

# Analysis of Head Cabbage Value Chain in Guji Zone, Southern Oromia, Ethiopia

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**Abstract:** Cabbage is highly nutritious, and it is an economically important vegetable in Ethiopia which is widely cultivated in Guji zone especially at highland districts. The study was aimed to analysis head cabbage value chain with the specific objectives of identifying actors, estimate marketing cost and margins identify determinants of market outlets choice decisions and head cabbage market supply in the study area. Data were collected from 128 farmers, 25 traders and 15 consumers and analyzed. Identified actors include input suppliers, producers, rural collectors, brokers/dealers, wholesalers, retailers, and consumers by which 94.63% of product pass through. The highest total gross margins 48.1% and highest producer gross marketing margin of 68.2% was recorded in channel V and II respectively. Total livestock unit, area allocated to head cabbage, market information and market distance as important factors affecting head cabbage market supply in the study area. Family size, land total, total livestock unit, transport facility, production experience, area allocated to head cabbage, extension service, training, credit access, off farm income and selling price determine market outlet choice decision of head cabbage producers in the study area. This study suggests improving farmers' knowledge and experience on head cabbage production and marketing, encouraging producers through extension service, land allocation for head cabbage, improving productivity and volume sales, improving market information access, expanding accessibility of market infrastructure and strengthening supportive institutions like credit access. In addition to this, it shall be better to improve the farmers' market margins by strengthening farmers-traders linkage through reducing brokers' exploitation and solving related production and marketing problems there by establishing centers for wholesalers and retailers and linking producers with institution like university make producer more profitable in the study area.

**Keywords:** Guji, Actors, Head Cabbage, Producer, Value Chain, Analysis, Channel Choice, Multivariate Probit

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## 1. Introduction

### 1.1. Background and Justification

Head cabbage is leafy vegetables and highly nutritious with so many health reimbursements. It is rich in photo-nutrient anti-oxidants that are powerful oxidants and known to help protect against breast, colon, and prostate cancers blood. Additionally, fresh cabbage is an outstanding source of natural antioxidant, vitamin C that develops resistance against infectious agents and scavenges harmful, pro-inflammatory free radicals [14]. Its production is increasingly important activity in the agricultural sector of the country mainly due to increased emphasis of the government on the commercialization of smallholder farmers [12].

Integrating vegetable production into a farming system has contributes substantially to the Ethiopia's economy in terms of food and nutrition security as the vegetables complement stable foods for a balanced diet by providing vitamins and minerals [4]. It is economically important vegetables in the country which grows best under cool conditions. According to CSA [8], annual head cabbage production (in quintal) and area under production (in hectare) has increased by about 16 and 30 percent, respectively, from 2020/21 to 2021/22.

In Ethiopia, Head Cabbage is mostly produced for consumption and market through informal market. It grows best under cool conditions. During the 2018/2019 cropping season in Ethiopia, the total area under head cabbage production was estimated to be 5,170.52 hectares with an average yield of about 60.89 quintal per hectare where

Oromia region shared 2474.91 hectares [8, 9].

Guji Zone is one of the head cabbage producing Zones in the region. Head Cabbage is widely produced in highland of Guji Zone due to its suitable environmental condition. It is one of the cash crop vegetable produced and marketed by farmers.

However the development of horticulture production and marketing in Ethiopia is constrained factors like policy implementation gap, inadequate vegetable seed regulatory frameworks, inadequate quality control and certification mechanisms, limited public institutional capacity and capability supporting efficient and regular vegetable seed supply, inefficient seed importation and distribution system, high post-harvest losses, high incidence of diseases and insect pests, poor vegetable marketing and value chain development and weak linkage and integration among stakeholders [6].

As Bezabih the major horticulture production constraints include lack of improved varieties and relying on own seed, high fertilizer cost and food prices and high price of fuel for pumping water for irrigation. Institutional factors in terms of provision of inputs and extension services and poor infrastructure are also limiting. The major constraints of marketing include lack of markets to absorb production, low price for the products, large number of middlemen in the marketing system, lack of marketing institutions safeguarding farmers' interest and rights over their marketable produces like cooperatives, lack of coordination among producers to increase their bargaining power, poor product handling and packaging, imperfect pricing system, and lack of transparency in market information system.

In the study area, head cabbage is one of the cash crop vegetable produced. Farmers produce head cabbage especially for market purpose for cash income. However, there are problems related to head cabbage in the country in general and in the study area in particular; Input supply shortage, low productivity, product perishability, poor post-harvest management, price drop after harvest, limited recipes at consumption level [5, 13, 7], limited infrastructural development, transportation problem and low negotiation of producers who can be cheated by marketing agents.

The development and upgrading of the value chains is an important agenda for the government, companies and other institutions. Entry into higher value markets requires an understanding of the requirements and dynamic forces within the value chain [15]. Understanding of the existing inputs supply systems, production, marketing systems and consumption of head cabbage is important for developing/upgrading value chain in the study areas. In order to motivate head cabbage producers for improving the

production and marketing of head cabbage has not been undertaken in the study areas. Therefore, there is a strong need to make value chain analysis to identify the major value chain actors, and to identify factors that affecting volume of supply of head cabbage to market, to estimate marketing costs and margins at different market channel and to identify factors affecting producer's market outlets choice in the study area.

## 1.2. Objectives of the Study

### 1.2.1. General Objective

The general objective of this study was to analysis of head cabbage value chain in Guji Zone, Southern Oromia.

### 1.2.2. Specific Objectives

The specific objectives of the study were to:

- 1) Identify head cabbage value chain actors and draw value chain map;
- 2) Analyze respective marketing costs and margins across market channels;
- 3) Identify the determinants of market outlets choice decisions of head cabbage producers and;
- 4) Identify the determinants of head cabbage market supply by farmers in the study areas.

## 2. Methodology

### 2.1. Research Design

A cross sectional survey research design was employed for this study. Quantitative and qualitative research data were collected from primary and secondary data sources. Quantitative data was collected from district agricultural offices whereas qualitative data was collected from farmers, traders and consumers using questionnaires.

### 2.2. Sampling Technique and Sample Size

The study was undertaken in two districts of the highland area of the zone in which Head cabbage is potentially produced. The districts used for the study were Bore and Ana Sora where three PA of Bore Bidika, Ano keransa and Alayo Diba were selected from Bore and Yirba Buliyo, Gosa Ilu, Raya Boda and Homa shela were purposively selected from Ana Sora district respectively. Based on the completed enumeration or sampling frame of the household in each selected PAs, Household farmers were selected based systematic sampling where the total sample size is the summation of sample household selected from each PAs as described in table 1.

