Does APMC Market Increase Farmer's Income? Evidence from Value Chain Analysis of Sweet Potato in Karnataka

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ABSTRACT

In recent times, value chain management in agriculture has taken pivotal role in enhancing farmer's income. This study has been undertaken to analyse the existing sweet potato value chain in the Belagavi district of Karnataka. Intensive primary survey and focused group discussions of 112 farmers, 10 commission agents in APMC market, 5 wholesalers and 10 retailers were conducted for the study by using well-structured and pre-tested questionnaire. Multiple regression modelwas employed for assessing farm harvest prices of sweet potato. The study revealed that the only sale-specified time as months of September, October and November to get a significantly higher price. The cost and returns analysis indicates that labour cost and chemical fertilisers/farm yard manure were the major expenditure in production accounting for 32 and 26 per cent respectively. The major constraints in sweet potato value chain are price volatility, lesser/no processing units, commission charged by traders in APMC market and high marketing cost. But the findings indicated that there are huge possibilities and potential to set up sweet potato based industries which will ensure remunerative prices for doubling farmers' income.

Keywords: Sweet potato, Value chain, mapping, APMC market, Karnataka.

JEL:O18, P22, P23, Q11, Q13.

I

INTRODUCTION

Agricultural value chains in the developing countries are witnessing significant changes in the recent years due to shifting of focus towards maximising income at producers' level, while rationalising traders' earnings and reducing consumers price (Minton *et al*., 2011; 2012; 2013; Reardon *et al*., 2012). The innovations in agricultural technology development process have resulted in high yielding, good quality varieties and efficient irrigation systems which significantly increased agricultural productivity overtime (Hossain *et al.,* 2006; Spielman and Pandya-Lorch, 2009). Technological and marketing innovations in midstream at traders level and downstream with retailers in the value chain also contributed to the efficient performance of agricultural value chains (Reardon *et al*., 2009).

Sweet potato is considered as a versatile food crop owing to its adaptability to diverse soil and climatic conditions. With an annual production of 105.10 million

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tonnes, it is ranked as the fifth most important food crop in the world in terms of its new weightage (FAO, 2016). In India, sweet potato is one of the important staple food crops among disadvantaged section of population, and majority of the farmers consider it as a major source of food but used it in limited extent as animal feed and industrial raw materials (Prakash *et al*., 2016; 2017). Though sweet potato is cultivated in almost all states of India, four states, viz., Odisha, West Bengal, Uttar Pradesh and Kerala contribute nearly three fourth of total area and production among which Kerala contribute 74 per cent of area and 71 per cent of production in India (Government of India, 2017). Karnataka is one of the emerging states in sweet potato production in India with production of over 36000 tonnes annually and Belagavi district accounted for the highest productivity of sweet potato (14.2 t/ha) in comparison to other districts of Karnataka (Government of India, 2017*)*. With the existence of well-developed marketing system especially in the Belagavi and Uttar Kannada districts along with entrepreneurial attitude of the farmers, the Karnataka state has the ideal ecosystem of developing sweet potato based industries. Considering the potential of sweet potato processing industries to enhance farmers' income in a shorter period, there is a need to analyse and strengthen sweet potato value chain in Karnataka to help the emerging industries. With this backdrop, a research study was conducted in Belagavi district of Karnataka with the following objectives (i) To analyse the sweet potato value chain; (ii) To identify the processes and actors involved in the sweet potato value chains including their roles and interactions; (iii) To estimate price spread in sweet potato marketing; and (iv) To suggest suitable strategies to improve sweet potato value chain in Karnataka.

II

DATA AND METHODOLOGY

The study was conducted in the Belagavi district of Karnataka, which contribute 36 per cent of total sweet potato production in Karnataka.A multi-level stratified sampling was used to select samples for the study. Two taluks, namely,Belagavi and Khanapur were selected based on higher area allocation under sweet potato. In subsequent stratification, five villages from each taluk were selected randomly. A total of ten villages comprising 112 sweet potato growers from two taluks were intensively surveyed for the basic socio-economic characteristics and particularly their farm size, crop area allocation by season and cost and return of cultivation and existing marketing channels to the attain objectives of the study. Representative sample drawn for the study consisted of equal proportion large and small farmers. A semi-structured questionnaire was used to interview 10 commission agents of APMC Market, Belagaviand five wholesalers from Delhi, Maharashtra, Punjab and Gujarat who visited APMC for procuring sweet potato and 10 retailers in Belgaum town. The effects of various personal and production factors on the farm harvest price of sweet

potato at the farmers' level were estimated through multiple regression analysis using Ordinary Least Square (OLS) method.

