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**CLUSTER DEVELOPMENT BASED AGRICULTURE TRANSFORMATION PLAN  
VISION-2025**

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**Banana Cluster Feasibility and Transformation Study**



**Planning Commission of Pakistan, Ministry of  
Planning, Development & Special Initiatives**

**February 2020**





## FOREWORD

In many developed and developing countries, the cluster-based development approach has become the basis for the transformation of various sectors of the economy including the agriculture sector. This approach not only improves efficiency of development efforts by enhancing stakeholders' synergistic collaboration to resolve issues in the value chain in their local contexts, but also helps to gather resources from large number of small investors into the desirable size needed for the cluster development. I congratulate the Centre for Agriculture and Bioscience International (CABI) and its team to undertake this study on **Feasibility Analysis for Cluster Development Based Agriculture Transformation**. An important aspect of the study is the estimation of resources and infrastructure required to implement various interventions along the value chain for the development of clusters of large number of agriculture commodities. The methodology used in the study can also be applied as a guide in evaluating various investment options put forward to the Planning Commission of Pakistan for various sectors, especially where regional variation is important in the project design.

Muhammad Jehanzeb Khan,  
Deputy Chairman  
Planning Commission of Pakistan  
Ministry of Planning Development and  
Special Initiatives  
Government of Pakistan.



## FOREWORD

To improve enhance Pakistan's competitiveness in the agriculture sector in national and international markets, the need to evaluate the value chain of agricultural commodities in the regional contexts in which these are produced, marketed, processed and traded was long felt. The Planning Commission of Pakistan was pleased to sponsor this study on the **Feasibility Analysis for Cluster Development Based Agriculture Transformation** to fill this gap. The study aims to cover a large number of agriculture commodities spread in various clusters throughout the country.

I truly hope that the policies, strategies, and interventions suggested in this report will facilitate the federal and provincial governments to chalk out and implement plans for cluster-based transformation of the agriculture sector.

Zafar Hasan,  
Secretary,  
Ministry of Planning Development and Special  
Initiatives  
Government of Pakistan



# FOREWORD

This is part of the series of studies on 33 agriculture commodities undertaken for the purpose of preparing a cluster-based transformation plan based on the regional realities in the entire value chain including production, processing, value addition, and marketing. I congratulate the whole team of the project especially the Team Lead, Dr. Mubarik Ali to undertake and successfully complete this monumental study. We are thankful to all commodity specialists who have contributed to this assignment. The CABI Project officers Mr. Yasar Saleem Khan and Ms. Aqsa Yasin deserve appreciation. I truly believe that this study will serve as a basis to make and implement plans for cluster-based agriculture transformation. I hope the study can help you making your investment decisions along the value chain of various agriculture commodities.

Dr. Babar Ehsan Bajwa  
Regional Director  
CAB International



# FOREWORD

This report is part of the series of studies on 33 agriculture commodities to prepare the agriculture transformation plan by incorporating regional realities at the cluster level. In the report, the clusters of various commodities are identified and characterized, and viable investment options along the value chain of each cluster are proposed. For this purpose, the study team has analyzed macro data, reviewed the literature, and made extensive consultation with stakeholders along the value chain. Foreign and local internationally reputed consultants, Dr. Derek Byerlee and Dr. Kijiro. Otsuka and national consultant Mr. Sohail Moghal were also engaged to understand the cluster-based development approach and conduct cluster-based feasibility analysis. An EXCEL-based Model was developed which was validated by our national consultants. Separate viabilities for individual technologies and products suggested in each commodity are also estimated. This humongous task would not have been possible to complete without the excellent cooperation and facilities provide by CABI, the hard work of commodity specialists and our research team especially Mr. Yasar Saleem Khan and Ms. Aqsa Yasin The true reward of our hard work is the implementation of the proposed policies, strategies and interventions to develop agriculture commodity clusters in the country.

Dr. Mubarik Ali  
Team Leader  
Cluster Development Based Agriculture  
Transformation Plan-Vision 2020 Project  
Planning Commission of Pakistan and  
CAB International



# ACKNOWLEDGEMENT

It is not possible to mention the names of all those who collaborated with us in completing this report, but my foremost gratitude goes to numerous stakeholders along the value chain who generously shared the information about Banana production, marketing, trade and value chain. Without their support, this report would not have reached to the level of present quality.

My sincere thanks go to **Planning Commission of Pakistan** for this initiative and especially financial assistance to complete the project activities. Here I am especially thankful to **Dr. Muhammad Azeem Khan** (Ex-Member, Food Security and Climate Change), **Mr. Muhammad Akram Khan** (Project Director; CDBAT) and the team from Planning Commission of Pakistan **Mr. Muhammad Arif** (Research Associate) and **Dr. Habib Gul** (Research Associate) for successful coordinating the project activities and preparation of this report.

I am also grateful to **Centre for Agriculture and Bioscience International** (CABI) and its Director for Central and Western Asia, Dr. Babar Ehsan Bajwa, and his team especially Mr. Yasar saleem for selecting me as commodity specialist for this task and for offering outstanding cooperation, support and advice during all the stages of this project. However, the research team takes the responsibility of any shortcoming left in the report.

**Dr. Abdul Fatah Soomro**  
**Senior Author**

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## **DISCLAIME**

This report is prepared by using the data from various published and unpublished sources and that obtained during the consultations with stakeholders. The research team took utmost care to arrive at the figures to be used, but is not responsible for any variation of the data in this report than those reported in other sources. Moreover, the views expressed in this report are purely of the authors and do not reflect the official views of the Planning Commission of Pakistan, Ministry of Planning Development and Reforms or the Centre for Agriculture Bioscience (International).





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# LIST OF ACRONYMS

ADP	Annual Development Plan
CPEC	China Pakistan Economic Corridor
CO	Community Organization
FFs	Farmer Field School
FEG	Farmer Enterprise Group
GAP	Good Agriculture Practices
GB	Gilgit-Baltistan
GI	Geographical Identification
GoP	Government of Pakistan
Ha	Hectare(s)
ISO	International Standard Organization
KIU	Karakorum International University
Kg	Kilogram
KKH	Karakoram Highway
KPK	Khyber Pakhtunkhwa
MARC	Mountain Agricultural Research Centre
MINFAL	Ministry of Food, Agriculture and Livestock
NARC	National Agriculture Research Council
NGOs	Non-Governmental Organizations
PARC	Pakistan Agriculture Research Council
PCSIR	Pakistan Council for Scientific and Industrial Research
PKR	Pakistani Rupee
PHDEC	Pakistan Horticulture Development and Export Company
R&D	Research & Development
SWOT	Strengths, Weaknesses, Opportunities, Threats
UAE	United Arab Emirates
UK	United Kingdom
USA	United States of America
USD	United States Dollar
VO	Village Organization



# EXECUTIVE SUMMARY

According to latest available data, internationally 114 million tonnes of bananas are produced from 5.6 million ha with an average per ha yield of 20 tonnes. India and China are the leader in global banana production. The global trade of banana has reached over US\$11 billion in 2017. Ecuador leads the world in exports followed by USA and Belgium.

Pakistan produces banana on about 30 thousand ha with a total production of 135 thousand tonnes giving an average yield of 4 tonnes per ha, which is only one-fifth of the world average. In addition, Pakistan is further losing its competitiveness in the international market as its area under cultivation and yield both have been on declining trend during 2001-17. As a result, per capita consumption and exports of banana are also on the declining trends. Pakistan gets only 22% of the world average yield in banana while its exports get 86% of the world average export price. Since 2001, the global export of banana is expanding at an annual rate of 6.5% per annum (in value terms), Pakistan did not benefit from this global expanding market and its export-production ratio remained lower than the world average, despite the fact that exporters can purchase banana from farmers at a lower farmgate prices than the world average.

Realizing this situation, the Planning Commission decided to transform banana into globally competitiveness sector that can generate sustainable growth and profit to all stakeholders in the value chain. For this purpose, it initiated this study to analyze the whole value chain of banana production, identify gaps and potentials, formulate plan, policies, and strategies, and come up with viable intervention at various segments of the value chain. To incorporate the local variations in banana value chain, it was suggested to conduct this analysis at the cluster level.

To achieve these objectives of the study, a large number of stakeholders were consulted, macro data were analyzed, and literature were reviewed. Based on this exercise, banana clusters were identified, constraint, gaps, and potential along the banana value chain were highlighted, targets were fixed, policies and strategies were specified and interventions were suggested to harness these potentials, and socioeconomic viabilities of these interventions were estimated.

Central & lower Sindh with Thatta as its focal point and Upper Sindh with Khairpur as its focal points are identified as the main banana growing clusters in Pakistan. Several performance gaps were identified in the production, processing and trading components of the value chain, specifically with the technology, market structure and availability of inputs. These include the lack of improved banana germplasm, commercial cultivars to produce high quality marketable fruit and the absence of packaging, commercial tissue culture labs, cold storage and refrigerated transport for trading in the high-value fresh banana market. However, Pakistan has great potential to catch up on all these fronts, because of a number of advantages, including availability of improved production technologies like tissue culture seedling and improved varieties, physical proximity with big banana markets like China, East Asia, and Saudi Arabia and low production costs, especially cheap labor.

In order to address multilevel challenges from production to product and market development, benchmarks and performance targets were set, based on global average for yield, quality and export, and the interventions were designed to meet these benchmarks over the period of five



years. These interventions include introduction of latest high-yielding banana varieties, improved management practices, disease free and tissue culture-based plantation by enhancing the capacity of banana research and extension, incentivizing private sector to invest in bunch management, introduction of mobile pack houses, and improve pre and post-harvest technology such as pre-cooling and cold chains, and linking banana traders with international markets.

These interventions are to be initiated by government and executed in collaboration and participation of the private sector including Farmers' Entrepreneur Groups, traders and their groups/associations. A time-horizon of nine years has been set for realizing the intended outcomes of the cluster development interventions. The total estimated investment required of this cluster development/upgradation plan at the focal points of two cluster is US\$11.45million for both the clusters. About 42% of this cost will be borne by the government in terms of strengthening banana research, capacity building of farmers and other stakeholders along the value chain, subsidies on the establishment of tissue culture labs, promoting processing, orchard renovation, and collection centers at the farm-level, and providing interest free loans. We believe that these incentives will encourage private investment to bring 58% of the investment to meet the goals of the Plan.

The above investments on banana value chain will increase the operation costs of various activities which is estimated at US\$8.22 million during the 7<sup>th</sup> year of the project in both the clusters. Accounting for all the fixed costs and variable costs including the production, processing and marketing cost over the period of seven years, the cluster interventions at the focal points of both the clusters are estimated to create positive economic returns, the undiscounted value of which is US\$8.4 million in the 7<sup>th</sup> year of the project. The estimated discounted value of these returns over the period of seven years is US\$11.0 million which will produce 42.2% an overall Internal Rate of Return (IRR) for both the clusters. These returns are based on respective investment and operational costs in the focal point of each cluster for a period of five years and the present value of resulting revenues over a period of seven years. This indicates that cluster development interventions are likely to increase the overall returns of the banana value chains in both the clusters. The details of the individual cluster investment requirement, operational costs, gross benefits, net cash flow, NPV and IRR can be seen in the 'Summary Sheet attached below.

These interventions are expected to produce far reaching economic and social impacts, including increased productivity and production of higher quality, value, income, employment, and foreign exchange earnings that will benefit all the banana stakeholders of both clusters and will have positive impact on other banana growing areas of the country.

However, these benefits will be achieved only if the holistic cluster approach is adopted. Strengthening of research and capacity building of stakeholders will be the key in the whole success of the cluster up gradation plan.





## Summary Sheet

	C. Lower Sindh	Upper Sindh	Total
Area under cultivation in focal point (ha)	5,176	5,161	10,337
Total Production (tonnes)	20,229	22,064	42,293
Yield (tonnes/ha)	3.91	4.28	4.09
Area of the cluster (ha)	17120	7680	24,800
Production of the cluster (tonnes)	63190	33200	96,390
Additional production from renovated gardens (tonnes)	1,168	854	2,022
Expected returns from renovated garden in 7th year (000USD)	524.3	383.4	907,7
Additional production from improved practices (tonnes)	9,731	10,673	20,404
Additional value from improved practices in 7th year(000USD)	3,191.8	3,500.6	6,692.4
Enhanced production due to reduced post-harvest losses (t)	6,072	6,574	12,647
Additional value from reduction of losses in 7th year (000USD)	1,991.7	2,156.3	4,148.1
Production to be processed (tonnes)	364.3	788.9	1,153.3
Total volume of chips produced (tonnes)	72.9	157.8	230.7
Expected additional value of Chips In 7th year (000USD)	437.2	946,7	1,383.9
Total expected volume of to be exported in 7th year (ton)	8,088	8,757	16,845
Increase in exports in 7 <sup>th</sup> year (000USD)	978.7	1,059.6	2,038.3
Domestic production to receive improved VC operation (tonnes)	911	986	1,897
Increase in value due to value chain improvement in 7th year both in domestic and international market (000USD)	749.1	811.1	1,560.2
Banana chips making units	6	10	16
Tissue culture labs	3	3	6
Collection Centers	9	14	23
<b>Investments (Mil. USD)</b>			
Investments required on strengthening research	0.741	0.741	1.481
Investment on capacity building of stakeholders	0.548	0.546	1.094
Investments required on orchard renovation	1.886	1.254	3.140
Tissue culture lab establishment costs	0.132	0.132	0.264
Investments required on processing level interventions	0.178	0.296	0.474
Investments on collection centers	1.698	2.642	4.340
Linking stakeholders with markets, e-commerce platform, etc.	0.050	0.050	0.100
Government loans	0.216	0.338	0.554
<b>Total investments</b>	<b>5.449</b>	<b>5.999</b>	<b>11.448</b>
Public Investment	2.293	2.500	4.793
Private Investment	3.156	3.499	6.655
<b>Economic Analysis (Mil. US\$)</b>			
<b>Gross revenue from all Interventions in 7<sup>th</sup> year (USD)</b>	<b>7.873</b>	<b>8.858</b>	<b>16.731</b>
<b>Value Chain Operational Costs in Year 7 (USD)</b>	<b>3.880</b>	<b>4.345</b>	<b>8.224</b>
<b>Net cash flow after deducting all costs in 7<sup>th</sup> year (USD)</b>	<b>3.993</b>	<b>4.464</b>	<b>8.457</b>
<b>NPV (USD)</b>	<b>5.562</b>	<b>5.438</b>	<b>11.000</b>
<b>IRR</b>	<b>45.9%</b>	<b>39.0%</b>	<b>42.2%</b>



# 1 INTRODUCTION

## 1.1 Banana Sector in Pakistan

Banana (*Musa* spp.) is a plant of great socio-economic and socio-cultural importance, of the *Musagenus*, belonging to the *Musaceae* family. Banana is the common name for the fruit produced by herbaceous plants of genus, *Musa*. It was native to South East Asia. Over a period, banana has been domesticated worldwide and today it is grown in 130 countries worldwide, more than any other fruit crop (Confederation of Indian Industry, 2012).

It is mainly grown for its fruit in humid tropical regions worldwide (TuoSeydou, *et al.*, 2017) Banana plays an important role in the diet of people due to its high nutritive value like carbohydrates content and energy (100 Calories per 100g), vitamins A, B1, B2, and C (Simmonds, 1990). It aids in digestion and helps in the retention of calcium, phosphorus and nitrogen, the three minerals which work towards building sound and regenerated tissues. In addition, bananas are good food for those suffering from any intestinal disorder like constipation, diarrhea and dysentery. Being rich in iron, it is beneficial for anemic people.

Banana plantation plays a vital role in food security and rural development<sup>3</sup>. Indeed, for 600 million people, banana is the main source of daily energy, while for another 400 million people; banana is an important food supplement<sup>4</sup>. Banana ranks fourth in human food after rice, wheat and corn.

Banana has many uses: the ripe fruit is pureed, candied, and preserved in various forms when not eaten fresh. Its extract is used in the manufacture of ketchup, vinegar, and wine. The unripe fruit is powdered and chipped. In rural areas, the young leaves are pounded and applied to injuries to suppress bleeding. The leaves are also used widely as packing materials for fruits and vegetables in market centers'. Banana fiber is woven into rope, and mat. Sheets of paper and paper boards are also made from banana peel. Banana blossom is exported dried and usually added to meat recipes (Anonymous, 2010).

Banana is a major and important fruit crop of Pakistan. Majority (93%) area and production (83%) of Pakistan lies in Sindh province, followed by Khyber Pakhtunkhwa (KPK), Baluchistan and Punjab (Table 1). According to FAO statistics of 2016, banana in Pakistan is cultivated on 27 thousand ha with a total production of 116 thousand tonnes, (although Agricultural Statics shows an area of 28.2 thousand ha and 119 thousand tonnes during 2015-Table 1) having an average yield of 4.2 tonnes per ha.



**Table 1: Province wise area production of banana from 2001-2016**

Year	Sindh		Baluchistan		Punjab		KPK		Pakistan	
	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.
	000 ha	000 tonnes	000 ha	000 tonnes	000 ha	000 tonnes	000 ha	000 tonnes	000 ha	000 tonnes
2001-02	27.3	113.5	0.8	8.1	2.4	15.8	0.7	12.3	31.2	149.7
2002-03	25.4	112.9	1.5	3.1	2.2	14.7	0.6	12.2	29.7	142.9
2003-04	27.5	125.7	1.4	2.3	2.0	12.9	0.7	13.1	31.6	154.0
2004-05	29.0	129.6	1.5	2.9	1.9	12.4	0.7	13.1	33.1	158.0
2005-06	29.7	134.8	0.4	3.6	1.7	11.4	0.7	13.7	32.5	163.5
2006-07	32.2	126.3	0.4	0.2	1.6	10.4	0.7	13.6	34.9	150.5
2007-08	32.9	127.0	0.4	7.3	1.5	9.9	0.7	13.8	35.5	158.0
2008-09	33.4	128.9	0.5	5.7	1.4	9.5	0.7	13.2	36.0	157.3
2009-10	32.2	127.4	0.5	4.8	1.4	9.4	0.7	13.2	34.8	154.8
2010-11	26.8	113.4	0.9	4.9	1.2	10.3	0.7	12.6	29.6	141.2
2011-12	19.8	76.0	0.9	3.0	1.1	6.2	0.7	13.0	22.5	98.2
2012-13	25.0	121.2	0.9	2.7	0.7	4.3	0.7	13.1	27.3	141.3
2013-14	25.9	100.8	0.9	2.7	0.5	3.8	0.7	13.1	28.0	120.4
2014-15	26.3	102.0	0.9	2.0	0.3	1.7	0.7	13.1	28.2	118.8
2015-16	26.7	112.4	0.9	7.9	0.2	1.4	0.7	13.0	28.7	134.7
<b>Annual growth (%)</b>	<b>-0.87</b>	<b>-1.42</b>	<b>-0.79</b>	<b>1.12</b>	<b>-15.08</b>	<b>-15.05</b>	<b>0.33</b>	<b>0.16</b>	<b>-1.33</b>	<b>-1.86</b>

Source: MNFS&R (2017-18)

In Pakistan average yield of banana is about 4t/ha which is very low as compared other banana growing countries of the world. China produces a maximum yield of 44.5t/ha while the average yield of banana in India is 30.87 t/ha. Banana sector of Pakistan is facing serious problems from production to post-harvest management. Therefore, banana production has been declining at a rate of 1.86% per annum, while area is has been plummeting at a rate of 1.33% per annum during 2001-16. As production decline is higher than that area implying that per ha yield has also been declining over the period (Table 1).

Due to lack of proper post harvesting infrastructure, bananas have a lower shelf life and up to 40% of the production is lost ([www.foodjournal.pk/./Exclusive on-Banana.pdf](http://www.foodjournal.pk/./Exclusive%20on%20Banana.pdf)). Due to several diseases that affect banana and poor management practices during this stage. Reduction in such losses in the post-harvest phase is of utmost importance not only to meet the increasing domestic demands but also to maintain competitiveness in world trade.

The world banana per capita annual consumption reached at 11.9 kg, while in Pakistan the consumption is 0.9 kg which is one of the lowest in the world and it is declining overtime.



Ecuador has the record of maximum of 99.0 kg followed by Philippine and Angola at 55.6Kg and 48.9kg, respectively.

## 1.2 Global Context

Pakistan lags behind the world scenario of banana production in terms of per ha yield, export-production ratio, and export price (Table 2). During 2016, the global production of banana was around 113.9 million tonnes of which Pakistan has negligible share of 0.11%, although it contributes about 5 times more in global banana area. During the same year, volume of global gross banana exports reached a record high of 23.2 million tonnes worth of US\$11.5 billion (Table 2). Banana trade of Pakistan remains at 46 thousand ton having the worth of US\$17 million. The quantitative and value based share of Pakistan in international trade is 0.20% and 0.15%, respectively.

