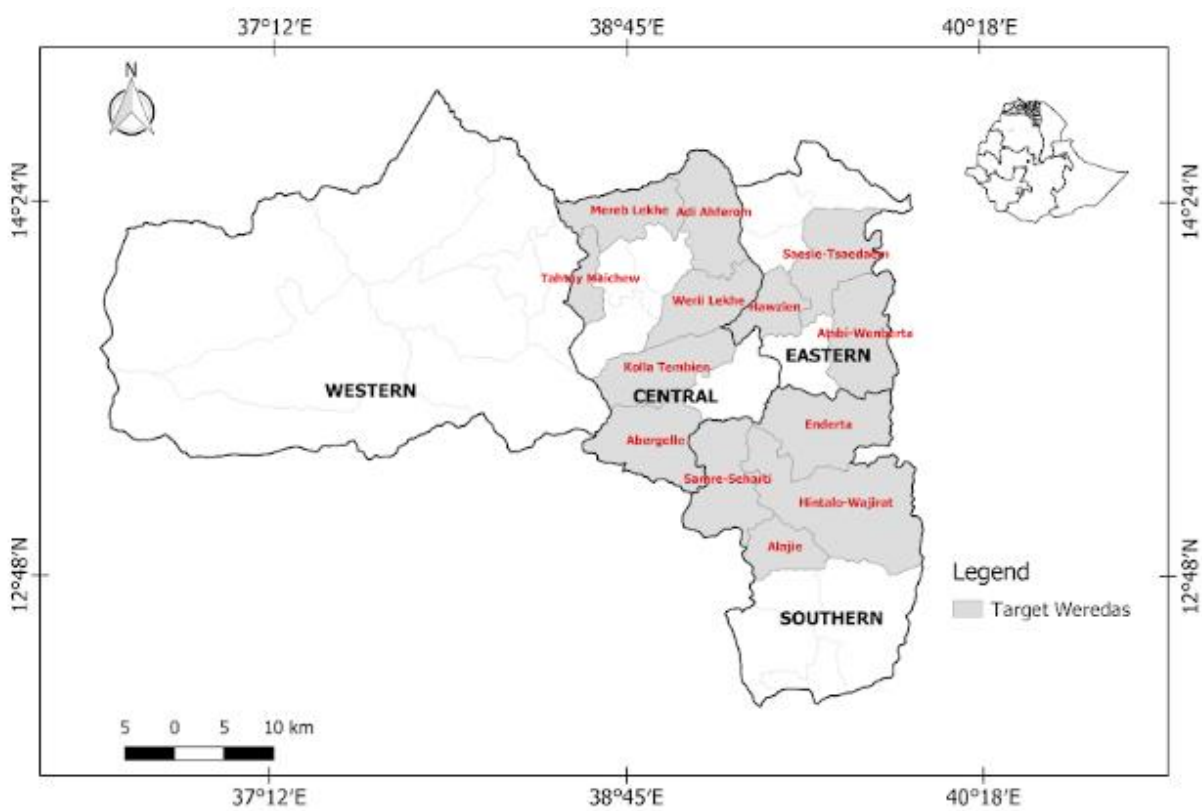


Regional Market Opportunity Study (RMOS) for Irrigated High Value Crops (iHVC) in Tigray Region, Northern Ethiopia



Mekele, Ethiopia

July, 2019

Participatory Small-Scale Irrigation Development Program (PASIDP-II)

Regional Market Opportunity Study (RMOS) for Irrigated High Value Crops (iHVC) in 13 Woredas of Tigray Region, Northern Ethiopia

Prepared by the Bafana Business Management Consultant (BBBMC) and commissioned by Tigray Regional State Bureau of Agriculture and Rural Development (BoARD) and Financed by the International Fund for Agricultural Development (IFAD) through its project Participatory Small-Scale Irrigation Development Program (PASDIP).

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PREFACE

This document is the final report¹ to the assignment to study regional market opportunity study (RMOS) for irrigated high-value crops in 13 *Woredas* of Tigray Region of Ethiopia. The report is based on primary data of individual farmer survey, compilation of secondary data, in-depth literature review as well as combination of Participatory Rural Appraisal (PRA) based data collection approaches such as key informant interviews, field observations and Focus Group Discussions (FDG). The report is prepared by Temesgen Magule, Admassu Baffa, Timoteos Hayesso, Biruk Hailemariam and Takele Honja.

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List of abbreviations and acronyms

AAA	Adaptation of African Agriculture
AGP	Agricultural Growth Program
AISE	Agricultural Input Supply Enterprise
ATA	Agricultural Transformation Agency
BBBC	Bafana Bafana Business Consulting
BoA	Bureau of Agriculture
BoARD	Bureau Of Agriculture and Rural Development
BoTI	Bureau of Trade and Industry
CBO	Community Based Organization
CSA	Central Statistical Agency
CSO	Civil Society Organization
DAs	Development Agents
DCSI	Dedebit Saving and Credit Institute
EEW	Expert Elicitation Workshops
EHDA	Ethiopian Horticulture Association
EIAR	Ethiopian Institute for Agriculture
ETB	Ethiopian Birr
FAO	Food and Agriculture Organization of the United Nations
FDRE	Federal Democratic Republic of Ethiopia
FFS	Farmers Field School
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GIS	Geographic Information System
GoE	Government of Ethiopia
GTP	Growth and Transformation Plan
IFAD	International Fund of Agricultural Development
IFC	Irrigation Farmers Cooperative
IFPRI	International Food Policy Research Institute
iHVC	irrigated High Value Crops
IoT	Institute of Technology
IWUA	Irrigation Water Use Association
KII	Key Informant Interviews
MAA	Market Access Alliance
MFI	Microfinance Institutes
MoFED	Ministry of Finance and Economic Development
MPCs	Multi-Purpose Cooperatives
MSEs	Medium and Small Enterprise
NGO	Non-Governmental Organization
OoARD	Office of Agriculture and Rural Development
PASIDP	Participatory Small-Scale Irrigation Development Program
PIM	Project Management Implementation Manual

PRA	Participatory Rural Appraisal
QGIS	Quantitative Geographic Information System
REST	Tigray Regional Seed Enterprise
rHVC	rain-fed High Value Crops
RMOS	Regional Market Opportunity Study
RPSC	Regional Program Steering Committee
RuSACCO	Rural Saving and Credit Cooperatives
SCP	Special Country Programs
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Science
SSI	Small-Scale Irrigation
TAMPA	Tigray Agricultural Marketing Promotion Agency
TARI	Tigray Agricultural Research Institute
TBoWR	Tigray Bureau of Water Resources
TRS	Tigray Regional State
TVET	Technical and Vocational Education and Training
TWWSDE	Tigray Bureau of Water Works Study, Design & Supervision Enterprise
UDB	Urban Development Bureau
UNFCCC	United Nations Framework Convention on Climate Change
WoARD	Woreda Office of Agriculture and Rural Development

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EXECUTIVE SUMMARY

The Regional Market Opportunity study (RMOS) was conducted in 13 PASDIP target Woredas that are found in four Zones (Central, Eastern, South Eastern and Southern) of Tigray Region. International Fund for Agricultural Development (IFAD) has been providing financial and institution supports for implementation of a program entitled "Participatory Small-Scale Irrigation Development Program (PASIDP) in two phases (PASDIP I and PASDIP II) in partnership with Regional Bureau Agriculture and Rural Development (BoARD) since 2008. The program goal in the country is to contribute to the improvement of income, food security and livelihood of smallholder farming communities through small-scale irrigation (SSI) development programs. Particularly the on-going PASDIP II phase incorporates agribusiness linkages in order to create opportunities to access input and output markets as well as financial services. In this regard Regional PASDIP program duly planned to conduct a RMOS for irrigated high value crops (iHVC) in its target Woredas with overall objective of assessing market opportunity and outlining scenarios of insights for interventions. The RMOS is based on combination of data collection tools that bring together approaches of participatory rural appraisals (PRA) involving individual household interviews, focus group discussion (FGD), and Key informant interviews (KII), expert elicitation workshops (EEW), direct field observation and review of secondary data. The survey was conducted using structured and semi-structured questionnaires to collect primary data from 280 smallholder farmer producers and other market actors including wholesalers, retailers and consumers. The results of RMOS are presented in three core areas of the iHVC valuechains: input supply, production and marketing.

Inputs and input supply

Seeds/seedlings of iHVCs, fertilizers (NPS, NPS-Zn, NPS-B and Urea), pesticides (Karate, Mancozeb and Fenotrotine), herbicides and irrigation tools/equipments are the major inputs for production of iHVCs. Seeds and crop protection chemicals are either collected from local markets from agro-dealers or through multi-purpose cooperatives (MPCs). Very little to no inputs are accessed through irrigation farmers cooperatives (IFCs) in exclusively all PASDIP Woredas. The role MPCs in importing and distributing inputs is growing. Currently there are MPCs in each of the Woredas and the regional government deals and facilitates input supply through the Cooperative Unions Federations to members and to farmers. Private seed and input agro-dealers, retailer shops, Tigray Seed Enterprise, Agricultural Input Supply Enterprise (AISE) and microfinance institutes (MFIs) like Dedebit Credit and Saving Institute (DCSI) are among the important actors involved in supporting input supplies.

Production of iHVCs

*Different types of vegetables are the primary irrigated high value crops (iHVC) in the studied areas. The dominant vegetables in terms of the number of growers are tomato (*Solanum lycopersicum* L.), onion (*Allium cepa* L.) and pepper (*Capsicum annum* L.). Each of these crops were produced by 154 (53.6 %), 141 (50.4%) and 135 (48.2%) of the respondent (N = 280) producers. Maize (*Zea mays* L.) and sorghum (*Sorghum bicolor* (L.) Moench) are a surprise cereal packages as irrigated crops in the Region. In fact, over 183 (65.3%) of the total respondents (N = 280) indicated that they have experience of producing cereals like maize using irrigation. Only there is difference across the Woredas in extent of iHVC production and marketing. For instance extent of iHVC production in Emba Alaje (Adikorakuro) and Tanqua Abergele (Giba) is either entering or better positioned to penetrate markets through cooperatives. In other Woredas, like Enderta, Hentalo Wojerat and Kolla Temben (Midmar) the schemes are under construction and the IFCs are in the phase of formation than production and functioning as IFCs .*

Markets and Marketing of iHVCs

Our finding indicates that there is high potential opportunity for market integration of PASIDP Woreda smallholder farmers producing iHVC in Tigray Region. The market analysis shows that the markets for

*iHVC in PASIDP Woredas are highly scattered with fragmented produce flows across local, Woreda, Zonal and Regional cities and towns. Major and potential iHVC market destinations and distribution centers are Mekele, Axum, Adigrat, Shire cities and niche institute markets such as Universities, industrial parks, military camps and Hospitals among others local and Woreda markets. There are various actors involved in marketing of iHVCs other than the primary actors (producers, IFCs, collector, broker, whole seller, processor, and retailer) which include transporters, GOs [TAMPA, ATA, Cooperative Agencies, Urban Development Bureau (UDB), Bureau of Trade and Industry (BoTI)] financial institutes (DCSI, RuSSACO) and development partners (IFAD). Most commonly traded iHVCs are tomato (*Solanum lycopersicum* L.), onion (*Allium cepa* L.) and pepper (*Capsicum annum* L.). Most commonly practiced selling method is for this crop is cash based and very rarely credit based mainly when the farmers are connected to whole sellers and supermarkets in big cities. The prices of these iHVCs highly fluctuate seasonally because of oversupply, perishable nature of the produces and lack storage infrastructures. Often the farmers are with low bargaining powers operating in the market mainly as price takers and not as price makers due to the fear of post-harvest loss, lack of alternative market outlets, opaque market information. Every primary iHVC market actor makes its own profit margin. On average in the PASIDP Woredas producers, whole sellers and retailers get ETB 1280, ETB 1303.33 and ETB 1168.33 profit with share-margin percentage of 34.12%, 34.74% and 31.14% from the markets.*

Opportunities and Constraints

The studied PASIDP Woredas have several prospects that can be explored and harnessed for improved iHVC production and marketing. Among the important opportunities are, the willingness of smallholder farmers to get engaged in iHVC sub-sector, strategic geographic location of the region, availability of land and water resources, availability of infrastructures (eg. Irrigation facilities), market demand and support (eg. input supplies and training) and promotion of iHVC in their region. However there are also limiting constraints such as logistical inefficiencies, under developed facilities and services, limited and deteriorating infrastructures, together limited functionality of cooperatives that create less integration of production and marketing of iHVC are cross-cutting constraints in all the three components of iHVC marketing chains (input supplies, production and marketing). Particularly limited awareness on business oriented farming and knowledge in management and planning of inputs and production from farmers and limited support from extension in areas of agribusiness and cooperative promotion are among major constraints.

Required Intervention Framework and Recommendations

*Over all the profound implication is that the investment on construction of modern small-scale irrigation schemes alone cannot be relied upon to bring about the aspired income, food and livelihood security in the studied areas. For small-scale irrigation programs to continue sustainably and play a significant role in the improvement of smallholder livelihoods, production and marketing risks driven by the constraints at each level of value chain identified above merit strategic interventions. Equally important to the long-term and short-term interventions is also harnessing the available opportunities. These can be brought together in a widely applicable, systemic framework, consisting of three intervention areas that pertain to 'capacity, 'capital' and 'cooperation': **Capacity:** provides iHVC actors, especially smallholder farmers, with the awareness, knowledge, technology and know-how required to make the shift towards market oriented iHVC production; **Capital:** provide the financial backing (eg. Insurances, lone, grants, subsidies and credits) for iHVC actors, primarily smallholder farmers operating in marginal arid environments, to venture into unsatisfied and challenging niche markets; **Cooperation:** provides competitive advantage and bargaining power in accessing inputs, finances, markets and its information especially for smallholder iHVC producers*

Key Words: *Irrigated high value crops (iHVC), Participatory Small-Scale Irrigation Development, market opportunities and constraints, Irrigation user cooperatives, Tigray, Ethiopia*

1. Introduction

1.1. Background

Agriculture dominates the livelihoods and landscapes of rural Ethiopia like elsewhere in sub-Saharan Africa (SSA). It is a leading sector of the economy as source of income, employment and foreign exchange, supporting 85% of the country's population, 85% export earnings and 41% the GDP (MoFED, 2010). Ethiopia with an estimated arable land of 55 million hectares currently cultivates only about 20% its arable land mostly in smallholder based subsistence rain-fed farming system. Unfortunately, the current trend of changing climates with unpredictable rainfall patterns is putting the livelihoods of these smallholder farmers under threat. Climate projections indicate scenarios of spatial and temporal variability of rainfall distribution and intensity resulting in extended frequent droughts leading to loss of agricultural production and volatility in food price (START, 2013).

To overcome the threats and enhance climate resilience, Government of Ethiopia (GoE) is relentlessly investing in identified priority areas particularly on irrigation and private-public partnership for market development (GTP –II, 2015). Transforming Ethiopia's agriculture from its current subsistence form to market orientated production system is major goal of the agricultural development strategy of the GoE. The small-scale irrigation (SSI) is one of the strategic plans that have a central role to play in the transformation process (AGP II; GTP II). In this regard, GoE views small-scale irrigated agriculture as a potential driver for reducing the impact of climate change, and enhancing economic growth and poverty reduction.

According to Lipton et al, (2004) cited in Haile, 2008 and Zhou et al (2008) there are four interrelated and synergetic mechanisms by which irrigated agriculture can play a potential role in reducing poverty and improving food security: (i) increasing production and income, as well as reduction of food prices, that help very poor households meet the basic needs and associated with improvements in household overall economic welfare, (ii) mitigation and protecting against risks of crop loss due to erratic, unreliable or insufficient rainwater supplies, (iii) promoting greater use of yield enhancing farm inputs and (iv) creation of additional employment for economically marginalized groups (eg. youth and women), which together enables people to move out of the poverty cycle. Therefore, irrigation can be an indispensable technological intervention to improve income, food and nutrition security, as well as overall resilience of livelihoods among farming communities.

1.2. Small-scale irrigation development in Tigray

The provision of irrigation facilities in strategic locations across Ethiopia is deemed an important component of the agricultural transformation agenda being pursued in the country. To this end the GoE has been co-working and partnering with international development partners in expansion and advancing of small-scale irrigation programs in different regions of the country including Tigray Region. To take advantage of the positive impacts of irrigation, small, medium, and large-scale irrigation schemes have been provided across the country to enhance agricultural production and encourage all year production, which will ultimately lead to improvements in livelihoods of smallholder farmers.

In line with the development policy of the country, the Regional Government of Tigray has been promoting irrigation development in the region. According to BoARD (2013) the total 392,687 beneficiary smallholder farmers cultivated 149,205 hectares of land producing total of 21,261,859 quintals. The major irrigated high value crops in the region being vegetables like onion (*Allium cepa* L.), tomato (*Solanum lycopersicum* L.) and pepper (*Capsicum annuum* L.) among others. The Region has more potential attractive portfolio of small-holder farming systems with reasonably ample water resources for participatory small-scale irrigation led market oriented agricultural development. Harnessing limited resources for improving the efficiency of the available schemes and/or constructing new once to increase irrigated lands in Tigray Region requires substantial technical, social, financial and institutional support.

1.3. The PASIDP Program and Rationale of RMOS

The International Fund for Agricultural Development (IFAD) has been providing financial and institution supports for small-scale irrigation in its many programs including Special Country Programs (SCP-I and SCP-II) (Sleshi et al., 2007) and Participatory Small-Scale Irrigation Development Program (PASIDP I) and recently signed PASIDP II in Tigray Region and the country at large (PIM, 2017).

IFAD's very recent initiative in small-scale irrigation financing in Ethiopia is the completed Participatory Small-Scale Irrigation Development Program (PASIDP I) from 2008 -2015 and recently signed PASIDP - II. The PASIDP II targets 110 food insecure *Woredas* in the country, of which 13(11.3 %) are from Tigray Region. PASIDP has been coordinated by Regional Program Steering Committee (RPSCs) and implemented at regional level by Tigray BoARD with close partnership with stakeholders such as Tigray Bureau of Water Resources, Tigray Water Works

Study, Design & Supervision Enterprise (TWWSDSE), Tigray Bureau of Water Resource (TBoWR), Cooperative Agency, Tigray Agricultural Research Institute (TARI), Tigray Agricultural Market Promotion (TAMPA) and Microfinance Institutions (MFI) in 13 different *Woredas*. The main aim of the IFAD in financing the PASIDP projects is to support and contribute to the realization of second Growth and Transformation Plan (GTP II, 2015) priorities particularly the agriculture and natural resource pillar through boosting small-scale irrigation schemes, capacity building and watershed development. The ultimate PASIDP project development goal is to contribute to the improvement of income, food security and livelihood of smallholder farming communities (PIM, 2017).

The achievement of agricultural transformation goal partly depends on linking small-scale irrigation using farmers' livelihood with markets (GTP II, 2015). The PASDIP II has come to implementation with additional program dimension embracing agribusiness linkage and market access through strengthening existing cooperatives and establishing new ones to efficiently access financial services, input and output markets compared to PASDIP I (PIM, 2017).

Improvement of rural agrarian livelihoods through irrigation development requires adequate production-market linkage and substantial key government institutional interventions. As a point of entry irrigation farmers like to have efficient, transparent and sustainable market system in order to ensure the livelihood development. However, agricultural markets in general have not worked efficiently for poor smallholder producers in Ethiopia. Agricultural markets for smallholder producers are characterized by, among others, the following constraints: long chains of transactions between the producer and the consumer, poor access to appropriate and timely market information, small volumes of products of highly varied quality offered by individual smallholder producers and poorly structured and inefficient markets. The lack of market linkages substantially increases transaction costs, post-harvest losses, perpetuates farming as a social rather than business activity and reduces market efficiency. To this end prior exploration of market opportunity from smallholder farmer's perspective, specifically in IFAD-PASIDP target *Woredas* of Tigray Region is essential to plan and develop scenarios of strategies for linking the producers with markets for improved income and food security (PIM, 2017)

1.4. Objectives the RMOS

The overall objective of this study is to carry out an in-depth market opportunity assessment of irrigated high value crops (iHVC) and provide insights for interventions.

1.5. Scope of the study

To assess regional market opportunity for irrigated high value crops (iHVC) this study geographically limits its scope to 13 PASIDP *Wordas* of Tigray Region and focused on participatory market-oriented value chain diagnosis aimed at identifying i) potential profitable high value crops, ii) potential market places, iii) competitors and their characteristics, iv) major actors and their roles and linkages, v) required market infrastructure, vi) pricing and selling methods, vii) quality requirements of target market and its measurement, viii) enabling environment in market chain and its gap, ix) type and source of major inputs required, x) financial service providers, xi) constraints and potentials for each value chain and its components.

1.6. Organization of the RMOS Report

This study is organized in five chapters:

- **Chapter 1** sets the scene by describing national and regional small-scale irrigation (SSI) development frameworks and policies to promote sustainable and resilient livelihoods through linking smallholder producers with markets. It also sets background and looks specifically at PASDIP in context of irrigated high value crops (iHVCs) production and marketing
- **Chapter 2** gives an up-to-date and general overview of approaches and tools implemented to assess the market opportunity and challenges of iHVC in Tigray Region
- **Chapter 3** discusses present situation analysis and key findings of iHVCs production and marketing at all value chain actor level and specifically from smallholder farmers' perspectives
- **Chapter 4** identifies key opportunities and constraints for iHVC in production-marketing continuum specifically from smallholder farmers' perspectives and presents the best practices to overcome impacts and externalities/challenges as well as options to capitalize on the available opportunities.
- **Chapter 5** summarizes the study presenting mechanisms of harnessing potential iHVC markets through gearing efficient production and input supply. It also suggests recommendations for intervention strategies to capitalize on market opportunities

1.7. Limitation of RMOS

The RMOS has two major scope delineations, (i) geographic delineation focusing on only 13 PASDIP target Woredas of Tigray Region and (ii) crop delineation targeting only on crops produced using irrigation either from PASDIP schemes or traditional practices. These two scope delineations caused the following study limitations.

The marketing of any high value crops in Tigray region extends to products coming from/going to neighboring and distant regions in the country let alone non-PASDIP Woredas in the Region. In RMOS neither non-PASDIP *Woredas* within Tigray Region nor other areas outside Tigray Region were considered. Similarly, destination markets for both rain-fed high value crops (rHVC) and irrigated high value crops (iHVC) are more or less the same as marketing of any crop produce in general is not segmented into production type in Tigray Region like elsewhere in Ethiopia. However, in the present RMOS, we studied iHVC marketing opportunities which are also equally open for competition by rain-fed high value crops.

2. Study Methodology

2.1. Study area and local context

Ethiopia is a Federal Republic, with five administrative tiers: Federal, Regional, Zonal, *Woreda* and Kebele/Tabia. Tigray Region is one the 9 Regions and 3 Chartered Cities in which the Federal Democratic Republic of Ethiopia is composed. Tigray is located in the northern part of the country between 12°15'N and 14°05'N latitude and 36°02'E and 39°05'E longitude. The region is bounded by Eritrea to the North, the Sudan to the West, and the Ethiopian regions of Amhara and Afar to the South and the East respectively. Tigray consists of seven administrative zones including Mekelle town which are further divided in to 34 rural districts and 12 town districts. The Tigray Region has an estimated area of 80,000 square kilometers (GoE-TRS, 2019), from which 1.5 million hectare of land is cultivable. Currently one million hectare of land is under cultivation with 420, 877 hectares of which is terraced. Wide range of altitudes (200 – 3900m), diverse soil types and high topographic variation (8% peak highlands, 39% midlands and 53% lowlands) characterize the Tigray Region (Hagos et. al, 1999). Together these factors create diversified agro-ecological conditions and many niches for production of diverse crops including high-value crops such as vegetables, roots and tubers, fruits, spices, stimulants and industrial crops. The key inputs in crop production are family labor and oxen traction. Only 12 per cent of farmers use chemical fertilizers, while improved seeds and pesticides are used by 25 per cent of farmers (Hagos et al., 1999).

The study is conducted in 13 *Woredas* PASDIP target *Woredas* found in 4 Zones of Tigray Region (Figure 1, Table 1). Although the *Woredas* are variable socio-demographically, all the PASIDP *Woredas* are characterized by extreme spatial and temporal rainfall variability, frequent drought and food insecurity.

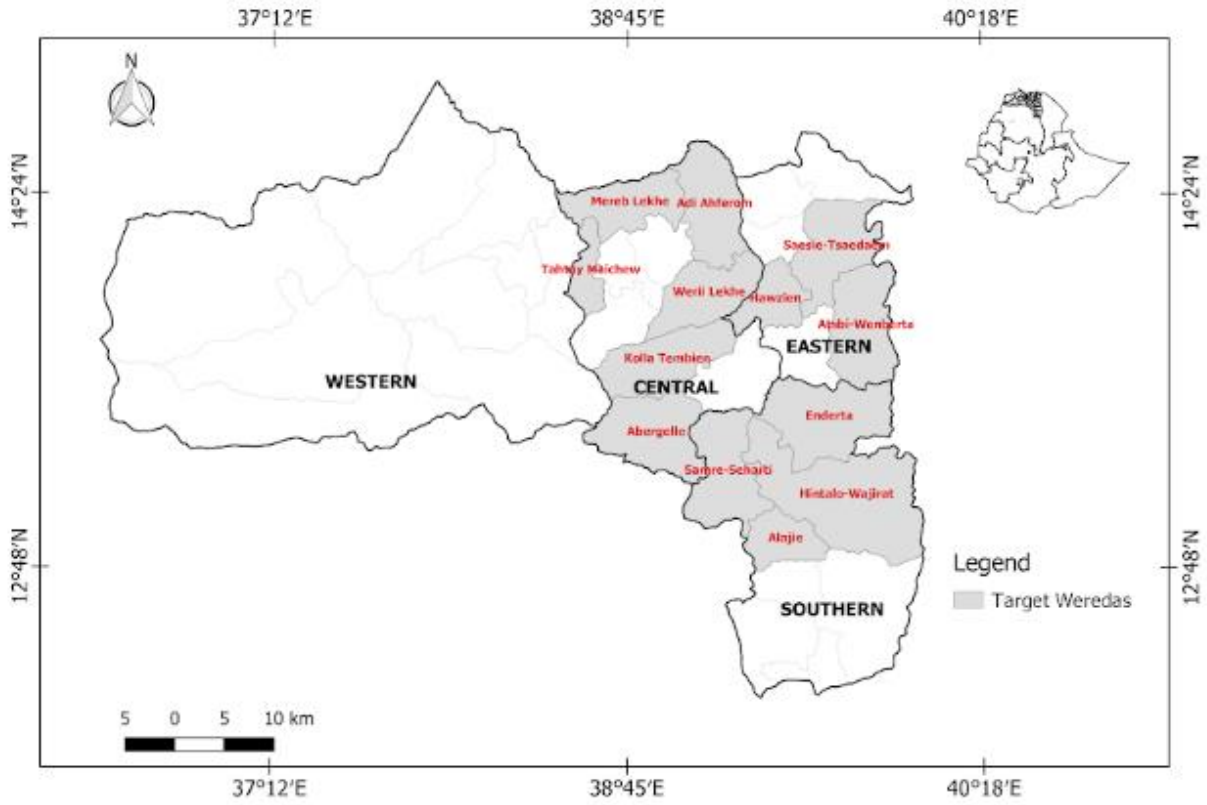


Figure 1. Map of PASID Zones and Woredas identified for regional market opportunity study in Tigray Region, Ethiopia

Table 1. Description of IFAD-PASIDP Wordas included for RMOS with respective sample size irrigation type and scheme names

Zone	Woreda	Kebele	Scheme name	Sample size	Beneficiaries (Female)	Name of Cooperatives	Members (Female)	PASDIP Phase
Central (n =130)	Tanqua Abergele	Agbe	Giba	25	662 (109)	Hadash Gereb	360 (113)	I
	Kolla Temben	Wuhdet	Midmar	20	106(19)	New	*	II (UC)
	Werie Leke	Hibret	Mai-Timket	20	223(7)	Mai-Timket	137(23)	II
	Mereb Leke	Haftom	Mai Tsahilo	25	317(60)	Mai Tsahilo	55(10)	I
	Ahferom	Hoya Medeb	Daero	20	174(56)	Belesat	37(6)	II
	Tahtay Machew	Wuhdet	Baekhel	20	121(23)	Baekhel	37(7)	II
Eastern (n =70)	Hawzen	Debrebhrhan	Hzaetiwedilomin	25	35(12)	Hizaetiwedilemin	35(12)	I
	Saesie Tsedaemba	Saz	Enda Cherkos	25	115(39)	Dimolo	115(39)	I
	Atsbi Wenberta	Hayelom	Adi Felasti	20**	180(36)	Megabit	98(39)	I
South East (n =80)	Enderta	Mah/genet	Misrar Teli	20	108(16)	New	*	II (UC)
	Hentalo Wejerat	Muja	Greb fiftyaye	20	181(42)	New	*	II (UC)
	Seharti Samre	Hintsa	Setsegebreal	20	185(15)	Lemlem Gujiber	*	II
South (n =20)	Emba Alaje	Tekhea	Adikerakro	20**	310(65)	Lemlem Seqota	200(30)	I

Source: PASDIP-Tigray, 2019

* No cooperative established yet

** Five samples with poor data quality where not passed quality standards did

UC-schemes under construction

2.2. Sampling methods and sample sizes

The BoARD and PASIDP reports and staff confirmed that the performance of the schemes and production status as well as respective opportunities and challenges vary across the *Woredas*; therefore, geographically, the study was based at population level considering all the 13 PASIDP project *Woredas* of Tigray Region. In three of the PASIDP *Woredas* (Hintalo Wejerat, Enderta and Kolla Temben) where the schemes are under construction, traditional irrigation users were sampled. For the remaining ten target *Woredas* which are with operational PASIDP schemes the beneficiaries of the program were considered for the study. In all the study *Woredas* households for individual interview were randomly sampled. The sampling frame was derived from the list of PASIDP sites in the target *Woredas* and beneficiary households participating in irrigation farmers' cooperatives (IFC). For the sampling of individuals for the survey, cooperative members were used as a target population. As a rule of thumb we used minimum member number for the *Woredas* for which we did not get information on the members. Accordingly, a total of 1046 cooperative members were estimated in all the thirteen *Woredas*. Using Yamane's method total of 290 households was calculated as a total sample size. This sample size was distributed uniformly to subsample size of 25 IFCs members for PASIDP I and 20 households from each of PASIDP II sites. Ten sample interviews did not pass the quality standard hence out of 290 household interviewed 280 sample data sets were considered. A total of 403 individuals were participated in RMOS including 280 Individual household interviews, 117 FGD participants in the 13 *Woredas* (each FGD with 8 –12 people) (A total of 6 expert elicitation KII and 13 focus group discussions were held (Table 2). Yamane's method (1967) uses the formula $n = \frac{N}{1 + N(e)^2}$ Where, n is number of respondent farmers, N is the total number of iHVC cooperative farmers benefiting from the schemes; e is the precision level. A 95% confidence level was taken and $e = 0.05$. For the *Woredas* with the PASIDP schemes, the target population in each *Woreda* is relatively homogenous sharing the same scheme in the same command area and grouped in the same cooperative accessing comparable inputs and markets.

Table 2. Summary of participatory methods and sample size involved

Methods	Sample
Individual interviews	280 households
Focus group discussion (FGD) (13)	8 - 12 groups
Key informant interviews (KII)	6 informants
Expert elicitation	2 experts

2.3. Data and data collection methods

The study was conducted in May and June of the year 2019 (ግንቦት እና ሰኔ 2011 ዓ.ም.). Team of experts specializing in Horticulture and Agronomy, Agribusiness and Value Chain Management, Geographic Information System (GIS) and Statistician were involved. In all the study *Woredas* the respective enumerators spoke local languages. The enumerator's data collection was guided by local expert. The study is based on combination of data collection tools that bring together approaches of participatory rural appraisals (PRA) involving individual household interviews, focus group discussion (FGD), and Key informant interviews (KII), expert elicitation workshops (EEW), direct field observation and secondary data.

Individual household interviews – were conducted using semi-structured questioners. The tools were used to capture information on input use, production, consumption, and marketing and of high value crops produced using PASIDP irrigation infrastructure. Datasets such as access to infrastructure and institutional services, market outlets, income derived from produce sales and proportions spent on farm inputs, production challenges and opportunities were collected.

Focus group discussion (FGD)-the FDGs were conducted with PASIDP scheme participants at each of the study *Woredas* except for Hintalo Wejerat, Enderta and Kolla Temben for which traditional irrigation users were participated in FGD. The FDGs were held with households other than those involved in the individual interviews. The discussions were primarily used to capture quantitative and qualitative data related to the PASIDP performance and achievements since the schemes became operational, including inputs and output market access and benefits obtained from the irrigation schemes to date and any challenges faced by the group. The FGD also involved the evaluation of crop preference and profitability ranking.

Key Informant Interviews (KII): KII was held with individual informants from organizations represented in PASIDP project Regional Program Steering Committee (RPSC) members. The organizations such as BoARD, TAMPA, TWWSDSE, TBoWR, TARI, Cooperative Agency, ATA, and

DCSI play supporting role from the inception of the project to its implementation. Information related to key challenges in coordination, implementation and monitoring the projects from smallholder farmers' perspectives was discussed. Possible intervention strategies in coordinated innovation for development of market oriented high value crop production.

Direct field observation - the team observed and reviewed the work on the ground as implemented by cooperative efforts of partner organizations. Field observation assisted the team in contextualization of the irrigation practice among participating communities.

Secondary data- data derived from the literature including list of irrigation schemes, their types and number of beneficiaries were gathered. Other dataset including high value crop production status in Tigray Region was gathered and trends were assessed. The secondary data sources were both published and unpublished reports of different level of agricultural bureau (country, regional, zonal, *Woreda* and *Kebeles*), report from central statistical agency (CSA).

2.4. Pre-testing

Field testing of the data collection tools as well as FGD was done together with enumerators in selected Woredas including Emba Alaje and Mereb Leke. Following the pre-tests, the research team revised the tools and finalized the data sheet.

2.5. Conceptual framework

The study team employed the methodologies that ensure the gathering of adequate information to clearly understand the current status of irrigated high value crop sub sectors and the key actors involved in input supply, in production, in assembly/bulking, in processing, in storing, and in marketing (actors and activities along the value chain) as indicated below in conceptual framework (Figure 2) and within the frame of delineated scopes (Figure 3).

