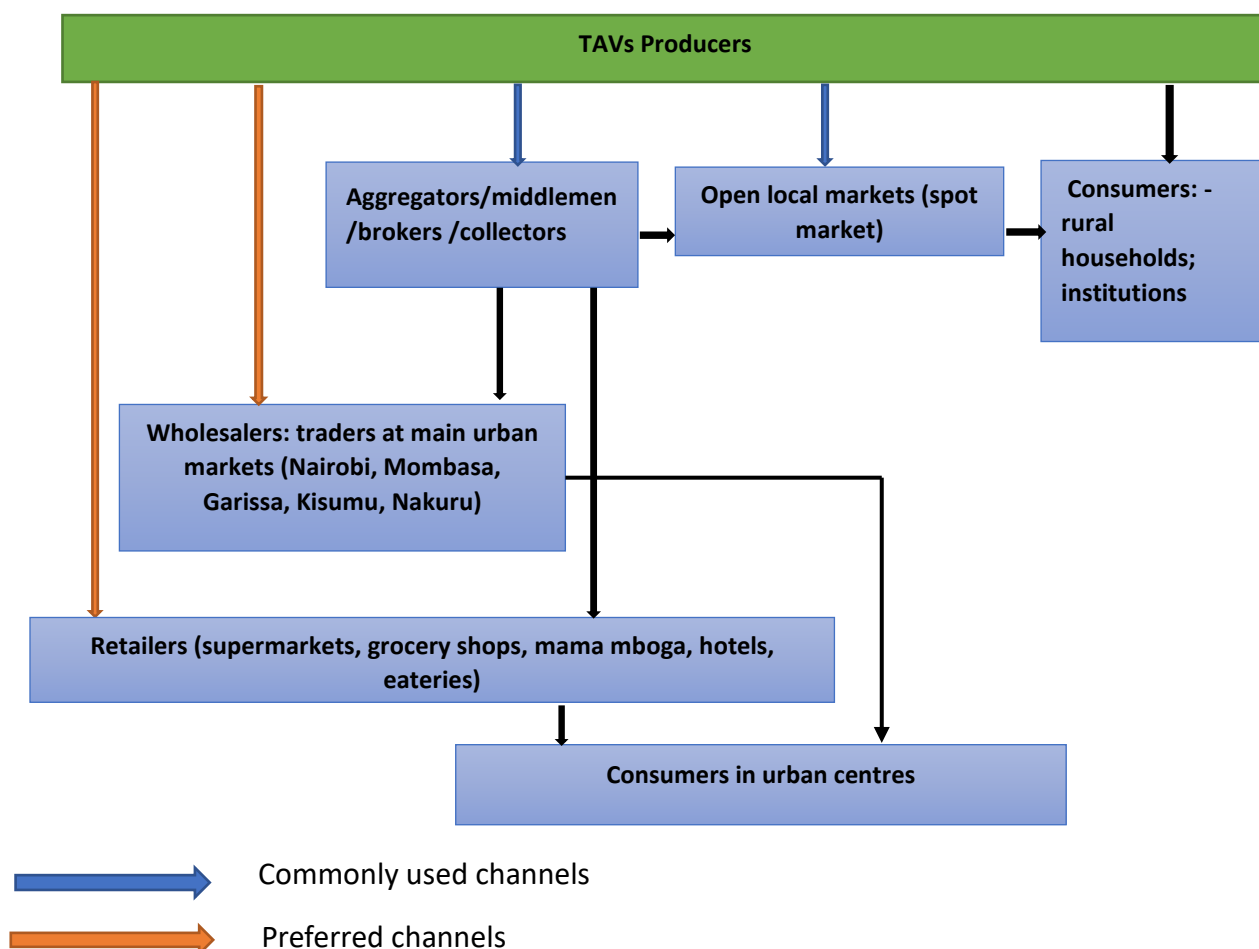


Figure 2: Marketing channels for TAVs

The main urban markets for TAVs are Nairobi (City market, Kangemi, Marikiti, Mudhurwa, City park, Githurai) Mombasa (Kongowea), Garisa, Nakuru and Kisumu.