**Table 2: Comparison of world vs. Pakistani banana sector during 2016**

Parameter	World	Pakistan	Share (%)
Area (000 ha)	5638	30.1	0.5
Production (000) ton-dry	113919	135	0.1
Value of production (Million US\$)	38543	44	0.1
Yield (ton/ha)-dry	20.2	4.5	22
Farm gate price (US\$/ton)	338	328	97.0
Quantity of international trade (000 ton)	23181	45.9	0.20
Value of international trade (Million US\$)	11490	16.8	0.15
Export quantity as % of production	18%	37%	-
Export value as % of production value	28%	51%	-
Average export prices (US\$/ton)	520	449	86.35

Source: FAOSTAT 2018, Production, Crops <http://www.fao.org/faostat/en/#data/QC>

FAOSTAT 2018, Trade, Crop and Livestock Products <http://www.fao.org/faostat/en/#data/TP>

Due to poor variety selection, crop management and post-harvest fruit handling, Pakistani exporters get lower price than that earned by other banana exporting countries (Table 2). However, Pakistani banana prices at the farmgate is lower than in international market suggesting perhaps Pakistani banana is competitive with international market at the farmgate. Most of the banana export takes place informally to Iran, Azerbaijan and Afghanistan. It is believed (among traders) that about 20% (around 25,000 tonnes) of Sindh's production crosses borders into Iran and Afghanistan via Balochistan and KPK every year.

Unlike in Pakistan, globally banana production during the last ten years has been increasing at a rate of 1.39% per annum, which is higher than the population growth of 1.19%, implying that globally per capita banana consumption is improving over the years. The increase in



production came from the expansion in area at the rate of 0.51% per annum, while per ha yield has increased at the rate of 0.88% per annum (Table 3).

**Table 3: Global trends in banana production during 2008-2017**

Year	Area (million ha)	Production (million ton)	Yield (t/ha)
2008	5.17	98.76	19.11
2009	5.31	103.42	19.47
2010	5.40	108.66	20.13
2011	5.49	109.41	19.93
2012	5.32	109.34	20.57
2013	5.33	112.24	21.05
2014	5.35	112.80	21.09
2015	5.45	115.11	21.11
2016	5.38	112.60	20.94
2017	5.64	113.92	20.21
<b>Growth rate (%)</b>	<b>0.511</b>	<b>1.385</b>	<b>0.875</b>

Source: FAOSTAT 2018, Production, Crops <http://www.fao.org/faostat/en/#data/QC>

More importantly, the international trade in banana is increasing at a higher rate than the production growth suggesting higher share of banana production is being traded in international market. However, Pakistan's export jumped from an insignificant level of 3.8 thousand tonnes in 2001 to 86.7 tonnes in 2009 with high growth rate, but remained on a declining trend with lots of variation since then until 2017, indicating that banana export market for Pakistan is not very stable (Table 4).

**Table 4: Trend in world trade of banana in comparison with Pakistan during 2001-16**

Year	International		Pakistan	
	Quantity (000 t)	Value (000 US\$)	Quantity (000 ton)	Value (000 US\$)
2001	14588	4200	3.8	0.2
2002	14489	4287	3.7	0.2
2003	15238	4687	7.2	0.7
2004	15672	4991	6.1	0.7
2005	16329	5639	0.9	0.1
2006	16946	5767	10.9	1.4
2007	18072	6610	7.9	1.2
2008	18300	7667	13.0	1.2
2009	18213	8128	86.7	10.6
2010	17491	8098	84.5	12.6
2011	18720	8853	58.8	25.4
2012	19099	8630	47.6	20.2
2013	20098	9689	86.1	33.4



Year	International		Pakistan	
	Quantity (000 t)	Value (000 US\$)	Quantity (000 t)	Value (000 US\$)
2014	21647	10760	43.2	18.2
2015	19659	9589	53.5	20.6
2016	20826	10176	50.3	22.6
2017	23181	11490	45.9	16.8
<b>Growth rate (%)</b>	<b>2.4</b>	<b>6.5</b>	<b>23.9</b>	<b>38.7</b>

FAOSTAT 2018, Trade, Crop and Livestock Products <http://www.fao.org/faostat/en/#data/TP>

Major banana producing countries are India, China, Indonesia, Brazil (Table 5). Pakistan has lot to learn in Banana production from its neighboring countries like China and India and how they were able to significantly boost banana yield during the last 2-3 decades.

**Table 5: Major banana producing countries of the world, 2016**

Rank	Production (000 Tonnes)			Area (000 ha)		
	Country	Production	Share (%)	Country	Area	Share (%)
1	India	30477	26.8	India	860	15.22
2	China	11170	9.8	Tanzania	490	8.67
3	Indonesia	7163	6.3	Brazil	465	8.24
4	Brazil	6675	5.9	Rwanda	465	8.23
5	Ecuador	6282	5.5	Philippines	447	7.91
6	Philippines	6041	5.3	China	366	6.48
7	Angola	4302	3.8	Burundi	186	3.29
8	Guatemala	3887	3.4	Ecuador	158	2.80
9	Colombia	3787	3.3	Angola	142	2.52
10	Tanzania	3485	3.1	Uganda	139	2.46

Source: FAOSTAT 2018, Production, Crops <http://www.fao.org/faostat/en/#data/QC>

In terms of Banana export, Ecuador, Philippine Costa Rica are the international competitors (Table 6). Pakistan ranks 24<sup>th</sup> in production and 57<sup>th</sup> in export in the world. According to Pakistan Bureau of Statistics (2016), export of Banana fresh and dried from Pakistan has decreased from 75.5-thousand-ton worth of Rs2.957 billion in 2013-14 to 38.2-thousand-ton worth of Rs1.618 billion in 2014-15, thus showing decline of 45% in terms of value during the period.

**Table 6: Top Banana Exporting Countries of the World (2017)**

Rank	Country	Quantity (000 tonnes)	Share (%)	Country	Value (Million US\$)	Share (%)
1	Ecuador	5974	28.9	Ecuador	2657	25.0
2	Costa Rica	2365	11.5	Guatemala	1007	9.5
3	Guatemala	2147	10.4	Costa Rica	995	9.4



4	Colombia	1842	8.9	Belgium	929	8.7
5	Philippines	1397	6.8	Colombia	857	8.1
6	Belgium	1130	5.5	Philippines	619	5.8
7	Honduras	659	3.2	Netherlands	420	4.0
8	USA	573	2.8	USA	416	3.9
9	Netherlands	506	2.4	Germany	333	3.1
10	Mexico	448	2.2	Dominican, R.	301	2.8

FAOSTAT 2018, Trade, Crop and Livestock Products <http://www.fao.org/faostat/en/#data/TP>

Major banana importing countries are USA, Belgium, Germany, Russian Federation in terms of quantity and USA, Belgium, and Russian Federation in terms of banana import values (Table 7). These are high end markets and require high quality standards. Pakistan is not reaching to any of these markets.

**Table 7: Top 10 Banana Importing Countries**

Major importing Countries of the world 2016				
Rank	Country	Quantity (000 tonnes)	Country	Value (Million US\$)
1	USA	4597	USA	2436
2	Germany	1391	Belgium	1201
3	Russian Federation	1356	Russian Federation	999
4	Belgium	1282	Germany	997
5	United Kingdom	1148	Japan	923
6	Japan	956	United Kingdom	796
7	China, mainland	887	China, mainland	586
8	Netherlands	771	Italy	478
9	Italy	712	Iran	457
10	Iran	590	Netherlands	443

FAOSTAT 2018, Trade, Crop and Livestock Products <http://www.fao.org/faostat/en/#data/TP>

Among the above countries fastest growing market for banana since 2013 are Netherland, China, South Korea and Saudi Arabia with growth of 162.7%, 72.5%, 44.2% and 31.9%, respectively. According to report by Ministry of National Food Security & Research during 2015-16, Pakistan's main banana export markets remain Afghanistan, Bahrain, Qatar and UAE. However; Pakistan may increase banana export by catering the potential market of China, Saudi Arabia, Russia, etc. by meeting the phytosanitary standards of these and other countries in the world.

From the macro-level data analysis, it can be concluded that banana production in Pakistan is losing its competitiveness in the international market as its area under cultivation and per ha yield both are declining overtime. As a result, during 2010s period, per capita consumption and exports are also on the declining trends. Pakistan gets only 22% of the world average yield in banana while its exports gets only 86% of the world average export



price. Despite the fact that average farmgate prices in Pakistan is lower than the world average, its export-production ratio is lower than the world average.

The Planning Commission intends to transform banana production into globally competitiveness with sustainable growth that can self-strive and generate profit to all stakeholders in the value chain. For this purpose, it initiated this study to analyze the whole value chain of banana production, identify gaps and potentials, formulate plan, policies, and strategies, and come up with viable intervention at various segments of the value chain. To incorporate the local variations in banana value chain, it was suggested to conduct this analysis at the cluster level.





## 2 GOALS AND OBJECTIVE

The overall goal of this study is to contribute to *the Cluster Development Based Agriculture Transformation Plan -V2025*. The specific objectives of the study are:

1. To identify the major clusters of Banana production in Pakistan
2. To conduct a detailed diagnosis and SWOT of the Banana value chain in each cluster
3. To identify technological, institutional, infrastructure and policy gaps in each cluster
4. Assess the potential of Banana production in each Banana producing cluster
5. Suggest technological, institutional, infrastructure and policy interventions to achieve the cluster potentials
6. Conduct economic and social feasibility of the suggested interventions. The purpose of the whole exercise is to develop a research-based cluster development plan for Banana to achieve the following targets.

## 3 METHODOLOGY

The data and information related to the characteristics, gap, potential and needed interventions to meet the gaps in Banana clusters were collected from three sources:

- a) *Macro-Data*. Relevant macro data were collected from various published and unpublished reports of government and non-governmental organizations and internet search on Banana value chain (See annexure 1 for the macro data sources)
- b) *Literature Review*. The literature related to the functioning, gaps, and interventions in Banana value chain is reviewed and synthesized (See Annexure 2 for the literature reviewed-No list is provided).
- c) *Stakeholders Consultations*. Primary information was collected through meetings, consultations, key informant interviews, surveys and focus group discussions using structured tools and open-end questionnaires (See Annexure 3 for the list of stakeholders consulted).



## 4 LITERATURE REVIEW

According to Indian Horticulture Database NHB (2013), improper post-harvest infrastructure reduces banana shelf life and up to 30-35% of the production is lost. Different post-harvest diseases like: Anthracnose (*Gloeosporium musarum*), Botryodiplodiarot (Black tip –Fingertip rot – Black rot: *Botrytis cinerea*) and Crownrot disease (*Ceratocystis paradoxa*) that affects the banana fruits <http://agropedia.iitk.ac.in/content/post-harvest-diseases-banana>, Managing these losses with proper management practices is of utmost importance not only to meet the increasing domestic demands but also to maintain competitiveness in world trade. Our discussions with stakeholders suggest that post-harvest losses in banana in Pakistan are in the range of 30-40%.

A disease called Panama Tropical races 4 (TR4) is sweeping parts of the globe, decimating banana plantations and hurting livelihoods. The popular Cavendish variety is the world largest crop, is highly susceptible (Kate Webber and Marty McCarthy, 2016). The fungus has already spread in Asia, particularly in China, Philippines, Malaysia, Taiwan and in Pakistan from India. Tropical race 4 is a serious threat to the Australian industry (Plant Health Australia). Panama disease devastates the commercial Cavendish banana, which is eating by the most of people in temperate zone (Dan Koeppel, 2007).

In Sindh the cultivation of Musa Cavendish Banana (Basrai) variety is more than 98%, which is under serious threat of BBTV and PANAMA diseases. Sindh Agriculture Department has conducted a survey and found the existence of Panama and Bunchy Top Virus, while the latter one has caused major loss in banana during five years in the lower Sindh. (DoA Sindh, 2012)

Low genetic variability of cultivated bananas significantly increases their susceptibility to diseases such as black leaf streak disease (BLSD), caused by *Mycosphaerella fijiensis* Morelet and considered to be the most severe disease of cultivated bananas (Churchill, 2011).

Given the high susceptibility of cultivated bananas to pathogens, the development of resistant varieties is a vital tool for effective crop management (Gody *et al.*, 2016). The development of new banana varieties that are resistant to this disease is a major focus of the agro-businesses across the world (Ferris *et al.*, 2009). Internationally, different banana cultivars Nanicão (AAA), Prata (AAB), Vitória (AAAB), Maçã (AAB) and Caipira (AAA) are popular for disease resistance (<https://doi.org/10.1590/1807-1929/agriambi.v20n8p702-708>) (2016).

Clusters of three fruits are kept in cold storage for 7, 14 and 21 days, with average temperature of  $10.53 \pm 0.37^{\circ}\text{C}$  and relative humidity of 85%. Subsequently, the clusters are transferred to temperatures of  $22 \pm 0.39^{\circ}\text{C}$  and evaluated for 16 days. The fruits of all cultivars remained green after 21 days of storage at  $10.53 \pm 0.37^{\circ}\text{C}$ . <http://dx.doi.org/10.1590/1983-21252016v29n313rc>

The shelf life of perishable product (including banana) is enhanced by packaging and it is also safe for the produce to be transported over long distance and to attract the consumer. Packaging also helps in branding the commodity, which gives long term benefits. The



storage of fruits and vegetables for preserving their edible characteristic and freshness for a longer period of time has become an integral part of fresh fruits and vegetables market supply chain systems. All fruits and vegetables require specialized post-harvest treatment, appropriate temperature and relative humidity for their storage. Establishment of cold storage provides refrigerated storage and preservation facilities for different fruits, vegetables as well as flowers. Because of technology advancements and logistic strategies, the cold storage of perishable items has become an important stage in the distribution between manufacturers / processors and retail locations. The cold storage will ensure the increased availability and improved quality of high value perishable fruits and vegetables for both export and local sale, which would otherwise perish or deteriorate (SMEDA 2015)

Banana ripening is an irreversible process, characterized by a climacteric respiratory pattern, which is stimulated by an autocatalytic production of ethylene and physiological and metabolic changes that are sensitive to temperature and ethylene itself (Xiao et al., 2013). Several studies have been conducted on control of postharvest banana quality, discussing storage conditions and treatments to prolong its shelf life (Zhang et al., 2010). The maintenance of cold storage from harvesting to marketing is undoubtedly the main technique available to delay senescence of plants (Martins et al., 2007).

Although low temperature storages (<13°C) slow fruit ripening and prolong its shelf-life, beneficial effects are limited by disorders associated with chilling injury, including peel browning and ripening problems (Nguyen *et al.* 2003; Promyou, *et al.*, 2008).

Chilling injury symptoms vary depending on the banana cultivar and appear to be related to a genomic group (Lichtemberg *et al.*, 2001). Fernandes *et al.* (2010) reported that a temperature of 13°C is effective in delaying ripening of bananas (cultivar **Nanicão**) stored for 17 days. Bananas (cultivar *Prata-Anã*) stored for 35 days at temperatures of 10 to 12°C showed no symptoms of chilling injury (Martins, *et al.*, 2007).

According to Mondal (2016) mobile pack houses is the most efficient way to export bananas in India, where production plots are small and road quality is often poor. Taking four 10-metric tonnes (MT) trucks to every farm, two of the vehicles carry all the materials necessary to build the temporary structure within 1.5 hours. Harvesting is finished within a day, load the product into the same trucks which actually will carry to the main reefer container about 10-20km away, and then the bananas are sent to the port.

In Pakistani, like in India, banana cultivation fields are scattered and relatively small mostly 1-2 acres compared to that of major exporting nations, like the Philippines or Ecuador where banana fields as big as 5,000-6,000 acres in contiguous place are cultivated. Bumpy roads and long distance require more time to reach pre-cooling place and bananas gets damaged when they are inside the crates. This issue can be tackled through mobile packing technology (Mondal 2016).



# 5 C.LUSTER IDENTIFICATION AND CHARACTERIZATION

## 5.1 Geographical Identification of Clusters

In Sindh, major banana growing production districts are shown in Figure 1.

Figure 1: Map of Sindh Showing Banana Production



Based on the climate and other eco-regional factors, banana cultivation in Sindh can be divided into two clusters: 1) Central & Lower Sindh, and 2) Upper Sindh (Table 8).



### 5.1.1. Central & Lower Sindh Cluster:

This cluster is constituted of Thatta, Matiari, Shaheed Benazir Abad, Mirpur Khans, Tando Muhammad Khan, Sanghar, Tando Allhyar and Badin (Table 8). This is a major banana cluster as it contributes 67% of the provincial banana cultivation area. Thatta is the focal point of this cluster which alone contributes about 20% in the provincial banana area and production. The fruit quality of this cluster is comparatively better than the upper Sindh therefore has a potential to produce exportable quality of banana. The connectivity of cluster with airport and seaport further improve the potential of this banana cluster for export.

**Table 8: Area Production of Major Banana Growing Districts by Cluster of Sindh, 2013-14**

District	Area (ha)	Share (%)	Production (tonnes)	Share (%)	Yield (ton/ha)
<b>Central &amp; Lower Sindh Cluster</b>					
Thatta	5176	20.2	20229	20.2	3.91
Matiari	3485	13.6	13090	13.1	3.76
Shaheed Benazir Abad	3103	12.1	13183	13.2	4.25
Mirpurkhas	1433	5.6	3051	3.0	2.13
T.M.Khan	1250	4.9	4404	4.4	3.52
Sanghar	958	3.7	3073	3.1	3.21
Tando Allahyar	897	3.5	3272	3.3	3.65
Badin	820	3.2	2892	2.9	3.53
<b>Total Central &amp; Lower Sindh</b>	<b>17122</b>	<b>66.7</b>	<b>63194</b>	<b>63.2</b>	<b>3.69</b>
<b>Upper Sindh Cluster</b>					
Khairpur	5166	20.1	22064	22.1	4.27
N. Feroze	2514	9.8	11177	11.2	4.45
<b>Total upper sindh</b>	<b>7680</b>	<b>29.9</b>	<b>33241</b>	<b>33.2</b>	<b>4.33</b>
<b>Non-cluster districts</b>					
Hyderabad	322	1.3	1337	1.3	4.15
Ghotki	261	1.0	1130	1.1	4.33
Karachi	160	0.6	557	0.6	3.48
Sukkur	141	0.5	593	0.6	4.21
Total non-cluster districts	884	3.4	3617	3.6	4.09
<b>Total Sindh</b>	<b>25686</b>	<b>100.0</b>	<b>100052</b>	<b>100.0</b>	<b>3.90</b>

### 5.1.2. Upper Sindh Cluster:

This cluster comprised of two districts: Khairpur and Noshehro Feroze with share of 30% in banana area under cultivation in the province. Khairpur is the focal point of the cluster as it contributes 20% of the banana area in the cluster. This cluster has unique quality as the banana season starts (in August) from this cluster due to high temperature which favors to early fruit maturity and requires less time to reach big national market of Punjab, Balochistan and Khyber Pakhtunkhwa and receives excellent rate due to high demand and low supply.



## 5.2 Comparison of Cluster Characteristics

A detailed comparison of both the clusters identified above is presented in Annexure 4. A brief description of the comparison of these cluster is given here.

Coastal belt of Thatta in Sindh (Central and Lower Sindh Cluster) possesses all the features such as right soil, climatic conditions, cheap labor, effective irrigation system, near to sea and airport of Karachi and efficient road & rail networks that are required to produce and export world class bananas while the Upper Sindh Cluster acquire unique quality as the banana season starts early from this cluster because summer sets up early here which favors early fruit maturity. The cluster produces better yield than the Central and Lower Sindh cluster. The cluster is linked with other provinces of the country; therefore, fruit can be transported quickly to big national markets in Punjab, Baluchistan and KP

Ninety-five percent of area is under Basrai variety (Cavendish dwarf), and the remaining under William Hybrid. Recent introductions include Grand Naine (G-9) variety while the work is underway to introduce high yielding Chinese varieties viz. B-10, W-11, and Pisangin both the clusters.

Majority of banana farmers in Pakistan operates less than 20ha. Commonly banana growers are small land holders while few growers in both clusters own land holdings as well. The big land holding farmers maintain their farms according to modern procedures & techniques used by developed countries like, proper input, bunch management, drip irrigation and fertigation at small scale.

## 5.3 SWOT Analysis

The SWOT analysis is carried out in focus group consultation conducted in major banana producing areas with the participation of different banana stakeholders along the value chain. The results are organized around the value chain functions, including inputs, production, storage, and marketing. The detailed SWOT analysis is presented in Annexure 5, and brief summary of the analysis is presented below.

