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**Policy and Institutional Reforms to Improve Horticultural Markets in Pakistan  
(ADP/2014/043)**

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**Preliminary Report on the Survey of Tomato Growers in Sindh, Punjab  
and Balochistan.**

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**Abstract**

Tomato is an important crop in Pakistan though it produces only 0.3% of world tomato supply, and its share in global trade is negligible. We report here on results of surveys of farmers cultivating tomatoes in the provinces of Punjab, Sindh and Balochistan. We find that tomato production is profitable, but its profitability is affected by extreme seasonal price volatility. Highest per acre net returns were reported in Balochistan followed by those of Sindh while Punjabi farmers earned the lowest returns, while costs of production were highest in Punjab, followed by those in Sindh and Balochistan. Punjab's produce comes to the market at the peak of harvesting time and therefore receives a lower price. Sindh and Balochistan also have a comparative advantage due to favourable climate and seasonality in tomato production over Punjab. Females usually do the picking while sorting, packaging, transportation and marketing are done by males. Packaging and transport costs depend on the distance to the market. Major production issues mentioned by farmers included high seed cost, poor seed quality, lack of disease and harsh climate resistant hybrid seed varieties, incidence of severe pest attack due to low quality pesticides, lack of proper training regarding production technologies and labour shortages particularly at the harvesting time. All these findings helped us to identify important policy relevant issues for rigorous investigation in future.

**Keywords**

Horticulture, Tomato, Farmers, Supply Chain, Pakistan

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## 1 INTRODUCTION

Agriculture is the lifeline of Pakistan's economy accounting for about 19.5 percent of the Gross Domestic Product (GDP), employing 42.3 percent of the labour force and providing raw material for several value-added sectors. It thus plays a central role in national development, food security and poverty reduction. Despite its pivotal importance in the economy of Pakistan, the contribution of agriculture in GDP is gradually decreasing over the years. The slow rate of agricultural growth leads to low income, low savings and low investment opportunities in rural areas. This in turn results in lack of employment opportunities as well as increase in poverty in rural areas (Khan and Saeed 2011). The employment opportunities, particularly for smallholders, can be enhanced by increasing the area and yield of high value and labour-intensive crops like fruits and vegetables. Government of Pakistan has declared Horticulture as one of the priority areas for the future development in agriculture sector. The reason behind this push is high demand for fresh produce, both in domestic and international markets. The rapid growth of Pakistan's urban areas and the size of its middle class resulted in a higher demand for high-value perishable products such as fruits, vegetables, dairy, and meat is rising (GOP, 2016). It also offers high returns and multiple job opportunities compared to other competing crops (PHDEB, 2007).

Horticultural crops offer more prospects than other agricultural crops due to their high yield potential and net return per unit area. Most of them are highly labour-intensive crops and thus can create more employment opportunities. In the global context, the horticulture sector predicates a major economic opportunity with an estimated global export market worth USD 150 billion (FAO, 2012). Cultivation of vegetables is helpful in achieving the target of food security and reduction in poverty as well. On average, annual vegetable consumption is 35.6 kg per capita in Pakistan (Abedullah *et al.*, 2006), whereas, the recommended consumption by the World Health Organization (WHO) is 73 kg per annum (Shaheen *et al.*, 2011). Lower yield and a trifling sum of area under vegetable cultivation are two of the main factors behind low production and less per capita consumption of vegetable in Pakistan. Vegetables being a minor segment of agriculture in Pakistan catch lesser attention for conducting empirical studies as well (Bakhsh, 2007).

Tomato is one of the most important vegetables in the world. It is an important cash and industrial crop in many parts of the world (Babalola *et al.*, 2010). Tomato and onion are most common and important kitchen items cooked as vegetables, used as condiments and salad in Pakistan. The consumption of tomato and onion has high income elasticity of demand. Thus, there

will be more demand for these vegetables with population growth, economic growth, and urbanization (Fateh, 2009). Among the vegetables, tomato is one of the most important vegetables in terms of acreage, production, yield, commercial use and consumption. It is used as food item on daily basis and forms a very important component of food consumed in Pakistan. This is evident from the fact that many Pakistani dishes have tomatoes as a complementary ingredient. It is mostly used as fresh vegetable and can be used for making different products as well like ketchup and different sauces. It is a good source of vitamin C (31 mg per 100g), vitamin A, calcium, iron etc. (Matin *et al.*, 1996). Lycopene is a dominant antioxidant, which is naturally available in tomatoes and it is useful to avoid the growth of various cancer types (Adenuga *et al.*, 2013).

Tomato is mainly produced by small farms in Pakistan. It offers relatively better profits to producers and generates better employment opportunities to rural labourers as this is a labour-intensive crop. However, the yield of the crop is relatively lower, compared to the international level. (Mari *et al.*, 2007). Keeping in view the economic importance and employment generation capacity of tomato in rural smallholder's economy the present study is the first stage of research into the marketing system of tomato in Pakistan where the focus is on the farm level supply side issues and markets that directly involve the farmer producers. The main objectives of this study are,

- To assess the costs and profitability of tomato producers
- To identify the major issues and seasonality in the tomato production and marketing systems across three provinces
- To formulate the policy recommendations for tomato growers, researchers and development planners to improve tomato productivity, profitability and marketing.

## **2 Tomato Production, Acreage and Export**

### **2.1 Global Tomato Production**

The world production of tomato experienced a steady and continuous growth in the last decades of the twentieth century. Total tomato production was over 154 million tons in 2009 and 174 million tons in 2015. Pakistan produced 0.566 million tons as the 37<sup>th</sup> largest producer in the world. According to the FAO, among the top ten producers of tomato were China, USA, India, Turkey, Egypt and Italy and the top fifteen countries produce about 82.21 % of the total world

produce. China is the leading producer with 31.47 % global production and 53% of the tomatoes produced in Asia.

**Table 1: Global Tomato Production and share of Countries**

Sr. No.	Countries	Production 000(Tons)	Area 000 (Hectares)	%age Share
1	China	54795.6	996.2	31.5
2	India	16385.0	767.0	9.4
3	USA	14580.4	163.0	8.4
4	Turkey	12615.0	193.2	7.2
5	Egypt	7737.8	196.9	4.4
6	Italy	6410.3	107.2	3.7
7	Iran	6013.1	152.0	3.5
8	Spain	4832.7	58.1	2.8
9	Brazil	4187.7	63.6	2.4
10	Mexico	3782.3	92.0	2.2
11	Russia	2840.5	117.8	1.6
12	Uzbekistan	2562.3	63.8	1.5
13	Ukraine	2274.4	75.4	1.3
14	Nigeria	2208.3	557.5	1.3
15	Portugal	1929.1	20.8	1.1
34	Pakistan	566.0	60.7	0.3
Total of Other 159 Countries		30401.7	1101.1	17.5
Total World		174122.5	4786.1	100.0

*Source (FAO, 2015)*

## **2.2 Tomato Area and Production in Pakistan**

Pakistan had 150 thousand ha area and 57094 tons production of tomato in 2014-2015. Sindh is the highest tomato producing province with tomato grown on an area of 67.46 thousand hectares followed by Balochistan with 31.38 thousand hectare of area while Punjab had 18.29 thousand ha under tomato cultivation. Overall an increasing trend is observed in the acreage of tomato crop during the last two decades.

**Table 2: Tomato Area (000 Ha) and Production (000 Tones) in Pakistan**

Years	Punjab		Sindh		KPK		Balochistan		Pakistan	
	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod
2000-01	10.87	60.80	15.07	32.90	29.31	140.00	14.66	36.10	69.91	269.8
2001-02	11.12	62.20	14.33	32.80	34.84	146.20	12.36	52.90	72.65	294.1
2002-03	11.86	65.20	15.07	35.00	36.08	148.30	13.59	57.80	76.60	306.3
2003-04	12.85	64.00	15.32	35.70	37.31	157.50	30.89	155.60	96.37	412.8
2004-05	12.60	63.70	15.07	34.00	39.04	146.90	35.58	181.60	102.30	426.2
2005-06	13.10	64.60	23.23	48.30	39.78	161.60	38.05	193.60	114.16	468.1
2006-07	13.10	64.80	21.50	60.50	39.78	160.80	42.01	216.20	116.39	502.3
2007-08	13.53	70.09	27.01	91.78	40.05	162.00	50.75	212.35	131.34	536.22
2008-09	13.84	72.50	30.39	100.90	40.77	161.80	46.95	226.70	131.96	561.9
2009-10	14.83	77.90	30.15	100.40	32.37	119.30	46.21	179.20	123.56	476.8
2010-11	16.56	87.80	36.08	114.80	31.14	113.20	45.47	213.80	129.24	529.6
2011-12	16.56	86.00	46.46	141.60	33.85	129.90	44.97	220.40	141.84	577.9
2012-13	16.31	86.30	55.60	174.80	33.61	131.10	38.30	181.90	143.82	574.1
2013-14	19.27	100.10	66.72	200.60	34.60	135.70	35.58	163.30	156.17	599.7
2014-15	18.29	94.60	67.46	202.40	32.87	132.00	31.38	141.60	150.00	570.6

Source: Agricultural Statistics Pakistan

### 2.3 Global Tomato Import

**Table 3: Global Tomato Import Value (USD 000)**

Rank	Countries	2016 (Import Value)	Percent Share
	World	8,754,765	27.0
1.	United States of America	2,362,944	14.8
2.	Germany	1,296,246	7.2
3.	France	635,021	7.0
4.	United Kingdom	613,629	5.6
5.	Russian Federation	490,582	4.0
6.	Canada	350,577	3.5
7.	Netherlands	306,797	2.5
8.	Belarus	218,458	1.9
9.	Sweden	165,319	1.8
10.	Poland	161,740	1.8

*(ITC, 2016)*

In 2016, the world's major top ten tomato importers were USA, Germany, France UK, Russian Federation, Canada Netherlands, Belarus, Sweden and Poland. These 10 countries imported 75 % of total world tomato imports. Pakistan is not a major player in import market. Data revealed that in 2016 Pakistan was the 14<sup>th</sup> largest importer of tomato in term of value in the world market. Pakistan imports tomato mainly from India and Afghanistan. It spent an amount of 120746 USD for importing tomato in 2016 and 95 percent of it was form India and Afghanistan (Table 4).

**Table 4: Tomato Imports by Pakistan (Value in USD)**

List of Countries	2012	2013	2014	2015	2016
World	115,077	132,367	126,152	90,851	120,746
India	112,635	128,165	119,664	69,207	104,145
Afghanistan	2,237	3,770	6,067	21,173	16,492
Iran	189	399	388	397	80
Iceland	0	0	15	0	11
United Arab Emirates	17	21	10	13	11
Croatia	0	0	0	48	9
Bahamas	0	0	0	13	0
Indonesia	0	9	0	0	0
United Kingdom	0	0	1	0	0
United States of America	0	2	8	0	0

## 2.4 Global Tomato Export

**Table 5: Export of Tomato (in USD 000)**

Rank	Exporter	Tomatoes Export	% World Total
1	Mexico	2100000	25.1
2	Netherlands	1600000	19.0
3	Spain	1100000	12.6
4	Morocco	509200	6.1
5	Canada	373100	4.4
6	France	355100	4.2
7	United States	352000	4.2
8	Belgium	287900	3.4
9	Jordan	255500	3.0
10	Turkey	239900	2.9

(ITC, 2016)

The world's major tomato exporters in terms of export volume in 2016 were Mexico, Netherlands, Spain, Turkey and Jordan. These countries contribute 68 % of total world exports. Pakistan is not a major player in the export market. Data revealed that in 2016 Pakistan was the 20<sup>th</sup> largest exporter of tomato in term of quantity in the world market.

## 2.5 Pakistan Tomato Exports by Destination

A very little quantity of tomato is exported from Pakistan to other neighboring countries like Afghanistan. About 97.2 percent (24,786 tons) of tomato is exported to Afghanistan. The export of tomato to other countries is very limited (Table 6). Pakistan also import tomato from Afghanistan and the import value is quite higher than that of export.

**Table 6: Export of Tomato by Pakistan (Quantity in Tons)**

Importers	2012	2013	2014	2015	2016
World	9,704	5,403	14,173	9,184	24,792
Afghanistan	9,612	5,386	13,042	9,184	24,786
United Arab Emirates	42	0	311	0	4
Bahrain	8	3	0	0	0
Sri Lanka	0	0	26	0	0
Malaysia	0	0	90	0	0
Qatar	30	11	18	0	0
Saudi Arabia	13	4	13	0	0
Ukraine	0	0	674	0	0

## 3 Research Methodology

### 3.1 Data Collection and Study Area

The aim of the present research investigation was to assess the production, marketing system, and seasonal price variations of tomato in Punjab, Sindh and Balochistan. The study was based on primary data collected in 2017 by using comprehensive and pre-tested questionnaire from tomato growers in selected districts of Sindh, Punjab and Balochistan. Districts with higher area of tomato acreage were selected on the basis of cropped area of tomato reported in Agriculture Statistics of Pakistan. Major tomato production pockets were identified by the information

gathered by local agricultural research and extension departments, during pretesting of the questionnaire.

### 3.2 Sampling Frame and Sample Size

Poate and Daplyn (1993) suggested that a sample size of 60 is generally regarded as the minimum requirement that will yield a sufficient level of certainty for decision-making.<sup>1</sup> Rodriguez, *et. al.* (1995) selected 50 producers and 50 market intermediaries to collect information regarding expected prices of sheep and goats in Balochistan. Hugar and Hiremath (1984) selected 120 producers to study the efficiency of alternative channels in the marketing of vegetables in Belguam city, India. The total sample size for study was 220 out of which 80 respondents were selected each from Sindh and Punjab while 60 were selected from Balochistan. District wise detail of the sample size in given in Table 7.

**Table 7: Sampling Distribution for Tomato Growers' Survey**

District	No of Farmers	Percentage
Thatha	35	15.8
Karachi	6	2.8
Badin	28	12.7
Mirpur khas	12	5.4
<b>Sindh</b>	<b>81</b>	<b>36.7</b>
Khushab	29	13.1
Sheikhpur	30	13.6
Muzafargarh	21	9.5
<b>Punjab</b>	<b>80</b>	<b>36.2</b>
Pishin	28	12.7
Qilla saif ullah	32	14.5
<b>Balochistan</b>	<b>60</b>	<b>27.2</b>

## 4 Results and Discussion

### 4.1 Involvement in Farming, Farming Decisions and Primary Occupation

Overall 76 percent farmers in our sample were involved in agriculture full time. More farmers were involved full time in farming in Sindh and Punjab (77.8 and 76.9 %) than in Balochistan (72.4%). Majority of tomato growers took decisions about different farming activities themselves. On an

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<sup>1</sup> Of course this depends on the variability in the population being sampled.

average 86.2 % of the household heads were the decision makers in farming. Overall 78.4 percent of the respondents interviewed were household heads while almost 10% were the sons of the household heads'. Majority of the farmers reported farming as their primary occupation. Highest percentage (96.6 %) was reported in Balochistan followed by Punjab (90.7 %) and Sindh (86.4 %).

**Table 8: Household Heads' Involvement in Farming (% of farmers)**

Primary Occupation	Province			Overall
	Sindh	Punjab	Balochistan	
Involvement in farming-Full Time	77.8	76.9	72.4	76.0
HH Farm Decision Making	82.7	87.2	89.8	86.2
<b>Relationship of Respondents with Household head</b>				
Self	74.1	82.1	79.7	78.4
Son	16.0	11.5	6.8	11.9
Son-in-law	1.2	2.6	11.9	4.6
Brother	2.5	1.3	1.7	1.8
Brother-in-law	0.0	2.6	0.0	.9
Other related	6.2	0.0	0.0	2.3
<b>Primary occupation</b>				
Farming	86.4	90.7	96.6	90.7
Self-employed (off-farm)	2.4	5.3	1.7	3.3
Government servant	3.7	1.3	0.0	1.8
Looking for work	5.0	0.0	0.0	1.8
Employed in private sector	1.2	2.7	0.0	1.4
Livestock (commercial)	0.0	0.0	1.7	.5
Agricultural wage labour	1.2	0.0	0.0	.5

#### 4.2 Family Size and Education of the Household

In our sample areas, the mean household size varies from 8.77 in Punjab to 18.95 in Balochistan. The overall mean household size is 12.68. Majority of the sample respondents were married. The married respondents' proportion was highest in Sindh (100 percent) followed by Balochistan (98.2 percent) and Punjab (96 percent). Overall, the farm families settled in the tomato growing regions a long time ago (58.50 years). Majority of the respondents were born in these areas. Looking at HH literacy rate in three provinces, the education level of the farmers in Punjab was relatively better as nearly 77.5 percent of the sample farmers were able to read and write followed by 60.5 % in Sindh while Baluchistan had the lowest proportion of household heads (45 percent) who could read and write. Overall mean schooling year of farmers who had some formal education was also reported high in Punjab (8.62 years) followed by Balochistan (8.11 years) and

Sindh (6.87 years). Overall literacy was 61.1 percent and schooling years were 7.79 depicting that majority of farmers are literate expect Balochistan.

**Table 9: Household Characteristics**

	Province			Overall
	Sindh	Punjab	Balochistan	
Family Size (Number of people)	11.69	8.77	18.95	12.68
Houshold Head Married (%)	100.0	96.0	98.2	98.1
Settlement in village (Years)	44.26	75.43	56.72	58.50
<b>Education Status of the head</b>				
Cannot read or write	33.3	20.0	55.0	34.4
Can read only	6.2	2.5	5.0	4.5
Can read or write	60.5	77.5	40.0	61.1
Education ( Schooling Years)	6.87	8.62	8.11	7.79

### 4.3 Farm attributes

The mean farming experience of the farmers in the study area was 20.57 years while mean experience in tomato production was 14.85 years. Punjabi farmers were more experienced in overall farming and tomato growing (21.88 and 18.03 years) followed by Balochistan and Sindh provinces. The mean operational land holdings were 21.93 acres. Sindh had the largest operational land holdings (31.48 acres) followed by Balochistan (17.83 acera) and Punjab (15.34 acres). Out of total operational land holdings mean operational irrigated land was 17.65 acres.

**Table 10: Farming experience (years) and Land Ownership Details (Acres)**

	Province			Overall
	Sindh	Punjab	Balochistan	
Farming experience (Years)	19.81	21.88	19.88	20.57
Tomato farming experience (Years)	11.51	18.03	15.22	14.85
Total Own Cultivated	22.52	9.98	24.78	18.59
Total Own Uncultivated	2.38	0.93	12.57	4.62
Shared In	1.69	0.63	0.37	0.95
Shared Out	0.99	0.49	0.50	0.67
Rented/Leased IN	8.65	5.32	0.00	5.10
Rented/Leased OUT	0.33	0.24	0.00	0.21
Total Operational Holding	31.48	15.34	17.83	21.93
Operational Irrigated	29.32	14.03	6.73	17.65
Operational Rained	2.16	1.31	11.10	4.28

On average Sindh had the highest area of irrigated land (29.32 acres) and it was lowest in Baluchistan (6.73 acres). The mean operational land that was raid fed was 4.28 acres. A considerable amount of operational land was leased-in in Sindh and Punjab. The share of

operational land in sharecropping (both in and out) was negligible in our study area. The mean total own cultivation land was around 18.59 acres. The overall trend of leaving land uncultivated was relatively lower, particularly in Sindh and Punjab while it was considerably higher in Baluchistan (12.57 acres). The main reason is the dearth of irrigation water in this province.

#### 4.4 Soil Type

According to Khokhar (2015), tomato thrives well on all types of soils. A well fertile sandy loam soil is best suited to produce early crop. The loams and clay loams have greater water-holding capacity and are better suited to prolong the harvesting period. Overall the majority of farmers reported their land as clay loam soil (36 percent and 49 percent owned and rented land respectively). In Sindh province more farmers reported this type of soil (62.5 % of own land and 54.2 % of rented land). Overall 18.8 and 20.8 percent farmers reported their own and rented land respectively as sandy loam. The third major soil type in Sindh was loam soil.

**Table 11: Soil type of owned cultivated land (Percent Farmers)**

Soil Type	Sindh		Punjab		Balochistan	Overall	
	Own	Rented	Own	Rented	Own	Own	Rented
Sandy	3.1	8.3	2.7	2.7	0.0	4.9	2.0
Sandy Loam	18.8	20.8	32.9	27.0	10.0	24.6	21.3
Loam	9.4	8.3	37.0	43.2	18.3	29.5	22.3
Clay Loam	62.5	54.2	23.3	24.3	68.3	36.1	49.7
Clayey	1.6	0.0	1.4	2.7	1.7	1.6	1.5
Saline	1.6	4.2	1.4	0.0	0.0	1.6	1.0
Mixed	3.1	4.2	1.4	0.0	1.7	1.6	2.0

Only a small number of farmers reported other soil types like Caley, Saline, and mixed soil. In Punjab majority of the farmers (37 percent and 43.2 percent) reported their owned and rented land as loam soil. The second major soil type reported was sandy loam (32.9 percent for owned and 27 percent for rented land) and the third major soil type was clay loam (23.3 percent for owned and 24.3 percent for rented land). Sandy, clayey and saline soils were not very common soil types in Punjab. In Baluchistan majority of farmers (68.3%) reported clay loam. Loamy soil and sandy loam soils were reported by only 18.3 and 10 percent farmers.

#### 4.5 Cropping Pattern in Rabi Season

The cropping patterns of a region are usually influenced by the geo-climatic, socio-economic, historical and political factors (Hussain, M. 1996). Patterns of land use of a region are

manifestation of combined influence of physical and human environment. Wheat, tomato, other winter vegetables and winter fodders were major crops grown in winter season. The main crop of the selected regions was wheat with an average allocation of 27.80 percent of total operational land. Of the three provinces, Punjab had the highest share of land (32.90 percent of total cultivated area) allocated for wheat. Tomato was the second largest crop reported in the study area occupying 21.60, 40.80, 13.40 percent of cultivable area in Sindh, Punjab and Baluchistan respectively. The other crops - winter vegetables, fodder, mango orchards and sugarcane, were grown on relatively smaller areas.

**Table 12: Cropping Pattern in Rabi Season**

		<b>Sindh</b>	<b>Punjab</b>	<b>Balochistan</b>	<b>Overall</b>
Wheat	%	25.0	32.9	27.5	27.8
	Acre	8.0	5.0	4.9	5.6
Tomato	%	21.6	40.8	13.4	27.4
	Acre	6.8	6.3	2.4	6.0
Rabi Vegetables	%	14.9	7.5	4.1	10.6
	Acre	4.7	1.2	0.7	2.3
Rabi Fodder	%	7.6	5.5	6.3	6.9
	Acre	2.4	1.5	1.7	1.9
Mango Orchard	%	3.92	1.63	0	2.48
	Acre	1.2	0.25	0	0.54
Other Orchards	%	5.37	0.29	20.75	7.31
	Acre	1.7	0.04	3.7	1.6
Sugarcane	%	3.3	0.1	0.0	1.8
	Acre	1.0	1.5	0.0	0.9
<b>Fallow land</b>	<b>%</b>	<b>18.3</b>	<b>0.0</b>	<b>32.1</b>	<b>14.0</b>
	<b>Acre</b>	<b>5.8</b>	<b>0.0</b>	<b>5.7</b>	<b>3.1</b>

#### **4.6 Cropping Pattern in Kharif Season**

The major crops grown in summer were rice, cotton, kharif fodder and kharif vegetables. Rice is high delta crop mostly grown in Sindh and Punjab where canal irrigation water is available. Rice and cotton are not cultivated in Baluchistan as canal irrigation water is not available there. Rice, cotton, Kharif fodder and kharif vegetables were grown on 19.48, 7.30, 8.12 and 5.79 percent of the cultivated area respectively. Quite a high percentage of area remained fallow during kharif season with the highest share reported in Baluchistan due to shortage of irrigation water. In Baluchistan, tomato acreage (3.56 acres) was higher in kharif season than that in rabi season. The main reason is that during summer Baluchistan is more suitable for tomato cultivation due to the

relatively lower temperature in Balochistan compared to other provinces. The acreage of other crops are marginal during this season.

**Table 13: Cropping Pattern in Kharif Season**

		<b>Sindh</b>	<b>Punjab</b>	<b>Balochistan</b>	<b>Overall</b>
Rice	%	23.77	27.54	0.00	19.48
	Acre	7.48	4.23	0.00	4.27
Cotton	%	13.88	0.00	0.00	7.30
	Acre	4.37	0.00	0.00	1.60
Kharif Fodder	%	4.42	13.75	10.43	8.12
	Acre	1.39	2.11	1.86	1.78
Kharif Vegetables	%	7.94	3.91	2.80	5.79
	Acre	2.50	0.60	0.50	1.27
Kharif Tomato	%	0.00	0.00	20.02	5.43
	Acre	0.00	0.00	3.57	1.19
Sugarcane	%	3.29	9.82	0.00	4.22
	Acre	1.04	1.51	0.00	0.93
Mango Orchard	%	3.92	1.63	0	2.48
	Acre	1.2	0.25	0	0.54
Other Orchard	%	5.37	0.29	20.75	7.31
	Acre	1.7	0.04	3.7	1.6
Fallow	%	37.33	43.02	45.99	40.36
	Acre	11.75	6.60	8.20	8.85

#### 4.7 Cost of Production

As tomato a cash crop, farmers use extensive inputs for getting its good yield. This leads to relatively higher cost of production per acre. Tomato Production costs vary in different tomato production regions and for different tomato growers. Per acre production cost was PKR140383.85 in Sindh, PKR144942.63 in Punjab and PKR 117224.93 in Balochistan. The breakdown of total production costs of tomato crop are presented in figures 1, 2 and 3 for Punjab, Sindh and Baluchistan province respectively. The figures show fertilizer has the largest share in production cost (21.41 percent) in Punjab and Sindh (33.03 percent). Plant protection/pesticide cost constitutes about 15.61 percent in Punjab and 16.72 percent of total production cost in Sindh. Most of the farmers used hybrid seed. Seeds and nursery cost was about 9.56 percent in Punjab and 10.90 percent in Sindh. Sowing cost was 3 % and 2% of total production cost in Punjab and Sindh respectively. Irrigation cost was higher in Punjab (11.63 %) than that in Sindh (2.41%). This huge difference was due to the shortage of canal water available in Punjab where farmers by used tube-well water for irrigating their tomato fields. In Sindh, canal water was readily available and tube-well was rarely used for irrigation. Land preparation cost was 8.13 percent in Punjab and 6.39 % in Sindh. Harvesting and sorting/packaging

cost was 12.27 percent in Punjab while 9.78 percent in Sindh. The high labour cost contributed to the higher cost of harvesting in Punjab.

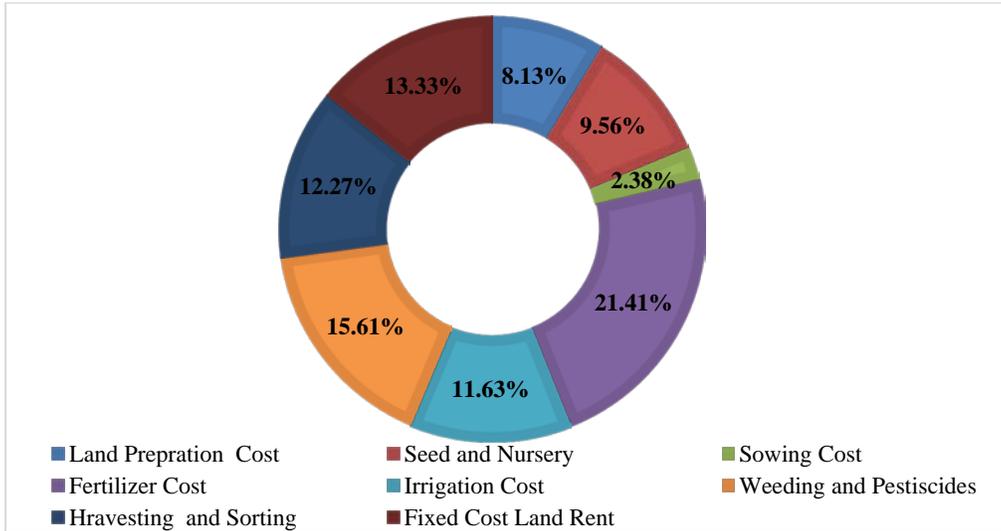


Figure 1: Cost of Tomato Production in Punjab

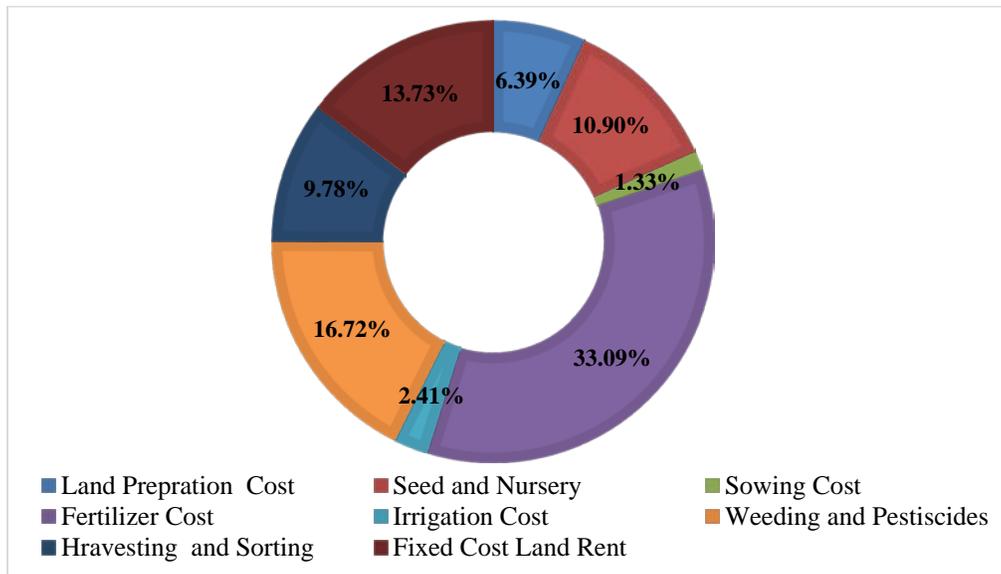


Figure 2: Cost of Production of Tomato in Sindh

The breakdown of total cost of production for Balochistan is presented in figure 3. It shows that fertilizer has the largest share in production cost (22.12 percent). Plant protection/pesticide cost constitutes about 10.88 percent. Baluchistan had relatively lower cost of plant protection due to relatively cooler climate and lesser insect/pest attack. Seed cost share was about 12.5 percent while sowing cost was 5.53 percent. The irrigation cost was relatively higher (9.41percent) as only tube-well was used for irrigation. Land preparation cost was 8.61 percent because per unit cost of tillage

operation was high in Baluchistan. Harvesting, sorting and packing cost was 11.81% and the share of fixed cost (land rent) was 13.43 percent.

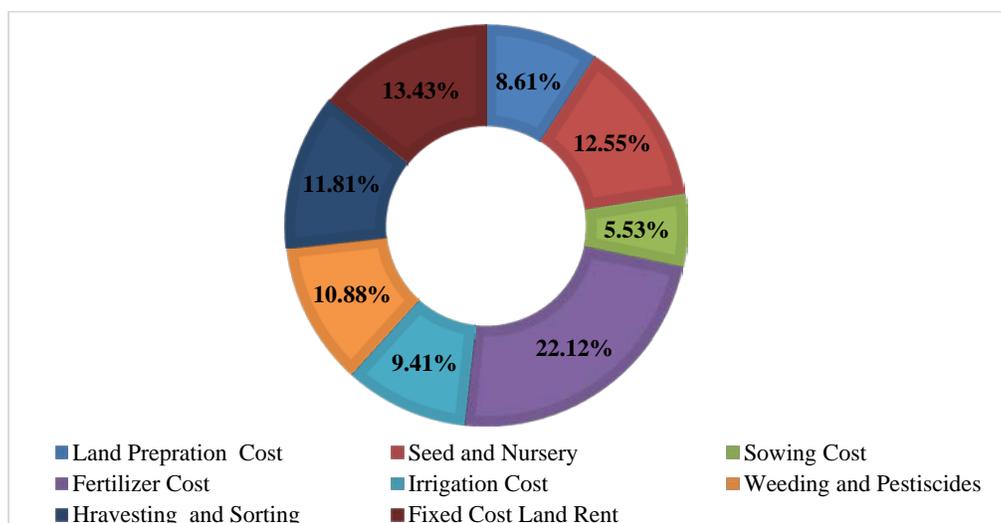


Figure 3: Cost of Production of Tomato in Baluchistan

Table 14: Cost of Production for Tomato

Province	Sindh			Punjab			Balochistan		
	Qty/Acre	Price/Unit	Price/Acre	Qty/Acre	Price/Unit	Price/Acre	Qty/Acre	Price/Unit	Price/Acre
Deep Ploughing	1.93	1164.29	2245.41	1.55	1670.00	2588.50	0.95	2721.05	2585.00
Cultivator	2.94	898.75	2640.08	4.87	912.34	4443.20	2.80	2108.47	5896.58
Dics/ Rotavator	2.76	1038.03	2865.54	2.40	1444.23	3471.71			0.00
Leveling Cost	1.17	1046.15	1220.51	1.64	776.47	1274.42	2.05	787.00	1615.71
<b>Land Preparation Cost</b>			<b>8971.54</b>			<b>11777.84</b>			<b>10097.29</b>
<b>Share In Total Cost</b>			<b>6.39%</b>			<b>8.13%</b>			<b>8.61%</b>
Seed Cost	1.00	13659.00	13659.00	1.00	12060.38	12060.38	1.00	12000.00	12000.00
Nursery Cost	1.00	1647.12	1647.12	1.00	1800.00	1800.00	1.00	2716.67	2716.67
<b>Seed and Nursery</b>			<b>15306.12</b>			<b>13860.38</b>			<b>14716.67</b>
<b>Share In Total Cost</b>			<b>10.90%</b>			<b>9.56%</b>			<b>12.55%</b>
Ridges/beds making Cost	1.00	1141.54	1141.54	1.00	1802.94	1802.94	1.00	3550.00	3550.00
Transplanting labour cost	1.00	730.17	730.17	1.00	1648.53	1648.53	1.00	2933.33	2933.33
<b>Sowing Cost</b>			<b>1871.71</b>			<b>3451.47</b>			<b>6483.33</b>
<b>Share In Total Cost</b>			<b>1.33%</b>			<b>2.38%</b>			<b>5.53%</b>
FYM	2.60	9825.00	25589.66	1.76	1222.22	2153.44	2.58	4261.36	10979.53
Urea	2.74	1476.91	4046.74	2.35	1545.30	3635.49	2.59	2022.64	5237.20
DAP	2.01	2533.44	5085.23	2.03	2954.68	6006.56	1.80	3028.89	5458.31
NP	2.67	2051.39	5470.37	2.20	1954.26	4298.55	1.73	2193.10	3793.48

Province	Sindh			Punjab			Balochistan		
	Qty/ Acre	Price/U nit	Price/ Acre	Qty/ Acre	Price/Un it	Price/ Acre	Qty/ Acre	Price/U nit	Price/ Acre
SSP	1.95	1325.00	2586.90	1.31	2760.00	3609.23	0.14	3200.00	457.14
Other	1.97	1862.21	3671.22	4.00	2831.48	11325.93	0.00		0.00
<b>Fertilizer Cost</b>			<b>46450.12</b>			<b>31029.20</b>			<b>25925.66</b>
<b>Share in Total Cost</b>			<b>33.09%</b>			<b>21.41%</b>			<b>22.12%</b>
Canal Irrigation	10.12		266.00	2.36		100.00	0.00		0.00
Tube well Irrigation	4.22	738.24	3112.56	11.56	1096.53	12670.99	11.80	934.62	11025.29
Mix Irrigation	0.00		0.00	7.22	566.67	4092.59	0.00		0.00
<b>Irrigation Cost</b>			<b>3378.56</b>			<b>16863.58</b>			<b>11025.29</b>
<b>Share In Total Cost</b>			<b>2.41%</b>			<b>11.63%</b>			<b>9.41%</b>
Manual Weeding(Man Days)	16.27	300.00	4880.63	18.14	450.00	8162.50	11.54	500.00	5771.93
Weedicides	1.50	500.00	750.00	1.00	3533.33	3533.33	0.36	1200.00	428.57
Pesticides Cost	8.63	2067.50	17841.76	7.45	1467.56	10931.47	3.43	1908.62	6548.54
<b>Weeding and Pesticides</b>			<b>23472.38</b>			<b>22627.30</b>			<b>12749.04</b>
<b>Share In Total Cost</b>			<b>16.72%</b>			<b>15.61%</b>			<b>10.88%</b>
Harvesting Cost			9676.19			12716.85			8042.57
Packing Sorting Cost			4057.35			5071.17			5805.87
<b>Harvesting and Sorting</b>			<b>13733.54</b>			<b>17788.02</b>			<b>13848.43</b>
<b>Share In Total Cost</b>			<b>9.78%</b>			<b>12.27%</b>			<b>11.81%</b>
Variable Cost			113183.97			117397.79			94845.73
Intrest Rate@7%			7922.88			8217.85			6639.20
<b>Total Variable Cost</b>			<b>121106.85</b>			<b>125615.63</b>			<b>101484.93</b>
<b>Fixed Cost Land Rent</b>			<b>19277</b>			<b>19327</b>			<b>15740</b>
<b>Share in Total cost</b>			<b>13.7%</b>			<b>13.3%</b>			<b>13.4%</b>
<b>Total Cost</b>			<b>140383.85</b>			<b>144942.63</b>			<b>117224.93</b>
Yield Per Acre @ 40kg			290			278			260
Price Per 40 Kg			878			816			1010
<b>Total Revenue</b>			<b>254620</b>			<b>226848</b>			<b>262600</b>
<b>Gross Margins</b>			<b>133515.15</b>			<b>101232.37</b>			<b>161115.07</b>
<b>Net Return</b>			<b>114236.15</b>			<b>81905.37</b>			<b>145375.07</b>

Cost of production and gross returns are presented in table 14. Overall tomato was reported as a profitable crop except in the years when prices were too low. Profitability of tomato in Punjab was lower compared to other two provinces. Major share of produce from Punjab comes when tomato supply in market is at its peak. Other provinces have relatively higher profitability than that of Punjab as they take the natural advantage of seasonality. Highest per acre net returns were earned by farmers

in Balochistan (PKR145375 per acre) followed by those in Sindh (PKR114236 per acre) while farmers of Punjab earned the lowest net returns (PKR 81905.37 per acre).

#### 4.8 Determination of Tomato Maturity

Tomato maturity is closely related to its surface color, so the level of maturity is normally determined by visual analysis of the fruit (Manasi et al, 2016). Tomato is harvested when its colour turns red and the detection is usually done by the farmer himself. Maturity detection by farmers was reported as 96.3, 94.9 and 96.6 percent in Sindh, Punjab and Balochistan. Sometime permanent labours also detect the maturity but their share is very low.

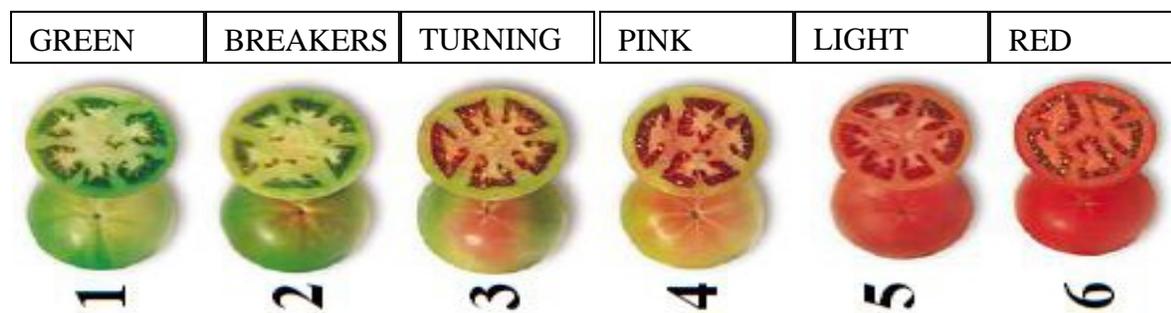


Figure 4: Stages of Tomato Maturity (*Source (Manasi, 2016)*)

#### 4.9 Type of Labour Used for Tomato Harvesting

Harvesting labor plays key role in yield, better harvest and post-harvest handling to avoid sizable losses (Chohan, 2008). Decision regarding the status of maturity of tomato ready for harvesting is also very important for getting good yield and profits from tomato. Farmers used family labour, permanent hired labour or casual labour for harvesting. The use of family labour was highest in Sindh (72.5 percent) followed by Punjab (50 percent) and Balochistan (37.3 percent). Casual labour, mostly involved in the picking, sorting and packing of tomato in Punjab come from Sindh as the wage rate is higher in Punjab compared to that in Sindh. In Sindh and Punjab both male and female labor were involved in the harvesting, sorting and packing of tomato (82.7 and 32.1 percent). In Punjab the female to male labor ratio in tomato harvesting was the highest (59.0 %). In Balochistan the involvement of female labor in tomato harvesting, sorting and packing activities was reported negligible. This was mainly due cultural/social barrier and taboos restricting the women from participating in the labour market.

**Table 15: Maturity Detection and Type of Labour Used for Harvesting (% of farmers)**

Type of Labour	Province			Overall
	Sindh	Punjab	Balochistan	
<b>Maturity Detection Decision Taken</b>				
Myself/Family	96.3	94.9	96.6	95.9
Permanent Labour	3.7	3.8	3.4	3.7
<b>Type of Labour Used</b>				
Myself/Family	72.8	50.0	37.3	55.0
Permanent Labour	8.6	6.3	13.6	9.1
Casual Labour	18.5	43.8	49.2	35.9
<b>Gender of Labour Used</b>				
Both (Males/Females)	82.7	32.1	5.1	43.6
Male	9.9	9.0	94.9	32.6
Female	7.4	59.0	0.0	23.9

#### 4.10 Tomato Harvesting, Packing and Wage Rates

Tomato matures gradually during the season and hence harvesting cannot be done in one go. Number and timing of picking vary depending on a number of factors. Picking time is decided based the level of maturity and farmer's commitment to commission agents in the wholesale markets. There is also considerable difference in the numbers of picking across the provinces. Climate in Sindh province is relatively hot so the tomato ripening process is quicker than those in Punjab and Baluchistan. In Sindh and Punjab the picking is carried out on alternate days or at 2-3 days interval because of hot temperature while in Balochistan time of picking extends from one week to ten days due to lower temperature. Due to this reason the number of pickings was higher in Sindh (18.72 on average) followed by the Punjab (15.34 on average). In Balochistan , the average number of picking was 9.24.

Tomato harvesting is usually done by daily wage workers hired by the farmers or through permanent hired (contract) labour. Harvesting labour consists of 5-10 pickers and usually include both male and female workers. In Sindh and Punjab picking was done by females but in Baluchistan picking was done by males. After picking, tomatoes were placed into a plastic bucket which is called *gadar* in local language. After filling the bucket, pickers carried the filled bucket to the corner of farm where they were packed according to requirement of the destination markets. The time of picking and packing size also varied depending on the type of market they were sold to. Farmers who sold their produce to the local and nearby markets, picked tomato early in the morning and sent it to assembly market in the afternoon. On the other hand, the farmers who

transported their produce to distant markets, picked the tomatoes in the afternoon and packed them in wooden crates in the evening. The produce was transferred to the distant wholesale market at night so that they could be available for sale in the wholesale markets early in the morning.

On average, a male labour picked 24.96 crates and a female labour picked 19.68 crates of tomatoes per day. They got a wage rate of PKR307.17 and PKR251.38 a day respectively in Sindh. The daily wage rate was higher for males in Punjab (PKR 454.84) and Baluchistan (PKR516.86) while the average wage rate for females in Punjab was quite low (PKR 260.14/day). On average, in Punjab and Baluchistan males picked 26.00 and 32.45 crates of tomatoes a day respectively while in Sindh they picked 24.96 crates.

Tomatoes need to be sorted and graded before they are packed to get a price premium. Packaging in bulk without sorting and grading of produce, improper transportation and storage, distant and prolonged market distribution system cause post-harvest losses. These losses bring low returns to growers, processors and traders and on aggregate the whole supply chain suffers (Kader, 1992). Sorting is mostly done by male labour. Sometimes females also take part in sorting, though their role is limited to separating the damaged produce. On average wage rate for male labour involved in sorting was PKR 300.47 in Sindh, PKR455.78 in Punjab and PKR530.56 in Balochistan they sorted and packed 53.23, 52.26 and 60.57 crates of tomatoes a day respectively.

**Table 16: Wage Rate for Harvesting of Tomato**

	Province			Overall
	Sindh	Punjab	Balochistan	
No of Pickings	18.72	15.34	9.24	14.76
<b>Harvesting</b>				
Adult Male Wage (Rs/Day )	307.17	454.84	516.95	413.81
Quantity Harvested ( Crates/ day)	24.96	26.00	32.45	27.86
Adult Female Wage (Rs/Day)	251.38	260.14	500.00	262.64
Quantity Harvested (Crates/ day)	19.68	15.68	55.00	18.69
<b>Sorting/Packing</b>				
Adult Male (Rs/Day )	300.47	455.78	530.56	426.06
Quantity Sorted/packed ( Crates/ day)	53.23	52.26	60.57	55.36
Adult Female (Rs/Day)	151.00	200.00	0.00	167.33
Quantity sorted/packed ( Crates/ day)	40.00	25.00	0.00	32.50

#### 4.11 Harvesting Schedule of Tomato Early Crop

Tomato is grown in all four provinces of Pakistan and significant variation in sowing and harvesting of tomato crop was reported both across provinces and across districts within a province. In KP and Balochistan, it is produced both in rabi and kharif season, while in Punjab and Sindh, it is a rabi crop. Tomato early crop mostly grows in Sindh. The sowing starts in August-September while harvesting starts during November-December. In Khushab district of Sindh tomato is relatively early sown and its harvesting starts from last week of December to mid of March. Sindh starts supplying tomato in winter when the supply in the domestic market is relatively low and its price is good. This results in higher profits for the Sindh tomato producers. During November-March tomato also comes from KP but its supply is relatively low and only fulfills the demand of KP province.

**Table 17: Month Wise Harvesting of Tomato Early Crop (No of Crates/day)**

	Province			Overall
	Sindh	Punjab	Balochistan	
<b>Early Crop</b>				
October	100.0	0.00	0.00	100.0
November	531.5	0.00	0.00	531.5
December	1039.1	563.3	0.00	1010.5
January	567.8	421.2	0.00	524.8
February	416.9	784.6	0.00	532.6
March	466.4	591.5	0.00	531.5
April	135.0	30.0	0.00	100.0
<b>Late Crop</b>				
April	300.00	1013.00	0.00	926.58
May	200.00	2747.32	200.00	2502.38
June	0.00	1634.85	522.13	1031.17
July	0.00	587.63	885.96	844.81
August	0.00	100.00	845.90	831.83
September	0.00	0.00	585.00	585.00

In Punjab, normally the tomato is sown in the months of November-December and picking starts in March-April. The picking continues until July. In Balochistan tomato is usually sown as kharif crop in March-April and its produce comes to the market in June and it lasts till September. In Sindh the harvesting of tomato starts in the month of October with smaller quantity (100 crates daily) and it reaches its peak in December (1039.1 crates daily) and then declines in April (435 crates daily). In Punjab the harvesting of tomato starts in the month of December with a smaller

quantity (563.3 crates daily) and in May it reaches its peak (2747.32 crates daily) and then declines in August (100 crates daily). In Baluchistan, the harvesting of tomato starts in the month of May with a smaller quantity (200 crates daily) and it reaches at peak in July (885.96 crates daily) and then declines in September (585 crates daily). The cycle of tomato cultivation shows that the tomato of Sindh starts entering the market in October-November and ends in April-May, in Punjab it starts in December-January and last till July August. In Baluchistan and KP, the tomato season starts in May and lasts till September.

#### **4.12 Packing and Packaging Material**

Packaging of any horticulture crop is important to maintain its quality, as most horticulture crops including tomato are perishable in nature. The quality of fresh tomatoes is mainly determined by appearance (color, visual aspects), firmness, flavor and nutritive value (Giovannoni, 2001). It has been observed that improper packing often reduces the quality of the produce. The packaging materials used for tomato in the study area were shopping bags, plastic crates and wooden crates. All three materials were in practice in Sindh and Punjab. There was a little variation in the size of shopping bags and plastic crates, while a significant difference in the size of wooden crates was found between Sindh (54.06 kg) and Punjab (20.50kg). In Sindh province most of the farmers sold tomato to local dealers who took the produce in big wooden crates and later on packed them in smaller crates and sent the produce to the wholesale market. The distance of the market where tomato has to be transported was the main driving factor behind the packaging decision. For instance, for the local wholesale market, tomatoes were packed in small shopping bags, whereas, they were packed in plastic or wooden crates for the distant wholesale markets. Cost of shopping bags, plastic crate and wooden crate was PKR7.26, PKR32.50 and PKR15.86 in Sindh. In Punjab, the cost of plastic crate and wooden crate were PKR96.22 and PKR43.81 respectively. Preferred packing material was wooden crates as they were cheaper. In Baluchistan, only wooden crates were used for tomato packing and cost was PKR52.54 per crate of size 15.90 kg.



Figure 5: Wooden Crates



Figure 6: Plastic Crates

**Table 18: Size and Cost of Packaging Material for Tomato**

Type of Packing Material	Province			Overall
	Sindh	Punjab	Balochistan	
Shopping bags Size (KG)	11.18	9.14	--	10.28
Cost (PKR/ Unit)	7.26	7.34	--	7.29
Plastic crates Size (KG)	15.00	20.50	--	19.58
Cost (PKR/ Unit)	32.50	96.22	--	84.64
Wooden crates Size (KG)	54.06	14.49	15.90	24.05
Cost (PKR/Unit)	115.86	43.81	52.54	56.40

#### 4.13 Postharvest Handling and Transportation

Postharvest handling techniques, packaging materials helps to protect and retain the quality of fresh horticultural produce and reduce damage during transport. Losses in fresh horticultural produce are directly related to quality degradation. Improper handling and transportation are the main reasons for quality loss in marketable produce (Kumar *et al.*, 2015). Tomato handling loss has been defined as a “measurable quantitative and qualitative loss of a given product at any moment along the postharvest chain” (De Lucia and Assennato, 1994). Handling methods of tomato in the study areas include, open transportation in pickups, shopping bags, plastic crates and wooden crates. Transporting tomatoes in wooden crates was the most common practice, reported in Sindh, Punjab and Baluchistan as 47.5, 54.5 and 98.3 percent of tomato producers reported the use of this method respectively. The use of wooden crates was higher in Baluchistan because it had to be transported to very distant markets. Shopping bags, called *palli* in local language, held the second place. They are usually used when the produce is transported in smaller quantity to the local assembly markets. Plastic crates were also used for tomato transportation in three provinces.

However, its use was relatively low, 2.5 percent in Sindh, 15.6 percent in Punjab and only 1.7 percent in Baluchistan.

**Table 19: Tomato Produce handling Methods (% of Farmers)**

	Province			Overall
	Sindh	Punjab	Balochistan	
Open transport in pickups	1.3	0.0	--	0.5
Shopping Bags	38.8	29.9	--	24.9
Plastic Crates	2.5	15.6	1.7	6.9
Wooden Crates	47.5	54.5	98.3	64.1
Others	8.8	0.00	0.00	3.2

#### 4.14 Marketing Channel

An efficient marketing system is essential for sustained agricultural development. Agricultural marketing channel is concerned with the concept of marketable surplus of farm commodities that enter the process of circulation and exchange. The purpose of exchange of commodities for money and vice-versa is to have access to a variety of products (Baki *et al*, 1997). The table below describes the different marketing channels the farmer use to sell their produce. The agencies include pre harvest contractor, local dealer, village level assembly markets and wholesale markets. Pre-harvest contractor is the person to whom farmers sell the standing crop. This practice was not very common for tomato. Local dealer is a person to whom farmers sell their produce at farm gate. Local dealers come to tomato farms, look at farmers' produce and then price per crate is determined after negotiation. Normally farmers arrange the labour for picking tomato while labour for sorting and packing is arranged by the dealers. Transportation of the produce to the wholesale market is arranged by the local dealers. This marketing practice was more common in Sindh (41.9 percent). 12.2 percent of the farmers in Baluchistan also used local traders.

Assembly Markets are often situated near the farms, generally in small towns, where farmers bring major portion of the marketable surplus. Local dealers, wholesalers, and retailers participate as buyers in these markets. In these markets farmers take their produce themselves. The price formation process is simply based on direct negotiation between traders and farmers. The selling at assembly markets was more common in Punjab as 33.3 percent producers reported this. In Sindh 21 percent of the famers sold their produce in the local assembly markets. These markets are well connected to the wholesale markets of the districts or other bigger regional

wholesale markets. The traders of assembly markets buy tomato from this market and transports to the wholesale market.

Wholesale Markets are usually located in a district or a major sub-division. These markets are the main trading centers for the surplus fruits and vegetables of the surrounding areas. Wholesale markets have better storage, transport, communication and working conditions than the assembly markets. These markets have commission agents, wholesalers and retailers. Farmers sell produce through commission agents (Middleman) to wholesalers in these markets. Farmers have interaction with commission agents who normally give advance to producers to cover the cost of tomato production. The selling in these markets is done through open bidding. Price is determined by demand and supply. About half of all farmers in the three provinces reported to sell their produce in the wholesale markets. The majority of tomato producers (84.5 %) in Baluchistan sold their produce at this type of markets while more than half of Punjabi farmers also sold their produce in these markets. The selling of tomato produce in these markets was relatively lesser in Sindh province as only one third (32.1%) of the farmers sold their produce in these markets.

**Table 20: Marketing Channels for Tomato (% of Farmers)**

Selling agency	Province			Overall
	Sindh	Punjab	Balochistan	
Pre Harvest Contractor	3.7	0.0	0.0	1.4
Local Dealer	41.7	0.0	12.2	14.7
Local Village Assembly Market	21.0	33.3	0.0	19.8
Wholesale Market	32.1	53.8	84.5	53.9
Other	2.5	12.8	3.4	6.5

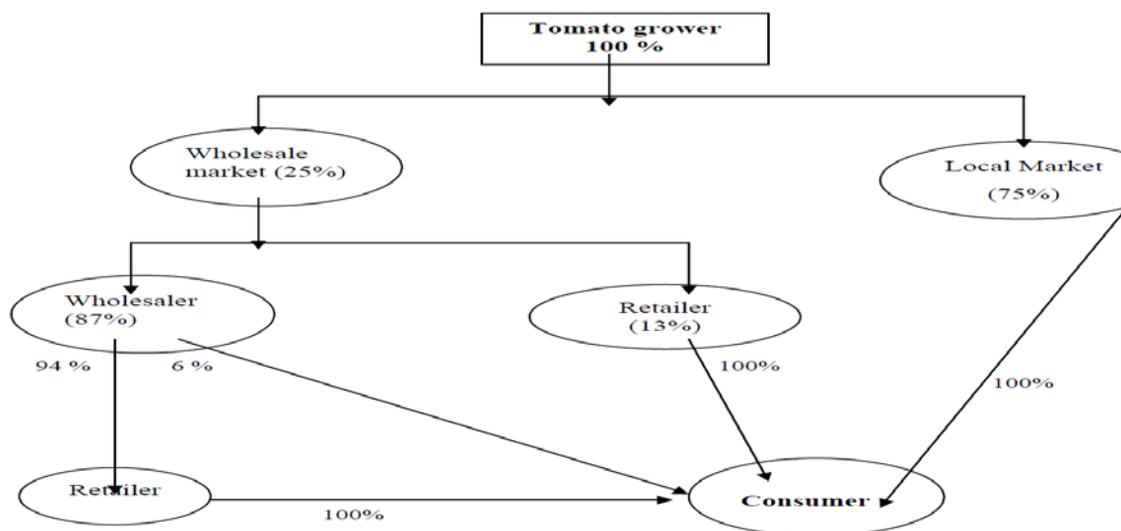


Figure 7: Marketing Channels of Tomato Crop (Source , Chohan, T. Z 2008)

#### 4.15 Mode of Transportation to Different Markets

Tomato is one of the very perishable commodity and its physical appearance changes continuously after harvesting. Depending on the humidity and temperature it ripens very soon, resulting in poor quality as it becomes soft and unacceptable (Ullah, 2009). Hence, it must be harvested at the right time because overripe tomato is more susceptible to physical injury than ripe and pink ones (Ullah, 2009). After harvest, ripening continues and tomatoes become overripe very rapidly. This can result in loss of quality and restricted shelf life (Geeson *et al.*, 1985). The entire farming community in Sindh and Balochistan reported that they send their produce for marketing immediately after harvest. Only 2.6 percent farmers in Punjab held tomato produce up to 24 hour because the harvested produce from one farmer was not large enough to load a truck so he had to wait for other farmers' produce to be ready to jointly transport to the market.

Transport is an important aspect in tomato marketing system, the goal of transport in marketing is to convey produce from production centers to consumer markets with minimal loss of quality (Karaköy *et al.*, 2012). An inefficient transport system is a disadvantage to tomatoes marketing since it has direct influence on cost, its quality and overall postharvest losses. As high as 10-20% postharvest losses occur due to delays in transport arrangements and long distances to urban markets (Sugri *et al.*, 2013). Decision about modes of transportation was on the basis of distance from farm to market and quantity of produce to be transported. If produce is small in

quantity then rickshaw was used, otherwise pickup and truck were used. In Sindh rickshaw, pickup, and truck were used to transport tomato to village level assembly markets. The producers who reported to use these modes of transportation were 30.0, 56.7 and 13.3 percent respectively. In Punjab rickshaw was the most popular transport (75 %) for assembly market, followed by pickup (17.9 %). In Baluchistan, only pickup was reported as mode of transportation.

For wholesale markets, the use of pickup was highest in Sindh (73.9 percent) followed by truck (26.1 percent). In Punjab, 91.9 percent farmers reported that they used truck for wholesale market while only 8.1 % farmer reported to use pickups. In Baluchistan, 55.8 percent farmers used truck while the rest used pickups for transportation of produce to wholesale markets. In Sindh, all farmers used pick up to transport produce to regional markets while in Punjab 60 percent farmers used truck and the rest used pickup. In Balochistan all farmers used truck as the mode of transportation to regional market.

**Table 21: Mode of transportation (% of Farmers)**

Market Type	Transport	Province			Overall
		Sindh	Punjab	Balochistan	
Produce transported immediately		100.0	97.4	100.0	99.1
Village Level/Assembly Market	Rickshaw	30.0	75.0	0.0	50.0
	Pickup	56.7	17.9	100.0	40.0
	Truck	13.3	3.6	0.0	8.3
Wholesale Market	Pickup	73.9	8.1	44.2	37.9
	Truck	26.1	91.9	55.8	62.1
Regional Markets	Pickup	100.	40.0	0.00	23.3
	Truck	0.0	60.0	100.0	76.7

#### 4.16 Distances of Different Tomato Markets

In the study area village level assembly markets were at the distance of 15-20 km radius in all the provinces. These markets are not permanent as they are established only for the harvesting season. Wholesale and regional markets in Sindh were Karachi and Hyderabad which were almost 66.04 km away from the production area. In Punjab main wholesale markets were Sheikhpura, Sargodha, Faisalabad, Lahore, and Multan. Their average distances from farms was 238.89 km. Regional markets for Punjabi farmers were Islamabad, Hyderabad, Peshawar, and Mardan. Their average distance was 668.4km from the study area. In Baluchistan, Quetta (Hazar Gunji) was the wholesale market at a distance of 91.66 km on average, while regional markets were DG khan , Multan, DI Khan, Sukkur, and Mardan with an average distance of 540 km.

In agriculture the demand for any crop does not play important role in determining the price. The demand for tomato crop remains usually inelastic while supply is highly elastic. That is why high variations in the supply of the crop are the major drivers for variability in price. The major problems in the marketing of horticultural crops are inter- and intra-seasonal fluctuations in prices (Aujla and Jagirani, 2002). Farmers reported that once in almost four or five years they got very attractive price for their produce. According to farmers price was different every day. Sometimes they sell tomato at a good price and the very next day they get very low prices. Overall, more than half of the producers were not satisfied with price they received for their produce during the year 2016-17. Almost three fourth of the Baluchistan producers (74.5 %) were satisfied with the price they received. Majority of the farmers in Sindh and Punjab (72.7 and 63.2 % respectively) were not satisfied with the price received for their produce. Despite the fact that prices were relatively better in the year 2016-17 majority of the producers in Sindh and Punjab were not satisfied with the prices they received. Baluchistan farmers got the benefit of seasonality as their major supply started after July, which was a lean tomato season in Pakistan during 2017.

**Table 22: Distance to Various Markets (Km) and Satisfaction about Tomato Price**

	Province			Overall
	Sindh	Punjab	Balochistan	
Village Level/Assembly Market	16.12	13.33	12.50	14.67
Wholesale market	66.04	238.89	91.66	119.67
Regional market	65.00	668.48	540.00	614.38
<b>Satisfaction about tomato price</b>				
Not Satisfied	72.7	63.2	25.5	57.5
Satisfied	27.3	36.8	74.5	42.5

#### 4.17 Awareness about Registering as Tomato Grower

In Pakistan, most of the farmers are not aware of the market committees or registration requirements as growers of horticulture commodity. The table below shows that 98.8 percent farmers in Sindh and 98.7 percent farmers in Punjab did not know about the registration requirements. In Balochistan a small percentage (8.6 %) of farmers were aware of the requirement and only 5.7 percent were registered as tomato growers.

GOP, 2008 stated the existence of over 700 fruit and vegetable wholesale markets in Pakistan. The province of Punjab had the largest share followed by Sindh, KPK and Baluchistan respectively. In Balochistan, there is only one central wholesale market for fruits and vegetables in Quetta. Vegetables marketing system is prone to various sources of inefficiencies. Farmers in

vegetable producing areas are unable to attract competitive buyers. Many of the farms are located in relatively isolated areas. Large distances to improved roads and markets make it difficult for farmers to access competitive markets (Massawe, 2007).

None of the farmers reported that they were governed by the market committee and had registered with them. In Balochistan farmer action committee has been established in Qilla Saifullah. This committee is supervised by local agriculture department and usually farmers are registered with this action committee. There is semi-formal marketing system established for horticulture commodities, especially for tomato and apple. There are more than 100 small agriculture companies to whom 10-30 farmers are attached. These companies usually help the farmers in getting credit during production season and also operate the marketing activities of tomato and other horticulture crops.

**Table 23: Knowledge of Registration Requirement (% of Farmers)**

	Province			Overall
	Sindh	Punjab	Balochistan	
<b>Knowledge of a Requirement to register as a Tomato grower</b>				
Not aware	98.8	98.7	85.7	96.4
Aware	1.3	1.3	8.6	1.0
Aware and have registered	0.0	0.0	5.7	1.0
<b>Knowledge About Market Committees</b>				
Not aware	98.7	98.6	97.1	98.4
Aware	1.3	1.4	0.0	1
Aware and have registered	0.0	0.0	2.9	.5

#### **4.18 Trainings for Improving Tomato Production and Value Chain**

Agricultural markets are rapidly globalizing, generating new consumption patterns and new production and distribution systems (FAO, 2010). The value chain emerged as a tool for increasing competitiveness and efficiencies, reducing costs (Porter, 1985), improving performance (Hawkes and Ruel, 2011), and upgrading products/functional processes (Kaplinsky and Morris 2000; Knorringer and Pegler 2006). Marketing and pricing of agriculture produce are strongly linked with quality of produce. In our study areas most of the farmers were using traditional knowledge and practices for tomato production. Only 11.1 percent farmers in Sindh and 23.1 percent farmers in Punjab received training on tomato production technologies while no tomato producer got any type of training in Balochistan. It was also observed during the field survey that farmers who got the training were performing well and their yield was relatively higher compared

to others. Training on value addition in tomato was received only by a few producers in Punjab (2.7 percent). In Balochistan only 1.7 percent of the farmers were interested in ketchup processing, pack house establishment and cooperative, whereas in Punjab only 1.3% showed intension to start making ketchup/pury from tomato.

**Table 24: Trainings for Improving Tomato Production and Value Chain (Percent Farmers)**

	Sindh	Punjab	Balochistan	Overall
Training for growing the tomato	11.1	23.1	0	12.9
Tomato Value Addition Training	0	2.7	0	.9
<b>Training Benefits Achieved</b>				
Other ways to sell fruit	3.8	2.7	4.3	3.6
Started processing for ketchup/Pury	0	1.3	1.7	0.9
Establish own Pack house	0.0	0.0	1.7	0.5
Join a Cooperative/ Union	0.0	0.0	1.7	0.5

#### 4.19 Information Sources for Tomato Marketing

Ayanyemi (2006) referred to information as an essential resource for individual growth and survival as an informed mind is an enriched mind. Farmers in study area were well informed and connected to the wholesale markets and commission agents through their mobile phones. Some farmers had permanent commission agents to whom they had been selling their produce for the last 10 years. These commission agents were the major source of information for them regarding marketing and prices. Some producers got information directly through different markets and sent their produce where they got high prices. Overall cell phones and commission agents (44.39 percent and 28.29 percent) were the major sources of information regarding the prices and marketing situation of tomato for the growers. Telephone/mobile and commission agents were major information sources for tomato growers in Sindh (53.16 percent and 21.52 percent respectively).

**Table 24: Sources of Tomato Marketing Information (% of Farmers)**

Information Sources	Sindh	Punjab	Balochistan	Overall
Telephone/mobile,	53.16	37.33	41.18	44.39
Commission Agent	21.52	41.33	33.33	28.29
Personal Visit	1.27	1.33	5.88	2.44
Fellow farmer	2.53	1.33	3.92	2.44
More than One sources	20.29	17.33	15.68	17.83

In Punjab farmers used commission agents more (41.33 percent of farmers) than telephone/mobiles (37.33 percent farmers) as source of market information. In Balochistan farmers

were connected to farmer's action committee through mobiles (41.18 percent) and commission agents (33.33 percent). Fellow farmers and personal visit were not important information sources.

## **5 Conclusion and Recommendations**

Pakistan needs dynamic, integrated and pro-active policy framework to rehabilitate the agricultural marketing system. There is strong need for commitment by the government, private sector and the relevant stakeholders in the marketing system to adhere to the policy agendas of reforms, initiated by the government, for the welfare and betterment of farming community and consumers as well as the market players (GOP, 2009). The recent food crisis and occasional surpluses and shortages of agricultural commodities underline the need for taking measures by the government to improve the working of agricultural marketing system.

Tomato is grown in all the four provinces of Pakistan. In KP and Balochistan it is grown both in rabi and kharif season, while in Punjab and Sindh it is a rabi crop. In this report we present preliminary analysis of data gathered from a survey of 220 tomato farmers, of which 80 respondents each were from Sindh and Punjab, while 60 were from Balochistan.

Overall tomato production appears to be a profitable business. The major issue hampering the profitability of tomato production was the extreme price volatility during different time of the year and its cyclical trend. Per acre tomato production costs were highest in Punjab, followed by those in Sindh while these costs were lowest in Balochistan. Profitability of tomato in Punjab was lower than other two provinces. Highest per acre net returns were reported by Balochistan farmers followed by those of Sindh while Punjabi farmers earned the lowest returns. The main reason was that Punjab's produce comes to the market at the peak of harvesting time. Sindh and Balochistan provinces have comparative advantage due to favourable climate and seasonality in tomato production over Punjab. Picking is usually carried out by the female while sorting, packaging, transportation and marketing by males. Marketing is done at local assembly markets, distant wholesale and regional markets. Packaging and transport usually depends on the distance of market where it has to be transported. For local level selling shopping bags are used while for distant markets wooden and plastic crates are used as packing material. Tomato is mostly transported on trucks and

pickups for wholesale and regional markets while rickshaws are mostly used for transportation of tomato produce to local assembly markets.

Major production issues mentioned by farmers included high seed cost, poor seed quality, lack of research for disease and harsh climate resistant hybrid seed varieties, incidence of severe pest attack due to low quality pesticides, lack of proper training regarding production technologies resulting in high cost of production and labour shortages particularly at the harvesting time.

Major marketing problems of tomato producers according to survey respondents were high price fluctuations, traditional post-harvest handling, low shelf life, limited cold storage and refrigerated transportation, higher post-harvest losses in terms of quantity and quality, lack of organized price information system, lack of training facilities for marketing and low value addition opportunities.

Poor farm to market infrastructure, inefficient factor and product markets, volatile prices, consecutive shortages and hoarding, inefficient storage capacity, poor implementation of grades and standards are identified as some of the prominent challenges, which need to be tackled. Implementation of rules and regulation is weak or even non-existent as most of farmers and other stakeholders are working in isolation without any formal registration.

Bearing in mind that the research is at an early stage, some issues that require rigorous analysis to formulate effective policy recommendations for improving the productivity and marketing of tomato appear to be:

1. The costs and benefits of a policy of imposing restrictions on Indian tomato imports particularly in peak tomato production season to minimise the seasonal price fluctuations
2. Measures to ensure fertilizer and pesticides meet specified quality standards
3. Price policies on fertilizer and pesticides
4. Ensuring quality of imported hybrid seed through strict quarantine and quality check measures.
5. Policies to enhance value addition in the tomato industry, including training programs for farmers through effective extension services, including training of farmers' families/women.

6. Heat tolerant seeds to avoid the yield fluctuations due to severe climatic conditions
7. Policies to improve local hybrid seed production system
8. Investigate mutually beneficial contractual arrangements involving vertical linkages with downstream processing firms that can provide a minimum guaranteed price to tomato producers, drawing on successful experiences in other agricultural products such as such as the cases of Rafhan Maize Products Company limited and maize producers, Nestle/Angro Foods and milk producers.
9. Investigate the regulatory systems for market intermediaries, particularly commission agents, to assess the feasibility of reducing the commission charged in Wholesale Markets which normally ranges between 7 and 15 percent depending upon the amount of loan/credit taken by producers from commission agents.

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