The retailer outlets include supermarkets, grocery shops (upcoming trend in the urban centers) *Mama mboga* (women selling vegetables in the street), hotels and eateries which serve TAVs as part of the main dish or a side dish accompanying the main meal. There is an increasing demand for TAVs in boarding schools especially in Western Kenya.

3.4.1 Constraints in Market access of TAVs

The commonly used channels are the local markets and traders who buy at farm gate. These channels are characterized by multiple actors i.e. farmers and various intermediaries. Prices are not determined by forces of supply and demand but by the intermediaries, especially during the rainy seasons, leaving farmers with no options. During the dry seasons, the power shifts and farmers have a higher bargaining power due to low supply of vegetables. However, most producers don't benefit because they depend on rain rather than irrigation.

Producers have adopted a market-oriented approach because they are keen to only produce what they can sell in the market. The preferred channels are wholesalers in urban market and retailers. However, most VBNs have not been able to exploit these markets because of several challenges:

- i) Limited or distorted market information on available market opportunities, prices, quality and quantity standards required by different markets. The traders, who have good market intelligence hoard or give false market information to have an upper hand in business dealings. This limits the market outlets available to producers and promotes exploitation from middlemen.
- ii) Inconsistency and seasonality of supply because of overdependence on rain fed agriculture and limiting or small parcels of land among producers. High-end market outlets require large volumes of the product, but the producers don't have the capacity to supply.

"There are opportunities that have come our way and we haven't been able to seize them for instance I was approached by a certain Indian trader who wanted large volumes per week but as a group we could not meet this requirement so we ended up not taking the opportunity" Source: (KII Kakamega County -VBN coach).

*"**Shida yetu kubwa sana ni maji (our biggest problem is water), we only plant during the rainy seasons and the water we store is not enough to take us through the dry season when the prices are good, we end up losing out on making money"*** Source (FGD 2 -VBN member)

- iii) Stringent quality requirements for some outlets such as grocery shops and supermarkets which farmers are unable to meet.
- iv) Cartels operating in the market
"You can't just go in and sell your goods, you have to go through some middlemen, agents, merchants or brokers who then sell your goods for you, for instance Mombasa, Marikiti, Githurai, Gorogotho, Huruma and City Park. Source (FGD Kiambu County - VBN member)
- v) Lack of trust between the VCAs especially between producers and traders due to absence of binding contractual agreements resulting to low uptake of aggregation.
*"Some buyers take vegetables on credit, they go to the market and sell the produce then pay, **akienda achomeke huko, nyote mnachomeka**" - translated as " If he goes and gets losses, then you all share in the losses"*
 Source: (FGD Murang'a County -VBN member) Most of the trade occurs through verbal contracts based on a gentlemen's agreements.
- vi) Weak governance systems among farmer organizations which do not facilitate access to markets, increased bargaining power and credit access to its members.
- vii) Lack of incentives for production of organic produce for instance premium prices and inadequate market outlets for organic produce.
- viii) Lack of aggregation/collection centres in most counties.
- ix) Hotels, supermarkets and grocery shops have long payment or credit periods up to 30 days. Farmers prefer an arrangement where they are paid within 24 - 48 hours.

There is no uniform unit of measure for the TAVs, they are sold in bundles or bunches of various sizes depending on the species, season and locality. The bunches are bigger during the rainy seasons and smaller during the dry seasons.

3.4.2 Value addition and post-harvest losses

There is some value addition of TAVs such as sorting, grading, and cleaning. There is inadequate knowledge on other value addition technologies and markets for processed products like dried vegetables. In Machakos County, some dry vegetables during periods of excess production to ensure availability for household consumption during the dry seasons, while also identifying market outlets for dried vegetables.

"In this area (Machakos county) during the dry seasons there is completely no vegetable available and you find a family eating Ugali and salt water as a meal, while during the rainy season their a lot of vegetable that goes to waste. The dried vegetables can increase food security during the dry season and families can have vegetables for themselves and then later link to a market to sell" Source (KII Machakos County - Agriculture extension officer)

Post-harvest losses occur mostly at market level in terms of unsold produce. Some losses also occur during transportation.