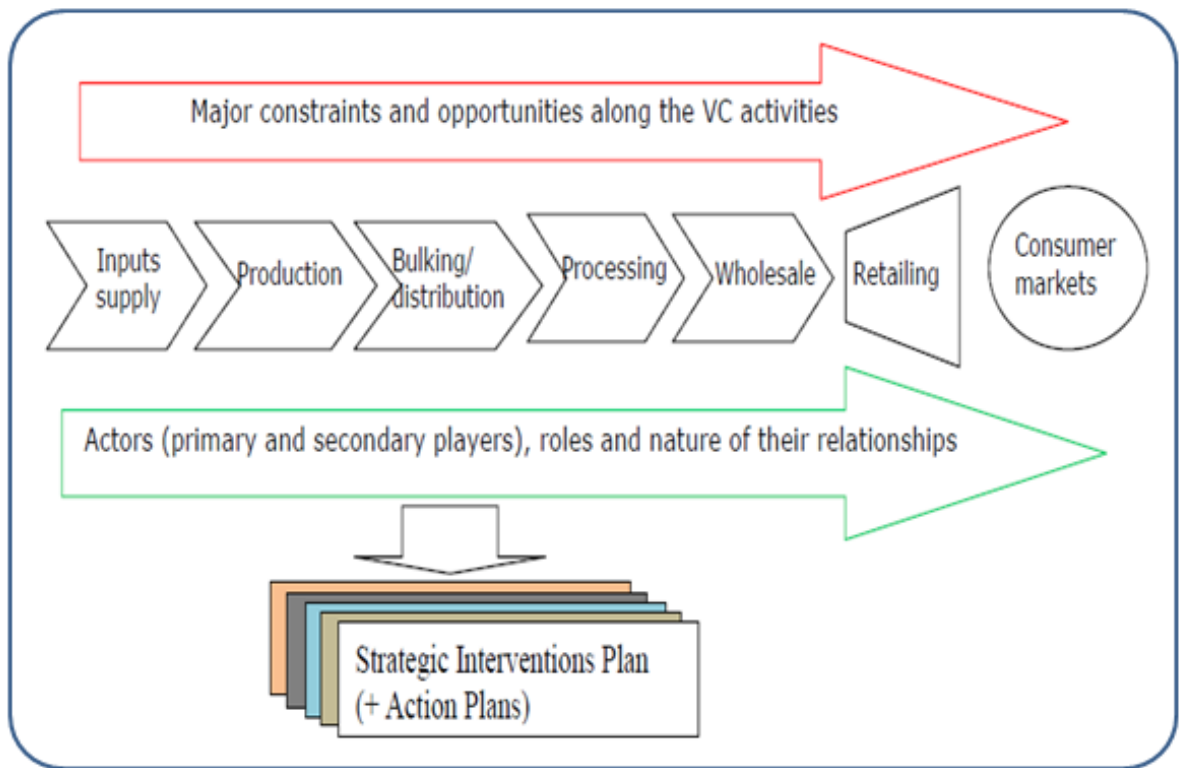


Figure 2. Conceptual framework of the regional market opportunity study for irrigated high-value crops

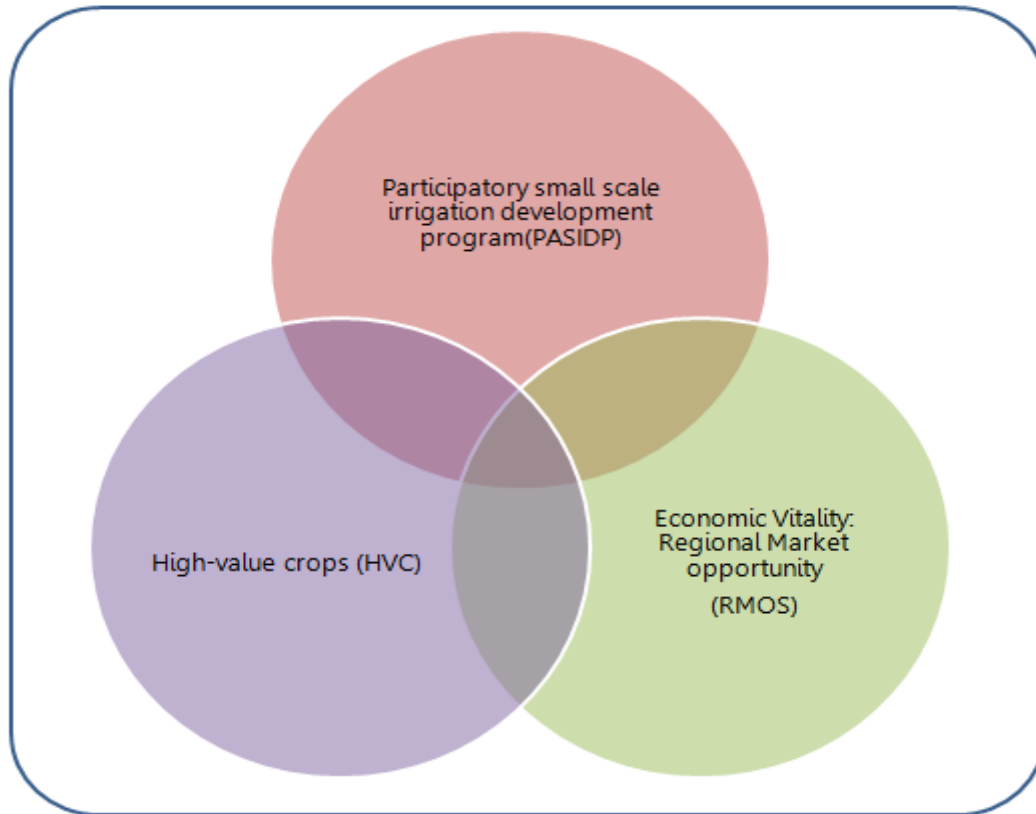


Figure 3. Schematic representation for the three pillars of the market opportunity study linking participatory small-scale irrigation development program (PASIDP) for the high-value irrigated crops.

Sources: Own Schematic Representation, 2019

2.6. Data verifications, triangulation and analysis

2.6.1. Verifications and triangulation

Collected data were carefully cross-checked for completeness and reliability. Expert elicitations, key informant comments and informal discussion with farmer groups were conducted to verify inconsistencies, enrich and validate information gathered from individual interviews.

2.6.2. Descriptive and multivariate analysis

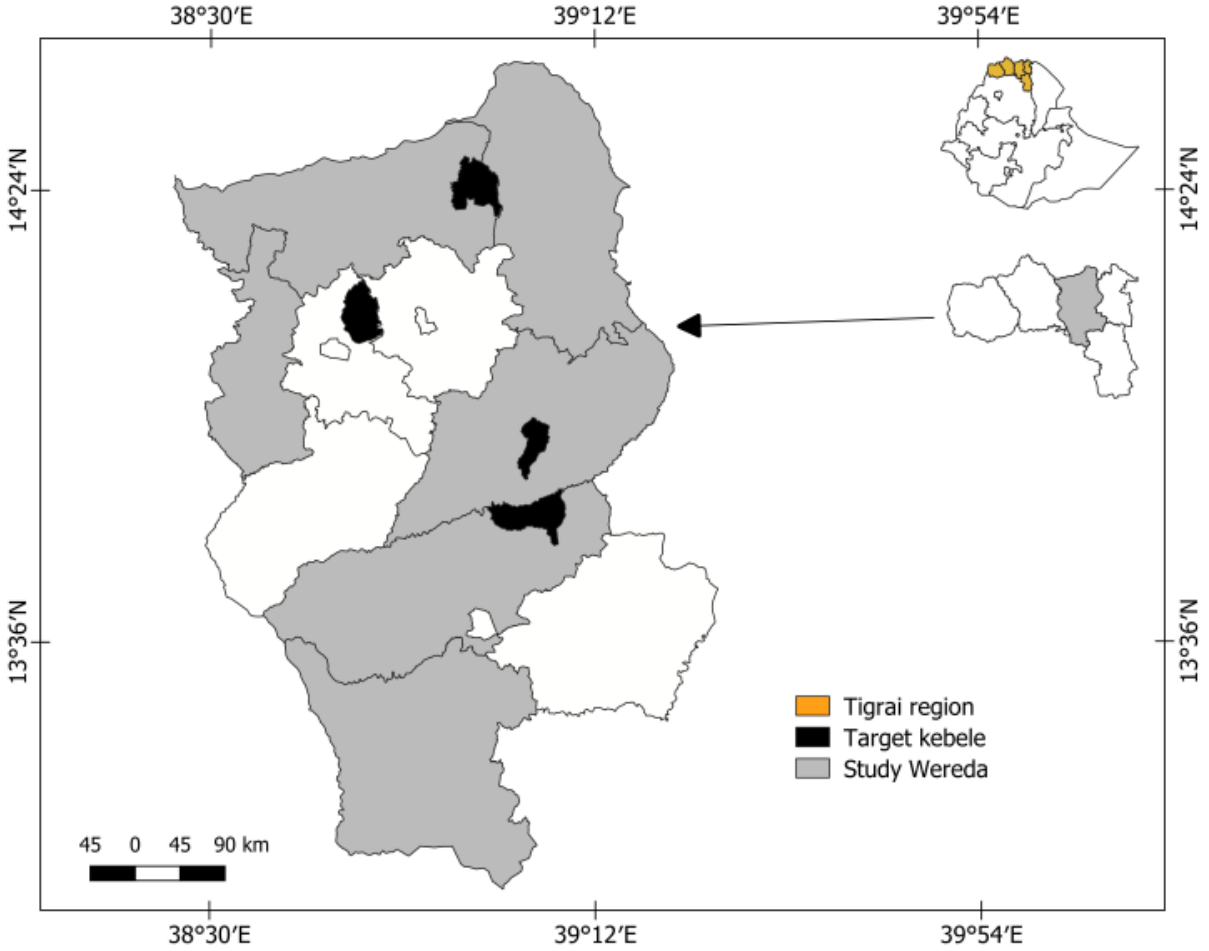
Collected data set was analyzed and descriptive statistical summaries such as frequencies, percentages and averages as well as multivariate analysis including CircularAnalysis were computed using Microsoft Excel 2007, SPSS Version 20 and R Version 3.5.2. Graphical visualization of maps of the study area were generated using QGIS 3.41 was used.

3. Assessment findings

The findings and discussion part of the RMOS were structured into two major sections production and marketing for each of the Zones independently. The order of the Zones was based on the alphabetical orders. Accordingly the results of irrigated crop production and marketing diagnosis in PASIDP *Woredas* of Tigray Region has been presented in the following order from Central Zone (six *Woredas*), Eastern Zone (three *Woredas*). Eventually South Eastern (three *Woredas*), and South Zone (one *Woredas*, Emba Alaje) were presented together as latter was only one *Woreda*.

Irrigated high value crop production and marketing: history and diagnosis in IFAD-PASIDP Woredas

3.1. Central Zone



3.1.1.iHVC Production in Central Zone, Tigray

3.1.1.1. Socio-demographic and socio-economic contexts of iHVC production

In the Central Zone of Tigray, iHVC are produced by households with variable socio-demographic and socio-economic contexts (Table 3). Although efforts were made to account for gender representation of iHVC producing HHs, the actual random sampling resulted in a total of 28 (21%) female headed HHs from 130 interviewed iHVC growers in the Zone. Nevertheless, attempts were made to interview the household head in the presence of his spouse and family members and incorporated the views of the household.

The iHVC producing respondents of Central Zone were aged from 23 to 79 with an average age of 48.4 years. About 20(15.4%) of the producers were 35 or below 35 years and 78(60%) of them were aged between 35 and 55 years. The remaining 32(24.6%) were aged more than 55 years. All the respondents had experience in agricultural crop production including iHVC production, hence could provide information related to the constraints and potentials of promoting the iHVC sector in their area.

Most (80.5%) of the farmers in the six *Woredas* of Central Zone represent married households with family size ranging from 1 to 10 with an average of 5.29. Mean family size ranged from 3.9 in Werie Leke to 6.5 household members in Ahferom. Very few households were unmarried or divorced. The iHVC production system is often intensive and requires more labor for cultivation than traditional rain-fed crop production systems. The household provides a major source of labor for iHVC production. The labor available for work per household is directly proportional to the family size

Education is a crucial factor for skill development and enhancing effective production and marketing decisions. The survey shows that 52(40%) of the producers do not have formal education while about 69(53.1%) attended primary level and 5.4 % secondary/high school level education. The largest proportion of those who attended formal education are the HHs of Tanqua Abergele *Woreda*.

Table 3. Demographic and socio-economic characteristics of households in PASIDP Woredas of Central Zone in Tigray Region

Characteristics		Ahferom (N = 20)	Kolla Temben (N = 20)	Mereb Lake (N = 25)	Tahtay Machew (N = 20)	Tanqua Abergele (N =25)	Were Leke (N =20)
Marital status	Single	-	-	2(8)	1(5)	1(4)	1(5)
	Married	20(100)	16(80)	22(88)	17(85)	20(80)	10(50)
	Divorced	-	-	1(4)	-	1(4)	7(35)
	Widowed	-	4(20)	-	2(10)	3(12)	2(10)
Education level	No formal education	4(20)	8(40)	18(72)	5(25)	3(12)	14(70)
	Primary	16(80)	11(55)	6(24)	13(65)	19(76)	4(20)
	Secondary	-	1(5)	-	1(5)	3(12)	2(10)
	Certificate/above	-	-	1(4)	1(5)	-	-
Sex	Male	17	15	21	17	20	12
	Female	3	5	4	3	5	8
		Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)
Age HH		50.4(50.2)	52.9(50.5)	45.2(50.4)	50.2(55.6)	43.1(48.5)	50.5(45.2)
Family size		6.45(5.8)	5.6(3.85)	4.4(6.45)	5.8(3.72)	5.76(5.65)	3.85(4.4)
Number of Parcel		0.8(2.85)	2.53(1.0)	3.47(0.8)	2.85(2.24)	2.92(1.65)	1.0(3.47)
Arable land owned HH (ha)		1.4(0.62)	1.4(0.64)	1.12(1.4)	0.62(0.51)	1.18(0.84)	0.64(1.12)
Irrigable land HH family (ha)		0.53(0.29)	6.56(0.24)	0.51(0.52)	0.29(0.23)	0.32(0.40)	0.24(0.51)
Land size (ha)		1.4(0.62)	1.66(0.69)	1.63(1.4)	0.62(0.64)	1.26(0.83)	0.69(1.63)

Source: Own survey (May 2019)

3.1.1.2. Agronomy and production practices of iHVC

High value crops and their current production status⁶²

The primary iHVC cultivated in PASIDP target *Woredas* of Central Zone are vegetables (Table 4 and Figure 4). Various types of vegetable crops are grown in the studied areas with different intensities interims of land and other input allocation both for household consumption as well as for market. The most commonly grown vegetables in terms the numbers of growers are tomato (*Solanum lycopersicum* L.), onion (*Allium cepa* L.) and pepper (*Capsicum annum* L.) which are produced more or less half of the interviewed 130 households in the Zone. Diversification of iHVC has different merits in terms of tolerance to diseases and pest, as insurance in cases of crop failures and marketability. The iHVC diversity richness in the Central Zone *Woredas* ranges from 4 - 8, Mereb Lekeis the richest *Woreda* whereas Kolla Temben is less diverse in terms of iHVC production with only four crops including two vegetables tomato (*Solanum lycopersicum* L.), onion (*Allium cepa* L.) and two cereals maize (*Zea mays* L.) and sorghum (*Sorghum bicolor* (L.) Moench). Other than vegetables, cereals, fruits like Mango (*Mangifera indica* L.) were reported to benefit from irrigated agriculture in Central Zone of Tigray Region.

Table 4. Proportion of households producing iHVC in PASIDP Woredas of Central Zone, in Tigray Region

Types	Woredas	Kolla Temben					Werie Leke	No. of producers	Percent (%)	Relative importance
		Ahferom	MerebLeke	Tahtay Machew	Tanqua Abergele					
Vegetables	Tomato	16	1	23	16	3	16	75	57.69	2
	Onion	2	4	21	7	23	13	70	53.85	3
	Pepper	14	0	17	2	12	18	63	48.46	4
	Cabbage	12	0	3	1	0	7	23	17.69	7
	Garlic	0	0	8	0	2	0	10	7.69	8
Cereals	Maize	20	2	15	12	19	21	89	68.46	1
	Sorghum	14	10	0	0	7	23	54	41.54	5
Fruit	Mango	12	0	4	8	1	1	26	20.00	6
	Richness Sample size	7	4	7	6	7	7	-	-	-
		20	20	25	20	25	20	130	100	-

Source: own survey (May2019)

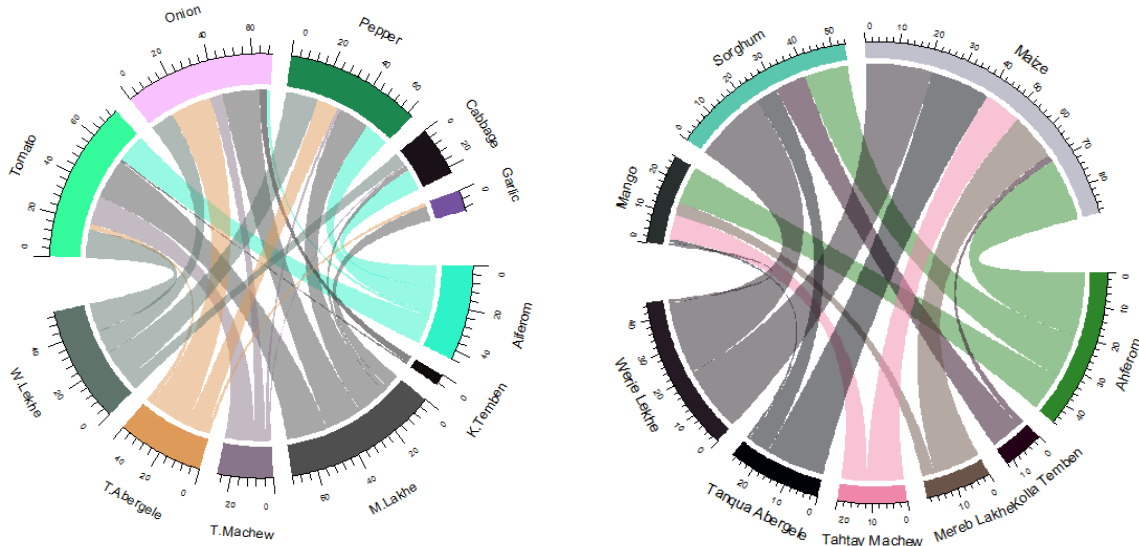


Figure 4. Comparison of type and number of irrigated high value crops in PASIDP target Woredas of Central Zone in Tigray Region (Lower half of the circular figure depiction indicates the 6 Woredas in Central Zone while the upper half is the type of crops cultivated as irrigated crops in the Zone)

3.1.1.3. Inputs and input use for iHVC production

Input use for iHVC production: Fertilizer

In the Central Zone PASIDP *Woredas* farmers tend to use either organic (compost, manure) or both mineral and organic fertilizers depending on availability (Figure 5). Except the farmers of Tanqua Abergele and Werie Leke, others mainly used both types of fertilizers at least for one type of iHVC production. Animal manure is transported from homestead to the field mostly during the dry season and spread in the field. Irrigated high value crop fertilization is very limited in Kolla Temben. Onion (*Allium cepa* L.), tomato (*Solanum lycopersicum* L.), and pepper (*Capsicum annum* L.) are among the top fertilized irrigated high value crops in the Central Zone. In focus group discussion and key informant interviews farmers revealed that although the fertilizers are primarily supplied through Cooperatives, WoARD Extension services and NGOs, there are challenges to these input supplies primarily because of household financial shortage, timely availability and high costs. Most commonly supplied inorganic/mineral fertilizer types in the Central Zones as revealed by FGD and KII are NPS, NPS-Zn, NPS-B and Urea.

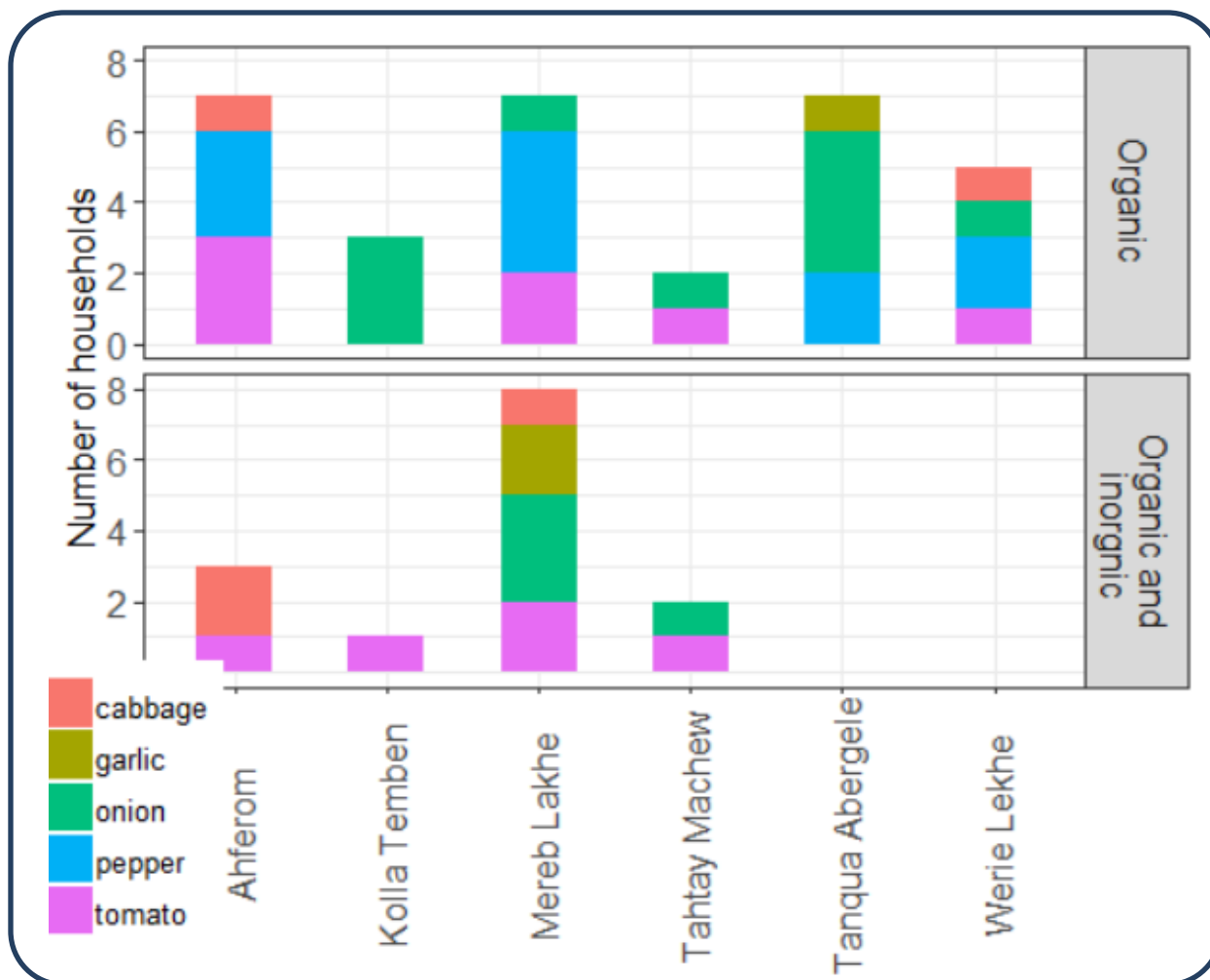


Figure 5. Mineral and organic fertilizer use for iHVC production in Central Zone, Tigray Region

Input use for iHVC production: Seeds and seedlings

Sufficient quantity and good quality seed is at the heart of the agricultural technology package needed to increase production and productivity as well as livelihoods of rural communities (Alemu 2011). In the six *Woredas* of Central Zone, iHVCs are produced using seeds primarily accessed through farmer’s Cooperatives (MPCs), Unions, private dealers and sealers, donation from government or NGO projects facilitated by WoARD. Seeds of iHVC are rarely accessed from other sources including home saved own stock, exchanges with friends/neighbors/relatives, which are also seeds saved from earlier donation and shared among fellow farmers.

Input use for iHVC production: Pesticides and herbicides

Disease and pest management and control is an important aspect of irrigated high value crop production. Recommended pesticides and/or herbicides types and doses are particularly

important inputs iHVC production. Disease and pests can considerably affect the yield of all crops under irrigated conditions and may sometimes result in complete crop failures. From the focus group discussion most the farmers seldom use pesticides for their iHVCs. It is very difficult to imagine market oriented cultivation of high value crops under irrigation without appropriate pest and disease management and control mechanism. To control such disease and pests they use chemicals such as Karate, Mancozeb and Fenotrotine. Most of the farmers of Central Zone use pesticides than herbicides (Figure 6) which are accessed like other inputs through Cooperatives, private dealers or local markets. The availability of the chemicals, their quality and use is very concerning issues as per the KII and FGD.

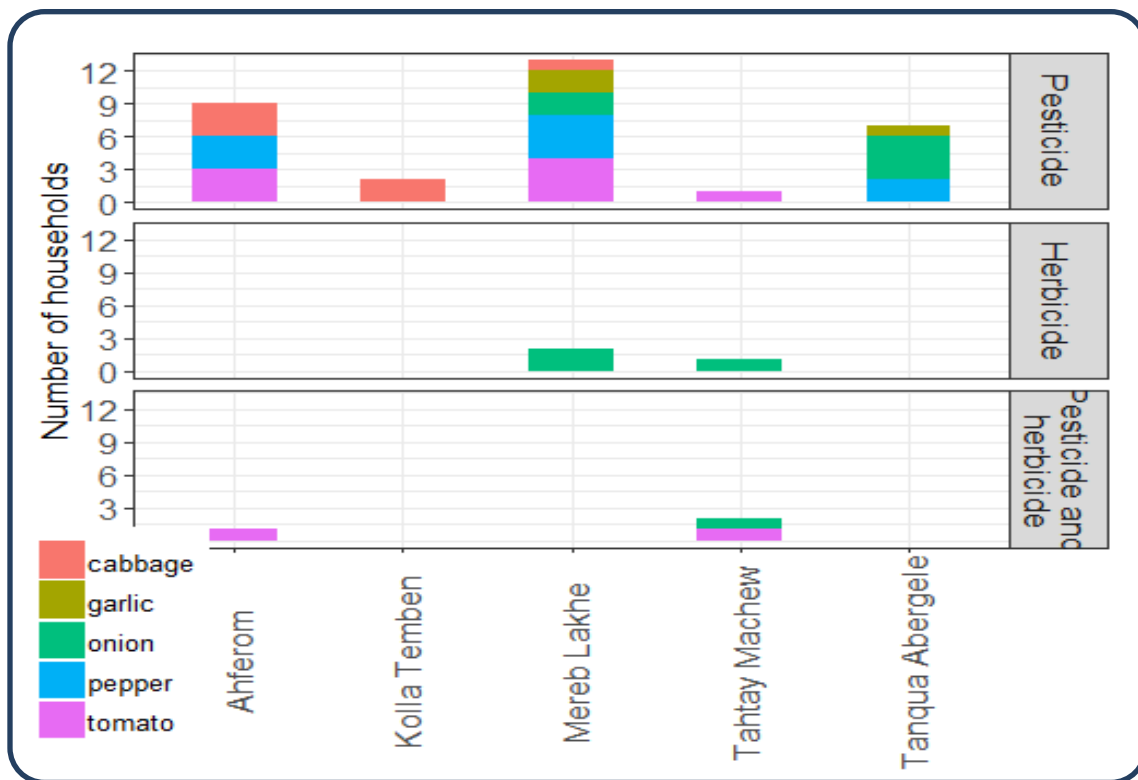


Figure 6. Pesticide and herbicide and application for production of iHVC in the PASIDP target Woredas of Central Zone, Tigray Region

3.1.1.4. Access to institutional service and infrastructure to farm households

It is well established fact that availability and access to institutional services and rural infrastructure is crucial element of agricultural production as well as marketing and contributes to productivity of smallholder farmers. However, throughout Ethiopia and Tigray like elsewhere in the developing world, rural service provision is extremely difficult because of a triple challenges (Marc and Mamusha 2010). Private sector does not provide institutional services and

facilities to poor rural dwellers due to market failures; the state is not very effective in providing the services. Nongovernmental organizations (NGOs) or communities themselves are interesting alternative providers of these services, but they can also fail (Birner and Anderson 2007). In the PASDIP *Woredas* of Tigray Region we considered seven different institutional service and infrastructure indicators such as access to all weather road, markets, agricultural extension service, public telephone, and mobile phone access and credit services.

Access to all weather roads

Overall, about 96(73.8%) of the interviewed HHs reported that they have either limited or poor access to all weather roads (Table 5). The remaining 34(26.2%) of the farmers in the PASDIP target *Woredas* of the Central Zone perceived that access to all weather road infrastructure is good or average. Weather roads are limited both for collection of iHVC produce from scheme site as well as supplying it to the market. Specifically HHs from Kolla Temben (70%), Were Leke (90%), Mereb Leke (92%) and Tahtay Machew (100%) reported limited and or poor access to all weather roads. According FGD, poor roads coupled with lack of storage facilities and transportation limits iHVC marketing in the study area.

Access to market and market information

In rural context with the development of production for the market oriented commodities like iHVC, the need for institutional support services such access to the market and market information like commodity price, credit, input supply and marketing services increases significantly (Berhanu et al., 2006). In this regard, evaluation of access to market information shows that producers are less aware of available formal system in place for systematically collecting, analyzing and disseminating market information in PASDIP Central Zones of Tigray Region. This was corroborated with interview report of farmers from Kolla Temben, Tahtay Machew and Mereb Leke where 100%, 95% and 88% respectively who indicated that they have limited market information options to sell their iHVC produces. On the other hand, farmers of Ahferom, Tanqua Abergele and Were Leke indicated better access to the iHVC marketing information.

The FGD highlighted the type of information shared informally include price information, prices, buyers information, market place and demand information. Mostly the farmers produce iHVC both for home consumption and markets (Figure 7). The sampled respondents revealed that the major source of market information were traders, brokers, neighboring fellow farmers, friends/ relatives, DAs, and *Kebeles* administrations and combinations of those.

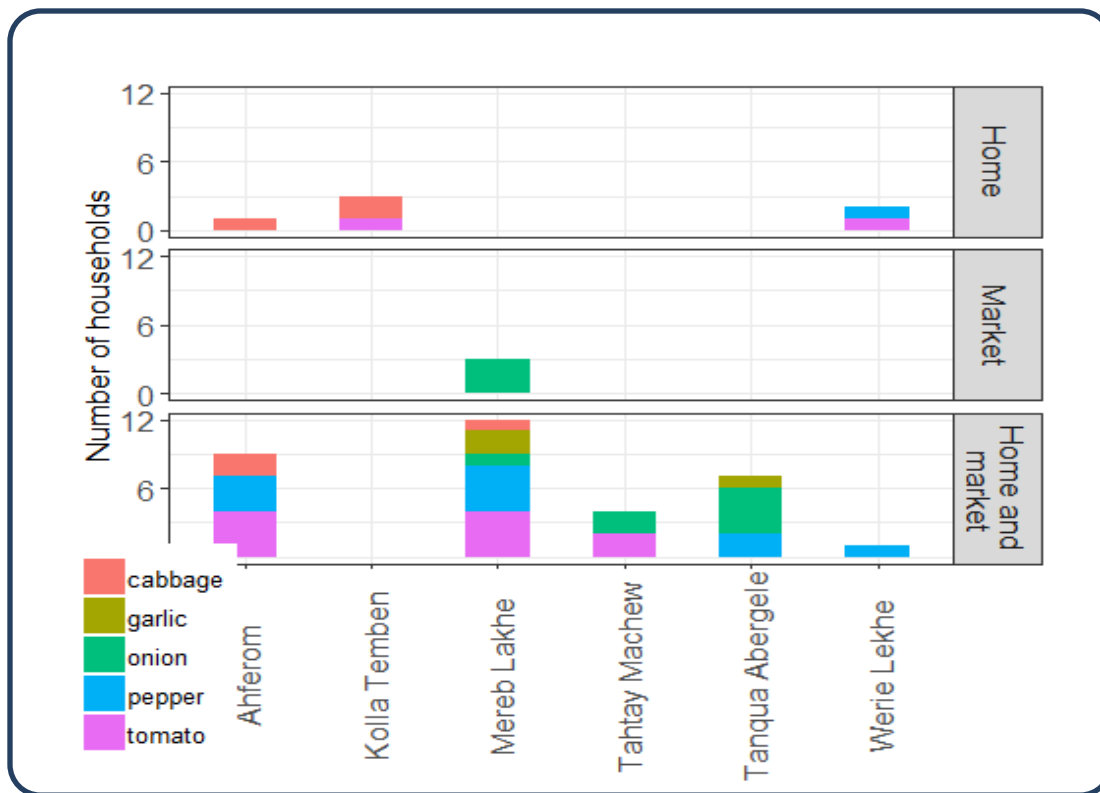


Figure 7. Purpose (home consumption, marketing and/or both) of iHVC production by the households of PASIDP target Woredas in the Central Zone, Tigray Region

Access to agricultural extension service

From all the seven institutional services and infrastructures considered in this study in, farming households of Central PASDIP target *Woredas* are most satisfied with the extension services (Table 5). From the total of 130 respondents in the six *Woredas*, great majority 119 (91.5%) of the respondents were satisfied with the extension service which commonly they get from *Woreda* Office of Agriculture and Natural Rural Development and with respective *Tabia* extension workers or Development Agents (DAs). In four (Ahferom, Mereb Leke, Tahtay Machew and Tanqu Abergele) of the *Woredas* over all the interviewed households responded that they get visit and advice from development agents and indicated their satisfaction with the service. Extension service and trainings are provided not only by government extension workers but also to some extent by non-governmental organizations. In the moisture stressed areas, such as the PASDIP target *Woredas* in Central Zones, extension services primarily focus on the packages centered on the construction of water harvesting ponds, or shallow well development, or ensuring access to different forms of irrigation such as river diversion or irrigation dams. In addition, enabling farmers adopt improved seeds, soil fertility management practices (e.g.

application of mineral fertilizers, compost and manure) and soil moisture conservation practices. Overall, DAs have good rapport with farmers and understating of their needs and concerns.

However, according to Marc and Mamusha (2010), extension services are effective if they succeed in facilitating community development, rural poverty reduction, gender equality, and agricultural development that spur improvement in the livelihoods of the farming communities. Reports indicate that in Tigray DAs know the local situation well, but they do not get the same support from Woreda level technical experts (Marc and Mamusha 2010). Researches also show that most agricultural DAs are trained in the field of Plant Sciences/Horticulture, Animal Sciences and Natural Resource Management (Zerihun, 2014) with very few to none trained in irrigation agronomy. In this regard, irrigation agriculture is constrained by multiple challenges related to knowledge and skill gaps among development agents which could limit not only the productivity of iHVC but also farmer's participation in technology adoption and up-scaling.

DAs on-job capacity building trainings tailored towards irrigation agronomy, developing relation with service users, facilitating farmer empowerment and social mobilization in areas of iHVC production and marketing is needed to benefit from the DAs deployment to the *Kebeles*. An important aspect of a more market oriented extension service is the role of the extension system in facilitating linkages between producers and market parties which is not yet part of extension service in the study area or elsewhere in the country.

Table 5. Links to Institutional services and infrastructure access to the interviewed iHVC farmers (N = 130) in Central Zone Tigray Region

Woredas	Frequency of respondents (%) to access to facilities and infrastructures							
		Weather road	Market information	Irrigation	Extension	Telephone	Mobiles	Credit
Ahferom (n = 20)	Yes	16(80)	20(100)	20(100)	20(100)	-	20(100)	18(90)
	No	4(20)	-	-	-	20(100)	-	2(10)
K.Temben (n = 20)	Yes	14(70)	-	18(90)	18(90)	1(5)	16(80)	12(60)
	No	6(30)	20(100)	2(10)	2(10)	19(95)	4(20)	8(40)
M.Leke (n = 25)	Yes	-	3(12)	25(100)	25(100)	-	25(100)	6(24)
	No	25(100)	22(88)	-	-	25(100)	-	19(76)
T.Machew (n = 20)	Yes	1(5)	1(5)	20(100)	20(100)	1(5)	15(75)	10(50)
	No	19(95)	19(95)	-	-	19(95)	5(25)	10(50)
T.Abergele (n = 25)	Yes	23(92)	19(76)	24(96)	25(100)	-	14(56)	25(100)
	No	2(8)	6(24)	1(4)	-	25(100)	11(44)	-
W.Leke (n = 20)	Yes	-	11(55)	18(90)	11(55)	3(15)	13(65)	9(45)
	No	20(100)	9(45)	2(10)	9(45)	17(85)	7(35)	1(5)
Grand Total (n = 130)	Yes	54(41.5)	54(41.5)	125(96.2)	119(91.5)	5(3.8)	88(67.7)	80(61.5)
	No	76(58.5)	76(58.5)	5(3.8)	11(8.5)	125(96.2)	42(32.3)	50(38.5)

Source: Own survey (May 2019)

Access to telephone service

Rural telecom service like public telephone or mobiles can help farmers improve agricultural productivity and marketing by giving them access to basic financial services, new agricultural techniques (eg. Inputs like seeds, chemicals) and new markets, in turn helping them to secure better prices for crops and a better return on investments (Getaw and Godfrey , 2015). Especially the availability of such services would help in building trusts among farming communities working in cooperatives and to transparently communicate market related information such as prices. In all the PASIDP *Woredas* of Central Zone in Tigray there are mobile services. However, the number of users of mobile phones varied across the studied *Woredas*. Ahferom, T. Abergele, and Kolla Temben more than 80% of the respondents were mobile phone users. From the FGD, farmers use mobile phones to access information related to iHVC production and marketing (eg. Current output price, market trends, agricultural inputs, weather, disease and pest, credit facilities and related information such as terms, loans and mode of repayment) households reported that there is mobile telephone service. However, availability of mobile phones for young family members helps in communications.

Access to credit service

Access to rural credit market is essential component of strengthening iHVC production and marketing as it is crucial element starting from land preparation, input access and output marketing. As depicted in Table 5 and Figure 8, credit service access varies across the four PASIDP *Woredas* of CentralZone. More than half (80%) of the farmers in the six *Woredas*Zone reported availability of credit services, the number is higher in Tanqua Abergele (85%) and Ahferom (70%) *Woredas*. Although the credit facility is available, farmers seldom access the service for iHVC production; partly because most inputs such seeds, pesticides/herbicides for iHVC are either individually purchased or supplied through multipurpose cooperatives. Awareness creation on wisely benefiting from available credit services could contribute to market oriented and self-sufficient iHVC production systems. Overall, historically there is credit for purchase of high value crops inputs such as water lifting devices was available from credit facilitators such as DECSI, OoARD and NGOs in many *Woredas* in the Zone.