Extensive canal irrigation system, presence of progressive farmers, strong input supply systems are few of the strengths of both the banana clusters. Major weaknesses, on the other hand, are poor planning, poor policy and priority neglect, nonexistence of a banana research institute, inadequate investment in R&D, minimum production of healthy, lack of tissue culture nursery sector, weak extension, poor marketing infrastructure, etc. Threats include diseases and natural disasters, such as BBTV & Panama, climate change, sudden shortage of irrigation and occurrence of floods, energy shortages, lack of cold storage facilities, high transport cost specially of reefer/cold containers, lack of any credible banana processing infrastructure, and non-transparent trading practices in local market systems. These factors generally hold back investment into the value chain, inhibiting its development. Table 9 presents the SWOT analysis for Banana Central & Lower Sindh cluster. Despite many similarities across the two clusters, lower Sindh has relatively less irrigation water and mostly the quality of underground water is poor. However, the cluster starts banana harvesting earlier thus fetch higher prices. Moreover, it is relatively well connected with Karachi and export market while upper Sindh is better connected with big Punjab markets



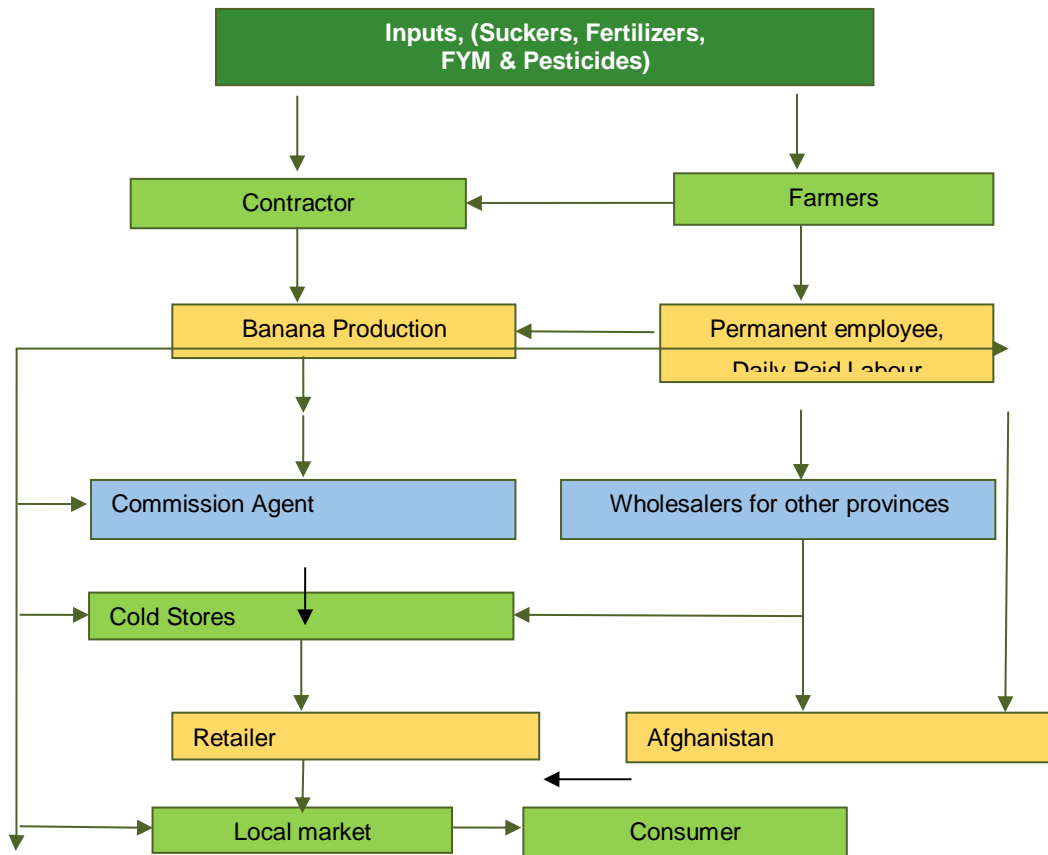
(Annexure 5). The Coastal belt of Thatta Sindh possesses all the features such as right soil and climatic conditions; cheap labor; effective irrigation system; Sea & Airport in Karachi and efficient road & rail networks that are required to produce and export world class bananas, moreover the Presence of advanced growers in this cluster which are applying latest cultivation techniques by using advanced technology and few of them also have established tissue culture labs .Out of five tissue culture labs three labs have established by growers in central and lower Sindh cluster. By exploiting the favorable factors Government may declare this belt as a Banana Export Zone.

## 5.4 Description of Value Chain

Banana was introduced in Sindh before independence at Ghorabari, district Thatta. Due to mild climate, the coastal belt of Sindh was selected for the introduction and acclimatization of banana. After successful results, it spread towards Tando Mohammad Khan, Hyderabad, Matiari, Mirpur Khas, TandoAllahyar in initial phase for commercial cultivation. After passing some period, banana moved towards northern part of Sindh: Khairpur, Ghotki, Sukkur, Noushehro Feroz and then entire left bank of Indus river in Sindh.

In the Central and Lower Sindh cluster some progressive banana growers established banana tissue cultural labs privately and they are producing healthy, disease free plants of improved varieties for their own plantation as well as for sale to other farmers which will not only boost the banana production but help to reduce spreading of Panama & Bunchy Top Diseases.

The transportation of the banana fruit towards the market is practiced in open pickups, mazdas and trucks; farmers are not interested to apply further procedures/fatigues because commonly they are not receiving any premium on extra efforts taken for quality produce. Majority of farmers surrender their harvest rights through pre-harvest sale agreement. Banana involves grading and cooling before packing and loading onto cold containers for transportation. Commonly, traders skip many of the basic processing steps, and just pack in simple wooden or cardboard boxes, often without any labels or brand names. Many of the processing technologies are lacking in both clusters, which currently is the major value addition problem but creates an opportunity for improvement. The trading in cities is getting more space in the horticultural fruit marketing because this is a single fruit which is being cultivated through the year and available at cheap price as compared to other seasonal fruits in Pakistan. It has a good potential for higher productivity, and value addition by at small scale. A large number of small farmers, traders and service providers are involved in this cluster. Banana value chain is vertically integrated with the larger wholesale and retail systems in big cities like in Karachi, Quetta, Lahore, Peshawar and Islamabad. There are some famous companies which are involve in banana value chain and trade of fresh fruit supply to the domestic markets in general and international market in particular. The flow of banana from farmers to consumers is shown in Figure 2.



**Figure 2: Description of Banana Value Chain in both the Clusters of Sindh**

There are numerous buyers and sellers creating a competitive market environment. A license is not required for small-scale trading and beyond access to finance; there are no barriers to entry in banana trading. Traders typically strive to achieve the highest margins by buying at the lowest price and selling at the highest price. Communication technologies and internet services are easily obtainable; labor is available on a permanent and seasonable basis and financial services to traders are provided by both formal and informal banking institutions. However; some surveyed traders at fruit and vegetable markets of Karachi, Quetta and Swat complained regarding the facilities providing by the Market Committees/ Government are insufficient.





## 6. CHALLENGES FACED BY THE CLUSTERS

### 6.1. Climate Change & Shortage of Water

Generally, the impact of climate change has impacted overall agricultural productivity but particularly banana which considered to be the most affected crop. The average rainfall (150-200 mm) in banana growing region is already on a lower side as the optimum requirement is 1200 mm for optimum growth and yield of banana crop. Further reduction in rains has reduced the water availability to the crop not only through natural source of rain but also in irrigation canals. The global (including in Pakistan) increase in temperature is adding into the miseries of farming communities. As in the tail end of Indus delta (the major banana producing cluster), the region is facing severe irrigation water shortage during the summer/critical growth stage of banana which has reduced the banana yield and shrunk the area under its cultivation. Banana cultivation has almost wiped out from Lasbella Baluchistan due to low rainfall, no recharge, fallen underground water, and finally energy crises.

### 6.2. Constraints at Production Level

The farmers in both clusters are facing lots of production problems especially non-availability of disease free tissue cultured plants, diverse germ plasm and modern production technology, shortage of irrigation water, Banana Bunchy Top Virus (BBTV), PANAMA caused by *Fusarium Oxysporum Cubense* TR4, lack of services by the Agriculture Research and Extension Department. Generally harvesting of banana in both the cluster is carried out through conventional and traditional techniques.

**Table 9: Gaps and Constraints at Production Level**

S#.	Parameter	Central & Lower Sindh cluster	Upper Sindh Cluster
2.	New germplasm	non availability of diverse germplasm	non availability of diverse germplasm
3.	Mother nurseries	Not available	Not available
4.	Orchard size/type	Mix (Small/medium & large)	Small/medium
5.	Certified plants	Less than 0.5%	Less than 0.5%
6.	Extension services	Weak	Weak
7.	Commercial inputs	Imbalanced use	Imbalanced use
8.	Labor input	(Hired+ Family)	(Hired+ Family)
9.	Harvesting	Traditional	Traditional

### 6.3. Constraints at Value Chain Level

Despite the availability of modern technologies for several value chain processes, their uptake and adoption are not significant and requires support, strategy and incentives. The



public sector does not have to take up the entire responsibility upon itself, but seek win-win solutions by working with the private sector and NGO partners. In both clusters, market linkages are heavily dependent on the tenacity of the individual processor, creating a contracted market structure. The following table presents an overview of constraints at processing level barriers to entry into Banana value chain as processor, market linkages and investment capital.

**Table 10: Gaps and Constraints at Processing Level**

Parameter	Central & Lower Sindh cluster	Upper Sindh Cluster
Processing and value addition technologies in use	Negligible	Negligible
Cold chains	Insignificant	Not available
Technologies for processed products	Not available	Insignificant (Banana powder, Figs, chips & Chattni)
Shovel ready investment projects	Not Available	Not Available
Access to energy for processing	Limited availability	Limited availability

## 6.4. Constraints at Trading Level

There are no cold stores in banana cultivation areas only cold rooms are present in big city markets like Karachi, Lahore, and Islamabad for banana ripening purposes. Banana trading needs proper cold chain to reduce post-harvest losses. No attention is paid to product differentiation and quality aspects to achieve price premiums. Information about banana prices and quality traded in the domestic market is available from traditional sources of friends, which is scanty and not regular. No information dissemination mechanism about the international banana prices, and quality and SPS standards (Table 12).

Energy shortage (electricity load shading) is a common constraint for the processing segment in both the clusters. Furthermore, if the processing segment is to grow, a diversification strategy is necessary to develop new products and new markets. The model structure for banana pack house is present in Tando Allahyar district which previously was used for two to three years by some individuals. While mobile pack houses (Indian model) will be most suitable in our ecological conditions and best fitted for small land holders (>90%) in our country. If this model comes under practice, then large refer containers (already available) in the country will be used only for safe transport to long destinations. However cold stores are needed at each banana growing districts. Such infrastructure has the potential to benefit the whole horticulture sector, along with banana.



**Table 11: Gaps and Constraints at Trading Level**

Parameter	Central & Lower Sindh cluster	Upper Sindh Cluster
Marketing channels	Traditional	Traditional
Provision of market information	Scanty information about local market, and no information about international markets	Scanty information about local market, and no information about international markets
E-commerce platforms	Not available	Not available
Contract farming	No	No
Export readiness	Limited	Limited
Certifications (phytosanitary)	No	No
Branding	Minut level	Not available



## 7. CLUSTER DEVELOPMENT POTENTIAL

### 7.1. Overview

Ninety-five per cent of banana area is under Basrai variety (Cavendish dwarf), and the remaining is under William Hybrid. Recent introductions of Grand Naine (G-9) variety and possibly soon high yielding Chinese varieties viz. B-10, W-11, and Pisang have created big potential for productivity improvement. With the introduction of tissue-culture disease free plantation, these varieties have 400-500 percent more potential than the existing varieties.

### 7.2. Production Potential

The global average yield is 21 tonnes/ha whereas in Pakistan is only 4.2 tonnes/ha – thus a yield gap of 16.8 tonnes/ha exists. The cluster-level yields are 4.0 tonnes/ha in Central & Lower Cluster and 4.6 ton/ha for Upper Sindh cluster.

The population of Pakistan has crossed the figures of 197 million as reported in census 2017. The banana production in Pakistan gives the annual per capita consumption of banana at 0.58 kg which is less than previous figures at 0.9 kg per capita in 1995. These consumption levels are negligible and at the bottom line. However, banana annual per capita consumption of world has reached at 11.9 kg; Ecuador has the record of maximum of 99.0 kg followed by Philippine and Angola at 55.6 and 48.9 kg, respectively.

Thus there is huge demand potential within the domestic market. Pakistan can increase the banana production to meet its domestic demand through vertical increase in production by introducing modern production technologies including high yielding and disease free banana varieties, good agronomic practices, and improved value chain practices.

If we just double the banana yield up to (8.0 t/ha), i.e., two fold in both clusters by replacing the very low yielding banana gardens with high-yielding improved variety gardens, against the 400-500% higher yield potential of these gardens, and 30% increase in the yield of all the gardens due to improved management practices, this will increase the banana production by 50% in Central and Lower Sindh with an additional value of about US\$6.5 million (or Rs.877 million according to existing exchange rate of 1 US\$ = 135 PKR).

In Pakistan unemployment is a major problem and it increases day by day with the increasing population. Presently agriculture sector is unable to generate sufficient employment opportunities to absorb the growing labor force. The employment elasticity of agriculture is 0.13% in long run and 0.9% in the short run. However, by adopting the latest production techniques banana clusters will not only increase income up to 500% but also generate employment about 6.5% as indicated by Kalsoom et al (2008) "Ten percentage increase in GDP leads to generate 1.3% jobs in short run and 1.1% jobs in long run." Currently, an estimated number of people are engaged in banana production in Sindh. Introduction of new technologies are expected to generate employment opportunities in the Sindh banana cluster.



### **7.3. Production to Export Ratio**

Pakistan stands at 24<sup>th</sup> rank in the export of banana by exporting 74.5% of its production, while the global average production to export ratio is 18.7%. However, new export opportunities have been created, especially with China, Saudi Arabia, UAE, Iran and Tajikistan with soon opening up of new CPEC routes. With the increase in production-export ratio to the world average level, the export will increase from the current level, which will generate US\$ in foreign exchange earnings.

This additional export is possible from the enhanced production due to the adoption of improved management practices and high-yielding varieties, renovation of banana gardens, and reducing post-harvest losses without having much impact on the local supplies. Only of the additional production in Lower and Central and upper Sindh cluster will be go for export purpose and remaining production will be used to enhance per capita consumption. In addition to additional foreign exchange earnings, this will improve the health of Pakistani consumer.

### **7.4. Improvement in Quality and Price**

One of the areas of concern in banana sector of Pakistan is that there exists a gap in export price of banana when Pakistani export prices are compared with the global average export prices of the commodity. Average export price of Pakistani banana is US\$449 per tonnes compared to international banana at US\$ for per tonnes. We are suggesting interventions and strategies which will improve the quality of exportable banana to at least equal to the international average export price. This will bring additional revenue of US\$520 from enhanced export from both clusters.

Similarly, strategies are suggested to enhance the quality of 10% banana production destined to the domestic market equal to the average export quality. This improvement in the quality will bring the price of 10% banana in the country equal to the international average export price which will bring additional revenue to the domestic value chain actors from both the clusters.

### **7.5. Reduction in Post-Harvest Losses**

One of the major concerns of agriculture in the country is high post-harvest losses. Strategies are available to reduce post-harvest losses which will be explained in the next section. The reduction in post-harvest losses from 30 to 10% will bring US\$ additional revenue to various stakeholders in the value chain from both the cluster.

### **7.6. Improved Processing**

Currently, very little work has been done on banana processing in the country, while internationally different products are being processed like banana powder, puree, banana flour, jam, figs, chips and beverages. In upper Sindh cluster, three small value added product units have been established by Pakistan Agriculture Research Council at Khairpur district where initially banana chips, powder, fig, biscuits, cakes and chatti and the products are



marketed at local level. The trainings were also imparted to local male and female farmers by these units. The recipes of banana powder, figs, chips, jam, puree and beverages have been successfully developed and introduced in the market at some extent by PARC through these values added units at khairpur and Sindh. There is potential to extend this work to union council level in banana cluster areas by introducing small processing units to farmers' groups.



## 8. PLAN, POLICIES AND STRATEGIES

### 8.1. Plan

Looking at the potential and discussions with the stakeholders along the value chain, following plan was made and targets are fixed (Table 13) to achieve the potential in banana value chain

**Table 12: Following the targets of banana cluster development plan**

Sr.	Targets
1.	Increase yields by 30% from the current base.
2.	Reduce post harvest losses from 30 % to 10% in both clusters.
3.	Enhance banana processing to 5% of the banana production
3.	Increasing the export from 33% to 50% of the production
4.	Improve export value chain thus enhancing export price at least equal to the world average export price
5.	Enhanced value addition of banana to bring the price of 10% of banana produce destined in the domestic market equal to the world average price.

### 8.2. Policy Reforms

Pakistan needs a parametric shift in its policies towards the banana sector. The sector needs big investment at the production, processing, and value chain level to make it viable and competitive with international market. First of all, the R&D capacity related to banana needs to be substantially enhanced. A Banana Research and Development Institute should be established in Sindh to cover all aspects of banana value chain issues including tissue culture nursery production. Secondly, the government should recognize that most of the existing banana bunches are effected with virus thus producing low yield with low quality banana. Thus if banana sector has to survive in Pakistan, the government has to make investment to replace old banana bunches with the high-yielding and virus free bunches through a special program for this purpose. This will require big investment and farmers' persuasion but it would be worth making it as India has transformed its banana sector competitive by making such investment quite a long time before. As a part of the bunch replacement program, tissue culture labs should be established in which can regularly supply the virus free seedlings and regularly update the banana variety. Thirdly, collection centers at union council level should be established which are equipped with appropriate information dissemination mechanisms, cold storage, moving pre-cooling chambers, small packing facility, etc. so that these can become the focal point for the banana development in the province; and Finally training of value chain actors including on improved production and value chain management practices will be needed.



### **8.3. Production Level Strategies**

Increase yields by 50% in five years from the current base will be achieved by: a) establishing Sindh Banana Research and Development Center which will continuously supply and promote innovative technologies along the value chain; b) introducing latest available varieties as discussed in the previous section, c) encouraging the establishment of banana tissue culture labs through proper incentives, d) demonstrating and training of farmers on improved management practices, e) control of BBTV & PANAMA diseases through prevention and plantation of diseased free, healthy tissue cultured plants; f) renovation of existing low yielding gardens through proper incentives.

### **8.4. Reduction in Post-Harvest Losses**

The strategies suggested to reduce post-harvest losses from 30% to 10% are bunch management, modern harvesting techniques, pre-cooling, the strategies suggested to reduce post-harvest losses from 30% to 10% are bunch management, modern harvesting techniques, de handling, pre-cooling, small packing, safely transportation, use of refer containers, etc. in both clusters. Small packing, safely transportation, use of refers containers, etc. in both clusters.

### **8.5. Value Chain Improvement**

The banana value chain will be improved to enhance banana quality and its export price at least equal to the world average by adopting best practices, such as globally accepted phyto-sanitary standards and certification regimes. The strategies to be adopted for this purpose are a) organizing Farmer Management Groups (FEG) to manage the cluster infrastructure and ensure quality, b) establishment of banana collection centers at the union council level which will be equipped with appropriate space for the collection of banana from the farm, moving pre-cooling chambers, grading facilities, cold storage and processing units; c) raining of farmers for good agronomic practices and harvesting; d) training of stakeholders for the efficient management of banana value chain; e) training for certification in food safety and quality management systems; and (f) organic and GI (Geographical Identification) and certification costs.

The Indian model for mobile pre-cooling units in the private sector is a good example to develop dedicated supply chains with farmer groups, although these units are suggested to be owned by the FEG in Sindh who is also managing the collection centers. Certifications for IPPC, phyto-sanitary, organic banana, and registration of Geographical Indication<sup>1</sup> may also add value.<sup>1</sup>

### **8.6. Processing of Banana**

The opportunities for product development are unlimited, from improving the quality, packaging and marketing of all these products and seeking new markets, especially in the

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<sup>1</sup>GI can be used on products that have a specific geographic origin and possess qualities or a reputation that are intrinsically due to that place of origin





organic and ingredients market niches. However, we suggest initially limited processing for dried bananas.

The PARC work on banana processing will be extended and banana processing units will be established in the collection centers at the union council level. Machine and equipment for processing fresh banana into dried product will be provided in each unit on cos sharing basis. Interested processors will be trained through FEGs. Moreover, some big firm will be engaged to collect these products and find their markets at national and international levels. The economic viability of small scale banana processing plant for chips is elaborated in Annexure 6.

