

Opportunities and Constraints of Ware Potato Value Chain Analysis: West Showa Zone, Central Ethiopia

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Abstract

Potato plays important roles in local food systems and for food security; however due to the prevalence of production and marketing constraints, the crop haven't supply majority of its advantages. Thus the study was conducted in order to assess the constraints, opportunities and to develop strategic interventions in ware potato production and value chain in Ambo and Dendi districts, Ethiopia. Both primary and secondary data collections were used. Primary data were collected from 227 sampled respondents randomly. Descriptive statistics and opportunities and constraint were used as a means of data analysis. The study revealed that there were high ware potato production potentials in the study areas and from the total potato produced by sample respondents, about 76.28% and 68.68% were sold from Ambo and Dendi districts, respectively. Even though there were potential conditions, in the study areas, the sector was constrained by different production and marketing problems like diseases, drought, insects problems, lack of sufficient irrigation water, limited access to supply of agricultural inputs, lack of adequate extension services, postharvest loss of produce, and others. Thus, to advance the crop productivity, post-harvest value and marketing systems, the ware potato value chain needs an organized and modern agricultural practices, pre and post-harvest management systems, creation of value in order to increase benefits and sufficient technical, financial support services, regulatory framework and availability of information systems. Generally, interventions are required to improve the efficiency and profitability of ware potato value chain in the study areas.

Keywords: Ware potato, Constraints and opportunities, Value chain analysis

INTRODUCTION

There are over 4,000 varieties of potato in the globe which are safe to eat. Also, more than 180 wild potato species were existed but are too bitter to eat. According to CIP report, potato is the third most significant type of food crop in the globe in terms of human consumption after rice and wheat. The global potato production now exceeds more than 300 million metric tons supporting billions of people in food consumption around the globe and potato are produced in more than 100 countries worldwide. To cope up with the increased number of population and hunger rates, potato is a vital crop needed to achieve food self sufficiency and food security of a given nation. Hence, more than half of global potato production now comes from developing nations (CIP, 2016). Nutritionally, potato is a great, having low fat source of carbohydrates, having more protein content than maize and twice of calcium. An average size of potato with the skin fulfills around 10% of the recommended daily intake of fiber. In addition, The protein content of potato is higher than a soybean and can provide half of the daily requirement of vitamin C of an adult (Anderson *et al.*, 2010).

In terms of production, potato is one of a high yielding crop that can be produced two to four times of grain crops in just one hectare. In terms of potato production per unit of water, potato yields more than any other major crops, yielding seven times more than cereals efficiently and can grow at harsher climatic conditions than any other crops such as wheat, corn or rice. On average, potato requires only 90-120 days to mature than any of major food crops existed and edible tubers can be harvested in 60 days making potato one of crop that have quicker return.

Having cool temperature with high volume of rainfall, Ethiopian highlands are solidly populated supporting millions of small holder farmers in that more than 86.4 % of agricultural households own land with areas of two hectares or less (Girma, 2006). But, the area is creating a very fertile ground for the production of disease-free potatoes (CIP, 2016). Potato plays a significant role in achieving food security in that potato is considered as an important staple crop in which almost every households allocate a fragmented land for potato crop every year. As compared to cereal crops, however, farmers that cultivate a small plot of land considered potato as a hunger breaker due to its short vegetative cycle that makes potato well suited with other major crops such as soybeans, teff or corn (FAO, 2010; CIP, 2016). Potato can be produced in two growing seasons: the Belg season ranging from March to June, which is a short rainy season and during the Meher season ranging from July to November, which is a long rainy season with bulk of production is undertaken.

Despite its potentiality and having advantage of the agro ecology with good weather condition, the productivity of potato is very low, which is 8.2 t/ha (CIP, 2016; Larry O'Loughlin, N.P). However, the potential yield of potato can reach up to 50 t/ha (Joshi *et al.*, 2009).