*Table 1. Sampling producers of head cabbage producers.*

No	PA	Total Number of head cabbage producers (N = 862)	Number of sampled households
1	Bore Bidika	140 (k = 140/20 = 7), j = 2	20
2	Anno Keransa	120 (k = 120/20 = 6), j = 3	20
3	Alayo Diba	160 (k = 120/20 = 8), j = 5	20
4	Gosa Ilu	180 (k = 180/30 = 6), j = 6	20
5	Homa Shela	124 (k = 124/15 = 8), j = 3	15
6	Yirba Buliyo	132 (k = 120/16 = 7), j = 2	16
7	Raya Boda	106 (k = 106/17 = 6), j = 1	17
Total		862	128

Sample traders were collected using a purposive sampling method where the actors, wholesalers (7), rural collectors (2) and retailers (16) from the markets that head cabbage passed through. Accordingly, a total of 25 traders were selected. Furthermore, 15 consumers were interviewed.

### 2.3. Methods of Data Analysis

Descriptive statistics was used to analyze the data collected, employed maps, percentages, frequencies, means and standard deviations. To evaluate the market performance in the value chain net returns and estimated costs of value chain actors along the value chain were calculated. for describing market chain actors of producing and transacting Head cabbage from farmers to final consumer were identified and mapped. This actors include head cabbage producing farmers, input suppliers, wholesalers, retailers, collectors, brokers and final consumers. The value chain was visualized the chain of actors, identify roles and linkage among the actors. The data of production, cost of production and marketing were obtained from survey result.

Head cabbage market performance of the area was examined by analyzing market cost and price margins among different head cabbage marketing actors in order to measures the degree of head cabbage marketing efficiency where marketing margin is the difference between prices at different levels in marketing system and total marketing margin is different between what a consumer pays for head cabbage per quintal and what producers or farmers receives for the produce [18].

$$TGMM = \frac{\text{final consumer price} - \text{farmer price}}{\text{final consumer price}} \quad (1)$$

Where, TGMM is Total Gross Marketing Margin which is useful to introduce here the idea of producer participation, farmer's portion or producer's gross margin (GMM) which is the portion of the price paid by the end consumer that belongs to the farmer as a producer. The producer's margin or share in the consumer price (GMMp) is calculated as:

$$GMMp = \frac{\text{consumer price} - TGMM}{\text{consumer price}} = 1 - TGMM \quad (2)$$

The consumer price share or portion of market intermediate is calculated as:-

$$MM = \frac{\text{selling price} - \text{buying price}}{\text{consumer price}} * 100 \quad (3)$$

Where MM is Marketing Margin in percentage

Net marketing margin (NMM) which is the percentage over the final price earned by the intermediaries as their net income after their marketing costs are deducted. Thus, the net marketing margin is calculated as:

$$NMM = \frac{GMM - \text{marketing cost}}{\text{consumer price}} * 100 \quad (4)$$

### 2.4. Econometric Model

In this study, multiple linear regression models was used to

analyze data to generate information about determinants of head cabbage market supply and Multivariate probit model was used to analyze the producers channel choice.

Multiple linear regression models are employed to estimate the determinants continuous dependent variables and two or more continuous or categorical independent variables. This model is also selected for its simplicity and practical applicability [23]. Based on literatures, the head cabbage supply model to be estimated in this study was taking the following form.

$Y_i = f(x_1, \dots, x_n)$  Where sample size and n is number of explanatory variables used for building model.

Where Econometric model specification of supply function defined as:

$$y_i = \alpha + x_i \beta_i + \varepsilon_i \quad (5)$$

Where is  $\varepsilon_i$  distributed as  $\varepsilon_i \sim N(0, 1)$

$X_i$  is a vector of explanatory variables hypothesized to affect farmers' head cabbage market supply,  $\beta_i$  is a vectors of parameters to be estimated which measures the effects of explanatory variables on the farmers decision of potato market supply.  $\varepsilon_i$  is random error normally distributed with mean zero and constant variance.

It is known that, the selection decision is inherently multivariate and attempting univariate modeling excludes useful economic information contained in interdependent and simultaneous choice decisions. Based on this argument, the study adopted multivariate probit (MVP) econometric model to simultaneously model the influence of the set of explanatory variables on each of the different market channel choices, while allowing the unobserved or unmeasured factors (error terms) to be freely correlated [2].

In multivariate probit model, where the choice of several market channel choice is possible, the error terms jointly follow a multivariate normal distribution (MVN) with zero conditional mean and variance normalized to unity (for identification of the parameters) where  $(\mu y_1, \mu y_2, \mu y_3, \dots) MVN \sim (0, \Omega)$ , the symmetric covariance matrix is given by:

$$\begin{bmatrix} 1 & \dots & \rho y_1 y_j \\ \vdots & \ddots & \vdots \\ \rho y_j y_i & \dots & 1 \end{bmatrix} \quad (6)$$

Similarly, since the decision to select market channel or channels might be affected by some dependent variables the multivariate model will be specified of all actors across each channel. Where the model is described as follow.

$$\begin{cases} \text{Wholesales} = x'_1 \beta_1 \varepsilon^w \\ \text{Retailers} = x'_2 \beta_2 \varepsilon^R \\ \text{Consumers} = x'_3 \beta_3 \varepsilon^C \\ \vdots \\ \vdots \end{cases} \quad (7)$$

### 3. Result and Discussions

#### 3.1. Descriptive Statistics

##### 3.1.1. Demographics and Socioeconomics Characteristics of Households

The variables used to describe demographic characteristics of sample farmers were sex, marital status, transport facility, extension service, training off farm income and credit from categorical variables and family size, total land owned, total livestock unit, production experience of head cabbage, area allocated to head cabbage, selling price, market supply and distance to nearest market of continuous variables were contributed influence on the head cabbage and head cabbage channel choice of the producers respectively. The results presented in Table 2 depicts that, about 85.16% of the producers were male and the remaining 14.84% were female headed households revealing that females participation is low in determining family livelihood among assessed respondents.