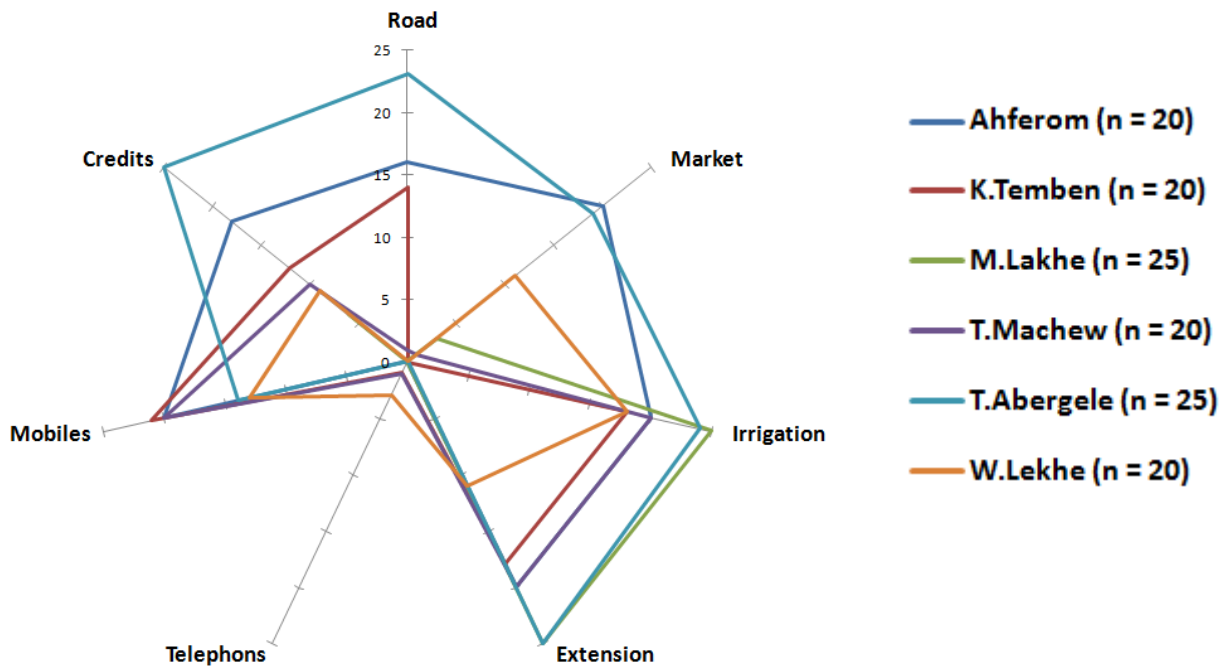


Figure8. Institutional service and infrastructure access of irrigated high crop producing households in PASIDP target Woredas of Central Zone, Tigray Region

3.1.2 Irrigated high value crop (iHVC) Marketing

High value crops such as fruit and vegetable crops are important both for health and economy; but the amount and mode of production and marketing is still weak in Ethiopia. Demand for these HVCs consumption tends to grow very rapidly with urbanization, increased awareness and income of the peoples. Exports of fruit and vegetable products from Ethiopia have also increased from 25,300 tons in 2002/03 to 63,140 tons in 2009/10 (EHDA, 2011). Horticultural produce is a high value item. Diversity of fruits and vegetables are demanded by consumers, such growth provides major opportunities for farmers and retailers to diversify increase their incomes. Such opportunities may be especially valuable for women, who are the primary producers and marketers/retailers of horticultural produce throughout Ethiopia.

3.1.2.1. Markets for iHVC

Agricultural marketing is inferred to cover the services involved in moving an agricultural product from the farm to the consumer. It is also the planning, organizing, directing and handling of agricultural produce in such a way as to satisfy the producer and the consumer demand. Irrigated High Value crops (iHVC) are produced in some specific locations in the PASIDP *Woredas* of Central Zone and supplied to the local markets, zonal market and to the neighboring regions through the regional hub Mekele. The major markets identified for collection and distribution of iHVCs are Tanqua Abergele *Woreda* (Yechila town), Were Leke *Woreda* (Edaga Aribi town), Mereb Leke *Woreda* (Rama town), Kola Temben *woreda* (Abi Adi town), Thatai Maichew *woreda* (Wukuro Maray) and Ahferom *woreda* (Inticho Town). The market actors namely farmers (producers), wholesaler, retailer, consumer, collectors, and brokers play different roles along the market chain. Vegetables, notably, onion, tomato, pepper and potato are major products offered in the iHVC horticulture market. Some other products such as fruits like mango, orange and banana are also offered at relatively smaller quantities by a few farmers. The flow of products is dictated by seasonal supply deficit. The study reveals that Axum, Wukiro, Abi Adi, Edaga Arbi, Inticho towns and Mekele City markets serve as iHVC collection and marketing Centers, while Gerhu Sernai, Edaga rebue', Ahsa, Chila, Selektel are local links of iHVC markets (Figure 9). In addition, there are potential niche markets, including Axum, Mekele and Adigrat Universities in near proximity to benefit from the supply if the market develops.

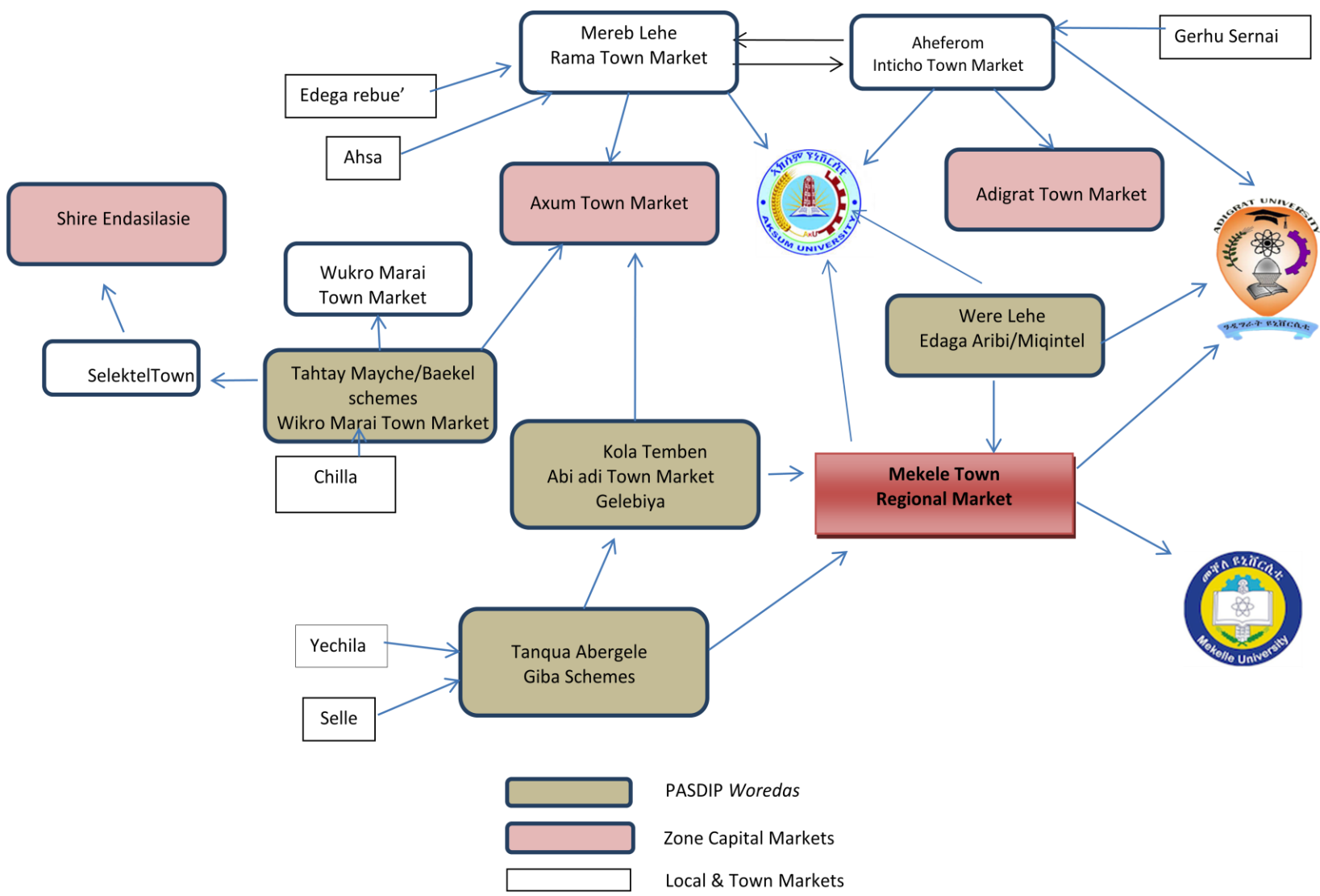


Figure 9. Major iHVC markets and flow channel flon IFAD-PASIDP target Woredas of Central Zone, Tigray Region

The study result reveals that market attractiveness and dynamics in most of PAISDP Woredas of Tigray zones smallholder farmers responded that they have experience of selling their product in the market in local,woreda,zonal and regional market and the remaining used their produces for household consumption.

3.1.2.2 Segmenting and targeting iHVC in Tigray Central Zone

The marketing channel in the iHVC marketing system can be broadly categorized into four levels of flows (Figure 10). There are different brokers and traders with different roles in the marketing system. Along the marketing channels, there are different actors contributing to different and complementary marketing functions. These include production, facilitation, buying and selling, transporting, packing, sorting and, processing. In our study area it is interesting to note that some key functions such as packaging, sorting and processing are poorly developed and the sense of value adding is practically not observable. The changes in the value of products as they move away from production along the marketing channel to the consumers is the increased utility by making the goods available rather than adding value in terms of increased shelf life, improved quality or increased safety.

The shortest channel occurs when producers produce and use iHVC for household consumption. The next shortest chain in the central Zone is when producers directly sell it to the consumers. This occurs when the farmer brings small quantity of the product to market and when the farm is closer to urban centers like Yechila town, Edaga Aribi town, Rama town, Abi Adi town, Wukuro Maray and Enticho Town. In Central Tigray zone the most common type of market channel in study area is the channel where rural retailer buys from farmers and sells to consumers.

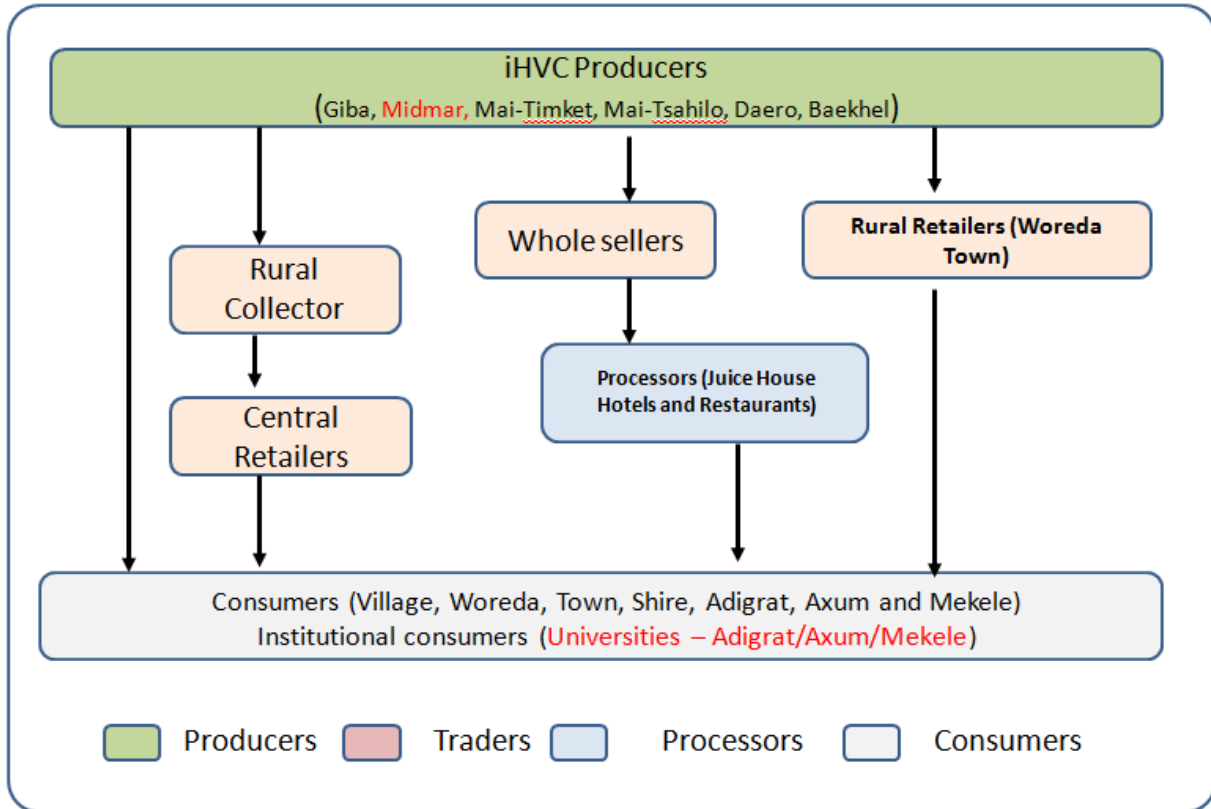


Figure 10. Marketing channels and flow of iHVC in PASDIP Woredas of Central Zone, Tigray Region

From FGD data source most of PASIDP Woredas in Central Tigray zones small holder farmers responded that they used to sell their produces on cash basis for ready purchaser rather than credit. A target market is a group of customers (individuals, households or organizations), for which an organization designs, implements and maintains a marketing mix suitable for the needs and preferences of that group (Pride, 2017). Most of PASIDP Woredas in Central Tigray zone small holder farmers in KII responded that they target to sell their produce nearest village markets.

From FGD data small holder farmers segment the potential and existing market based on their product quality and quantity i.e. high quality and quantity iHVC supplied to the regional market, and the remaining amount sold on local market and farmers make important segment of the rural consumers since they consume part of their produces. Wholesalers and retailers purchase the product from farmer who has the capacity to supply sustainably based on trust agreements. Consumers prefer medium size and free from damage HVC. In general consumers have their own quality criteria to purchase HVC. Farmers' bargaining power is low due to the lack of

alternative market outlet. The most common marketing channel immediately available to the farmer is through collector and brokers. There are up to three collector and brokers between the producer and the consumer. The traders/wholesaler and the producer do not have any contact in which case the broker is decisive in setting the price, often making his own margin (unknown to both trader and producer). There is no norm or regulation governing the acts of the brokers and their behavior that negatively affects the farmers.

From buyer's behavior majority of (83%) respondents replied from central zone they did not trust their buyers and 65% responded that they offer unfair price by buyers.

3.1.2.3 Nature and size of the iHVC market

In KII and FGD smallholder farmers in the PASDIP Woredas of Central Zone responded that their agricultural production and marketing is overwhelmingly of a subsistence nature and the size of the market is small and fragmented with dominance of the middle men(brokers) still have high market potential. There are four higher academic institutes in nearby Zonal cities including Axum (Axum University), Adigrat (Adigrat University), Maichew (Raya University) and Regional city of Mekele (Mekele University) hosting over 50, 000 students per year and as a niche market has market potential of 9,414 quintals of tomato, 10,066.8 quintals of onion, 7,842 quintals of potato, 864 quintals of Cabbage and 94.8 quintals of Pepper.

3.1.2.4 Major actors and their functions in the Market Chain of iHVC

There are different factors contributing to different and complementary marketing functions along the market chain of the high value crops (Table 6 and Table 7). The whole high value crops marketing chain can be broadly categorized into three levels; the production side where farmers and supporting institutions are major actors, the market where different intermediaries like brokers with their varied functions and the consumption side.

Actors can have direct or indirect roles in the process of production as well as marketing of HVC (Figure 11). Actors who have direct role are those involved in the product handling and transaction process whereas the indirect actors are different service providers from production up to marketing. Direct market chain actors include producers, assembly traders, wholesalers, retailers and consumers.

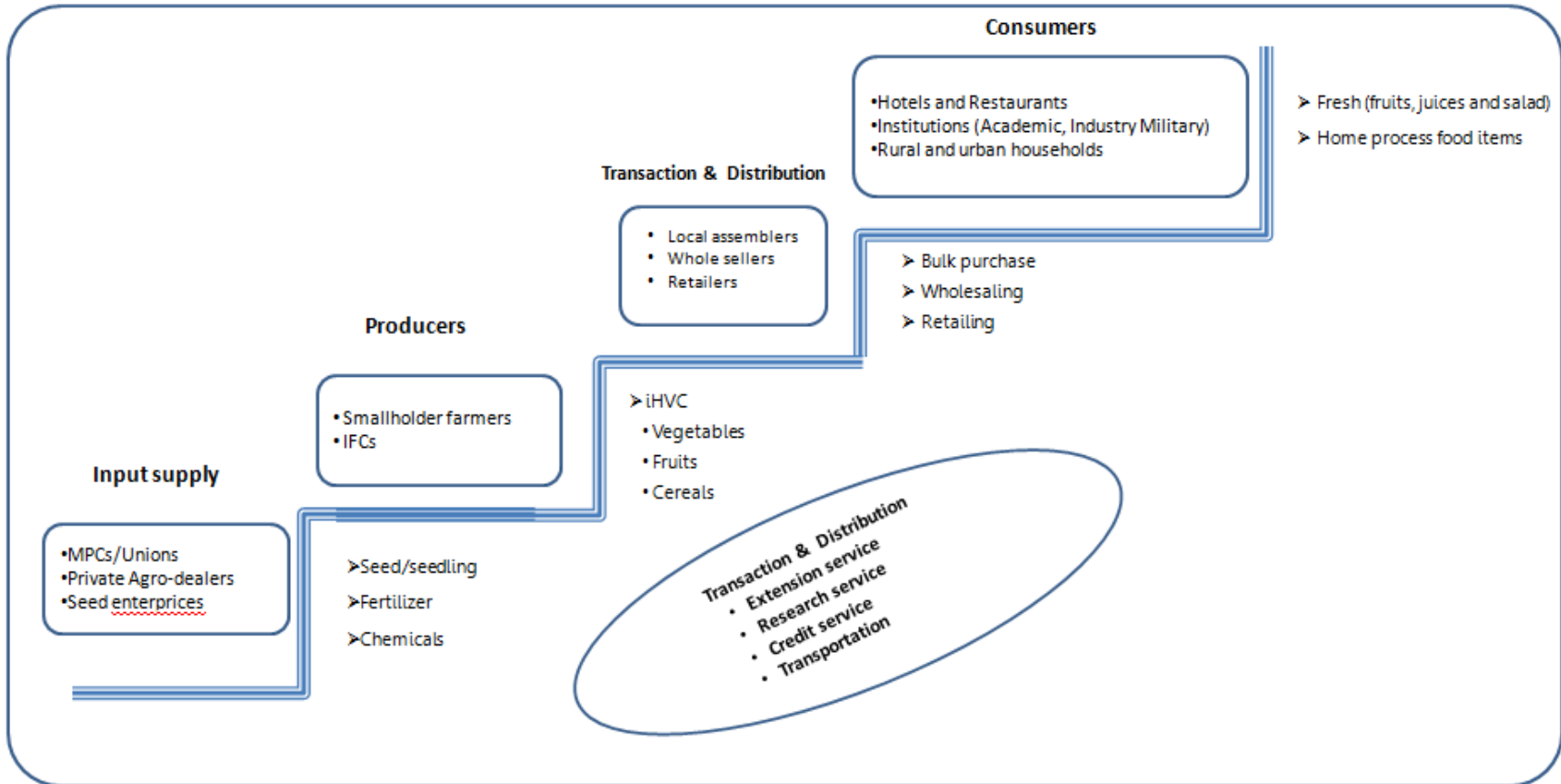


Figure 11. Major actors and their functions in iHVC value chains in Central Zone of Tigray Region (Adapted from Timmer P., 2008)

The marketing channel in the iHVC marketing system in Central zone of Tigray can be broadly categorized into three levels, namely the producers, traders (Wholesalers and retailers) and consumers. There are different brokers and traders with different roles in the marketing system. Along the marketing channels, there are different actors contributing to different and complementary marketing functions. These include production, facilitation, buying and selling, transporting, packing, sorting and etc. It is interesting to note that some key functions such as packaging, sorting and processing are poorly developed. This section discusses the major market actors and identifies the constraints of an efficient marketing system and the opportunities for improvement.

According to KIT *et al.* (2006), the direct actors are those involved in commercial activities in the chain (input suppliers, producers, traders, consumers) and indirect actors are those that provide financial or non-financial support services, such as credit agencies, business service providers, government, NGOs, cooperatives, researchers and extension agents.

Functions of Primary actors

Input Suppliers

For HVC Producers in central zones of Tigray PASIDP *Woredas* small holder farmers apply different inputs in the production process of vegetables and fruits. More specifically, seeds/seedlings of fruits and vegetables, fertilizer, and pest and disease control chemicals are the major inputs that farmers in the irrigation schemes apply and there are different suppliers who provide these inputs.

The office of agriculture and rural development bureau and Tigray regional seed enterprisethrough Primary multipurpose cooperatives/union are the major Input suppliers of fertilizer, seeds and pest and weed control chemicals. There are also private agro input dealers who supply seeds of different vegetables such as Onion, Pepper, maize and sorghum from cereals and Mango from vegetables as well as weed controlling chemicals. Fruit seedlings are mainly obtained from nursery sites established by the office of agriculture and rural development bureau and REST.

The seed from office of agriculture and rural development is cheap and of good quality but not timely, which is why farmers buy seeds from private agro dealers/traders. Seeds from private agro dealers/traders are past their expiry date. There is no specialized seed supplier in the study area. Due to the seasonal nature of improved seed business, private input suppliers do not want to specialize on seed business in central zone.

On conclusion, majority group in the FGD ranked service related to seed/seedling supply by cooperatives, research/universities, and nurseries of both REST and office of agriculture and rural development as poor. However, large majority of the producers are not satisfied with the supply of seed/seedling. The most important challenge in relation to seed/seedling supply raised during the group discussion was that supply is not timely. As far as the supply of different plant protection chemicals is concerned majority of the groups in the study schemes were not satisfied and rated it as poor and very poor. They expressed that the chemicals they mostly use as disease control was less effective.

Producers

Smallholder farmers' producers is the major actors or primary suppliers of vegetables and fruits. These are the supply side actors who apply all the required cultivation practices to produce vegetables and fruits and supply directly to the consumers or to other market intermediaries. They need agricultural inputs such as seed, fertilizers, chemicals, packing materials, and other farm tools from input suppliers. Being smallholders, the HVC producers in the study schemes have common feature that operate in a very small and fragmented plot of land and supply their products to the nearby markets in a very fragmented way. Mostly they produce crops of high value using conventional type of irrigation method.

They transport iHVC to the nearest markets (village market) or sold to collectors at farm gate; secondary market and destination markets themselves, either carrying sack themselves over a distance of 1.00 and above hours on an average. Alternatively, they sell to village collectors known as "farmer traders" who assemble/ collect HVC from large number of farmers. Farmers also sell their products directly to wholesalers in destination market.

Village markets are markets which are the closest to the nearest of farmers, but has less marketing facilities (electricity storage, water) and farmers sell large quantity of HVC to these agents. Regional markets are surplus markets, which are found in the regional town where, most of surplus iHVC (For example Onion, Tomato, and Pepper) are transacted. Terminal or destination markets are deficit markets which are found in central zone town, and most of surplus products flow to these markets.

From our study HVC productions in central Tigray zones of PASIDP *Woredas* are relatively diverse. The major value chain functions that HVC growers perform include plowing, planting, fertilization, irrigating, weeding, harvesting and post-harvest handling.

The diverse agro-climatic conditions can make growing HVC crops highly cost-effective and competitive, and provide vast opportunities in study areas. Unfortunately, these opportunities

have not been yet exploited by the farmers due to the lower price they receive for their produce in the markets, as well as bearing the cost of post-harvest handling.

Collectors (Rural – Assemblers)

From our FGD data in places where there is relatively bulk production of HVC assemblers or local collectors collect products from small producers and supply in bulk to the market. These are traders in assembly markets who collect HVC from farmers in village markets and from farms for the purpose of reselling it to wholesalers and retailers. They use their financial resources and their local knowledge to bulk HVCs from the surrounding area. They play important role and they do know areas of surplus well. Collectors are the key actors in the HVC value chain, responsible for the trading of HVC from production areas to wholesale and retail markets in the study areas. The trading activities of collectors include buying and assembling, reducing the size, drying, repacking, sorting, transporting and selling to wholesale and retail markets. Collectors /Assemblers sometimes act as agents of wholesalers in the woreda, zonal and regional Markets and collect about 5% commission for their facilitative roles in product collecting products from producers and facilitating transportation. Individual assemblers who operate with their own working capital collect products from farmers and sale to wholesalers or retailers. There are also other assemblers that act as agents of wholesalers in other places and collect commission from their customers.

Wholesalers

Wholesalers are large traders who handle bulk volumes of vegetables and fruits. These are someone who buys large quantity of HVC and resell to merchants rather than to the ultimate customers. Wholesalers are the major actors in the marketing channels. These were those participants of the marketing system who used to buy iHVC on a large volume than other actors did.

In the study areas wholesalers are mainly involved in buying HVC from producers and collectors in larger volume than any other actors and supplying them to processors and others. The Survey result indicated that wholesale markets are the main assembly centers (Mekele Town regional whole sale HVC market-Adha) for HVC in their respective surrounding areas. They have better transport and communication access than other traders. Almost all wholesalers have a warehouse in a market either self-owned or rental basis.

From our FGD data wholesalers collect products from producers (within and outside the region) directly or through collectors reside in the local areas or woreda urban centers. In areas where there are high productions volume wholesalers made temporary/seasonal agreements with

farmers. They made tacit agreement with producers regarding to the volume of produces they can purchase, the price they will pay, product delivery time and mode of payment. Wholesaler explained that they have close contact with fruit and vegetable producers in the following belts like Raya Azebo and Raya Alamata, Rama, Gundagundo, Adiha/Kola Tembien, around Tekeze River, and other vegetable (Onion, Tomato, Green Pepper) producing areas and who can supply the volume of full truck load. Wholesalers in zonal towns such as Axum and Adigrat also do the same with farmers in their surrounding production areas.

The regional wholesalers also bring significant proportion of fruits and vegetables from different parts of the country. But, the volume of each product brought from other regions varies depending on season and supply from the region. These products are then distributed to other zonal wholesalers, bulk buyers such as supermarkets/shops, institutional buyers like universities/big hotels/restaurants, and roadside retailers. It has been also observed that wholesalers sale to household consumers who can buy more than 5 kg per type of product. But, they are well aware of that legally they are not allowed to sale directly to household consumers.

Retailers

Retailers are agents that resell HVC to end users. These include Shops and juice house in all zonal, woreda town and Mekelle markets that perform HVCs retailing. Some of them like vegetable shops and supermarkets handle vegetables and fruit for sale as supplementary business while others like those sit along roadside on non-market days, open market retailers and small business operate in separate sheds work on HVCs retailing as means or source of livelihood. Retailers are large in number compared to other intermediaries in the high value crops marketing but handle small volume of the commodities. The majority of retailers are characterized by having road side shade and used to sell vegetables purchased from wholesalers or farmer traders or farmers to ultimate consumers in pieces after receiving large volumes without any legal permission from concerned government bodies. The numbers of legal vegetable and fruit retailers in all the study districts were found to be very small compared to those who operate in an illegal way.

Retailer involvement in the chain includes buying of HVCs, transport to retail shops; grading, displaying and selling to consumers. Retailers are key actors in HVC value chain in the study *Woredas*. They mostly buy from assemblers and sell to urban consumers. Sometimes they could also directly buy from the producers. Consumers usually buy the product from retailers as they offer according to requirement and purchasing power of the buyers.

From our FGD data majority of the retailers in the woreda towns buy and sale HVC once a week while others who work as road side and open market retailers work throughout a week but their number is small. In Mekelle, large numbers of retailers are found in the major market centers like kedamay woyane market areas, Adihaki, Adihawusi, Adiha, 05 kebele, and along the major streets. Women and young children are the major groups of the communities engaged in vegetables and fruits retailing.

Middlemen/ broker

A broker is an individual or party that arranges transactions between a buyer and seller for a commission when the deal is executed. In our study area unlawfully broker also acts as a seller or as a buyer, becomes a principal party to the deal.

In our FGD data no formally registered brokers have been observed in all market centers. But, as mentioned earlier drivers who transport vegetables and fruit play the brokers role. Some young people living in the rural areas (production areas) that have exposure about market opportunities for the HVCs also act as brokers by linking producers with traders. As it has been explained by farmers during the FGD producers are not happy with the role of brokers. Farmers believe that brokers provide distorted market information especially on price though they compete the market margin/profit margin otherwise go to the pocket of the producers.

Transporter

Transporters have are very crucial role in the high value crops production and marketing. Transporters fill the distance between the points of production of HVC and the potential market places. They add value in terms of place by transporting and distributing products from the area of surplus (including production point and large wholesaling markets like the case of Mekelle/Adiha market) to the area where there is shortage of the commodities. With such role, they balance the availability of products in surplus and deficit areas by using ISUZU, FSR –ISUZU and local Carts. Long truck owners also transport fruits and vegetables from other parts of the country and neighboring countries like Sudan. Transporters closely work with wholesalers and there are truck owners who mainly work on transporting HVCs. There are also cases where transporters, particularly the drivers (who are not owners of the truck) act as brokers. Because of their exposure to different production areas they have access to information related to locations having bulk products. Whenever they observe excess products on their way they communicate with wholesalers in big market centers like Mekelle and the zonal towns.

There are also people in the urban areas that have animal driven carts and Bajaj. These provide transportation service mainly to retailers, hotels/restaurants in urban areas to transport commodities from the wholesaling market to their working places. Producers located in schemes that are easily reachable with these kinds of transport facilities also use carts/Bajaj to take their produces to the nearby local or woreda town market.

Consumers

Consumers are those purchasing the products for consumption. These are the actors at the end node of the high value crops marketing. Consumers include households of both urban and rural dwellers who purchase HVC for home consumption, hotels/restaurant/juice houses as inputs to their business and institutions. Household consumers buy different types of HVC mostly from the nearby shops/supermarkets or small roadside retailers. However, some individual consumers also reported that they purchase from wholesalers in relatively larger volume because the price is by far less than the retailing price of supermarkets and other retailers in their vicinity. The most commonly purchased HVC by household consumers are vegetables (tomato, potato, onion, Pepper, lettuce, Swiss chard, carrot, head cabbage and garlic) and fruits (banana, orange, mango, and guava). Farmers also make important segment of the rural consumers since they consume part of their produces. Institutions purchase (university campus, prison house and hotels) their product from wholesaler who has the capacity to supply sustainably based on contractual agreements. Consumers prefer medium size and free from damage; and medium size HVC. In general consumers have their own quality criteria to purchase HVC.

In the HVC marketing Hotels/restaurants and juice houses are the major bulk buyers. They mostly buy from wholesalers while some of them have direct contact with producers. For hotels/restaurants the volume and frequency of purchase depends on the size of their business as well as availability of the products in the market. In terms of volume large hotels and restaurants purchase quintals of different HVCs while small snack and juice houses purchase in kilos. In terms of varieties of produces still hotels/restaurants purchase wide varieties of vegetables and except some juice houses that prepare fast foods like "Selata" many of them buy fruits such as mango, papaya, avocado, and banana which are the major inputs for preparation of juice. Almost all hotels in the district towns purchase the required volume of produces once a week; during the weekly market day. This is mainly due to the reason that the produces are available during the weekly market day to the required volume and types.

For the household consumers the respondents explained that frequency of purchase varies depending on the availability of the products in the market, food habit of the house and their

economic status. According to the opinion of the household buyers contacted in the district markets they mostly purchase vegetables once a week since fresh vegetables are only available in that day. But, sometimes they also purchase vegetables like tomato, onion and potato during non-market days from shops and road side retailers.

The institutional buyers like universities/colleges, military camps around the Ethio-Eritrea border and other areas, and prison centers (detention centers) are important actors in the HVCs marketing. Institutions mainly purchase vegetables from wholesalers in bulk volume. Mostly government institutions particularly higher learning institutions and detention centers buy vegetables and fruits based on an open bid which allows potential wholesalers to compete. The bid document aired by the government institutions contains all the detail quality requirements of the products to be supplied. Then, the winner/least cost bidder signs an agreement to supply the produce for a limited time period, usually one year. For the case of military camps the purchase is not based on open bid system rather they purchase vegetables and fruits in bulk but on weekly basis from potential suppliers on negotiation. As it is known organizing farmers in cooperatives is a way out in order to buy inputs and selling their HVC produces but lack of well-functioning structured cooperative organization plus its members poor attitude of assembling and selling as their produces together on the side of small holder farmer is the major reason for not exploiting the potential Institutional consumer market.

Functions of secondary actors

Such actors are those who provide supportive services including training and extension, information, financial and research services. According to Scott, (2007), access to information or knowledge, technology and finance determines the state of success of value chain actors. Zone agricultural & rural development office, Dedit- micro finance, NGOS/Project (IFAD) is main supporting actors who play a central role in the provision of such services.

Agricultural and Rural development Office: This is the governmental institution which provides extension service for small scale farmers in agricultural sector in the study area. This organization provides various extension services specifically in HVC sector in the study area. The major services which this organization is providing in the HVC sector are provision of improved HVC variety, compost application, harvesting and post-harvest handling, and provision of improved harvesting material working on introduction of improved irrigation technologies (varieties, improved practices, efficient irrigation methods). The office of agriculture provides technical backstopping to farmers in all the production related activities. The woreda and kebele level extension experts assist farmers technically on how to apply different improved

agronomic practices (time and method of planting, use of improved varieties, soil fertility management), use of irrigation water, disease control methods, commodity selection, etc.

With its very limited capacity to provide alternative technologies to the required level, research is also one of the supporting institutions working to improve production and productivity of the HVC. For instance, in areas where Mekelle, Axum and Abergelle Agricultural Research there are operating there have been some efforts to introduce improved varieties of vegetables and fruits, improved crop husbandry practices (plant spacing and disease control), and technologies that improve irrigation water use efficiency.

From our KII data assessment has further indicated that despite extension service is providing technical advice in iHVC sector, provision of extension service is not covered the whole irrigation farming families

Agricultural Marketing Promotion Agency

Tigray Agricultural Marketing Promotion Agency is governmental organization responsible for promoting the agricultural commodities of the region in national and international markets and for the advancement of entrepreneurial know-how among agribusiness actors (farmer and farmers association, the private sector and the community at large).

In addition, the agency involve collecting, processing and disseminating of market information to all concerned and interested governmental and non-governmental organizations in and outside the region.

Agricultural Input Supply Enterprise

Agricultural Input Supply Enterprise involve for a long period of time in delivering commercial fertilizer to farmers throughout the country. Farmers in the area are also using DAP and UREA fertilizers from the distribution centers.

Farmers Cooperatives and Unions

Farmer's cooperatives and unions are actively participating in supplying inputs to farmers through member cooperatives. The unions are mainly concerned with provision of commercial fertilizer from federations at regional level to farmers grass root level on credit and cash bases. The farmer's cooperatives also provide other commodities like soap, sugar and oil among others to the farmers. In addition, they provide credit to the farmers. But lack of well-functioning organizational structure problems deters farmers not to benefit from collective bargaining market price decision.

Trade and industry Office

This is also governmental organization which provides Trade/marketing services in the certain stages of HVC value chain in the study area and have regulatory framework to control the illegal

traders. This organization provides services like quality control, licensing, and market place for wholesalers, collectors and retailers. The organization provides license to wholesalers emerging from the near area and certifies licensed HVC traders to secure their freely involvement in HVC transactions. At the same time, the organization prohibits direct entry of unlicensed HVC traders in order to uphold the rights of traders who have been licensed. By performing all this responsibilities, the organization enables HVC marketing environment for the traders and sets rules and regulations guiding traders in the study area. But, the study has further indicated that some HVC traders like collectors act illegally by drying HVC on the ground without using plastics or sack and enter into the business without receiving trade license from the woreda agricultural product trade and cooperative office.

Finance Institutions

This is financial organization which provides credit and saving services to HVC producers, assemblers and retailers in the study area. The organization first provides credit to the farmers for capital investment in HVC processing in annual base and in the second term allows farmers to save a certain portion of income obtained from their involvement in HVC processing. The organization also provides credit service for HVC assembles retailers and wholesalers as initial capital. In the study zone financial institution like DECSI, Rural Saving and Credit cooperatives (RuSACCO) that provide credit service to small holder farmers particularly to those who want to purchase irrigation equipment.

Rural saving and credit associations (RuSACCOs)

RuSACCOs educate the farmers and other rural dwellers to save regularly and to plan for their household economies. In our study area RuSACCOs played major roles but they are not accessible to all small holder farmers in the study areas.