The Ethiopian agriculture, challenged by subsistence production, rainfall dependent with recurrent drought, using hoe technology and in adequate rural market, the potato production specifically and agricultural production in general is very low (Kumilachew, 2016; MoARD, 2010). In addition to the above, according to Gebremedhin Woldegiorgis (2016), depending on seed that have poor quality, greatly affects potato production in the country in that only 3% of Ethiopian farmers apply improved or not contaminated potato seed. In addition to this, practicing traditional farming system and giving less focus on tackling potato diseases such as late blight, which can cut yields by 50 percent destroying leaves, steams and tubers.

However, the ware potato sub-sector in Ethiopia is relatively underdeveloped and is faced low productivity of less than 10 t/ha. Also, CSA (2012/13) revealed that in Ethiopia average tuber yield of ware potato was almost constant between 6-8 t/ha in the last 20-30 years while the area planted with ware potato increased from 30,000 ha to about 74,934.57 ha in 2012 during the main rainy season.

In Ethiopia, ware potato is produced in the rainy and dry seasons using rain and irrigation, respectively. For example, by using irrigation and rain fed, in the Ambo district, 2,036.37 hectares of land and in Dendi district, 2,310 hectares of land were covered by ware potato during 2014 (AWAO, 2014; DWAO, 2014). Even though there is huge demand and potential for ware potato production in both districts, the production of ware potato carried out in this particular study areas is low and below its potential. Still now, farmers are facing different problems such as the use of local inputs, spread of pests and diseases, inadequate logistical facilities (storage, transport and handling) and low production and productivity. Therefore, this indicates a need for more generalized study which carefully examines constraints and opportunities of ware potato value chain analysis in the study areas. This study, therefore, investigates the creation of value addition in the production of ware potato by applying the concept of value chain analysis, to identify the major constraints and opportunities faced by the value chain actors in the selected study areas.

METHODOLOGY

Description of the Study Areas

The study was conducted in two major ware potato producing districts, West showa zone located in the Oromia National Regional State. These include: Ambo and Dendi districts (locally known as Woreda) and Kebele (the lowest administrative organ in the Ethiopian government structure which is equivalent to villages) in each of the selected zones. Together, 74 kebeles in Ambo and 82 kebeles in Dendi district were purposefully selected based on potentiality of ware potato production.

Table 2: Household sample design, 2015

Study area (District)	Sample kebele	Total number of HHs			Sample HHs		
		Male	Female	Total	Male	Female	Total
Ambo district	Ya'eChebo	224	44	268	21	4	25
	IlamuGoromti	230	50	280	21	5	26
	Golja	215	36	251	19	4	23
Dendi district	Galesa kota Gashere	343	74	417	32	7	39
	Galesa Koftu	384	84	468	35	8	43
Total		1396	288	1684	128	28	156

Source: Field survey by the author (2015)

Research design

The study applied both qualitative and quantitative approaches of mixed method descriptive research design.

Sampling techniques

Samples were taken from the total population in the study area. A total of 156 farmers, 8 input suppliers, 5 processors, 8 wholesalers, 9 retailers, 20 consumers, 13 support service providers and 8 local collectors. Together, 227 sampled respondents were selected and interviewed from both districts. The study area, Ambo and Dendi districts were chosen because of the potential for potato production.

Data analysis

Both qualitative and quantitative methods of data analysis were used. Key informant interview, interviewing different value chain stakeholders and secondary document analysis were used.

The data collected from different sources has been analyzed using descriptive statistics such as tables, graphs and percentages. In relation to the quantitative data analysis, the collected data through questionnaire has been prepared by coding and entering them into the computer and analyzed by the help of statistical package for social science (SPSS) version 20.0. Analysis results were presented using tables and figures. The Inferential statistics were used to analyze the data collected from value chain producers.

RESULTS AND DISCUSSION

Demographic characteristics of sample households

The major variables used to describe the demographic characteristics of sample producers include gender of the household, age, marital status and education level and these factors significantly influenced the crop production. The results of the study (Table 2) indicated that from the total respondents, 82.4% were male headed households and only 17.6% were female headed households in Ambo district; and 81.7% were male headed households and 18.3% were female headed households in Dendi district. A chi square test has been made to test the influence of household type (Male or Female headed) on the market supply of ware potato. In case of marital status, 95.9% in Ambo and 90.2% of Dendi respondents were married.

Table 2: Demographic and socioeconomic characteristics of sample respondents (categorical variables)

Variables	Items	Number of respondents				X ² -test		
		Ambo (N=74)		Dendi (N=82)		Total (N=156)		
		N	%	N	%	N	%	
Sex	Male	61	82	67	82	128	82	0.0121
	Female	13	18	15	18	28	18	
Education	Illiterate	11	15	4	5	15	9.6	19.182*
	Literate	63	85	78	95	141	90	
	Read and write	12	19	14	19	26	19	
	Primary education	25	40	33	42	58	41	
	Secondary education Certificate & above	25	40	31	40	56	40	
Marital status	Married	71	96	74	90	145	93	3.1601
	Unmarried	3	4.1	5	6	8	5.1	
	Divorced	-	-	2	2	2	1.3	
	Widowed	-	-	1	1	1	0.6	
Cooperatives	Yes	51	69	51	62	102	65	0.5254
	No	23	31	31	38	54	35	

* Significant at 10% probability level, N is number of respondents

Source: Own computation from survey result, 2015

The age of ware potato producing household showed variation; thus the age of ware potato producing household respondents ranged from 39 to 63 with a mean age of 47.2 years in Ambo and from 39 to 63 with a mean age of 44.4 in Dendi district (Table 2). The Chi-square test indicated that average household head age in the two districts had a significant difference at 5% significance level. The mean age of total sample of respondents was 45.7 years. This indicated that ware potato producing farmers in Ambo district have higher mean age as compared to Dendi ware potato producing farmers. The mean age of Dendi district helped the farmers to supply more ware potato product because the largest proportions of the household lie within a working age group (within 15 and 64 years). This is in line with Biruk Seifu (2013) which showed that if the majority of the household are under the active age group, there is perception to new technologies.

Education level of the household head in the two districts has significant variation at 10% significance level. About 85.1% and 95.12% were literate in Ambo and Dendi districts, respectively and the rest are illiterates. This result is in line with the findings of Astewel (2010) who found that if paddy producer gets educated, the market supply increases as well. The Dendi producers had relatively higher literacy rate and the literacy rate helped them to supply the crop product more.

Table 3: Demographic and socioeconomic characteristics of sample respondents (continuous variables)

Variables	Ambo (N=74)		Dendi (N=82)		Total (N=156)		t-test
	Mean	SD	Mean	SD	Mean	SD	
Age	47.2	8.4	44.4	7	45.7	7.8	2.2**
Experience	8.3	4.2	6.9	3.2	7.5	3.8	2.28**
Family size	9.03	3	7.92	2.7	8.44	2.9	2.43**

** Significant at 5% probability level, N is number of respondents

Source: Own computation from survey result, 2015

There was significant difference in ware potato production experience within the households in the two districts at 5% significance level. The average year of farming experience in ware potato production was 8.3 and 6.9 years in Ambo and Dendi districts, respectively. Availability of cooperative membership of the ware potato producing household head was also affecting the total crop supply. Thus, majority of the respondents, 68.9% and 62.2%, have been a member of cooperatives from Ambo and Dendi districts, respectively. This indicated that

larger numbers of the households were accompanied under the cooperative member in Ambo district as compared to Dendi district.

The available data indicated that the average family size of the respondents were 9.03 and 7.92 in Ambo and Dendi districts, respectively. T-test was also conducted to observe the significance difference between family size groups in the two selected districts. The result showed that there was a significance difference in ware potato production family size in the two districts at 5% significance level. Biruhalem (2010) and Dessalegn (2008) indicated that larger families with their greater supply of labor are expected to adopt a technology than the smaller family size; hence better access to input such as labor, seed and information. Ware potato production and selling to the market requires higher labor with households having larger family size were likely to produce and sell more of ware potato than those who have lower family size.

Production overview

Land holding size and area allocated for ware potato production

The average land holding size of the respondents showed significant variation between the two districts. The average land holding size of the respondents were 3.59 and 3.5 ha in Ambo and Dendi districts, respectively which is higher than the average national land holding size per households (1.77 ha) (CSA and World Bank, 2013). In all regions of Ethiopia, more than 90% of farm households own the land they cultivate (CSA and World Bank, 2013). The whole sampled farmers, (100%) have their own arable land and the cultivated land used for the production of ware potato has a mean of 2.9 ha and 2.7 ha at Ambo and Dendi districts, respectively. The remaining land was allocated for grazing and irrigable purposes.

According to Desta (2004) report the availability of land enabled farmers to earn more agricultural output, which in turn increased market supply. Also, as Biruk (2013) revealed that more land size means more cultivation and more possibility of production which in turn increases farm income and improves food security. This indicated that farmers in both districts have their own land in which they produce and supply the crop to the nearby market.

Productivity: In Ambo district, average land allocated for the ware potato production was 0.37 ha per a household and 0.38 ha in Dendi districts under both rain and irrigation production in the year 2015. Moreover, the average ware potato yield in Ambo district was higher (7.4 t/ha) as compared to that of Dendi district (5.8 t/ha) (Table 4). The production in both district was below the average national ware potato production during the main rainy season, which was 11.61 t/ha during 2013/14 (CSA, 2013/14). There was also statistically significant relationship between yield and market supply of ware potato product. This low yield production might be due to availability of several factors such as farmers' usage of local seed variety, occurrence of diseases and others. The yield gap also exists among the household members. The results showed a clear yield variation; Ambo district have better ware potato productivity than Dendi district.

Table 4: Average productivity of ware potato in 2015 production year (t/ha)

Districts	Production system	N	Minimum	Maximum	Mean	Std. Deviation
Ambo	Rain fed	56	2	20	7	4.84
	Irrigation	18	2.5	32	8.8	4.73
Dendi	Rain fed	59	2	16	5.1	5.6
	Irrigation	23	2	24	5.9	3.4

Source: Own computation from survey result, 2015

The study results showed that farmers in both districts have been produced more yield by irrigation than by rain-fed. The low yield was attributed to the type of variety farmers are growing which was local, poor seed quality, disease, unpredictable weather condition and weed. The mean productivity of ware potato produced under rain-fed was 7 t/ha in Ambo district and 5.1 t/ha in Dendi district. Production using irrigation in Ambo district was also higher than that of Dendi district with an average yield of 8.8 t/ha during the study time.

Constraints and Opportunities in Ware potato Value Chain

Value chain analysis is helpful to identify the constraints to the development of the chain from the initial input supply stage, through various phases of production, to the final consumption.

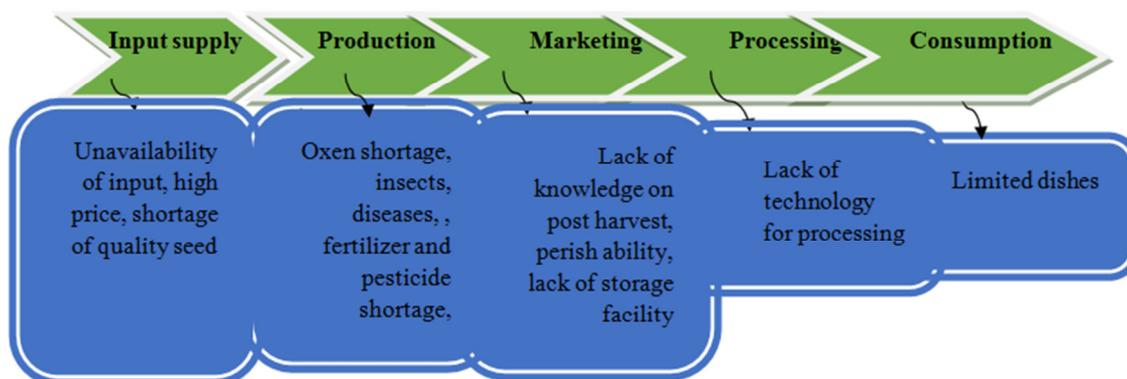


Figure 3: Major constraints in ware potato value chain

Production constraints

The major factor that reduces the production level in the study area includes: Fertilizer shortage, lack of pesticides, insects, diseases, weeds and seed shortage. The major problems faced by the producers (Figure below).