**Table 2.** Demographic and Socio-economic characteristics of Respondents.

Variables	Descriptions	Frequency	Percent
Sex	Female	19	14.84
	Male	109	85.16
Marital status	Unmarried	1	0.78
	Married	127	99.22
Transport facility	No	32	25
	Yes	96	75
Extension Service	No	60	46.88
	Yes	68	53.13
Training	No	97	75.78
	Yes	31	24.22
credit access	No	112	88.19
	Yes	15	11.81
Off farm income	No	39	30.71
	Yes	88	69.29
Market information	No	26	20.47
	Yes	101	79.53
Family size	Mean	8.4 (3.5)	-
Land Total	Mean	6.6 (4.8)	-
Total Livestock Unit	Mean	13.3 (7.3)	-
Production Experience	Mean	4.9 (4.1)	-
Area allocated	Mean	0.5 (0.4)	-
Selling price	Mean	383.9 (163.4)	-
Market supply	Mean	45.8 (37.8)	-
Market Distance	Mean	34.9 (25.5)	-

The average head cabbage harvested which was taken to the market for sale by the respondents in rural area was 5787.3 quintal. The average household size is about 6.6 hectare, with family size of 8.4 persons per household, which is larger than the national average 4.6 persons per household [10]. Livestock owned TLU of 13.3 in average. A household on average allocated 0.5 ha of land for head cabbage production, which is very small, perhaps due to the in availability seed for the crop. The extension services reached out 53.13% of the farm households, while the credit service extended only credit about 11.81%.

Though all the respondents in this survey are primarily engaged in crop production and livestock rearing, 69.29% of them are also participated in off/non-farm activities to

generate additional income. Off/non-farm activities refer both to self-employments in non-farm sectors such as petty trade, mining and off-farm employment such as government, daily labor, and guard non-government organizations.

Access to agricultural markets and marketing information are essential factors in promoting competitive markets and improving agricultural sector development. A well-organized market intelligence information system helps all the producers and traders freely interact with one another in arriving at prices. Access to reliable market information help farmers sell their surpluses of head cabbage and choose modes of transaction, each of which yields a different benefit. It has been postulated that farmers will choose a profitable mode of transaction if they can receive reliable market information on the prevailing market conditions. The result revealed that about 79.53% the producer obtain market information.

##### 3.1.2. Input Utilization

Inputs used by farmers of the study area are Seed, fertilizer, herbicides and pesticides. These inputs are supplied to farmers either by District Agricultural office, union, private traders or local markets.

The value chain map of head cabbage in both district was similar and presented in Figure 1, the two head cabbage value chain actors were identified namely direct actors those are input suppliers, producers, traders, consumers and indirect actors were those that provide financial or non-financial support services, such as government offices, credit agencies, business service providers and union.

The survey result indicated that around 93.75 of sample respondents applied fertilizers for production of head cabbage in the study area (Table 3).

**Table 3.** Input usage of sample Respondents.

Input	Measurement	Total (N=128)	
		Frequency	Percentage (%)
Improved Seed	Yes	128	100
	No	0	0
Fertilizer	Yes	120	93.75
	No	8	6.25
Chemicals	Yes	18	14.06
	No	110	85.59

Input Suppliers: Primary multipurpose farmers' cooperatives, Union, district agricultural office and local market were major suppliers' seed, fertilizer and chemical input to producers in both districts (Table 4). Head cabbage farmers also participated in preparing their own inputs and they also supply to fellow farmers. Over all, these actors supplied seeds, fertilizers, chemicals and trainings. In the study area, farmers use inorganic fertilizer of DAP and UREA fertilizers supplied from cooperatives and agricultural office (Table 5).

A larger proportion of farmers (97.66%) were purchased seed from local market (Table 5). This contradicts with the finding of Kassa T. Alemu which stated that the most common seed sources were producers themselves [13].

*Table 4. Major input Suppliers.*

Input	Source	Total (N = 141)	
		Frequency	Percentage (%)
Improved Seed	Agriculture Office	0	0
	Local Market	125	97.66
	Union	0	0
	NGOs	3	2.34
Fertilizer	Agriculture Office	120	93.75
	Local Market	8	6.25
Chemicals (Pesticides and Herbicides)	Agriculture Office	3	2.34
	Local Market	25	19.53
	Family labor	83	64.84
Labor	Hired labor	15	11.72
	Labor Exchange	15	11.72
	Cooperation	15	11.72

*Table 5. Marketing margin (Birr/Quintal).*

Channels	GMMP	GMMbr	GMMr	GMMc	GMMw	TGMM
I	100	-	-	-	-	0.00
II	51.9	0.0064	0.481	-	0.015	0.481
III	60.2	-	0.174	-	0.398	0.398
IV	56.6	-	0.431	0.15	0.021	0.431
V	56.9	-	0.015	0.431	-	0.431
VI	68.6	-	0.314	-	-	0.314

Producers: Farmers are the primary and most valued actor in the head cabbage value chain. Producers decide, what input to use, when to seed and harvest, how much to consume, and how much to sell, considering the available resource. They perform most of the value chain functions right from farm inputs preparation on their farms to post harvest handling and marketing. The major value chain functions that head cabbages producers perform include land preparation, growing/planting/, fertilization, protecting from weed, pest/disease, harvesting and post-harvest handling and marketing [3]. Head cabbage sole cropping is the most popularly practiced cropping pattern in the study area. Sample farmers sold their head cabbage produce at the available market options which were at farm gate and nearest village market or urban (town) market to different value chain actors like collectors, wholesalers, retailers and consumers (including individual households, hotels and restaurants).

Collectors: Rural collectors are independent operators at primary markets who assemble and transport head cabbage from smallholder farmers, using pack animals and small trucks for sale to larger markets. The local traders play the key role as in the head cabbage value chain in area; their trading activities include buying and assembling, repacking, sorting, and selling to wholesalers typically transport on horse to nearest town. Their major sales outlets are relatively rural collector. And most of these outlets own or rent storage but usually do not store for more than two or three days. These local traders collect head cabbage for wholesalers and wholesalers purchase from rural collectors by covering all cost and also additional fee for their services.