International Fund for Agriculture Development (IFAD)

This is international financial institution project which is working in the HVC sector in the study area in collaboration with the woreda agricultural & rural development office in providing fund by forming steering committee consists of woreda Administration (Chair), office of agriculture and rural development, finance and economy office, and office cooperatives and agricultural marketing and women and youth office. This organization emphasizes on promotion of major HVC product of the particular community to the national market thereby linking particular producers with the market and upgrading of HVC. In addition to this, the organization is working in capacity building of the farmers on small scale HVC processing.

Table 6. Summary of Irrigable HVC value chain stages, functions (roles), actors, and their gaps

R/N	Value chain stages	Functions(Roles)	Actors	Gaps
1	Input supply	Seed/seedling	BoA, Cooperatives, Research centers, Retailer shops, Tigray seed enterprise, AISE, Individual agro-dealer /suppliers	<ul style="list-style-type: none"> • Lack of quality seed supply • Not delivering input for small holder farmers in timely manner. • The costs of inputs are very high by government bureau Ex-BoARD. • Poor Quality of Inputs supply from private agro dealers • Illegal Agro-dealers supply expired Input for small holder farmers with low cost. • Farmers have organized in cooperatives but not yet started to buy and distribute inputs because of attitudinal problem.
		Fertilizers	Cooperatives/Unions, AISE, DCSI	
		Agro-chemicals	Private Agro dealers ,Retailer shop, AISE Cooperatives	
		Farm Equipments	BoA, Gunna, Biruh Tesfa Cooperatives, Retail shops, NGO, Private workshops, TVET, Agricultural mechanization, MSEs	
		Packing and transporting materials	Private workshops, Factories, Farmers	
2	Production	Vegetable production	Farmers, Organized groups, Private & Public Enterprise	<ul style="list-style-type: none"> • Low supply of HVC seed • Low irrigation facility • Poor disease control • Lack of technical training • Lack of credit access • Mistrust/Lack of trust among members with co-operatives leaders. • Challenges to produce required quantity and quality, e.g. pests and diseases, adverse climatic conditions, • Presence of wrong type of middlemen • Poor infrastructure, • Lack of involvement of the private sector

				<ul style="list-style-type: none"> • High cost of inputs • Low yield • Storage problems
3	Post-Harvest Handling	Sorting/grading, processing	Whole sellers, collectors, farmers, User groups, Processing plant owners	<ul style="list-style-type: none"> • Post harvesting handling problem like storage
4	Marketing/Whole sale	Whole sale, Transport Store	Investors, middle men, Efruit, Super markets, farmers,	<ul style="list-style-type: none"> • lack of market in time of perishability • illegal marketing activities i.e. Large number of middlemen in the marketing system;
5	Processing	Sorting/ Grading, Value addition/ juice house	Retail shops, Street, Supermarkets, Cafeteria Hotels, prison house, Colleges	Lack of standard for grading and value addition standards
6	Retail	Retailing	Open market retailers, Supermarket, vegetable retailers, farmers, Retailing shops	<ul style="list-style-type: none"> • There was no regulatory trade control on retail business so as to protect small holder farmers from cheating in scaling(weighing), • Lack of regulation in their buying and price setting pattern. • Farmers have organized in cooperatives but not yet started to market their HVC as one because of attitudinal problem.
7	Consumers	End users of vegetables	<ul style="list-style-type: none"> • Farmers, Universities, Hotels/Cafeterias, Military centers, urban dwellers, Prison centers, Orphanage, etc. 	Lack of lack of technical and production full scale supply of HVC on yearly basis by farmers cooperatives.

Table 7. Table 8 Summary of Irrigable HVC Service provider roles, actors and gaps at each stage

Stage	Service provider Roles	Actors	Gaps
Input	Provision of Seed/ seedling	BoA, Cooperatives, NGO, research centers, Tigray seed enterprise, Agricultural input supply enterprise(AISE), Organized farmers(Coop), Individual farmers, Gunna Trading, seed supplier from center	Not delivering input for small holder farmers in timely and cost effective manner.
	Provision of Fertilizers	Cooperatives/ Unions, AISE	
	Provision of Agrochemicals and spraying service	Retailing shop, Gunna Trading House, AISE, Cooperative, BoA, private	
	Provision of Farm Equipment/ Irrigation technologies and maintenance service	BoA, Gunna, Cooperatives, Retailing shops, NGO, Private workshops, TVET, Agricultural mechanization, Private workshops	
Production & Postharvest handling	Extension	BoARD, NGO, TARI, EIAR,	<ul style="list-style-type: none"> • Low supply of HVC seed • Low irrigation facility • Poor disease control mechanisms • Lack of technical training • Lack of credit access • High cost of inputs • Low yield
	Credit	DCSI, Cooperatives, NGO	
	Spraying service	Private shops, BoA, NGO,	
	Capacity building	BoA, TARI, Universities, TVET, NGO, Cooperative promotion agency	
	Extension service	<ul style="list-style-type: none"> • BoA, NGO, TARI, Universities 	<ul style="list-style-type: none"> • Lack of coordinated effort between extension service Cooperative agency • Storage problems

Trading/Marketing	Business development	Bureau Trade, Industry, Urban Dev't (BoTI & UD), TAMPA	<ul style="list-style-type: none"> • Low supply of HVC seed • Low irrigation facility • Poor disease control • Lack of technical training on marketing • Lack of credit access • High cost of inputs • Low yield • Storage problems • Lack of market infrastructure
	Capacity building	BoTI & UD, TAMPA	
	Transport	Private transporter, Share companies	
	Arrangement of market centers	Municipality	
Processing	Technical advice	BoTI & UD, TAMPA, TVETs, Quarantine regulatory department	<ul style="list-style-type: none"> • Lack of technical skill on marketing
Retailing	Arrangement of marketing sites	BoTI & UD and municipal	<ul style="list-style-type: none"> • Lack of market to absorb the production • Low price offered by the market • Large number of middlemen in the marketing system; • Absence (weakness) of marketing institutions safeguarding farmers' interest and rights over their market able produces (e.g. cooperatives);

Source: Own FGD and Survey, 2019

3.1.2.5 IHVC Selling Method

The majority of the small holder farmers handle small volume of iHVC produces. With these volumes, most of them opt to sale their HVC produces at the local village or local town market directly to the buyers on cash basis. With these volumes, most of them opt to sale their vegetable & fruits produces at the local or district market directly to the buyers on cash basis. Still, some farmers who handle relatively large volumes of produce sale to assemblers or wholesalers on cash base. There are also farmers who are connected to wholesalers and supermarkets in big urban center like Axum and Mekelle with whom they have acquaintance, on credit basis. Sometimes farmers deliver their products to the local cooperative to sale on behalf of them. In this case, they are obliged to wait until the products are sold by the cooperative. Similarly, the mode of payment among wholesalers and retailers is a combination of cash and credit. When the wholesalers and retailers are from the same market place mostly cash payment is practiced. However, if they are from different areas or markets both cash and credit payment is practiced. Wholesalers and collectors are communicating through phone with other wholesales and/or retailers in other zonal or regional markets in which they sent vegetable to the buyer and the buyer transfers the price after receiving the consignment. This kind of transaction reported in MerebLeke for instance collectors make communication through phone with buyers in Mekelle and send the product by lorry and the end receiver makes cable transfer of money to the sender.

Farmers and experts of the *Woredas'* Office of Trade and Industry explained that producers are not allowed to sit and sale their products in the district markets as retailers. This is because the retailers and wholesalers in the local markets claim that they are tax payers and that retailing place is allowed only for licensed traders. For this reason, farmers who try to set and sell products in urban market places are usually chased by guards assigned to do so. Hence, farmers who transported their products to local market places are forced to sale to wholesalers or retailers usually compelled at low price. According to the discussion made with TAMPA, the problem is well noticed and the regional government is working to introduce open markets for fruits and vegetables in urban areas where farmers are allowed to sale their products directly to consumers once a week. The open market is planned to be introduced first to Mekelle and then to other towns. For this purpose, TAMPA in collaboration with BoARD, Bureau of Trade, Industry and Urban Development and Mekelle City Administration are working to secure land to construct open market where farmers from woreda around Mekelle are allowed to sale their

products. The HVC production system in the schemes is not yet well developed and as a result supply of these crops from the smallholders is not a year round.

In some of the study areas farmers have formed cooperatives to sell their products collectively. This was witnessed in areas where there are relatively large numbers of producers in which farmers have begun to form cooperatives to sale their products. In *Woredas* such as Tanqua Aberegele, Mereb Leke, and Kola Temben, there are cooperatives organized to collect fruit and vegetable products from their respective members and sale their products in collective forms which shows there is the intention to influence the market but in the study zone there was no well-functioning cooperatives. Seasonally, there is high production and there are wholesalers coming to the area to buy in bulk with their cars. The farmers have realized that individually they cannot influence the price but organized they have begun to negotiate the price. These farmers have formed the cooperatives to market their agricultural products relying only on the human and social capital of their members. These cooperative charges the member farmers membership registration fee and service charge after every sale.

Smallholders cultivate on small plots of land and have low volume of supply which implies limited bargaining power compared to that of the buyers. This is observed from all the study schemes. According to the respondents in the schemes, supplying higher volume can increase the bargaining power of farmers and can also attract more buyers. They also notice that bulking up their produce to hire transport and travel to distant markets to find markets that pay better prices. In this case, they recognize local cooperatives play important role in bulking up and marketing of members' produce. They can increase the bargaining power of farmers through negotiation and reduction of cost of transportation. This organization can have useful market information and can get additional information from additional available information from the local office of agriculture. Cooperatives can also create market linkage for long time market access of the products in the production area. In this case, the farmers in the FGDs propose the establishment of such organization and support technically and financially so that they can provide other marketing functions such as packaging, grading and storing.

The majority of the small holder farmers handle small volume of iHVC produces. With these volumes, most of them opt to sale their vegetable produces at the local or local town market directly to the buyers on cash basis. Still, some farmers who handle relatively large volumes of produce sale to assemblers or wholesalers on cash base. There are also farmers who are

connected to wholesalers and supermarkets in big urban center like Axum and Mekelle with whom they have acquaintance, on credit basis.

FGD data mostly from PASIDP woreda of Tigray Central zone small Holder HVC farmers reported that they sold their produce to their regular customers. The selling strategy of the remaining respondent farmers was open to any buyer and their selling method is in a sequence: middlemen to retailers to consumers. Well organized marketing channels do not exist. Marketing of HVCs in the study areas are carried out in the following ways.

Farm-gate Selling

FGD data result showed that farm gate selling is not a prominent market practice. However, some small holder farmers sell their HVCs to the buyers at the farm-gate. In this mode of marketing, buying and selling of HVCs and other goods may be on an individual basis. Buyers go to the farm, usually at a fixed time given by producers, though it can occur at any time without notice. In the case of fruits and vegetables, sometimes, the produce can be sold “in the field,” and the buyer arranges for its harvesting. In the study area, farmers collect their produces in their collection center, and buyers purchased their produce from these collection centers.

Direct Selling

Majority of respondents from KII surveyed prefer to sell their products by themselves, believing that they will get a better price for their produce this way. In this case, after harvesting farmers do general grading and bring their produce to the nearby market on foot. In some cases, they have permanent buyers in the local market, and sometimes they visit house-to-house carrying their fresh HVCs.

Selling through Intermediaries

Distribution of produce to consumers can be undertaken either indirectly or directly. In the former case, intermediaries (retailers, wholesalers, brokers, etc.) are responsible for conveying consumer preferences to producers, who prepare the produce to satisfy this demand. On the other hand, selling directly provides farmers with the opportunity to explore the complex range of consumer behavior and to innovate by developing new alternatives.

In the study area direct selling is decreasing as the volume of production increases. It is not possible or profitable for producers to sell their products directly to consumers, so selling to a middleman is an option adopted strategy by rural and small-holder farmers. In addition, door-to-door selling makes price setting difficult because farmers have little information regarding prices being charged by other sellers. Engaging a middleman who is willing to collect products

from different producers and sell them to retailer to consumers provides employment and income to both producers and the middleman. Irrespective of volume, a middleman collects products from producers in rural areas, and after collecting a large enough volume, he/she sells the collection at market price at a retailer's shop in urban areas where demand is high. In areas where there is no strong cooperative network and road access to farms is limited, middlemen are key to bringing product into the market place.

Collective Marketing

Small holder Farmers in marketing groups or cooperatives brings their produce to collection centers that are managed by farmers marketing groups, or they wait for traders at collection centers. Data from respondents revealed that collective marketing greatly lacked well-functioning structure in all of surveyed schemes.

3.1.2.6 Pricing Method of iHVC

Prices of agricultural produce vary from season to season or year to year depending on their volume of production and availability. Especially the price vegetable crops are highly fluctuated from season to season. This is mainly due to by their nature vegetable crops are highly perishable with a short shelf life.

In the study area of all central zone of PASIDP woreda study zone small holder farmers Prices of HVC products show significant variations depending on the supply situation.

Generally, the smallholder farmers use flexible pricing method to sell their product and they are not organized and are not governing the value chain. Hence, they are price takers and hardly negotiate the price due to fear of post-harvest loss, in case the product is not sold. The value chain governance is similar both in HVCs.

3.1.2.7 Marketing Margin and Profit share of actors

In every layer of marketing segments there are intermediaries which have their own share out of the total market profit in the iHVCs. Under normal condition each actor including the smallholder producers should have to get reasonable share from the marketing margin/profit to stay in the business.

Knowing the profit share of each market participant is very important to clearly identify the leverage point along the market chain of the HVCs. Then, it helps to design effective intervention which can improve the profit share of the relevant actors in general and smallholder HVC producers in particular. The analysis of marketing margin for this particular

study is performed based on all the information obtained along the market chains. These include:

- The average production costs of farmers in all study schemes for each of the major commodity,
- The average farm gate prices of each commodity (purchase price of assemblers/wholesalers),
- Average marketing costs of each market intermediary (sorting/grading, transport, loading/unloading), and
- The average consumers' price aggregated from different market segments (district, zonal, regional) for each commodity.

Based on these indicators the profit share of each actor along the chain for each commodity is computed (Table 8), the total production cost per commodity was computed based on the information obtained from producers with respect to the use of production inputs (labor, seed, chemicals, etc.). Farmers were asked to estimate all the inputs applied and their associated costs as well as the yield harvested from the high value crops cultivated. Average production cost includes all costs incurred by the farmer to produce a quintal of the commodity (labor for land preparation, input application, guarding, harvesting estimated based on the wage rate for each schemes and taking the average; purchased inputs such as fertilizer, chemicals based on their purchasing price).

Table 8. Costs and benefits of major actors in the vegetable marketing (Birr/qt)

Actors	Parameters	Major HVCs		
		Onion	Tomato	Pepper
Producers	Production costs	600	700	700
	Farm gate price	900	850	1300
	Producers profit	300	150	620
Assemblers/wholesalers	Marketing costs	55	50	50
	Total costs	955	1050	1350
	Selling price	1400	1200	2000
	Assemblers/wholesalers profit	300	100	650
Retailer	Retailer's buying price	1400	1200	2000
	Marketing costs	90	75	60
	Total costs	1490	1255	2060
	Selling price	1800	1483	2540

	Retailer's profit	310	255	480
Consumer	Consumers' price (birr/qt)	1800	1483	2540
Total profit		910	505	1750

Source: Computed from survey data (June 2019)

The total profit generated from the transaction of a given commodity by all market actors was computed by adding the profit of each actor per commodity (Table 8). Then, the profit share of each actor in the HVCs marketing is estimated by dividing their respective profit from a given commodity to the total profit which is the sum of the profit of all actors from that commodity and expressed in percent (Tables 9).

The result has shown that an average profit share of about 32.30%, 29.97%, and 37.43%, from all the major vegetables commonly produced in almost all the study *Woredas* goes to producers, assemblers and retailers. This indicated that producers are in a better position in terms of their share of the profit margin.

Table 9. Actors Profit share by type of major vegetables at the District market

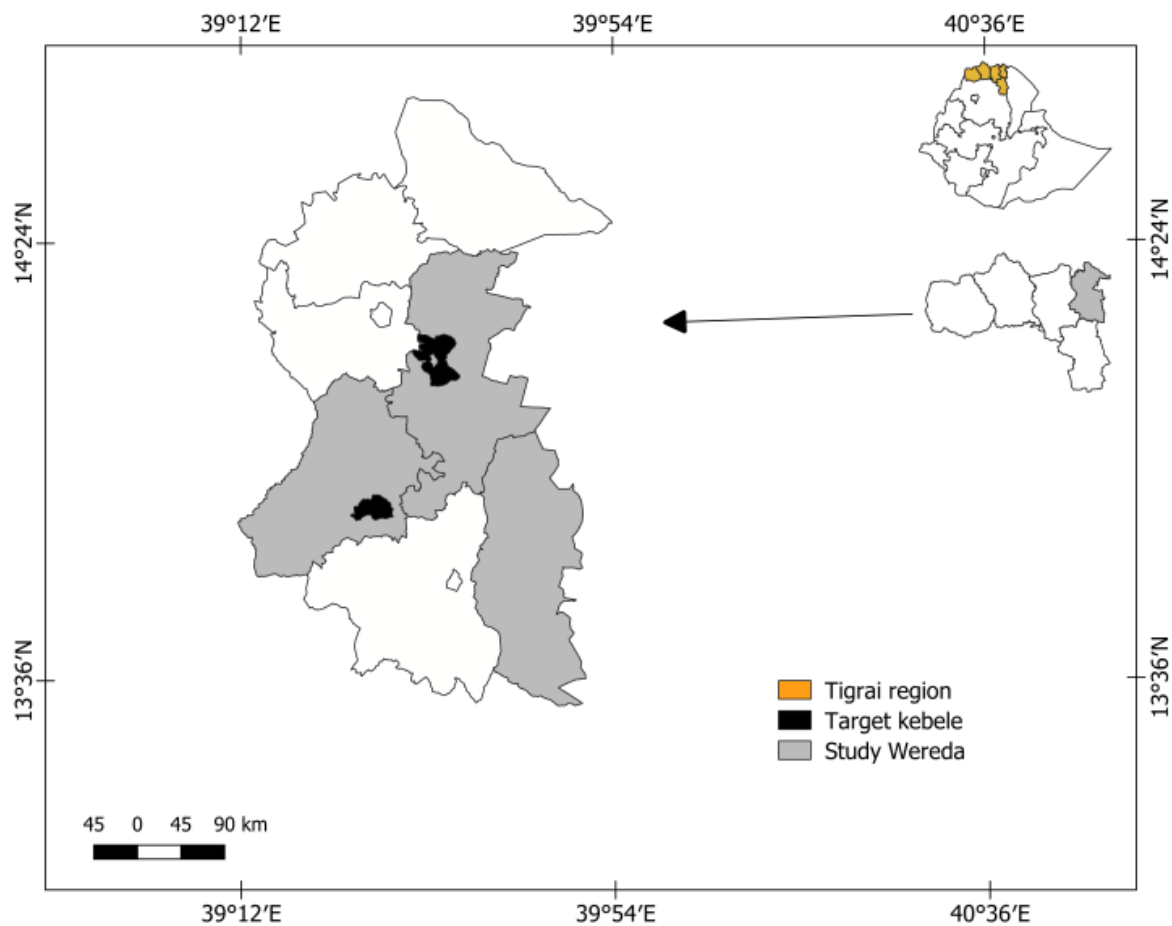
Actors	Profit share by type of commodities			Overall average Profit
	Onion	Tomato	Pepper	
Producers	32.97	29.70	35.43	32.30
Assemblers/wholesalers	32.97	19.80	37.14	29.97
Retailer's	34.06	50.50	27.43	37.43
Total	100.0	100.0	100.0	100.0

Source: Computed from survey data (June 2019)

In general, the average profit share of assemblers from vegetable they handle is found to be low as compared to those of retailers and producers which may not allow them to stay in the business. The longer market channels observed for majority of the products could be one reason for increasing marketing costs which affect consumers to pay unfair price. On the other hand small wholesalers have less influence on controlling the price. The commodities have very short shelf life and mostly wholesalers are having no facilities to store the commodities till price gets stabilized. So they are expected to sale the items before they get spoiled for a very small profit margin and finally as we see from the data above the small holder farmers are getting almost equal profit margin with wholesalers and retailers that are not equated with their efforts on iHVC farms.

Irrigated crop production and marketing: history and diagnosis in IFAD-PASIDP *Woredas*

3.2. Eastern Zone



3.2.1 iHVC Production in Eastern Zone, Tigray

3.2.1.1. Socio-demographic and socio-economic contexts of iHVC production

Survey results of demographic and socio-economic characteristics of iHVC growing farmers in Eastern Zone of Tigray Region indicated variability at *Woreda* level (Table 10). Relatively comparable female (41%) and male (59%) respondents were drowned and interviewed in Eastern Zone than other PASDIP *Woredas* either in Central or Southern Zones of Tigray Region. Demographic characteristics such as age, education and family size showed wide range variation among the interviewed iHVC farming HHs of Eastern Zone. The HHs were on average 52 (SD = 10.7) years old with the youngest and oldest HH being 28 and 78 years old. Great majorities (70%) of the HHs were married and the remaining is single, widowed or divorced. Most (77.1%) of the farmers had never been to school where as 15 out of 70 (21.3%) interviewed had some formal education. The family size of households ranged from one to ten persons with average number of 4.5 (SD = 1.9) members per HH. From the FGD the age structure of iHVC farming HH members indicated that majority of the members were in economically active age group very few children and elders in the community.

Table 10. Demographic and socio-economic characteristics of households in PASIDP *Woredas* of Eastern Zone in Tigray Region

Qualitative Characteristics		Hawzen (N = 25)	Saesie Tsedaemba (N = 25)	Atsbi Wenberta (N = 20)
Marital status	Single	-	2(8)	1(5)
	Married	15(60)	18(72)	16(80)
	Divorced	3(12)	3(12)	3(15)
	Widowed	6(24)	2(8)	-
Education level	No formal education	22(88)	16(64)	16(64)
	Primary	1(4)	7(28)	7(28)
	Secondary	1(4)	2(8)	2(8)
	Certificate/above	1(4)	-	-
Sex	Male	15	11	15
	Female	10	14	5
Quantitative Characteristics		Mean(SD)	Mean(SD)	Mean(SD)
Age HH		55.6(48.6)	48.6(54.9)	54.9(48.8)
Family size		3.72(4.68)	4.68(5.2)	5.2(5.08)
Number of Parcel		2.24(3.32)	3.32(1.53)	1.53(2.35)
Arable land owned HH (ha)		0.51(0.59)	0.59(0.54)	0.5375(0.94)
Irrigable land HH family (ha)		0.23(0.23)	0.24(0.27)	0.26(0.76)
Land size (ha)		0.64(0.28)	0.28(0.79)	0.79(1.08)

Source: Own survey (May 2019)

Regarding the household resources and socio-economic characteristics, interviewed iHVC farming HH of Eastern Zone had a total of 170 parcel of land holding ranging from 1 to 5 with mean parcel number of 2.42. The average farmland area was 0.55 (SD = 0.34) hectares (ha) across interviewed HHs with the minimum and maximum farmland area of 0.13 and 1.5 ha, respectively. Mostly the arable land is also the irrigable farm size which is on average 0.24 ha. The arable and irrigable land size owned by iHVC farming HHs is comparable across the three Woredas of Eastern Zone (Table 10)

3.2.1.2. Agronomy and production practices of iHVC

Crop and cultivar types grown

The major iHVC cultivated in PASIDP *Woredas* of Eastern Tigray Zone are vegetables (Figure 12, Table 11). The only crops reported to be cultivated using irrigation other than vegetables were maize (*Zea mays* L.) and Irish Potato (*Solanum tuberosum* L.). In Atsbi Wenberta, Hawzen and Saesie Tsedaemba at least two farmers reported experience of producing vegetable crops including, tomato (*Solanum lycopersicum* L.), onion (*Allium cepa* L.) and pepper (*Capsicum annuum* L.) Some crops are reported only in limited *Woredas*, for instance carrot (*Daucus carota* L.) and garlic (*Allium sativum* L.) were reported only in Saesie Tsedaemba *Woreda*. In focus group discussion the participants rated tomato, onion and pepper as important irrigated high value crops in the Zone.

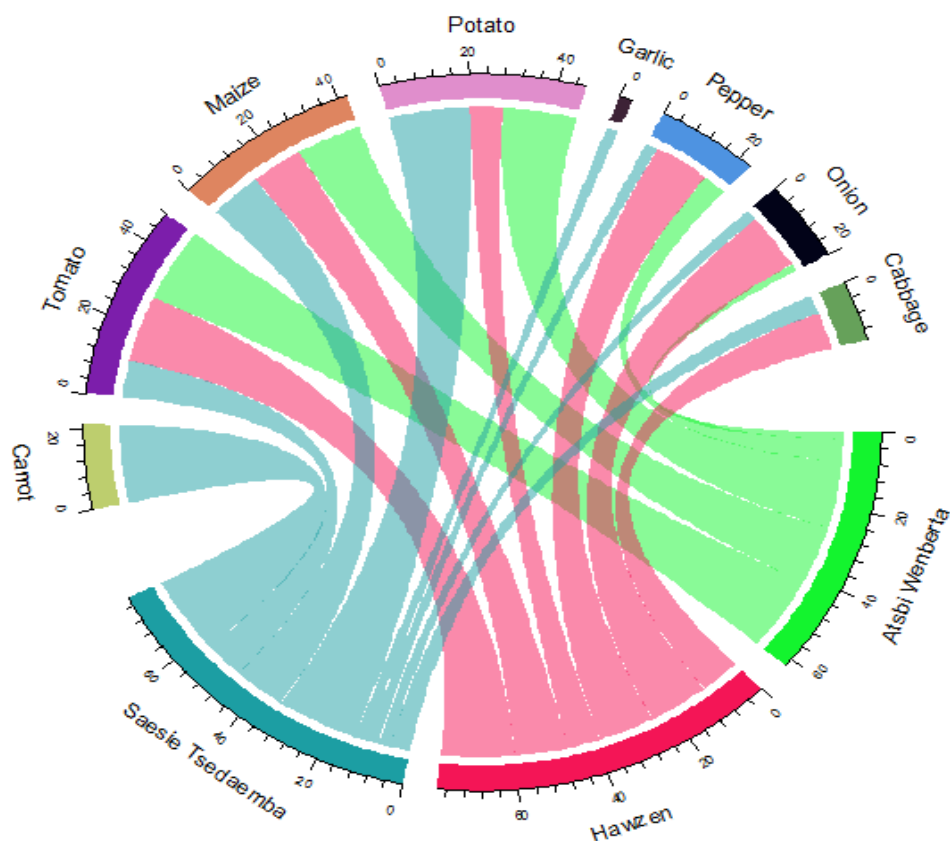


Figure 12. Comparison of type and number of iHVC in target *Woredas* of Eastern Zone, Tigray Region (Lower half of the circular figure depiction indicates the three *Woredas* in Eastern Zone while the upper half is the type of crops cultivated as irrigated crops in the Zone)

Table 11. Relative importance of iHVC and proportion of households producing iHVC in PASIDP *Woredas* of Eastern Zone Tigray Region

Types	iHVC	Atsbi Wenberta	Hawzen	Saesie Tserdaemba	No. Producers	Percent	Relative importance
Vegetables	Tomato	20	18	10	48	68.57	1
	Pepper	6	14	3	23	32.86	2
	Carrot	0	0	21	21	30.00	3
	Onion	2	15	3	20	28.57	4
	Cabbage	0	10	5	15	21.43	5
	Garlic	0	0	3	3	4.29	6
Cereals	Maize	16	13	13	42	60.00	-
Tubers	Potato	18	8	20	46	65.71	-

Source: Own Survey (May 2019)

3.2.1.3. Inputs and input use for iHVC production

Input use for iHVC production: Fertilizer

In Eastern Zone PASIDP *Woredas* farmers tend to use both mineral and organic fertilizers depending on availability (Figure 13). Where there is higher production farmers fertilize their iHVC in Eastern Zone with combination of organic and/or mixture of both organic and inorganic fertilizers. Onion (*Allium cepa* L.), tomato (*Solanum lycopersicum* L.) and pepper (*Capsicum annuum* L.) are the most fertilized crops. In Atsbi Wenbererta farmers tend to apply organic fertilizers, where as in Hawzen and Saesie Tsedaemba apply both organic and inorganic fertilizers. The commonly applied fertilizers are NPS, NPS-Zn and Urea. TheFGD and KII revealed that the inorganic fertilizers are supplied by WoARD, farmer’s cooperatives and Unions as well as individual purchases from lacial markets. However the challenged pointed out indicate timely supply, high coast and irregular supply.

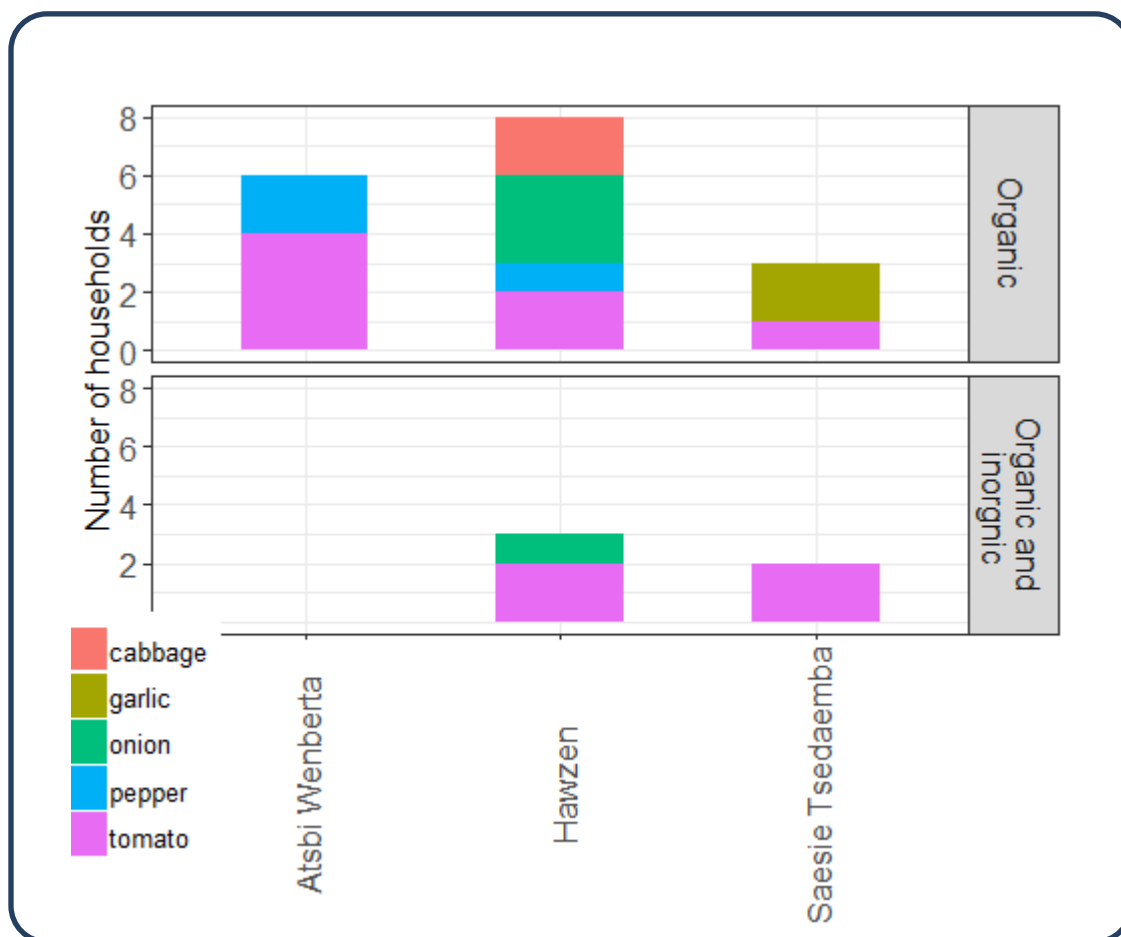


Figure 13. Mineral and organic fertilizer application for production of iHVC Eastern Zone, Tigray Region

Input use for iHVC production: Pesticide

Chemical weed, disease and pest management and control options are practiced at least for five iHVC including the most commonly chemical protected crops such as (*Allium cepa* L.), tomato (*Solanum lycopersicum* L.) and pepper (*Capsicum annuum* L.) (Figure 14). Farmers of Hawzen are major users of chemicals for pest and weed control among the Eastern Zone PASIDP *Woredas*.

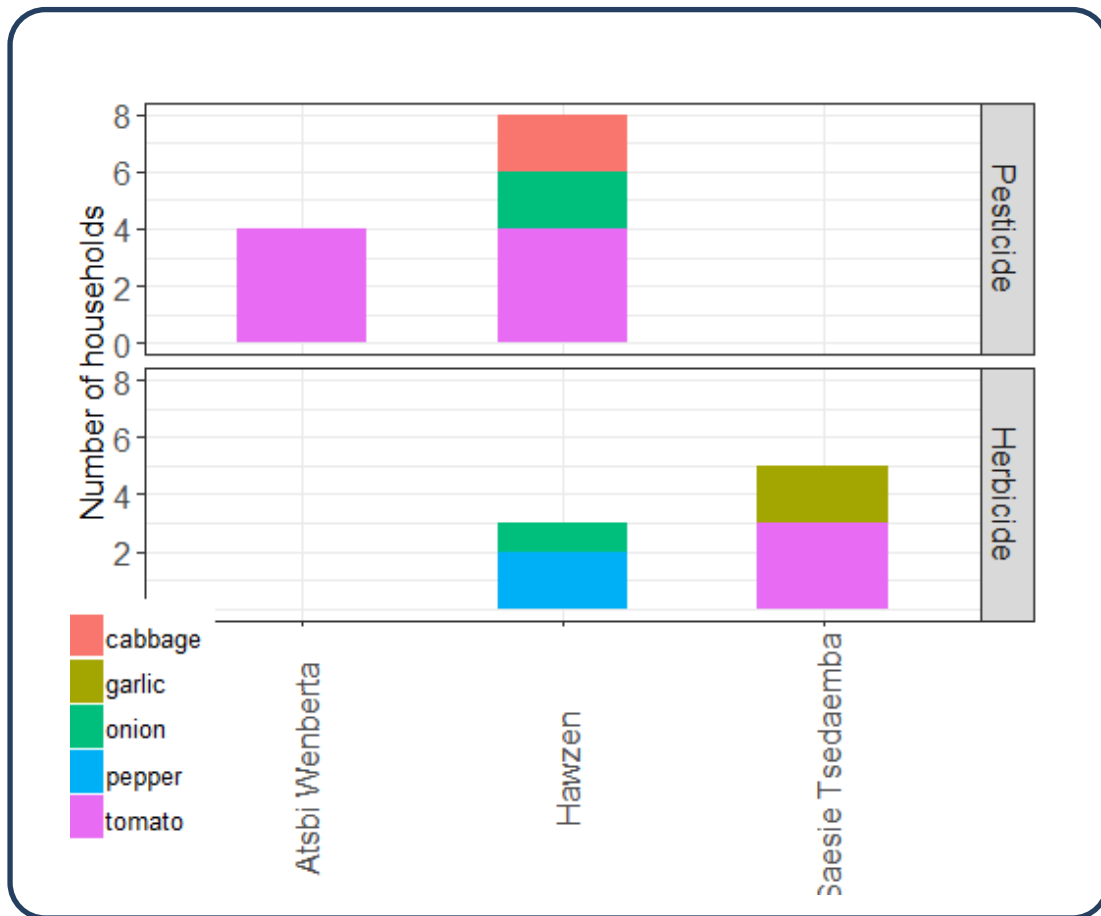


Figure 14. Pesticide and herbicide application for production of iHVC in PASIDP target *Woredas* of Eastern Zone, Tigray Region

Input use for iHVC production: Seeds and seedlings

Farmers of the Eastern Zone PASIDP *Woredas* reported using seeds primarily accessed through, farmer's cooperatives and Unions specially through MPCs. Seeds of iHVC are rarely accessed neither from home saved own stock nor exchanged with friends/neighbors/relatives. Both quantity and quality of the required seed is one of the major challenges reported in the Zone.

3.2.1.4. Access to institutional service and infrastructure to farm households

Access to all weather roads

Road network is a decisive factor in improvement of rural livelihoods as it is a means of accessing inputs and distribution of outputs. The Eastern Zones of Tigray Region are relatively in near proximity to the Regional capital Mekele and enjoy better road connectivity. According to the respondents, Atsbi Wenberta and Hawzen are better connected to road networks than Saesie Tsedaemba with 100 % and 78% agreed on availability roads in the former two and only 7(28%) out of the 25 interviewed households confirmed road availability and access in Saesie Tsedaemab.