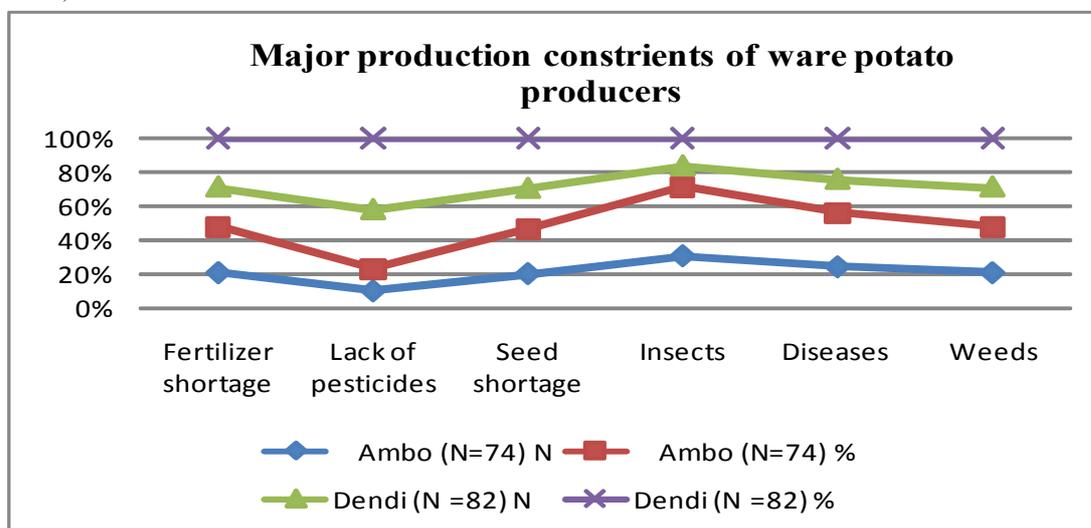


Figure 4: Major production constraints of ware potato producers

Source: Own computation from survey result, 2015

Lack of modern agricultural inputs

Some of the type of modern agricultural inputs that the farmers faced in both districts include: Fertilizer shortage, lack of pesticides and improved seed shortage. Among the sample respondents, 70.27% and 69.51% in Ambo and Dendi districts respectively replied that they have limited access to credit. This in turn have a negative impact on the application of modern agricultural inputs. Other factors includes: seed supply shortage, delay in supply of inputs, high input price and others.

Occurrence of diseases and weeds

This is the consequence happened due to the problems faced in application of agricultural inputs caused by credit access and other factors mentioned above. Low usage rate of anti insect and anti weed might be created due to these problems. This showed that most of the farmers were dependent on the use of local seeds. According to Muhammed (2011), prevalence of disease was one of the production problems encountered by farmers in the study areas. About 32.43% and 24.04% of the farmers replied that they faced disease problems in Ambo and Dendi districts, respectively. Due to low usage of herbicide, about 9.46% and 9.76% of the farmers faced weed problem in Ambo and Dendi districts, respectively (Table 5).

Natural Problems - Unpredictable weather conditions

These natural factors are beyond the control of the farmers which mainly includes rainfall fluctuation. From the total respondents, 75.68% and 71.95%, in Ambo and Dendi districts were replied that they depend on by rain fall. The major production constraint was water shortage or erratic rainfall (Tewodros *et al.*, 2014). This indicated that utilization of irrigation scheme by farmers in the study areas were limited. In Ethiopia, the main production season for ware potato, at altitudes higher than about 2,500 masl is June to September (Anton Haverkort *et al.*, 2012). This in turn resulted in low production and supply of the produce into the market, and also caused

fluctuation in volume of productivity in the respective study areas.

Production opportunities

Suitable climatic condition and existence of favorable land

The climatic condition of both study areas was favorable for ware potato production. The study results indicated that all the respondents replied that there are fertile soil and climatic conditions. The type of soil existed in the study areas include mainly brownish to grey and black soil with high clay content (AWAO, 2014; DWAO, 2014). With proper drainage and conditioning, these soils have excellent agricultural potentials. Bezabih and Mengistu (2011) also found that fertility of the land creates huge opportunity for increased production and productivity.

High productivity potential of ware potato

Ware potato product can be produced in difficult conditions or in the environmental conditions where other crops may fail. According to Endale *et al.* (2008) ware potato can yield up to 30-35 t/ha in 3-4 months in Ethiopia and the potential yield reaches up to 50 t/ha (Joshi *et al.*, 2009). Also, ware potato can yield high output from a small plot of land and it's a good opportunity for the farmers who cultivates a fragmented land.

Other opportunities the farmers are having in the production of ware potato crop includes; increasing price and demand of ware potato, high growth rate of population, cheap labor force and availability of irrigation water in the study areas. Also, the prevalence of conducive policies and strategies of the government are the opportunities that the farmers are having in the study areas.

Marketing constraints

The marketing problems mentioned by farmers include low selling price (especially during July and August), high seed ware potato price, interference of brokers in the market and using backward transport systems. All the value chain actors confirmed that there exists marketing problems in ware potato value chain.

Postharvest losses of Ware potato were high primarily because of poor postharvest handling, poor storage infrastructure and transportation facilities as well as poor market information and support systems in the study areas. In Ethiopia, post harvest loss of horticultural crops on average ranged between 30-50% caused by temperature, moisture, pests of stored products, spillages during handling and transportation (Rick Hodges, 2013). About 24.32% and 15.85% of the respondents responded that they have storage problem, in Ambo and Dendi districts, respectively.

Farmers in the study areas are often poorly linked to markets and do not adequately access market information. Often middlemen do make much higher marketing margins than the producers, limiting the motivation of farmers to expand ware potato production. In contrary, the farmers were incurring high costs for inputs such as fertilizers and agrochemicals.

Storage problem, information flow problem, lack of value addition in the chain, lack of technical assistance from the stake holders and quality problem were some of the marketing constraints that the farmers faced.

Table 6: Major marketing constraints of ware potato producers

Major constraints	Ambo (N=74)		Dendi (N=82)	
	N	%	N	%
Storage problem	18	24.3	13	15.9
Perish ability	8	10.8	9	11
Low price of product	29	39.2	24	29.3
Transport problem	4	5.4	9	11
High ware potato seed price	15	20.3	27	32.9

Source: Own computation from survey result, 2015

Marketing opportunities

Al most all of the respondents replied that there was a growing market demand for ware potato product. This availability of market demand throughout the year can create an important opportunity for the producers as well as for the other value chain actors. Since both of the districts geographical location nearness to major town and cities such as Addis Ababa and Ambo has created a better advantage to the actors to sell their product.

Conclusion

The major findings of the study are summarized as follows. The most commonly produced crops in the study areas include: Ware potato, onion, maize and barley. From the listed crop items, ware potato production is dominant in terms of total area covered by ware potato product.

The study revealed that most of ware potato product was produced for the market.

From the study results it is possible to conclude that, even though there were potential conditions for ware potato production in the study areas; the sector was constrained by different production and marketing problems like diseases, drought, insects(pests)problems, lack of sufficient irrigation water, limited access to supply of agricultural inputs, lack of adequate extension services, poor linkage with value chain actors, loss of produce, low produce quality and price fluctuation.

Ware potato value chain was affected by several problems at each stage of the main value chain functions those influenced the efficiency and competitiveness of the whole chain in the study areas. Therefore, interventions are required to improve the efficiency of ware potato value chain in the study areas and the following main issues are forwarded as recommendations for the interventions.

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DECLARATION OF CONFLICT OF INTEREST

The authors fully declare that they have no conflict of interest in publishing the manuscript.

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