"Like in my case, transporting the vegetables to the market is 50 Ksh, when I don't sell, I have to use another 50 Ksh to transport the produce back to the farm, sometimes it's cheaper when you leave the unsold produce in the market for those who have livestock to collect and feed their animals rather than losing another 50 Ksh on transport". Source (FGD Murang'a County -VBN member)

The major constraints reported by traders are infrastructural problems causing post-harvest losses due to damage during handling and transportation, and lack of storage facilities. TAVs are delicate and highly perishable, most of the market outlets don't have proper storage or cooling facilities. This forces the traders to stock only the vegetables that can be sold in a day using estimates from previous demand patterns.

"Consumers want to purchase fresh-looking vegetables and therefore the day's leftovers are either sold at a lower price so that we don't lose customers, or we are forced to eat them ourselves." Source (Kil Kakamega County - Trader)

Other challenges raised by the traders are inconsistent supply of TAVs with oversupply during the rainy seasons and under supply in the dry seasons, lack of quality control, and infestation by pests and diseases.

3.4.3 Access to credit facilities

Access to micro finance from institutions and banks is limited to a few actors such as traders and agro-dealers. Most VBNs have a component of table banking or merry go rounds for members. Sometimes loans aren't paid back. Some VBNs give in kind loans like inputs needed for agricultural production. VBNs can also access small loans through mobile money platforms such as Mshwari, KCB Mpesa, Fuliza and Tala among others.

Most VBN members fear loans due to stringent repayment terms, uncertainties and market risks (price fluctuations) and production risks (pests and diseases, hailstones and flooding in Western Kenya).

"We are afraid to borrow money because we are not guaranteed of selling the vegetable and returning money invested" Source (FGD Vihiga County-VBN member)

"When we get a reliable market, we can talk about expansion and getting credit, for now, let's work from the market coming backwards" Source (FGD Machakos County -VBN member)

3.4.4 Effect of Covid 19 on TAVs value chain

The Covid-19 pandemic had both positive and negative effects of the TAVs as indicated below,

- i) Increased awareness in healthy benefits of TAVs thereby increasing consumption in the long run.

"The pandemic has increased awareness on healthy eating, most households are now consuming more vegetables because they want to be healthy, build a strong immunity to fight off the Corona virus" Source: (KII Vihiga County - Trader)

- ii) Market closures led to low sale volumes, big losses at farm level, and reduced production.
- iii) Curfews reduced market hours for traders hence reducing the amount that they can absorb from producers.
- iv) Reduced sales caused by substitution of other products such as cabbage and kale. Closure of schools, which are the main market for cabbage and kales, caused all these products to flood the local markets and compete because they are cheaper than TAVs.

3.4.5 Proposed interventions to improve market access

The study participants suggested several interventions to increase market access:

- i) Develop and test collective action models.
- ii) Facilitate market linkages to credible, consistent and reliable markets for fresh and processed products through contract farming.
- iii) Identify and link VBNs to markets for organic produce and support organic certification processes.
- iv) Create linkages to providers of irrigation equipment who can offer flexible payment terms.
- v) Lobby for the establishment and operationalization of aggregation centres fully equipped with storage and cooling facilities.
- vi) Develop simple technologies for carrying and transporting vegetables to reduce post-harvest losses, and maintain freshness of TAVs in the market.
- vii) Training on value addition technologies and markets for processed products.
- viii) Use of mobile platforms to access markets and market information.

3.4.6 Policy issues

Some of the key policy interventions proposed during the study are:

- i) There is an urgent need for the development, finalization and cascading of policy guidelines in the establishment and operationalization of aggregation centers for TAVs. This will enhance engagement of the private sector, reduce post-harvest losses, and increase bargaining power of producers.

- ii) The county governments should provide designated markets for TAVs to encourage bulking and increase market areas. This has been done in Murang'a county and greatly increased market access of small-scale farmers and awareness of organic produce including vegetables.
- iii) Identify export markets for processed products.
- iv) Lobbying for policy change to legalize seed sales through community seed banks. KEPHIS to take into consideration quality assurance of locally produced TAV seeds.
- v) Counties with competitive advantage in the production of TAVs to prioritize them and provide resources in their CIDPS to support the development of TAV value chains.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Implications for Veggies 4 Planet & People.