Access to extension services

Transformation of traditional subsistence agriculture to irrigated and market oriented HVC farming hinges on capitalizing knowledge based practices integrating the agronomic, post-harvesting and marketing activities. This requires well-functioning extension system and services. According to Van Den Ban and Hawkins (1988), the main aim of extension program is to initiate change to bring about sound extension service in the Eastern Zone of Tigray Region, the respondents indicated sufficient access to agricultural extension services through DAs and WoARD (Figure 16). Overall, in Atsbi Wenberta (80%), Saesie Tsedaemba (96%) and Hawzen (100%) of respondents confirmed availability of good extension service.

However, according to KII, there is consensus all over studied *Woredas* (including other Zones) that there is lack of DAs specializing or knowledgeable about irrigated agriculture (eg. Irrigation agronomy – staking, raised bed planting, watering frequency). That means that on farm level, farmers who do not get sufficient support face challenges in technical know-how on crop water management, water application methods and irrigation intervals. Farmers lacking proper knowledge on irrigation water management also resulted in wastage of water, intensified salinity and water logging problems in addition to producing low quality produce. On the other hand, arguably DAs have hardly any clear job description, apart from their professional support to farmers, conventionally they engage in different tasks such as farm inputs distribution, collection of loans including land use taxes, participation in various administrative and political committees.

To improve the extension service support to iHVC producers, the major role of DAs should be to enlighten and equip farmers with sufficient and appropriate knowledge in order to change their

attitude in a certain desirable direction. For this of course the Das themselves need special training in irrigation water management and irrigation agronomy that enables them to provide proper advice to farmers assigned to the irrigation systems.

Access to market and market information

PASDIP *Woredas* of Eastern Zone including Atsbi Wenberta, Hawzen and Saesie Tsedaembaare situated around Mekelle city which is the administrative center and metropolitan area of Tigray Regional this makes the Zone a market potential. About 88% of respondents of Hawzen and Saesie Tsedaemba as well as 100% in Atsbi Wenberta confirmed availability of markets for iHVC in their respective *Woredas* (Figure 15, Figure 16). Market information (eg. price) is often through informal networks of farmers in absence of organized market information centers.

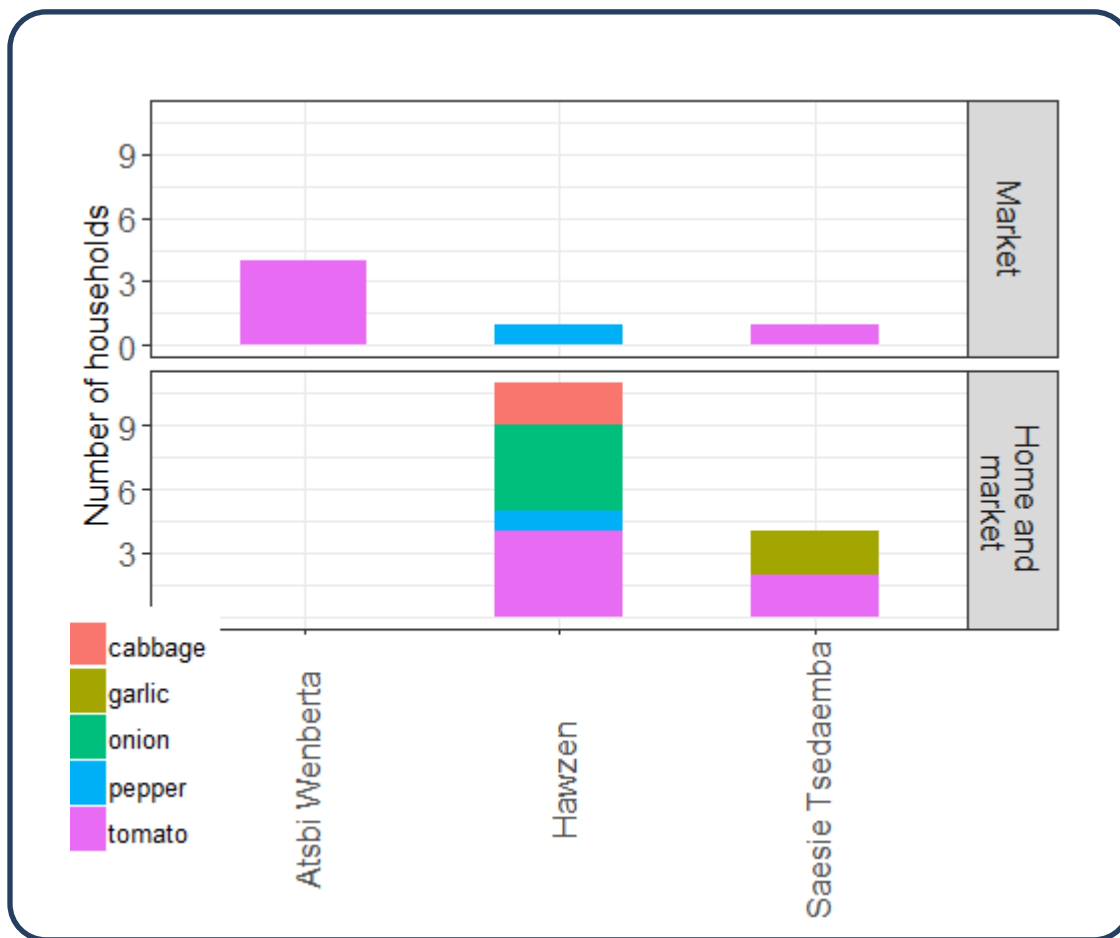


Figure 15. Purpose (home consumption, marketing and/or both) of iHVC production by the households of PASIDP target *Woredas* in the Eastern Zone, Tigray Region

Access to telephone services

Rural telecom service expansion in rural and urban towns is one of the most expanding infrastructures across Ethiopia. Improvement of telephone use in Tigray Region is getting better from time to time. The *Woredas* in Eastern Zone have an advantage with geographic proximity to Mekele which is an administrative city. However, the study area except some settlements along the road side is not accessible to electricity. In addition, the study area has no access to fixed telecommunication service. However, in the area mobile network service is working in most parts of the study area.

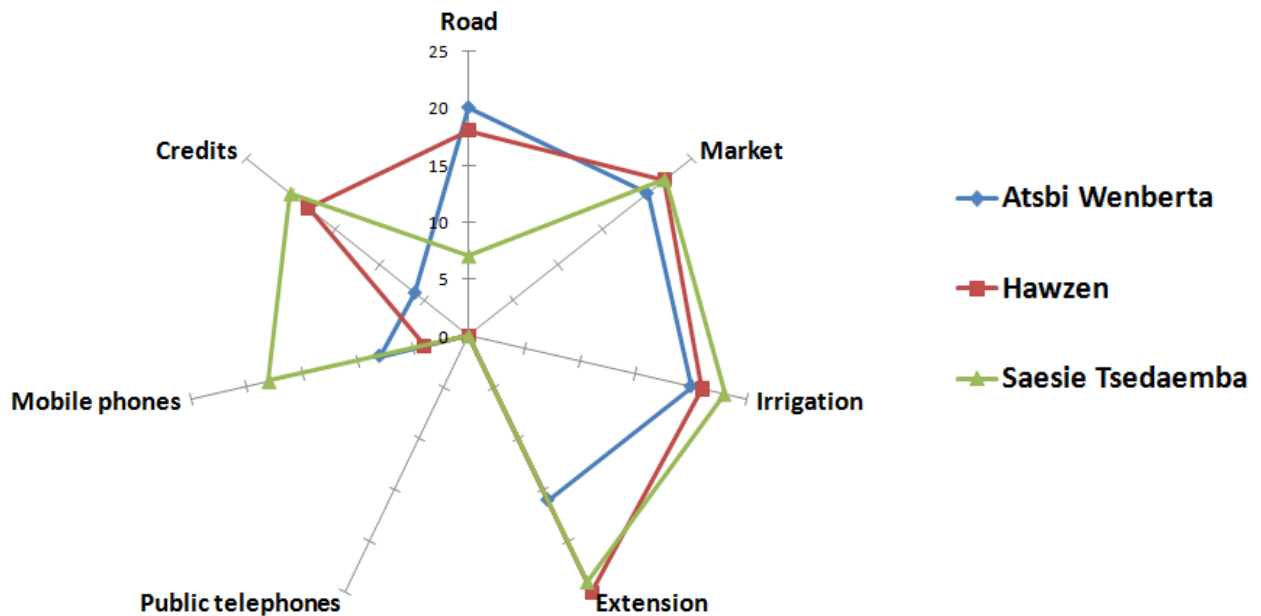


Figure 16. Institutional service and infrastructure access for iHVC producing households in PASIDP target *Woredas* of Eastern Zone, Tigray Region

Access to credit service

Farmers in the study area receive credit from Dedit credit and saving institution, RuSACCO and from Food Security Program of the region. Dedit credit and saving institution give credit to individual farmers directly; whereas Food Security functions through the cooperatives of the *Tabia*. There are also different micro finance institutions and public and private banks at Mekele. Hence, from one or the other, the farmers have good access to credit services.

3.2.2. Irrigated High Value Crops (iHVC) Marketing, Eastern Zone

3.2.2.1. Markets for irrigated High Value Crops (iHVC)

Agricultural marketing is inferred to cover the services involved in moving an agricultural product from the farm to the consumer. It is also the planning, organizing, directing and handling of agricultural produce in such a way as to satisfy the producer and the consumer.

In our study in some specific locations in the in PASIDP *Woredas* of Eastern Zone, iHVC are produced and supplied to the local markets, *Woreda* markets, Zonal market and to the neighboring regions (Figure 17). We found that the tomato, onion and paper markets are buoyant, and are likely to grow, although they could function better through supports. The major markets identified for collection and distribution of iHVC from Atsbi Wonberta *Woreda* include actual and potential markets destinations such as Haiqi, Meshal and Atsbi (local market), Wikuro (*Woreda* market), Adi-Grate (Zonal market) and Mekele (Regional market). When also we took Hawzen *Woreda* actual and potential market destination are Hawzen *Woreda* (Hawzen Town market), Adigrat town (zonal markets), Mekele town (Regional markets) and niches of institutions like colleges and universities (Mekele /Adigrat Universities) are potential destinations. For Saesi Tsedaemba *Woreda* actual and potential markets destinations are (Frewyni town, town, Edaga Hamus town, and Wakero town), Adi-Grat (Zonal market) and Mekele Regional market and institutions like Adigrat Universities and Mekele Universities are the potential markets. The study reveals that Adigrat town, and Mekele town markets serve as iHVC collection and marketing centers for Eastern *Woredas*.

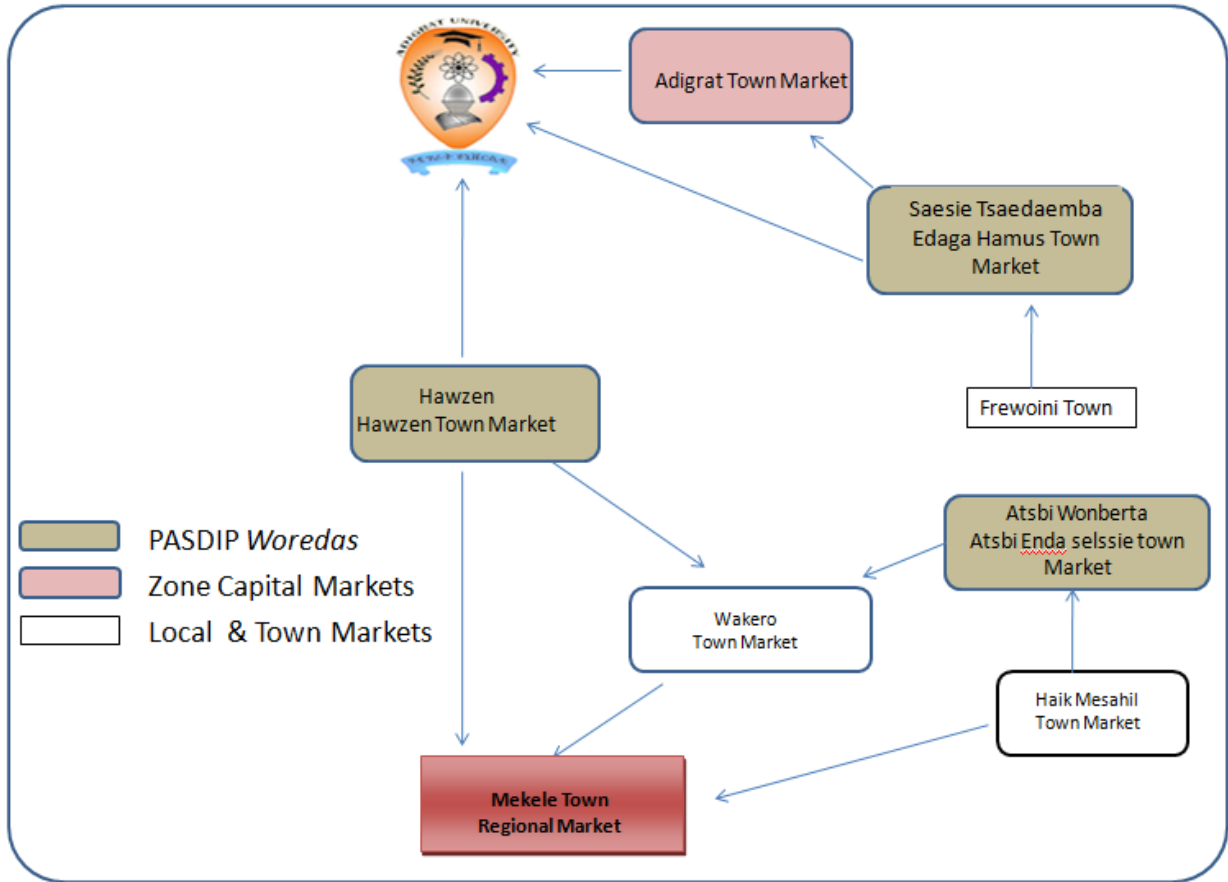


Figure 17. Major iHVC markets and flow channel flow in IFAD-PASIDP target *Woredas* of Eastern Zone, Tigray Region

A market analysis studies the attractiveness and the dynamics of a special market within a special industry (Dillerup et al, 2006). The study reveals that market attractiveness and dynamics most of PASIDP *Woredas* in Eastern zones most farmers responded that they have experience of selling their product in the market and the remaining for used their produces household consumption. From buyers' behavior majority of 83% small holder farmers from Eastern zone they do not trust their buyers and 65% responded that they offer unfair price by buyers.

3.2.2.2. iHVC Segmenting and Targeting

Marketing channel (segmenting) refers to the routes taken by products from producers to consumers (Wedel et al., 2000). In the PASIDP *Woredas* of Eastern Zone most smallholder farmers informed the routes taken by each of the iHVCs and the market channels. In the Zone, iHVC flow through various channels until they reach the final consumers. Three iHVC flow channels have been identified for carrot, tomato, and cabbage marketing in Eastern Zone

(Figure 19). The shortest channel occurs in Eastern *Woredas* when producers directly sell it to the consumers. This occurs when the farmer brings small quantity of the product to market to local markets and urban centers like Atsbi Wonberta (Atsibi Town), Hawzen *Woreda* (Hawzen Town) sells them to consumers.

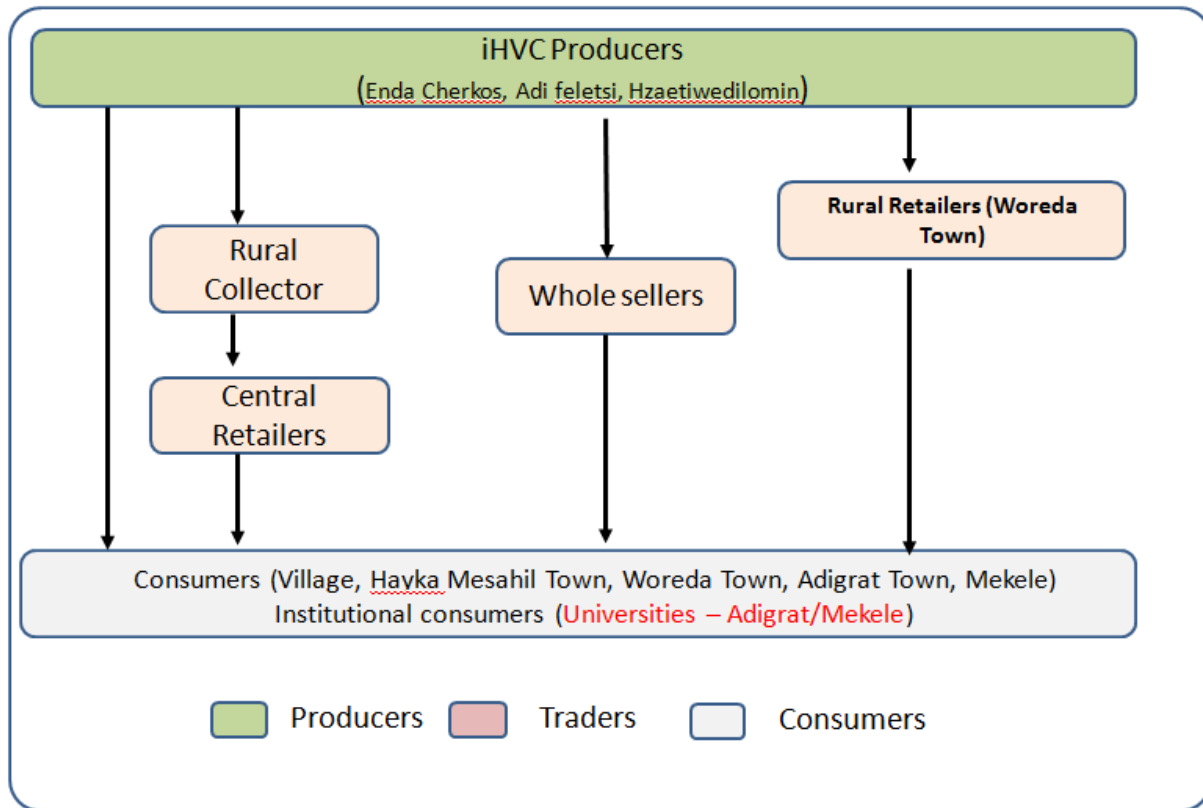


Figure 18. Marketing channels and flow of iHVC in PASDIP Woredas of Eastern Zone, Tigray Region

From FGD data most of smallholder farmers in PASIDP *Woredas* in Eastern Zones follow need based segmenting by purchase readiness i.e. they sell for ready purchaser. A target market is a group of customers (individuals, households or organizations), for which an organization designs, implements and maintains a marketing mix suitable for the needs and preferences of that group (Pride, 2017). The producers in Zone sell their produce in nearby village retail market. From FGD data small holder farmers make important segment of the rural consumers since they consume part of their produces. Consumers prefer medium size and free from damage; and medium size iHVC like tomato and onion. In general consumers have their own quality criteria to purchase iHVC. Farmers’ bargaining power is low due to the lack of alternative market outlet. The most common marketing channel immediately available to the farmer is through collector

and brokers. Sometimes, there can be up to three collector and brokers between the producer and the consumer. Each of the brokers makes a known margin of profit. The traders/wholesaler and the producer do not have any direct link or contact in which case the broker is decisive in setting the price, often making his own margin (unknown to both trader and producer). There is no norm or regulation governing the acts of the brokers and their behavior that negatively affects the farmers. Selling iHVC through IFCs is very uncommon in the Zone mostly because of the attitudinal perception towards their IFC leaders.

3.2.2.3. iHVC Nature and Size of the Market

PASIDP *Woredas* in Eastern zones of Tigray small holder farmers was responded in KII and FGD that their agricultural production and marketing is overwhelmingly of a subsistence in nature and the size of their market small due to lack of market infrastructure like selling shades, and market information center but the market potential is high in nearby town Adigrat, Atsibi Wenberta, Hawzen, Tsatse Demba town and Mekele city. In KII and FGD respondents revealed in the PASDIP *Woredas* of central Zone responded that their agricultural production and marketing is overwhelmingly of a subsistence nature and the size of the market is small but with high potential. There is Adigrat University hosting about over 10000 students per year and the niche market have market potentials of 3312 quintals of tomato, 3442 quintals of onion and 3156 quintals of potato and 864 quintals of cabbage per year in addition the Zone has access to supply iHVC to Zonal centers (Adigrat) and Regional city of Mekele (Mekele University).

3.2.2.4. Major actors and their functions in the Market Chain of HVC

There are different factors contributing to different and complementary marketing functions along the market chain of the high value crops. The whole high value crops marketing chain can be broadly categorized into three levels; the production side where farmers and supporting institutions are major actors, the market where different intermediaries with their varied functions and the consumption side (Figure 19).

Actors can have direct or indirect roles in the process of production as well as marketing of HVC. Actors who have direct role are those involved in the product handling and transaction process whereas the indirect actors are different service providers from production up to marketing. Direct market chain actors include producers, assembly traders, wholesalers, retailers and consumers.

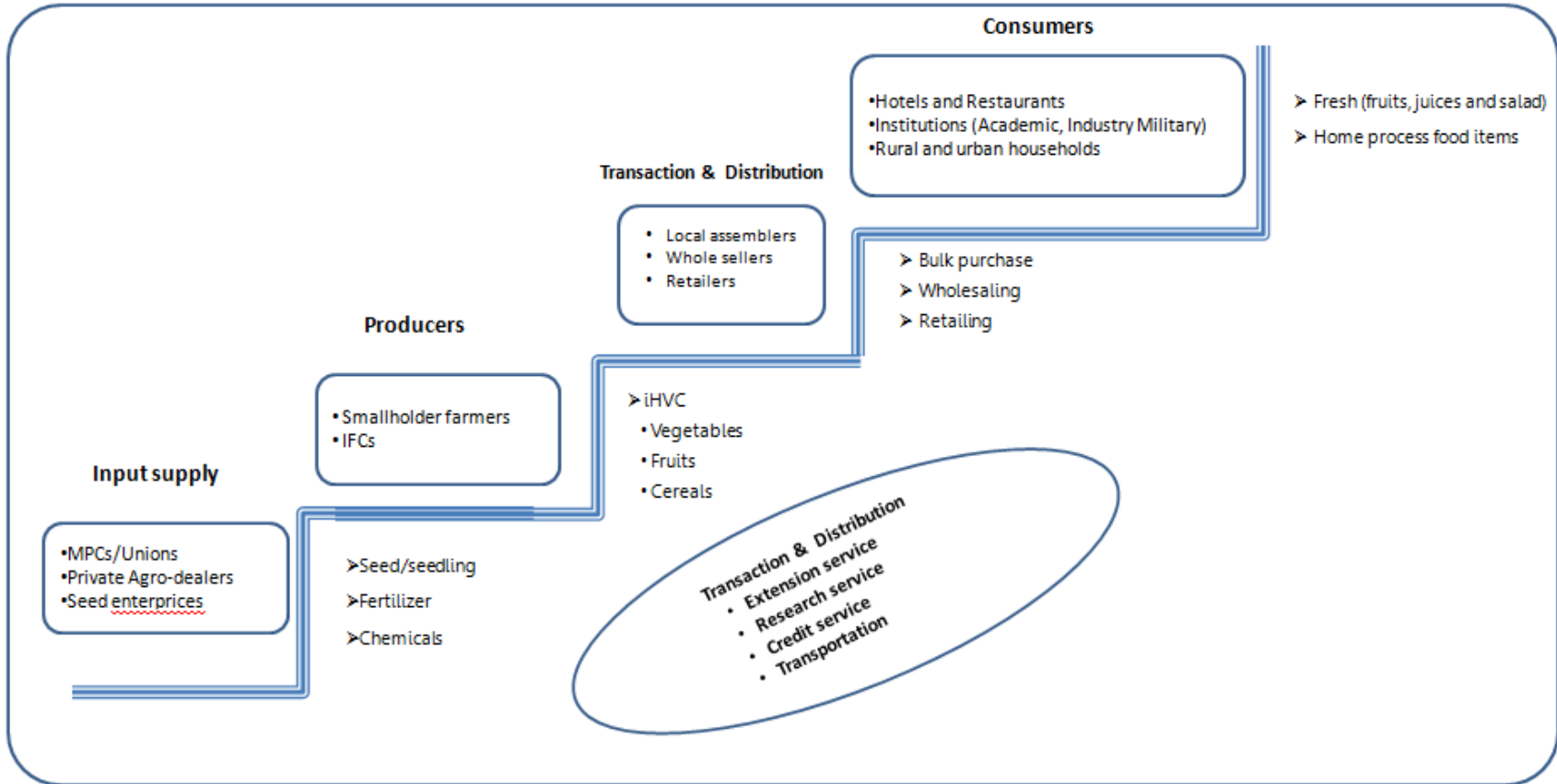


Figure 19. Major actors and their functions in iHVC value chains in Eastern Zone of Tigray Region (Adapted from Timmer P., 2008)

The marketing channel in the iHVC marketing system in Eastern zones of Tigray can be broadly categorized into three levels, namely the producers, traders (Whole sellers and retailers) and consumers. There are different brokers and traders with different roles in the marketing system. Along the marketing channels, there are different actors contributing to different and complementary marketing functions. These include production, facilitation, buying and selling, transporting, packing, sorting and etc. It is interesting to note that some key functions such as packaging, sorting and processing are poorly developed. This section discusses the major market actors and identifies the constraints of an efficient marketing system and the opportunities for improvement.

According to KIT *et al.* (2006), the direct actors are those involved in commercial activities in the chain (input suppliers, producers, traders, consumers) and indirect actors are those that provide financial or non-financial support services, such as credit agencies, business service providers, government, NGOs, cooperatives, researchers and extension agents.

Functions of Primary actors

There are different primary and secondary actors with different functions in iHVC market chains (Table 12 and Table 13). The following section describes each of the actors their roles in detail.

Input Suppliers

For HVC Producers in Eastern zones of Tigray PASIDP *Woredas* small holder farmers apply different inputs in the production process of vegetables and fruits. More specifically, seeds/seedlings of fruits and vegetables, fertilizer, and pest and disease control chemicals are the major inputs that farmers in the irrigation schemes apply and there are different suppliers who provide these inputs.

The office of agriculture and rural development bureau and Tigray regional seed enterprisethrough Primary multipurpose cooperatives/union are the major Input suppliers of fertilizer, seeds, and pest and weed control chemicals. There are also private agro input dealers who supply seeds of different vegetables such as Onion, Tomato, Pepper, Cabbage, and Lettuce as well as weed controlling chemicals. Fruit seedlings are mainly obtained from nursery sites established by the office of agriculture and rural development bureau and REST.

IFAD project provide seeds to selected model research group farmers. The seed from office of agriculture and rural development is cheap and of good quality but not deliver inputs on timely basis, which is why farmers buy seeds from private agro dealers/traders. Seeds from private agro dealers/traders are past their expiry date. Thereis no specialized seed supplier in the study area.

Due to the seasonal nature of improved seed business, private input suppliers do not want to specialize on seed business in eastern zone.

On conclusion, majority group in the FGD ranked service related to seed/seedling supply by cooperatives, research/universities, and nurseries of both REST and office of agriculture and rural development as poor. However, large majority of the producers are not satisfied with the supply of seed/seedling. The most important challenge in relation to seed/seedling supply raised during the group discussion was that supply is not timely. As far as the supply of different plant protection chemicals is concerned majority of the groups in the study schemes were not satisfied and rated it as poor and very poor. They expressed that the chemicals they mostly use as disease control was less effective.

Producers

Producers or farmers produce and harvest their HVC and they are the major actors in the HVC production who apply different farm inputs to produce (vegetables and fruits); Smallholder farmers are the major actors or primary suppliers of vegetables and fruits. These are the supply side actors who apply all the required cultivation practices to produce vegetables and fruits and supply directly to the consumers or to other market intermediaries. They need agricultural inputs such as seed, fertilizers, chemicals, packing materials, and other farm tools from input suppliers. Being smallholders, the HVC producers in the study schemes have common feature that operate in a very small and fragmented plot of land and supply their products to the nearby markets in a very fragmented way. Mostly they produce crops of high value using conventional type of irrigation method.

They transport iHVC to the nearest markets (village market) or sold to collectors at farm gate; secondary market and destination markets themselves, either carrying sack themselves over a distance of 1.00 and above hours on an average. Alternatively, they sell to village collectors known as "farmer traders" who assemble/ collect HVC from large number of farmers. Farmers also sell their products directly to wholesalers in destination market.

Village markets are markets which are the closest to the nearest of farmers, but has less marketing facilities (electricity, storage, water) and farmers sell large quantity of HVC to these agents. Regional markets are surplus markets, which are found in the *Woreda* town where, most of surplus iHVC (For example onion, tomato, and Pepper) are transacted. Terminal or destination markets are deficit markets which are found in town, and most of surplus products flow to these markets.

HVC productions in Eastern Tigray zones of PASIDP *Woredas* are relatively diverse. The major value chain functions that HVC growers perform include plowing, planting, fertilization, irrigating, weeding, harvesting and post-harvest handling.

The diverse agro-climatic conditions can make growing HVC crops highly cost-effective and competitive, and provide vast opportunities in study areas. Unfortunately, these opportunities have not been exploited by the small holder farmers due to the lower price they receive for their produce in the markets, as well as bearing the cost of post-harvest handling.

Collectors (Rural – Assemblers)

In places where there is relatively bulk production of HVC assemblers or local collectors collect products from small producers and supply in bulk to the market. These are traders in assembly markets who collect HVC from farmers in village markets and from farms for the purpose of reselling it to wholesalers and retailers. They use their financial resources and their local knowledge to bulk HVCs from the surrounding area. They play important role and they do know areas of surplus well. Collectors are the key actors in the HVC value chain, responsible for the trading of HVC from production areas to wholesale and retail markets in the study areas. The trading activities of collectors include buying and assembling, reducing the size, drying, repacking, sorting, transporting and selling to wholesale and retail markets. Collectors /Assemblers sometimes act as agents of wholesalers in the *Woreda*, zonal and regional Markets and collect about 5% commission for their facilitative roles in product collecting products from producers and facilitating transportation. Individual assemblers who operate with their own working capital collect products from farmers and sale to wholesalers or retailers. There are also other assemblers that act as agents of wholesalers in other places and collect commission from their customers.

Wholesalers

Wholesalers are large traders who handle bulk volumes of vegetables and fruits. These are someone who buys large quantity of HVC and resell to merchants rather than to the ultimate customers. Wholesalers are the major actors in the marketing channels. These were those participants of the marketing system who used to buy iHVC on a large volume than other actors did.

In the study areas wholesalers are mainly involved in buying HVC from producers and collectors in larger volume than any other actors and supplying them to processors and others. The Survey result indicated that wholesale markets are the main assembly centers (Mekele Town regional whole sale HVC market-Adha) for HVC in their respective surrounding areas. They have better

transport and communication access than other traders. Almost all wholesalers have a warehouse in a market either self-owned or rental basis.

From our FGD data wholesalers collect products from producers (within and outside the zones & region) directly or through collectors reside in the local areas or *Woreda* urban centers. In areas where there are high productions volume wholesalers made temporary/seasonal agreements with farmers. They made agreement with producers regarding to the volume of produces they can purchase, the price they will pay, product delivery time and mode of payment. Wholesalers explained that they have close contact with fruit and vegetable producers in the following belts like Raya Azebo and Raya Alamata, Rama, Gundagundo, Adiha/Kola Tembien, around Tekeze River, and other vegetable (onion, tomato, green paper cabbage and others) producing areas and who can supply the volume of full truck load. Wholesalers in zonal towns such as Axum and Adigrat also do the same with farmers in their surrounding production areas.

The regional wholesalers also bring significant proportion of fruits and vegetables from different parts of the country. But, the volume of each product brought from other regions varies depending on season and supply from the region. These products are then distributed to other zonal wholesalers, bulk buyers such as supermarkets/shops, institutional buyers like universities/big hotels/restaurants, and roadside retailers. It has been also observed that wholesalers sale to household consumers who can buy more than 5 kg per type of product. But, they are well aware of that legally they are not allowed to sale directly to household consumers.

Retailers

Retailers are the final link between fruit and vegetable producers and consumers. Mostly retailers are known for their limited capacity of purchasing and handling products and low financial capital. They buy fruits and vegetables from wholesalers and sell to urban consumers. These include shops and juice house in all zonal, *Woreda* town and Mekelle city markets that perform HVCs retailing. Some of them like vegetable shops and supermarkets handle vegetables and fruit for sale as supplementary business while others like those sit along roadside on non-market days, open market retailers and small business operate in separate sheds work on HVCs retailing as means or source of livelihood. Retailers are large in number compared to other intermediaries in the high value crops marketing but handle small volume of the commodities. The majority of retailers are characterized by having road side shade and used to sell vegetables purchased from wholesalers or farmer traders or farmers to ultimate consumers in pieces after receiving large volumes without any legal permission from concerned

government bodies. The numbers of legal vegetable and fruit retailers in all the study districts were found to be very small compared to those who operate in an illegal way.

Retailer involvement in the chain includes buying of HVCs, transport to retail shops; grading, displaying and selling to consumers. Retailers are key actors in HVC value chain in the study *Woredas*. They mostly buy from assemblers and sell to urban consumers. Sometimes they could also directly buy from the producers. Consumers usually buy the product from retailers as they offer according to requirement and purchasing power of the buyers.

From our FGD data majority of the retailers in the *Woreda* towns buy and sale HVC once a week while others who work as road side and open market retailers work throughout a week but their number is small. In Mekelle, and in the eastern zone capital city large numbers of retailers are found in the major market centers like Kedamay woyane market areas, Adihaki, Adihawusi, Adiha, 05 kebele, and along the major streets. Women and young children are the major groups of the communities engaged in vegetables and fruits retailing.

Middlemen/ broker

Brokers play a vital role in networking producers to market and other stakeholders of the products. These agents work for a benefit on behalf of other participants/actors. They enhance the selling and/or buying process between producer, wholesalers, and retailers and sometimes with consumers without handling any product for sale.

In our FGD data brokers sometimes go beyond facilitation and tend to control and fix prices and at last make extra benefits from the process. And in our study area no formally registered brokers have been observed in all market centers. But, as mentioned earlier drivers who transport vegetables and fruit play the brokers role. Some young people living in the rural areas (production areas) that have exposure about market opportunities for the HVCs also act as brokers by linking producers with traders. As it has been explained by farmers during the FGD producers are not happy with the role of brokers. Farmers believe that brokers provide distorted market information especially on price though they compete the market margin/profit margin otherwise go to the pocket of the producers.

Transporter

Transporters have are very crucial role in the high value crops production and marketing. Transporters fill the distance between the points of production of HVC and the potential market places. They add value in terms of place by transporting and distributing products from the area of surplus (including production point and large wholesaling markets like the case of Mekelle/Adiha market) to the area where there is shortage of the commodities. With such role,

they balance the availability of products in surplus and deficit areas by using ISUZU, FSR –ISUZU and local Carts. Long truck owners also transport fruits and vegetables from other parts of the country and neighboring countries like Sudan. Transporters closely work with wholesalers and there are truck owners who mainly work on transporting HVCs. There are also cases where transporters, particularly the drivers (who are not owners of the truck) act as brokers. Because of their exposure to different production areas they have access to information related to locations having bulk products. Whenever they observe excess products on their way they communicate with wholesalers in big market centers like Mekelle and the zonal towns.

There are also people in the urban areas that have animal driven carts and Bajaj. These provide transportation service mainly to retailers, hotels/restaurants in urban areas to transport commodities from the wholesaling market to their working places. Producers located in schemes that are easily reachable with these kinds of transport facilities also use carts/Bajaj to take their produces to the nearby village/local or *Woreda* town market.

Consumers

Consumers usually buy HVCs from retailers as they offer according to requirement and purchasing power. They have their own quality criteria to purchase fruits and vegetables. These are the actors at the end node of the high value crops marketing. Consumers include households of both urban and rural dwellers who purchase HVC for home consumption, hotels/restaurant/juice houses as inputs to their business and institutions. Household consumers buy different types of HVC mostly from the nearby shops/supermarkets or small roadside retailers. However, some individual consumers also reported that they purchase from wholesalers in relatively larger volume because the price is by far less than the retailing price of supermarkets and other retailers in their vicinity. The most commonly purchased HVC by household consumers are vegetables (tomato, potato, onion, Pepper, lettuce, Swiss chard, carrot, head cabbage and garlic) and fruits (banana, orange, mango, lemon and guava). Farmers also make important segment of the rural consumers since they consume part of their produces. Institutions purchase (university campus, prison house and hotels) their product from wholesaler who has the capacity to supply sustainably based on contractual agreements. Consumers prefer medium size and free from damage; and medium size HVC. In general consumers have their own quality criteria to purchase HVC.