Brokers/dealers: Brokers/dealers in the districts have regular and temporary customers from major towns and cities across the country. They facilitate transaction by convincing farmers to sale his product and facilitating the process of searching good quality and quantity head cabbage to wholesalers. The share of profit that goes to brokers/dealer varies from farmer to farmer and from trader to trader. The brokers/dealers sometimes go beyond facilitation of transaction and tend to set prices and make extra benefits from the process. A few wholesalers go straight to farmers' fields without using brokers/dealers to purchase the head cabbage products from the farmers where they negotiate prices. Brokers/dealers do not follow proper business conduct and as a result they constrain the marketing system more than they facilitate. In case the producer is not sold through broker/dealer, they forced to sell at the lower price because of perishability of the product. The broker/dealers travel to the rural areas and contact producers, they inspect the product quality, estimate output, set price and come back to communicating with wholesalers to purchase and transport. The farmers have no idea of the price paid by the wholesalers and only receive what has been bargained with the broker/dealers.

Wholesalers: Wholesalers are traders that buy head cabbage from rural collectors and also directly from farmers, usually those in surplus areas for resale in deficit, to larger market centers and retailers with better financial and information capacity. Wholesalers are major buyers of head cabbage as they buy at least a truck load of head cabbage at a time from farmers. They mostly purchase from farmers, local collectors and using brokers/dealers. They buy head cabbage

from producers, collectors and by using brokers/dealers from Bore and Ana sora districts and sell to retailers and consumers at Bore, Sora, Adola, Shakkiso, Negele and Hawassa markets.

**Retailers:** Retailers are key actors in head cabbage value chain within and outside the study area. These are known for their limited capacity of purchasing and handling products and low financial and information capacity. They are the last link between producers and consumers. There are two types of retailers in the study area districts retailers and central retailers. Districts retailers are buying head cabbage either from farmers or wholesale traders. While district or zonal or regional market retailers in major cities mostly buy from wholesalers and sell to town consumers. The shops are mainly in the major cities and commonly buy head cabbage from wholesalers. During the market visit, it was observed that retailers keep small amount of head cabbage. Consumers usually buy the product from retailers as they offer according to requirement and purchasing power of the buyers.

**Consumers:** Consumers are final purchasers of head cabbage products mostly from retailers for consumption purpose. Head cabbage consumers are individual households (rural and urban dwellers) and hotels. The majority of sampled consumers preferred undamaged and clean head cabbage. Consumers think that if the chain becomes shorter and shorter the price of head cabbage will be reduced.

**Enablers and facilitators:** In a value chain, enablers include all chain-specific actors providing regular support services or representing the common interest of the value chain actors. The supporting function players for the head cabbage value chain are those who are not directly related to the head cabbage value chain but provide different supports to the value chain actors. The support functions include different services like credit, research and development, infrastructure, and information. Support service providers are essential for

value chain development and include sector specific input and equipment providers, financial services, extension service, and market information access and dissemination, technology suppliers, advisory service [3].

In the study areas, there are many institutions supporting the head cabbage value chain in one way or another. The most common support providers are District Agriculture Office, District Trade and Market Development Office, Research and Private transporters. Some service providers extend services beyond one function and others are limited to a specific function.

Private Transporters and NGOs are value chain supporters identified in the study area. Some service providers extend their supportive functions along the value chain and also have multiple functions. Agricultural offices provided agricultural extension services, follow closely the head cabbage farmers, they advise on head cabbage cultivation, management of agronomic practices and organizing and providing trainings.

### 3.2. Value Chains, Marketing Margins and Marketing Channels of Head Cabbage

#### 3.2.1. Value Chain Analysis

Five marketing channels were identified for head cabbage value chain in the study area. The total product passed through the channel was 5857.30 quintal or 58.573 tons of head cabbage. The channel comparison was made based on volume passed through. Accordingly, a channel of Farmers → Wholesalers → Retailers → consumers is the largest in which was about 59%(3432.8 quintal) of the product passed through (channel I) and followed by a channel of Farmers → Retailers → Consumers in which 19.55% (1145 Quintal) of the product passed through it (channel II) in the study area (figure 1).

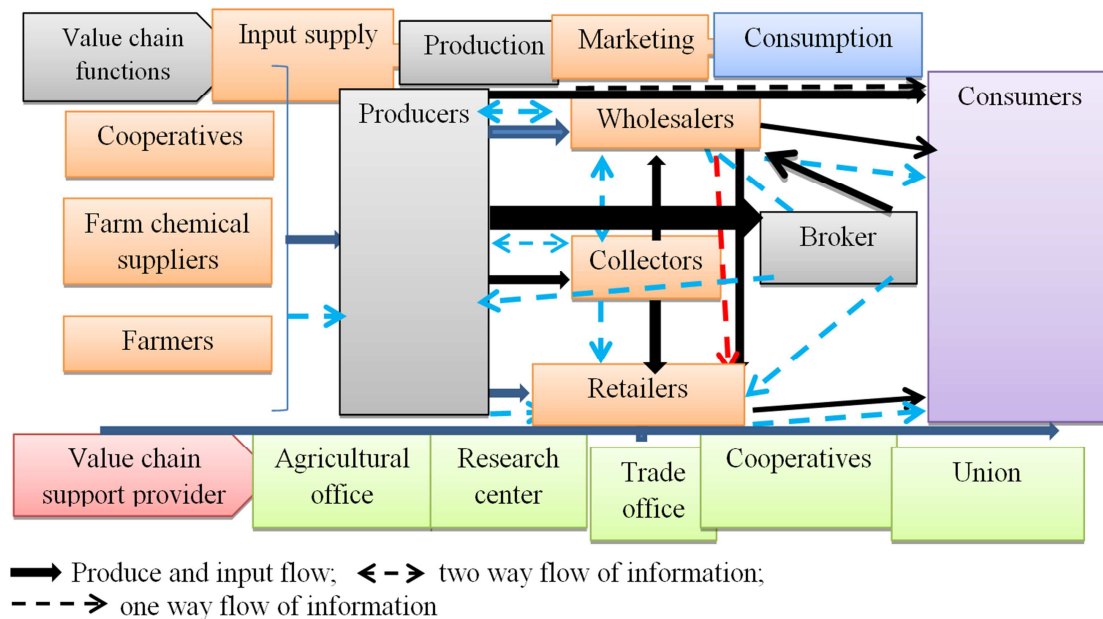


Figure 1. Production, Input and Information flow of head cabbage value chain.