The study looked at four main areas that are critical to the implementation of V4P&P, namely the management of VBNs; availability, quality and utilization of TAVs seeds; awareness and use of regenerative technologies in vegetable production; and market systems of TAVs.

The study found that management within VBNs is democratic with members having a stake in decision making. While VBNs are mostly comprised of producers and few traders, it is important that other actors within the value chain are brought into the VBNs to stimulate relationships that make vegetable value chains more efficient. The VBNs have adopted both individual and collective production models for crops and livestock. The basic principles of collective action that reduce the cost of production, increase bargaining power and provide access to markets and credit facilities have not been exploited in the VBNs. This is due to lack of trust among VBN members, uncoordinated production cycles, lack of quality control measures, and poor market linkages. It is important to develop and test an aggregation model among VBN members and ensuring that VBNs generate enough volumes to access good market outlets. The main incentives for membership of VBNs currently are opportunities for capacity building, technical support on production of vegetables, and informal loans. Youth and women are actively participating in the VBNs but are biased towards certain activities. Women are interested in seed production while youth are interested in vegetable varieties that have short production cycles with quick benefits, and technologies that reduce drudgery.

The prioritized varieties of TAVs vary across different project counties, however, African nightshade was prioritized across all counties and was preferred for both household consumption and markets. Seeds of TAVs come from formal and informal sources. Formal systems include agrovets, seed companies, and research organizations. Informal systems include local markets, seed banks, seed exchange among farmers, farmer saved seeds, and village seed traders. Most of the TAV seeds are supplied through informal systems with a large shortage of cowpea seed, which is not supplied through the formal

system. The perceived quality of seed varies depending on the source of the seeds where seeds from the formal sources are perceived to be of better quality than those from the informal sources. There are opportunities to engage farmers in contact farming to produce TAV seeds for seed companies. The informal seed systems also have a potential to increase access and utilization of good quality seed.

VBNs have adopted several regenerative technologies that improve soil fertility, conserve moisture and help in management of pests and diseases. The main reasons for adoption of regenerative practices include lowering the cost of production, ineffective chemical pesticides and concerns about food safety. The study also identified several concerns raised about the adoption of regenerative technologies related to differentiation of organic product in the market outlets, production losses in the initial years, and inadequate access to biopesticides. The VBN members were not willing to invest resources to experiment on a new technology and required someone else to ascertain its effectiveness. Project learning sites would help farmers to experiment and test effectiveness.

The commonly used marketing channels for TAVs by the VBNs are the local markets and brokers who buy at farm gate. Brokers dictate prices especially during the rainy seasons. The VBNs are not able to access the preferred markets like wholesalers in urban market and retailers because of inconsistent supply, poor market linkages, strict quality standards, lack of trust between producers and traders, and cartels operating in the main markets. Long credit days also hinder certain retail markets. V4P&P needs to link with actors that can improve access to and enhance efficient use of water, provide training on regenerative agricultural technologies, and encourage aggregation models which are all prerequisites for accessing profitable markets.

4.2 Study recommendations

1. Build the capacity of VBNs to understand and exploit the benefits of collective action through trainings in group dynamics, governance and marketing. This includes developing aggregation models.
2. Promote farmer seed systems through capacity building and improved technologies, to enable individual farmers produce, dry, store and sell quality seeds to VBNs and farmers. Alternatively link farmers to seed companies or research organizations for contractual production of TAVs seed. Support mechanization in seed production for commercial seed producers of cowpea and amaranth.
3. Demonstrate regenerative technologies at the learning site to create awareness, ascertain their effectiveness, reduce levels of risks, and promote adoption.
4. Create awareness of the benefits of consuming organic products through media and campaigns to stimulate demand of organic vegetables.
5. Create market linkages with reliable and credible off-takers through formal agreements or contracts.

6. Train farmers on water conservation methods and link the farmers to irrigation service providers whom can supply them with solar irrigation kits at flexible repayment terms to ensure continued production throughout the year.

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