The following model was used:

$$\ln Y = A + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \beta_5 \ln x_5 + D_1 + D_2 + D_3 + D_4 + D_5 + D_6$$

where,
Y=Price (Rs./kg), X_1=Quantity sold (quintal), X_2=Age head of household (years), X_3=Size of the family (number), X_4=Distance to the market (Km), X_5=Area cultivated under sweet potato (ha) D_1=Immediate payment ('1' if yes or else '0'), D_2= September ('1' if yes or else '0'),D_3= October ('1' if yes or else '0'), D_4= November ('1' if yes or else '0'), D_5= January ('1' if yes or else '0'), D_6=Head of the household is literate ('1' if yes or else '0'). All the statistical analyses were performed using SPSS software v.18.0 (IBM Corp., Armonk, NY, USA).

III

RESULTS AND DISCUSSION

Mapping of the Sweet Potato Value Chainin Karnataka

The value chain of sweet potato in Belagavi district representing various actors at the upstream, mid-stream and downstream levels, along with their functions and interrelationships is illustrated in Figure 1.
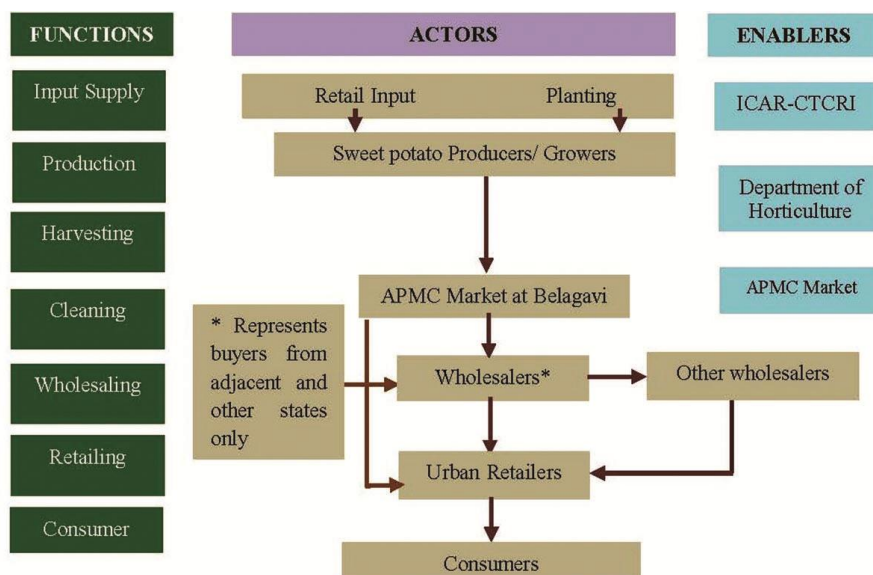

Figure 1.Sweet Potato Value Chain Map in Belagavi District, Karnataka.

Upstream

The upstream level consists of primary farmer producers, who acquire information/ materials of new technologies for sweet potato from extension agents, retail input dealers and bankers/agents who provide finance too. At this level, the primary farmer producers are considered important as they deliver the primary product of the value chain in the form of sweet potato tubers.

Household Characteristics of Producers

Table 1 presents the household characteristics of sweet potato farmers. The average age of sweet potato growers was 50 years with household size of 6.60 and 22 per cent of the sweet potato farming households head were illiterate. Over 97 per cent of the farmers followed farming as primary occupation while 21 per cent of the farmers were engaged in wage labour as secondary occupation. Sweet potato farmers had average landholding size of 2.49 ha in total, of which about 40 per cent area was allocated to sweet potato cultivation. Farmers have grown sweet potato since they started farming as sweet potato farming experience was nearly equal to their farming experience. This indicates that they are well versed with the sweet potato cultivation and it might have played crucial role in their farming. The average production of sweet potato was 9.83 tonnes during *kharif* season.

Table 1 indicates that more than 90 per cent of the sweet potato produced has been sold immediately after harvest, thereby establishing sweet potato as a cash crop for the farmers while 10 per cent has been retained for home consumption. Majority of the farmers in the study area are cultivating local varieties due to their better adaptability, good yield and better market price. But there is vast scope for technology breakthrough in order to reach higher production level and to orient farmers in higher income strata.

Economics of Sweet Potato Production at Producer Level

The cost and return analysis of sweet potato based on primary survey has been given in Table 2. The total cost for cultivating sweet potato per ha is estimated to be Rs.24262 and the cost of production worked out to be Rs.246.81 per quintal of tubers. The human labour and chemical fertiliser + farm yard manure (FYM) emerged as the major expenditure accounting about 32 per cent and 26 per cent respectively.

On an average, net income of Rs.34586 per ha is obtained from sweet potato cultivation which is much more beneficial than even cereals crops in the study area. The benefit-cost ratio of sweet potato was estimated to be 2.42:1 which further reinforced our statement in support increasing of sweet potato acreage in order to enhance farmer's income (Table 2).

TABLE 1. HOUSEHOLD CHARACTERISTICS OF SWEET POTATO FARMERS

Particulars	Statistics	
	Mean or per cent	SD
(1)	(2)	(3)
Number of observations	112	-
Age head of household (years)	50.21	14.32
Household size (in number)	6.60	3.26
Illiterate heads of household (per cent)	22.32	-
Experience in farming (years)	31.64	15.59
Experience in sweet potato farming (years)	30.66	15.13
Primary occupation (per cent)		
Farming	97.32	-
Wage labour	2.68	-
Secondary occupation (per cent)		
Farming	69.64	-
Wage labour	21.43	-
Others*	8.93	-
Total area of land owned (ha)	2.49	2.67
Area under sweet potato cultivation (ha)	1.00	0.75
Own consumption (in per cent)	9.99	-
Quantity sold immediately after harvest (per cent)	90.01	-
Total sweet potato sales in 2017-*kharif* season (tonnes)	9.83	13.94
Variety use (per cent)		
Local variety	95.00	-
Improved variety	5.00	-

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India.
Note: * includes Self-employment and do not have employment.

TABLE 2. COSTS AND RETURNS IN SWEET POTATO CULTIVATION
FOR *KHARIF* SEASON DURING 2017

Operational costs	Statistics		
	Unit	Mean	Per cent share in total cost
(1)	(2)	(3)	(4)
Input costs			
Expenditure on planting materials	Rs./ha	26.54	0.11
Expenditure on chemical fertiliser + FYM	Rs./ha	6336.95	26.12
Expenditure on plant protection chemicals	Rs./ha	343.36	1.42
Expenditure on irrigation	Rs./ha	7.61	0.03
Expenditure on human labour	Rs./ha	7862.38	32.41
Expenditure on animal traction	Rs./ha	1533.22	6.32
Expenditure on tractor machine	Rs./ha	2097.34	8.64
Interest on working capital	Rs./ha	497.27	2.05
Fixed costs			
Rental value of owned land	Rs./ha	5000.05	20.61
Rent paid for leased in land	Rs./ha	0.00	0.00
Land revenue , taxes and cesses	Rs./ha	16.80	0.07
Depreciation on implements and farm buildings	Rs./ha	308.11	1.27
Interest on fixed capital	Rs./ha	232.70	0.96
Total cost	Rs./ha	24262.33	100
Land size , production and price			
Sweet potato area	ha	1.00	-
Production	tons	9.83	-
Price	Rs./qtl	598.66	-
Gross income	Rs./ha	58848.27	-
Net income	Rs./ha	34585.94	-
Benefit cost ratio	BCR	2.42:1	-

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India.

Determinants of Farm Harvest Price

The determinants of farm harvest price of sweet potato identified through multiple regression are displayed in Table 3. During the estimation, the independent variables were checked for multicollinearity and no variance inflation factor was higher than 5.

TABLE 3: DETERMINANTS OF FARM HARVEST PRICES OF SWEET POTATO

(1)	(2)	Coefficient (3)	t-value (4)
Characteristic transaction			
Quantity sold in quintal	Log (qtl)	0.02	1.27
Immediate payment	yes=1	-0.01	-0.58
Timing of sales			
December (default)	yes=1		
September	yes=1	0.48	15.06***
October	yes=1	0.26	8.12***
November	yes=1	0.14	3.88***
January	yes=1	-0.10	-1.60
Characteristics of farmers			
Age of the head of household	years	-0.00	-0.20
Size of the household	number	-0.02	-0.93
Head of household is literate	yes=1	-0.02	-1.61
Distance to market	km	0.00	0.91
Area of sweet potato cultivated in ha	Log (area)	-0.02	-1.17
Intercept		1.45	15.41
Number of observations		112	
R-Squared		0.74	
Root Mean Square Error		0.12	

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India
Note: ***, ** and *denote significance at 1,5 and 10 per cent level, respectively.

Table 3 shows regression coefficients of various factors which determined farm harvest price and their significance levels. In this study, the logarithm of the price per kg was used as a dependent variable, and personal and production characteristics were included as dependent/explanatory variables. The independent variables together explained 74 per cent of the variation in the farm harvest price. The results of regression indicated that significantly higher price realisation was in month of September (r=0.48; p<0.01), October (r=0.26; p<0.01) and November (r=3.88; p<0.01), if farmers sold their produce during this period. Other household characteristics incorporated in the model emerged to be statistically insignificant.

Marketing Behaviour of Sweet Potato Farmers

The marketing behaviour of sweet potato farmers is given in Table 4. Very unique characteristics were found in study area that all the farmers sold their produce through the Agricultural Produce Market Committee (APMC), indicating APMC's gravity in marketing of sweet potato in Belagavi district.

TABLE 4. MARKETING BEHAVIOUR OF SWEET POTATO FARMERS

(1)	Unit (2)	Mean or per cent (3)
	Statistics	
Quantity sold	tonnes	9.83
Price	Rs./quintal	598.66
Do you store sweet potato after harvest	Per cent Yes	0.00
Month of sales		
September	Per cent	26.79
October	Per cent	23.21
November	Per cent	16.96
December	Per cent	29.46
January	Per cent	3.57
Type of Buyers		
APMC Market	Per cent	100
Payment types		
Immediate payment	Per cent	83.93
Late payment	Per cent	16.07

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India.

All the respondent farmers sold their produce immediately after harvest due to satisfactory price realisation. The reason for this peculiar trend was analysed and it was found that during this period demand for sweet potato was high due to coincidence of harvesting period with the Hindu festival during which consumption was considered to be auspicious. Further, one of the major reasons why farmers settle on a particular buyer was immediate cash payment of about 83 per cent of the transactions. Farmers did all these transactions through APMC market which was considered as formalisation of the marketing channel.

Midstream

The commission and wholesalers are the two prominent actors involved in the midstream of the sweet potato value chain.

Commission Agents

The commission agents are authorised traders in the APMC who facilitate the sales of sweet potato from producers to buyers, while the wholesalers procure the sweet potato from commission agents in bulk quantity for sale in local and distant markets. The method of sale of sweet potato in APMC market was open auction method as prescribed in the Government of India Act. These agents collect 6 per cent of the total procurement cost as transaction commission from the buyers.

Table 5 presents the descriptive statistics of commission agents in APMC market. The average age of commission agents was 38 years and they had 15.70 years of experience in sweet potato trade. As the sweet potato trade is seasonal in APMC, the commission agents were involved in marketing of other commodities. The entire

sweet potato quantity was purchased by commission agents from producers through aggregators. The average quantity purchased during *kharif* season 2017 was estimated as 3065 tonnes. As sweet potato is a highly perishable commodity which can be stored in ambient conditions not more than one or two weeks, the commission agents has to sell all the sweet potato procured from farmers or aggregators immediately after arrival. Further it was estimated that 40 per cent of the respondents reported that there was post-harvest losses in the form of weight loss and sometimes tubers were infested by weevil.

TABLE 5. DESCRIPTIVE STATISTICS OF COMMISSION AGENTS/TRADERS IN APMC MARKET (N=10)

	Statistics	
	Unit	Mean or per cent
(1)	(2)	(3)
Age of commission agent	years	38.00
Gender head of household	Per cent male	100.00
Rank sweet potato in order of value of your business	number	1.80
Average experience in sweet potato business	years	15.70
Type of sellers you buy from		
Producers	Per cent	100.00
Quantity purchased during 2017 for *kharif* season	tonnes	3065.00
Do you store the sweet potato after purchase?	Per centNo	100.00
Do you have any post-harvest losses?	Per centYes	40.00

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India

Table 6 depicts the procurement method of sweet potato by commission agents in the APMC Market. On an average, per season transaction by commission agent was 3035 tonnes with an average sale price of Rs.635 per quintal. Majority of the commission agents mentioned that base price of auction was determined by prevailing rates in other markets, quantity arrived at APMC on a specific day, estimated consumer demand, good size and shape of sweet potato tubers and free from sweet potato weevil infestations.

Similarly, their network with buyers from distant markets helps them to sell farmers produce arrived in the market. Many of the commission agents also act as local wholesalers in the market. The maximum transactions were observed in December about 58 per cent, while the peak period of demand was recorded during September, October and first week of November which led to good return to farmers as prices were much higher in comparison to the other month's arrival.

Wholesalers

The wholesaler survey was conducted with people from Delhi, Maharashtra, Punjab and Gujarat who come for buying sweet potato at APMC market in Belagavi district of Karnataka. Table 7 shows descriptive statistics on characteristics of sweet potato wholesalers.

TABLE 6. MARKETING OF SWEET POTATO BY COMMISSION AGENTS IN APMC MARKET

	Statistics	
	Unit	Mean or per cent
(1)	(2)	(3)
Time of sales		
Immediate sales	Per cent	100.00
Type of buyers		
Wholesalers	Per cent	100.00
Average quantity sold / year	tonnes	3034.65
Average price	Rs./quintal	635.00
Maximum distance	Km	970.00
Time of payment		
Immediate payment	Per cent	100.00
Peak season of purchase and price of sweet potato		
Second week of November	tonnes	1123.00
Price	Rs./quintal	560.00
December	tonnes	1738.00
Price	Rs./quintal	460.00
Peak periods of demand and price of sweet potato		
September	tonnes	784.00
Price	Rs./quintal	1200.00
October	tonnes	767.00
Price	Rs./quintal	1100.00
First week of November	tonnes	933.00
Price	Rs./quintal	900.00

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India.

TABLE 7. DESCRIPTIVE STATISTICS OF WHOLESALERS IN THE SWEET POTATO VALUE CHAIN
AT BELAGAVI DISTRICT, KARNATAKA (N= 5)

	Statistics	
	Unit	Mean or per cent
(1)	(2)	(3)
Average age of the wholesalers	years	38.00
Gender	Per cent male	100.00
Do you deal in any other commodities?	Per cent Yes	60.00
Rank sweet potato in order of value of your business	number	1.22
Experience in sweet potato business	years	17.60
Type of sellers you buy from		
APMC market	Per cent	100.00
Quantity purchased during 2017 for *kharif* season	tons	400.00
Do you store the sweet potato after purchase?	Per cent No	100.00
Do you have any post-harvest losses? (till reaching wholesale market at their place)	Per cent Yes	100.00
Total losses due to weight loss and tubers infected by weevil	tonnes	40.00

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India.

Among the surveyed wholesalers, 60 per cent of them were found to be trading multiple commodities including sweet potato due to seasonality of sweet potato.The wholesalers had an average experience of 17 years in the sweet potato trade and considered it as the best business commodity than other agricultural commodities. The average quantity purchased by wholesalers during the *kharif* season was 400 tonnes. The sweet potato procured from APMC, Belagavi was transported to

wholesale markets in Delhi, Maharashtra, Punjab and Gujarat through trucks. The respondents reported over 10 per cent of transportation and other post-harvest losses of sweet potato at the wholesale level.

Marketing behaviour of wholesalers for sweet potato is given in Table 8. The results indicated that predominance of wholesaler to wholesaler trade (60 per cent) followed by selling to retailers (40 per cent). On an average the wholesalers sold 360 tonnes of sweet potatoes during 2017 at a price of Rs.1800/quintal. They travelled an average distance of 975 km for procuring and transporting sweet potato. In all these transactions payment was immediate.

TABLE 8. MARKETING BY SWEET POTATO WHOLESALERS

(*per cent of transaction*)

	Statistics	
(1)	Unit (2)	Mean or per cent (3)
Time of sales		
Immediate sales	Per cent	100.00
Type of buyers		
Other wholesalers	Per cent	60.00
Retailers	Per cent	40.00
Who pays the transport cost if the wholesalers buy		
sweet potato from point of sale at APMC		
Wholesalers	Per cent	100
Average quantity sold / year	tonnes	360
Average price	Rs./quintal	1800.00
Average distance transported	Km	975.00
Time of payment		
Immediate payment	Per cent	100.00

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India.

Table 9 indicates that all the respondents had advance information on quantity of sweet potato available for procurement at APMC, Belagavi during the season. All the wholesalers had accessed information about sweet potato's prices and their arrival from APMC market at Belagavi and they considered it very reliable and authenticated. Further, the results indicated that production and consumption of sweet potato have increased more than 60 per cent since the wholesalers had started their business and farmers are able to get fair prices for their produce and it is available to farmers at reasonable prices and they expect the consumption to increase much further in the coming years due to various initiatives taken by the government like e-NAM.

Downstream

The downstream of the value chain consists of retailers and consumers. The details of sweet potato retailers' survey are presented in Table 10.

TABLE 9. MARKET INTELLIGENCE BY SWEET POTATO WHOLESALERS

	Statistics	
(1)	Unit (2)	Mean or Per cent (3)
Do you collect information on expected production of sweet potato in Belgaum?	Per centYes	100.00
Source of information		
APMC market, Belgaum, Karnataka	Per centYes	100.00
Perceived reliability of the information		
Very reliable	Per cent	100.00
Has production of sweet potato changed since you started your business		
Increased	Per cent	80.00
Remain constant	Per cent	20.00
Has consumption of sweet potato changed since you started your business		
Increased	Per cent	60.00
Remain constant	Per cent	40.00
Your opinion on the expected changes in consumption of sweet potato during next five years		
Will increase	Per cent	80.00
Remain constant	Per cent	20.00

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India.

TABLE 10. DESCRIPTIVE STATISTICS OF RETAILERS VALUE CHAIN SURVEYS (N= 10)

	Statistics	
(1)	Unit (2)	Mean or per cent (3)
Age head of retailer	Years	39.60
Gender	Per cent male	100.00
How long doing sweet potato business	Years	7.00
Type of retailers		
Unorganised retailing (Kirana shop/vegetable Mandi)	Per cent	100.00
Average number of customers served daily	number	11.00
Average quantity sold per person per day	Kg	5.00
Do you deal any other commodities	Per cent	100.00
Average quantity procured during 2017	tonnes	40.00
Do you store the sweet potato after purchase	Per centYes	100.00
Maximum how long do you store sweet potato	Days	4.5
Type of buyers		
Household consumers	Per cent	100.00
Quantity sold	Quintal	39.60
Price	Rs./quintal	2000.00

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India.

All the retailer respondents sold sweet potato through unorganised retailing, i.e., kirana shops and vegetable mandis. These shops served an average 11 customers daily who purchased about 5 kg per day. The retailers procured sweet potato from APMC market/wholesaler and sometimes directly from producers and sold it directly to the consumers. Further it was estimated that all the respondents stored sweet potato after purchase for very short duration and the maximum storage period for sweet potato on an average was 4.5 days. The average quantity sold during the season was 39 tonnes at the rate of Rs.2000/quintal.

Marketing Costs and Margins and Price Spread in Sweet Potato Marketing
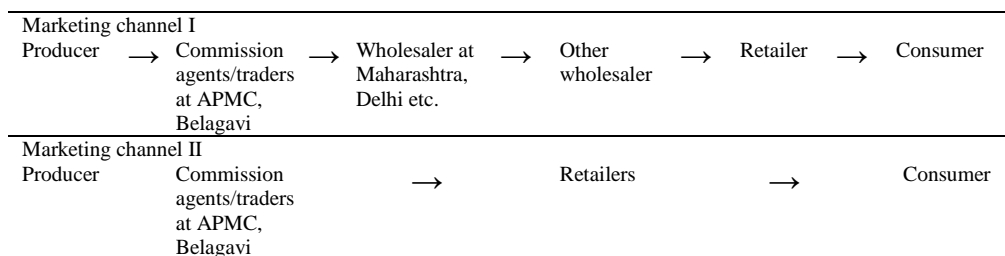
Marketing Costs

The share of marketing costs incurred by different market intermediaries at various stages of marketing is depicted in Table 11. The commission charged by commission agents in APMC market has occupied major share (34 per cent) among the total marketing cost of the producers followed by packaging (24 per cent) and cleaning (16 per cent). Weighing and loading charges from wholesalers accounted for major share (55 per cent) among the total marketing cost of the commission agents followed by charges for unloading and weighing from producers (44 per cent). Eighty six per cent of the total marketing cost was paid for transportation by the wholesalers followed by market fees at APMC market (9 per cent). In case of retailers, the commission charged by commission agents at APMC market accounted for major share (33 per cent) followed by transportation cost (31 per cent).

TABLE 11. MARKETING COST INCURRED BY VALUE CHAIN ACTORS

Particulars (1)	Amount (Rs./quintal) (2)	Per cent to total# (3)
Producers		
Packaging cost includes sacks and thread	30.00	24.24
Loading cost at farmers field	10.53	8.51
Transportation cost	13.34	10.78
Weighing and unloading cost at APMC market	8.00	6.46
Commission charges by traders at APMC	41.90	33.85
Cleaning cost	20.00	16.16
Value added cost *	50.00	-
Total marketing cost#	123.77	100.00
Commission agents/traders in APMC Market		
Weighing and unloading cost charged from sellers	8.00	44.44
Weighing and loading cost charged from buyers	10.00	55.56
Total marketing cost#	18.00	100.00
Wholesalers		
Market fees charged at 6 per cent of the total value of the product sold by commission agents	35.91	9.25
Transportation cost	332.00	85.58
Weighing and loading cost at APMC market	10.00	2.57
Weighing and unloading cost at selling point	10.00	2.57
Total marketing cost#	387.91	100.00
Retailers		
Transportation cost	34.00	30.93
Sacks and thread cost	30.00	27.29
Loading and unloading cost	10.00	9.09
Market fees charged at 6 per cent	35.91	32.67
Total marketing cost#	109.91	100.00

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India.

Note: * value added cost included packaging and cleaning cost. #indicate the percentage share of total marketing cost of each value chain actors.

Price Spread of Sweet Potato

Marketing channel I					
Producer $\rightarrow$	Commission agents/traders at APMC, Belagavi $\rightarrow$	Wholesaler at Maharashtra, Delhi etc. $\rightarrow$	Other wholesaler $\rightarrow$	Retailer $\rightarrow$	Consumer
Marketing channel II					
Producer	Commission agents/traders at APMC, Belagavi	$\rightarrow$	Retailers	$\rightarrow$	Consumer

Price spread has been tabulated in Table 12. Majority of the farmers are following the marketing channel I. The gross price received by the producers was Rs.599/quintal and this constituted 20 per cent of the retail price. The marketing cost incurred by producers, commission agents/traders at APMC market, wholesalers, other wholesalers and retailers were 4.12, 0.6, 11.73, 7.60 and 4 per cent of the price paid by consumers. Further, the wholesaler derived the highest marketing cost (12 per cent) followed by other wholesaler (8 per cent) due to transportation of sweet potato for long distance. These marketing costs together account for 28 per cent of the consumer price.The wholesaler (27 per cent) occupied major share among total margins of the consumer price followed by retailers (23 per cent). Therefore, the marketing channel I being longer with more number of intermediaries involved, the producers' share in consumer's rupee is low (20 per cent).The marketing channel II

TABLE 12. PRICE SPREAD OF SWEET POTATO VALUE CHAIN IN KARNATAKA

Particulars (1)	Amount (Rs./qtl) (2)	Per cent share[#] (3)	Particulars (4)	Amount (Rs./qtl) (5)	Per cent share[#] (6)
Channel-I			Channel-II		
1.Producers gross price	598.66	19.95	1.Producers gross price	598.66	29.93
2.Cost incurred by			2.Cost incurred by		
2.1.Producers	123.77	4.12	2.Producers	370.58	18.52
2.2.Commission agents/traders at APMC	18.00	0.6	2.1.Commission agents/traders at APMC	18.00	0.9
2.3.Wholesalers	352.00	11.73	2.2.Retailers	111.80	5.59
2.4.Other wholesalers	230.25	7.60			
2.5.Retailers	120.00	4.00			
Total costs	844.02	28.05	Total costs	500.38	25.01
3.Margins earned by			3.Margins earned by		
3.1.Commission agents/traders at APMC	18.34	0.61	3.1.Commission agents/traders at APMC	18.34	0.91
3.2.Wholesalers	813	27.1	3.2.Retailers	1253.20	62.66
3.3.Other wholesalers	169.75	5.65			
3.4.Retailers	680	22.66			
Total margins	1681.09	56.02	Total margins	1271.54	63.57
4.Consumer price[#]	3000	100	4.Consumer price[#]	2000	100
5.Price spread	2277.57			1277.47	

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India.
#indicate the percentage share of consumer price.

involves sale of sweet potato in Karnataka itself which is consumed locally. Producers share in consumer price on the sale of sweet potato through channel II was 30 per cent. Retailers received the maximum margin of Rs.1253 per quintal which accounts about 63 per cent of the consumer price is displayed in Table 12.

IV

CONSTRAINTS IN SWEET POTATO VALUE CHAIN

The Garrett ranking technique was used to identify the constraints in the value chain of sweet potato. The results from Table 13 indicate the various constraints experienced during production and marketing by the sweet potato farmers in Karnataka. The major problem faced by the sweet potato farmers was incidence of pests and diseases during production besides unforeseen weather due to erratic rainfall which affects the production. The farmers reported low price for their produce and high commission fee charged by the commission agents at APMC market where farmers have to pay commission of around 7-8 per cent of the total value of produce to commission agents. Many of the farmers were also indicated that high marketing cost, long distance to the APMC market and lack of access to processing units as theimportant constraints for marketing their produce.

TABLE 13. MAJOR CONSTRAINTS FACED BY SWEET POTATO FARMERS IN THE VALUE CHAIN

Constraints (1)	Mean Score (2)	Rank (3)
Production		
1. Incidence of pests and diseases	55.90	I
2. Unforeseen weather -lack of rainfall	51.54	II
3. Lack of storage facilities	43.56	III
4. Lack of quality planting materials	40.21	IV
Marketing		
1. Low price for the produce	57.65	I
2. High commission fees for their produce	53.80	II
3. High marketing cost	47.23	III
4. Long distance to the market	37.43	IV
5. Lack of access to processing units	31.21	V

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India.

The constraints faced by intermediaries involved in sweet potato value chain are presented in Table 14. The major constraints faced by commission agents were lack of cold storage facilities, price fluctuations, delay in receiving the payments from buyers and lack of processing units of sweet potato, whereas the constraints faced by the wholesalers and retailers are price fluctuations, high cost of transportation, lack of cold storage facilities and post-harvest loss due to weight loss and weevil infestation in tubers.