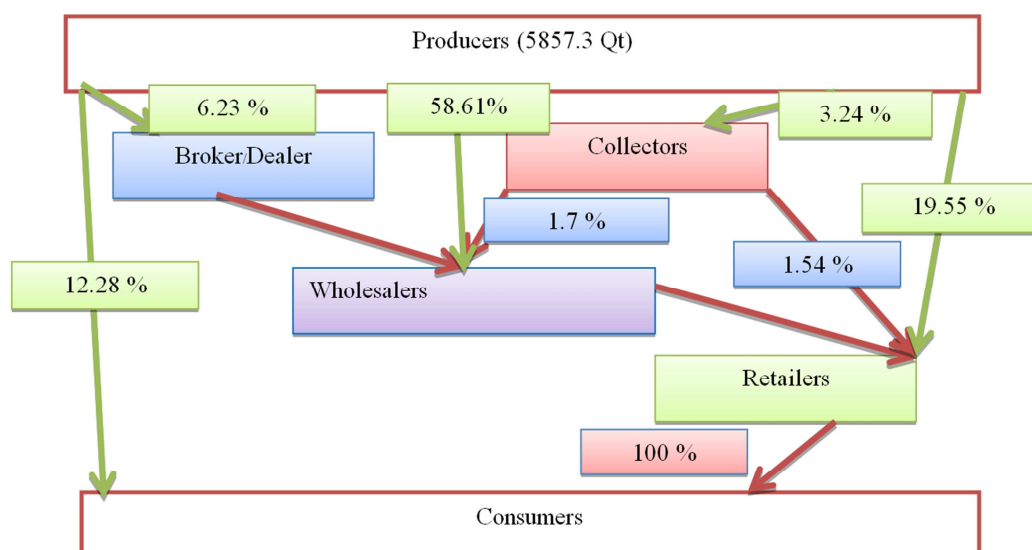


Figure 2. Head cabbage value chain map of study area.

Channel I. Producer → Consumers (12.28%)

Channel II. Producer → Broker → Wholesalers → Retailers → Consumers (6.23%)

Channel III. Producer → Wholesalers → Retailers → Consumers (58.61%)

Channel IV. Producer → Collectors → Wholesalers → Retailers → Consumers (1.7%)

Channel V. Producer → Collectors → Retailers → Consumers (1.54%)

Channel VI. Producer → Retailers → Consumers (19.55%)

Farmers sold about 58.61% of their head cabbage produce to wholesalers, 19.55% Retailers, 6.23% to brokers/dealers and 12.28% to consumers.

### 3.2.2. Marketing Margin

Marketing margin is one of the commonly used measures of the performance of a marketing system. It is defined as the difference between the price the consumers pay and the price the producers receive. Computing the total gross marketing margin (TGMM) is always related to the final price or the price paid by the end consumer, expressed in percentage [18].

Gross marketing margin (GMM) is the gap between prices at consecutive levels in the marketing channel. Therefore for this study the marketing margins were computed based on the data collected of value chain actors.

In Table 5 GMMp, GMMbr, GMMr, GMMc and GMMw means gross marketing margins for producers, retailers, collectors and wholesalers agents respectively were computed.

Total gross marketing margin is the highest in channel II which is 48.1%. Without considering channel I, which farmers sell directly to consumers, producers gross marketing margin is the highest in channel VI which is 68.2%.

### 3.2.3. Profitability of Head Cabbage Production in the Study Areas

In conducting profitability analysis of head cabbage production, market prices for purchased inputs and output were considered. For inputs like family labor, exchange labor,

own animal draft power, own land and other inputs which the households use in head cabbage production without paying direct cost, its opportunity costs were used. Sampled farmers sold head cabbage product in fresh form so the reference product was taken in fresh head cabbage form. Prices differ per marketing channel, per quantity sold, change over the season, and even prices can vary during one single day. Therefore, weighted average price was used in analyzing profitability of head cabbage production and marketing for the value chain actors.

Table 6. Profitability analysis of head producer sample farm households.

Input cost Items	Average Cost	
	Birr/Qt	Production cost (%)
Seed cost	41.03	40.6
Labor cost	27	26.71
Land rent	8.30	8.21
Fertilizer cost	20.17	19.95
Oxen cost	2.10	2.08
Pesticide cost	2.5	2.06
Total cost	101.10	
Marketing cost		
Packing material	12.5	
Loading and unloading	10	
Transportation	19.50	
Broker	10.20	
Sell tax	0.2	
Other cost	15.40	
Loss	0	
Total marking cost	67.8	
Overall total cost	168.9	
Selling price	393.5	
Net return	292.4	

Qt = quintal, % = percentage, other cost implies opportunity costs  
Source: Own survey result, 2021

As observed in Table 7, the average production cost of head cabbage was 168.80 Birr/ Qt. Out of the total costs of production, seed accounts 40.6% of the total production cost



which was major cost component in head cabbage production in the study area. The average selling price was 393.5 Birr/Qt and net return of farmers from head cabbage production was estimated at 292.4 Birr/Qt, which is 56% their selling price and 127.4% of total cost of the area in the year 2021/22. The study result was high as compared with the study of head cabbage value chain by Beriso et al. in West Arsi of Kofale and Kore of [3]. As reported by Masuku, M. B. and Xaba which stated that the variation could be arise from types of market agency where farmers were selling and land allocation affected vegetables production profitability [16].

Table 7, depicts the total cost and net return of different actors from a quintal of head cabbage. Retailers in general

get highest net return of 120 Birr per quintal than other value chain actors followed by wholesalers and collector where the least earner was broker. Among actors, retailers earn highest percentage of net profit that was a net return about 22.41% of the purchase price. But this does not mean that retailers are generating more profit in total than other actors. Even if they get highest net profit per unit, they handle small quantity of head cabbage than wholesaler of low profit. This finding is in line with Beriso et al. which stated that the retailers earn the highest marketing margin from all other vegetable traders in East Shoa, Ethiopia [3]. Wholesaler's total benefit is greater than the others because they handle large volume.