In the HVC marketing Hotels/restaurants and juice houses are the major bulk buyers. They mostly buy from wholesalers while some of them have direct contact with producers. For hotels/restaurants the volume and frequency of purchase depends on the size of their business

as well as availability of the products in the market. In terms of volume large hotels and restaurants purchase quintals of different HVCs while small snack and juice houses purchase in kilos. In terms of varieties of produces still hotels/restaurants purchase wide varieties of vegetables and except some juice houses that prepare fast foods like "Selata" many of them buy fruits such as mango, papaya, avocado, and banana which are the major inputs for preparation of juice. Almost all hotels in the district towns purchase the required volume of produces once a week; during the weekly market day. This is mainly due to the reason that the produces are available during the weekly market day to the required volume and types.

For the household consumers the respondents explained that frequency of purchase varies depending on the availability of the products in the market, food habit of the house and their economic status. According to the opinion of the household buyers contacted in the district markets they mostly purchase vegetables once a week since fresh vegetables are only available in that day. But, sometimes they also purchase vegetables like tomato, onion and potato during non-market days from shops and road side retailers.

The institutional buyers like universities/colleges, military camps, registered juice house and other areas, and prison centers (detention centers) are important actors in the HVCs marketing. Institutions mainly purchase vegetables from wholesalers in bulk volume. Mostly government institutions particularly higher learning institutions and detention centers buy vegetables and fruits based on an open bid which allows potential wholesalers to compete. The bid document aired by the government institutions contains all the detail quality requirements of the products to be supplied. Then, the winner/least cost bidder signs an agreement to supply the produce for a limited time period, usually one year For the case of military camps the purchase is not based on open bid system rather they purchase vegetables and fruits in bulk but on weekly basis from potential suppliers on negotiation. As it is known organizing farmers in cooperatives is a way out in order to buy inputs and selling their HVC produces but lack of well-functioning structured cooperative organization plus its members poor attitude of assembling and selling as their produces together on the side of small holder farmer is the major reason for not exploiting the potential Institutional consumer market.

Functions of secondary actors

Such actors are those who provide supportive services including training and extension, information, financial and research services. According to Scott, (2007), access to information or knowledge, technology and finance determines the state of success of value chain actors. Zone agricultural& rural development office, Dedebit- micro finance, NGOS/Project (IFAD) is main supporting actors who play a central role in the provision of such services.

Agricultural and Rural development Office

This is the governmental institution which provides extension service for small scale farmers in agricultural sector in the study area. This organization provides various extension services specifically in HVC sector in the study area. The major services which this organization is providing in the HVC sector are provision of improved HVC variety, compost application, harvesting and post-harvest handling, and provision of improved harvesting material working on introduction of improved irrigation technologies (varieties, improved practices, efficient irrigation methods). The office of agriculture provides technical backstopping to farmers in all the production related activities. The *Woreda* and kebele level extension experts assist farmers technically on how to apply different improved agronomic practices (time and method of planting, use of improved varieties, soil fertility management), use of irrigation water, disease control methods, commodity selection, etc.

With its very limited capacity to provide alternative technologies to the required level, research is also one of the supporting institutions working to improve production and productivity of the HVC. For instance, in areas where Mekelle, Axum and Abergelle Agricultural Research there are operating there have been some efforts to introduce improved varieties of vegetables and fruits, improved crop husbandry practices (plant spacing and disease control), and technologies that improve irrigation water use efficiency.

The assessment has further indicated that despite extension service is providing technical advice in iHVC sector, provision of extension service is not covered the whole irrigation farming families.

Agricultural Marketing Promotion Agency

Tigray Agricultural Marketing Promotion Agency is governmental organization working in searching of market and linking the producers with local and international markets. In addition, the agency involve collecting, processing and disseminating of market information to all concerned and interested governmental and non-governmental organizations in and outside the region.

Agricultural Input Supply Enterprise

Agricultural Input Supply Enterprise involve for a long period of time in delivering commercial fertilizer to farmers throughout the country. Farmers in the area are also using DAP and UREA fertilizers from the distribution centers.

Farmers Cooperatives and Unions

Farmer's cooperatives and Unions are actively participating in supplying inputs to farmers through member cooperatives. The unions are mainly concerned with provision of commercial fertilizer from federations at regional level to farmers grass root level on credit and cash bases. The farmer's cooperatives also provide other commodities like soap, sugar and oil among others to the farmers. In addition, they provide credit to the farmers.

Trade and industry Office

This is also governmental organization which provides Trade/marketing services in the certain stages of HVC value chain in the study area and have regulatory framework to control the illegal traders. This organization provides services like quality control, licensing, and market place for wholesalers, collectors and retailers. The organization provides license to wholesalers emerging from the near area and certifies licensed HVC traders to secure their freely involvement in HVC transactions. At the same time, the organization prohibits direct entry of unlicensed HVC traders in order to uphold the rights of traders who have been licensed. By performing all this responsibilities, the organization enables HVC marketing environment for the traders and sets rules and regulations guiding traders in the study area. But, the study has further indicated that some HVC traders like collectors act illegally by drying HVC on the ground without using plastics or sack and enter into the business without receiving trade license from the *Woreda* agricultural product trade and cooperative office.

Financial Institution

This is financial organization which provides credit and saving services to HVC producers, assemblers and retailers in the study area. The organization first provides credit to the farmers for capital investment in HVC processing in annual base and in the second term allows farmers to save a certain portion of income obtained from their involvement in HVC processing. The organization also provides credit service for HVC assembles retailers and wholesalers as initial capital. In the study zone financial institution (DECSI, Saving and Credit cooperatives) that provide credit service to small holder farmers particularly to those who want to purchase irrigation equipment.

Rural saving and credit associations (RuSACCOs)

RuSACCOs educate the farmers and other rural dwellers to save regularly and to plan for their household economies. In our study area RuSACCOs played major roles but they are not accessible to all small holder farmers in the study areas.

International fund for Agriculture Development (IFAD)

This is international financial institution project which is working in the HVC sector in the study area in collaboration with the *Woreda* agricultural & rural development office in providing fund by forming steering committee consists of *Woreda* Administration (Chair), office of agriculture and rural development, finance and economy office, and office cooperatives and agricultural marketing and women and youth office. This organization emphasizes on promotion of major HVC product of the particular community to the national market thereby linking particular producers with the market and upgrading of HVC. In addition to this, the organization is working in capacity building of the farmers on small scale HVC processing.

Table 12. Summary of Irrigable HVC value chain stages, functions (roles), actors, and their gaps

R/N	Value chain stages	Functions(Roles)	Actors	Gaps
1	Input supply	Seed/seedling	BoA, Cooperatives, Research centers, Retailer shops, Tigray seed enterprise, AISE, Individual s	<ul style="list-style-type: none"> • Lack of quality seed supply • Not delivering input for small holder farmers in timely manner. • The costs of inputs are very high by government bureau Ex- BoARD. • Poor Quality of Inputs supply from private agro dealers • Illegal Agro dealers supply expired Input for small holder farmers with low cost. • Farmers have organized in cooperatives but not yet started to buy and distribute inputs because of attitudinal problem. • low level of farmer cooperation for the market
		Fertilizers	Cooperatives/Unions, AISE, DECSI	
		Agro-chemicals	Private Agro dealers ,Retailer shop, Gunna, AISE Cooperatives	
		Farm Equipments	BoA, Gunna, Biruh Tesfa Cooperatives, Retail shops, NGO, Private workshops, TVET, Agricultural mechanization, MSEs	
		Packing and transporting materials	Private workshops, Factories, Farmers	
2	Production	Vegetable production	Farmers, Organized groups, Private & Public Enterprise	<ul style="list-style-type: none"> • Low supply of HVC seed • Low irrigation facility • Poor disease control • Lack of technical training • Lack of credit access • High cost of inputs • Low yield • Storage problems
3	Post-Harvest Handling	Sorting/grading, processing	Whole sellers, collectors, farmers, User groups, Processing plant owners	<ul style="list-style-type: none"> • Post harvesting handling problem like storage

4	Marketing/Whole sale	Whole sale, Transport Store	Investors, middle men, Efruit, Super markets, farmers,	<ul style="list-style-type: none"> • lack of market in time of perishability • illegal marketing activities i.e. Large number of middlemen in the marketing system;
5	Processing	Sorting/ Grading, Value addition/ juice house	Retail shops, Street vendors, Supermarkets, Cafeteria Hotels, prison house, Colleges	Lack of standard for grading and value addition standards
6	Retail	Retailing	Open market retailers, Supermarket, vegetable retailers, farmers, Retailing shops	<ul style="list-style-type: none"> • There was no regulatory trade control on retail business so as to protect small holder farmers from cheating in scaling(weighing), • Lack of regulation in their buying and price setting pattern. • Farmers have organized in cooperatives but not yet started to market their HVC as one because of attitudinal problem.
7	Consumers	End users of vegetables	<ul style="list-style-type: none"> • Farmers, Universities, Hotels/Cafeterias, Military centers, urban dwellers, Prison centers, Orphanage, etc. 	Lack of lack of technical and production full scale supply of HVC on yearly basis by farmers cooperatives.

Table 13. Summary of Irrigable HVC Service provider roles, actors and gaps at each stage

Stage	Service provider Roles	Actors	Gaps
Input	Provision of Seed/ seedling	BoA, Cooperatives, NGO, research centers, Tigray seed enterprise, Agricultural input supply enterprise(AISE), Organized farmers(Coop), Individual farmers, Gunna Trading, seed supplier from center	Not delivering input for small holder farmers in timely and cost effective manner.
	Provision of Fertilizers	Cooperatives/ Unions, AISE	
	Provision of Agrochemicals and spraying service	Retailing shop, Gunna Trading House, AISE, Cooperative, BoA, private	
	Provision of Farm Equipment/ Irrigation technologies and maintenance service	BoA, Gunna, Cooperatives, Retailing shops, NGO, Private workshops, TVET, Agricultural mechanization, Private workshops	
Production & Postharvest handling	Extension	BoARD, NGO, TARI, EIAR,	<ul style="list-style-type: none"> • Low supply of HVC seed • Low irrigation facility • Poor disease control mechanisms • Lack of technical training • Lack of credit access • High cost of inputs • Low yield
	Credit	DCSI, Cooperatives, NGO	
	Spraying service	Private shops, BoA, NGO,	
	Capacity building	BoA, TARI, Universities, TVET, NGO, Cooperative promotion agency	
	Extension service	<ul style="list-style-type: none"> • BoA, NGO, TARI, Universities 	<ul style="list-style-type: none"> • Lack of coordinated effort between extension service Cooperative agency • Storage problems

Trading/Marketing	Business development	Bureau Trade, Industry, Urban Dev't (BoTI & UD), TAMPA	<ul style="list-style-type: none"> • Low supply of HVC seed • Low irrigation facility • Poor disease control • Lack of technical training on marketing • Lack of credit access • High cost of inputs • Low yield • Storage problems • Lack of market infrastructure
	Capacity building	BoTI & UD, TAMPA	
	Transport	Private transporter, Share companies	
	Arrangement of market centers	Municipality	
Processing	Technical advice	BoTI & UD, TAMPA, TVETs, Quarantine regulatory department	<ul style="list-style-type: none"> • Lack of technical skill on marketing
Retailing	Arrangement of marketing sites	BoTI & UD and municipal	<ul style="list-style-type: none"> • Lack of market to absorb the production • Low price offered by the market • Large number of middlemen in the marketing system; • Absence (weakness) of marketing institutions safeguarding farmers' interest and rights over their market able produces (e.g. cooperatives);

Source: (FGD, Own Survey, 2019)

3.2.2.5. iHVC Selling method in Eastern Zone

FGD data mostly from PASIDP *Woreda* of eastern zone small Holder HVC farmers respond that their selling method is in a sequence: middlemen to retailers to consumers. Well organized marketing channels do not exist. Marketing of HVCs in the study areas are carried out in the following ways.

Farm-gate Selling

From our FGD data this is not a prominent market practice. However, some small holder farmers sell their HVCs to the buyers at the farm-gate. In this mode of marketing, buying and selling of HVCs and other goods may be on an individual basis. Buyers go to the farm, usually at a fixed time given by producers, though it can occur at any time without notice. In the case of fruits and vegetables, sometimes, the produce can be sold “in the field,” and the buyer arranges for its harvesting. In the study area, farmers collect their produces in their collection center, and buyers purchased their produce from these collection centers.

Direct Selling

Most of small holder farmers from KII surveyed prefer to sell their products after harvesting them by themselves, believing that they will get a better price for their produce this way. In this case, after harvesting farmers do general grading and bring their produce in bamboo baskets to the nearby market on foot. In some cases, they have permanent buyers in the local market, and sometimes they visit house-to-house carrying their fresh.

Selling to Middlemen

In the study area direct selling is decreasing as the volume of production increases. It is not possible or profitable for producers to sell their products directly to consumers, so selling to a middleman is an oft adopted strategy by rural and small-holder farmers. In addition, door-to-door selling makes price setting difficult because farmers have little information regarding prices being charged by other sellers. Engaging a middleman who is willing to collect products from different producers and sell them to retailer to consumers provides employment and income to both producers and the middleman. Irrespective of volume, a middleman collects products from producers in rural areas, and after collecting a large enough volume, he/she sells the collection at market price at a retailer’s shop in urban areas where demand is high. In areas where there is no strong cooperative network and road access to farms is limited, middlemen are key to bringing product into the market place.

Collective Marketing

Small holder Farmers in marketing groups or cooperatives brings their produce to collection centers that are managed by farmers marketing management groups, or they wait for traders at collection centers.

3.2.2.6 Pricing Method of iHVC

Prices of agricultural produce vary from season to season or year to year depending on their volume of production and availability. Especially the price vegetable crops are highly fluctuated from season to season. This is mainly due to by their nature vegetable crops are highly perishable with a short shelf life.

In the study area of Eastern zone of PASIDP *Woreda* study zone small holder farmers Prices of HVC products show significant variations depending on the supply situation.

Generally, the smallholder farmers use flexible pricing method to sell their product and they are not organized and are not governing the value chain. Hence, they are price takers and hardly negotiate the price due to fear of post-harvest loss, in case the product is not sold. The value chain governance is similar both in HVCs.

3.2.2.7 Marketing Margin and Profit share of actors

In every layer of marketing segments there are intermediaries which have their own share out of the total market profit in the HVCs. Under normal condition each actor including the smallholder producers should have to get reasonable share from the marketing margin/profit to stay in the business.

Knowing the profit share of each market participant is very important to clearly identify the leverage point along the market chain of the HVCs. Then, it helps to design effective intervention which can improve the profit share of the relevant actors in general and smallholder HVC producers in particular. The analysis of marketing margin for this particular study is performed based on all the information obtained along the market chains. These include:

- The average production costs of farmers in all study schemes for each of the major commodity,
- The average farm gate prices of each commodity (purchase price of assemblers/wholesalers),
- Average marketing costs of each market intermediary (sorting/grading, transport, loading/unloading), and

- The average consumers' price aggregated from different market segments (district, zonal, regional) for each commodity.

Based on these indicators the profit share of each actor along the chain for each commodity is computed (Table 14), the total production cost per commodity was computed based on the information obtained from producers with respect to the use of production inputs (labor, seed, chemicals.).Farmers were asked to estimate all the inputs applied and their associated costs as well as the yield harvested from the high value crops cultivated. Average production cost includes all costs incurred by the farmer to produce a quintal of the commodity (labor for land preparation, input application, guarding, harvesting estimated based on the wage rate for each schemes and taking the average; purchased inputs such as fertilizer, chemicals based on their purchasing price).

Table 14.Costs and benefits of major actors in the vegetable marketing (Birr/qt)

Actors	Parameters	Major HVCs			
		Onion	Tomato	Pepper	Potato
Producers	Production costs	600	650	650	740
	Farm gate price	1000	750	1400	900
	Producers profit	400	100	750	160
Assemblers/wholesalers	Marketing costs	65	50	60	40
	Total costs	1065	800	1460	940
	Selling price	1450	1200	1900	1050
	Assemblers/wholesalers profit	385	400	440	70
Retailer	Retailer's buying price	1600	1200	1900	980
	Marketing costs	80	65	60	55
	Total costs	1680	1265	1960	1035
	Selling price	1950	1420	2440	1460
	Retailer's profit	270	155	480	405
Consumer	Consumers' price (birr/qt)	2000	1580	2560	1640
Total profit		1055	655	1670	635

Source: Computed from survey data (June 2019)

The total profit generated from the transaction of a given commodity by all market actors was computed by adding the profit of each actor per commodity (Table 4). Then, the profit share of each actor in the HVCs marketing is estimated by dividing their respective profit from a given commodity to the total profit which is the sum of the profit of all actors from that commodity and expressed in percent (Tables 15).

The result has shown that an average profit share of about 35.45%, 37.30%, and 27.26%, from all the major vegetables commonly produced in almost all the study *Woredas* goes to producers, assemblers and retailers. This indicated that producers are in a better position in terms of their share of the profit margin. (Table 19).

Table 15. Actors Profit share by type of major vegetables at the District market

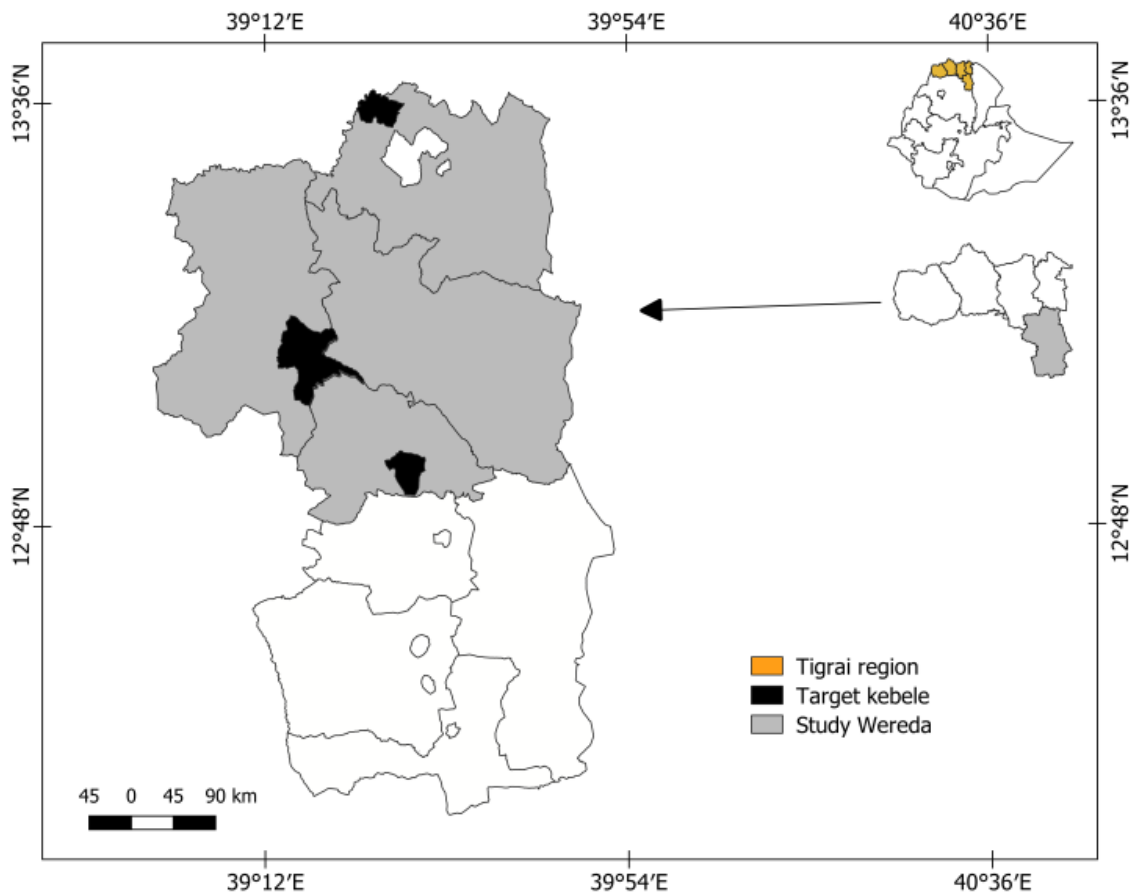
Actors	Profit share by type of commodities				Overall average profit
	Onion	Tomato	G. Pepper	Potato	
Producers	37.92	15.27	44.91	43.68	35.44
Assemblers/wholesalers	36.49	61.07	26.35	25.29	37.30
Retailer's	25.59	23.66	28.74	31.03	27.26
Total	100.0	100.0	100.0	100.0	100.0

Source: Computed from survey data (June 2019)

In general, the average profit share of retailer from vegetable they handle is found to be low as compared to those of producers and assemblers which may not allow them to stay in the business. The longer market channels observed for majority of the products could be one reason for increasing marketing costs which affect consumers to pay unfair price. On the other hand small retailers have less influence on controlling the price. The commodities have very short shelf life and mostly wholesalers are having no facilities to store the commodities till price gets stabilized. So they are expected to sale the items before they get spoiled for a very small profit margin and finally as we see from the data above the small holder farmers are getting almost equal profit margin with wholesalers and retailers that are not equated with their efforts on iHVC farms.

Irrigated crop production and marketing: history and diagnosis in IFAD-PASIDP *Woredas*

3.3. Southern Zone



3.3.1. iHVC production in Southern Zone, Tigray

3.3.1.1. Socio-demographic and socio-economic contexts of iHVC production

Socio-economically and demographically the respondents of Southern Zone showed great variability. Most (72.5%) of the respondents were male headed households while about 22 (27.5%) out of 80 interviewed households in four of the Southern *Woredas* were female headed households. The age of respondents ranged from 25 – 68 years with mean of 45.8 (SD = 9.86) years. Majority of the respondents have some formal education while 47.5% had never been to school. Married households dominated the interviewed groups representing 80% of respondents with the remaining few either unmarried, widowed or divorced singles. The family size of interviewed households which is considered as an indicator of the household labor potential ranged from 2 – 11 members with average of 5.24 (SD = 1.99).

Regarding the household resources and socio-economic characteristics, interviewed iHVC farming HH of Southern Zone number parcelland holding ranging from 1 to 4 with mean parcel number of 2.42. The average farmland area per *Woreda* ranged from was 0.6 hectares (ha) in Seharti Samre to 1.6 ha Hentalo Wejerat. Mostly the arable land is also the irrigable farm size which is on average ranged from 0.28 ha. The arable and irrigable land size owned by iHVC farming HHs is comparable across the four *Woredas* of Southern Zone (Table 16).

Table 16. Demographic and socio-economic characteristics of households in PASIDP *Woredas* of Southern Zone in Tigray Region

Characteristics		Enderta (N = 20)	Hentalo Wejerat (20)	Seharti Samre (N = 20)	Emba Alaje(N = 20)
Marital status	Single	5(25)	1(5)	-	6(30)
	Married	14(70)	19(95)	13(65)	14(70)
	Divorced	1(5)	-	4(20)	-
	Widowed	-	-	3(15)	-
Education level	No formal education	16(80)	6(30)	12(60)	
	Primary	4(20)	12(60)	8(40)	
	Secondary	-	2(10)	-	2(10)
	Certificate/above	-	-	-	-
Sex	Male	16	19	13	10
	Female	4	1	7	10
		Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)
Age HH		48(43)	43(48.95)	49(42.9)	43(52.9)
Family size		5.65(4.9)	4.9(6.25)	6.25(4.15)	4.15(5.6)
Number of Parcel		1.65(2.0)	2.0(4.2)	4.2(1.38)	1.38(2.53)
Arable land owned HH (ha)		0.84(1.61)	1.61(1.22)	1.22(0.60)	0.60(1.4)
Irrigable land HH family (ha)		0.40(0.33)	0.33(0.26)	0.26(0.16)	0.16(6.56)
Land size (ha)		0.83(2.0)	1.95(1.57)	1.57(0.85)	0.85(1.66)

Source: Own survey (May 2019)

3.3.1.2. Agronomy and production practices of iHVC

Crop and cultivar types grown

Diverse crop types including vegetables, cereals, fruits and root and tubers were reported to be irrigated in PASIDP target *Woredas* of Southern Zone in Tigray Region (Figure 20 and Table 17). Emba Alaje and Hintalo Wejerat were the most diverse in terms of crop types cultivating 10 different crop types each followed by Enderta and Seharti Samre. In the Zone maize (*Zea mays* L.), onion (*Allium cepa* L.) and pepper (*Capsicum annuum* L.) were ranked as the most important irrigated crops. However for individual *Woreda* different crops appeared to be ranked as important in terms of number of producers. In Emba Alajewhere vegetables and fruits dominate the irrigated production onion (*Allium cepa* L.) and (*Mangifera indica* L.) were ranked joint first important irrigated crops with all farmers tend to produce the crops. In Enderta sorghum (*Sorghum bicolor* (L.) Moench) followed by maize (*Zea mays* L.) were produced by most farmers. While in Hintalo Wejerat pepper (*Capsicum annuum* L.) is produced by most number of HHs, in Seharti Samre mango (*Mangifera indica* L.) ranked as important. Over all the four *Woredas* share 4(40%) the crops cultivated in Zone mostly the three vegetables and maize (Figure 21). Southern Zone is one of the most diversified irrigated high value crops producing Zone in Tigray Region with 10 different crops reported to benefit from irrigation. Produces from Hentalo Wojerat and Enderta were produced mostly from traditional irrigation.

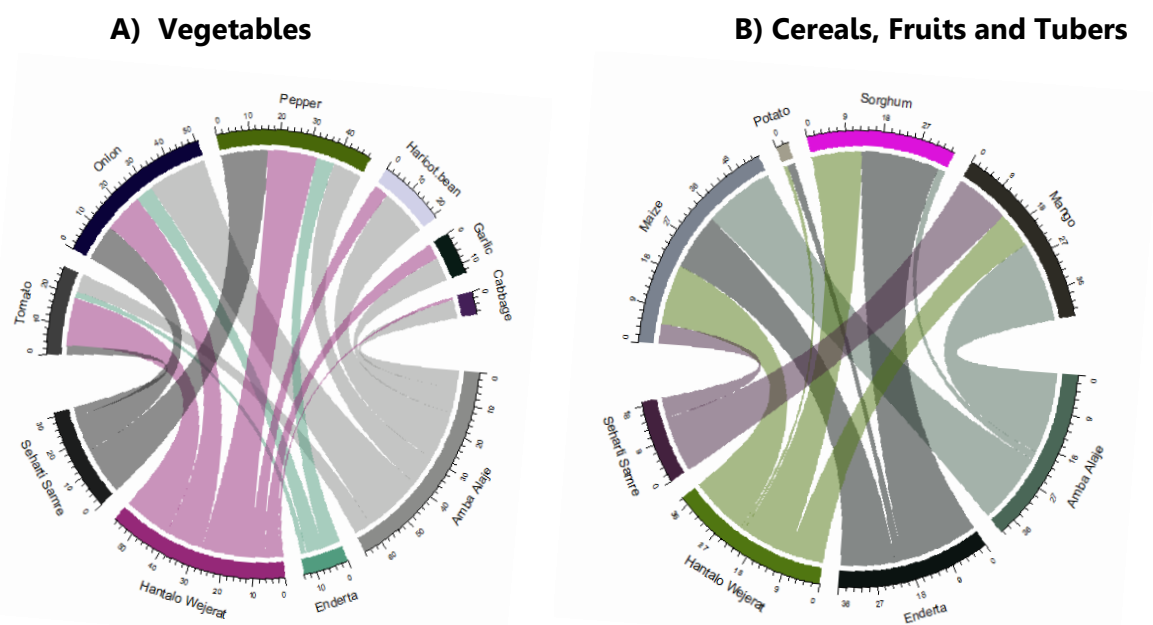


Figure 20. Comparison of type and number of iHVC in PASIDP target *Woredas* of Southern Zone, Tigray Region (Lower half of the circular figure depiction indicates the four

Woredas in South Eastern and Southern Zone while the upper half is the type of crops cultivated as irrigated crops in the Zone)

Table 17. Proportion of households producing iHVC in PASIDP *Woredas* of Southern Zone Tigray Region

Types	iHVC	Emba Alaje	Enderta	Hentalo Wejerat	Seharti Samre	No. of producers	Percent	Relative importance
Vegetables	Onion	20	6	13	12	51	63.75	2
	Pepper	10	6	17	16	49	61.25	3
	Tomato	6	2	16	3	27	33.75	6
	Haricot bean	16	0	5	0	21	26.25	7
	Garlic	8	0	5	0	13	16.25	8
	Cabbage	6	0	1	0	7	8.75	9
Cereals	Maize	18	14	15	5	52	65	1
	Sorghum	2	20	13	0	35	43.75	5
Fruits	Mango	20	0	9	14	43	53.75	4
Tubers	Potato	0	2	1	0	3	3.75	10

Source: own survey (May 2019)

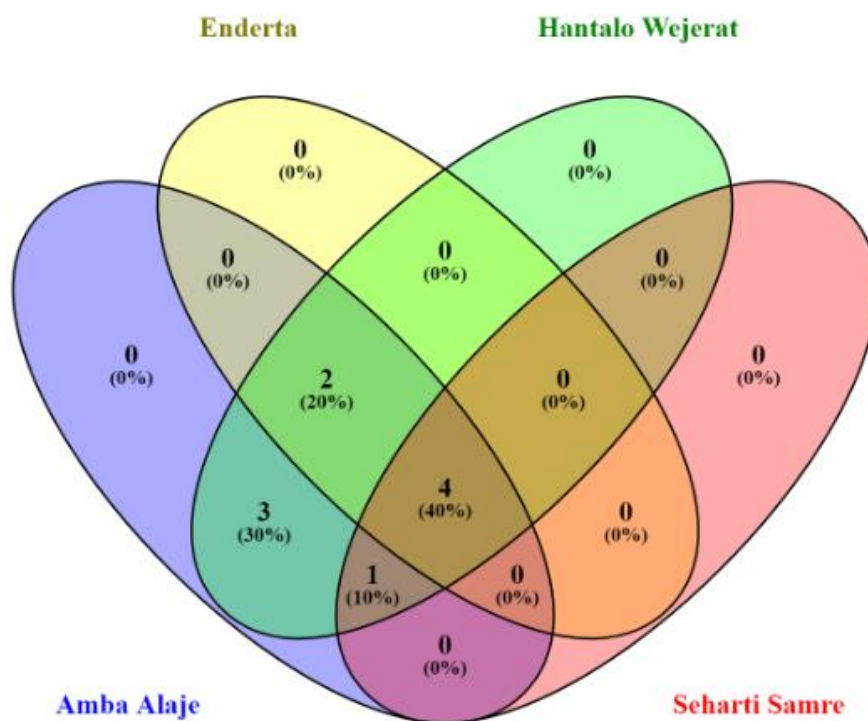


Figure 21. Comparison of type and number of iHVC in commonly cultivated in all four PASIDP target *Woredas* of Southern Zone, Tigray Region

3.3.1.3. Inputs and input use for iHVC production

Input use for iHVC production: Fertilizer

Farmers of the Southern Zone in PASIDP target *Woreda* tend to use more of organic fertilizers than mineral or combinations of organic and inorganic fertilizers. In Emba Alaje and Enderta the interviewed farmers reported they have never used inorganic fertilizers. Where as in Hentalo Wejerate and Seharti Semre farmers use either organic, inorganic or combination of both depending on availability and crop types cultivated (Figure 22).The use of fertilizers types appears to be specific to certain crops in specific *Woreda*, for instance farmers apply inorganic and organic fertilizers for mostly for onion (*Allium cepa* L.), tomato (*Solanum lycopersicum* L.) and pepper (*Capsicum annum* L.).

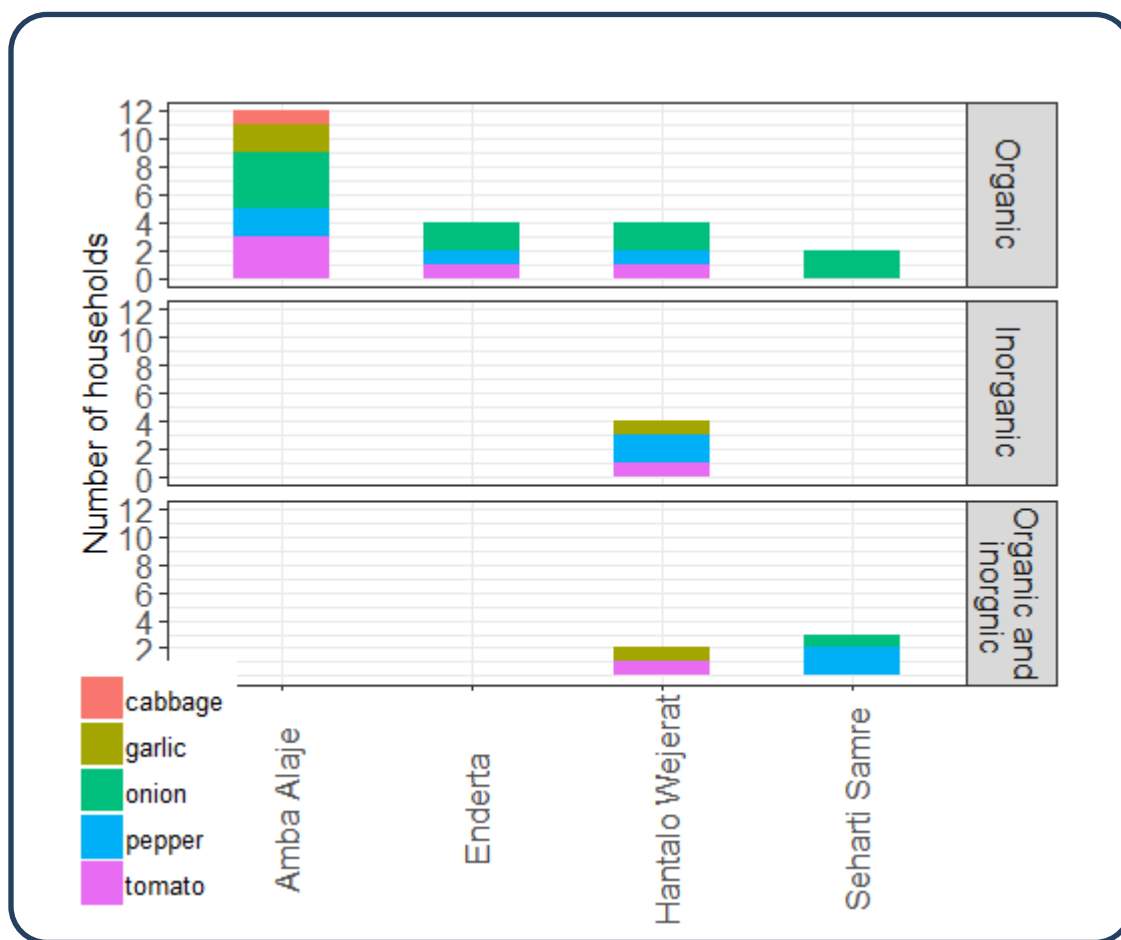


Figure 22. Mineral and organic fertilizer application for production of iHVC Southern Zone, Tigray Region

Input use for iHVC production: Pesticides

Chemical control of pests and weeds is practiced to variable degree in the PASDIP target *Woredas* of Southern Zone. While pesticides use is common across all the four *Woredas*, herbicides use is practiced in Enderta for onion (*Allium cepa* L.), and Seharti Samre for onion (*Allium cepa* L.), pepper (*Capsicum annum* L.) and tomato (*Solanum lycopersicum* L.)(Figure 23). As revealed by individual interviews as well as FGD, the cost of pesticides and herbicides expensive and are only used for protection economically important iHVC types such as onion (*Allium cepa* L.), tomato (*Solanum lycopersicum* L.) and pepper (*Capsicum annum* L.). These crop protection chemicals are distributed among iHVC farming households mainly WoARD, farmer’s cooperatives and Unions. As per the discussion made with farmers the supply of pesticides is not sufficient enough especially during pests outbreaks when the chemicals are required in large quantities. Commonly used types of pesticides/herbicides (Karate and Mancozeb are often accessed from near-by towns and Mekele through private agro-dealers and/or farmer’s cooperatives and Unions.

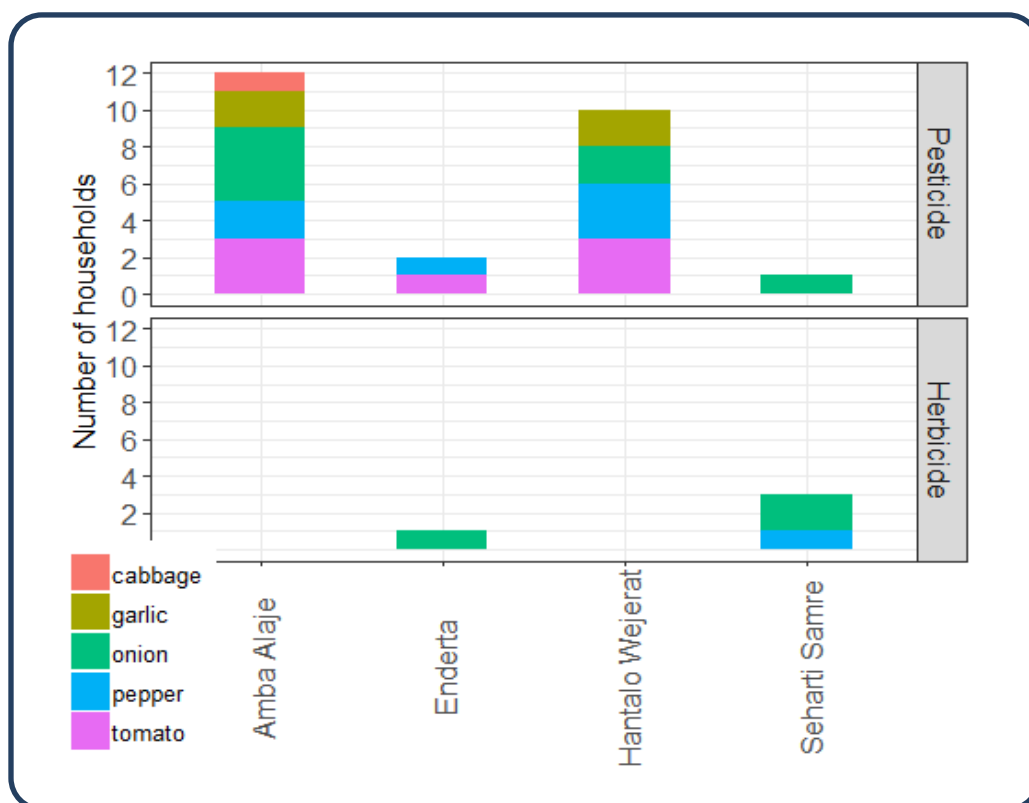


Figure 23. Pesticide and herbicide application for production of iHVC in PASIDP target *Woredas* of Southern Zone, Tigray Region

Input use for iHVC production: Seeds and seedlings

Primarily seeds of iHVC are accessed from WoANRD and very rarely from local markets. There are severe problems associated with regular quality seed supplies. Multipurpose cooperatives are primary source of inputs such as seeds while IFCs are not yet active in accessing seeds. Some initiatives in taking advantage of multiplying some vegetable seeds might help the IFCs as well as solve the shortage of good quality and sufficient quantity of iHVC seeds.

3.3.1.3. Access to institutional service and infrastructure to farm households

Access to all weather roads

Like elsewhere in rural economy, improved market access through better transport conditions like connectivity with all-weather road networks can lead to increased surpluses due to higher producer prices, lower production and transportation costs and reduced spoilage of iHVC. The Southern Zone PASDIP target *Wordas* and their respective scheme command areas are relatively better connected to all weather roads specifically Enderta and Emba Alaje (Figure 25). On the other hand, farmers of Hentalo Wejerat and Seharti Samre reported either limited or poor access to roads. In FGD, farmers of Tekhea *Tabia* benefiting from Adikerakro scheme in Emba Alaje indicated that it is costly to get the iHVC harvests from the fields in command area to the main road.

Access to market and market information

Market information is very crucial for the producers to maximize their benefits from the sale of their iHVC produce. Access to market information helps producers when and where to sale their iHVC produce so as to get better price. Most of the farmers in the Southern Zone produce their crops both for home consumption and surpluses for the market (Figure 24, Figure 25). Although very few, farmers of Enderta produce for markets than home, while others such as Hentalo Wejerat and Seharti Samre produce specific crops both for market and home consumption. Mostly marketed crops are vegetables including (*Allium cepa* L.), pepper (*Capsicum annum* L.) and tomato (*Solanum lycopersicum* L.). At *Woreda* level, farmers access market information including price from *Woreda* office of Cooperatives and Marketing (WoCAM), or from radio aired by TAMPA and BoARD. FGD and KII indicated that the information is limited does not reach and every iHVC farming household for the reason that either the program does not cover the *Woreda* or the farmers have no radio. Currently the main source of price information in the

study area is the prevailing price of the previous week. Other sources include relatives, neighboring farmers and traders.

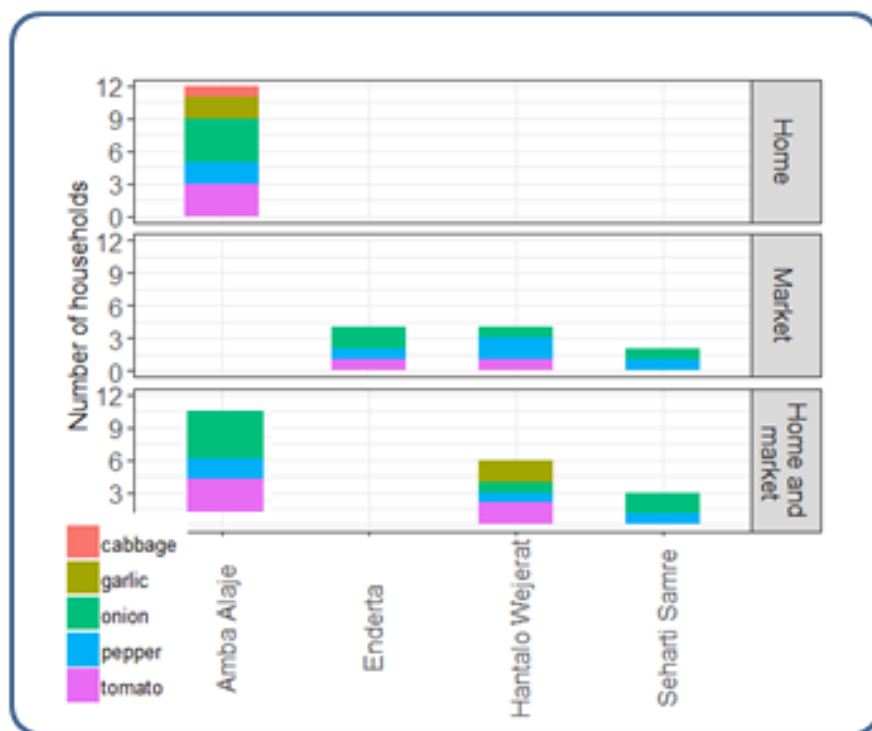


Figure 24. Purpose (home consumption, marketing and/or both) of iHVC production by the households of PASIDP target *Woredas* in the Southern Zone, Tigray Region

Access to extension services

Like the other two Zones (Central and Eastern) encompassing PASDIP target *Woredas*, the availability of extension service in Southern Zone is acknowledged by at least 80% of interviewed iHVC producers sometimes reaching up to 100% in Hantalo Wejerat and Enderta (Figure 25). Mainly provided through DAs with direction from WoARD the extension service includes guidance and direction in accessing inputs, in planning production, crop husbandry and protection practices as well as assisting in harvesting, postharvest handling and marketing activities.

Access to telephone services

Telecommunication services are becoming important market infrastructures particularly in rural Ethiopia. In all the study area there is limited or no access to fixed and public telephones especially in closer proximity to command areas. In all the four study areas there is mobile network coverage, Except in Emba Alaje, in all the three other *Woredas* at least 50% of the

interviewed iHVC producing farmers have access to mobiles(Figure 25). Tailored use of telecommunication services (eg. Four digit text based inquiry numbers) for *Woreda* agriculture including iHVC production and marketing could help the farmers.

Access to credit service

Availability of credit services is very crucial for facilitating input and output supply from production to marketing of iHVC. There are several rural financial institutes in each of the PASDIP target Southern Zone *Woredas*. DCSI, Farmers Cooperatives and Unions among others which are onboard to deliver and administer agricultural input credit and/or petty trade activities to farming communities. However, the iHVC producing farmers rarely access these resources for iHVC production or marketing neither as cooperatives nor as individuals. According to FGD and KII, there is general perception that credits provided by the institutions are of high interest rate and credit repayment periods are very short. Although the status of credit services is comparable among the Southern Zone PASDIP *Woredas*, Hentalo Wejerat and Seharti Samre with *Woredas* are relatively better than Emba Alaje and Enderta in access to credit facilities and services (Figure 25). For example, in Hentalo Wejerat and Seharti Samre about 85% and 80% of the respondents confirmed awareness on the availability of the services while Enderta only 30% and in Emba Alaje none confirmed the availability.

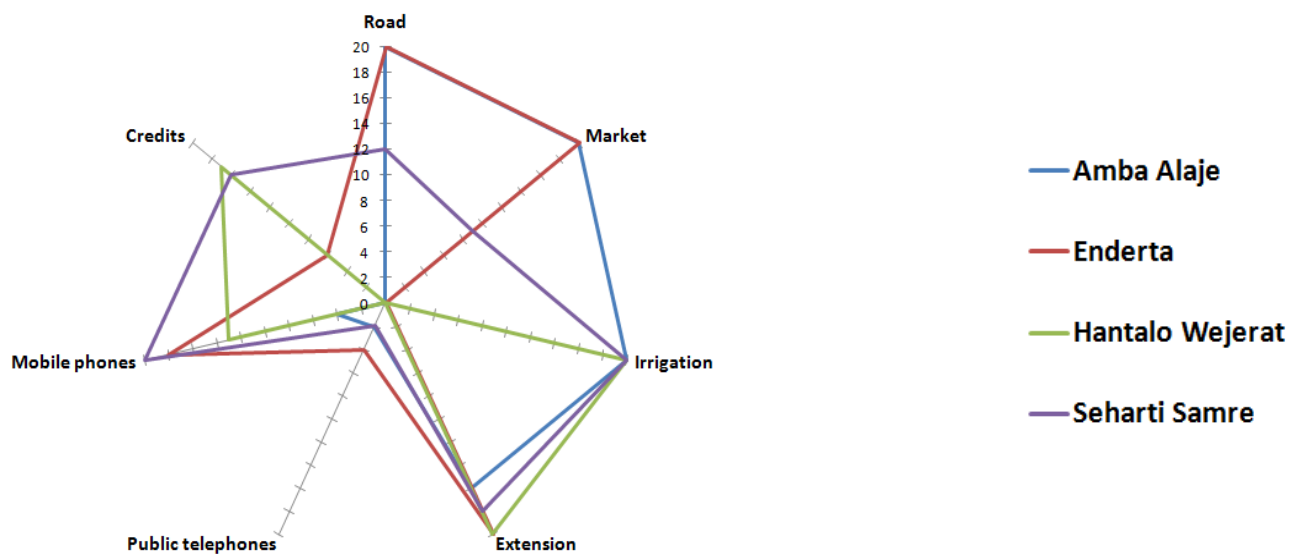


Figure 25. Institutional service and infrastructure access for iHVC producing households in PASIDP target *Woredas* of Southern Zone, Tigray Region

3.3.2. Irrigated High Value Crops (iHVC) Marketing South Zone

3.3.2.1 Markets for Irrigated High Value crops (iHVC)

Irrigated High Value crops (iHVC) are produced in some specific locations in the in PASIDP *Woredas* of Southern Zone and supplied to the local markets, *Woreda* market, Zonal market and Regional market. The major markets identified for collection and distribution of large volumes of iHVCs in the Zone include (Hareqo and Hiwanelocal market in Sharti Samre), and Emba Alaje (Adei Sheou)has potential to supply Maichew and Mehoni in South and in north on the way to Mekele City. Adi Gudom, Hiwane and Enderta Towns. There are also potential niche markets in near proximity to the Southern Zone including Mekele and Raya Universities as well as military camps and Hospitals (Figure 26).

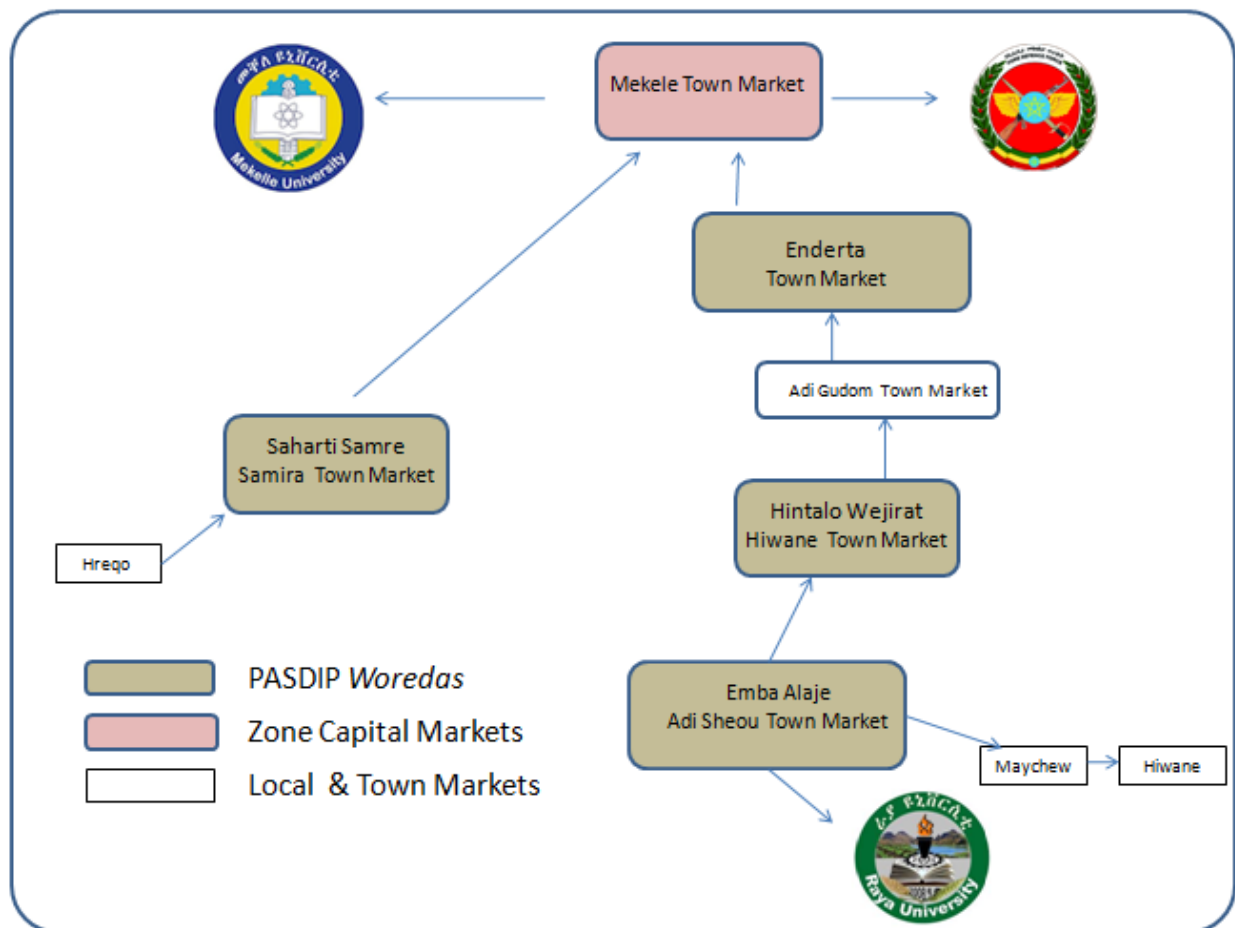


Figure 26. Major iHVC markets and flow channel flow in IFAD-PASIDP target Woredas of Southern Zone, Tigray Region

3.3.2.2 Segmenting and targeting iHVC

Most smallholder farmers of PASIDP *Woredas* in South zones indicated that the routes taken by each iHVCs could be different. In the study areas, iHVCs pass through various channels until they reach the final consumers. In this regard three routes of iHVC channels have been identified for onion, tomato, pepper, and cabbage marketing the Zone (Figure 27). The shortest channel occurs in *Woredas* when producers directly sell it to the consumers. This occurs when the farmer brings small quantity of the product to market and when the farm is closer to urban centers like Adi-shu, Maichew, and Tekela. The flow of products is dictated by seasonal supply deficit. The study FGD data reveals that Adi-shu, Mehoni, Maychew and Mekele markets serve as iHVC collection markets including other PASIDIP *Woreda* towns like Enderta and Hewani centers. In South zone the most common type of market channel in study area is the one where retailers buy from farmers and sell the produce to consumers.

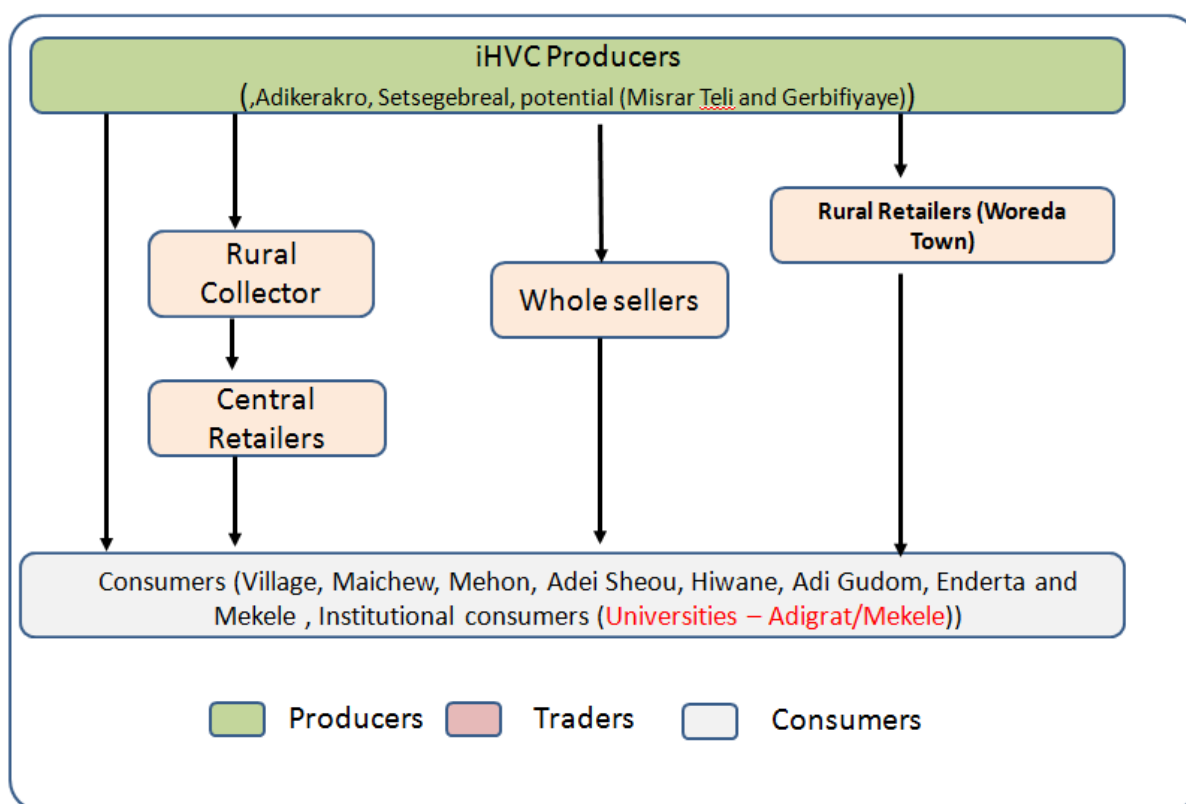


Figure 27. Marketing channels and flow of iHVC in PASIDIP *Woredas* of Southern Zone, Tigray Region

From FGD data source most of PASIDP *Woredas* in South zones small holder farmers was responded that they used need based segmenting i.e. they sell for ready purchaser. A target

market is a group of customers (individuals, households or organizations), for which an organization designs, implements and maintains a marketing mix suitable for the needs and preferences of that group (Pride, 2017). Most of PASIDP *Woredas* in South zones small holder farmers was responded that in KII that they target to sell their produce nearby retail market.

From FGD data Small holder farmers make important segment of the rural consumers since they consume part of their produces. Retailer purchase their product from farmer who has the capacity to supply sustainably based on contractual agreements. Consumers prefer medium size and free from damage; and medium size HVC. In general consumers have their own quality criteria to purchase HVC. Farmers' bargaining power is low due to the lack of alternative market outlet. The most common marketing channel immediately available to the farmer is through retailer and brokers. There are up to two collector and brokers between the producer and the consumer. Each of the brokers makes a known margin of Birr per quintal. The traders/wholesaler and the producer do not have any contact in which case the broker is decisive in setting the price, often making his own margin (unknown to both trader and producer). There is no norm or regulation governing the acts of the brokers and their behavior negatively affects the farmers.

3.3.2.3 iHVC nature and size of the market

In KII and FGD smallholder farmers in the PASDIP *Woredas* of southern Zone responded that their agricultural production and marketing is overwhelmingly of a subsistence nature and the size of the market is small but with high potential. Raya University which is hosting over 3900 per year can be a potential niche market for the Southern Zone. In addition, the Zone can supply iHVC to military camps and Regional city of Mekele and Mekele University.

3.3.2.4 iHVC Major actors and their functions

The marketing channel in the iHVC marketing system in South zone can be broadly categorized into four levels, namely the producers, trader's consumers and Institutions. There are different brokers and traders with different roles in the marketing system (Figure 28 and Table 18 and Table 19). Along the marketing channels, there are different actors contributing to different and complementary marketing functions. These include production, facilitation, buying and selling, transporting, packing, sorting and etc. It is interesting to note that some key functions such as packaging, sorting and processing are poorly developed .This section discusses the major market actors and identifies the constraints of an efficient marketing system and the opportunities for improvement.

According to KIT *et al.* (2006), the direct actors are those involved in commercial activities in the chain (input suppliers, producers, traders, consumers) and indirect actors are those that provide financial or non-financial support services, such as credit agencies, business service providers, government, NGOs, cooperatives, researchers and extension agents.

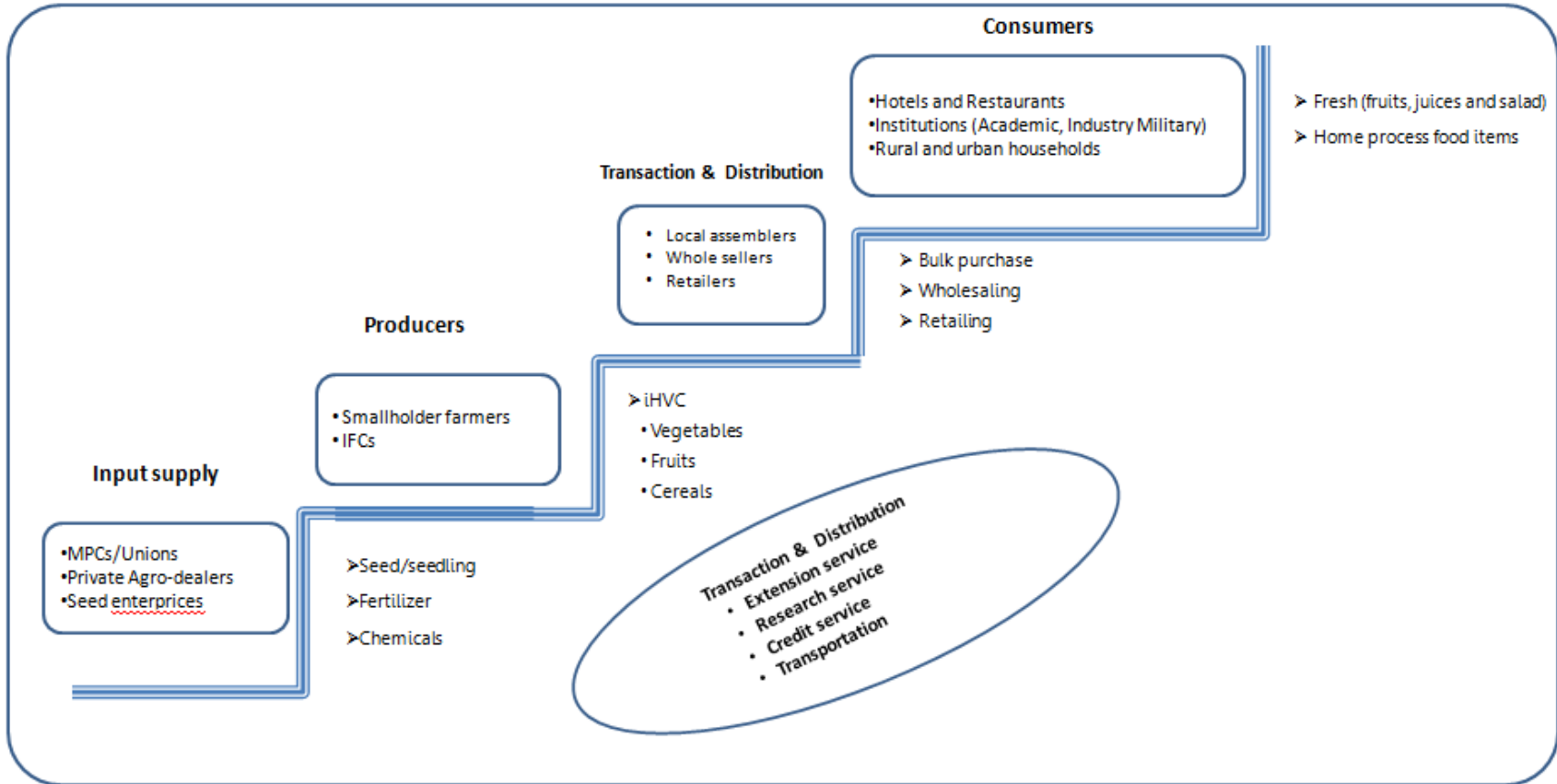


Figure 28. Major actors and their functions in iHVC value chains in Southern Zone of Tigray Region (Adapted from Timmer P., 2008)

Functions of Primary actors

Input Suppliers

South zones of PASIDP *Woredas* HVC Producers in input suppliers are the office of agriculture and rural development (seed), IFAD project provides seeds to some selected research group farmers, private traders and primary cooperatives/union. The horticultural seed from office of agriculture and rural development is cheap and of good quality but not available on time, which is why farmers buy seeds from private traders. Seeds from traders are past their expiry date. The cooperatives do not supply the seeds of HVCs but the cooperatives deliver improved seed of HVC. Primary cooperatives are the main supplier of inorganic fertilizers for farmers in the study area. There is no specialized seed supplier in the study area. Due to the seasonal nature of improved seed business, input suppliers similar to other zonal *woredas* in the region do not want to specialize on seed business.

Producers

Farmers produce and harvest their HVC. They transport iHVC to the nearest markets (village market) or sold to collectors at farm gate; secondary market and destination markets themselves, either carrying sack themselves over a distance. Alternatively, they sell to village collectors known as "farmer traders" who assemble/ collect HVC from large number of farmers. Farmers also sell their products directly to wholesalers in destination market.

Village markets are markets which are the closest to the nearest of farmers, but has less marketing facilities (electricity, storage, water, etc) and farmers sell large quantity of HVC to these agents. Regional markets are surplus markets, which are found in the *Woreda* town where, most of surplus iHVC(eg. Carrot, Tomato, Pepper and Cabbage) are transacted. Terminal or destination markets are deficit markets which are found in town, and most of surplus products flow to these markets.

HVC production in South zones of PASIDP *Woredas* is relatively diverse. The major value chain functions that HVC growers perform include plowing, planting, fertilization, irrigating, weeding, harvesting and post-harvest handling.

The diverse agro-climatic conditions can make growing HVC crops highly cost-effective and competitive, and provide vast opportunities in study areas. Unfortunately, these opportunities have not been exploited by the farmers due to the lower price they receive for their produce in the markets, as well as bearing the cost of post-harvest handling.

Collectors (Rural – Assemblers)

In the study areas wholesalers are mainly involved in buying HVC for the trading of HVC from production areas to wholesale and retail markets in the study areas. The trading activities of collectors include buying and assembling, reducing the size, drying, repacking, sorting, transporting and selling to wholesale and retail markets.

Retailers

Retailers are agents that resell HVC to end users. The majority of retailers are characterized by having road side shade and used to sell vegetables purchased from wholesalers or farmer traders or farmers to ultimate consumers in pieces after receiving large volumes.

Retailer involvement in the chain includes buying of HVCs, transport to retail shops, grading, displaying and selling to consumers. Retailers are key actors in HVC value chain in the study *Woredas*. They mostly buy from assemblers and sell to urban consumers. Sometimes they could also directly buy from the producers. Consumers usually buy the product from retailers as they offer according to requirement and purchasing power of the buyers.

Consumers

Consumers are those purchasing the products for consumption. About two types of HVC consumers were identified: households, and institutions which give services such as higher education institutions and hospitals.

The private consumers are urban and rural dwellers who purchase and consume HVC either the raw HVC. Private consumers purchase HVC directly from producers, retailers and processor. Though most of the consumers purchase from retailers. Farmers also make important segment of the rural consumers since they consume part of their produces. Institutions purchases (Raya University, Prison house and hotels) their product from wholesaler who has the capacity to supply sustainably based on contractual agreements. Consumers prefer medium size and free from damage; and medium size HVC. In general consumers have their own quality criteria to purchase HVC.

3.3.2.6 The functions of secondary actors

Such actors are those who provide supportive services including training and extension, information, financial and research services. According to Scott, (2007), access to information or knowledge, technology and finance determines the state of success of value chain actors. Zone agricultural & rural development office, Dedit- micro finance, NGOS/Project (IFAD) is main supporting actors who play a central role in the provision of such services.

Agricultural and rural development Office: This is the governmental institution which provides extension service for small scale farmers in agricultural sector in the study area. This organization provides various extension services specifically in HVC sector in the study area. The major services which this organization is providing in the HVC sector are provision of improved HVC variety, compost application, harvesting and post-harvest handling, and provision of improved harvesting material. The assessment has further indicated that despite extension service is providing technical advice in HVC sector, provision of extension service is not covered the whole farming families in the study area.

Agricultural Marketing Promotion Agency

Tigray Agricultural Marketing Promotion Agency is governmental organization working in searching of market and linking the producers with local and international markets. In addition, the agency involve collecting, processing and disseminating of market information to all concerned and interested governmental and non-governmental organizations in and outside the region.

Agricultural Input Supply Enterprise

Agricultural Input Supply Enterprise involve for a long period of time in delivering commercial fertilizer to farmers throughout the country. Farmers in the area are also using DAP and UREA fertilizers from the distribution centers.

Farmers cooperatives and Unions

Farmer's cooperatives and Unions are actively participating in supplying inputs to farmers through member cooperatives. The unions are mainly concerned with provision of commercial fertilizer from federations at regional level to farmers grass root level on credit and cash bases. The farmer's cooperatives also provide other commodities like soap, sugar and oil among others to the farmers. In addition, they provide credit to the farmers.

Trade and industry office

This is also governmental organization which provides marketing services in the certain stages of HVC value chain in the study area. This organization provides services like quality control, licensing, and market place for wholesalers, collectors and retailers. The organization provides license to wholesalers emerging from the near area and certifies licensed HVC traders to secure their freely involvement in HVC transactions. At the same time, the organization prohibits direct entry of unlicensed HVC traders in order to uphold the rights of traders who have been licensed. Inters of quality control, the organization prohibits traders who collect and dry HVC on the ground without using plastics or sack which totally changes the color of HVC. By performing all

this responsibilities, the organization enables HVC marketing environment for the traders and sets rules and regulations guiding traders in the study area by forming a committee called market access alliance for trade. But, the study has further indicated that some HVC traders like collectors act illegally by drying HVC on the ground without using plastics or sack and enter into the business without receiving trade license from the *Woreda* trade and industry office.

Financial Institution

This is governmental organization which provides credit and saving services to HVC producers, assemblers and retailers in the study area. The organization first provides credit to the farmers for capital investment in HVC processing in annual base by coupon and in the second term allows farmers to save a certain portion of income obtained from their involvement in HVC processing. The organization also provides credit service for HVC assembles retailers and wholesalers as initial capital.

Rural saving and credit associations (RuSACCOs) - RuSACCOs educate the farmers and other rural dwellers to save regularly and to plan for their household economies.

International Fund for Agriculture Development (IFAD) - This is an international financial institution which is working in the HVC sector in the study area in collaboration with the *Woreda* agricultural & rural development office in providing capacity building training by forming steering committee consists of *Woreda* Administration (Chair) ,office of agriculture and rural development ,finance and economy office, and office cooperatives and agricultural marketing and women and youth office .This organization emphasizes on promotion of major product of the particular community to the national market thereby linking particular producers with the market and upgrading of HVC. In addition to this, the organization is working in capacity building of the farmers on small scale HVC processing.

Table 18. Summary of Irrigable HVC value chain stages, functions (roles), actors, and their gaps

R/N	Value chain stages	Functions(Roles)	Actors	Gaps
1	Input supply	Seed/seedling	BoA, Cooperatives, Research centers, Retailer shops, Tigray seed enterprise, AISE, Individual s	<ul style="list-style-type: none"> • Lack of quality seed supply • Not delivering input for small holder farmers in timely manner. • The costs of inputs are very high by government bureau Ex- BoARD. • Poor Quality of Inputs supply from private agro dealers • Illegal Agro dealers supply expired Input for small holder farmers with low cost. • Farmers have organized in cooperatives but not yet started to buy and distribute inputs because of attitudinal problem. • low level of farmer cooperation for the market
		Fertilizers	Cooperatives/Unions, AISE, DECSI	
		Agro-chemicals	Private Agro dealers ,Retailer shop, Gunna, AISE Cooperatives	
		Farm Equipments	BoA, Gunna, Biruh Tesfa Cooperatives, Retail shops, NGO, Private workshops, TVET, Agricultural mechanization, MSEs	
		Packing and transporting materials	Private workshops, Factories, Farmers	
2	Production	Vegetable production	Farmers, Organized groups, Private & Public Enterprise	<ul style="list-style-type: none"> • Low supply of HVC seed • Low irrigation facility • Poor disease control • Lack of technical training • Lack of credit access • High cost of inputs • Low yield • Storage problems
3	Post-Harvest Handling	Sorting/grading, processing	Whole sellers, collectors, farmers, User groups, Processing plant owners	<ul style="list-style-type: none"> • Post harvesting handling problem like storage

4	Marketing/Whole sale	Whole sale, Transport Store	Investors, middle men, Efruit, Super markets, farmers,	<ul style="list-style-type: none"> • lack of market in time of perishability • illegal marketing activities i.e. Large number of middlemen in the marketing system;
5	Processing	Sorting/ Grading, Value addition/ juice house	Retail shops, Street vendors, Supermarkets, Cafeteria Hotels, prison house, Colleges	Lack of standard for grading and value addition standards
6	Retail	Retailing	Open market retailers, Supermarket, vegetable retailers, farmers, Retailing shops	<ul style="list-style-type: none"> • There was no regulatory trade control on retail business so as to protect small holder farmers from cheating in scaling(weighing), • Lack of regulation in their buying and price setting pattern. • Farmers have organized in cooperatives but not yet started to market their HVC as one because of attitudinal problem.
7	Consumers	End users of vegetables	<ul style="list-style-type: none"> • Farmers, Universities, Hotels/Cafeterias, Military centers, urban dwellers, Prison centers, Orphanage, etc. 	Lack of lack of technical and production full scale supply of HVC on yearly basis by farmers cooperatives.

Table 19. Summary of Irrigable HVC Service provider roles, actors and gaps at each stage

Stage	Service provider Roles	Actors	Gaps
Input	Provision of Seed/ seedling	BoA, Cooperatives, NGO, research centers, Tigray seed enterprise, Agricultural input supply enterprise(AISE), Organized farmers(Coop), Individual farmers, Gunna Trading, seed supplier from center	Not delivering input for small holder farmers in timely and cost effective manner.
	Provision of Fertilizers	Cooperatives/ Unions, AISE	
	Provision of Agrochemicals and spraying service	Retailing shop, Gunna Trading House, AISE, Cooperative, BoA, private	
	Provision of Farm Equipment/ Irrigation technologies and maintenance service	BoA, Gunna, Cooperatives, Retailing shops, NGO, Private workshops, TVET, Agricultural mechanization, Private workshops	
Production & Postharvest handling	Extension	BoARD, NGO, TARI, EIAR,	<ul style="list-style-type: none"> • Low supply of HVC seed • Low irrigation facility • Poor disease control mechanisms • Lack of technical training • Lack of credit access • High cost of inputs • Low yield
	Credit	DCSI, Cooperatives, NGO	
	Spraying service	Private shops, BoA, NGO,	
	Capacity building	BoA, TARI, Universities, TVET, NGO, Cooperative promotion agency	
	Extension service	<ul style="list-style-type: none"> • BoA, NGO, TARI, Universities 	<ul style="list-style-type: none"> • Lack of coordinated effort between extension service cooperative agency • Storage problems

Trading/Marketing	Business development	Bureau Trade, Industry, Urban Dev't (BoTI & UD), TAMPA	<ul style="list-style-type: none"> • Low supply of HVC seed • Low irrigation facility • Poor disease control • Lack of technical training on marketing • Lack of credit access • High cost of inputs • Low yield • Storage problems • Lack of market infrastructure
	Capacity building	BoTI & UD, TAMPA	
	Transport	Private transporter, Share companies	
	Arrangement of market centers	Municipality	
Processing	Technical advice	BoTI & UD, TAMPA, TVETs, Quarantine regulatory department	<ul style="list-style-type: none"> • Lack of technical skill on marketing
Retailing	Arrangement of marketing sites	BoTI & UD and municipal	<ul style="list-style-type: none"> • Lack of market to absorb the production • Low price offered by the market • Large number of middlemen in the marketing system; • Absence (weakness) of marketing institutions safeguarding farmers' interest and rights over their market able produces (e.g. cooperatives);

Source: (FGD, Survey, 2019)

3.3.2.7 iHVC Selling method in South Zone

FGD data mostly from PASIDP *Woreda* of South zone small Holder HVC farmers respond that their selling method is in a sequence: middlemen to retailers to consumers. Well organized marketing channels do not exist. Marketing of HVCs in the study areas are carried out in the following ways.

Farm-gate Selling

From our FGD data this is not a prominent market practice. However, some small holder farmers sell their HVCs to the buyers at the farm-gate. In this mode of marketing, buying and selling of HVCs and other goods may be on an individual basis. Buyers go to the farm, usually at a fixed time given by producers, though it can occur at any time without notice. In the case of fruits and vegetables, sometimes, the produce can be sold "in the field," and the buyer arranges for its harvesting. In the study area, farmers collect their produces in their collection center, and buyers purchased their produce from these collection centers.

Direct Selling

Most of small holder farmers from KII surveyed prefer to sell their products after harvesting them by themselves, believing that they will get a better price for their produce this way. In this case, after harvesting farmers do general grading and bring their produce in bamboo baskets to the nearby market on foot. In some cases, they have permanent buyers in the local market, and sometimes they visit house-to-house carrying their fresh.

Selling to Middlemen

In the study area direct selling is decreasing as the volume of production increases. It is not possible or profitable for producers to sell their products directly to consumers, so selling to a middleman is an oft adopted strategy by rural and small-holder farmers. In addition, door-to-door selling makes price setting difficult because farmers have little information regarding prices being charged by other sellers. Engaging a middleman who is willing to collect products from different producers and sell them to retailer to consumers provides employment and income to both producers and the middleman. Irrespective of volume, a middleman collects products from producers in rural areas, and after collecting a large enough volume, he/she sells the collection at market price at a retailer's shop in urban areas where demand is high. In areas where there is no strong cooperative network and road access to farms is limited, middlemen are key to bringing product into the market place.

3.1.2.6 Pricing Method of iHVC

Prices of agricultural produce vary from season to season or year to year depending on their volume of production and availability. Especially the price vegetable crops are highly fluctuated from season to season. This is mainly due to by their nature vegetable crops are highly perishable with a short shelf life.

In the study area of south zone of PASIDP *Woreda* study zone small holder farmers Prices of HVC products show significant variations depending on the supply situation.

Generally, the smallholder farmers use flexible pricing method to sell their product and they are not organized and are not governing the value chain. Hence, they are price takers and hardly negotiate the price due to fear of post-harvest loss, in case the product is not sold. The value chain governance is similar both in HVCs.

3.1.2.7 Marketing Margin and Profit share of actors

In every layer of marketing segments there are intermediaries which have their own share out of the total market profit in the HVCs. Under normal condition each actor including the smallholder producers should have to get reasonable share from the marketing margin/profit to stay in the business.

Knowing the profit share of each market participant is very important to clearly identify the leverage point along the market chain of the HVCs. Then, it helps to design effective intervention which can improve the profit share of the relevant actors in general and smallholder HVC producers in particular. The analysis of marketing margin for this particular study is performed based on all the information obtained along the market chains. These include:

- The average production costs of farmers in all study schemes for each of the major commodity,
- The average farm gate prices of each commodity (purchase price of assemblers/wholesalers),
- Average marketing costs of each market intermediary (sorting/grading, transport, loading/unloading), and
- The average consumers' price aggregated from different market segments (district, zonal, regional) for each commodity.

Based on these indicators the profit share of each actor along the chain for each commodity is computed (Table 20), the total production cost per commodity was computed based on the information obtained from producers with respect to the use of production inputs (labor, seed,

chemicals, etc.). Farmers were asked to estimate all the inputs applied and their associated costs as well as the yield harvested from the high value crops cultivated. Average production cost includes all costs incurred by the farmer to produce a quintal of the commodity (labor for land preparation, input application, guarding, harvesting estimated based on the wage rate for each schemes and taking the average; purchased inputs such as fertilizer, chemicals based on their purchasing price).

Table 20: Costs and benefits of major actors in the vegetable marketing (Birr/qt)

Actors	Parameters	Major HVCs			
		Onion	Tomato	Pepper	Potato
Producers	Production costs	550	700	700	660
	Farm gate price	900	900	1300	800
	Producers profit	350	200	620	190
Assemblers/wholesalers	Marketing costs	45	50	50	40
	Total costs	945	950	1350	840
	Selling price	1500	1200	2000	950
	Assemblers/wholesalers profit	555	250	650	110
Retailer	Retailer's buying price	1500	1200	2000	950
	Marketing costs	90	75	60	45
	Total costs	1590	1275	2060	995
	Selling price	1800	1600	2540	1130
	Retailer's profit	210	325	480	135
Consumer	Consumers' price (birr/qt)	1800	1483	2540	1130
Total profit		1115	775	1750	435

Source: Computed from survey data (June 2019)

The total profit generated from the transaction of a given commodity by all market actors was computed by adding the profit of each actor per commodity (Table 17 for vegetables). Then, the profit share of each actor in the HVCs marketing is estimated by dividing their respective profit from a given commodity to the total profit which is the sum of the profit of all actors from that commodity and expressed in percent (Tables 21).

The result has shown that an average profit share of about 30.87%, 39.73%, and 29.40%, from all the major vegetables commonly produced in almost all the study *Woredas* goes to producers, assemblers and retailers. This indicated that producers are in a better position in terms of their share of the profit margin. Commodity wise producers obtained a minimum and maximum profit share of 10.5% from onion and 59.6% from cabbage, respectively (Table 19).

Table 21: Actors Profit share by type of major vegetables at the District market

Actors	Profit share by type of commodities			Overall average
	Onion	Tomato	Pepper	
Producers	31.39	25.80	35.43	30.87
Assemblers/wholesalers	49.78	32.26	37.14	39.73
Retailer's	18.83	41.94	27.43	29.40
Total	100.0	100.0	100.0	100.0

Source: Computed from survey data (June 2019)

In general, the average profit share of retailers from vegetable they handle is found to be low as compared to those of retailers and producers which may not allow them to stay in the business. The longer market channels observed for majority of the products could be one reason for increasing marketing costs which affect consumers to pay unfair price. On the other hand small retailers have less influence on controlling the price. The commodities have very short shelf life and mostly wholesalers are having no facilities to store the commodities till price gets stabilized. So they are expected to sale the items before they get spoiled for a very small profit margin and finally as we see from the data above the small holder farmers are getting almost equal profit margin with wholesalers and retailers that are not equated with their efforts on iHVC farms.

4. Constraints and Opportunities for iHVC Production and Marketing

4.1. Opportunities

The studied PASIDP *Woredas* have several prospects that can be explored and harnessed for improved iHVC production and marketing. The primary prospect for expanding the production iHVCs depends on the willingness of the producer. Great majority of the respondents of Tigray Region in the PASIDP *Woredas* reported that they are willing either to commence or to continue produce iHVC and expand their production because of opportunities such as availability of infrastructures (eg. Irrigation facilities), market demand and WoARD support (eg. input supplies and training, although limited) and promotion of iHVC in their region. There are also other practical and tangible opportunities that can visibly change the landscape of irrigated high value crop production and marketing in PASIDP *Woredas* and Tigray Region (Table 22).

Table 22. Potential Opportunities for iHVC Production and Marketing in Tigray Region

Opportunities	Description of the opportunities
Suitable agro-ecological conditions	Wide range of altitudes (200 – 3900m), diverse soil types and high topographic variation (8% peak highlands, 39% midlands and 53% lowlands) characterize the Tigray Region (Hagos et. al, 1999). Together these factors create diversified agro-ecological conditions and many niches for diversified crop production including high-value crops such as vegetables, roots and tubers, fruits, spices, stimulants and industrial crops.
Urbanization and growing population Tourists and visitors	Over 4 million population with growth rate of 2.7 % each year (Solomon 2005) with about 14.93% living in urban area Tigray Region is historically important tourist destination in the country; which is likely to bring life style changes prompting vegetable and fruit consumptions. Tourists seeking cultural and natural attractions in rural Tigray Region promote investment opportunities particularly in Hotel business which also promotes consumptions iHVCs such as vegetables and fruits
Potential niche market destination of iHVC	(i) University (Mekele, Raya, Adigrat and Axum) accounting for over 50, 000 resident students in Tigray Region. (ii) Prisoners, people in hospitals can be extremely profitable niche destination for iHVC in Tigray Region (iii) Availability of Industries and Industrial Park employing large number of workers. (iv) FDRE Defense Force North Front members
Strategic government Policy and plans	The existence of conducive policy directions and framework in intensive irrigated agricultural development and commercialization (eg. GTP-II) both for food and nutrition security as well as livelihood improvement of rural farming communities. GTP-II in its AGP-II program Sub-Component 3 focused on small-scale irrigation (SSI) development and Sub-Component 4 focused on agricultural marketing and value chain development
Market Infrastructure and Institutes development	Initiatives such as Adeha whole sale markets in Mekele and other selling sheds in <i>Woreda</i> availability

On-going and planned Potential Regional Projects	Rail-networks, cold storage at Alulua Aba Nega International Airport, <i>Woreda</i> Road Networks, improving the quality and coverage of telecommunication services including mobile networks, electricity supply
Enabling environment and funding support from organization and NGOs.	GOs, NGOs, CBOs and Agencies providing various supports including agricultural market information; cooperatives involvement in agricultural commodity processing; marketing, establishment of distribution channels; low cost and labor based market infrastructures through community involvement participation; Training and capacitating entrepreneurship skill; irrigation development and expansion; microfinances institutions (eg. TAMPA, REST, ATA, IFAD, DCSI, RUSSACCOs)
Availability of Academic and Research Institutes	The availability of academic institutes such as Agricultural Research Center (AARC), Universities and Agriculture Colleges, Technology Institutes is an important opportunity to complement the iHVC production and marketing, irrigation technology development and management with tangible research results and harness the available resources.
Willingness of the producers, availability of labor	From the FGD and individual interviews farmers of PASDIP <i>Woredas</i> in Tigray Region are willing to continue producing iHVC. They committed working labor which is one of the primary opportunity for iHVC sector
Geographic proximity and location advantage	Geographic proximity of Tigray Region and PASDIP <i>Woredas</i> to near-by countries such as Sudan, Eriteria and near-by regions like Afar where less iHVC are produced
Organization at Kebele and Close extension services	Initiatives of integration among the <i>Woreda</i> level government offices, particularly the establishment and linkage between WoARD and farmer's organizations such as Irrigation farmers' cooperative (IFCs), Market Access Alliance (MAA), multi-purpose cooperatives (MPCs), Irrigation Water Users Association (IWUA)
Changing climates limiting rain-fed agriculture are forcing irrigated farming	In arid-areas such as Tigray Region particularly the PASDIP <i>Woredas</i> special and temporal variability of rainfall distribution and intensity resulting in extended frequent droughts leading to loss of agricultural production. In these areas irrigation is becoming a must and not an optional alternative
Availability of underground and spring water resources	The PASDIP <i>Woredas</i> of Tigray Region have portfolios of water resources that can be developed for small-scale irrigation based iHVC production

Sources own: (FGD, KII, Survey, 2019)

4.2. Constraints

4.2.1 Constraints

Several factors that limit the production and marketing potential of iHVC in the PASIDP *Woredas* of Tigray Region were identified. The challenges were summarized in each of the three pillars of iHVC sector including (i) input supply, (ii) production and (iii) market factors (Table 23).

Table 23. Summary of the constraints in iHVC production and marketing of PASID *Woredas* in Tigray Region and key intervention areas

Constraints	Detailed Description of the Constraints	Strategies of overcoming the constraints
<p>Input supplies for iHVC</p> <ul style="list-style-type: none"> • Seeds/seedlings, • Fertilizers, • Pesticides, • Herbicides, • Irrigation tools/equipments • Micro-loans/subsides/grants 	<ul style="list-style-type: none"> • Lack of improved good quality and quantity of seed/seedlings • Poor qualities (seeds that are expired and with low germination percentage, mixed seeds) • High cost of inputs (seeds, fertilizers, crop protection chemicals) • Lack of private and GOs developing • Timely delivery of inputs • Expired chemicals • Poor knowhow of the chemicals and their use • Safety issues in using the chemicals • Price fixing by input agro-dealers • Limitation in active participation of the IFCs, MPUs • Expensive irrigation tools and equipments (eg. Pumps, water tanks, irrigation canals, generators, seed storage) • Difficult to access accessories • Underdeveloped agricultural credit market • Limited knowhow of producers in accessing available credits 	<ul style="list-style-type: none"> • Local Research Institutes and Universities has continueadaptation and development of new varieties • Legally benefiting from geographic proximity to access seeds and other agricultural inputs from neighboring countries (eg. Sudan) • Aligning extension, cooperative and agricultural businesses through trained professionals, specific job descriptions • Considering the PASDIP drought prone <i>Woredas</i> under priority list of development projects such as road infrastructure Tigray Regional Seed Enterprise • Agricultural insurances and loan linked with banks and insurances the IFCs and MPCs • Government support for easy access to inputs by strengthen linkage between input suppliers and farmers by forming seed producers/supplier associations(Coops) • Investing on rural infrastructure ex, telecom ,access to road, forming contract farming
<p>Production of iHVC</p> <ul style="list-style-type: none"> • Soil management • Irrigation water use and management • Production technologies • Production calendar planning • Post-harvest management • Grading and storing • Extension services/supports 	<ul style="list-style-type: none"> • Timely supply of inputs because of factors mentioned above • Lack of co-planning input supplies and delivery with MPCs and other agro-dealers • There is a shortage of irrigation water (where construction is either planned or on-going) • Low & Poor irrigation facility (high water leakage, backflow percolation, siltation) • Lack of scheduling irrigation water usage by farmers • Not clearly defined role and benefit claims between IFCs and IWUA mandates • Limited sustainable development based initiatives to manage soil and natural resources • Limitation of skills base of farmers and supports in agronomic practices and improved product management techniques • Maintaining limited number of crop types under production • Envisioning only one or two, instead of three cropping seasons per year • High seasonal pick over production and harvests to much supply at the same time • Limited farmer's know-how of product sorting, grading, storing, packing and transporting • Diseases and pest attacks • Lack of storage and high post-harvest loss • Limited awareness on business oriented farming • Economy of scale – very small produce for buyers but big volume for individual farmer • Insurance against crop failures by cooperatives 	<ul style="list-style-type: none"> • Strengthening watershed management (soil and water conservation) through rehabilitative measures • Conservation agriculture through promotion of organic fertilizer use and trainings • Skills on on-farm water, nutrient and pest management practices introduced and • Strengthening extension activities on-farm demonstration trials and technology dissemination programs • Diversification of crops and staggering of dynamic market-oriented cropping pattern, cropping calendar and multiple harvesting instead of one time harvesting • Conduct trainings to farmers for improved quality production and post-harvest handling, disease/pest control method, strategy • Strengthen credits service providers institutions and improve storage facility • Market integration through contract farming for niche markets (e.g. For Universities)

<p>Marketing Marketing Different actors (producers, road side retailers, wholesalers, processors, consumers)</p>	<p>or government</p> <ul style="list-style-type: none"> • Opaque market information, flows requirements • different markets • Lack of specific market days and places at Zone and <i>Woreda</i> level for HVCs • High requirements of time, quantity and quality for specific niche markets (eg. Universities) • Little product differentiation, no producer incentives for quality and grade premiums • Lack of clearly defined quality standards for • Imperfect pricing system i.e. price setting problem like frequent low price at peak supply period, and price fluctuation • Market structure – driven by limited buyers and suppliers from producers to market • Business environment and provision of services favoring middle-men in the VC • Lack of storage facility often forcing dumping of produces with low prices • Dedicated market shades protecting produce quality and reducing losses • High price fluctuations and changing market environments • Economy of scale – very small produce for buyers but big volume for producers • Poor market infrastructures – shades • Broker driven market linkages (old relationships) • Lack of business management and marketing skills • Lack of market regulation – eg. Adeha market • Limited support in marketing iHVC produces through IFCs • Limited technical support from extension and cooperative agencies in marketing 	<ul style="list-style-type: none"> • Product differentiation through thorough training and capacity building both for DAs and farming communities • Market infrastructure (storage, sailing place and market information) – Strengthening existing and establishment new of market information resource centers at least at Zone level to build database of iHVC market information actors, demand, supply and prices • Market counseling through mobile text-messages at least for DAs, IFCs and MPCs together with ATA, TAMPA • Strengthening the weekly market information provision through radios • Mobilizing communities for building local stores and selling shades for iHVCs; mainstreaming market infrastructure development through GO, NGO projects and programs • Increase credibility and market linkages of vegetables value chain actors • Domestic market and export market promotion • Improving farmers bargaining power by supporting farmers cooperatives • Coordinated efforts trade, revenue and farmers cooperatives to minimize price setting, unlicensed trading • Dedicated vehicles for supplying iHVCs through loans by MPUs or IFCs
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4.2.1 Differences in Constraints among PASDIP *Woredas*

Although there is similarity in the identified constraints across the 13 studied PASDIP *Woredas* of Tigray Region, there is difference in the importance rank of the constraints among the *Woredas* and Zones (Figure 29, Figure 30 and Figure 31). For example, in *Woredas* where the PASDIP schemes (eg. Enderta and Kolla Temben –Midmar) are planned to be constructed, the priority constraints for high value crop producing farmers primarily include lack of irrigation water and input access (Figure 29 and Figure 30). While in *Woredas* where schemes as well as agribusiness activities are progressing very well like in Emba Alaje and Tanqua Abergele, the major problems are access to inputs (eg. seeds, chemicals), disease and pest problems as well as market access and associated infrastructures.

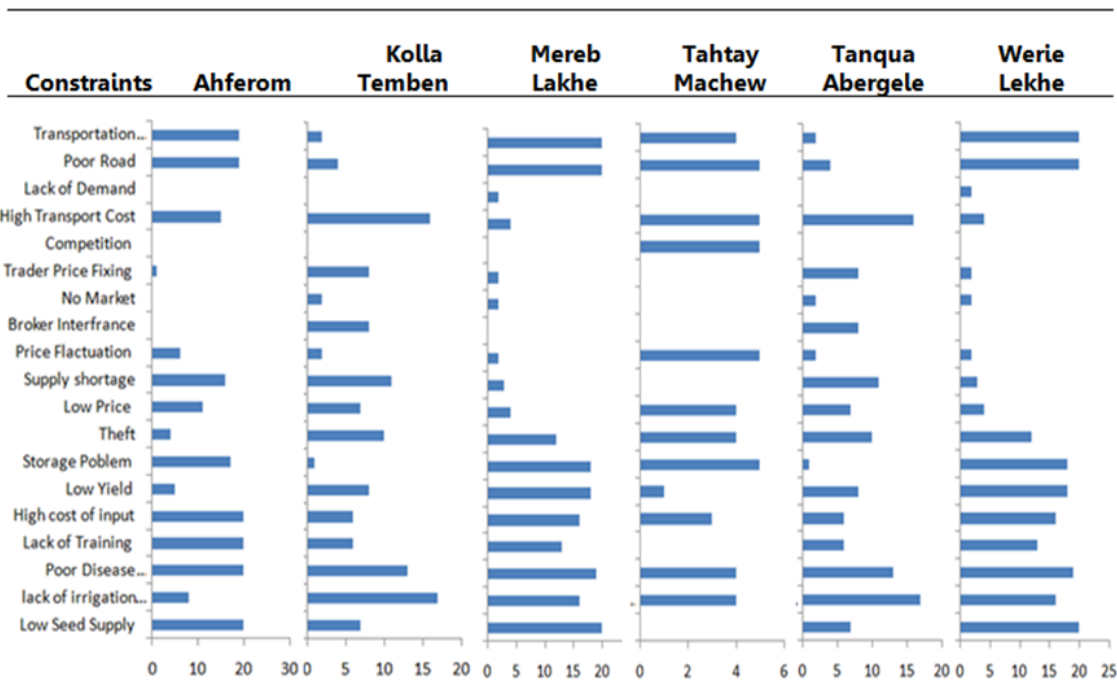


Figure 29. Constraints reported by individual interviews in PASDIP *Woredas* of central Zone, Tigray Region

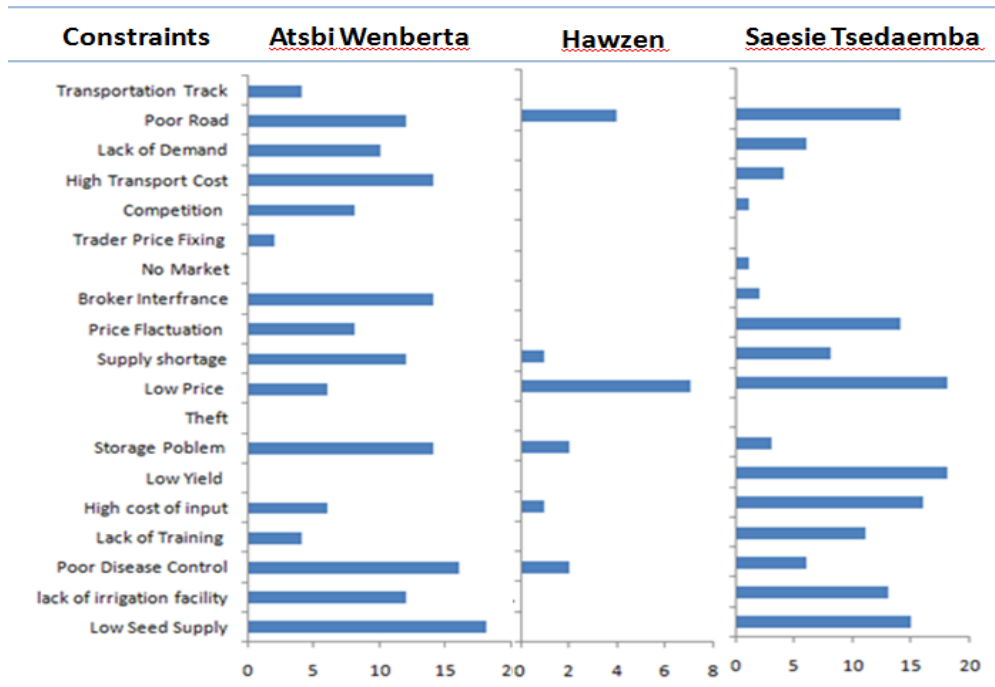


Figure 30. Constraints reported by individual interviews in PASDIP *Woredas* of Eastern Zone, Tigray Region

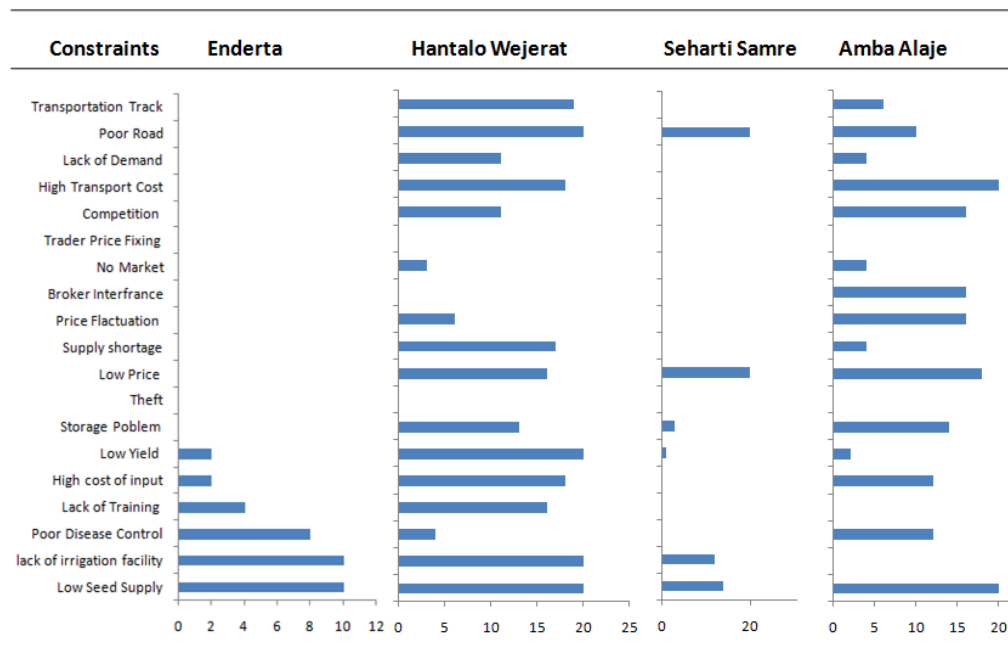


Figure 31. Constraints reported by individual interviews in PASDIP *Woredas* of Eastern Zone, Tigray Region

4.2.1 Barriers of iHVC produce flow

Apart from the constraints directly related to iHVC input supply, production and marketing, there are potential barriers hindering the produce flow among actors (Figure 32). Primarily these include infrastructure related problems which could persist even when inputs and outputs are available in surplus. These include infrastructures such as information, storage, road and transportation among others.

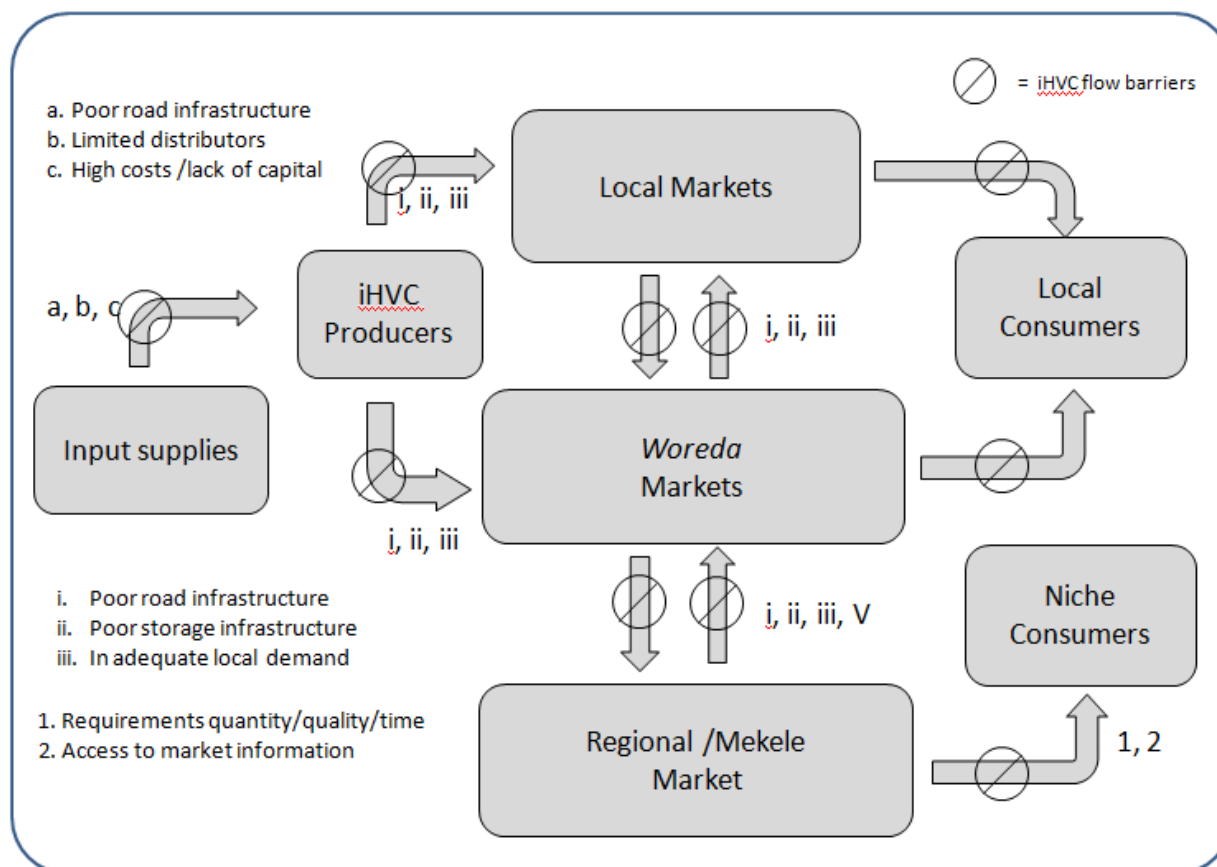


Figure 32. Schematic representation of the flow of iHVCs among different actors and specific barriers to the flow barriers are denoted by

5. Interventions, Recommendations and Conclusions

5.1. Required Intervention Frameworks and Recommendations

Drawing from the detailed diagnosis and synthesis of existing potentials and limitations, this final chapter looks at interventions that can further promote and scale-up practices for fending-off constraints and harnessing opportunities indicated in developing efficient iHVC sector from input supplies to production and marketing in PASDIP *Woredas* of Tigray Region (Table 22,

Table 23). These can be brought together in a widely applicable, systemic framework, consisting of three intervention areas that pertain to 'capacity, 'capital' and 'cooperation':

- **Capacity:** provides iHVC actors, especially smallholder farmers, with the awareness, knowledge, technology and know-how required to make the shift towards market oriented iHVC production
- **Capital:** provide the financial backing (eg. Insurances, loans, grants, subsidies and credits) for iHVC actors, primarily smallholder farmers operating in marginal arid environments, to venture into unsatisfied and challenging niche markets;
- **Cooperation:** provides competitive advantage and bargaining power in accessing inputs, finances, markets and its information especially for smallholder iHVC producers

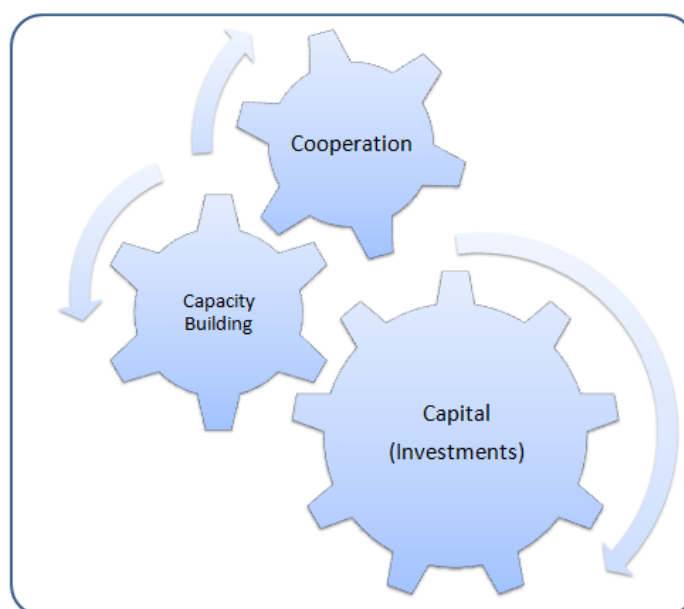


Figure 33. Three intervention areas to gear action to fend-off constraints and harness the opportunities in iHVC sector from input supply to production and marketing (Source: Author)

These three elements of the broad intervention framework, if moved in the right direction, could synergistically gear each other to supportive sector through provision of the marketing infrastructures and logistics, bargaining powers and economic incentives for the producers. Capacitated farmers can easily form functional cooperatives that can access inputs, market information and finances. In this regard, public-private collaboration mechanisms and enabling policies are helpful. Building partnership through involving the missing links of stalk holders like

academic research institutes and Universities would be effective for capacity building through training of actors in the chain, monitoring and evaluation of facilities.

The transition towards harnessing available market oriented iHVCs is an iterative process that can best be visualized as gear circles, composed of three intervention areas, as depicted in Figure 33. For each of these intervention areas, recommended entry-points for change and actionable solutions are proposed, not necessarily limited to a specific iHVC or geographical location of PASDIP *Woredas*, but based on the most important needs highlighted in previous chapters (Chapter 3 and Chapter 4). The following sections discuss the three interventions areas in more detail.

Capacity: Capacity Building

- Provision of training for farmers to improve their skills in irrigation agronomy(e.g., organic/mineral fertilizers, optimum plant populations, land preparation, disease management, insect pest control, crop calendaring),crop inter- and intra-specific diversification, on-farm water management, and general farm management capabilities.
- Use centers of extension services, farmers field and information places where modular training to farmers from input – production – marketing of iHVCs demonstrated involving research institutes and Universities
- Train DAs and experts in irrigation production technologies, agribusiness as and market linkage development as well as cooperative promotion which is lacking in the extension systems
- Capacitate farmers, DAs and other actors in the chain, like wholesalers, retailers and small juice processers and venders through experience sharing platforms, on-job training, field days and visits, FFS
- Involve the research and teaching academic institutes for capacity building to all the actors in different disciplines such as Agriculture, Horticulture, Agribusiness and Value Chain, Management , Cooperatives Management, Institutes of Technology (IoT) and other relevant fields
- After capacity building, there must be consultative meeting to develop strategic business planning for at least 5 years

Cooperatives:

- Linking cooperatives with financial institutes such as microfinances, insurances and banks through forums to promote access to capital for input and output markets

- Engaging the IFCs and Unions in capital venture investments for example in small scale agro-processing, seed enterprises and other input importer firms
- Best practice experience sharing between and among different cooperatives including IFCsm MPCs within or other Unions and/or Federations with in the Tigray Region or elsewhere in other Regions
- Platform for meetings and discussions between agricultural extension, cooperative, TAMPA and other concerned *Woreda*, Zone and Regional stalk holders to identify current status, challenges and way-forward
- Organization of discussion platforms comprising farmers' organizations, IFCs, MPCs, service providers(eg. transporters, input providers, primary processors, collectors, aggregators), traders to build trusts
- Within a market oriented agricultural development like iHVCs, private production companies including co-operatives may employ extension staff specializing in agribusiness and cooperatives which is lacking currently at Keble/ Tabia level
- Membership of irrigation beneficiaries in the IFCs is proof of farmer's willingness to be part of the IFCs, attitude and/or lack of incentives from the membership. Cooperative promotion, incentives (eg. early provision of inputs, discounts on inputs) for members could address some of these challenges
- Encouraging cooperatives to get engaged in niche and contract farming with potential consumers such as universities, hospitals, industrial parks and military camps through dialogues and discussion forums

Capital: Investment

- Investments on central market infrastructures and logistics such as market information resource centers, storages/cold stores, selling shades
- Crop insurances financing for crop failures and harvest losses
- Provision of credit, grant, subsidies and revolving fund for different actors in iHVC chain to maintain product quality and provide better services to final users and consumers

5.2. Conclusion

The RMOS examined the iHVC sector from input supply to production and marketing towards transformation of smallholder farmers of PASDIP *Woredas* focusing on assessment of iHVCs, their potential markets, competitors, major actors, enabling environments and market infrastructures. The results indicate that there is high potential and scope of opportunity for market integration of PASDIP *Woreda* smallholder farmers producing iHVC. The primary prospect for expanding the production and marketing of iHVCs drives from the smallholder farmers' willingness and their available resources such as land, labor and water. In addition strong initiatives of support from the Regional government as well as development partners through direct investment on infrastructures (eg. irrigation facilities, capacity development) and promotion of iHVC. However, logistical inefficiencies, under developed facilities and services, limited and deteriorating infrastructures, together with limitation of cooperative functionality, lack of production – market integration to reach unserved and unmet market demands (eg. niche markets) are cross-cutting constraints. The key implication of these findings is that all actors and stalk holders need to develop strategic short-term, mid-term and long-term action plans that will accelerate leveraging and harnessing of opportunities and fending-off the constraints to transform the iHVC agriculture in the Region. The transitions strategies and action plans should derive from widely applicable, systemic framework, consisting of three intervention areas that pertain to 'capacity, 'capital' and 'cooperation'. Over all the profound implication is that the investment on construction of modern small-scale irrigation schemes alone cannot be relied upon to bring about the aspired income, food and livelihood security in the studied areas. For small-scale irrigation programs to continue sustainably and play a significant role in the improvement of smallholder livelihoods, production and marketing risks driven by the constraints at each level of value chain identified above merit strategic interventions. Equally important to the long-term and short-term interventions is also harnessing the available opportunities.

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