TABLE 14. MAJOR CONSTRAINTS FACED BY TRADERS IN THE SWEET POTATO VALUE CHAIN

Constraints	Mean Score	Rank
(1)	(2)	(3)
Commission agents/ traders in APMC market		
1. Lack of cold storage facilities	65.10	I
2. Price fluctuations	562.34	II
3. Delay in receiving the payments from buyers	54.57	III
4. Lack of processing units for sweet potato	50.22	IV
Wholesalers		
1. Price fluctuations	59.12	I
2. High cost of transportation	54.90	II
3. Lack of cold storage facilities	45.43	III
4. Post-harvest loss due to weight loss and weevil	35.45	IV
Retailers		
1. Price fluctuations	50.90	I
2. High cost of transportation	45.20	II
3. Distance to the market is high	42.32	III

Source: Authors calculations using data from the sweet potato value chain surveys, 2017, Karnataka, India.

IV

CONCLUSIONS AND POLICY IMPLICATIONS

The farmers earn nearly Rs. 35000 per hectare from sweet potato cultivation which is even more remunerative than cereals crop in the state. But then, in spite of good return from sweet potato cultivation, its value chain in Karnataka is highly constrained by various factors from farming side and marketing communities which need to be addressed genuinely to sustain farming. Further, technology breakthrough required in terms of shorter duration variety of sweet potato so that harvesting period coincided with the festival which is missing at present. To improve the value chain, it is suggested to ensure adequate training to farmers and integrating them with the market intermediaries so that production and marketing system become more robust in nature. Government interventions similar to Minimum Support Price need to be unfolded in order to protect farmers against price risk. Inclusion of farmers in the value chain and developing effective market system to improve the bargaining power will go a long way in increasing the farm income of the sweet potato growers in the state. Further, to promote sweet potato production, newer value added products should be innovated and the agribusiness entrepreneurs need to be made aware of the existing products like jam, gulab jamun mix, pickles, sweet potato puree, fries etc. The Agricultural Produce Market Committee (APMC) should take effective steps to rationalise commission fee, marketing cost and more precisely market margin by intermediaries through its management regulation practices. Government should intervene for creation of storage structure for sweet potato so that price volatility remains at bay.

REFERENCES

Food and Agriculture Organization of the United Nations (2016), *FAO Statistics*, Rome, Italy.

Government of India (2017), *Horticultural Statistics at a Glance*, National Horticultural Board, Ministry of Agriculture and Farmers Welfare, New Delhi.

Hossain, M.; M.L. Bose and B.A.A. Mustafi (2006), "Adoption and Productivity Impact of Modern Rice Varieties in Bangladesh", *The Developing Economics*, Vol.2, pp.149-166.

Minton, B.; T. Reardon K.M. Singh and R. Sutradhar (2011), *The Potato Value Chain in Bihar: An Assessment and Policy Implications*, Report of IFPRI project for International Fund for Agricultural Development (IFAD) and the National Agricultural Innovation Project (NAIP) of India, New Delhi, India.

Minton, B.; K.M. Singh and R. Sutradhar (2012), *Branding and Agriculture Value Chains in Developing Countries: Insights from Bihar, India*, IFPRI Discussion Paper, International Food Policy Research Institute (IFPRI), Washington, D.C., U.S.A.

Minton, B.; K.A.S. Murshid, and T. Reardon (2013), "Food Quality Changes and Implications: Evidence from the Rice Value Chain of Bangladesh", *World Development*, Vol.42, pp.100-113.

Prakash, P.; Avinash Kishore, Devesh Roy, DebduttBehura and Sheela Immanuel (2017), "Bio Fortification for Reducing Hidden Hunger: A Value Chain Analysis of Sweet Potato in Odisha, India", *Agricultural Economics Research Review,* Vol.30, No.2, pp.20-30.

Prakash, P.; Avinash Kishore, Devesh Roy and DebduttBehura (2016), "Economic Analysis of Sweet Potato Farming and Marketing in Odisha", *Journal of Root Crops*, Vol.42, No.2, pp.163-167.

Reardon, T.; C.B. Barrett, J.A. Berdegue and J. Swinnen (2009), "Agri-Food Industry Transformation and Farmers in Developing Countries", *World Development*, Vol.37, pp.1717-1727.

Reardon, T.; K. Chen, B. Minton and L. Adriano (2012), *The Quiet Revolution in Stable Food Value Chains*, Enter the Dragon, the Elephant, and the Tiger, Mandaluyong City, Philippines: Asian Development Bank (ADB); International Food Policy Research Institute (IFPRI).

Spielman, D.J. and R. Pandy-Lorch (2009), *Millions Fed: Proven Successes in Agricultural Development*, International Food Policy Research Institute (IFPRI), U.S.A.