## **8.7. Marketing and Trading Level Strategies**

Establishment of Fruit Processors/Traders Association may be established as a platform for promoting banana trade with overseas and domestic level. Through increased collaboration between processors, larger orders will be achieved through one portal. Marketing and promotion costs will be shared across the association and banana will be marketed with brand name. Potential market linkages include contacting and visiting overseas processors using new technologies for production and post-harvest handling.

These strategies will be common in both the clusters, although their priorities and levels will vary depending upon the level of banana production, extent of the problem to be solved, market proximity for various product, etc.



## 9. BENEFITS AND COSTS OF CLUSTERING

Interventions are being proposed here to increase banana yield, reduce post-harvest losses, improve value chain, and convert basic crop production into high value added products; so as to enhance export and increase the overall value of the produce for the farmers and for other sector stakeholders. Cost and benefit analysis has been done separately for each of the two clusters.

The economic and financial analysis of banana clusters has been carried out by identifying the benefits of the proposed interventions and their associated costs. Cost and benefit analysis has been done in a five-year timeframe; separately for each of the three clusters. Discounted cash flow analysis has been carried out to work out the economic viability of the proposed interventions in terms of NPV and IRR.

### 9.1 Key Interventions and Benefits of Clustering

Following five key interventions have been proposed for transformation of banana sector of Pakistan.

- i) improvement in yield by orchards renovation
- ii) improvement in banana yield by introducing new varieties and improved management practices
- iii) improvement in management practices to reduce post-harvest losses
- iv) improvement in value addition which will result:
  - a. increase in banana exports
  - b. improvement in banana quality in export and domestic markets

The expected benefits by implementing the proposed interventions have been based on certain assumptions which have been decided in discussion with banana sector experts. Expected benefits have been calculated with reference to the baseline situation of each of the three clusters. Based on the assumptions, the value addition by implementing these interventions has been calculated in a seven-year timeframe; so as to incorporate the two-year gestation period for the new orchards.

The resources required for the implementation of the proposed interventions package includes i) additional operational costs of improved banana production, value chain development, and processing, and ii) sector development investments like R&D by government, iii) fixed capital investment in machinery, etc. by government and private sector. The whole analysis has been based on incremental costs and benefits of the proposed interventions.

The detailed feasibility of banana chips plant is separately estimated and explained in Appendix 6. For each cluster, the number of banana chips plants required was estimated based on the estimated banana quantities that will be processed and capacity of the chips



plant. Total investment and operational costs of processing in each cluster were incorporated in the main feasibility model. However, in the following section, we just explained the feasibility of the whole package of interventions.

## 9.2 Lower Sindh Banana Cluster

### 9.2.1 Current Situation

The study has considered 4,532 ha of area under banana production in the focal point of Lower Sindh banana cluster which is currently producing 18,008 tonnes of bananas per year. Current yield in the cluster is 3.97 tonnes/ha; growing negatively at -0.55% per annum shows the cluster's current production performance.

**Table 13: Lower Sindh Cluster – Current Production Situation at the Focal Point**

Banana Cluster in Lower Sindh – Current Situation	
Area under cultivation in cluster (ha)	5,176
Total Production (tonnes)	20,229
Production yield (tonnes/ha)	3.91
Annual yield growth without intervention	-0.55%
Farm gate price of banana (USD/tonnes)	328

Banana production and its value at the current farm gate price in the next seven years in a no-intervention scenario is shown in **Error! Reference source not found.5**.

**Table 14: Lower Sindh Cluster Focal Point – Banana Production in No-Intervention Scenario**

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Default yield (tonnes/ha)	3.87	3.84	3.82	3.80	3.78	3.76
Annual expected production without intervention (Tonnes)	20,006	19,896	19,787	19,678	19,570	19,462
Total value of production at farm gate (000 USD)	6562.1	6526.0	6490.1	6454.4	6418.9	6383.6

### 9.2.2 Benefits of the Proposed Interventions

#### 9.2.2.1. *Benefit 1 - Increase in Production Yield by Banana Orchards Renovation*

Banana orchards will be renovated on certain share of the cultivated area to introduce new improved varieties that will have higher yields. R&D will be initiated to ensure right selection of varieties and to demonstrate successful cultivation of those varieties. New varieties may be imported from other countries. The renovation of these orchards will start from the first year and will contribute till fifth year. There will be a gestation period of two years which means that the first crop will be harvested in third year and the crop cultivated in fifth year will be harvested in seventh year. It is estimated that the new orchards will have double the



yield of the existing varieties. It is assumed that renovated orchards will be established on 30% of the cultivated areas. This will be done over a period of five years which means that 6% area will be added in each year from first year to fifth year. Based on these assumptions, the value of increased banana production at the new improved price of USD 449 per ton (Table 16).

**Table 15: Focal Point Lower Sindh Cluster- Increased Banana Yield by Renovated Orchards**

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Percentage of area for orchard renovation (%)	6%	6%	6%	6%	6%		
Area on which orchards would be renovated per year (ha/y)	311	311	311	311	311		
Additional production from increased yield (t)			1,194	1,187	1,181	1,174	1,168
Expected additional returns from this intervention at value added price(000 USD)			536.0	533.1	530.1	527.2	524.3

#### **9.2.2.2. Benefit 2 - Increase in Production Yield by Improved Farm Management Practices**

Improved management practices, and R&D in banana cultivation will lead to increase in crop production yield. The research will introduce new varieties and hybrids available from research system in the country or import those from other countries. These new hybrids and varieties (in other countries having similar situation) will be directly tested under farmers' condition starting from the first year and continue until the seventh year of the project. Farmers will be allowed to select the best material for cultivation. Large scale field demonstration of improved farm management practices and new best performing varieties will also be demonstrated by the provincial extension department in collaboration with NGOs and development partners starting from the first year and continue until the fourth year. It is estimated that these efforts in Lower Sindh cluster will increase the banana yield by 50% over a period of five years. However, it is assumed that farmers will gradually adopt new practices and variety; thus yield increase in the cluster will also be gradual at a rate of 12.5% per year starting from the second year. Based on these assumptions, the value of increased banana production at the existing rate of USD 328 per ton is shown in 17.

**Table 16: Focal Point Lower Sindh Cluster - Increased Banana Value by Increased Production Yield**

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Yield increase over four years	12.50%	25.00%	37.50%	50.00%	50.00%	50.00%
Increase in yield (tonnes/ha)	0.48	0.96	1.43	1.90	1.89	1.88
Additional production from enhanced yield (tonnes)	2,501	4,974	7,420	9,839	9,785	9,731
Expected additional value (USD)	820,266	1,631,509	2,433,803	3,227,223	3,209,473	3,191,821



### 9.2.2.3. *Benefit 3 – Reduction in Post-Harvest Losses*

Banana crop faces the issue of high post-harvest losses of up to 30%. Pack houses with the facility of sorting, grading, washing, packaging and cold storage will be incentivized in the cluster. Farmers will be trained on the harvesting index for banana to help them identify appropriate matured banana. Proper harvesting baskets will be introduced to the harvesters. It has been estimated that with these proposed improved farm management and post-harvest practices, these losses can be reduced to 10%. This will lead to increasing the value of the banana crop for the farmer and the downstream players in the value chain. It has been assumed that reduction in post-harvest losses will occur from the second year of interventions when the results of improved value chain management practices will be realized. Again the adoption of these practices will be gradual by the farmers, thus a linear gradual reduction in losses at a rate of 5.0% per year has been assumed. Based on these assumptions, the value of increased banana production in Lower Sindh cluster at the existing rate of USD 328 per ton is shown in **Error! Reference source not found.18**.

**Table 17: Focal Point Lower Sindh Cluster – Increased Banana Production by Reducing Post-Harvest Losses**

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Post-harvest losses after intervention	5.0%	10%	15.00%	20.00%	20.00%	20.00%
Increased marketable Production due to reduced losses (Tonnes)	1,125	2,606	4,258	6,140	6,106	6,072
Expected additional value (000 USD)	369.1	854.9	1396.7	2013.8	2002.7	1991.7

### 9.2.2.4. *Benefit 4 – Value Addition*

Banana can be processed into different value added products like dried banana, banana chips, etc. It has been estimated that 1% of the total production from the cluster will be processed into banana chips which can be currently sold to the consumers in the local market. It is assumed that 1% conversion into chips will be achieved in four years at a linear rate of 0.25% per year. Conversion factor of banana into pulp has been considered to be 20%. It is estimated that 5 plants will be required in the whole cluster to process one percent banana into chips by fifth year. Banana chips making plants will be provided to farmers at 20% subsidy rates to those farmers who organize themselves into Farmers Enterprise Groups (FEG) and deposit in advance 80% of the plant cost. The government will incentivize the banana chips manufacturing. Economic feasibility of banana chip making plant is elaborated in Annexure 6. This intervention will add value to the banana production from the cluster. Projected values of this value addition activity at a banana chips price of USD 6,000 per ton is shown in **Error! Reference source not found.19**.

**Table 18: Lower Sindh Cluster - Value Addition by Banana Paste Production**

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
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Production to be processed into banana chips (Tonnes)	0.25%	0.50%	0.75%	1.00%	1.00%	1.00%
Banana converted into chips (Tonnes)	52.6	127.6	218.0	327.9	326.1	324.3
Total chips produced (tonnes)	10.5	25.5	43.6	65.6	65.2	64.9
Expected additional value (USD)	63,114	153,138	261,608	393,517	391,352	389,200

#### 9.2.2.5. *Benefit 5 – Increase in Exports*

The proposed plan envisages increasing banana exports of the country. Pakistan currently exports 27.8% of the total national production of banana which is very low. It is estimated that with focused efforts, it will be possible to export 50% of the total production of the Lower Sindh banana cluster. These efforts will include sponsored trip of current and intended banana exporters to potential markets, sponsored participation of exporter to international food festivals, introducing banana brands, setting up an information desk by the FEG (incentivized by the government) to provide information related to international banana market requirements, etc. A linear export growth at the rate of 5.55% per year has been assumed. Additional exports have been valued at the existing average export price of USD 449 per ton. It is assumed that increased exports will start from the second year of interventions. Based on these assumptions, the value of increased banana exports is shown in **Error! Reference source not found.20**.

**Table 19: Lower Sindh Cluster – Expected Increased Banana Exports Value**

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Increase in export to production ratios (%)	5.55	11.10	16.65	22.20	22.20	22.20
Increased volume to be exported (ton)	1,168	2,833	4,840	7,280	7,240	7,200
Additional value from exports (000USD)	141.3	342.8	585.6	880.9	876.0	871.2

#### 9.2.2.6. *Benefit 6 – Increased Price in Domestic and International Market*

The improved value chain activities as highlighted in the post-harvest section and improved interaction with international market as highlighted in the previous section will improve the quality and price of banana to be marketed in the national and international markets. For export market, it is estimated that the exporter will be able to achieve the average international export price of US\$520 instead of current Pakistani export price of US\$449. This improvement in price will be achieved at a linear rate in four years; with the export price being increased by USD 17.8 per ton each year. For the domestic market, it is assumed that 10% of the total production from the cluster will be sold at par with the export market price. This will be achieved in four years with the addition of 2.5% each year. Benefits from this intervention over four years are shown in table 21.

**Table 20: Lower Sindh Cluster – Additional Value by Price Increase in Export and Local Markets**

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
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Improved export price (USD/ton)	17.8	35.5	53.3	71.0	71.0	71.0
Expected additional value from exports (USD) (A)	20,725	100,573	257,716	516,884	514,041	511,214
% of domestic production to be evaluated at international prices	2.50%	5.00%	7.50%	10.00%	10.00%	10.00%
Domestic production that will receive improved value chain operation (tonnes)	526	638	727	820	815	811
Expected additional value from exports (USD) (B)	100,982	122,510	139,524	157,407	156,541	155,680
Total expected additional value (USD) (A+B)	121,707	223,083	397,240	674,291	670,582	666,894

### 9.2.3 Total Benefits Summary

Summary of the value of the benefits of the proposed interventions is shown in Table 22.

**Table 21: Focal Point of Lower Sindh Cluster - Summary of the Value of Benefits of Interventions**

Benefits Value (000USD)	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Orchard Renovation	0.0	536.0	533.1	530.1	527.2	524.3
Improved practices	820.3	1631.5	2433.8	3227.2	3209.5	3191.8
Reduced Post-Harvest Losses	369.1	854.9	1396.7	2013.8	2002.7	1991.7
Processed Products	70.9	172.0	293.9	442.1	439.6	437.2
Increased Exports	158.7	385.1	657.8	989.5	984.1	978.7
Improved Prices	136.7	250.6	446.2	757.5	753.3	749.1
Total Value	1555.7	3830.1	5761.5	7960.2	7916.4	7872.9

### 9.2.4 Enhanced Costs of the Proposed Interventions

The above proposed interventions will add cost of orchard renovation, producing, processing, and value addition of banana. The costs of the proposed interventions involve two types of costs i) value chain improvement costs and ii) sector support interventions costs.

#### 9.2.4.1. Value Chain Improvement Operational Costs

The proposed sector transformation plan includes interventions both for on-farm and off-farm activities. Improvement entails spending more money for carrying out those activities on modern lines. Existing costs and the proposed incremental increases for different cost heads are shown in 6 and Table23.

**Table 22: Lower Sindh Cluster – Orchard Renovation Costs**

Cost Head	Cost (USD)
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Cost of orchard renovation (USD/ha) - only labor	50
Cost of new orchard during gestation period (USD/ha/year)	1,842
Benefit from intercropping when banana plants in gestation period (USD/ha)	1,200

**Table 23: Lower Sindh Cluster – Value Chain Costs and Proposed Incremental Increases Cost Head**

	Cost	Incremental Increase
Production Inputs and Harvest (land preparation, inputs, labor, etc.) (USD/ha)	1,588	16%
Transportation and Storage (USD/ton)	53	20%
Grading and packaging (USD/Ton)	12	0.31%
Processing (USD/ton chips)	4,000	0%
Wholesaling in domestic market (USD/ton)	74	1.25%
Wholesaling/retailing in export market (USD/ton)	100	2.5%
Branding (USD/ton)	7	0%

Based on the above unit costs, total value chain costs for the entire cluster were calculated. It was assumed that costs will be incurred from the second year of implementation. Total planned increase in cost was distributed over four years as per the interventions in those years. Value chain costs projections are shown in Table 25.

**Table 24: Lower Sindh Cluster – Value Chain Improvement Costs**

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Production Inputs and Harvest (USD/ha)	287,693	575,387	863,080	1,150,774	1,150,774	1,150,774
Transportation and Storage (USD/ton)	176,679	435,098	655,357	901,087	896,131	891,202
Grading and packaging (USD/Ton)	251,482	609,207	894,846	1,195,962	1,189,384	1,182,842
Processing (USD/ton)	42,076	102,092	174,405	262,345	260,902	259,467
Wholesaling in domestic market (USD/ton)	206,701	499,388	664,049	803,633	799,213	794,818
Wholesaling/retailing in export market (USD/ton)	53,910	66,998	78,119	90,181	89,685	89,192
Branding (USD/ton)	12,545	25,712	41,233	59,999	59,669	59,341
Total Costs (USD)	1,341,368	2,450,378	3,373,968	4,323,044	4,093,274	3,879,685

#### **9.2.4.2. Cluster Development Investment Costs**

Lower Sindh banana cluster has huge growth potential by virtue of the diverse agro ecological conditions of the province. A mega program will be launched that will include





variety development suited to local environment, establishment of Banana tissue culture labs, cost sharing strategy for the provision of healthy & diseased free seedlings to the farmers for the replacement of old, infested, low yielding, uneconomical Banana variety, Good agronomic practices, technical guidelines for establishing, managing and certification of proper Banana orchards, through the establishment of High class Banana Research institute. In addition, it will also include establishment of cold storages packs houses, processing units to promote the production of quality banana to meet the domestic demand as well as export purposes.

The proposed budget for cluster development interventions in Lower Sindh will be USD 3.62 million). About 70% of this investment should be provided by the federal government, by establishing a Cluster Development Fund (CDF) under PSDP. The remaining 30% should come from the provincial budgets. Details are provided in Table 26.

**Table 25: Lower and Central Sindh Cluster - Inputs and Infrastructure Needs for Cluster Development**

S #	Strategy	Interventions	Implementing Agency
1.	Orchard Renovation	Renovate the orchards with new high yielding varieties	
2.	Production Level Strategies: (Increase yields by 30% in 5 years)	Develop a Cluster Development Project	PARC/DoA Lower Sindh/Private sector
		<ul style="list-style-type: none"> <li>Establishment of Banana Research Institute in Thatta for varietal development.</li> <li>Establishment of Banana Tissue culture labs at each banana growing district.</li> <li>Replacement of diseased infested old Banana orchards (30%) with healthy, diseased free and high yielding varieties.</li> <li>Supply of healthy, diseased free Banana plants through public and private nurseries @ 50% discount rate.</li> <li>Establishment of model farms with good agronomic practices: planting geometry, bunch cover &amp; management practices.</li> </ul>	
3.	Processing and Value Addition Level Strategies: (Establish storage, grading, packing and increase quantities of dried by products at least 3-5% of production)	<ul style="list-style-type: none"> <li>Application of latest post-harvest technologies used by other banana exporting countries.</li> <li>Send groups of farmers, traders and scientists to these countries to learn post-harvest techniques.</li> <li>Introduction of Mobile processing units(Indian Model) for export of quality products</li> </ul>	PARC/DoA Lower Sindh/Private sector
		<ul style="list-style-type: none"> <li>Training and certification in processing and food safety and quality management systems</li> </ul>	PARC/DoA Sindh
		<ul style="list-style-type: none"> <li>Provide tax incentives to investors for establishing commercial storage and cold chains; a small cold-room facility at airport is needed for avoiding breaking the cold chain during custom checking</li> </ul>	PARC/DoA Sindh
		<ul style="list-style-type: none"> <li>Establishment of Cold stores at Thatta &amp; Matiari&amp; development of complete cold chain from harvesting field to transportation and marketing</li> </ul>	PARC



4.	Marketing and Trading Level Strategies: (Increase the export to production ratio up to 10% in five years; Improve the quality and export price up to international standards)	<ul style="list-style-type: none"> <li>• Require public sectors transporters, Cargo services, (PIA) to offer discounted cargo services especially refer containers.</li> <li>• Formation of Banana Board and build its institutional capacity.</li> <li>• Develop Banana Product Brands, and organize a national competition for designing attractive packaging that follow international specifications.</li> <li>• Sponsor/ cost-share CGAGB members to attend international exhibitions and trade fairs, and summits Include Banana bilateral/ multilateral trade agreements with friendly countries (OIC, Arab League, China).</li> <li>• Undertake high quality research on all aspects of the Banana value chain</li> </ul>	PARC/DoA Lower Sindh
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Note: Investment cost of each component can be seen in Table 27.

This proposed cluster development cost will be spent in a period of four years starting from year 1. Yearly distribution of these costs will be driven by the interventions planned for that year. For example, the processing cost will be driven by the number of banana chips manufacturing units that will be required each year to meet the set production target. Similarly, the marketing costs will be driven by the number of banana collection centers that will be established each year. For production level strategies, it is assumed that 40% of this cost of production level strategies and marketing/trading level strategies will be spent in year 1, 30% in year 2 and 15% each in year 3 and year 4. With these assumptions, the cost distribution is shown in Table 26.

**Table 26: Lower Sindh Cluster–Cluster Development Investments (000 US\$) Projections**

Investment Head	Total	Year 1	Year 2	Year 3	Year 4	Year 5
Strengthening research	740.7	296.3	222.2	111.1	74.1	37.0
Capacity building of farmers and value chain agents	547.7	219.1	164.3	82.2	54.8	27.4
Orchard renovation-Plant material	1886.4	377.3	377.3	377.3	377.3	377.3
Tissue culture lab establishment	132.0	66.0	0.0	66.0	0.0	0.0
Processing level intervention	177.8	29.6	29.6	59.3	59.3	
Value Chain Improvement-Collection Center	1698.4	424.6	424.6	424.6	424.6	0.0
Linking stakeholders with markets, e-commerce platform, foreign trips, etc.	50.0	20.0	15.0	7.5	5.0	2.5
Government loans	215.8	52.2	52.2	55.6	55.6	0.0
<b>Total Investment</b>	<b>5448.7</b>	<b>1485.1</b>	<b>1285.3</b>	<b>1183.5</b>	<b>1050.6</b>	<b>444.2</b>

## 9.2.5 Economic Viability of Cluster Development Plan

Based on the benefits and the costs of the proposed interventions package in the above paragraphs, the economic viability of the proposition has been calculated in terms of



project's NPV and IRR. Discounted cash flow analysis has been carried out using an annual discount rate of 8.5%. Calculations and results are shown in Table 27.