*Table 7. Cost, Marketing margin and profit margin of value chain actors.*

Cost items	Producers	Broker	Collectors	Wholesalers	Retailers	Total
Production cost	101.10	-	-	-	-	-
Purchasing price	-	393.5	383.91	400	440	1208.91
Labor for packing	-	-	0	1.5	2	3.5
Loading and unloading	-	-	20	25	28.25	73.25
Transport	-	-	0	40	30	70
Packing material	-	-	15	17	17.5	49.5
Sorting	-	-	20	0	5	25
Telephone	-	58.25	15	57.25	26	98.25
Storage	-	-	0	0	-	0
Marketing cost	67.80	-	70	75	90	302.8
Total cost	168.9	58.25	140	215.75	198.75	781.9
Total cost (%)	21.6	7.45	17.91	27.6	25.42	100
Sale price	393.5	480	623.91	716.25	758.75	2960.82
Marketing Margin	215.01	86.5	240	316.25	318.75	1220.01
Share (%)	17.62	-	19.67	25.92	26.13	100
Profit margin	292.40	71.75	100	100.5	120	535.51
Share (%)	40.15	13.4	18.67	18.77	22.41	100

Source: Own computation from survey result, 2022

### 3.3. Marketing Channels

Head cabbage market performance was evaluated based on the level of marketing margins obtained and considering associated marketing costs for each key market channels. Accordingly, during the study time costs and purchase prices of the main chain actors', margins at farmers', collectors, wholesalers, urban retailers and consumers' level were analyzed. Of total respondents farmers 58.61% sold head cabbage to wholesalers, 19.55% to retailers and 12.28% to consumers.

Marketing channel and marketing margins were used in the analysis of supply chain performance. Four parameters are necessary to measure the efficiency of a channel. These are quantity handled, producers share, total marketing margin, and rate of return. Out of these volumes handled, producers share and marketing margin were considered for all the head cabbage in this study. Six marketing channels of head cabbage are exhibited in the study areas. It was estimated that 5857.3 quintals of head cabbage were supplied to market by sampled farmers. Wholesalers and retailers were the main receivers of head cabbage with percentage shares of 58.61%

and 19.55%, respectively from producers (Figure 1).

### 3.4. Econometrics Model Results

#### 3.4.1. Determinants of Head Cabbage Market Supply

Several variables were hypothesized to influence the volume of head cabbage market supply by sampled farmers. The results for all VIF values were ranges between 1.1 and 1.74. Hence, multicollinearity was not a serious problem among the variables used for constructing the model.

The regression model has also no problem of heteroscedasticity which proves that all the explanatory variables were included for the model can be used to analysis determinants of market supply of head cabbage. Similarly, the model has no the problem of endogeneity. Generally, the overall goodness of fit of the regression model, was measured by the coefficient of determination,  $R^2$ .  $R^2$  Values of the model were 0.90 which shows that what proportion of the variation in the dependent variable is explained by the explanatory variable. Hence this result indicates that about 90% of the variation in marketed supply of head was attributed to the hypothesized variables in the study area. There are 7 continuous and 8 dummy independent variables of which 5 variables significantly affect the market supply of head Cabbage (table 8).



**Total Livestock unit:** The model result showed that total livestock owned of the household was positively associated with the quantity of head cabbage market supply indicating a one unit increase in livestock likely to increase head cabbage market supply by 0.66 quintal in average. The positive relationship indicates that farmers having large total livestock are able to purchase more input for head cabbage production intern produce more quintal of head cabbage and supplied a large quantity of head cabbage to the market outlet. In the other cases, farmers with more livestock assets have better animal manure for input production which helps to increase productivity and production and finally farmers would supply more head cabbage to market where livestock also used as transport facility in transporting head cabbage produce.

**Table 8.** Head cabbage market supply factors result.

Market Supply	Coef.	SE	P> t
Sex	-2.46	8.66	0.777
Age	0.12	0.42	0.777
Family size	-0.22	1.23	0.86
Education level	-12.3	9.68	0.207
Land Total	0.49	1.26	0.7
Total Livestock Unit	0.66*	0.36	0.071
Transport facility	-0.62	6.88	0.928
Production Experience	0.02	0.77	0.982
Area allocated to Head cabbage	57.11***	14.01	0.00
Extension Service	7.96	5.82	0.174
Training	-3.02	8.55	0.725
Credit access	-4.88	7.80	0.533
Cooperative member	2.31	7.11	0.746
Market information	9.85*	5.80	0.092
Market distance	-0.16*	0.10	0.103
Constant	-27.3	23.73	0.252
Number of observation	128	-	-
F(16, 110)	4.9	-	-
Prob >F	0.000	-	-
R- squared	0.912	-	-
Root MSE	30.249	-	-
Breusch Pagan test	-	-	-
Chi-square (1)	13.98	-	-
Prob > chi-square	0.0002	-	-

**Land allocation:** The result also revealed farmers who allocated more land for head cabbage production significantly and positively affect the quantity of head cabbage market supply. It revealed that as the land allocation is increased in 1 hectare the quantity supply of head cabbage is increased by 57.11 in average.

**Market information:** market information access was positively affected the head cabbage market supply at 10% significance level. This shows head cabbage producers who mostly accessed to true market information of selling price from different sources had supplied large amount of their product to the appropriate market channel where they can get expected profit. The result is in line with [19]. Who identified that access to market price information is directly related to households' choice of wholesaler market channel.

**Market Distance:** Distance from the nearest market

positively influenced the household's market supply at 10% significance level. This indicates that as the distance from the nearest market (walking minute) increases the head cabbage market supply decreased by 0.16. The result agrees with the findings of Megersa Adugn and Sori, O. who identified market distance has positively affected the probability of selling at farm gate and to collector market channel [17]. This might be due to that the type of product where to be mostly supplied regardless of the distance like sesame being produced for export while horticultural crops cannot be stored for a longer time due to their perishability.

### 3.4.2. Determinants of Market Channel Choice

Three binary dependent variables, wholesaler, retailer and consumer were used to jointly estimate the multivariate Probit model (Table). The Wald test was used to test the model fits, the data is statistically significant at 1% significance level, which implied that the subsets of coefficient are jointly significant and the independent variable include in the model is acceptable. Moreover the likelihood ratio test in the model ( $p_{21} = p_{31} = p_{32} = 0$ ) is significant at 1%. Therefore, the null hypothesis that all the  $\rho$  (Rho) values are jointly equal to 0 is rejected, indicating that the decisions to choose these market channels are interdependent.

Hence, the use of multivariate probit model is justified to determine factors influencing choice of market channels. Further, there are  $\rho$  values ( $\rho_{ij}$ ) indicate the degree of correlation between market channel choices. The  $p_{21}$  (correlation between the choice for retailer and wholesaler market outlet) and  $p_{32}$  (correlation between the choice for consumer and retailer market outlet) are both negative and statistically significant at the 1% and 10% significance level respectively (Table 9). The study revealed that farmers delivering to the wholesalers are less likely to deliver to retailer ( $p_{21}$ ). Equally, farmers who involved in retailer market outlet are less likely to send their head cabbage to the wholesaler ( $p_{21}$ ). Moreover the Simulated maximum likelihood estimation results suggested that there was positive and significant interdependence between farmers selection of market outlet of retailer and consumers which implied that the  $p_{31}$  (correlation between choice for consumers and retailer) are positively and statistically significant at 1% level.

The marginal success probability for each equation (market channel decision) is reported below. The likelihood of choosing retailer is relatively low (41.7%) as compared to the probability of selecting consumer market channel (59.5%) and selecting wholesaler market channel (54.9%). This is good evidence because farmers were not interested in selling their products to retailer market channel even if they get good price than other market channel due to marketing cost.

If head cabbage farmers choose all three market channels, their joint probabilities of choosing these market channels would be only 6.14%. It was unlikely for farmers to choose all three market channels simultaneously. This was justified either by the fact that simultaneous chose of all market

channels was unaffordable for the smallholders head cabbage farmers, or that all three market channels were not simultaneously accessible in the study areas. However, their joint probability of not choosing all three market channels was 5.13%, implying that the households were more unlikely to fail. This evidence suggests that choosing the right mix of market channels is determined by different factors for each market channels.

**Total livestock unit:** The model result showed that total livestock owned of the household was positively associated with the wholesaler market outlet at 5% significant level. The positive relationship indicates that farmers having large total livestock are able to purchase more input for head cabbage production and produce more quintal of head cabbage and supplied a large quantity of head cabbage to the retailer market outlet. In the other cases, farmers with more livestock assets have better animal manure for input production which helps to increase productivity and production and finally farmers would supply more head cabbage to wholesaler market outlet. This study in line with Kuma, D. Baker, K. Getnet, and B. Kassa confirmed that livestock hold had positively and significantly affected the access of milk and onion market outlet respectively [15].

**Land allocation:** The result also revealed farmers who allocated more land for head cabbage production significantly and negatively associated with the choice of retailers outlet chose at 5%, level of significant. This is in line with the study of Woldie, G. A., and Nuppenau, E. and Kuma, D. Baker, K. Getnet, and B. Kassa who reported that large land size allocated for banana and potato positively and significantly affects the proportion sold to wholesaler traders and cooperative milk market outlets, [22, 15].

**Quantity of head cabbage supplied:** It affected the probability of selecting wholesaler market channels positively and significantly at 1% significance level. This implies that farmers who produce and supplied larger quantities of head cabbage sell to markets that purchase a large quantity of groundnut for sale. The result agrees with the findings of Bazie, M. who revealed that a quantity of onion product supplied to market had a positive influence on the probability of selecting wholesalers market channel [1].

**Access to transport facility:** access to transport services has positively influenced the likelihood of head cabbage producers to select wholesaler market channels at a 5% significance level. Transport facilities increase the likelihood of farmers to select wholesaler channels than other market channels. Having transport services minimize transportation cost, the problem related with it and supplies the product where the market channel they want locating timely. The result is consistent with the findings of Sori, M. Ketema, M. Aman which stated that access to transport facilities has a positive effect on the probability of selecting a wholesaler market channel of tomato and groundnut, respectively [20].

**Off-farm income:** The likelihood of households to select retailer market channels were positively affected by access to off/ non-farm income at a 5% significance level. It implies that farmers who have access to off/non-farm income choose

retailer channels over others. This is due to farmers who have non-farm income wanting to sell head cabbage smaller quantities and want to practice retail business by using their income from other businesses.

**Family size:** family size influences positively the likelihood of choosing wholesalers outlet at 5% significance level and influenced negatively the likelihood of choosing retailer outlet at 5% level of significance. This result indicated that those households with large number of family size were more likely to sell to whole sellers. This is because the wholesalers has the capacity to purchase large quantity of head cabbage expectations of future benefits like share dividend for those households who supply more product where the farmers having large number of family size produce ore and supply more by using family labor. The implication is that if the family have enough family labor, it is possible to produce large quantity of head cabbage to be sold is large, farmers search market outlets that buy large volume with reasonable price and incentive.

**Production experience:** Head cabbage producing experience has a negative relationship with likelihood of choosing retailer outlet at 5% levels of significance. The result showed that those households with a more number of year engagement in cabbage production and marketing are more likely to choose other outlet. This may be due to that experienced producers had better knowledge of cost and benefits associated with various cabbage marketing outlets that give the producers desire to adjust their market links, trying alternative marketing outlets to increase sales volume so as to increase the profits. The finding Tarekegn, K., Haji, J. and Tegegne, B. of showed that the number of years a household spent in beekeeping positively and significantly affected using cooperative market outlet [21]. Additionally selling price of head cabbage has positive relationship with the likelihood of choosing retailers outlet at 5% level of significance implying that since retailers buy small quantity in relation to wholesalers at market place they had owe to pay good price.

**Extension service:** extension service has a positive and significant influence on both wholesalers and retailer and retailer's outlet choice decision at 1% and 5% significance level respectively. Extension services increase the ability of farmers to acquire important market information as well as enable the head cabbage producers to improve production methods, hence leading to more output which in turn increases producers' ability to choose the best market outlet for their product. Thus, households who were visited more by extension agents were more likely to deliver head cabbage via wholesalers and retailers outlets. This result is similar to a study by Bezabih E, Mengistu K, Jeffreyson KM, Jemal Y. and Habtamu Mossie,, Berhanie, Z. and Alemayehu, G. that confirmed regular contact with extension functionaries had a positive influence on the likelihood choice of cooperative outlet by milk producer in Uttarakhand [4, 11]. Tarekegn, K., Haji, J. and Tegegne, B. also reported that extension service positive influence on likelihood choice of retailers and cooperatives by beekeepers [21].

Table 9. Determinants of head cabbage market channel choice.