**Table 27: Lower Sindh Cluster-Economic Viability of Proposed Intervention Plan**

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Total Benefits of the Interventions (Mil. USD)	-	1.556	3.830	5.761	7.960	7.916	7.873
Total operational costs (Mil. USD)	-	1.341	2.450	3.374	4.323	4.093	3.880
Total investment costs (Mil. USD)	1.485	1.285	1.184	1.051	0.444	0	0
Net Cash Flows (Mil. USD)	-1.485	-1.071	0.196	1.337	3.193	3.823	1.485
<b>NPV (Mil. USD)</b>				<b>5.562</b>			
<b>IRR</b>				<b>45.9%</b>			

A positive NPV of USD 3.1 million indicates that the interventions package proposed for uplift and transformation of Lower Sindh banana cluster is an economically viable proposition.

## 9.3. Upper Sindh Banana Cluster

### 9.3.1. Current Situation

The study has considered 6,151 ha of area under banana production in the focal point of Upper Sindh banana cluster which is currently producing 28,456 tonnes of bananas per year. Current yield in the cluster is 4.63 tonnes/ha; growing negatively at -0.55% per annum shows the cluster's current production performance.

**Table 28: Upper Sindh Cluster – Current Production Situation**

<b>Banana Cluster in Upper Sindh – Current Situation</b>	
Area under cultivation in cluster (ha)	5,161
Total Production (tonnes)	22,064
Production yield (tonnes/ha)	4.28
Annual yield growth without intervention	-0.55%
Farm gate price of banana (USD/ton)	328

Banana production and its value at the current farm gate price in the next seven years in a no-intervention scenario is shown in Table 29.

**Table 29: Focal Point Upper Sindh Cluster – Banana Production in No-Intervention Scenario**

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7



Default yield (tonnes/ha)	4.23	4.20	4.18	4.16	4.14	4.11
Annual expected production without intervention (Tonnes)	21,821	21,701	21,582	21,463	21,345	21,228
Total value of production at farm gate (000 USD)	7157.4	7118.0	7078.9	7039.9	7001.2	6962.7

## 9.3.2. Benefits of the Proposed Interventions

### 9.3.1.1. *Benefit 1 - Increase in Production Yield by Banana Orchards Renovation*

Banana orchards will be renovated on certain share of the cultivated area to introduce new improved varieties that will have higher yields. R&D will be initiated to ensure right selection of varieties and to demonstrate successful cultivation of those varieties. New varieties may be imported from other countries. The renovation of these orchards will start from the first year and will contribute till fifth year. There will be a gestation period of two years which means that the first crop will be harvested in third year and the crop cultivated in fifth year will be harvested in seventh year. It is estimated that the new orchards will have double the yield of the existing varieties. It is assumed that renovated orchards will be established on 20% of the cultivated areas. This will be done over a period of five years which means that 4% area will be added in each year from first year to fifth year. Based on these assumptions, the value of increased banana production at the new improved price of USD 449 per ton (Table 30).

**Table 30: Focal point Increase in Banana Yield by Renovated Orchards**

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Percentage of area for orchard renovation (%)	4%	4%	4%	4%	4%		
Area on which orchards would be renovated per year (ha/y)	206	206	206	206	206		
Additional production from increased yield (t)			868	863	859	854	849
<b>Additional revenue from the intervention at farmgate price (USD)</b>			389,755	387,611	385,479	383,359	381,251



### 9.3.1.2. *Benefit 2 - Increase in Production Yield by Improved Farm Management Practices*

Improved management practices, and R&D in banana cultivation will lead to increase in crop production yield. The research will introduce new varieties and hybrids available from research system in the country or import those from other countries. These new hybrids and varieties (in other countries having similar situation) will be directly tested under farmers' condition starting from the first year and continue until the seventh year of the project. Farmers will be allowed to select the best material for cultivation. Large scale field demonstration of improved farm management practices and new best performing varieties will also be demonstrated by the provincial extension department in collaboration with NGOs and development partners starting from the first year and continue until the fourth year. It is estimated that these efforts in Upper Sindh cluster will increase the banana yield by 50% over a period of five years. However, it is assumed that farmers will gradually adopt new practices and variety; thus yield increase in the cluster will also be gradual at a rate of 12.5% per year starting from the second year. Based on these assumptions, the value of increased banana production at the existing rate of USD 328 per ton is shown in Table 31.

**Table 31: Focal point Upper Sindh Cluster - Increased Banana Value by Improved Management Practices**

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Yield increase over four years	12.50%	25.00%	37.50%	50.00%	50.00%	50.00%
Increase in yield (tonnes/ha)	0.53	1.05	1.57	2.08	2.07	2.06
Additional production from enhanced yield (tonnes)	2,728	5,425	8,093	10,732	10,673	10,614
Expected additional value (000USD)	894.7	1779.5	2654.6	3520.0	3500.6	3481.4

### 9.3.1.3. *Benefit 3 – Reduction in Post-Harvest Losses*

Banana crop faces the issue of high post-harvest losses of up to 30%. Collection Centers with the facility of sorting, grading, washing, packaging and cold storage will be incentivized in the cluster. Farmers will be trained on the harvesting index for banana to help them identify appropriate matured banana. Proper harvesting baskets will be introduced to the harvesters. It has been estimated that with these proposed improved farm management and post-harvest practices, these losses can be reduced to 10%. This will lead to increasing the value of the banana crop for the farmer and the downstream players in the value chain. It has been assumed that reduction in post-harvest losses will occur from the second year of interventions when the results of improved value chain management practices will be realized. Again the adoption of these practices will be gradual by the farmers, thus a linear gradual reduction in losses at a rate of 5.0% per year has been assumed. Based on these assumptions, the value of increased banana production in Upper Sindh cluster at the existing rate of USD 328 per ton is shown in table 32.

**Table 32: Focal Point Upper Sindh Cluster – Increased Banana Production by Reducing Post-Harvest Losses**



	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Post-harvest losses after intervention (%)	5.0	10.0	15.0	20.0	20.0	20.0
Increased marketable Production due to reduced losses (Tonnes)	1,227	2,799	4,580	6,611	6,574	6,538
Expected additional value (000 USD)	402.6	918.2	1502.3	2168.3	2156.4	2144.5

#### 9.3.1.4. Benefit 4 – Value Addition

It has been estimated that 2% of the total production from the cluster will be processed into banana chips which can be currently sold to the consumers in the local market. It is assumed that 2% conversion into chips will be achieved in four years at a linear rate of 0.5% per year. Conversion factor of banana into pulp has been considered to be 20%. It is estimated that 12 plants will be required in the whole cluster to process one percent banana into chips by fifth year. Banana chips making plants will be provided to farmers at 20% subsidy rates to those farmers who organize themselves into Farmers Enterprise Groups (FEG) and deposit in advance 80% of the plant cost. The government will incentivize the banana chips manufacturing. Economic feasibility of banana chip making plant is elaborated in Annexure 6. This intervention will add value to the banana production from the cluster. Projected values of this value addition activity at a banana chips price of USD 6,000 per ton is shown in 33.

**Table 33: Upper Sindh Cluster - Value Addition by Banana Chips Production**

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Production to be processed into banana chips (ton)	0.50%	1.00%	1.50%	2.00%	2.00%	2.00%
Banana converted into chips (tonnes)	128.9	307.9	526.8	793.3	788.9	784.6
Total volume of chips produced (tonnes)	25.8	61.6	105.4	158.7	157.8	156.9
<b>Expected additional value (000 USD)</b>	<b>154.7</b>	<b>369.5</b>	<b>632.1</b>	<b>951.9</b>	<b>946.7</b>	<b>941.5</b>

#### 9.3.1.5. Benefit 5 – Increase in Exports

The proposed plan envisages increasing banana exports of the country. Pakistan currently exports 27.8% of the total national production of banana which is very low. It is estimated that with focused efforts, it will be possible to export 50% of the total production of the Upper Sindh banana cluster. These efforts will include sponsored trip of current and intended banana exporters to potential markets, sponsored participation of exporter to international food festivals, introducing banana brands, setting up an information desk by the FEG (incentivized by the government) to provide information related to international banana market requirements, etc. A linear export growth at the rate of 5.55% per year has been assumed. Additional exports have been valued at the existing average export price of USD 449 per ton. It is assumed that increased exports will start from the second year of interventions. Based on these assumptions, the value of increased banana exports is shown in Table 34.



**Table 34: Focal Point Upper Sindh Cluster – Increased Banana Exports Value**

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Increase in export to production ratios over five years (%)	5.55	11.10	16.65	22.20	22.20	22.20
Expected increased volume to be exported (Tonnes)	1,431	3,418	5,847	8,805	8,757	8,709
Expected additional value from enhanced exports (000 USD)	173.1	413.6	707.5	1065.5	1059.6	1053.8

### 9.3.1.6. *Benefit 6 – Increased Price in Domestic and International Market*

The improved value chain activities as highlighted in the post-harvest section and improved interaction with international market as highlighted in the previous section will improve the quality and price of banana to be marketed in the national and international markets. For export market, it is estimated that the exporter will be able to achieve the average international export price of US\$520 instead of current Pakistani export price of US\$449. This improvement in price will be achieved at a linear rate in four years; with the export price being increased by USD 17.8 per ton each year. For the domestic market, it is assumed that 10% of the total production from the cluster will be sold at par with the export market price. This will be achieved in four years with the addition of 2.5% each year. Benefits from this intervention over four years are shown in 35.

**Table 35: Upper Sindh Cluster – Additional Value by Improved Quality in Export and Local Markets**

(000 US\$)	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Improved export price (USD/ton)	0.0	0.0	0.1	0.1	0.1	0.1
Expected additional value from exports (000 US\$) (A)	25.4	121.3	311.4	625.2	621.7	618.3
% of domestic production to be evaluated at international prices	0.0	0.0	0.0	0.0	0.0	0.0
Domestic production that will receive improved value chain operation (tonnes)	0.6	0.8	0.9	1.0	1.0	1.0
Expected additional value from exports (000 US\$)(B)	123.7	147.8	168.6	190.4	189.3	188.3
Total expected additional value (000 USD) (A+B)	149.1	269.2	479.9	815.6	811.1	806.6

### 9.3.3. **Total Benefits Summary**

Summary of the value of the benefits of the proposed interventions is shown in Table 36.

**Table 36: Upper Sindh Cluster - Summary of the Value of Benefits of Interventions**

Benefits Value (000 USD)	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
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Value of Orchard Renovation	0.0	389.8	387.6	385.5	383.4	381.3
Value of Improved practices	894.7	1779.5	2654.6	3520.0	3500.6	3481.4
Value of Reduced Post-Harvest Losses	402.6	918.2	1502.3	2168.3	2156.4	2144.5
Value of Processed Products	154.7	369.5	632.1	951.9	946.7	941.5
Value of Increased Exports	173.1	413.6	707.5	1065.5	1059.6	1053.8
Value of Improved Quality	149.1	269.2	479.9	815.6	811.1	806.6
<b>Total Value</b>	<b>1774.2</b>	<b>4139.8</b>	<b>6364.0</b>	<b>8906.7</b>	<b>8857.7</b>	<b>8809.0</b>

### 9.3.4. Enhanced Costs of the Proposed Interventions

The above proposed interventions will add cost of orchard renovation, producing, processing, and value addition of banana. The costs of the proposed interventions involve two types of costs i) value chain improvement costs and ii) sector support interventions costs.

#### 9.3.4.1. Value Chain Improvement Operational Costs

The proposed sector transformation plan includes interventions both for on-farm and off-farm activities. Improvement entails spending more money for carrying out those activities on modern lines. Existing costs and the proposed incremental increases for different cost heads are shown in Table 37.

**Table 37: Upper Sindh Cluster – Orchard Renovation Costs**

Cost Head	Cost (USD)
Cost of orchard renovation (USD/ha) - only labor	50
Cost of new orchard during gestation period (USD/ha/year)	1,842
Benefit from intercropping when banana plants in gestation period (USD/ha)	1,200

**Table 38: Upper Sindh Cluster – Value Chain Costs and Proposed Incremental Increases Cost Head**

	Cost	Incremental Increase
Production Inputs and Harvest (land preparation, inputs, labor, etc.) (USD/ha)	1,588	16%
Transportation and Storage (USD/ton)	53	20%





Grading and packaging (USD/Ton)	12	1.25%
Processing (USD/ton chips)	4,000	0%
Wholesaling in domestic market (USD/ton)	74	1.25%
Wholesaling/retailing in export market (USD/ton)	100	2.5%
Branding (USD/ton)	7	0%

Based on the above unit costs, total value chain costs for the entire cluster were calculated. It was assumed that costs will be incurred from the second year of implementation. Total planned increase in cost was distributed over four years as per the interventions in those years. Value chain costs projections are shown in Table 39.

**Table 39: Focal Point Upper Sindh Cluster – Value Chain Improvement Operational Costs (000 US\$)**

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Production Inputs and Harvest	327.6	655.2	982.9	1310.5	1310.5	1310.5
Transportation and Storage	216.5	507.3	775.8	1075.2	1069.3	1063.4
Grading and packaging	49.3	113.4	168.9	227.0	225.8	224.5
Processing	103.1	246.4	421.4	634.6	631.1	627.7
Wholesaling in domestic market	253.3	569.4	772.2	944.5	939.3	934.1
Wholesaling/retailing in export market	66.1	80.8	94.4	109.1	110.9	112.8
Branding	15.4	31.0	49.8	72.6	72.2	71.8
<b>Total Costs</b>	<b>1802.5</b>	<b>2974.8</b>	<b>4036.6</b>	<b>5144.8</b>	<b>4359.1</b>	<b>4344.8</b>

#### **9.3.4.2. Cluster Development Investment Costs**

Upper Sindh banana cluster has huge growth potential by virtue of the diverse agro ecological conditions of the province. In this cluster all the activities and plans will be the same as the ones for Lower Sindh cluster; however, with the establishment of Banana Research Station (instead of full Institute) which will operate under the main Banana Research Institute Thatta.

The proposed budget for cluster development interventions in Upper Sindh will be USD 3.85 million). About 70% of this investment should be provided by the federal government, by establishing a Cluster Development Fund (CDF) under PSDP. The remaining 30% should come from the provincial budgets. Details are provided in Table 40.

**Table 40: Upper Sindh Cluster - Inputs and Infrastructure Needs for Cluster Development**



S #	Cluster Strategy	Interventions	Implementing Agency
1.	Orchard Renovation	Renovate the orchards with new high yielding varieties	
2.	Production Level Strategies: (Increase yields by 30% in 5 years)	<p>Develop a Cluster Development Project</p> <ul style="list-style-type: none"> <li>Establishment of Banana Tissue culture labs at each banana growing district.</li> <li>Replacement of diseased infested old Banana orchards at least (30%) with, healthy, diseased free and high yielding varieties.</li> <li>Supply of healthy, diseased free Banana plants through public and private nurseries @ 50% discount rate.</li> <li>Establishment of model farms with good agronomic practices: Planting geometry, Bunch cover &amp; management techniques.</li> </ul>	PARC/DoA Upper Sindh/Private sector
3.	Processing and Value Addition Level Strategies: (Establish storage, grading, packing and increase quantities of dried by products at least 1-3% of production)	<ul style="list-style-type: none"> <li>Application of latest post-harvest technologies used by other banana exporting countries.</li> <li>Send groups of farmers, traders and scientists to these countries to learn post-harvest techniques.</li> <li>Introduction of Mobile processing units (Indian Model) for export of quality products</li> </ul>	PARC/DoA Upper Sindh/Private sector
		<ul style="list-style-type: none"> <li>Training and certification in processing and food safety and quality management systems</li> </ul>	PARC/DoA Sindh
		<ul style="list-style-type: none"> <li>Provide tax incentives to investors for establishing commercial storage and cold chains; a small cold-room facility at airport is needed for avoiding breaking the cold chain during custom checking</li> </ul>	PARC/DoA Sindh
		<ul style="list-style-type: none"> <li>Establishment of Cold stores at Thatta &amp; Matiari &amp; development of complete cold chain from harvesting field to transportation and marketing</li> </ul>	PARC
4.	Marketing and Trading Level Strategies: (Increase the export to production ratio up to 10% in five years; Improve the quality and export price up to international standards)	<ul style="list-style-type: none"> <li>Require public sectors transporters, Cargoservices, (PIA) to offer discounted cargo services especially refer containers.</li> <li>Formation of Banana Board and build its institutional capacity.</li> <li>Develop Banana Product Brands, and organize a national competition for designing attractive packaging that follow international specifications.</li> <li>Sponsor/ cost-share CGAGB members to attend international exhibitions and trade fairs, and summits Include Banana bilateral/ multilateral trade agreements with friendly countries (OIC, Arab League, China).</li> <li>Undertake high quality research on all aspects of the Banana cluster</li> </ul>	PARC/DoA Upper Sindh

Note: The cost of each component can be seen in Table 42.

This proposed cluster development cost will be spent in a period of four years starting from year 1. Yearly distribution of these costs will be driven by the interventions planned for that year. For example, the processing cost will be driven by the number of banana chips manufacturing units that will be required each year to meet the set production target.



Similarly, the marketing costs will be driven by the number of banana collection centers that will be established each year. For production level strategies, it is assumed that 40% of this cost of production level strategies and marketing/trading level strategies will be spent in year 1, 30% in year 2 and 15% each in year 3 and year 4. With these assumptions, the cost distribution is shown in table 41.

**Table 41: Focal Point Upper Sindh Cluster – Cluster Development Investments Cost Projections**

Investment Head (000 US\$)	Total	Year 1	Year 2	Year 3	Year 4	Year 5
Investments required on strengthening research	740.7	296.3	222.2	111.1	74.1	37.0
Investment on capacity building of farmers and value chain agents	546.1	218.5	163.8	81.9	54.6	27.3
Investments required on orchard renovation	1253.9	250.8	250.8	250.8	250.8	250.8
Tissue culture lab establishment costs	132.0	66.0	0.0	66.0	0.0	0.0
Investments required on processing level interventions	296.3	59.3	59.3	88.9	88.9	0.0
Investments required on Value Chain Improvement-collection centers	2642.0	660.5	660.5	660.5	660.5	0.0
Linking stakeholders with markets, e-commerce platform, foreign trips, etc.	50.0	20.0	15.0	7.5	5.0	2.5
Government loans	337.9	82.8	82.8	86.2	86.2	0.0
Total investments	5998.9	1654.0	1454.4	1352.9	1220.0	317.6

### 9.3.5. Economic Viability of Cluster Development Plan

Based on the benefits and the costs of the proposed interventions package in the above paragraphs, the economic viability of the proposition has been calculated in terms of project's NPV and IRR. Discounted cash flow analysis has been carried out using an annual discount rate of 8.5%. Calculations and results are shown in 42.

**Table 42: Upper Sindh cluster - Economic Viability of Proposed Interventions Package**

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Total Benefits of the Interventions (Mil. USD)		1.774	4.140	6.364	8.907	8.858	8.809
Total operational costs of the Interventions (Mil. USD)		1.80	2.97	4.04	5.14	4.36	4.34
Total investment costs of the interventions (Mil. USD)	1.654	1.454	1.353	1.220	0.318	-	-
Net Cash Flows (Mil. USD)	-1.654	-1.483	-0.188	1.107	3.444	4.499	4.464
<b>NPV (Mil. USD)</b>	<b>5.438</b>						
<b>IRR</b>	<b>39.0%</b>						



A positive NPV of USD 5.437million indicates that the interventions package proposed for uplift and transformation of the focal point of Upper Sindh banana cluster is an economically viable proposition.

Any environmental degradation and is unlikely to happen from promotion of Banana clusters; rather the increase in Banana plantation shall contribute towards plant diversification and soil stabilization. With the climate change impact manifesting in fluctuating temperatures, disease havoc, variable precipitation, and more frequent and intense climate events, there is clearly a need to reduce the risks so as to make the communities more self-reliant and climate resilient.

## 9.4. Conclusion

In conclusion, the overall economic, social and environmental impact of the cluster development program shall be positive, sustainable and long lasting. Accounting for all the fixed costs and variable costs including the production, processing and marketing cost, the estimated Internal Rate of Return (IRR) for Central & lower Sindh is 23% and for Upper Sindh IRR is 42%, based on respective investment costs in each region and the present value of resulting revenues over the period of nine years. These estimated IRRs signify the fact that cluster development interventions are likely to positively impact not only the existing output of Banana clusters, but also likely to add additional value increasing the overall potential of the Banana value chain in both the regions.



## 10. PROGRAMS AND PLANS

This report presented an overview of the potential of Banana sector in Pakistan. Identified the Bananas clusters as part of the V2025 of GoP, Discussed the gaps and constraints of identified Banana clusters in Central & lower Sindh and Upper Sindh. Offer recommendations for cluster development in both the regions; and estimated the economic and social impact of the cluster development interventions that shall set new frame conditions at production, processing, and marketing level of Banana value chain in both the regions. In support of the findings and recommendations presented in previous chapters, the following plans and programs are proposed for further value addition.

In support of the strategies and interventions proposed in chapter 8 of this report, the following programs/plans are recommended to further strengthen the interventions and to creating greater opportunities for participation and learning.

### 10.1. Program for Organization and Networking of Stakeholders

The following program is proposed for organization of stakeholders at different levels of value chain in table 43.

**Table 43: Program for Organization and Networking of Stakeholders**

S#.	Area of Action	Purpose	Institutions to be involved	Priority
1. Central & Lower Sindh				
1.1	Form Banana Farmer Enterprise Groups (FEGs) at grassroots level. 5 FEGs in total with each having a membership of at least 25 farmers. Central & lower Sindh has 5 Banana producing districts, and thus 1 FEGs per district	Organization of Banana farming community for collective action	Sindh Abadghar Board, Village Organizations (VOs), LSOs, NGOs (AKRPS), DoA Sindh, Department of rural development Sindh.	Short to medium term (1 to 2 years)
1.2	Form Banan Processors and Traders Association at market/business level. At least 4 processors should be initially involved.	Improve coordination between the stakeholders of Banan value chain	DoASindh, NGOs, Private Sector	Short to medium term (1 to 2 years)



2. Upper Sindh				
2.1	Form Banana Farmer Enterprise Groups (FEGs) at grassroots level. 4 FEGs in total with 1 FEG in each Banana producing district and FEG each having a membership of at least 25 farmers.	Organization of Banana farming community for collective action	NGOs, DoA Sindh, Department of rural development Sindh.	Short to medium term (1 to 2 years)
2.2	Form Banana Processors and Traders Association at market/business level. At least 4 processors ( 1 processor in each Banana producing district) should be initially involved.	Improve coordination between the stakeholders of Banana value chain	DoA Sindh, NGOs, Private Sector	Short to medium term (1 to 2 years)

## 10.2. Program for Research Reform

The following program indicative areas for further research to strengthen the Banana cluster in the two regions are proposed along with the estimated costs.

**Table 44: Program for Research Reform**

S#.	Identification of Areas for Further Research	Research Purpose/ Priority	Indicative Research Institutions
1. Central & Lower Sindh			
1.1	To start Banana variety Development Program(Selection,adoption & hybridization) Develop strategy for accelerated production of Tissue cultured Banana plants and replacemnt of old diseased infested and unproductive banana orchards with healthy & diseased free seedlings. Quickly distributing improved seedlings. To take Preventive & curative measures to eradicate the BBTV and PANAMA	Improve & secure Banana production  ( medium term to long term (1 to 5 years)	PARC, SAU T.Jam,DoA,Sindh



	diseases through strict quarantine measure, imposed banon Banana import. Establishment of Banana diagnostic centers at least at devision level.		
	Developm Mobile Banana processing Units(Indian Model) 20 mobile units in each Banana growing districs To evaluate quality , shelf life economic effecency and market value (premium) for Bunch cover,Grading,Handing,cooling and transport in refer containers	Production,Harvesting (pre & post) techniques,proper use of ethylene and On-farm Processing. Develop Cold-Chain Infrastructure for Fresh Fruit Trading (Short to Long term (1 to 5 years))	PARC, SAU T.Jam,DoA,Sindh
1.2	Develop training modules Develop formats for Farmer Field Schools (FFS) for on-farm training of Banana producers	Improve Agronomic prctices,bunch ,sucker management pre & post harvet tecniques,proper use of ethylene and On-farm Processing Skills (Short to medium term (1 to 2 years))	PARC, SAU T.Jam,DoA,Sindh
1.3	Survey for identification of target group of 4 processors	Product Diversification from Processed Banana (Short to medium term (1 to 2 years))	Private businesses, DoA,Sindh
1.4	Consultation with processors to assess interest in establishing a Fruit Processor Association Scoping survey to identify new products and potential buyers	Create market Linkages for quality Processed Banana (Domestic and Export) Medium to long Term (2 to 5 years)	Private businesses, DoA Sindh, TDAP, Export promotion board, Embassies
1.5	Identify suitable fresh fruit traders to support the cluster Identify suitable fresh fruit buyers to link with in premium markets through a market survey Consultation to decide on implementation strategy – wholesale market or individual traders	Develop Cold-Chain for Fresh Fruit Trading Medium to long Term (2 to 5 years)	FEG clusters; Farmer Associations; Business associations and cooperatives.



	Identify most suitable cold storage and fresh fruit trading technology		
1.6	Research into Climate change related negative impacts such as new diseases and shifts in crop cycle	Investigate into climate related negative impacts on horticulture Medium to Long term (2 to 5 years)	PARC, SAU T.Jam,DoA,Sindh

**Table 45: Program of Banana Research for Upper Sindh**

2.1	<p>Multiple research trials will be conducted at Banana Research Station, Kairpur: Screening &amp; evaluation of Banana germplasm, varieties developed by Banana Research Institute Thatta under agro ecological conditions of upper Sindh (Ghotki, Khairpur and Nushahroferoz).</p> <p>Accelerated production of Tissue cultured Banana plants and replacement of old diseased infested and unproductive banana orchards with healthy &amp; disease free seedlings.</p> <p>Quickly distributing improved seedlings.</p> <p>To take Preventive &amp; curative measures to eradicate the BBTV and PANAMA diseases through strict quarantine measure, imposed ban on Banana import.</p> <p>Establishment of Banana diagnostic centers at least at division level</p>	Product Diversification from Processed Banana Short to medium term (1 to 2 years)	Private businesses, DoA Sindh
2.2	<p>Develop Mobile Banana processing Units (Indian Model) 10 mobile units in each Banana growing districts</p> <p>To evaluate quality, shelf life economic efficiency and market value (premium) for Bunch cover, Grading, Handling, cooling and transport in refrigerated containers</p>	Production, Harvesting (pre & post) techniques, proper use of ethylene and On-farm Processing. Develop Cold-Chain Infrastructure for Fresh Fruit Trading (Short to Long term (1 to 5 years))	PARC, SAU T.Jam, DoA, Sindh





2.3	<p>Field Schools,(FFS) for on farm trainings of Banana Farmers .</p> <p>Identify suitable fresh fruit traders to supporting the cluster</p> <p>Identify suitable fresh fruit buyers to link with in premium markets through a market survey</p> <p>Consultation to decide on implementation strategy – wholesale market or individual traders</p> <p>Identify most suitable cold storage and fresh fruit trading technology</p>	<p>Improve Agronomic practices,bunch ,sucker management pre &amp; post harvest techniques,proper use of ethylene and On-farm Processing Skills (Short to medium term (1 to 2 years)</p>	<p>Private businesses, DoA,Sindh</p>
2.4	<p>Research into Climate change related negative impacts such as new diseases and shifts in crop cycle</p>	<p>Investigate into climate related negative impacts on horticulture</p> <p>Medium to Long term (2 to 5 years)</p>	<p>Private businesses, DoA Sindh, TDAP, Export promotion board, Embassies</p>

(The estimated costs for research plan mentioned in the above table have already been counted as part of the cluster investments given in chapter 10)



# 11. Annexures

## Annexures 1: List of Data

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<https://www.globalbananasummit.com/en/>

<https://www.thenews.com.pk/print/381300-china-ready-to-help-boost-pakistan-s-farming-sector>

<http://www.fao.org/faostat/en/>

<http://www.mnfsr.gov.pk/pubDetails.aspx>

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## Annexure 3: List of Stakeholders Consulted

	Name & Address	Scientist /Trader / Grower	Cell No:
1	Raies A.Majeed Nizamani(Hyderabad)	Grower	03332629070
2	Mr. Imdad Khan Nizamani	Grower	03008372394
3	Mr.Noor Muhammad Baluch (Tando Jam)	Scientist	
4	Mr.Wali Muhammad Baluch,(Tando Jam)	Scientist	03003073673
5	Dr. Zulifqar Yousfani	Grower	03458888788
6	Mr.Darya Khan Nizamani( Badin)	Grower	03453691484
7	Haji Amin Soomro( Badin)	Commission Agent	030049077
8	Mr.Noor Ahmed Soomro(Badin)	Commission Agent	03458458135
9	Mr.Allah Dino Chandio(Thatta)	Grower	03008914755
10	Mr.Mehmood Nawaz Shah	Grower	03332602962
11	Mr.Azam Rindh	Grower	03008378677
12	Mr.Imran Ali	Grower	03003354288
13	Mr.Asalm Mari	Grower	0300300002
14	Mr.Lal Bux Siyal	Grower	0300310978
15	Mr.Mir Noor Ahmed	Grower	03023087770
16	Mr.Shahneed Panhwar	Grower	033332635772
17	Mr.Fida Thebo	Grower	03333559948
18	Mr.Aslam Arbab	Grower	03332447000
19	Mr.Mushtaq Nizamani	Grower	03003077706
20	Mr.Abul Rehman Khatti	Grower	03336749406
21	Mr.Abdul Ghani Soomro	Grower	03003863462
22	Mr.Nusherwan Mughal	Banana T.Lab Owner Karachi	03332228287
23	DR.Fayaz Ahmaed Siddique	Banana T.Lab Owner Karachi	
24	Mr. Niaz Muhammad Nizamani	Grower & Banana T.Lab Owner at T.Allahyay	03008376381
25	Mr.Zarar Hyder Shah	Grower	03473572694
26	Mr.Allah Bux Panhwar	Grower	
27	Mr.Ghulam Sarwar Abro	Grower	03003002852
28	Mr.Syed Rahil Shah	Grower	03008378129
29	Mr.Syed Nadeem Ahmed Shah	Grower	03003044726
30	Mr.Imdad Kumbhar	Commision Agent Karachi	
31	Dr.M.Isamil Kumbhar	Professor	03013569244
32	Mr.A.Majid Siyal	Grower	
33	Mr.Parvez Ahmaed Balouch	Grower & Trader	03003456742



## Annexure 4: Characteristics and Comparison of Clusters

Salient Features	Central & Lower Sindh Cluster	Upper Sindh
<b>Districts</b>	Shaheed Benazir Abaad, Matiari ,TandoAllahyar and Thatta	Ghotki, Sukkur, Khairpur and Noshehroferoze
<b>Product</b>	Fresh Banana or table Fruit	Fresh Banana or table Fruit
<b>Districts</b>	Thatta, Matiari, Shaheed Benazir Abad, Mirpurkhas, T.M.Khan, Sanghar, Tando Allahyar, Badin	Khairpur and Noshehroferoze
<b>Area of the cluster: (000 Ha)</b>	17.12	7.68
<b>Production: (000 Tonnes)</b>	63.19	33.2
<b>Average yield: (Tonnes/Ha)</b>	3.69	47
<b>% of banana area that lies in the cluster (area of the cluster/area in the province)</b>	66.7%	29.9%
<b>Focal point</b>	Thatta	Mir PurKhas
<b>Area of Focal point(000)Ha</b>	5176	5166
<b>Production (Tonnes) of Focal Point</b>	20229	22064
<b>Percentage of the total cropped area in the cluster (Banana area in the cluster/total cropped area in the cluster)</b>	Data is not available	Data is not available
<b>Geographical and Environmental Factor</b>	Alluvial soils: Sand & silty loam	Suitable soils Silty and clay loams
	Flat plains	Flat plains
	26.2988 °N,25.7519°N, 25.4570° N and 24.7495° N	The latitude of Khairpur & N.Feroze is 27.5272°N and 26.5032°N respectively.
	Subtropical climate with hot and dry	Arid climate with very hot and dry summers and cold winters.
	Access to canal irrigation (Rohri&kalriBaghar) but in some areas growers used to lift the irrigation which is costly.	Access to canalirrigation (Nara &Rohri Canal)but in some areas growers used to lift the irrigation which is costly.
	Quality of ground water is fit for irrigation inMatiari and TandoAllahyar.	Poor quality of ground water.



	Average rainfall 150 to 210 mm per annum	Average rainfall 85–150mm per year.
	Lower Sindh has a damper and humid maritime climate affected by the southwestern winds in summer and northeastern winds in winter, with lower rainfall than Central Sindh. Temperature rises up to 46 °C during summer but drops to 10-20°C during winter. Cool weather and prolonged drought retard growth. Banana plants hardly produce only one leaf per month in winter, while 4 leaves per month in summer (maximum in the month of May). If temperature drops below 13 °C, bunch may not be able to emerge, the leaves and new suckers starts to burn.	Temperatures frequently rise above 48 °C during June to August sometimes it crosses the 50 °C. The highest temperature ever recorded in this cluster was 51.0 °C. Dry hot days and cool nights are typical during the summer. Temperature can drop to 2-0 °C during December and January. High temperature in summer favors to the farmers of this cluster because Banana matures early during August and they get handsome rate due to high demand in these days.
		The thermal equator passes through upper Sindh, where the air is generally very dry Monsoon occurs in summer from the month of June till September.
<b>Banana growers</b>	Small holding size (<20 ha) 90%, medium (20-40 ha) 8.0% Percentage; large (> 40ha) 02%.	Small holding size (<20 ha) 90%, medium (20-40 ha) 8.0% Percentage; large (> 40ha) 02%.
	A large number of farmers (35%) in this region are uneducated or not easily understand the current farming trends are unaware of modern methods of cultivation.	A large number of farmers (40%) in this region are uneducated or not easily understand the current farming trends are unaware of modern methods of cultivation.
		In this Banana cluster majority of farmers cultivate lands by themselves except few advance growers which hire the Farm managers
<b>Varieties and their Features</b>	Dwarf Basrai (more than 95%), Dhaka, Grand Naine&Willam Hybrid (less than 5%), Gel, ADI and Jaffa.	Basrai (more than 95%), Grand Naine&Willam Hybrid (less than 5%).
<b>Product Feature</b>	Fleshy, sweet and delicious taste when fully ripened (20-22 Brix %)	Fleshy, sweet and delicious taste when fully ripened (20-22 Brix %)



	<p>Average fruit weight of Basrai, Grand Naine &amp; Willam Hybrid is (95.65, 104.50 &amp; 107.60 grams) respectively.</p>	<p>Average fruit weight of Basrai, Grand Naine &amp; Willam Hybrid is (95.65, 104.50 &amp; 107.60 grams) respectively.</p>
	<p>The average Finger length of Williams, Grand Naine and Basrai cultivars are: 21, 19, and 16 cms respectively .</p>	<p>The average finger length of Williams, Grand Naine and Basrai cultivars are: 21, 19, and 16 cms respectively.</p>
<p style="text-align: center;"><b>Variety Feature</b></p>	<p>Basrai (cultivated on 98% area) is drought, heat, and cold tolerant and locally adapted variety since banana cultivation in Sindh; Williams and Grand Naine are tissue cultured and disease free hybrids which are in initial phase of introduction and cultivation.</p>	<p>Basrai cultivated on 98% area is drought, heat, and cold tolerant and locally adapted variety since banana cultivation in Sindh; Williams and Grand Naine are tissue cultured and disease free hybrids which are in initial phase of introduction and cultivation.</p>
	<p><b><u>Dwarf Cavendish (Basari)</u></b> Banana grows up to about 10 feet tall at maturity, with a spread of 10 feet. It has a low canopy with a typical clearance of 1 foot from the ground. It grows at a fast rate, and under ideal conditions can be expected to live for approximately 30 years. The plant stature is Dwarf making it less prone to wind damage. The bunch size, the fruit length and size is quite good though the keeping quality is rather poor. The average bunch weight with 6-7 hands and with about 13 fruits per hand is about 15-25 kg. (Rayan et al; (2016) "Evaluation of Two Banana Cultivars Produced from Meristem Culture in Comparison with Traditional Culture of Basrai under the Conditions of Sohag Governorate, Upper Egypt "American-Eurasian J. Agric. &amp; Environ. Sci., 16 (12): 1764-1768).</p>	<p><b><u>Dwarf Cavendish (Basari)</u></b> Banana grows upto about 10 feet tall at maturity, with a spread of 10 feet. It has a low canopy with a typical clearance of 1 foot from the ground. It grows at a fast rate, and under ideal conditions can be expected to live for approximately 30 years. The plant stature is Dwarf making it less prone to wind damage. The bunch size, the fruit length and size is quite good though the keeping quality is rather poor. The average bunch weight with 6-7 hands and with about 13 fruits per hand is about 15-25 kg. Rayan et al; (2016) "Evaluation of Two Banana Cultivars Produced from Meristem Culture in Comparison with Traditional Culture of Basrai under the Conditions of Sohag Governorate, Upper Egypt "American-Eurasian J. Agric. &amp; Environ. Sci., 16 (12): 1764-1768.</p>





**Nursery and Planting**

Traditionally banana is being propagated through suckers but recent trend of transplanting the diseased free tissue cultured plants are getting popularity in this cluster. But the rate of adoption of banana transplanting is minimal due to unavailability of tissue culture plants.	Traditionally banana is being propagated through suckers but recent trend of transplanting the diseased free tissue cultured plants are getting popularity in this cluster. But the rate of adoption of banana transplanting is minimal due to unavailability of tissue culture plants.
Most growers use their own suckers or get from neighbors which are unhygienic less productive and diseased susceptible suckers, while the availability of diseased free tissue culture plants are unavailable. Government of Pakistan started the program of supplying the diseased free and healthy tissue culture banana plants through Pakistan Agricultural Council (PARC) on very limited scale and initially established three Banana tissue culture labs at National Agriculture Research Center (NARC), Islamabad, National Sugar & Tropical Research Institute (NSTHRI) Thatta & Southern Zone Agriculture Research Center (SARC), and Karachi.	Most growers use their own suckers or get from neighbors which are unhygienic less productive and diseased susceptible suckers, while the availability of diseased free tissue culture plants are unavailable. Government of Pakistan started the program of supplying the diseased free and healthy tissue culture banana plants through Pakistan Agricultural Council (PARC) on very limited scale and initially established three Banana tissue culture labs at National Agriculture Research Center (NARC), Islamabad, National Sugar & Tropical Research Institute (NSTHRI) Thatta & Southern Zone Agriculture Research Center (SARC), Karachi.
Farmers are using one year old suckers, whereas three month old (one feet height) tissue cultured plant is recommended for banana plantation.	Farmers are using to plant one-year old suckers. Whereas three month old (one feet height) tissue cultured plant is recommended for banana plantation.
Generally, row to row and plant to plant distance of banana in this cluster is 7X7 feet.	Generally, row to row and plant to plant distance of banana is 7X7 feet.
Average number of plants in one ha =2195	Average number of plants in one ha =2195



	Some progressive growers are adopting wider space planting technique and using 8X8 feet, total of 1333 plants per ha.	Some progressive growers are adopting wider space planting technique and using 8X8 feet, total of 1333 plants per ha.
<b>Inputs/Management Practices</b>	<ul style="list-style-type: none"> <li>Majority of farmers are using below average and imbalance inputs which ultimately reduces the per acre yield.</li> <li>Advanced growers apply 20, 20, 40 bags of DAP, Potash &amp; Ammonium Nitrate, respectively per ha along with 25 &amp; 12.5 kg of Zinc and Boron (micronutrient) and 5 trucks of farm yard manure.</li> <li>Generally, fertilizers are being used in three splits.</li> </ul>	<ul style="list-style-type: none"> <li>Majority of farmers are using below average and imbalance inputs which ultimately reduces the per acre yield.</li> <li>Advanced growers apply 20, 20, 40 bags of DAP, Potash &amp; Ammonium Nitrate, respectively per ha along with 25 &amp; 12.5 kg of Zinc and Boron (micronutrient) and 5 trucks of farm yard manure.</li> <li>Generally, fertilizers are being used in three splits.</li> <li>Some growers apply fertilizer through fertigation in this cluster.</li> <li>Some contacted farmers informed that they are also applying compound fertilizer (Zarkhez) two bags per month and getting higher yield.</li> </ul>
	<ul style="list-style-type: none"> <li>1.5 bags of Confidor and Movento chemicals are commonly used during September and March for the control of Black Aphid career of BBTV.</li> </ul>	<ul style="list-style-type: none"> <li>2 bags of Carbofuran&amp;Thiodon chemicals are commonly used for Nematode control.</li> </ul>
	<ul style="list-style-type: none"> <li>Input monitoring and quality control for inputs is week, causing huge adulteration problem in pesticide.</li> <li>Federal and Provincial seed certification department and Plant protection departments in this region are not performing satisfactorily.</li> </ul>	<ul style="list-style-type: none"> <li>Input monitoring and quality control for inputs is week, causing huge adulteration problem in pesticide.</li> <li>Federal and Provincial seed certification department and Plant protection departments in this region are not performing satisfactorily.</li> </ul>