Variables	Market Channels											
	Wholesaler				Retailer				Consumer			
	Coef.	SE	Z	P> z	Coef.	SE	Z	P> z	Coef.	SE	Z	P> z
Household sex	0.67	0.44	1.5	0.133	0.11	0.39	0.28	0.779	-0.99	0.42	-2.33	0.2
Household age	0.02	0.02	0.73	0.464	0.01	0.02	0.76	0.445	0.02	0.02	0.95	0.34
Family size	0.12**	0.06	2.22	0.026	-0.07**	0.04	-1.86	0.062	0.05	0.05	1.03	0.305
Land total	0.14****	0.04	3.24	0.001	0.04	0.04	1.04	0.3	-0.01	0.04	-0.18	0.858
Total livestock nit	0.05**	0.02	2.24	0.025	0.02	0.02	1.17	0.242	0.01	0.02	0.26	0.792
Transport facility	0.82**	0.38	2.15	0.031	0.29	0.34	0.85	0.394	0.10	0.33	0.31	0.759
Production Experience	0.03	0.03	0.78	0.434	-0.06**	0.03	-1.67	0.095	-0.01	0.03	-0.26	0.792
Area allocated	0.27	0.49	0.54	0.587	-1.05**	0.45	-2.34	0.019	-0.12	0.44	-0.28	0.777
Extension service	1.42***	0.36	3.93	0.000	0.57**	0.32	1.76	0.078	-0.32	0.29	-1.09	0.274
Training	1.08***	0.39	2.81	0.005	0.55**	0.33	1.69	0.091	0.45	0.33	1.35	0.176
Credit access	0.16	0.41	0.41	0.685	-0.02	0.39	-0.06	0.953	0.68*	0.43	1.59	0.112
Cooperative	-0.25	0.31	-0.82	0.415	0.16	0.28	0.55	0.584	0.22	0.28	0.78	0.435
Off farm income	-0.35	0.34	-1.04	0.298	0.61**	0.32	1.9	0.058	-0.25	0.30	-0.81	0.415
Selling price	0.35	0.86	0.4	0.686	0.18**	0.791	2.23	0.026	0.0005	0.001	0.57	0.569
Market information	0.54	0.35	1.54	0.125	0.04	0.34	0.13	0.897	-0.18	0.33	-0.54	0.592
Education level	-0.27	0.44	-0.62	0.538	-0.11	0.36	-0.3	0.765	0.34	0.40	0.85	0.394
Market supply	0.02***	0.01	3.53	0.000	0.00	0.01	0.87	0.386	0.00	0.00	-0.74	0.458
Market distance	-0.002	0.01	-0.26	0.8	-0.002	0.005	-0.36	0.72	-0.001	0.005	-0.25	0.803
Constant	-1.32	0.89	-1.48	0.14	-1.28**	0.73	-1.74	0.081	0.07	0.78	0.09	0.924
Predicted Probability	0.55				0.417				0.595			
$\rho_{21}$	-0.86	0.09	-9.96	0.00***								
$\rho_{31}$	-0.30	0.17	-1.76	0.078*								
$\rho_{32}$	0.28	0.14	1.97	0.049**								
Number of Observation	122											
LRT (16)	61.46***											
LRT of correlations	31.99***											
Joint probability of success	0.064											
Joint probability of failure	0.051											

Table 10. Head cabbage marketing constraints of traders.

Constraints	Number of respondents	Percentage
Credit	9	36
Price	2	8
Lack of demand	7	28
Inadequate information	2	8
Quality problem	5	20

Source: Own survey result, 2021

Additionally Even though head cabbage is widely grown and marketed for a long time in the study area, farmers face many constraints such as availability of improved seed, disease,, pesticides, shortage of fertilizer, insect, pests, low linkage with lower value chain actors, lower price, low and consumer demand in cabbage production and marketing.

Moreover, poor product handling absence of storage facility, lack of credit availability, price fluctuation, poor sectorial support and inadequate market information were the common problems which have been raised by traders. Traders reported absence of proper standardization facility and product perishability as the main problems in head cabbage trading which cause price fluctuation and lower price. About 36% of the traders reported that in availability of credit access is their main problem trading the product in the area. They also reported, Even if suitable agro-ecology,

presence of experienced and interested farmers, the existence of non-governmental and governmental support to the crop is very low in improving farmer's livelihoods regarding head cabbage production and marketing.

## 4. Conclusions and Recommendations

### 4.1. Conclusion

The study analyzed value chain analysis of head cabbage in southern Oromia. Data collected from 128 head cabbage producers through systematic sampling techniques where data collected was analyzed by using both descriptive and econometric methods (linear regression and multivariate probit models). The result from the analysis showed that head cabbage producers market supply and decision to select

channel is determined by many factors where different market channels like collectors, wholesalers, retailers, and consumers were identified. Among these market channels wholesalers were the largest channel in terms of quantity of head cabbage supplied. However, the quantity of head cabbage supplied to broker market channels was relatively low when compared with other channels.

Multiple linear regression result revealed that head cabbage market supply affected by variables such as marital status, total livestock unit, land allocated to head cabbage, market information and market distance. Multivariate probit model result indicated that variables like producer's different alternative market outlets such as wholesalers, retailers and consumers are confirmation that the dependency of household level marketing decisions is empirically estimated by multivariate probit where variables like family size, total land, total livestock unit, transport access, extension service, training and market supply had significantly affected the probability of head cabbage producers to choose wholesalers market channel and the likelihood to select retailers market channel was also affected by the family size, production experience, land allocation, extension service, training, off farm income, and selling price. Farmers' choice of consumer's market channel is significantly affected by the sex of household and access to credit services.

The producers select multiple marketing outlets as a strategy to safeguard their savings and to maximize their incomes in the long term. Head cabbage producers involved in wholesalers marketing are less likely to send their head cabbage to the retailers and consumers. Significant negative correlations between some choices of market outlets support assumption that sellers can select two or more market outlets' simultaneously. The head cabbage producers who sell their produce to retailer and consumer are characterized small in volume as a result of poor access to road and market information (about quality and prices), low extension packages know how, and their weak capacity to comply with cooperative market requirements.

#### 4.2. Recommendations

Therefore, to increase production, market supply, select preferable market channels and supply the required amount of head cabbage to appropriate market channels at right time farmers need aware direction of the effects which could improve their production, marketing of head cabbage produce and market channel choices, developing production skills, willing to be cooperated with macro consumers, innovate new methods of head cabbage production and engage in other income-generating non-farm activities that improve their market channel choice likelihoods.

Expanding equal infrastructures like road and transportation facilities needs government intervention to promote the effective marketing of head cabbage through all outlets and establishing head cabbage collection centers in potential production areas that encourage better price for producer. Additionally, expanding rural micro finances to tackle shortage of credit provision and advising farmers to

use credit for head cabbage production create conditions for larger production of head cabbage, market supply and head cabbage market channel choices. Farmers should search market information and identify their choice of market information sources to supply for appropriate market channels. Minimizing transportation problems through shifting from local transport to vehicles for supplying for appropriate market channel could bring expected income of head cabbage selling for farmers.

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