	<ul style="list-style-type: none"> <li>Regular supply of inputs is another issue.</li> </ul>	<ul style="list-style-type: none"> <li>Regular supply of inputs is another issue.</li> </ul>
	<ul style="list-style-type: none"> <li>Generally, farmers irrigate the field through flood irrigation method.</li> <li>Total 25-30 irrigations are applied by the farmers in this cluster. Some farmers use lift or pump irrigation water.</li> </ul>	<ul style="list-style-type: none"> <li>Generally, farmers irrigate the field through flood method.</li> <li>Total 30-35 irrigations are applied.</li> </ul>
	<ul style="list-style-type: none"> <li>Normally, farm yard manure at the rate of 10 tonnes per acre is being applied in banana field.</li> </ul>	<ul style="list-style-type: none"> <li>Normally, farm yard manure at the rate of 10 tonnes per acre is being applied in banana field.</li> </ul>
	<ul style="list-style-type: none"> <li>Farmers avoid Intercropping in banana crop while garden is in fruiting. However, during gestation period when garden is not fully matured, farmers intercrop banana field with vegetable like chili.</li> </ul>	<ul style="list-style-type: none"> <li>Farmers avoid intercropping in banana crop while, some grower intercrop with date palm in this cluster. During gestation period when garden is not fully matured, farmers intercrop banana field with vegetable like chili.</li> </ul>
	<ul style="list-style-type: none"> <li>From February to August at least 3 hoeing/weeding are performed through hiring the labour at the rate of Rs.2200/hoeing.</li> <li>Sufficient labour is available for Banana production practices.</li> </ul>	<ul style="list-style-type: none"> <li>From February to August at least 3 hoeing/weeding are performed through hiring the labour at the rate of Rs.2200/hoeing.</li> <li>Sufficient labour is available for Banana production practices.</li> </ul>
<b>Pruning/Harvesting**</b>	<ul style="list-style-type: none"> <li>Few progressive farmers used to harvest their crop by hiring of labour at the rate of Rs.5000/Truck and then send it direct to the market.</li> </ul>	<ul style="list-style-type: none"> <li>Few progressive farmers used to harvest their crop by hiring of labour at the rate of Rs.5000/Truck and then send it direct to the market.</li> </ul>
	<ul style="list-style-type: none"> <li>Small suckers are removed on regular basis up to 7-8 months.</li> </ul>	<ul style="list-style-type: none"> <li>Small suckers are removed on regular basis up to 7-8 months.</li> </ul>



	<ul style="list-style-type: none"> <li>Harvesting of banana bunches with long sharp knife.</li> </ul>	<ul style="list-style-type: none"> <li>Harvesting of banana bunches with long sharp knife.</li> </ul>
	<ul style="list-style-type: none"> <li>Normally 99% banana producers' lease out the banana orchard to the pre-harvest contractor-who take care, watch and ward of the crop till harvest.</li> </ul>	<ul style="list-style-type: none"> <li>Producers normally lease out the banana orchard to the pre-harvest contractor-who take care, watch and ward of the crop till last harvest.</li> </ul>
	<ul style="list-style-type: none"> <li>Contractors or wholesalers buy the orchard from farmers as they have connection with the commission agents in the market. The price is offered to the farmer based on the size and variety.</li> </ul>	<ul style="list-style-type: none"> <li>Contractors or wholesalers buy the orchard from farmers as they have connection with the commission agents in the market. The price is offered to the farmer based on the size and variety.</li> </ul>
<b>Packaging/Transportation</b>	The fruit are mainly transported by open trucks and pickups.	The fruit are mainly transported by truck.
<b>Wholesaler/Retailer</b>	<ul style="list-style-type: none"> <li>The auction in the wholesale market is generally based on the fruit size, bunch weight and condition, but exact grading is not currently followed.</li> </ul>	<ul style="list-style-type: none"> <li>The auction in the wholesale market is generally based on the variety and weight, but exact grading is not currently followed.</li> </ul>
	<ul style="list-style-type: none"> <li>Final grading is done by the retailers.</li> </ul>	<ul style="list-style-type: none"> <li>Final grading is done by the retailers.</li> </ul>
	<ul style="list-style-type: none"> <li>The contractor is obliged to sell the produce through the leading commission agents as the former has borrowed money from the later.</li> </ul>	<ul style="list-style-type: none"> <li>The contractor is obliged to sell the produce through the leading commission agents as the former have borrowed money from the later.</li> </ul>
	<ul style="list-style-type: none"> <li>The commission agents and wholesale merchants do keep accounts of their transactions, but little information is available from their books regarding the quality sold by them.</li> </ul>	<ul style="list-style-type: none"> <li>The commission agents and wholesale merchants do keep accounts of their transactions, but little information is available from their books regarding the quality and the variety sold by them.</li> </ul>
	<ul style="list-style-type: none"> <li>The prices are high at the commencement of the season in August and during the holy month Ramadan, and decline</li> </ul>	<ul style="list-style-type: none"> <li>The prices are high at the commencement of the season, decline gradually as the supplies increase</li> </ul>



	<p>gradually as the supplies increase.</p>	<p>and increase again at the end of the season</p>
	<ul style="list-style-type: none"> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
	<ul style="list-style-type: none"> <li>• No premium is being given to the growers for quality products in domestic markets but retailer's sale the good quality banana at high rates.</li> </ul>	<ul style="list-style-type: none"> <li>• No premium is being given to the growers for quality products in domestic markets but retailers' sale the good quality banana at high rates.</li> </ul>
	<ul style="list-style-type: none"> <li>• No cold stores are present throughout the banana cultivated areas of Pakistan except few in Karachi, Hyderabad, and Lahore which are partially being used for ripening of the Banana fruit.</li> </ul>	<ul style="list-style-type: none"> <li>• No cold stores are present throughout the banana cultivated areas of Pakistan except few in Karachi, Hyderabad, and Lahore which are partially being used for ripening of the Banana fruit.</li> </ul>
	<ul style="list-style-type: none"> <li>• No proper precooling facilities are available in the cluster.</li> </ul>	<ul style="list-style-type: none"> <li>• No proper precooling facilities are available in the cluster.</li> </ul>
<p><b>New Technologies/Infrastructure</b></p>	<ul style="list-style-type: none"> <li>• Few advanced growers started drip irrigation technology and also applying fertilizers through fertigation on small scale.</li> </ul>	<ul style="list-style-type: none"> <li>• Some growers are applying input through fertigation method in this cluster.</li> </ul>
	<ul style="list-style-type: none"> <li>• Despite an agricultural &amp; banana producing country there is no single/sole research institute on banana in Pakistan.</li> </ul>	<ul style="list-style-type: none"> <li>• Despite an agricultural &amp; banana producing country there is no single/sole research institute on banana in Pakistan.</li> </ul>
	<ul style="list-style-type: none"> <li>• Production of diseased free tissue cultured banana plants have been started by Pakistan Agricultural Research Council since 2012.</li> <li>• PARC has established three banana tissue culture labs at National Agriculture Research Center (NARC), Islamabad, National Sugar &amp; Tropical Research Institute (NSTHRI) Thatta &amp; Southern Zone</li> </ul>	<ul style="list-style-type: none"> <li>• Production of diseased free tissue cultured banana plants have been started by Pakistan Agricultural Research Council since 2012.</li> <li>• PARC has established three banana tissue culture labs at National Agriculture Research Center (NARC), Islamabad, National Sugar &amp; Tropical Research</li> </ul>



	<p>Agriculture Research Center (SARC), and Karachi. Two banana tissue culture labs (Sprouts biotech) are working under private sector at Karachi National Sugar and Tropical Horticulture Research Institute, (NSTHRI) provided 70,000 healthy &amp; diseased free tissue culture plants to the farmers of different districts in the region.</p> <ul style="list-style-type: none"> <li>• There is high demand of tissue culture plants of different varieties.</li> </ul>	<p>Institute (NSTHRI) Thatta &amp; Southern Zone Agriculture Research Center (SARC), and Karachi. Two banana tissue culture labs (Sprouts biotech) are working under private sector at Karachi and National Sugar and Tropical Horticulture Research Institute, (NSTHRI) provided 70,000 healthy &amp; diseased free tissue culture plants to the farmers of different districts in the region.</p> <ul style="list-style-type: none"> <li>• There is high demand of tissue culture plants of different varieties</li> </ul>
<p><b>Export/Value chain</b></p>	<ul style="list-style-type: none"> <li>• Rising local and international consumption, export markets are now open in post WTO era.</li> </ul>	<ul style="list-style-type: none"> <li>• Rising local and international consumption, exports markets are now open in post WTO era.</li> </ul>
	<ul style="list-style-type: none"> <li>• Export potential: About 70- 80% exportable banana is available in the radius of 20 kilometers periphery of Tando Allah Yar, Matiari and Tando Adam. Banana quality of Thatta is also excellent for Export.</li> </ul>	<ul style="list-style-type: none"> <li>• Exporters from this region have the facility to export through direct flights and have adequate cargo space from Karachi.</li> </ul>
	<ul style="list-style-type: none"> <li>• Tough export procedures and formalities (regulations, charges and other restrictions) are hindering the banana export. After WTO these formalities /procedures applied in all agricultural commodities which are being export). Food safety standards and traceability (HACCP, Euro GAP, Global Gap, IFS, etc.) of Pakistani Products is another obstacle to enter into high end markets.</li> </ul>	<ul style="list-style-type: none"> <li>• Tough export procedures and formalities (regulations, charges and other restrictions) are hindering the banana export. After WTO these formalities /procedures applied in all Agricultural commodities which are being export). Food safety standards and traceability (HACCP, Euro GAP, Global Gap, IFS, etc.) of Pakistani Products is another obstacle to enter into high end markets.</li> </ul>



	<ul style="list-style-type: none"> <li>• The banana consigned to domestic and export markets suffer from fruit quality problems. A high incidence of diseases and green-ripe fruit result in loss of confidence by marketers, and reduced profits for everyone.</li> </ul>	<ul style="list-style-type: none"> <li>• The banana consigned to domestic and export markets suffer from fruit quality problems. A high incidence of disease and green-ripe fruit result in loss of confidence by marketers, and reduced profits for everyone</li> </ul>
	<ul style="list-style-type: none"> <li>• For banana supply chain, 90% of harvested produce is sold in national market, while 5% sell bananas direct to the nearby market through commission agents, and remaining 5% growers sell their produced at farm level. Farm-level sale is more profitable but has only limited market.</li> </ul>	<ul style="list-style-type: none"> <li>• For banana supply chain, 90% of farmers sell their orchard to contractors before harvesting and the contractors sell the produce in national market, while 5% sell bananas direct to the nearby market through commission agents, and remaining 5% growers sell their produced at farm level. Farm-level sale is more profitable but has only limited market.</li> </ul>
	<ul style="list-style-type: none"> <li>• The typical banana season starts from August to October when huge supply is available in the market and some traders/buyers from Afghanistan purchase banana from selected farmers inthis connection trader do not follow the recommended processing methods. There are some hindrances in contract farming like, unavailability of developed procedure, low education level, lack of confidence &amp; fear of discontinued supply etc.</li> </ul>	<ul style="list-style-type: none"> <li>• The typical banana season starts from August to October when huge supply is available in the market and some traders/buyers from Afghanistan purchase banana from selected farmers inthis connection trader do not follow the recommended processing methods. There are some hindrances in contract farming like, unavailability of developed procedure, low education level, lack of confidence &amp; fear of discontinued supply etc.</li> </ul>



<p style="text-align: center;"><b>Supply Chain</b></p>	<p>There are some orchards in this cluster which follow the Global GAP standard. The certification is costly and not affordable by most individual farmers. Lack of food safety standards and traceability (HACCP, Euro GAP, Global Gap, IFS, etc.) is another obstacle to enter into high end markets.</p>	<p>There are half a dozen orchards in this cluster which are Global GAP certified. This certification is costly and not affordable by most of the individual farmers.</p>
	<p>Involvement of women in Banana is negligible especially in harvesting because of heavy weight of bunch.</p>	<p>Involvement of women in Banana is negligible especially in harvesting because of heavy weight of bunch.</p>
<p style="text-align: center;"><b>Training Program</b></p>	<ul style="list-style-type: none"> <li>• Pakistan Agricultural Research Council imparted trainings on Banana which includes: Four trainings on banana tissue culture at National Agriculture Research Center (NARC), Islamabad, National Sugar &amp; Tropical Research Institute (NSTHRI) Thatta &amp; Agriculture Research Institute (ARI) Tandojam. Total numbers of people trained during were 107 out of which 53 students, 49 professionals, 04 progressive growers and one person from NGO. These trainings consisted of theoretical lectures followed by extensive lab/greenhouse practical.</li> </ul>	<ul style="list-style-type: none"> <li>• During 2015, a five days "Training on Banana Value Addition" was organized by Indus Development Federation (IDF is the federation of three different NGOs (WADO, SAO and FFOIDF) working on agriculture in this area. In this training course, 25 male and female farmers participated and got training. This training was funded by Pakistan Agricultural Research Council. The trainers were trained on the formation of value added products like banana chips, fig powder, cake, biscuits and banana chattni to increase their income through production of value added products from banana.</li> </ul>
<p style="text-align: center;"><b>Socioeconomic networking/Gender involvement</b></p>	<ul style="list-style-type: none"> <li>• TDAP gives substantial subsidy to the exhibitors in providing stall at 50% or more subsidized rates and also sponsors a large number of delegations to be sent abroad. TDAP agreed to help exporters in opening export offices</li> </ul>	





	<p>abroad by giving 50% of the rental and 50% of the salary.</p>	
	<ul style="list-style-type: none"> <li>• SMEDA took initiative and planned to develop some feasibility for the production of banana by products. Pakistan Agricultural Research Council in collaboration with SAARC Development Fund established three Banana processing units in Khairpur district of Sindh: (1) Banana value addition facility at Village M. AcharSolangi at KUMB (operated by NGO Woman Agricultural Development Organization (WADO). (2) Banana value addition facility at Theeri and (3) Banana value addition facility at Village ShuttalBhandPir jo Goth, so that stakeholders may get benefit of value added Banana products like banana fig powder, Chips, Cake, Biscuits and Banana Chattni.</li> </ul>	
<p><b>Subsidies/Incentives/Facilities</b></p>	<ul style="list-style-type: none"> <li>• Pakistan Radiation Services (PARAS) and Pakistan Horticulture Development &amp; Export Board (PHDEB) has the capacity to annually irradiate 60,000 tons of fruit, vegetables etc.</li> </ul>	
	<ul style="list-style-type: none"> <li>• Despite an agricultural &amp; Banana producing country there is no single/sole research institute on Banana</li> </ul>	
	<ul style="list-style-type: none"> <li>• Different development projects of USAID are working towards increasing income and generating additional employment in the country.</li> </ul>	
	<ul style="list-style-type: none"> <li>• Presence of Sindh Abadgar Board, Sindh Chamber of</li> </ul>	



	<p>Agriculture Commerce Association but no particular banana growers' Association exists.</p> <ul style="list-style-type: none"><li>• Some local level trainings are being imparted to male &amp; female farmers by HANDS &amp; NRSP especially on Banana by products, value addition and kitchen gardening.</li></ul>	
<p>**To obtain optimum quality and to avoid quick fruit deterioration, following harvesting practices should be adopted</p> <ul style="list-style-type: none"><li>• Harvest the fruit during the cool part of the day when possible.</li><li>• Shade the fruit during transport to the market.</li><li>• Avoid delays in transporting the fruit to market or packing shed.</li><li>• Cool the fruit in the packing sheds with sprays or water dips.</li><li>• Cool the packing shed with forced-air (not lower than 14°C).</li></ul> <p>Refrigerate the fruit during transport to market. For export purpose treatments with gases are carried out in air-tight room from 24 hours at 200 to 250C, 90 to 95% relative humidity. Concentrations of gas during exposure are 10 -100 ppm (0.001 – 0.01%) for ethylene and 1000 ppm (0.1%) for acetylene.</p>		



## Annexure5A. SWOT Analysis of Banana Central & lower Sindh cluster

Parameters	Strengths	Weakness	Opportunities	Threat
Environment/ Climate Change	Alluvial soils: Sand & slity loam in texture, Subtropical climate with hot and well drained land in cluster which are very much suitable for Banana cultivation.	Some times shortage of water and sudden rise in temperature affect growth and developmet which ultimately reduces the yield.	The Coastal belt of Thatta Sindh possesses all the features such as right soil and climatic conditions; cheap labor; effective irrigation system; Sea & Air port in karachi and efficient road & rail networks that are required to produce and export world class bananas,By exploting the favourable elements Government may declair this belt as a Banana Export Zone.	Some times fear of flood due to improper water management & maintenance of protection bunds. Shortage of water and sudden rise in temerature affects Banana crop and leaves start burning which ultimately reduces yield.  Drought during winter ,shortage of canal water & poor quality of under ground water.
	Availability of canal irrigation throughout the year from Kalri Baghar and Rohri canals irrigation but in some areas growers used to lift the iirigation which is costly. Quality of ground water is poor in all the districts except Matiari and Tando Allahyar			
Input Supplies	Reliable major fertilizer and pesticide supply system with many National / Multinational Companies	Non-availability of appropriate quality fertilizer and micronutrients	Already established soil testing labs in Sind can play a major role in matching input use with the soil nutrient conditions	Slow uptake of inputs by the farmers
		low organic matter in soils,no adding of organic mannures &	Integration of organic and inorganic fertilizers by using Sugarcane press	



	providing these chemicals	Imbalanced use of inorganic fertilizers.	mud, Farm yard manure & poultry manure to sustain the soil health .	
		Limited availability of tissue cultured ,healthy & diseased free planting material, no choice of variety only depends upon traditional Basrai .	Seed Act 2015 which has obligated to Agricultural Departments to establish certified nurseries has created an opportunity to increase certified nurseries. Establishment of tissue culture labs in each banana growing districts to fulfill the requirement and replacment of traditional varities through improved,healthy and diseased free banana varities.	
Cluster interaction	Presence of advanced growers in this cluster who are applying latest cultivation techniques by using advanced technology and few of them also established tissue cuture labs .Out of five tissue culture labs three labs established by growers in central and lower Sindh cluster.	Little interaction among farmers and researchers	Poossibility of learning from progressive farmers in the cluster	
		Majority of farmers don't care about quality because they used to sale their produce to the small contractor as a whole orchard on the seasonal basis.	Strong relation between Commission Agents/Wholesaler and Contractors (each have knowledge about quality demand at least in national maket) can be transformed into quality-based supply contract	Infestation of Fruit Fly,Pnama & BBTV. Pesticide residues
		No contract farming with defined quantities and quality parameter		



## Annexure 5B. SWOT Analysis of Banana Upper Sindh cluster

Parameters	Strengths	Weakness	Opportunities	Threat
Environment/ Climate Change	Availability of canal irrigation throughout the year from Nara and Rohri canals irrigation but in some areas growers used to lift the irrigation which is costly.	Suitable soils Slity and clay loams, Arid climate with very hot & dry summers and cold winters, well drained land in cluster encourages for Banana cultivation. While ; Hot summer favors this region, because high temperature acclerates fruit maturity of the Banana and bunches may become ready to harvest ealier in the month of August & in this way season get starts from upper Sindh cluster.	Some times shortage of water and sudden drop in night temperature ceases leaf emergence ,even and slowdown the growth & development in initial phase of growth cycle.	Upper Sindh cluster posseses all the factors responsible for Banana production Like: right soil and climatic conditions; cheap labor; effective irrigation. The location of this cluster is near the border of Punjab thats why the produce reaches in short time to the big national market of Punjab, Balochistan and Khyber Pakhtun Khuwa in this way shelf life of banana increases at some extent .
Input Supplies	Reliable major fertilizer and pesticide supply system with many National / Multinational Companies providing these chemicals	<p>Non-availability of appropriate quality fertilizer and micronutrients</p> <p>low organic matter in soils,no adding of organic mannures &amp; Imbalanced use of inorganic fertilizers.</p> <p>Limited availability of tissue cultured ,healthy &amp; diseased free planting material,</p>	<p>Already established soil testing labs in Sind can play a major role in matching input use with the soil nutrient conditions</p> <p>Integration of organic and inorganic fertilizers by using Sugarcane press mud,Farm yard manure &amp; poultry manure to sustain the soil health .</p> <p>Estabilshment of tissue culture labs in each banana growing districts to fulfill the requirement and replacment of</p>	<p>Use of adulterated ,expired pesticides &amp; presence of un reliable companiese.</p> <p>Injudicious use of chemicals declines soil productivity and affects soil health.</p>



		no choice of variety only depends upon traditional Basrai .	traditional varieties through improved, healthy and disease-free banana varieties.	
Cluster interaction	Presence of advanced growers in this cluster who are applying latest cultivation techniques by using advanced technology Drip & Fertigation.	Little interaction among farmers and researchers Majority of farmers don't care about quality because they used to sell their produce to the small contractor as a whole orchard on the seasonal basis. No contract farming with defined quantities and quality parameter	Possibility of learning from progressive farmers in the cluster  Strong relation between Commission Agents/Wholesaler and Contractors (each have knowledge about quality demand at least in national market) can be transformed into quality-based supply contract	Infestation of Fruit Fly, Panama & BBTV diseases and . Pesticide residues



## **Annexure 6: Feasibility Study of Banana Chips Manufacturing Unit**

### **Project Concept**

Banana is considered as the most popular fruit in the world. It is also a major fruit crop of Pakistan; mainly grown in Sindh province where the soil and climatic conditions are favorable for its successful cultivation. The total share of Sindh province alone in its cultivation is over 85%. Green banana is very perishable and is subject to very fast deterioration after harvesting. Total losses in banana transported from the major growing clusters in Nawabshah, Mirpur Khas and Hyderabad to the markets of Punjab during the months of December, February and March reach as high as 40%.

Processing is recognized as a way of preserving fruit and can be applied to banana fruit as well to increase its shelf life. All over the world, banana is being processed into a wide variety of products like banana chips, French fries, banana powder and flour, banana cocoa and coffee, alcohol, wine and vinegar. Banana chips have a crispy and unique taste and are consumed as a snack food and an ingredient in breakfast cereals. Deep fat frying is one of the oldest cooking methods for imparting the desired texture and flavor to a variety of food products. During frying, the product dehydrates from an initial moisture content of about 90% to less than 10% moisture content within a few minutes of frying extending its life up to one year. Banana chips represent the value added consumer product which can be manufactured at household level or small scale/cottage level with small investment. The basic chips after preparation are more commonly salted. However, different flavors, spices and herbs are also used to produce additional flavors of Banana chips.

### **Potential Market**

There, currently is no production of banana chips at local level. Small quantities of imported banana chips are sold in large retail stores as high value added consumer product. However, that Banana chips can be produced and a market can be created for this new product. The potential market of Banana chips will mostly concentrate in urban centers; however, over the years, the product may also gain popularity in less urbanized areas.

The proposed Banana chips production unit will sell its product in peri-urban and rural markets in the vicinity of the unit. The entrepreneur may also explore the possibility of selling its product in the existing urban markets. However, that will entail heavy marketing cost for advertising and promotion to create an awareness and visibility of the new product in those markets. The Banana chips produced by the proposed unit will be transported to market and sold through the existing general retail outlets and bakeries. Once a local market is established, the possibility of exporting banana chips can also be explored since it is a popular product in the international markets.

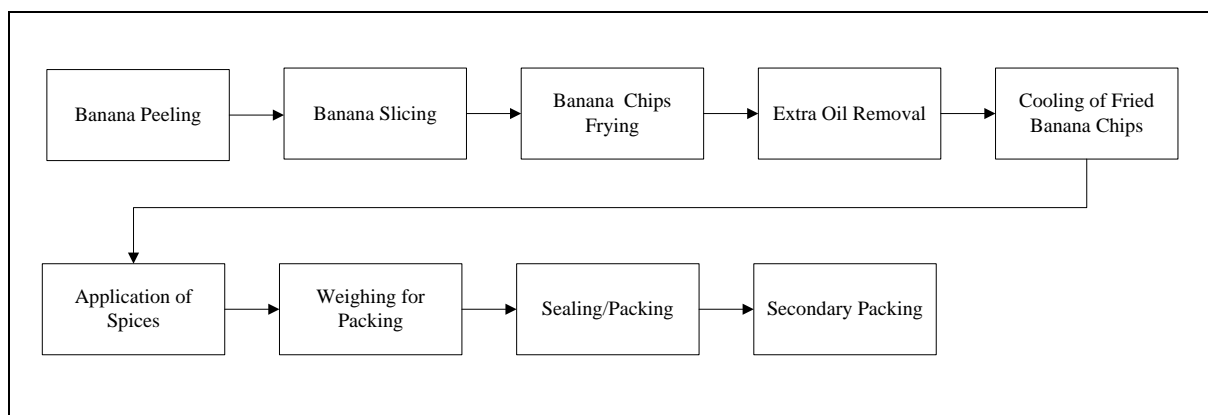
### **Banana Chips Production Process**

#### **Process Flow**

For fried banana production, mature raw (green) bananas are used. The bananas are peeled by using the automatic peeling machine. The other option is doing the peeling operation by



using manual labor. The peeled bananas are cut into 1/8-inch-thick slices by the slicing machine. The slices are fed to the fryer and deep fried generally in peanut or coconut oil at 170-175 C. The extra oil from the fried chips is removed by the oil remover by adopting vibrating or centrifuging technique. For cooling and desired texture development, after frying, the hot chips are kept in open air for about 10 minutes. Finally, the banana chips are manually weighed and fed to the packing machine for filling and sealing of the packs of the desired size. The sealed packs are packed in larger cardboard packing boxes for transporting to the retail outlets to be sold to the consumers. Process flow chart of Banana chips production is shown in the following Figure 3.



**Figure 3 – Banana Chips Production Process Flow**

### Project Cost

Total project cost of the proposed Banana chips production unit is PKR 4.04 million. Major items of project cost are listed in **Error! Reference source not found.**

**Table 46: Project Cost Details**

Cost Item	Cost (PKR)
Processing Machinery	2,800,000
Utility Machinery	250,000
Office Equipment & Furniture	40,000
Pre-operating expenses	203,000
<b>Capital Investment</b>	<b>3,293,000</b>
Working Capital	750,490
<b>Total Project Cost</b>	<b>4,043,490</b>

The project is assumed to be fully financed with shareholder's equity; without any debt financing.

### Land and Building

The proposed project will be established in a rented building with a covered area of around 2000 sq. ft. It is assumed that electricity and water connections will be available in the





space rented for the project. Thus, the costs of electricity and water connected have not been included in the project cost. In case, these facilities are not available at the selected location, the costs of obtaining the connections of these two utilities will have to be added in the project cost.

## Machinery and Equipment

The feasibility study of Banana chips production unit has been based on a mix of local and imported machinery. Banana peeler is not made locally and will have to be imported. Other components of the machinery will be local. This will keep the capital cost of the project in the lower range; within the reach of smaller investors in the rural areas. Total cost of the required machinery and equipment is PKR 3.05 million. The details are shown in **Error! Reference source not found.**

**Table 47: Machinery and Equipment Cost**

Sr.No	Name of the Machine	No.	Unit Cost (PKR)	Total Cost (PKR)
	Banana Peeler	1	1,300,000	1,300,000
1	Banana Chips Making Plant (Slicer, Fryer, Oil Remover, Spicer, Weighing, Packing Machine)	1	1,500,000	1,500,000
2	Generator	1	250,000	250,000
	<b>Total</b>			<b>3,050,000</b>

## Other Project Cost Items

- Office equipment and furniture has been included at a total cost of PKR 40,000.
- Pre-operating expenses include those expenses which have to be incurred before the business becomes operational. The costs included under this head are business registration/licensing, machinery transport, machinery erection and commissioning, personnel, routine administration and project's promotion. Pre-operating costs have been worked out to be PKR 203,000.
- Working Capital calculation includes the cost of half month supply of Bananas, frying oil, electricity bill, fuel, packing material and the staff salaries. Machinery spares equal to 1% of machinery cost and petty cash of PKR 200,000 have also been included in the working capital. With these assumptions, total working capital requirement has been calculated to be PKR 750,490.

## Revenues and Costs

### Revenues

Revenues will be generated by selling Banana chips in printed aluminum-lined packs. It has been assumed that the project will produce 4000, 30 grams packs of Banana chips per day. It is assumed that the project will operate at this capacity from the first year. Operating at 90 days per year, the project will be able to produce 360,000 packs of Banana chips per year.



At a selling price of PKR 25 per pack, project's revenues for the first year will be PKR 9.0 million. No growth in selling price has been assumed over the five-year period. Revenue calculations for five years are shown in **Error! Reference source not found.**

**Table 48: Revenue Calculations**

	Year 1	Year 2	Year 3	Year 4	Year 5
Production (packs)	360,000	360,000	360,000	360,000	360,000
Price (PKR/pack)	25.0	25.0	25.0	25.0	25.0
<b>Revenues (PKR)</b>	<b>9,000,000</b>	<b>9,000,000</b>	<b>9,000,000</b>	<b>9,000,000</b>	<b>9,000,000</b>

## Costs

### Banana Cost

Banana is the major cost of Banana chip production unit. At 4000, 30-grams packs per day, total requirement of Bananas will be 54,000 kg per year. This has been calculated on the assumption that five kg Bananas will be required for producing one kg Banana chips (20% yield). Banana's cost has been assumed considered to be PKR 30 per kg. At this rate, total cost of banana will be PKR 1.62 million. No growth has been assumed in the cost of Banana. With these assumptions, Banana cost for five years is shown in Table 51.

**Table 49: Banana Cost Calculations**

	Year 1	Year 2	Year 3	Year 4	Year 5
Packs (30 g) per year	360,000	360,000	360,000	360,000	360,000
Chips in the pack (kg)	10,800	10,800	10,800	10,800	10,800
Banana Requirement per year (kg)	54,000	54,000	54,000	54,000	54,000
Banana Cost (PKR/kg)	30.0	30.0	30.0	30.0	30.0
<b>Banana Cost (PKR)</b>	<b>1,620,000</b>	<b>1,620,000</b>	<b>1,620,000</b>	<b>1,620,000</b>	<b>1,620,000</b>

### Other Costs

- Banana chips will be fried in peanut or coconut oil which constitutes the other important cost. 40 kg oil will be required to fry about 100 kg banana chips. At a rate of PKR 200 per kg, total cost of oil comes out to be PKR 864,000.
- Processing cost includes the cost of fuel for frying the Banana chips. This has been assumed to be PKR 8.0 per kg of chips. Total processing cost for the whole year to produce 10,800 kg Banana chips comes out to be PKR 86,400. No inflationary factor has been considered in the processing cost over five years.
- Banana chips will be packed in 30-gram plastic Aluminum lined packs. The cost of this pack has been assumed to be PKR 2.0 per pack. At this rate, total cost of Banana chips packs was calculated to be PKR 720,000. These packs will be packed in larger cardboard packing that will hold 36 packs. The cost of one such packing box was taken to be PKR 40 and the total cost of these large packing boxes was found to be PKR 400,000. Total packing cost per year was found by adding these two costs to be PKR 1.12 million. Packing cost has been assumed to remain constant for five years.
- Building Lease cost has been assumed to be PKR 25,000 per month.



- Electricity cost has been worked out on the basis of an electricity connection of 10 KVA. Electricity cost for the first year has been calculated to be PKR 104,821.
- Plant maintenance cost has been assumed to be 1% of machinery cost. Maintenance cost during the first year has been calculated to be PKR 30,500.
- Marketing cost includes the cost of transporting the Banana chips to retail outlets and the cost of creating product awareness and promotion. It has been assumed to be PKR 3,000 per day or PKR 90,000 per month. Marketing cost during first year is calculated to be PKR 1,080,000.
- Administration cost includes the cost of travelling, office stationery, telephone and refreshment. Administration cost during first year of operations is calculated as PKR 134,400. No inflationary factor has been considered during five years.
- Depreciation cost has been calculated using straight line method. A life of ten years has been assumed for machinery and equipment and five years for office equipment. Pre-operating expenses have been amortized over a period of five years.

### Human Resource Cost

The proposed milk pasteurization unit will need small workforce; including a machine operator, machine helper and a security guard. The activities of production management, administration, bookkeeping and marketing will be carried out by the entrepreneur himself/herself. Human resource requirements and the associated costs are shown in **Error! Reference source not found..**

**Table 50: Human Resource Cost**

Designation	No.	Salary (PKR/month)	Total (PKR/month)	No. of Months	Salary per Year (PKR)
Production Supervisor	1	25,000	25,000	12	300,000
Workers	7	15,000	105,000	3	315,000
Watchman	1	15,000	15,000	12	180,000
<b>Total Staff</b>	<b>9</b>		<b>145,000</b>		<b>795,000</b>

### Projected Financial Statements

Projected Profit & Loss Statement

**Table 51: Projected Income Statement**



	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Revenues</b>	<b>9,000,000</b>	<b>9,000,000</b>	<b>9,000,000</b>	<b>9,000,000</b>	<b>9,000,000</b>
<b>Direct Costs</b>					
Bananas	1,620,000	1,620,000	1,620,000	1,620,000	1,620,000
Frying Oil	864,000	864,000	864,000	864,000	864,000
Processing Cost	86,400	86,400	86,400	86,400	86,400
Packing Cost	1,120,000	1,120,000	1,120,000	1,120,000	1,120,000
Direct Labor	615,000	615,000	615,000	615,000	615,000
Direct Electricity	82,021	82,021	82,021	82,021	82,021
Maintenance	30,500	30,500	30,500	30,500	30,500
<b>Total Direct Cost</b>	<b>4,417,921</b>	<b>4,417,921</b>	<b>4,417,921</b>	<b>4,417,921</b>	<b>4,417,921</b>
<b>Gross Profit</b>	<b>4,582,079</b>	<b>4,582,079</b>	<b>4,582,079</b>	<b>4,582,079</b>	<b>4,582,079</b>
<b>Indirect Costs</b>					
Building Lease	300,000	300,000	300,000	300,000	300,000
Indirect Labor	180,000	180,000	180,000	180,000	180,000
Fixed Electricity	22,800	22,800	22,800	22,800	22,800
Depreciation	313,000	313,000	313,000	313,000	313,000
Amortization	40,600	40,600	40,600	40,600	40,600
Marketing	1,080,000	1,080,000	1,080,000	1,080,000	1,080,000
Office Administration	134,400	134,400	134,400	134,400	134,400
Licensing/Regulatory Fee	5,000	5,000	5,000	5,000	5,000
<b>Total Indirect Costs</b>	<b>2,075,800</b>	<b>2,075,800</b>	<b>2,075,800</b>	<b>2,075,800</b>	<b>2,075,800</b>
<b>Net Profit</b>	<b>2,506,279</b>	<b>2,506,279</b>	<b>2,506,279</b>	<b>2,506,279</b>	<b>2,506,279</b>



## Projected Balance Sheet

**Table 52: Projected Balance Sheet**

<b>ASSETS</b>	<b>Year 0</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
<b>Current Assets</b>						
Cash	200,000	3,507,085	6,173,557	9,031,755	11,889,869	14,747,895
Raw material	390,000					
Advance Processing Charges	129,990					
Accounts Receivables		375,000	375,000	375,000	375,000	375,000
Spare Parts inventory	30,500	32,025	33,626	35,308	37,073	38,927
<b>Total Current Assets</b>	<b>750,490</b>	<b>3,914,110</b>	<b>6,582,184</b>	<b>9,442,063</b>	<b>12,301,942</b>	<b>15,161,821</b>
<b>Fixed Assets</b>						
Land	-	-	-	-	-	-
Building & Civil Works	-	-	-	-	-	-
Processing Machinery	2,800,000	2,520,000	2,240,000	1,960,000	1,680,000	1,400,000
Utility Machinery	250,000	225,000	200,000	175,000	150,000	125,000
Laboratory Equipment	-	-	-	-	-	-
Office Equipment & Furniture	40,000	32,000	24,000	16,000	8,000	-
<b>Net Fixed Assets</b>	<b>3,090,000</b>	<b>2,777,000</b>	<b>2,464,000</b>	<b>2,151,000</b>	<b>1,838,000</b>	<b>1,525,000</b>
<b>Other Assets</b>						
Pre-operating Expenses	203,000	162,400	121,800	81,200	40,600	-
Contingencies						
<b>Total Other Assets</b>	<b>203,000</b>	<b>162,400</b>	<b>121,800</b>	<b>81,200</b>	<b>40,600</b>	<b>-</b>
<b>TOTAL ASSETS</b>	<b>4,043,490</b>	<b>6,853,510</b>	<b>9,167,984</b>	<b>11,674,263</b>	<b>14,180,542</b>	<b>16,686,821</b>
<b>LIABILITIES</b>						
<b>Current Liabilities</b>						
Accounts Payables		303,740	111,935	111,935	111,935	111,935
Short term loan						
Other Current Liabilities						
<b>Total Current Liabilities</b>	<b>-</b>	<b>303,740</b>	<b>111,935</b>	<b>111,935</b>	<b>111,935</b>	<b>111,935</b>
<b>Long Term Liabilities</b>						
Lease payable						
Long term debt	-	-	-	-	-	-
<b>Long term debt</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Equity</b>						
Paid up Capital	4,043,490	4,043,490	4,043,490	4,043,490	4,043,490	4,043,490
Retained Earnings		2,506,279	5,012,558	7,518,838	10,025,117	12,531,396
<b>Total Equity</b>	<b>4,043,490</b>	<b>6,549,769</b>	<b>9,056,049</b>	<b>11,562,328</b>	<b>14,068,607</b>	<b>16,574,886</b>
<b>TOTAL LIABILITIES</b>	<b>4,043,490</b>	<b>6,853,510</b>	<b>9,167,984</b>	<b>11,674,263</b>	<b>14,180,542</b>	<b>16,686,821</b>



## Projected Cash Flow Statement

**Table 53: Projected Cash Flow Statement**

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Operating Activities</b>						
<b>Net Income</b>		<b>2,506,279</b>	<b>2,506,279</b>	<b>2,506,279</b>	<b>2,506,279</b>	<b>2,506,279</b>
Depreciation		313,000	313,000	313,000	313,000	313,000
Amortization		40,600	40,600	40,600	40,600	40,600
Change in raw material inventories	(390,000)	390,000	-	-	-	-
Change in advance processing charges	(129,990)	129,990				
Change in spares inventory	(30,500)	(1,525)	(1,601)	(1,681)	(1,765)	(1,854)
Change in Accounts Receivables		(375,000)	-	-	-	-
Change in Accounts Payables		303,740	(191,805)	-	-	-
<b>Cash from operations</b>	<b>(550,490)</b>	<b>3,307,085</b>	<b>2,666,473</b>	<b>2,858,198</b>	<b>2,858,114</b>	<b>2,858,026</b>
<b>Financing Activities</b>						
Short term debt principle repayment						
Long term debt principle repayment		-	-	-	-	-
Addition to short term debt						
Additions to long term debt	-					
Issuance of shares	4,043,490					
<b>Net cash from financing activities</b>	<b>4,043,490</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Investing Activities</b>						
Capital Expenditure	(3,293,000)					
<b>Cash from investing activities</b>	<b>(3,293,000)</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Net Cash</b>	<b>200,000</b>	<b>3,307,085</b>	<b>2,666,473</b>	<b>2,858,198</b>	<b>2,858,114</b>	<b>2,858,026</b>
Cash balance brought forward	-	200,000	3,507,085	6,173,557	9,031,755	11,889,869
Cash investment in securities		-	-	-	-	-
Cash available for appropriation	200,000	3,507,085	6,173,557	9,031,755	11,889,869	14,747,895
Dividend	-	-	-	-	-	-
<b>Cash carried forward</b>	<b>200,000</b>	<b>3,507,085</b>	<b>6,173,557</b>	<b>9,031,755</b>	<b>11,889,869</b>	<b>14,747,895</b>

### Financial Feasibility

The proposed project of Banana chips production unit is found to be financially viable with a positive NPV of PKR 5.03 million. NPV, IRR and payback period are shown in **Error! Reference source not found.**

**Table 54: Financial Feasibility Indicators**

NPV (PKR)	<b>5,028,577</b>
IRR	<b>68.93%</b>
Payback (years)	<b>1.60</b>

Profitability ratios are shown in **Error! Reference source not found.**

**Table 55: Profitability Ratios**

	Amount (PKR)	Percent
Sales	9,000,000	100.0%
Direct Costs	4,417,921	49.1%
<b>Gross Profit</b>	<b>4,582,079</b>	<b>50.9%</b>
Indirect Costs	2,075,800	23.1%
<b>Net Profit</b>	<b>2,506,279</b>	<b>27.8%</b>



Picture Gallery:



