



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

Peas 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 and 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.

A handwritten signature in black ink, appearing to read 'Zafar Hasan', with a long horizontal stroke extending to the right.

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 you will enjoy reading the study and it 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 barley 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, Planning Commission of Pakistan), **Dr. Aamir Arshad** (Chief Agriculture, Planning Commission of Pakistan), **Mr. Muhammad Akram Khan** (Project Director; CDBAT project) and other CDBAT project team member **Mr. Muhammad Arif** (Research Associate) and **Dr. Habib Gul** (Research Associate) for successful coordination and support for the project.

I am also grateful to **Centre for Agriculture and Bioscience International (CABI)** and its Regional Director for Central and West Asia, Dr. Babar Ehsan Bajwa and CABI team especially Mr. Yasar Saleem Khan for selecting me as commodity specialist for this task and 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.

Muhammad Najeeb Ullah
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DISCLAIMER

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 Special Initiatives or the Centre for Agriculture and Bioscience International (CABI).



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LIST OF ACRONYMS

AARI	Ayub Agricultural Research Institute
ADP	Annual Development Plan
AMRI	Agricultural Mechanization Research Institute
AOs	Agriculture Officers
ARI	Agriculture Research Institute
CPEC	China Pakistan Economic Corridor
DFM	Directorate of Farm Mechanization
DNA	Deoxy Ribo Nucleic Acid
FAO	Food and Agriculture Organization
FAOSTAT	Food & Agriculture Organization Statistics
FAs	Field Assistants
FEG	Farmer Enterprise Group
FS&TRP	Food Science & Technology Research Program
FSC&RD	Federal Seed Certification & Registration Department
GAP	Good Agriculture Practices
GI	Geographical Identification
GoP	Government of Punjab
Ha	Hectare
IQF	Individually Quick Frozen
IRR	Internal Rate of Return
ISO	International Standard Organization
ISPMs	International Standards for Phytosanitary Measures
Kg	Kilogram
KP	Khyber Pakhtunkhwa
MNFS&R	Ministry of National Food Security & Research
NARC	National Agriculture Research Council
NGOs	Non-Governmental Organizations
NPK	Nitrogen, Phosphorus & Potash
NYUT	National Uniform Yield Trials
PARC	Pakistan Agriculture Research Council
PCP	Planning Commission of Pakistan



PFVA	All Pakistan Fruits & Vegetables Association
PHRC	Post Harvest Research Centre
PKR	Pakistani Rupee
R&D	Research & Development
SOPs	Standard Operating Procedures
SWOT	Strengths, Weaknesses, Opportunities, Threats
UAE	United Arab Emirates
UAF	University of Agriculture, Faisalabad
UK	United Kingdom
USA	United States of America
US\$	United States Dollar
VRI	Vegetable Research Institute, Faisalabad
VRP	Vegetable Research Program



EXECUTIVE SUMMARY

According to the last available statistics, fresh peas were cultivated globally on an area 2.6 million has producing 19.9 million tonnes. With 12.2 million tonnes production, China leads the global production. France is ranked first in peas export and has 23% share in global trade followed by Guatemala and Mexico. The top importers of peas are Belgium, UK and USA.

Pakistan has achieved a phenomenal growth of 220% in Peas production as historical data was analysed from 2001-17. However, most of the increase came from the expansion in area rather than improvement in per ha yield. In fact, per ha yield of Peas which was once at par the global average has now deteriorated significantly over the period. In 2016, it has been reduced by 12% as compared to the world average. This has resulted due to the increasing global yields at the rate of 0.5% per annum. If Pakistan wants to enter into the global market, this is not a healthy sign as deterioration in yield has reduced the country's competitive position.

Despite fast expansion in Peas area and increase in its production, Pakistan could not benefit from the fast expanding global market which has reached at US\$2.6 billion in 2016 and has been growing at the rate of 4.6% per annum. Instead, Pakistan imports are ballooning at the rate of over 4% per annum, while its exports are almost stagnant over the period which resulting in fast increasing trade deficit which has reached to US\$2.6 million from just US\$0.7 million in 2001. Pakistan exports 0.13% of its production as compared to the world average export-production ratio of 1.3%. Moreover, Pakistan's export price is just about one half of the world average export price of Peas while its price at the farm gate level in the country is only 20% of the world average suggesting serious problems in the value chain of Peas.

Looking at the favourable production environment such as controlled irrigation, suitable weather and soils, escape of extreme cold weather in large areas of Pakistan when major Peas producing countries are in its' grip and country's proximity to big markets like China and Middle East, Pakistan has a rich potential to expand in its Peas production and contribute in the world Peas market. In view of these potentials, the Planning Commission of Pakistan has initiated this study to evaluate the whole value chain of Peas, identify gaps and potentials, and suggest strategies and interventions along the chain to improve Peas competitiveness in the world market. Keeping in view the large variations in which Peas crop is grown, this analysis is conducted at the Peas cluster level. A large number of stakeholders were consulted. Macro data were analysed and related literature was reviewed to achieve the objective of the study. An EXCEL model is developed to estimate the socioeconomic feasibility of variation interventions suggested in the study.

In Pakistan, peas are grown in all provinces but major production is concentrated in Punjab followed by KP. Two clusters, one in KP (upper KP with Swat as its centre point) and the other in Central Punjab with Sheikhpura are identified based upon area under the crop and supply period of the fresh produce. As part of this study, 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 input drivers in each cluster. These include rainfall at the sowing time in Punjab and at harvest time in KP, poor research on peas management practices and value chain issues, the lack of improved commercial peas cultivars to produce high quality marketable fresh produce (seed is mainly imported from India which is of low quality), poor conventional cultural practices and improper post-harvest practices for trading in the high-value fresh peas market. Pakistan exports a minimal quantity of fresh & chilled peas however, creating additional export market linkages and satisfying quality standards are needed to realize true potential of this sector.

In order to address multilevel challenges from production to product and market development, performance targets were set, based on global average for yield, quality and export, specific interventions have been proposed, for focal points of defined clusters. These interventions include introduction of new high yielding varieties from other provinces and/or imported from other countries having similar environment like Pakistan, improvement of farmer's production and cultural practices, improvement of post-harvest handling practices including grading, packaging and transportation through improving farmers' and institutional capacities, organizing producers into Farmers' Enterprise Groups (FEGs), incentivizing peas exporters and establishing value chain improvement infrastructure like pack houses, IFQ units etc. These interventions are to be initiated by government and executed in collaboration with participation of private sector including the farmers, traders and their groups/ associations. A time-horizon of five years has been set for realizing the intended outcomes of the cluster development interventions. The total estimated investment of this cluster Up-gradation Plan for the focal points of both the clusters would be US\$4.18 million. Out of this, US\$1.9 million or 46% will be shared by the government in terms of strengthening research, enhancing capacities of stakeholders, incentivizing value chain infrastructure. It is expected that these incentives will encourage the private sector to bring the remaining 54% of the total investment in the form of building value chain infrastructure.

This shall result in far reaching economic and social impacts, including increased productivity and production, higher quality, value and income and employment, benefiting all the stakeholders of peas value chain. The interventions will improve various operations along the whole value chain, thus increase their operational costs. During the last project year, the additional operational costs will reach to US\$1.5 million. These cluster interventions are estimated to create additional positive gross revenues worth of US\$6.9 million (undiscounted) in both the focal points. Accounting for all the investments and operational costs, the Net Present Value (NPV) of the net return would US\$5.09 million over a period of five years and generates an estimated Internal rate of Return (IRR) of 68% for both the clusters. The IRRs are based on respective investment costs in each region and the present value of resulting revenues over a period of five years. The cluster level information for economic analysis can be seen in the Summary Sheet given below.

The Upgradation Plan for peas will generate huge return to various stakeholders along the value chain in terms of additional income, employment and improvements in the peas related research and development organizations. However, the success of the program depends upon adopting the whole cluster approach to resolve the cluster-based issues at local level along the whole value chain. Strengthening of research and capacity building of farmers will be the key for the success of the program.



Summary sheet of Peas Cluster

Information	Upper KP	Central Punjab	Overall
Area of cluster focal point (ha)	1130	3885	5015
Production (tonnes)	9070	26587	35657
Yield of the cluster (tonnes/ha)	8.03	6.84	7.1
Area of the cluster (ha)	1335	17783	19118
Production of the cluster (tonne)	10350	113993	124343
Annual yield growth without intervention (%)	0.08%	-1.98%	
Increase in yield over five year due to improved varieties	20%	20%	20%
Increase in production due to improved varieties (tonne)	1821	4809	6631
Expected additional value of production (000 US\$)	733.97	2496.11	3230.08
Increase in production due mechanized planting (tonne)		301	301
Value of production due mechanized planting (US\$)	0	156,007	156007
Increase in quantity of export on fifth year (tonne)	546	1443	1989
Increase in value of export on the fifth year (000 US\$)	287.40	758.93	1046.33
Production that will pass through improved value chain (tonnes)	546	0	546
Value from exports with improvement in value chain (000 US\$)	310.89	0	310.89
Value of production due to improvement in value chain (000 US\$)	243.69	1950.71	2194.40
Total number of pack house required	2	4	6
Number of planters required	0	80	80
Number of IFQ unit required	0	2	2
Investments (000 US\$)			
Investments on R&D level interventions (US\$)	370.37	740.74	1111.11
Investment on IFQ units	0.00	1000.00	1000.00
Investments for value chain improvement	278.56	1000.00	1278.56
Investments on Marketing/Export level	296.30	518.52	814.81
Investment on planter	0.00	198.52	198.52
Total investment over five year	975.87	3208.02	4183.89
Public investment	515.98	1388.69	1904.68
Private investment	459.89	1819.33	2279.21
Economic Analysis (000 US\$)			
Increase in production due to all interventions (tonne)	1821	5110	6931
Gross revenue (undiscounted) in 5th year	1575.94	5.362	6.938
Additional operation costs in 5th year	0.427	1.088	1.515
Net cash flow (undiscounted) in 5th year	1.149	4.274	5.423
NPV	0.981	4.107	5.088
IRR	64%	69%	68%



1. INTRODUCTION

Peas are important Rabi vegetable of Pakistan which has low production cost, high profitability. It has good nutritional value and is the richest source of protein and is suitable for cultivation from small to large scales holding farmers. Moreover, peas remain available almost round the year due to Pakistan's diversity in agro-climatic conditions in different regions of Pakistan.

1.1 Nutritional Value of Peas

Peas are rich source of protein and have many vitamins and minerals essential for human body. Peas are one of the most nutritious leguminous vegetables rich in health promoting phytonutrients, minerals, vitamins and antioxidants and are relatively low in calories in comparison to beans, and cowpeas. Nonetheless, they are good sources of protein, vitamins, and soluble as well as insoluble fiber. Fresh pea pods are excellent sources of folic acid. Foliates are one of the B-complex vitamins required for DNA synthesis inside the cell. Studies suggest that adequate folate-rich foods when given to expectant mothers would help prevent neural tube defects in their newborn babies. Fresh green peas are healthy sources of ascorbic acid (Vitamin-C). Vitamin-C is a powerful natural water-soluble antioxidant. Vegetables rich in this vitamin would help the human body develop resistance against infectious agents and scavenge harmful, pro-inflammatory free radicals from the body. Peas contain phytosterols, especially β -sitosterol it helps to lower cholesterol levels inside the human body. They are also good in Vitamin-K which has been found to have a potential role in bone mass building function (mineralization) through the promotion of osteoblastic activity inside the bone cells. It also has an established role in the cure of Alzheimer's disease patients by limiting neuronal damage in the brain. Fresh green peas also carry adequate amounts of antioxidants flavonoids such as carotenes, lutein, and zeaxanthin as well as Vitamin-A. Vitamin-A is an essential nutrient required for maintaining healthy membranes, skin, and eyesight. Additionally, consumption of natural fruits/vegetables rich in flavonoids helps to protect from lung and oral cavity cancers.

1.2 Peas Production in Pakistan

In Pakistan, vegetables are grown on an area of 273.27 thousand ha with total production of 3305.40 Thousand tones. Peas are grown in all major agricultural pockets of Pakistan. Peas are grown on almost 22.43 thousand ha of area which is 8.20% of the total area under vegetables. Punjab contributes about 78% in total area under peas and its production (Table 1).¹

¹ However, there is difference between the statistics reported by FAOSTAT and that of Fruit, Vegetables and Condiments Statistics of Pakistan (MNFS&R). As per FAO statistics 2016, total area of peas in Pakistan is 23.58 thousand ha and production is 149.02 thousand tonnes with average yield of 6.32 tonnes/ha. These statistics are somewhat higher than reported by MNFS&R. In this report, FAO statistics are used for international comparison.



Table 1: Current status of peas in Pakistan

Territory	Area		Production		Yield	Value
	000 Ha	% of peas area	000 tones	% of peas production	Tonnes/Ha	Million US\$
Punjab	17.64	78.64	112.26	77.73	6.36	55.00
KP	1.85	8.25	12.50	8.66	6.75	6.13
Sindh	1.86	8.29	7.36	5.10	3.96	3.60
Baluchistan	1.07	4.77	12.28	8.50	11.47	6.01
Pakistan	22.43	8.20*	144.42	4.36*	6.43	70.76

Source: Source: MNFS&R (2018)

Peas cover almost 0.09 % of total cropped area of Pakistan. In Punjab, KP and Baluchistan, the shares of peas is about 0.10% of total cropped area. Whereas in Sindh, the share is only 0.05% (Table 2).

Table 2: Percentage area of peas in total cropped area of Pakistan

Name of territory	Total cropped area (000nha)	Total Vegetable Area (000 ha)	Area of Peas (000 ha)	Percentage cropped area of Peas (%)
Punjab	17040	144.20	17.64	0.10
KP	1850	40.90	1.85	0.10
Sindh	3220	54.23	1.86	0.05
Baluchistan	1060	33.40	1.07	0.10
Pakistan	23170	273.30	22.43	0.09

Source: MNFS&R (2018)

In addition to their domestic use, peas have huge potential as export commodity in raw fresh and processed form. Especially pea has high demand in international market in processed form like canned/frozen peas. However, full potential of this crop has not yet been utilized, reason of which include outdated and manual cultural practices, poor quality and costly seed and other inputs (fertilizers and pesticides), manual harvesting, no proper post-harvest handling and transportation system, unstable and highly fluctuated market conditions and the last but not the least, limited trend towards value addition of this commodity.

As per Fruit, Vegetable and Condiments Statistics of Pakistan, since 2004 to 2016, Pakistan's average annual growth rate of area under Peas cultivation has increased from 77.2 thousand tonnes in 2004 to 177.4 in 2015 with an average rate 8.5% per annum. All of this increase came from the expansion in area, while per ha yield of Peas is declining at quite a fast rate of 3.6% per annum (Table 3). The highest growth in area came from Punjab, while per yield decline was also highest in Punjab. In other provinces, the per ha yield remained almost stagnant. With this declining in per ha yield, it may not be possible to sustain the increase in Peas area and its production.

There are no exact statistics available about number of farmers engaged in production of Peas. However, as per statistics of agriculture census 2010, total number of farms in



Pakistan which reported vegetable cultivation is 507790 which are 6% of total agricultural farms. If only 10% of these farms cultivate peas, the number reaches to 50779. On the same ground, total number of farms engaged in peas production in Punjab are 24181 out of 241813, in KP 13129 out of 131299 and in Baluchistan 4829 out of 48290. There are approximately 119 vegetable markets in Punjab. There are about 300 fruits and vegetables exporters in Pakistan. Other stakeholders important in value chain of peas are Seed companies, seed dealers, Farm input suppliers (Fertilizers & Pesticides etc.), Vegetable markets wholesalers and processors

1.3 Peas Trade from Pakistan

Pakistan is the main importer of peas, while a small quantity is also exported. During 2013, peas export was highest at 9.6 thousand tonnes while 161 thousand tonnes were also imported during the year. However, afterwards, the export plummeted to 0.33 thousand tonnes while imports boomed to 460 thousand tonnes and deficit in balanced of trade also increased accordingly (Table 4). The trends in peas imports are increasing at an annual rate of 4.1% per annum, while the import values are expanding at about 6.8% annually. On the other hand, exports are highly variable and almost stagnant in terms of quantity.



Table 3: Trends in area, production, and yield of peas during 2004-05 to 2015-16

Year	Pakistan			Punjab			KP			Baluchistan			Sindh		
	Area (000ha)	Production (000 tonnes)	Yield (tonnes/ha)	Area (000ha)	Production (000 tonnes)	Yield (tonnes/ha)	Area (000ha)	Production (000 tonnes)	Yield (tonnes/ha)	Area (000ha)	Production (000 tonnes)	Yield (tonnes/ha)	Area (000ha)	Production (000 tonnes)	Yield (tonnes/ha)
2004-05	9.93	77.16	7.77	6.20	51.90	8.37	1.51	10.11	6.70	0.77	8.74	11.35	1.45	6.40	4.41
2005-06	10.59	81.94	7.74	6.56	54.18	8.26	1.82	12.77	7.02	0.74	8.44	11.41	1.47	6.54	4.45
2006-07	11.50	91.31	7.94	6.97	58.96	8.46	2.08	14.83	7.13	0.90	10.36	11.51	1.53	7.15	4.67
2007-08	12.17	82.54	6.78	7.70	49.31	6.40	1.77	12.56	7.10	1.28	14.53	11.35	1.40	6.12	4.37
2008-09	11.68	83.60	7.16	7.36	50.99	6.93	1.78	12.23	6.87	1.29	14.70	11.40	1.24	5.66	4.56
2009-10	11.90	79.91	6.72	7.85	53.33	6.79	1.81	12.94	7.15	1.04	8.42	8.10	1.19	5.21	4.38
2010-11	16.08	98.17	6.11	10.53	69.27	6.58	1.78	12.87	7.23	1.00	11.37	11.37	1.13	4.64	4.11
2011-12	15.83	104.99	6.63	11.70	74.81	6.39	1.86	13.37	7.19	1.04	11.88	11.42	1.22	4.92	4.03
2012-13	17.19	113.06	6.58	12.66	81.14	6.41	1.94	13.47	6.94	1.07	12.28	11.48	1.51	6.16	4.08
2013-14	17.40	114.92	6.60	12.87	82.98	6.45	1.94	13.41	6.91	1.07	12.36	11.55	1.51	6.15	4.07
2014-15	21.62	139.23	6.44	17.04	107.00	6.28	1.94	13.36	6.89	1.10	12.67	11.52	1.52	6.18	4.07
2015-16	22.43	144.42	6.44	17.60	112.26	6.38	1.85	12.50	6.76	1.07	12.28	11.48	1.86	7.36	3.96
Growth (% / annum)	12.49	8.5	-3.6	15.32	9.69	-5.63	1.88	1.97	0.08	3.25	3.38	0.09	2.11	1.25	-0.86

Source: MNFS&R (2018)



Table 4: Import and export of Peas in Pakistan

Year	Imports		Export		Deficit	
	Quantity (tonnes)	Value (000 US\$)	Quantity (tonnes)	Value (000 US\$)	Quantity (tonnes)	Value (000 US\$)
2001	109598	20347	1878	530	107720	19817
2002	91265	19336	2694	724	88571	18612
2003	64395	13525	1756	461	62639	13064
2004	40679	8883	493	178	40186	8705
2005	98695	22704	57	21	98638	22683
2006	139255	29943	7282	2131	131973	27812
2007	120900	28165	6731	2167	114169	25998
2008	47679	20227	827	455	46852	19772
2009	81388	45506	1638	1275	79750	44231
2010	107874	38989	65	47	107809	38942
2011	97512	41551	6736	4516	90776	37035
2012	195760	118537	6650	5154	189110	113383
2013	161070	98329	6927	5856	154143	92473
2014	258626	133055	553	320	258073	132735
2015	460068	253792	332	252	459736	253540
GR %	4.07	6.78	-0.14	3.73	4.1	6.5

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

1.4. Value Addition and Processing of Peas

In Pakistan, Vegetables value addition and processing has always been a poor sector. Same is the case with value addition and processing of peas. Generally, farm products including peas is exported as fresh vegetable. There is limited demand of frozen peas in the country due the availability of fresh pea throughout the year. However, now a famous food

processing company Fauji Fresh and Freeze has jumped into the market (Table 5). It involves mainly selling of frozen peas at national level and some extent to the international markets. They are also processing peas in mixed vegetables i.e. frozen mix of peas, peas and Cauliflower at national level according to domestic cooking habit. Entrance of processing industry in pea value addition and canning is a good hope for the growth of this sector. However, no exact statistics are available for extent of value addition and processing of peas in Pakistan.



Table 5: Value added products of pea in Pakistan

Manufacturers	Products
Fauji Fresh and Freeze, Sahiwal	<ul style="list-style-type: none"> Frozen diced peas Mix 3 (Peas, Peas and Cauliflower)
Icepack Limited, Lahore	<ul style="list-style-type: none"> Peas Cubes, Mix 2- (Peas + Peas) Mix 3-(Peas + Peas + S. Corn) Mix 3-(Peas + Peas + G. Beans) Mix 3-(Peas + Peas + S. Corn)

Source: Market Survey and Stakeholders Interaction

1.5. Pakistan in Global Context

Pakistan produced 0.75% of total world production for peas during 2016. Average yield of Pakistan for peas is 6.32 tones/ha which is 82% of the world average yield. Pakistan's yield is only 41.02% of Luxembourg yield which has the highest yield in the world. Pakistan exports 0.17% of its local production as compared to world average of 1.59%. Pakistan has only 0.04% share in world export value for peas. Average export price of Pakistani peas is only about one half of the world average price, while Pakistan has less than 20% of the world average farmgate prices (Table 6).

Table 6: Pea global market and Pakistan (2016)

Parameter	World	Pakistan	Rank	Share (%)
Area (000 Ha)	2589.1	23.6	9th	0.91
Production (000) ton	19,877.3	149.0	7th	0.75
Value (million US\$)	25,577.2	37.1		0.14
Yield (ton/ha)	7.7	6.3	26th	81.8
Farm gate price (US\$/ton)	1287	249		19.34
Peas export quantity (000 tones)	276.6	0.19	127th	0.069
Peas (fresh or chilled) export value (million US\$)	2640.7	0.1	117th	0.037
Export quantity as percentage of production (%)	1.3	0.13		
Export value as percentage of production value (%)	1.05	0.089		8.48
Peas (fresh or chilled) Import weight (000 tones)	267.64	0.4	134th	0.15
Peas (fresh or chilled) Import value (million US\$)	280.18	0.07	124th	0.02
Import quantity as percentage of production (%)	1.35	0.27		
Import value as percentage of production value (%)	1.10	0.2		
Average export prices (US\$/ton)	971.98	526.32		54.15

Source: FAO Statistics and UN Data (www.factfish.com)

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



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

As per FAO statistics, peas are sown on an area of 2589.09 thousand ha with production 19.88 million tones globally (Table 6). Pease production has been increasing at the rate of 3.3% per annum during 2008-16. In contrast to Pakistan where there is a sharp decline in per ha yield, the global peas yield is increasing at a rate 0.55% per annum during 2008-16. Area and production of peas are also growing positively at global level. However, due to fast expansion in peas area in Pakistan, its position among peas producing countries is improving overtime.

Table 7: Trends in international pea's production (fresh and dried) during 2008-16

Year	Area	Production	Yield
	(000 ha)	(000 ton)	(ton/ha)
2008	2050	14924	7.3
2009	2129	15745	7.4
2010	2185	15985	7.3
2011	2240	16970	7.6
2012	2285	17064	7.5
2013	2288	17428	7.6
2014	2354	17444	7.4
2015	2517	19433	7.7
2016	2589	19877	8.0
Growth rate (%)	2.63%	3.32%	0.55%

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

There is a fast increase in the export of peas at the global level. The fresh and dried pea's export has increased from US\$0.7 billion in 2001 to US\$2.6 billion in 2016 with an average growth rates of 4.6% per annum (Table 8). The growth in the quantity of global export of peas is lower than the increase in its production, suggesting that people increasingly like to consume home produced peas. Both green and dry peas are increasing at almost equal rate indicating an equal preference of international consumers for both the types of peas.

Pakistan did not benefit from the fast increasing international market for peas as its export remained almost stagnant during the period. This has created an opportunity for Pakistan to enter into this market if it can standardize its product and address the quality issues.



Table 8: International trade of (fresh and dried) during 2001-2017

Year	Peas Dry		Peas Green		Total	
	Quantity (000t)	Value (Mill US\$)	Quantity (000t)	Value (Mill US\$)	Quantity (000t)	Value (Mill US\$)
2001	3513.8	630.2	123.5	78.2	3637.4	708.4
2002	2747.1	556.7	157.5	89.8	2904.6	646.5
2003	2191.4	506.1	181.2	113.1	2372.6	619.2
2004	3096.1	675.0	149.8	110.0	3245.8	784.9
2005	3978.6	788.7	173.8	138.4	4152.5	927.0
2006	4171.7	872.4	150.1	128.2	4321.8	1000.6
2007	3639.7	1091.9	152.3	179.1	3792.1	1271.0
2008	3358.3	1434.8	167.9	211.2	3526.2	1646.0
2009	4239.2	1347.3	220.4	232.8	4459.6	1580.0
2010	4481.4	1443.3	198.7	247.5	4680.1	1690.8
2011	4821.0	1946.8	204.7	311.4	5025.6	2258.2
2012	4091.7	1784.9	284.5	332.2	4376.2	2117.2
2013	4635.4	2110.3	299.7	377.2	4935.1	2487.5
2014	5142.5	2101.5	260.2	357.3	5402.7	2458.8
2015	5270.9	1995.4	251.0	336.0	5521.9	2331.4
2016	6276.5	2305.1	246.1	335.6	6522.5	2640.7
Growth rates (%)	2.04	4.63	2.09	4.75	2.0	4.6

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

China is the major producers of peas contributing 59% of the total global area under peas and 61% in global peas production. Pakistan is ranked 9th in terms of area and 7th in terms of production of peas (Table 9). Pakistan has great opportunity to learn from China through its collaborative program under CPEC.

Table 9: World top peas producing country

Rank	Country	Production	Country Share	Area	Country Share	Yield
Rank	Country	000 tones	(%)	000 ha	(%)	Tones/Ha
1	China	12207	61.41%	1523	59%	8.01
2	India	4814	24.22%	497	19.20%	9.69
3	USA	332	1.67%	57.6	2.22%	5.76
4	France	233	1.17%	35.7	1.38%	6.53
5	Egypt	194	0.98%	20.0	0.77%	9.71
6	UK	154	0.77%	35.5	1.37%	4.32
7	Pakistan	149	0.75%	23.6	0.91%	6.32

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

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Majority of the export of peas is in the dried form. Canada is the largest exporter of dried peas. Although, China is the major producers of Peas but because of its strong demand within the country, it is the 4th largest exporter of fresh peas in the world. The first largest exporter of fresh peas (in terms of quantity) is France followed by Guatemala, and Mexico (Table 10). Pakistan exports of fresh peas is mainly concentrated with Afghanistan, United Arab Emirates, United Kingdom, Saudi Arabia, Kuwait, and Qatar.

Table 10: Major peas (fresh and dried) exporting countries of the world during 2016

Rank	Dry peas (Export)				Fresh peas			
	Country	Quantity (000 ton)	Country	Value (M. US\$)	Country	Quantity (000 ton)	Country	Value (M. US\$)
1.0	Canada	3137	Canada	1083	France	59.9	USA	57.2
2.0	Russian	702	USA	279	Guatemala	31.8	Guatemala	49.7
3.0	USA	542	Russian	200	Mexico	19.2	Netherlands	46.1
4.0	France	368	France	126	China	17.8	China	32.8
5.0	Ukraine	359	Ukraine	107	USA	17.1	Kenya	25.3
6.0	Australia	156	Australia	69	Germany	13.3	Peru	24.1
7.0	Lithuania	219	Lithuania	68	Poland	9.3	France	21.2

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

Pakistan should explore the potential to export peas to high potential markets like Russia, Belgium, USA, UK, Netherland and France which are among the top largest importers of fresh peas in the world. Recently, UAE, Saudi Arabia, and Russia are the attracting exporters for fresh and frozen peas.

Table 11: Major importers of fresh peas during 2016

Rank	Country	Quantity (000 tonnes)	Country	Value (Million US\$)
1	Belgium	112	USA	69
2	USA	41	Canada	53
3	United Kingdom	14	United Kingdom	53
4	Netherlands	13	Netherlands	51
5	France	12	Belgium	42
6	Canada	12	Germany	21
7	Germany	8	France	18
8	Thailand	7	Viet Nam	14
9	Malaysia	7	Denmark	10
10	Viet Nam	5	Norway	8

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



1.6. Need of the Study

From the macro situation analysis, we can conclude that Pakistan has achieved a phenomenal growth of 220% in Peas production during 2001-17, but most of the increase came from the expansion in area rather than improvement in per ha yield. In fact, per ha yield of Peas which was once than the global average has deteriorated significantly over the period, and in 2016 it has 12% lower compared to the world average. This is also because the global Peas yield has been increasing at the rate of 0.5% per annum over the period. If Pakistan wants to enter into the global market, this is not a healthy sign as deterioration in yield has reduced the country's competitive position.

Despite fast expansion in Peas area and increase in its production, Pakistan could not benefit from the fast expanding global market for Peas which has reached at US\$2.6 billion in 2016 and has been growing at the rate of 4.6% per annum during 2001-16. Instead, Pakistan imports are ballooning at the rate of over 4% per annum, while its exports in term of Peas quantities are almost stagnant over the period resulting a fast increasing trade deficit which has reached to US\$2.6 million in 2016 up from just US\$0.7 million in 2001. Pakistan exports just 0.13% of its production as compared to the world average export-production ratio of 1.3%. Moreover, Pakistan's export price is just about one half of the world average export price of Peas while its price at the farm gate level in the country is only 20% of the world average suggesting serious problems in the value chain of Peas.

Looking at the favorable production environment such as controlled irrigation, suitable weather and soils, escape of extreme cold weather in Pakistan when major Peas producing countries are in its' grip, and country's proximity to big markets like China and Middle East, Pakistan has a rich potential to expand in its Peas production and participate in the world Peas market. In view of these potentials, the Planning Commission of Pakistan has launched this project to evaluate the whole value chain of Peas, identify gaps and potentials, and suggest strategies and interventions along the chain to improve Peas competitiveness in the world market. In view of the large variations in which Peas crop is grown in the country, this analysis is conducted at the cluster level.



2. GOALS AND PURPOSE

The overall goal of this study is to contribute to the Cluster Development Based Agriculture Transformation Plan –V2025. Specific objectives of the study are

1. To identify the major clusters of pea production in Pakistan
2. To conduct a detailed diagnosis and SWOT of the pea value chain in each cluster
3. To identify technological, institutional, infrastructure and policy gaps in each cluster
4. Assess the potential of peas production in each 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 pea 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 peas clusters were collected from three sources:

- I. **Macro-Data.** Relevant macro data were collected from various published and unpublished reports of government and non-governmental organizations and internet search on peas value chain **(See annexure 1 for the macro data sources)**
- II. **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 2 for the list of stakeholders consulted).**
- III. **Literature Review.** The literature related to the functioning, gaps, and interventions in peas value chain is reviewed and synthesized **(See Annexure 3 for the literature reviewed).**

Following generic parameters and indicators are used in collecting the data:

- Global context of peas sector;
- Production potential and review of peas sector;
- Cost of production, harvesting, post-harvest processing of pea from the growers and grower associations;
- Marketing, trading, and processing from traders, wholesalers, retailers, and processors;
- Issues and constraints relating to production, harvesting, selling, marketing, trading, and processing from all stakeholders;
- Recommendations and benchmarks based on global parameters;

The author then used these data to first identify the peas cluster in the country and then used his subjective judgment in prescribing the characteristics of each cluster, identifying the cluster strengths, weaknesses, opportunities, and threats (SWOT), investigating the functioning of existing value chain, and quantifying the cluster potentials. Based on the above analysis, we then suggested the interventions for improvement in each cluster. The cost and benefits of each intervention are also estimated to finally work out the Internal Rate of Return of the whole package. A pea Transformation Plan is also formulated which identifies sustainable cluster upgrading strategies for the development of the peas sector that can help create significant economic opportunities for producers, processors and all the stakeholders participating at different points of the value chain.



4. LITERATURE REVIEW

In Pakistan, Peas is an important crop which plays an important role in farmer's economy. It is the most common crop and enjoys a great commercial demand due to its nutritional value. It is cultivated during winter in plains and during summer in highlands. [Munir, k 2013)]

According to All Pakistan Fruits and vegetables exporters, importers and merchants' association, R&D is a vital element to strengthen the vegetables exports of Pakistan. The R & D should focus on exploration of new varieties, enhancement of shelf-life and disease control in the existing products. PFVA states plan to establish R&D labs in all major vegetable growing areas in liaison with agricultural universities to tap the immense potential of this segment (Ahmad et al., 2015)].

Vegetables production requires improvement in order to get benefits of its high returns. Some immediate steps needed are to develop varieties with high demand, import substitutions, better quality seed, improved irrigation system, integrated pest management and establishment of vegetables processing plants (Chishti et al., 2018).

River Swat is major source of irrigation in Swat. But resource base of Swat is shrinking day by day creating major threat of water shortage for agriculture sector in future. Vegetables cultivation is vulnerable to both climatic and non-climatic factors in Swat resulting in low productivity (Ahmad et al., 2015).

Khyber Pakhtunkhwa has a comparative advantage in the production of pea only as an import substitution crop. Pea is the second most efficient winter vegetable crop studied in Khyber Pakhtunkhwa province. (Mohammad and Shahid 2002).

In Punjab, the harvesting of peas crop starts in December and continues till the end of April. The wholesale price trend of peas was seen to be very consistent during the three years. It was seen that the price of peas was the lowest in the months of February and March during different years. Therefore, the processing of peas to produce Individual Quick Frozen peas will be done during the months of February and March. (Chishti et al., 2018).

The sowing patterns significantly affected days to emergence, days to flowering and plant height. Peas sown on top ridges germinated and flowered as well as recorded the maximum height. The different sowing patterns significantly affected the pods per plant, grains per pod, 1000-grain weight and grain yield ultimately (Muhammad and Shaad, 2002).

In Pakistan, very limited quantity of fruits and vegetables is preserved leading to heavy post-harvest losses. Freezing is one of the many preservation methods which involve lowering the product temperature to -18C. Local market for frozen fruits and vegetables is not very large but Individual Quick Frozen vegetables' is a major category in the world export market of horticultural products. The world market of frozen vegetables is increasing. Pakistan doesn't have any considerable share in IQF exports. This report states that Pakistan can export frozen products of 0.85 Million US\$ to China. The establishment of frozen food



industry has direct effect on farmers and eventually government through value addition, reduction in post-harvest losses and price stability. The farmer gets direct benefit of food processing industry as he gets higher price for his produce (Government of Punjab, 2017).



5. CLUSTER IDENTIFICATION AND CHARACTERISTICS

In Pakistan, pea cultivation is distributed across the country. This commodity is cultivated almost in every district of Pakistan. However, over the year's certain areas have developed with relatively high acreage of peas due to various factors including but not limited to climate, crop suitability, market value and inputs availability etc. Three clusters are defined for pea crop in Pakistan based upon their suitability, present acreage under commodity, quality of the fresh produce and trend or scope of the value addition.

5.1. Geographical Identification of the Clusters

In KP, peas are grown on an area of 1.83 thousand ha. Pea is the major vegetable grown in KP along with peas and Peas. Based upon climatic conditions, cropping pattern and supply availability, two clusters are identified for peas in KP.

5.1.1. Upper KP Cluster

This cluster consists of two districts Swat and Chitral. Total area of peas in these two districts is 1.335 thousand ha, which is 72.63% of KP area whereas 7.87% of total pea area in Pakistan. Almost 76.98 % of the total production of KP comes from this cluster. The focal point of the cluster is Swat as it alone contributes 67.5% of the provincial peas production.

Table 12: Peas status in upper KP cluster

Districts	Production (Tonnes)		Area (Ha)		Yield (Tonnes/Ha)
	Peas	%age Share	Peas	%age Share	
Swat	9070	67.5	1130	61.48	8.03
Chitral	1280	9.5	205	11.15	6.24
Cluster Total	10350	77.0	1335	72.63	7.75
KP Total	13445	100	1838	100	7.32

5.1.2. Central Punjab Cluster

In Punjab, peas are grown in almost every district. However, 64.80% of total Punjab area is concentrated in five districts of Punjab, i.e. Chiniot, Gujranwala, Okara, Sahiwal and Sheikhpura. Total area of pea in these five districts is 13.1 thousand ha. This cluster contributes 67.38% of Punjab's production for peas. Sheikhpura is the focal point of this cluster as it contributes 20% in the provincial peas production.



Table 13: Peas status in central Punjab cluster

Districts	Production (Tonnes)		Area (Ha)		Yield (Tonnes/Ha)
	Peas	%age Share	Peas	%age Share	
Chiniot	24774	18.82	3468	17.156	7.14
Gujranwala	14348	10.90	2509	12.412	5.72
Okara	9372	7.12	1255	6.208	7.47
Sahiwal	13625	10.35	1983	9.810	6.87
Sheikhupura	26587	20.19	3885	19.218	6.84
Cluster Total	88706	67.38	13100	64.80	6.77
Punjab Total	131653		20215		6.51

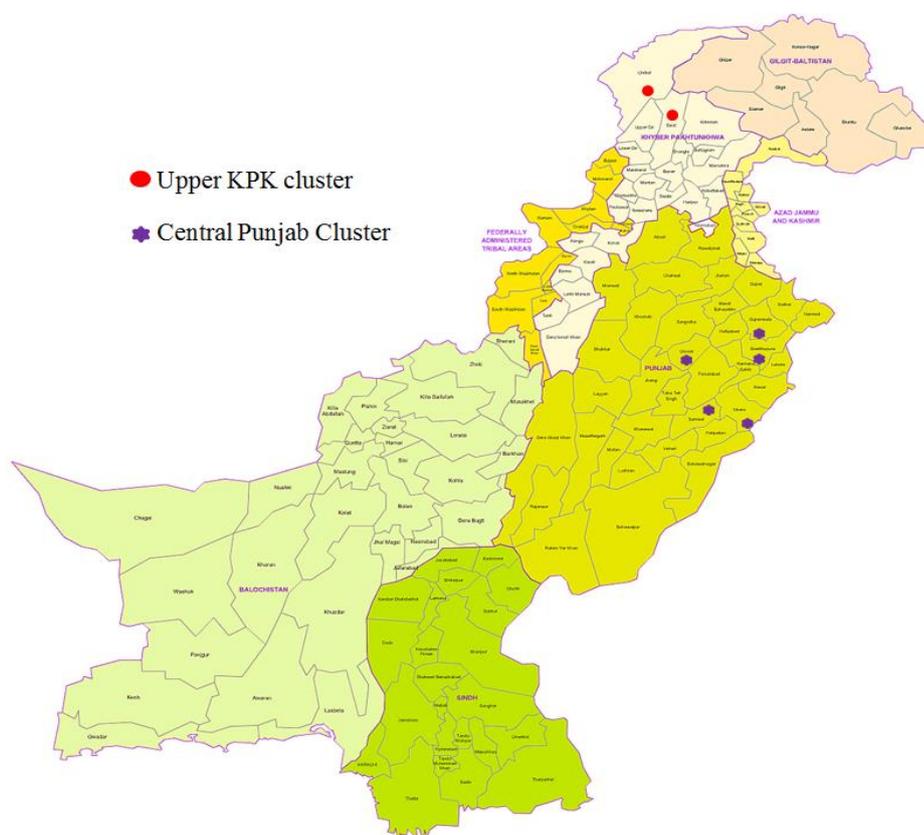


Figure 1: Map showing geographical identification of Peas clusters

5.2. Comparison of Clusters Characteristics

In this section, two clusters defined previously for peas have been compared for various factors like geographic environment, product type & quality, socioeconomic factors, cultivation practices, supply time, marketing & transportation infrastructure, nature and quantum of value addition and processing.



In Upper KP cluster, Districts Swat and Chitral (KP) are mountainous region and home to lush green valleys. It has fertile soils with good organic matter contents. This region has good quality ground water, and is very suitable for vegetables cultivation of pea. In Chitral pea crop is cultivated in the months of April –May and supply fresh peas from June to August. In district Swat sowing is done during months of May to August when its cultivation is not possible in other clusters of Pakistan due to unfavorable climatic conditions. This region supplies good quality pea to all major markets of Pakistan from end July up to September. Moreover, unique climatic conditions of this cluster offer great potential for organic cultivation of peas.

In central Punjab cluster supply of fresh peas is prolonged as compared with upper KP cluster. Sowing of pea in the districts central Punjab starts from September and continues up to mid-December whereas supply time of fresh produce/pods continues from November to start of April. The districts of central Punjab are also prominent for the production of quality pea seed due to favorable environment for seed crop. Mainly seed crop is produced in District Sahiwal, Okara, Toba Tek Singh and Faisalabad and this seed is sold in different markets of Pakistan through seed companies and merchants/seed traders.

Upper KP cluster offer high potential for export of fresh peas to high value markets like UAE due to organic nature of the produce. Whereas, Central Punjab cluster is ideal for establishment of peas processing industry like frozen pea and export of fresh peas due to prolonged supply period and lower prices during peak supply period (In Months of Jan-Feb). Also, this cluster offers high potential of local seed production of peas.

Cultural practices for pea are almost same across all regions with minor differences. Sowing is done manually on ridges/beds or through broadcast. After seed broadcast, ridges are made. Pre emergence weedicides are applied to escape hoeing in peas in all clusters. In district swat of KP, normally only one bag or half bag of DAP is applied at land preparation. However, sometimes one bag of Calcium Ammonium Nitrate is applied at flowering stage. In Central Punjab, farmers are more concerned about soil fertility levels and fertilization. Normal practice is adding two bag of DAP and one bag of SOP while land preparation, whereas almost 1-2 bags of Urea are applied in splits with water at flowering stage. However, in all the cases, no soil analysis is done and use of fertilizers varies from farmers to farmers as per personal experiences and financial circumstances. Harvesting is also manual. After harvesting fresh pods are filled in bags and transported to vegetable markets on trucks and mazdas, etc.

In all of these regions, marketing practices and protocols are more or less same. Fresh produce reached vegetable market on trucks. Price of the produce is finalized on spot depending upon visual grading, market demand and supply. Moreover, wholesalers of one market are connected with markets of other cities telephonically and these contacts play important role in whole sale prices of the fresh produce. Following table presents an overall comparison of key characteristics in these four clusters. Agriculture extension and R&D department in KP is not very effective. General reviews of farmers about government agricultural extension services were not so supporting. However, farmers of central Punjab passed comments about Agriculture extension services in the area.



Table 14: Characteristics and comparison of Pea clusters

Salient Features	Upper KP cluster	Central Punjab cluster
Product	Fresh Peas	Fresh Peas and seed
Districts	Sawat, Chitral (KP)	Chiniot, Gujranwala , Okara, Sahiwal, Sheikhpura districts (Punjab)
Focal point District/Tehsil/Mouza	Sawat	Sheikhpura
Focal point area (ha)	1130	3885
Focal point production (tonne)	9070	26587
Area of the cluster: (000 Hectare)	1.335	17.783
Production: (000 Tonnes)	10.350	113.993
Average yield: (Tonnes/Hectare)	7.75	6.41
Percentage of the crop area that lies in the cluster (Peas area of the cluster/Peas area in the country)	72.63%	87%
Percentage of the total cropped area in the cluster (Peas area in the cluster/total cropped area in the cluster)	0.79%	0.51%
Geographical and Environmental Factor	<ul style="list-style-type: none"> Fertile soils with good organic matter contents 	<ul style="list-style-type: none"> Sandy to clay loam soils
	<ul style="list-style-type: none"> Area is mountainous region and is home to lush green valleys, snow-covered glaciers, forests, meadows and plains 	<ul style="list-style-type: none"> Fertile flat plains
	<ul style="list-style-type: none"> Temperate zone. The summer in lower valley is short and moderate while it is cool and refreshing in the upper northern part 	<ul style="list-style-type: none"> The climate is subject to extreme variations with hot summers and cool winters
	<ul style="list-style-type: none"> Wells, water canals and lift pumps are major source of irrigation 	<ul style="list-style-type: none"> Access to canal irrigation (Lower Chenab) almost throughout the year although it is becoming increasingly scarce. Tube wells are major source of irrigation
	<ul style="list-style-type: none"> Good quality river swat and river chitral water 	<ul style="list-style-type: none"> Good quality ground water, but this ground water quality is also deteriorating
	<ul style="list-style-type: none"> The winter season is long and extends from November to March; rain and snowfall occurs during this season. The average annual precipitation ranges from 1000mm to 1200mm. As 	<ul style="list-style-type: none"> The average rainfall about 476-635 mm



	<p>there is currently no meteorological station in district Swat, data collected by the station in nearby Dir is used</p> <ul style="list-style-type: none"> The hottest month is June with mean maximum and minimum temperature of 33°C and 16°C, respectively. The coldest month is January with mean maximum and minimum temperature of 11°C and -2°C, respectively. 	
	<ul style="list-style-type: none"> Small land holdings 	<ul style="list-style-type: none"> Small to medium land holdings
Peas growers	<ul style="list-style-type: none"> A large number of farmers in this region are uneducated, so mostly unable to understand and follow new methods of cultivation No peas growers or farmers association 	<ul style="list-style-type: none"> Most of farmers in this region are uneducated No peas growers or farmers association
	<ul style="list-style-type: none"> Good quality peas 	<ul style="list-style-type: none"> Prolonged supply period (November to start April)
Product Feature	<ul style="list-style-type: none"> High demand produce due to scarcity period Less to no residues of pesticides 	<ul style="list-style-type: none"> Good quality peas cheaper rates Less attack of diseases
	<ul style="list-style-type: none"> Mostly imported varieties (Climax, Advanta selection, green cross) 	<ul style="list-style-type: none"> local and imported varieties (Meteor, lina pak, Alina, Green cross, Pea-2009, Green cross, Advanta selection)
	<ul style="list-style-type: none"> Long statured varieties 	<ul style="list-style-type: none"> Short statured varieties for early sowing (Sep- Oct) Long Statured varieties(Nov- Dec sowing)
Variety Feature	<ul style="list-style-type: none"> More pods bearing varieties 	<ul style="list-style-type: none"> Early season varieties (Meteor, Lina Pak, Alina) have less no of pods and small in pods length Normal season varieties (Green cross, classic, Pea-2009, Advanta selection, champion) long podded and more no of pods
	<ul style="list-style-type: none"> Green pods 	<ul style="list-style-type: none"> Pale green (Lina Pak) to green podded varieties
	<ul style="list-style-type: none"> Peas are grown through seeds 	<ul style="list-style-type: none"> Peas are grown through seeds
Sowing/Planting	<ul style="list-style-type: none"> All growers obtain seeds from seed companies 	<ul style="list-style-type: none"> Growers obtain seeds from seed companies and also used their own produced seed. Local seed production to meet the local seed requirement is also a feature of this area. Farmers grow seed crops on contact farming with seed



		companies.
	<ul style="list-style-type: none"> crop is grown on flat to raised beds techniques 	<ul style="list-style-type: none"> crop is grown on flat to raised beds techniques
	<ul style="list-style-type: none"> Row to row distance 100cm to 125 cm 	<ul style="list-style-type: none"> Row to row distance 75 cm for early varieties 100 - 125cm for normal season varieties
	<ul style="list-style-type: none"> Plant to plant distance 8cm to 10 cm 	<ul style="list-style-type: none"> Plant to plant distance 5cm to 10cm
	<ul style="list-style-type: none"> Average number of plants in one acre = 70000 to 80000 	<ul style="list-style-type: none"> Average number of plants in one acre = 70000 to 80000
	<ul style="list-style-type: none"> 3-4 seed per hole 	<ul style="list-style-type: none"> 1-2 seeds per hole
Inputs/Management Practices	<ul style="list-style-type: none"> Highly variable fertilizer application without any soil analysis Very less/nominal fertilizer is applied 	<ul style="list-style-type: none"> Highly variable fertilizer application without any soil analysis On average ratio of N:P:K is 35-40 : 25 : 25
	<ul style="list-style-type: none"> Farmers are using imbalance inputs without soil analysis 	<ul style="list-style-type: none"> Trend is increasing to use fertilizer with soil survey
	<ul style="list-style-type: none"> No effective inputs monitoring system 	<ul style="list-style-type: none"> Input supply system is monitored by the Government, but unable to monitor such a huge market
	<ul style="list-style-type: none"> Irrigation depends upon canals, tube wells, wells and lifting pumps etc. 	<ul style="list-style-type: none"> Irrigation depends upon canal water and underground water
	<ul style="list-style-type: none"> Manual cultural practices 	<ul style="list-style-type: none"> manual thinning and other cultural practices like weeding practiced very rarely
Harvesting	<ul style="list-style-type: none"> Manual harvesting through labor 	<ul style="list-style-type: none"> Manual harvesting through labor
	<ul style="list-style-type: none"> Generally 2-3 picking 	<ul style="list-style-type: none"> Generally 1-2 pickings
	<ul style="list-style-type: none"> No seed production 	<ul style="list-style-type: none"> Seed crop is also harvested manually and threshed through wheat thresher
Packaging/Transportation?	<ul style="list-style-type: none"> The fresh pods are packed in plastic bags generally and transported vegetables markets through goods transport 	<ul style="list-style-type: none"> The fresh pods are packed in plastic bags generally and transported vegetables markets through goods transport. The seed crop is dried in sunlight and after manual/mechanical cleaning is stored in gunny bags in ventilated stores.
Wholesaler/Retailer	<ul style="list-style-type: none"> Fresh produce is transported to whole sale markets and auctioning in the wholesale market with visual and spot grading 	<ul style="list-style-type: none"> Fresh produce is transported to whole sale markets and auctioning in the wholesale market with visual and spot grading
	<ul style="list-style-type: none"> The auction in the wholesale market is generally based on the variety and weight, but exact grading is not currently followed. 	<ul style="list-style-type: none"> The auction in the wholesale market is generally based on the variety and weight, but exact grading is not currently followed.
	<ul style="list-style-type: none"> Market prices depends upon 	<ul style="list-style-type: none"> Market prices depends upon



	demand and supply	demand and supply
New Technologies/Infrastructure	<ul style="list-style-type: none"> • No new technology / infrastructure in production and marketing 	<ul style="list-style-type: none"> • No new technology / infrastructure in production and marketing
	<ul style="list-style-type: none"> • No processing 	<ul style="list-style-type: none"> • Some new food processing companies are getting involved in peas processing (frozen peas) to meet the local need during scarcity period
Export	<ul style="list-style-type: none"> • export in fresh form 	<ul style="list-style-type: none"> • No export in fresh or processed form
Supply Chain/Supply cycle	<ul style="list-style-type: none"> • Fresh produce available from June to September which is high demand period in the country 	<ul style="list-style-type: none"> • Fresh produce available from November to April
	<ul style="list-style-type: none"> • From farmer field, fresh produce transported to big markets in Pakistan 	<ul style="list-style-type: none"> • From farmer field, fresh produce transported to whole sale markets
	<ul style="list-style-type: none"> • From these whole sale markets, produce is distributed throughout the country through retailers and local traders 	<ul style="list-style-type: none"> • From these whole sale markets, produce is distributed throughout the region through retailers and local traders
Certification	<ul style="list-style-type: none"> • No certification or quality control mechanism 	<ul style="list-style-type: none"> • No certification or quality control mechanism for fresh produce. Federal seed certification department (FSC&RD) looks over the quality assurance & seed certification matters.
Socioeconomic networking/Gender involvement	<ul style="list-style-type: none"> • Manual cultural practices (sowing, harvesting and packaging etc.) involves local labor • Socioeconomic networking; 	<ul style="list-style-type: none"> • Manual cultural practices (sowing, harvesting and packaging etc.) involves local labor including female labor as female labor is less costly • Socioeconomic networking;
Subsidies/Incentives/Facilities	<ul style="list-style-type: none"> • No specific subsidy/incentive or facility related to this commodity • Other subsidies for farmers (e.g. subsidized fertilizers or agricultural implements etc.) are available at limited scale. 	<ul style="list-style-type: none"> • No specific subsidy/incentive or facility related to this commodity • Other subsidies for farmers (e.g. subsidized fertilizers or agricultural implements etc.) are available at limited scale.
Socioeconomic Networks	<ul style="list-style-type: none"> • Family members (labor) involved in cultural practices 	<ul style="list-style-type: none"> • Both male & female labor involved. Female labor is preferred for sowing and picking



5.3. Description of Value Chain in the Upper KP Cluster

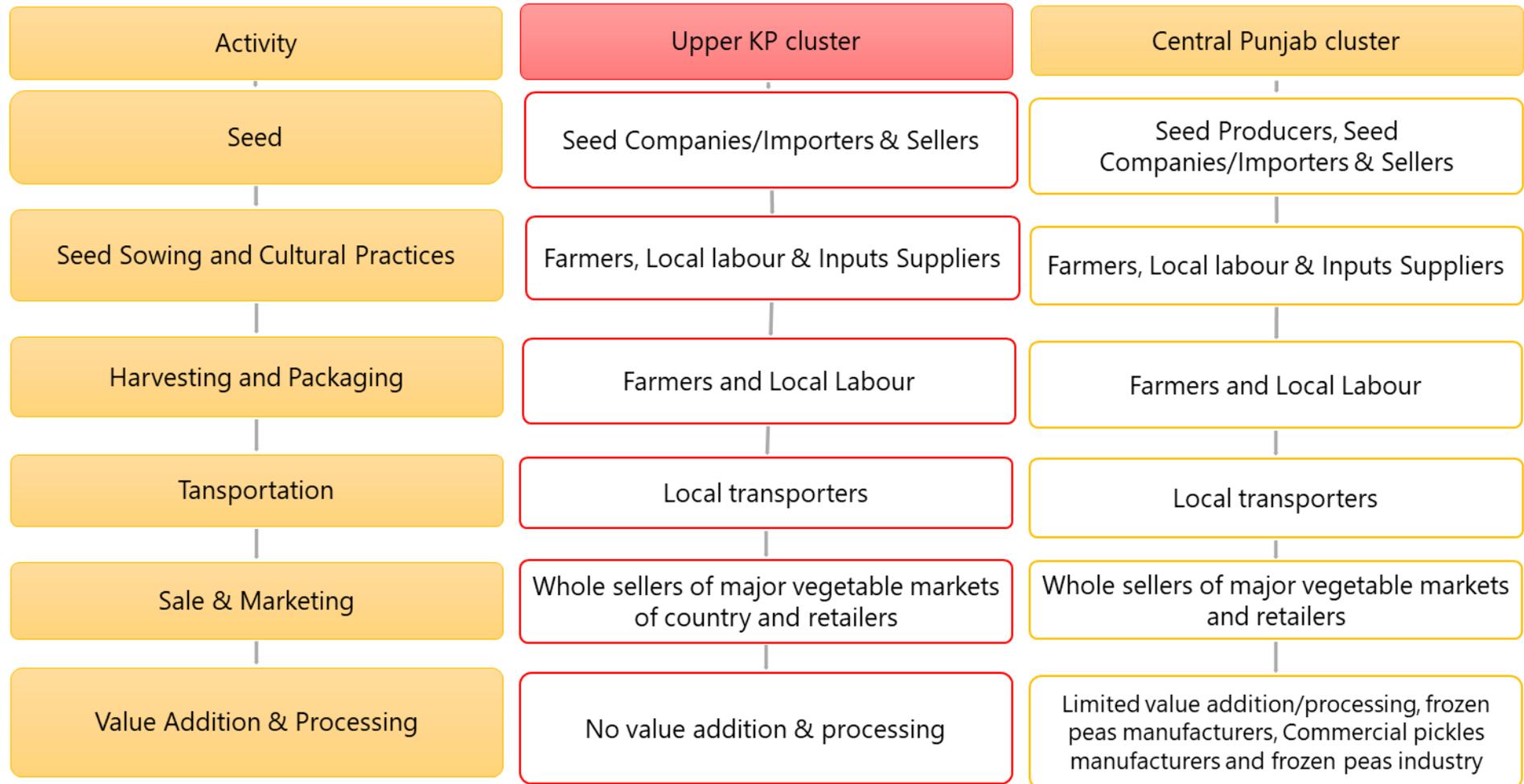
District Swat and Chitral (KP): Two pea varieties Climax and Advanta selection are mostly sown in this region. Both imported and local seed is available in the market but farmers of this region mostly use imported seed to grow their crop. Local seed available in the market is produced and supplied from Punjab. Many private seed companies are involved in seed business of pea in this region. Farmers sow the pea crop starting from May to June. Farm input supplies like fertilizer and pesticides are available in local market from local traders and outlets of agricultural companies. However, use of fertilizers and pesticides in this area is very limited. Harvesting, packaging and loading on trucks is done manually by local male labor. The fresh produce is transported to major vegetable markets of the country like Rawalpindi, Lahore, Faisalabad etc. No value addition or processing industry is involved in value chain of pea from this region.

5.4. Description of Value Chain Analysis in Central Punjab Cluster

Central (Punjab): Many national and international seed companies are involved in business of pea seed in this region. Both local and imported seed of different pea varieties like Meteor, Lina Pak, Pea-2009, Advanta selection, Green cross etc. are grown in this area. Some farmers also produce their own seed and seed companies'/ seed traders obtain seed by contract farming with farmers. Sowing is done manually by the local labor. Farm input supplies like fertilizer and pesticides are available in local market from local traders and outlets of agricultural companies. Harvesting, packaging and loading on trucks is done manually by local labor. The fresh produce is transported to vegetable markets throughout the county depending upon demand, supply and market prices. No small scale processing of pea is available in Pakistan. Some big food processors like Fauji Fresh n Freeze are involved in production of frozen peas and frozen peas mix vegetables recipe at national level and internationally. This industry is getting its position locally and also striving to take its share in international market. Government agriculture research and development structure is very effective in Punjab as compared to other provinces. Agriculture extension setup is not so effective in Swat and Swabi districts. Private seeds and pesticides companies are equally active in all the major clusters, however due to more area under crop Central Punjab is their primary focus area.



Figure 2: Value chain analysis of Pea across major cluster





5.5. SWOT Analysis

5.5.1. Overview

The SWOT analysis was carried out in focus group discussions conducted in major pea producing areas with the consultation and participation of different stakeholders. The results are organized around the value chain functions, including inputs, production, storage, and marketing, processing and trade.

5.6. SWOT Analysis

5.6.1. Upper KP Cluster

The upper KP cluster is home to good quality peas. This region has many strengths and opportunities including but not limited to favorable agro ecological conditions, less insect pressure and off season supply. Major weaknesses include, non-availability of area specific high yielding varieties for terracing of plants, small land holding, out dated cultural practices, weak agricultural R&D and extension setup, inadequate investment in research, technology development, breeding and marketing, no trend towards post-harvest grading and packaging and unstable marketing infrastructure. Branding of fresh peas of this region as organic mountain peas in international market is a good opportunity for this region by introducing standardized production and post-harvest practices. Threats include climate change and natural disasters. The produce of this cluster is being exported at high prices to different countries and is a big opportunity to increase its strength. Table 12 presents the SWOT analysis for this cluster.

5.6.2. Central Punjab Cluster

This cluster is the hub of pea production in Pakistan. Main strengths of this cluster are favorable climate for good quality peas production with multiple sowing times for early, mid and late planting, prolonged supply period of fresh production, already established peas processing (frozen peas) plants, highly favorable climate for local seed production, comparatively strong and effective agricultural extension system medium to large land holding of farmers, comparatively better cultural practices like use of fertilizers, literate farmers, excellent roads and transport infrastructure etc. Non availability of high yielding and determinate type of varieties suitable for single picking time to introduce mechanical harvesting, outdated manual cultural practices, poor post-harvesting handling practices, poor agricultural R&D structure and highly unstable and conventional marketing system are major weaknesses of this cluster. Worsening situation of water availability is major threat for pea production in this region. This cluster offers a huge potential for establishment of peas processing plants (Frozen peas/canned peas etc.) thanks to bulk produce and low prices during peak supply periods, easy access to international markets by air and already present setups of pea processing industry. Table 13. Presents the SWOT analysis of Central Punjab cluster for peas.



Table 15: SWOT Analysis of Upper KP Cluster (Output: Fresh Prouce)

Parameter s for SWOT Analysis	Strengths	Weakness	Opportunities	Threat
Environmen t/Climate Change	Medium to clay loam soil, cool climate and well drained land which are very much suitable for peas organic cultivation.	Short crop window, cultivation depends mostly on rain, High humidity favors disease incidence	Organic export quality farming	Humid climate favors diseases
				Declining organic matter in soils
Input Supplies	Reliable major fertilizer and pesticide supply system with many National / Multinational Companies providing these chemicals	Limited availability of certified, quality, and pure variety seed	soil testing labs can play a major role in matching input use with the soil nutrient conditions	Use of adulterated or expired pesticides.
			Increasing poultry production and poultry manure is an opportunity to halt the declining organic matter	Injudicious use of chemicals
				Poor quality seed n the market
Cluster interaction	High demand of product throughout the country and abroad	Little interaction among farmers and researchers	Possibility of learning from progressive farmers in the cluster	
		Producers have little information about the quality requirements in national and international market	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	Export opportunities may be declined due to declining quality of the farmgate produce
		No contract farming with defined quantities and quality parameter		
		Farmers don't accept loan on interest	Strengthen the research and farmers interaction	



Production Management practices		Injudicious use of pesticide	Availability of paper boxes in the market already being used in certain other vegetables	Illiterate farmers and small land holdings	
		Improper harvesting procedure			
		No contract farming with defined quantities and quality parameter			
	Good road infrastructure connecting cluster with all big cities	Plastic bags stacked on each other badly damage the fresh produce			Rain dependent cultivation may adversely affect crop in this area due to changing rain patterns.
		No environment (temperature, humidity, etc.) control during transportation			Non mechanized farming and dependence on human labor in cultivation practices increase cost of production making vulnerable to compete in international market.
		Improper staking during transportation			
		High fuel cost especially diesel used in transportation		Difficulty of training illiterate farmers about high tech methods and techniques	
	High price of the produce as harvesting time synchronize with scarcity period (High demand/Low supply) of the country	Farmers disconnect with the market	Financial support to farmers in form of quality based delivery contracts		
	Good quality produce	No grading and proper packaging and transportation			
Transportation		Auctioning in the wholesale market with visual and spot grading	Big opportunity to reform the old market practices in the province		



		Little capacity of farmers and traders and little quality infrastructure to produce, handle, and market the quality product	Emerging supermarkets can introduce contract with farmers which may improve retailing quality, and reduce post-harvest losses and trading margin	
	Export quality produce due to less residual effects	Less production hardly meet country requirement rather export to other countries	Increase area under crop	
		High fuel cost especially diesel used in transportation	Mechanized farming to reduce cost of production	
Marketing		High cost of production	Quality based contract farming between farmers and exporters	
		No trend of post-harvest grading and processing	Huge demand for processed / frozen peas	
		Unavailability of modern processing plants, technologies, and equipment for processing	Government incentives for the import of agriculture machinery especially cold storage machinery	
		Lack of capacity and resources for small scale stakeholders to get involved in processing		
Trade/Export	Existence of traders association		Fast growing international market	Slow development of quality infrastructure, lack of stakeholders interest in capacity building



Table 16: SWOT Analysis of Central Punjab Cluster (Output: Fresh peas and seed)

Parameters for SWOT Analysis	Strengths	Weakness	Opportunities	Threat
	Suitable environment for multiple sowing times (September to December for fresh produce)		Huge potential for local quality seed production to reduce import bill	Climate change
Environment/Climate Change	Suitable environment for quality seed production	Climate favours early and late fungal diseases (Root rot, Fusarium wilt, Powdery mildew and Collar rot)		Climate change disturbing cropping pattern
		Poor soils		Declining canal water and underground water
		Unfit underground water		Declining soils fertility
Input Supplies	Reliable major fertilizer and pesticide supply system with many National / Multinational Companies providing these chemicals	Limited availability of certified, quality, and pure variety seed	soil testing labs can play a major role in matching input use with the soil nutrient conditions	
				Use of adulterated or expired pesticides.
				Injudicious use of chemicals
Cluster interaction	Strong interaction among farmers and researchers		Possibility of learning from progressive farmers in the cluster	
	Effective agricultural extension setup	Producers have little information about the quality requirements in national and international market	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	
	Progressive farmers with large land holdings	Non availability of interest free loans		



			supply contract		
	Contract farming for quality fresh peas and seed production	No legislation at government end for contract farming	Strengthen the research and farmers interaction		
Producti on Manage ment practices	Progressive farmers with big land holdings	Lack of quality seed	Export quality produce may be increased significantly by adopting mechanized farming, water conservation technologies, systematic training modules for farmers and standardize post-harvest handling techniques		
	Easily labor availability for field operations	traditional method of sowing			
	Subsidized agricultural implements for field operations	Manual weeding and hoeing			
		Flooding irrigation wastes water and deteriorate fruit quality			
		Imbalance and sub-optimal use of fertilizer		Crop production may be adversely effected in this area due to changing rain patterns and water scarcity.	
		High seed rate		Non mechanized farming and dependence on human labor in cultivation practices increase cost of production making vulnerable to compete in international market.	
		Injudicious use of pesticide		High quality seed production	
		Improper harvesting procedure			Difficulty of training illiterate farmers about high tech methods and techniques
Transpor tation	Good road infrastructure connecting cluster with all big cities	Plastic bags stacked on each other badly damage the fresh produce	Availability of paper boxes in the market already being used in certain other vegetables		
		No environment (temperature, humidity, etc.) control			



		during transportation		
		Improper staking during transportation		
		High fuel cost especially diesel used in transportation		
Marketing	Bulk produce in peak season	Unstable market prices	Financial support to farmers in form of quality based delivery contracts	
	Good quality fresh peas and seed produce	No stable marketing policy / infrastructure		
	Prolonged availability of fresh produce	No grading and proper packaging and transportation	Big opportunity to reform the old market practices in the province	
		Auctioning in the wholesale market with visual and spot grading	Emerging supermarkets can introduce contract with farmers which may improve retailing quality, and reduce post-harvest losses and trading margin	
Trade/Export	Bulk surplus fresh produce during peak season	Little capacity of farmers and traders and no quality infrastructure to produce, handle, and market the quality product for export	Mechanized farming to reduce cost of production	Unstable electricity and gas prices and supply for industry
		High cost of production and can't compete in international market	Big opportunities for food processing companies and exporters in form of processed / frozen peas	
		No government policy to support the exporters and processors	Quality based contract farming between farmers and exporters	Slow development of quality infrastructure, lack of stakeholders interest in capacity building to produce and maintain quality product



		Lack of interest of exporters and processors		
Processi ng	Bulk fresh peas available for processing	High cost of production	Huge demand for processed / frozen peas	
		No trend of post-harvest grading and processing	Government incentives for the import of agriculture machinery especially cold storage machinery	
		Unavailability of modern processing plants, technologies, and equipment for processing	Food industry involvement for frozen peas for export and domestic use in scarcity period	
		Lack of capacity and resources for small scale stakeholders to get involved in processing		



6. CHALLENGES FACED BY THE CLUSTERS

6.1. Climate Change

Climate change is a common threat to whole agriculture sector of Pakistan; hence same is the case with peas. Rainfalls at maturity stage of peas in KP deteriorate the quality of the fresh pods badly and favors fungal disease incidence on crop. Likewise, in Punjab, rainfall right after sowing adversely affects the germination. Early onset of summer season badly damages the peas crop due to severe attack of fungal diseases which leads to crop failure ultimately. Late winters and early summers also create High temperature during summer lowers the yield and quality of seed crop and further it shorten the crop growth periods and leads in yield reduction of crop. In Punjab, limited supply of canal water and falling underground water level imposes serious threat to peas cultivation.

6.2. Constraints at Research & Development Level

Pea yield of Pakistan is lower than world average and is significantly lower than the neighbouring country India. The main reason for this is non-availability of high yielding varieties specifically breed for specific agro ecological conditions and conventional cultural practices. The seed market is mainly occupied by imported seed. NARC is responsible to conduct adaptability trials/NYUT trials of imported varieties at national level to check suitability of these varieties in local climatic conditions. But, in case of peas no adaptability/NYUT trials are being conducted. So various types of peas varieties/seed are being marketed by different seed company without any adaptability trials. FSC&RD department is responsible for registration of the varieties and issuance of import permit. But there are serious lop holes in variety registration system of FSC&RD which benefit seed companies marketing inferior seeds of different varieties. In Punjab, Vegetable Research Institute, AARI, Faisalabad is responsible to conduct adaptability trials of imported varieties of peas. But due to limited resources, this institute only evaluates the varieties in Faisalabad and on basis of one location performance; FSC&RD allows marketing of these varieties in whole province/country. Furthermore this department only evaluates the varieties being sent by seed companies and many companies and seed traders directly throw imported seed in market without any adaptability testing. At government level, breeding program for pea is very poor in KP despite it is a major vegetable of KP province. No new variety of peas has been evolved in KP since decades. In Punjab, VRI, Faisalabad has evolved four varieties of peas i.e. Pea-2009, Sarsabz, meteor and Climax. Here it is also point to ponder that VRI is government Institute working on more than 30 vegetables with very limited resources. Likewise, Pakistan far behind in research on improved production practices and mechanization of cultural practices like sowing and harvesting which are major limiting factor for low yield and poor quality of the fresh produce.



6.3. Constraints at Production Level

Cultural practices of farmers for peas are outdated and conventional across Pakistan. Sowing and harvesting is manual. Normally sowing is done through broadcast method. No proper plant to plant distance is maintained. This results in injudicious use of seed and less plant population per acre/ha. Fertilizer and other inputs use is high variable and varies farmer to farmer. Agricultural extension service is not very ineffective in KP. These practices result in low yield and poor quality of the produce and increase cost of production. Average cost of production of Pakistan is higher as compared to other countries like China. This difference in farmer cost of production adds up in complete value chain ultimately making it difficult to compete in international market.

Table 17: Gaps and constraints at production level

Sr.#	Parameter	Upper KP	Central Punjab
1	Locally evolved high yielding Varieties/Hybrids	Not available	Available
2	Certified Seed	Limited availability	Limited availability
3	Commercial inputs	Limited use	Limited use
4	Extension services	Very poor	Adequate
5	Labor input	Family/Local labor	Local labor

6.4. Constraints at Post-harvest & Processing Level

In case of peas, no post-harvest value addition or processing is being practiced. Almost all of the produce is traded and consumed fresh. Likewise, in Punjab, most of the produce is consumed fresh. Normal practice of farmers is manually picking of the crop (1-3 pickings) depends on variety and area and send it to vegetable markets either filled in plastic bags in trucks. A huge international market for fresh quality peas exists but there is need to develop proper fresh produce handling plants for grading and proper packaging of the produce as per international standards for transportation in national and international markets. Only few exporters are involved in export of fresh vegetables including Peas in country. These exporters preferably buy fresh produce directly from farmer field at different rates depending upon season and produce supply in market and do simply manual grading to export. In Punjab, some food processors are involved in manufacturing of frozen peas alone and mixed frozen peas with different other vegetables like (peas + peas) etc. but this is very limited almost negligible. There is huge demand of frozen/chilled peas in international market, but Pakistan fails to capture these markets due to its high cost of production and low quality of the produce. A strong relationship between producers and processors is needed for quality based contract farming to overcome these issues. Moreover, strong legislation at government end is required to protect the rights of all stockholders involved in value chain of processed peas.



Table 18: Gaps and Constraints at post-harvest and processing level

Sr.#	Parameter	Upper KP	Central Punjab
1	Fresh produce handling unit	Not available	Not available
2	Processing/value addition technologies in use	Not available	Limited
3	Shovel ready investment projects	Not available	Available
4	Access to energy for processing	Available	Available

6.5. Constraints at Trading Level

Peas are produced in small pockets and consumed across the country and are being traded in almost all the major vegetable markets. Farmers tend to send their produce far away markets to fetch higher prices, for example, Upper KP peas are sent to Punjab markets for high rates there. The transportation costs are high, and there are no proper storage facilities in vegetable markets. Fresh produce is kept in open and rates are decided on visual basis.

Market prices are highly variable depending upon season, demand and supply, resulting highly variable returns to producers. Many times, when market prices are so down that farmers can't even recover the harvest cost forcing them to plough their crop in the field. No contract farming is practiced.

At international level, Pakistan fails to fetch higher prices for its produce due to poor quality and higher cost of production. This high cost of production is at farmer and transportation levels. Almost 0.1 to 0.2 million PKR required for transport of fresh produce of peas in refer containers to seaport in Karachi from Punjab and KP. Another major constraint is poor system regarding the availability of required quarantine and quality certificates to exporters to export produce in high end international markets. It is tedious job to get required certificates in the existing system within days to export fresh vegetables.

Table 19: Gaps and constraints at Trading level

Sr.#	Parameter	Upper KP	Central Punjab
1	Marketing prices	Highly variable	Highly variable
2	Transportation costs to market	Very high	Moderate
3	Storage facilities	Non	Non
4	Quality based trading	Visual quality determination	Visual quality determination
5	E-Commerce platforms	Not available	Not available
6	Quality of the produce	Low	Low
7	Contract farming	No	Yes
8	Export readiness	No	Limited
9	Certification (Phytosanitary)	No	No
10	Branding and certification	No	No

A national level policy is needed to focus on quality production of fresh peas and establishment of frozen peas processing units as per international standards. This will not only help to stabilize market prices at national level but will also earn a huge foreign exchange to the country from exports.



7. CLUSTER DEVELOPMENT PORTENTIAL Potential

In this section an attempt has been made to evaluate the potential in all clusters in terms of production, quality and market side of peas value chain, and to establish benchmarks, based on the objectives for incremental improvements in the cluster performance. In addition, both quantitative and qualitative analyses are presented to explain the nature of active, dormant and inactive segments of the peas value chains in the clusters.

7.1. Production Potential

Upper KP cluster is home to fresh organic peas. Central Punjab is also blessed with prolonged supply period for fresh and good quality peas. However, per unit production of these clusters is less than world average and with neighbouring country India. The KP cluster have encouraging yield but in central Punjab cluster the yield gap is prominent. Both the clusters have the potential to improve the production per unit area to a great extent. A considerable yield gap of 26 % and 34% exists in upper KP and Central Punjab clusters respectively with main pea producer and neighbouring country India. This yield gap is due to many factors which may be summarized as non-availability of high yielding varieties and poor crop management practices for particular regions and agro climates. However, this is average yield data and not true representative of individual advanced farmers' production. Many farmers in both clusters get more than the average yields of the clusters.

By introducing high yielding, season specific varieties and adopting improved cultural and inputs management practices, this international yield gap can be covered easily. If average yield of these clusters is increased by only 20%, this will produce additional 2.1 thousand tonnes (worth 0.84 million US\$) in upper KP and 20.6 thousand tonnes (worth 10.7 million US\$) in central Punjab cluster for peas. Moreover, this significant increase in average yield of these clusters will ultimately result increase in average yield of other peas growing areas and ultimately national average yield and hence national production. By increase in local production quantity and quality, Pakistan will save about 0.07 Million US\$ which we spend on import of peas. Moreover, this additional production will create many farm level labor opportunities.

7.2. Potential Demand in National and International Market

Peas are very important winter vegetable and a huge demand exists both in national and international market. Peas are consumed both fresh and processed form throughout the world in different recipes like cooked, boiled, pastas etc. Peas are rich source of protein and are most cooked item in kitchens. So there is a considerable demand for value added or processed products of peas like frozen peas, canned peas, and Peas mix recipes at domestic and international level.



World production of peas has increased from 12.40 million tonnes in 2001 to 19.87 million tonnes in 2016 with average increase rate of 2.34% per year. Production and hence demand of peas is increasing rapidly at global level. If we look at production of world top 5 peas producing countries, USA, France and Egypt has negative annual growth rate of -4%, -0.3% and -0.9%. However, China and India has annual average growth rate of 6.0%, and 3.7%. Pakistan is ranked 7th in production and has annual growth rate 7.0%. The data predicts clearly that Pakistan has significant growth rate in pea production and has a potential to get its good share in international market.

7.3. Pakistan's Current and Potential Share of the Market

At present, total world export of peas (Fresh or Chilled) is 276.59 thousand tones. Pakistan is ranked at 127th position and exports only 0.33 thousand tones peas which is only 0.069% of world's total export. Export production ratio of Pakistan is only 0.13% which is less than world average export production ratio of 1.39%. Pakistan has the potential to get its export equal to world average by adopting the appropriate strategies for peas export as fresh and processed. By increasing export to production ratio of identified peas clusters to 5% in KP and Central Punjab in next five years, this will generate additional US\$3.58 million worth foreign revenue at current export price of 526 US\$/ton.

7.4. Emerging Trends and Potential Markets

At present, Pakistan is exporting peas mainly to gulf countries like Kuwait, Qatar, Saudi Arabia and UAE. The main reason for exporting to these countries is comparatively less strict quality parameters for export. Moreover, Pakistan produce has good demand in these regions due to large number of Pakistanis working in these countries. However, gulf countries are also implementing strict quality control laws for import of fruits and vegetables. Recently, UAE has banned import of fruits and vegetables from 5 countries due to inferior quality and high residues of pesticides in the product. Thailand has the highest annual growth rate of 416% for imports of peas either fresh or chilled followed by Germany (16.58%), USA (8.92%) and UK (5.07%). Belgium, Netherland, France and Canada are the high value markets for peas along with neighbouring gulf countries. But these European countries have very strict quality and quarantine standards for export of fruits and vegetables including peas. We are presenting in this report the measures by which we can capture these high end markets through improved production technology, standardized farm practices and production of high demand value added products and by facilitating the exporters for getting quality and quarantine certificates at their division level.

7.5. Quality Gaps and Improvement in Quality

Pakistan's current export price for peas (fresh or chilled) is 526 US\$/t which is considerably low than world average export price of 972 US\$/t. Pakistan has the cluster/areas which can



produce the high quality organic sweet peas and Pakistan can capture any considerable share of world export. This failure may be attributed to various factors start from farmer's field to National policy levels. Peas production, logistics, marketing and trade practices vary considerably from country to country at global level. However, there are some set rules for each practice which are being followed by top peas producing and exporting countries. In this section, we are describing these rules/practices being followed in world leading countries by various stakeholders of peas.

Table 20. International quality standards

Variety and Seed	<ol style="list-style-type: none"> 1- Agriculture R & D department ensures availability of high yielding good quality varieties suitable for specific agro ecological conditions. Objective oriented breeding is done to develop varieties suitable fresh consumption or value addition. e.g. High yielder, determinate, sweet, more shelling percentage varieties with good shelf life are required for both fresh and processed peas 2- Farmers select best variety as per their climatic conditions and end produce requirement e.g. for fresh consumption or processing. 3- Good quality pure seed is used
Production Practices	<ol style="list-style-type: none"> 1- Introduction of determinate varieties to promote mechanical harvesting and reduction in cost of production and harvesting damage. 2- Contract based farming between farmers and exporters or fresh produce marketers 3- Mechanical sowing which not only ensures proper plant to plant and line to line distance but also reduces cost of production 4- Use of recommended seed rate 5- Balanced use of fertilizers as per soil analysis and expert's recommendations 6- Balanced and controlled irrigation 7- Proper and/or limited use of pesticides 8- Proper cooling and packaging of the fresh produce
Transportation	<ol style="list-style-type: none"> 1- Purpose built containers and vehicles for transportation 2- Transportation in controlled environment vehicles (Controlled temperature and humidity)
Marketing	<ol style="list-style-type: none"> 1- Government policies ensure the stable market prices. 2- Interlinked and online marketing system which ensure up-to-date information to all stake holders about current market prices and trends
Value addition and/or Processing	<ol style="list-style-type: none"> 1- All standardized SOPs for quality assurance are strictly followed 2- Mechanized procedures to reduce cost of production 3- Sanitary practices are strictly followed 4- Proper and attractive packaging of desired volume/weight as per consumer preference
Extension Services	<ol style="list-style-type: none"> 1- Strong and efficient agricultural extension system 2- Provide guidance to farmers about latest and recommended varieties and cultural practice.



<p>Stakeholder's interaction</p>	<p>1- As practiced in Israel, a peas and pea growers' association financed by the farmers and other stake holders. This association holds weekly and monthly meetings in which government agricultural R&D and extension department representatives also participate. During these meetings, current crop situation, farmer's problems and requirements are discussed. This association gives targets to R&D departments to focus their research activities as per farmer's requirements. This type of growers association should be established for pea crop.</p>
<p>Government level Policies</p>	<p>1- Exporters friendly policies 2- Promote and incentivize the processing & value addition industry</p>

To compete in international market and to improve the quality and price of peas to international level, we have to adopt international quality standards at each segment of the value chain. If we increase export price of only 5% of the produce to international export price in previously defined clusters, it will generate additional revenue of 6.19 million US\$.

7.6. Improved Processing

The international trade of frozen peas is classified under HS 071021 (071021 Shelled or unshelled peas "*Pisum Sativum*", uncooked or cooked by steaming or by boiling in water, frozen). Central Punjab has bulk supply of fresh peas from January to March, which results in extremely low market prices. Sometimes farmers prefer not to harvest crop as cost of harvesting exceeds the market price. Processing of extra production of peas to frozen peas, during these months will not only stabilize the market prices but will also earn huge foreign revenue through export. If only 10% of the produce from central Punjab is processed/frozen and exported, it will generate an additional revenue of 4.3 Million US\$. This increase in production, processing and export will also create many job opportunities at different levels of value chain.



8. PLAN, POLICIES, STRATEGIES, POLICIES, AND NETWORKING TO REALIZE THE POTENTIALS

After the discussion with stakeholders and reviewing the literature, the issues and shortcoming of peas value chain, discussed in previous section, may be summarized as follows:

- 1- Less yield
- 2- Improper post-harvest handling of fresh produce
- 3- Poor marketing and trading practices
- 4- Limited value addition and processing

These four components of peas value chain in each cluster need to be improved to realize full potential of the clusters. To overcome these gaps, following targets are fixed for a development project over a period of five years.

Table 20: Targets of peas cluster plan

Sr. No.	Targets
1	To increase average per ha yield by 20% in each cluster by introducing improved varieties and management practices.
5	To further improve yield by 5% through mechanized planting on 15% of the total area in Punjab (Punjab was selected because of relatively bigger farm size here, while in KP such mechanization does not seem possible because of the small farm size)
2	To increase export of Peas from 0.13% of local production to at least 5%
3	To increase the quality of the exported produce equal to the world average quality so that its export price may be increased equal to world average export price
4	To improve the quality of 5% of total production in KP so that it can fetch the world average price (KP was selected because farm gate price here is far lower than the world average, while in Punjab it is close to the world average).

In this section, we defined policy, mechanism and gave strategies for each cluster to achieve these targets.

8.1. Policy Reforms

At national policy level, government should bring major reforms in seed sector, Agricultural R&D sector, Agriculture extension sector, and processing industry. At start, import of high yielding peas varieties should be introduced as per specific agro ecological conditions of each cluster but in long term Government should impose ban on seed import and devise



policy to promote local seed production, mechanized farming, quality based contract farming and value addition industry. Government should promote local value addition industry by imposing ban or high taxes on imported value added products. Subsidies and incentives should be specific and results driven. For instance, import duties on all farm machineries and post-harvest technologies should be eliminated, but these technologies should be clearly defined. Attractive subsidies and incentives should be given to attract local investors into mechanized farming and food processing industry. Moreover, a nationwide program should be developed, in which all rural districts can compete for Cluster Development Grants to specialize in high-value crops for export. Another policy recommendation is to include fresh peas and their frozen products in bilateral/multilateral trade agreements with friendly countries like gulf countries which are huge market of fresh and frozen vegetables.

At the local level, government should support and train farmers to make small marketing groups like Framers Enterprise Group (FEGs) especially in KP where land holdings are small and farmers have limited resources. These groups may be established at tehsil & union council levels. Government should incentivize these groups with farm machinery for mechanization, grading and packaging machinery for proper post-harvest handling of their produce. These groups will be trained for proper branding of their produce in collaboration with proposed Pakistan peas growers & exporters association under the umbrella of All Pakistan Fruits and Vegetables Exporters, Importers and Merchants Association. This association should have a website of its own and work to promote best practices, share knowledge, technology and lobby with Government for enabling policies on behalf of FEGs.

8.2. Strategies for Upper KP Cluster

In this section, strategies are described to increase production, improve value chain and promote export of fresh peas from this cluster.

8.2.1. Production Level Strategies

Major limiting factor for low yield of peas in this cluster is non-availability of quality seed of high yielding varieties specifically evolved for typical climatic conditions, small land holdings, cultivation on terraces, poor cultural practices and poor economic and education statuses.

8.2.1.1. Organization of Peas Growers

Farmers should be organized at multilevel in pea grower's association at union council level and FEGs on district level. As individual farmers in this region has limited resources, making growers association at union council level will pole the resources of farmers resulting in better crop management practices. Likewise, FEGs at district level will provide a platform to farmers for proper marketing practices and opportunity for product branding. These associations should be linked with the proposed National level peas growers and exporters association.



8.2.1.2. Importing High Yielding Germplasm

For immediate increase in per unit yield, high yielding varieties should be introduced from other countries as per specific climatic conditions. Provincial agricultural R&D department will decide specific varietal characteristics required for specific region by discussion with previously proposed FEGs. R&D department will also be responsible for varietal field trials and testing adaptability of imported germplasm. Private seed companies may also be involved for export of high yielding germplasm. But a strong variety/germplasm evaluation and seed quality control mechanism should be developed by provincial R&D department to test adaptability of germplasm imported by private seed companies. At least 2 years' adaptability data at 4 locations (two in swat & Chitral each) should be mandatory for getting import permit for a specific variety.

8.2.1.3. Improvement of Farmer's Cultural Practices

For farmers training, agriculture extension sector in the cluster should be restructured and strengthened. R&D department should develop a complete technology package for peas cultivation. Regional agricultural extension department should develop model plots of peas at union council level. Farmer's meetings should be arranged at these model plots for demonstration of improved production technology. Union council level peas grower's associations may provide a platform for establishment of model plots and trainings. In this region, pea sowing is done through broadcasting. This not only increase per unit seed rate and hence cost of production but also lines and plant spacing is not maintained. This results in uneven growth of plants and damages of green pods due to unexpected rainfall at pods maturity stage which leads to decrease in yield and damage the pods quality badly which fetch lower price in national and international market. Due to small land holding and terracing of land, large machines are not successful in this region. Small hand driven pea sowing drills are being proposed for this region. Through these drills, lines and plant spacing in the field is properly maintained. These hand drills may be imported by China and/or locally prepared by provincial farm mechanization department through reverse engineering. Government should provide 20% subsidy on import of these drills. Private agricultural companies may also be involved here.

8.2.2. Strategies for Value Chain Improvement

Fresh peas are high price commodity and offer high export potential. But peas from this region fail to fetch higher prices in the international market. One reason for this is poor/substandard post-harvest level practices. Strategies are proposed to improve fresh pea pods value chain and hence increase quantity, quality and price of fresh produce.

8.2.2.1. Establishment of Post-harvest Handling Units/Pack Houses

Exporters/FEGs should be incentivized to establish post-harvest handling units for fresh peas at union council level in each cluster. Fresh produce of farmers will be properly graded, packaged and stored as per national and international standards in these units. Subsidy may be given on the import of machinery required for establishment of these storage units.



From these units, fresh produce will be transported /exported in ordinary/refer to the port. Detail description of pack house and its cost analysis is given in Annexure IV.

8.2.2.2. Branding of the fresh produce

This cluster is home to high quality fresh peas. Fresh pea exporters should be motivated and trained to establish brands of their fresh produce like *fresh organic peas (Sweet organic peas etc.)* or *mountain fresh peas*. PFVA in collaboration with government should train and facilitate exporters about various certification requirements, marketing and international standards for successful establishment of brands.

8.2.3. Marketing and Trade Level Strategies

8.2.3.1. Increase the Export to Production Ratio

A small unit will be established in the department of agriculture at provincial level consisting of three scientists (marketing specialist, economists and information analyst) with supporting staff. It will provide information regularly to the stake holders about international market requirements (i.e. potential buyers, standards and prices etc.). This unit will work in collaboration with proposed national level peas growers and exporters association.

8.2.3.2. One Window Operation for Certifications

A major limiting factor of low export to production ratio is the difficulty faced by the exporters is in meeting mandatory registration and certification requirements of the importing country. No quality and quarantine testing laboratory is present in this area. Likewise, Government should ease the registration procedure for the exporters. Government should establish a collection/ facilitation center at district level to facilitate the exporters in required certifications.

8.2.3.3. Sponsoring International Tours

Top exporters of peas will be sent abroad every year to identify potential markets and new buyers at 50% government expenses.

8.2.3.4. Holding Competition and Rewards for Exporters

Special competition will be held and rewards will be provided for outstanding exporters of peas. These competitions will be held at cluster level and jointly organized by national peas growers & exporters association and Government.

8.2.3.5. Stakeholders Training to Adopt ISPMs

International consultants will be engaged by the National pea growers and exporters association to spell out requirements at production, processing, transportation, storage, and marketing levels and provide training to trainers who in turn will train farmers, traders & exporters, etc. to adopt the ISPMs standards. Fifty farmers and 10 other stakeholders will be trained to adopt the ISPMs in each district every year.



8.3. Strategies for Central Punjab Cluster

In this section, strategies are described to increase production, improve value chain, enhance processing and promote export of fresh peas from this cluster.

8.3.1. Production Level Strategies

Punjab province has major share in area & production of peas in Pakistan. Over the years, per unit yield of Punjab has declined with average annual growth rate of -1.98% . Main reason for this decline is early sowing of crop by farmers to get a sandwich crop between rice and wheat. Early season varieties are normally short stature and single pick varieties and having very low yield potential as compared with normal or late varieties. Two main crops of peas are sown in this region i.e. early and normal crop. Normally prices are higher for early crop due to limited supply. Farmers try to fetch higher market prices by sowing their crops earlier when temperature is high. Some varieties are available for early crop but these varieties have low yield potential and are tolerant to fungal diseases, which also lead to crop failure. No specific disease tolerant and high yielder varieties are available for early segment. This results in lower yield overall of the province. Other reason for low production is poor cultural practices across the cluster.

8.3.1.1. Strengthening of Research & Breeding:

Vegetable Research Sub-Station, Sahiwal of Vegetable Research Institute, Faisalabad will be upgraded to Peas Research Institute, Sahiwal. This institute will be responsible for evolution of high yielding and disease tolerant varieties for specific sowing seasons, development of improved technology package and training of master trainers (AOs & FAs) of agricultural extension department.

8.3.1.2. Importing High Yielding Germplasm

For immediate increase in per unit yield, high yielding varieties will be introduced from other countries as per specific climatic conditions and sowing season. For early crop (September sowing), high yielder, heat and disease tolerant varieties are required. Likewise, for normal season crop (November & December sowing) low temperature tolerant, disease tolerant and high yielder varieties are required with specific pod features according to their consumption (fresh or processed). Previously proposed Peas Research Institute will test the adaptability of these imported varieties for at least two years in each district. FSC&RD department will issue import permit to private companies based upon two years multilocational yield data.

8.3.1.3. Improvement of Farmer's Cultural Practices

Master trainers of agricultural extension department (AOs and FAs) will train the farmers about improved cultural practices by seminars, farmer meetings and demonstration plots. At least one demonstration plot will be established in each union council. Central Punjab consists of fertile plan lands very suitable for mechanized farming. Tractor mounted peas sowing and harvesting machines will be introduced in this area. For small farmers, hand



driven sowing drills will also be introduced. These machines will be imported from China and/or then locally prepared by AMRI through reverse engineering. Government will provide 20% subsidy on import of this machinery. Private agricultural companies may also be involved here.

8.3.1.4. Strengthening of Seed Production

This region offers great opportunity for quality local seed production. This seed will not only meet local requirement but also the requirement of other provinces. Many farmers in this region are producing their own seed and also producing seed on contracts with different seed company's/seed traders. Previously proposed Peas Research Institute will develop seed production technology and this will be disseminated to farmers through Agri. Extension department. Private seed companies will be motivated for quality based contract seed production with farmers to fulfill the country need.

8.3.2. Strategies for Value Chain Improvement

Central Punjab has glut period of peas during peak season, which results in low farmgate & wholesale price at domestic level. This offers a good potential for fresh vegetable exporters & processors to export and process the excess produce and earns foreign exchange. But export of fresh peas is very limited. Here, we are proposing strategies to increase export of fresh peas at good export price by improving overall value chain; proper post-harvest handling, grading, packaging of fresh produce as per international standards, branding and marketing of the fresh produce

8.3.2.1. Establishment of Post-harvest Handling Unit's/Pack Houses

Fresh vegetable exporters will be incentivized to adopt international standards through establishing post-harvest handling units for fresh peas. Contract based quality farming will be promoted between farmers & exporters. Exporters will purchase the fresh produce of farmers at farmgate and deliver to its warehouse where it will be properly graded, packaged and transported to the port. Subsidy may be given on the import of machinery required for establishment of these units. Direct linkage between farmers and exporters will eliminate the middle man hence reducing overall cost of value chain.

8.3.2.2. Branding of the Fresh Produce

Exporters will be motivated and trained to establish brands of their fresh produce. PFVA in collaboration with government will train and facilitate exporters about various certification requirements, marketing and international standards for successful establishment of brands.

8.3.3. Value Addition and Processing Level Strategies

Major world trade of peas is in processed/frozen form, trend of frozen peas consumption is rising globally including Pakistan. In central Punjab cluster, bulk supply of quality peas is



available from January to March at lower price which is ideal for production of frozen peas. The objective of these strategies is to convert 10% of the fresh produce to frozen peas products. Most of these frozen peas will be for export purpose. Some will be for domestic use in country at big stores to increase the trend of processed vegetables.

8.3.3.1. Establishment of IQF Plants

There are already two IQF units established in Punjab i.e. Icepac Ltd and Fauji Fresh n Freeze which are producing frozen peas on limited scale. We are proposing establishment of two IQF plants in central Punjab in Gujranwala and Faisalabad Division to convert 10% of cluster production into frozen peas. As, peas supply is seasonal and no fresh produce is available throughout the year, these IQF plants will also produce other frozen vegetables to function on year round basis. Various vegetables are available round the year in Punjab for year round economical functioning of these IQF units. These plants will be established through public private partnership in which government will provide land and subsidy on import of IQF machinery.

8.3.4. Marketing and Trade Level Strategies

Purpose of these strategies is to increase peas export production ratio of Pakistan up to 10%. Key strategies being proposed for this purpose are (a) establishment of a provincial level body consisting of three scientists (marketing specialist, economists and information analyst) which will provide information regularly to the stake holders about international market requirements, (b) Ease the registration procedure for fresh vegetable exporters and establishment of one window operation for various certifications/Quarantine & quality tests required for export of peas and peas, (c) Providing international exposure to top exporters, (d) holding competition and rewards for the exporters and I training stakeholders to adopt ISPMs.



9. BENEFITS AND COST OF CLUSTERING

This section discusses the costs associated with cluster development strategies presented in previous section in focal points of the clusters. This also identifies resources and requisite inputs for achieving all the targets given in section 8. An economic and social impact analysis has also been conducted that evaluates the benefits of the peas cluster development interventions in target regions.

9.1. Upper KP Cluster

9.1.1. Interventions and Implementing Agencies

The program will have four main components:

1. Improvement in productivity by introducing improved varieties and management practices.
2. Improvement in export-production ratio by introducing market/export level strategies and promoting quality through promotion of quality peas.
3. Improvement in value chain by establishing value chain infrastructure like pack-houses.

These interventions will be introduced in collaboration with various agencies like PARC, provincial agriculture departments, and private sector (Table 22).

Table 21: Interventions and implementing agencies for development of Focal Point of Upper KP cluster

S#	Cluster Strategy	Interventions	Implementing Agency
1	Production level strategies (<i>Increase yield by 20% in 5 years and reduce import of peas to zero</i>)	Organization of pea farmers	PARC, VRP (ARI,KP)
		Importing high yielding good quality cultivars	
		Adaptability testing and supply of certified seed to the farmers	
		Development of economical and sustainable production technology package involving mechanization of cultural practices (Sowing)	DoA
Establishment of demonstration plots and training of farmers for improved production practices			
2	Improvement in Value Chain (<i>Improve post-</i>	Incentivize the private sector to establish fresh peas handling units (Grading & Packaging)/Pack Houses	PARC, FS&TRP KP,



3	<i>harvest practices, transportation and fetch higher price for export)</i>	Branding of the fresh produce	
	Marketing & Trading level strategies <i>(Increase the export to production ratio to 5% in five years; Improve the quality and export price up to international standard)</i>	One window operation for quality and quarantine certification	
		Provision of market information on standards, price and potential customer segments	
		Sponsor international tours for high potential exporters	
		Holding of competition and rewards for exporters	
		Provide incentives for adopting best practice and certification regimes	
		Establish a pea exporters association under umbrella of PFVA with a website and marketing apps	
	Train the stakeholders to adopt ISPMs as per IPPC		

9.1.2. Benefits of Interventions

It is assumed that the introduced intervention at production level will increase productivity by 20% which will be achieved gradually over a period of 4 years starting from the 2nd year and will add gross revenue of US\$0.734 million during the last year of the project (Table 23).

The market level interventions like improving interaction with international market and getting awareness of these markets is expected to increase export from 0.13% to 5% which will gradually increase and bring a gross revenue of US\$0.287 million during the last year of the project (Table 23).

The improvement in value chain by introducing two pack-houses in the focal point of the cluster and training of farmers for harvesting, grading, etc. will improve the quality thus price of the produce which will be treated in the pack house. This is expected to increase prices of the export from US\$526 to US\$972 per ton. In addition, 5% of the produce destined in domestic market will also get international price. This will generate a total gross revenue of US\$0.55 million during the last year of the project. All these interventions will generate a total gross revenue of US\$1.58 million during the last year of the project (Table 23).



Table 23: Gross Revenue from interventions in focal point of Upper KP cluster

Parameters [All amounts: 000US\$]	Year 2	Year 3	Year 4	Year 5
Intervention-1: Yield increase (25% total)	5.0%	10.0%	15.0%	20.0%
Additional production (tonne)	454	909	1365	1821
Expected additional value (US\$)	183,053	366,399	550,038	733,970
Intervention 2: increase export-production ratio to 5%	1.25%	2.50%	3.75%	5.00%
Increase in export (tonne)	119	250	392	546
Expected additional value from export (US\$)	62,717	131,513	206,401	287,396
Intervention 3: Improvement in value chain Production that will pass through improved value chain (both for domestic and international market (tonnes)	27,960	86,508	179,521	310,890
Gross revenue from the improved value chain (US\$)	41,255	142,264	310,778	554,576
Total Expected Additional Gross Benefits (US\$)	287,025	640,175	1,067,217	1,575,942

9.1.3. Costs and Investments

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

i. Operational Cost at Value Chain Level.

The major cost drivers in peas value chain are the; a) Cost of production inputs and harvest; b) Cost of grading and packaging c) Cost of transportation; d) Cost of processing and marketing; and e) Cost of retailing and selling. These cost heads altogether make the cost structure of the value chain which may vary depending on nature of specific circumstances of the cluster. The cost structure for peas value chain in Swat focal points of Upper KP cluster is presented in following tables.



Table 24: Cost Structure at Value Chain Level at the Cluster Focal Point of Upper KP Cluster

	Total	Year 2	Year 3	Year 4	Year 5
Cost of the whole value chain (US\$/ha)	957	Incremented value			
Percent increase in the cost of production (inputs & harvest)	68%	17%	34%	51%	68%
Total increase in cost of production (inputs & harvest) (000 US\$)	431	82.469	164.938	247.407	329.876
Cost of grading & packaging for local low-end market (000US\$)	8/ton	1.99	3.78	5.35	6,72
Increase in the cost of grading & packaging for local low end market (000 US\$)	76	18.2	38.2	59.9	83.5
Total increase in cost of transportation & value addition (grading and packaging) in Pack House (000 US\$)	76/ton	18.2	38.2	59.9	83.5
Increase in field-market transportation cost (%)	20%	5%	10%	15%	20%
Total increase in the cost of transportation from field to market (000 US\$)	9/ton	0.3	1.3	3.0	5.4
Increase in wholesale, shelving & retailing (%)		5%	10%	15%	20%
Total increase in the cost of wholesale, shelving & retailing (000 US\$)	4/ton	0.1	0.4	1.0	1.7
Total increase in the cost (000US\$)		103.1	208.64	316.66	427.20

Note: Based on extensive consultation with stakeholders, it is evaluated that the total cost/ha of peas value chain is \$538/ha in District Swat of Upper KP cluster. These costs are expected to escalate over the period of 5 years along the expansion of volumes, services and new transactions in value chain due to positive effects of cluster development interventions. The yearly value chain costs have been calculated by multiplying increase in cost/ha (or per ton) in particular cost head with total number of has in focal point. Thus the total costs in 5th year shall stand at \$0.43 million with per ha increase of 378 US\$.

i. System Level Investment.

An investment of US\$0.976 million is needed to support the development efforts in focal point (district Killa Saifulah) of Upper KP cluster (Table 25). The major investment would be on strengthening research, establishing the pack houses, and on the promotion of export. About 53% of this investment will be made by the public sector in terms of strengthening research and development activities, and strengthening markets and promotion of exports. The Federal government will share 20% of the total public funding while remaining 80% may come from the provincial government by establishing a Cluster Development Fund under PCP.

The incentives given by the public sector will encourage the private sector and it will bring the remaining 47% investment on establishing the pack-houses in the cluster. Two pack houses will be established in the private sector by providing 20% subsidy. These pack house will also serve vegetable growers other than pack house, because the production of the cluster will be much lower than the capacity of these pack-houses in the season. These centres will be owned by FEGs. Any farmers can use the service of the centre and even can use the brand name of the centre on charge basis. The profit of the centre could be shared among farmers based on their investment share in establishing the centre.



Table 25. Investment requirements (US\$) at the Cluster Focal Point of Upper KP Cluster

Description	Total	Year-1	Year-2	Year-3	Year-4
Investments on R&D (US\$)	370,370	148,148	111,111	55,556	55,556
Investments required for value chain improvement –Pack houses (US\$)	278,560	-	139,280	139,280	-
Investments required on marketing/export (US\$)	296,296	118,519	88,889	44,444	44,444
Government loans on private investment	30,642	-	15,321	15320.8	-
Total investments (US\$)	975,868	266,667	354,601	254,601	100,000

9.1.4. Economic Viability

The estimated Net Present Value (NPV) of all the interventions over the period of five years is positive at US\$0.981 million, and the Internal Rate of Return (IRR) is 64% (Table 26).

Table 26. Net Cash flow, NPV, and IRR of the upgradation Plan at the Cluster Focal Point of Upper KP Cluster

Value Chain Based Costing (000)	Year1	Year 2	Year 3	Year 4	Year 5
Net cash flow (undiscounted) after deducting all costs and investments (US\$)	-266,667	-170,678	176,934	650,558	1,148,742
Net Present value (US\$)= 981,156					
Estimated Internal Rate of Return (IRR)= 64%					

9.2. Central Punjab (Sheikhupura Focal Point)

9.2.1. Interventions and Implementing Agencies

The program will have four main components:

1. Improvement in productivity by introducing improved varieties and management practices.
2. Improvement in quality (10 of the local produce and all the quantities of export) by establishing four pack houses, the IQF Units and training of stakeholders along the value chain
3. Improvement in export-production ratio by introducing market/export level strategies and establishing two IQF Vegetable units (one in Faisalabad and one in Sheikhupura).
4. Promotion of mechanized planting on 25% of the peas area.

These interventions will be introduced in collaboration with various agencies like PARC, provincial agriculture departments, and private sector (Table 27).



Table 27: Inputs and infrastructure needed for development of Central Punjab cluster

S#	Cluster Strategy	Interventions	Implementing Agency
1	Production level strategies (Increase yield by 20% in 5 years and reduce import of peas to zero)	Organization of pea farmers	PARC, UAF, AARI
		Importing high yielding good quality cultivars	
		Adaptability testing and supply of certified seed to the farmers	
		Strengthening the breeding program and quality seed production of pea in the region	
		Development of economical and sustainable production technology package involving mechanization of cultural practices (Sowing & Harvesting)	PARC, AARI, UAF, AMRI
		Incentivize farmers for import of peas & peas sowing and harvesting machinery	PARC, AMRI
		Establishment of demonstration plots and training of farmers for improved production practices including mechanized harvesting	DoA
		Incentivize mechanical transplanting	Field wing of DoA
2	Improvement in Value chain (Improve post-harvest practices and fetch higher price ¹ for export)	Incentivize the private sector to establish fresh peas handling units (Grading & Packaging)	PARC, PHRC (AARI)
		Branding of the product	
3	Processing & Value addition strategies (To process 5% of the fresh produce for frozen pea production)	Incentivize the private sector to establish one IQF plants for frozen pea production	PARC, PHRC (AARI), PFVA
		Branding of IQF frozen peas and peas mix recipes	
3	Marketing & Trading level strategies (Increase the export to production ratio to 5% in five years; Improve the quality and export price up to international	One window operation for quality and quarantine certification	PFVA & PARC
		Provision of market information on standards, price and potential customer segments	
		Sponsor international tours for high potential exporters	
		Holding of competition and rewards for exporters	
		Provide incentives for adopting best practice and certification regimes	



	standard)	Establish a peas and peas exporters association under umbrella of PFVA with a website and marketing apps	
		Train the stakeholders to adopt ISPMs as per IPPC	

9.2.2. Benefits of Interventions

It is assumed that the introduced intervention at production level will increase productivity by 20% which will be achieved gradually over a period of 4 years starting from the 2nd year and will add gross revenue of US\$2.5 million during the last year of the project (Table 28).

The campaign to increase the mechanized transplanting from 5% to 15% area in the focal point of this cluster will generate an additional gross revenue of US\$0.16 million to the farmers in the area.

The market level interventions like improving interaction with international market and getting awareness of these markets is expected to increase export from 0.13% to 5% which will gradually increase and bring a gross revenue of US\$0.76 million during the last year of the project (Table 28).

The improvement in value chain by introducing two pack-houses in the focal point of the cluster, establishing two IQF, and training of farmers for harvesting, grading, etc. will improve the quality thus price of the produce which will be treated in the pack house and IQF units. This is expected to increase prices of the export from US\$526 to US\$972 per ton. In addition, 5% of the produce destined in domestic market will also get international price because of improvement in its quality to international standards. This will generate a total gross revenue of US\$1.95 million during the last year of the project. All these interventions will generate a total gross revenue of US\$5.4 million during the last year of the project (Table 28).

Table 28: Gross Revenue from interventions in focal point of Upper KP cluster

Parameters [All amounts: 000US\$]	Year 2	Year 3	Year 4	Year 5
Intervention-1: Yield increase (20% total)	5.00%	10.00%	15.00%	20.00%
Additional production (tonne)	1277	2503	3680	4809
Expected additional value (US\$)	662,611	1,298,983	1,909,895	2,496,105
Intervention 2: Promotion of mechanized transplanting (from 5% to 25% in four years)	6%	13%	19%	25%
Production increase due to mechanized transplanting (tonne)	79.79	156.43	230.00	300.59
Gross revenue from mechanized transplanting (US\$)	41,413	81,186	119,368	156,007
Intervention 3: increase in export-production ratio to 5%	1.25%	2.50%	3.75%	5.00%
Increase in export (tonne)	335.14	688.29	1,057.99	1,442.84
Expected additional value from export (US\$)	176,281	362,038	556,501	758,931
Intervention 4: Improvement in value chain				
Production that will pass through improved value	79,427	316,612	722,605	1,307,209



chain (both for domestic and international market (tonne)				
Gross revenue from the improved value chain (US\$)	116,795	470,099	1,076,501	1,950,714
Total Expected Additional Gross Benefits (US\$)	997,101	2,212,307	3,662,265	5,361,757

9.2.3. Costs and Investments

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

ii. Operational Cost at Value Chain Level.

The major cost drivers in peas value chain are the; a) Cost of production inputs and harvest; b) Cost of grading and packaging c) Cost of transportation; d) Cost of processing and marketing; and e) Cost of retailing and selling. These cost heads altogether make the cost structure of the value chain which may vary depending on nature of specific circumstances of the cluster. The cost structure for peas value chain in Sheikhpura focal point KP cluster is presented in following tables.

Table 22: Cost Structure at Value Chain Level in Central Punjab Cluster

		Year 2	Year 3	Year 4	Year 5
Cost of the whole value chain (US\$/ha)	701	Incremented costs/year			
Percent increase in the cost of production (inputs & harvest)	33%	8%	17%	25%	33%
Total increase in cost of production (inputs & harvest) (000US\$)	622	199.7	399.4	599.1	798.8
Increase in the cost of grading & packaging for local low-end market (000US\$)	8	2.232	3.603	4.162	3.956
Total increase in cost of transportation & value addition (grading and packaging) in Pack House (000 US\$)	77	77.8	159.8	245.6	335.0
Additional cost of mechanization (planter) after deducting the cost of manual planting (US\$/Ha)	56	-0.07	-0.13	-0.20	-0.27
Percent increase in the cost of transportation from field to market	20%	5%	10%	15%	20%
Total increase in the cost of transportation from field to market (000US\$)	8	1.0	4.0	8.9	15.8
Percent increase in the cost of wholesale, shelving & retailing	20%	5%	10%	15%	20%
Total increase in the cost of wholesale, shelving & retailing (000US\$)	3	0.06	0.20	0.37	0.52
Total increase in the cost (000US\$)		281	567	858	1,154

Note: Based on extensive consultation with stakeholders, it is evaluated that the total cost/ha of peas value chain is \$701/ha in District Sheikhpura of Central Punjab cluster. These costs are expected to escalate over the period of 5 years along the expansion of volumes, services and new transactions in value chain due to positive effects of



cluster development interventions. The yearly value chain costs have been calculated by multiplying increase in cost/ha in particular cost head with total number of has in focal point. In District Sheikhpura, the costs of production/harvest, transportation, and shelving/retailing are set to increase by 33%, 20%, and 20% over five years respectively. Thus the total increase in costs in the 5th year shall stand at US\$1.154 million with total cost/ha of US\$297.

ii. System Level Investment.

An investment of US\$3.21 million is needed to support the development efforts in focal point (district Sheikhpura) of central Punjab cluster (Table 28). The major investment would be on establishing IQF facilities and pack house in the cluster. Strengthening of research especially the Peas research station in Shiekhpura is estimated to cost US\$ 0.74 million. About 43% of this investment will be made by the public sector in terms of strengthening research and development activities, incentivizing value chain infrastructure like pack-houses and IQF facilities, and promoting markets and exports. The Federal government will share 20% of the total public funding while remaining 80% may come from the provincial government by establishing a Cluster Development Fund under PCP.

The incentives given by the public sector will encourage the private sector and it will bring the remaining 57% investment on establishing the pack-houses, IGF facilities and purchase of mechanical drills in the cluster. Four pack houses will be established in the private sector by providing 20% subsidy. These pack-house centers will be owned by FEGs. Any farmers can use the service of the center and even can use the brand name of the center on charge basis. The profit of the center could be shared among farmers based on their investment share in establishing the center. Two IQF facilities will also be established in the public-private partnership. Farmers would require 80 tractor mounted drills to transplant 25% of total area in the focal point of the cluster.

Table 28. Investment requirements (000 US\$) at the Cluster Focal Point of Upper KP Cluster

Description	Total	Year-1	Year-2	Year-3	Year-4
Investments required on R&D and research level interventions	740.7	296.3	222.2	111.1	111.1
Investments required for IQF Plant	1000.0	500.0	500.0	0	0.0
Investment required for pack houses	557.1	139.3	139.3	139.3	139.3
Investments required for planter interventions	198.5	19.9	39.7	59.6	79.4
Investments required on Marketing/Export level interventions	518.5	207.4	155.6	77.8	77.8
Government loans on private investment	193.1	72.5	74.7	21.9	24.1
Total investments	3208.0	1235.3	1131.5	409.6	431.6

9.2.4. Economic Viability

The estimated Net Present Value (NPV) of all the interventions over the period of five years is positive at US\$4.1 million, and the Internal Rate of Return (IRR) is 69% (Table 26).

Table 26. Net Cash flow, NPV, and IRR of the upgradation Plan at the Cluster Focal Point of Upper KP Cluster



Value Chain Based Costing (000)	Year1	Year 2	Year 3	Year 4	Year 5
Net cash flow (undiscounted) after deducting all costs and investments (US\$)	-1,235,340	-98,515	1,268,995	2,422,327	4,274,155
Net Present value (US\$) = 4,106,820					
Estimated Internal Rate of Return (IRR)= 69%					

9.3. Conclusion

It is concluded that the overall economic, social and environmental impacts 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) based on respective investment costs in each region and the present value of resulting revenues over the period of five years. These estimated IRRs signify the fact that cluster development interventions have prospectively positive impact not only the existing output of peas clusters, but also likely to add additional value increasing the overall potential of the peas value chain across the country.



10. Programs and Plans

This report presented an overview of the potential of peas sector in Pakistan; Identified the peas clusters as part of the V2025 of GoP; Discussed the gaps and constraints of identified clusters; Gave recommendations for cluster development; 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 peas value chain in both the regions. In support of the findings and recommendations presented in previous sections, the following plans and programs are proposed for further value addition.

In support of the strategies and interventions proposed in sections 9 of this report, the following programs/plans are recommended to further strengthen the interventions and to creating greater opportunities for participation and learning in focal point of each cluster.

10.1. Program for Organization and Networking of Stakeholders

The following program is proposed for organization of stakeholders at different levels of value chain. Farmer level organization is being proposed specifically for upper KP clusters.

Table 23: Program for organization and networking of stakeholders

S#.	Area of Action	Purpose	Institutions to be involved	Priority
1. District Swat (Upper KP cluster)				
1.1	<ul style="list-style-type: none"> Form Farmers Enterprise Groups at union council level Form one Farmer Enterprise Group (FEG) at district level. Having a membership of at least 25 farmers. 	Organization of peas farming community for collective action	KP Agri. Extension Department	Short to medium term (1 to 2 years)
1.2	<ul style="list-style-type: none"> Form fresh Peas exporters Association at market/business level. At least 4 exporters should be initially involved. 	Improve coordination between the stakeholders of Peas value chain	NGOs, Private Sector	Short to medium term (1 to 2 years)
3. District Sheikhpur (Central Punjab cluster)				
	<ul style="list-style-type: none"> Form Farmers Enterprise Groups at union council level Form one Farmer Enterprise Group (FEG) at district level. Having a membership of at least 25 farmers. 	Organization of peas farming community for collective action	Punjab Agri. Extension Department	Short to medium term (1 to 2 years)
3.1	<ul style="list-style-type: none"> Form fresh peas exporters & processors Association at 	Improve coordination	PFVA, Provincial Agri R&D	Short to medium term (1 to 2 years)



	market/business level. At least 5 exporters and 2 processors should be initially involved.	between the stakeholders of peas value chain	department, Private Sector	years)
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These district level exporter associations should be linked with proposed national level Peas exporters and processors association under the umbrella of Pakistan Fruits and Vegetables Exporters, Importers and Merchants Association.

10.2. Program for Research Reform

The following program indicative areas for further research to strengthen the peas clusters in the focal points of identified clusters are proposed along with the estimated costs.

Table 24: Program for research reforms

S#.	Identification of Areas for Further Research	Research Purpose/ Priority	Indicative Research Institutions
1. District Swat (Upper KP Cluster)			
1.1	<ul style="list-style-type: none"> Identify suitable high yielding cultivars Develop improved production technology package for peas growers Introduction of hand driven peas seed drills 	Peas production improvement Short to medium term (1 to 2 years)	PARC, VRP (ARI,KP), KP agri. Extension Department
1.2	<ul style="list-style-type: none"> Develop strategy for quickly distributing improved cultivars and production technology among farmers Establishment of Peas model plots at Union Council level 	Improve cultural practices & hence Peas production Short to medium term (1 to 2 years)	PARC, VRP (ARI,KP), KP agri. Extension Department
1.3	<ul style="list-style-type: none"> Consultation with fresh vegetable exporters to assess interest in value chain improvement & establishing a Peas Exporters Association Scoping survey to identify new products and potential buyers 	Create market Linkages for quality Peas (Domestic and Export) Medium to long Term (2 to 5 years)	Private businesses, Export promotion board, Embassies, PFVA
1.4	<ul style="list-style-type: none"> 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, VRP (ARI,KP), KP agri. R&D Department
3.1	<ul style="list-style-type: none"> Identify suitable high yielding cultivars for early normal and 	Peas production improvement	PARC, AARI, UAF, AMRI, Private Seed Companies



	late sowing <ul style="list-style-type: none"> • Develop improved production technology package for peas growers • Introduction of hand driven & tractor mounted seed drills and harvesters 	Short to medium term (1 to 2 years)	
3.2	<ul style="list-style-type: none"> • Develop strategy for quickly distributing improved cultivars and production technology among farmers • Establishment of peas model plots at Union Council level 	Improve cultural practices & hence production Short to medium term (1 to 2 years)	PARC & Povincial Agri. Extension Department
3.3	<ul style="list-style-type: none"> • Development of Seed production technology and local seed production • Consultation with private seed companies to access interest & potential for local seed production 	Increase local seed production Short to medium term (1 to 2 years)	PARC, AARI & Private Seed Companies
3.3	<ul style="list-style-type: none"> • Consultation with fresh vegetable exporters and processors to assess interest in value chain improvement and processing & establishing a Peas Exporters Association • Scoping survey to identify new products/frozen peas and potential buyers 	Create market Linkages for quality freshed peas and processed/frozen Peas (Domestic and Export) Medium to long Term (2 to 5 years)	PARC, PHRC PFVA
3.4	<ul style="list-style-type: none"> • 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, UAF, AARI

The estimated costs for research plan mentioned in the above table have already been counted as part of the cluster investments given in Section 9



11. Annexures:

Annexure I: Macro Data Resources

Crop Reporting Services. (2017). Crop Statistics Khyber Pakhtunkhwa 2016-17. Agriculture Livestock and COOP Department, Government of KP, Peshawar.

Fact Fish Data Portal (www.factfish.com)

FAOSTAT (Food and Agriculture Organization Statistics) Production, Crops <http://www.fao.org/faostat/en/#data/QC>

FAOSTAT, (Food and Agriculture Organization Statistics). 2020. Trade, Crops and Livestock Products <http://www.fao.org/faostat/en/#data/TP>

Feasibility Study, Individual Quick Frozen (IQF) Vegetables/Fruits, Agriculture Department, Government of Punjab

Kharif crops final estimates data book 2016-17, Directorate of Agriculture, Crop Reporting Service, Punjab

Land Utilization Statistics of Baluchistan, Crop Reporting Services, Baluchistan

MNFS&R (Ministry of Food Security and Research). 2018. Agriculture Statistics of Pakistan 2017-18., Economic Wing, MNFS&R, Government of Pakistan, Islamabad.

Punjab Development Statistics 2015, Bureau of Statistics, Punjab



Annexure 2: List of Stakeholders Consulted

Sr.#	Name	Address
1	Hayat Ullah (Seed, Pesticide and Fertilizer dealer)	Kassan Zarai Spray Centre, Kunda Mor, Sawabi 0346-9833362
2	Syed Hadayt Hussain (Seed, Pesticide and Fertilizer dealer & Peas/Peas Farmer)	Zarai Falahi Markaz, Meros Mandi, Mardan 0334-9492806
3	Latif Ur Rehman (Seed, Pesticide and Fertilizer dealer)	Haseeb Seed Store, Peshawar 0300-5902756
4	Altaf Ahmad (Seed Importer/Dealer)	Gull International, Rawalpindi 0300-5163812
5	Hadayt Ullah (Peas/Peas Farmer)	Kunda More, Sawabi
6	Wasif Ali (Peas/Peas Farmer)	Village Tolandi, Shera Adda sawabi 0333-9417928
7	Mian Tahir Saeed (Peas/Peas Farmer)	Jhumra, Faisalabad 0300-8665110
8	Buland Iqbal (Seed, Pesticide and Fertilizer dealer)	Sheva Adda, Sawabi 0302-5683942
9	Raees Zaman (Agronomist, ICI Seeds, KP)	ICI Seeds, Sawabi 0303-7772702
10	Dr. Ahmad Din (Food Technologist)	Post-Harvest Research Institute, AARI, Faisalabad 0321-7535783
11	Dr. Ubaid Ur Rehman Director Seed, CKD Seeds,	Chaudhary Khair Din & Sons, Gujranwala 0300-8698182
12	Mr. Gulzar (Peas Grower)	Fasal Chak, Qila Deedar Singh, Gujranwala (0302-666202)1
13	Abdul Jalal (Peas Grower)	Mara Tangi, Nekheter, Loralai (0333-7190390)
14	Syed Usman Ali (Fresh Peas & Peas Exporter)	Suaz & Co. (pvt.) Ltd., Rawalpindi (0345-5161685)
15	Zulqarnain Haider (Peas Scientist)	ICI Pakistan, Sahiwal (0301-8226391)



Annexure 3: References (Literature Reviewed)

Ahmad, H., Öztürk, M., Ahmad, W., & Khan, S. M. (2015). Status of natural resources in the uplands of the Swat Valley Pakistan. In *Climate change impacts on high-altitude ecosystems* (pp. 49-98). Springer, Cham.

Chishtil S.A.S., M.Iqbal, N.Parveen, K. Nadeem, M. Iqbal, U.Shahzad, R.H.Shabbir and M. Najeebullah (2018). Sarsabz: A New High Yielding, Well Adapted Pea (*Pisum sativum* L.) Variety.). *Sarhad. J. Agri.*4(34):904-909

Feasibility Study Report; Fruit & Vegetable Canning Unit (<http://www.agripunjab.gov.pk/system/files/01Fruit%20and%20Vegetable%20Canning%201.pdf>)

Mohammad, A., & Shad, K. (2002). Yield and components of pea. *Pakistan Journal of Agricultural Research*, 17(4), 401-403.

Munir, K. (2013). Comparative advantage and competitiveness of pea crop in Khyber Pakhtunkhwa. *Sarhad Journal of Agriculture*, 29(2), 299-306.

Pre-feasibility study individual quick frozen (IQF) 2017 vegetables/fruits (<http://www.agripunjab.gov.pk/system/files/3%20%20Frozen%20Fruits%20and%20Vegetables%20Processing%20Unit%20-%20IQF.pdf>)

www.pfva.net

FAOSTAT (Food and Agriculture Organization Statistics) Production, Crops <http://www.fao.org/faostat/en/#data/QC>

FAOSTAT, (Food and Agriculture Organization Statistics). 2020. Trade, Crops and Livestock Products <http://www.fao.org/faostat/en/#data/TP>

MNFS&R (Ministry of Food Security and Research). 2018. Agriculture Statistics of Pakistan 2017-18., Economic Wing, MNFS&R, Government of Pakistan, Islamabad.

MNFS&R (Ministry of National Food Security and Research (2018). Fruit, Vegetable & Condiments Statistics of Pakistan: Economic Wing, MNFS&R. Government of Pakistan, Islamabad.

Frozen Vegetables Market Size, Share & Growth _ Industry Report 2018 <https://www.alliedmarketresearch.com/frozen-vegetables-market>



Annexure 4: Feasibility Study for Green Pea's Pack House

Pea is (*Pisum sativum L.*) the fourth important legume crop. Pea is important Rabi vegetable of Pakistan which has low production cost, high profitability. It has good nutritional value and is the richest source of protein and is suitable for cultivation from small to large scales holding farmers. Moreover, peas remain available almost round the year due to Pakistan's diversity in agro-climatic conditions in different regions of Pakistan. The issue of post-harvest handling facilities for horticultural products especially green peas has not been attended, especially for the emerging farmers. In addition, the low prices that farmers have received from local markets have convinced most peas growers to bypass local markets in established national markets, where demand is almost always high and prices are therefore good. (Frozen vegetable market, 2018) For most of the interventions initiated, the development of post-harvest handling technologies in the form of fresh product depots and fresh product packaging would reduce post-harvest losses.

The aim of this study is to produce a feasibility report on the peas pack house in the proposed cluster(s). The pack house will include packaging, grading and supply of cold stores, which could benefit emerging market producers to increase their income and gross output by supplying markets with high quality fresh peas, processors and retailers.

Following are the most common methods used (IQF,2017).

Objective

The objective of this feasibility study is to estimate feasibility of pack house in peas for the future investors so that following functions in value chain can be incorporated.

- Cleaning, Insect pest and diseases control after harvest grading, sorting, washing, peeling, blanching, precooling, packing, loading and shipment etc.

The process Harvesting

Postharvest quality control begins in the field. Clean hands and sanitary personal habits are required of workers at all times when handling food products like peas. Therefore, careful supervision and proper instruction of the harvesting crew are essential to the success of any hand harvesting operation. Careful supervision includes random checks of harvesting bags or pails for trash and poor-quality beans. Packing house problems and buyer complaints often result from a poorly instructed and supervised harvesting crew. Peas should be removed from the plants cleanly without tearing them or causing undue damage to the pods or plants. Over handling or rough handling of the pods will result in both visible and latent damage. In addition, harvested pods should never be packed tightly into harvesting containers or allowed to remain in the sun for extended periods.

Sizing and grading

Sorting is done to remove damaged or diseased produce or those not meeting quality requirements. It is usually the first pack house operation. Grading is done when the sorted defect-free produce is classified into grades or classes of specific weights or sizes (sizing) and maturity stage. It can be done after sorting or just before packing. Sorting and grading



can add 40-60% more value to the produce. Sorting and grading can reduce postharvest losses by:

- Preventing disease contamination of sound produce which otherwise occurs when sound and diseased produce are mixed.
- Minimizing ethylene damage (e.g. premature senescence or ripening) which otherwise occurs when injured produce or ripe fruit (high ethylene producers) is mixed with undamaged produce or unripe fruit.

Washing/ Dry Cleaning

Clean vegetables have higher market appeal and prices than dirty vegetables. Cleaning reduces microbial contamination, physical damage and transport cost. Produce can be cleaned by: - trimming fruit stems, roots of leaf. Washing using clean water to remove adhering soil and other debris. After washing, the produce should be air dried before packing. While cleaning, sorting can also be done.

Blanching

The cleaned peas are next passed into a vat of boiling water for a few minutes. This kills enzymes that effect the taste of the peas, but it does not cook them. After blanching, the peas are cooled with water and then passed to a specific gravity sorter.

Pre-cooling or chilling

Most optimum temperature for blanching of peas was found to be 76.6 to 87.77⁰ C. Below this temperature did not entirely inhibit the formation of flavour. Above this temperature result in loss of flavour and formation of cooked flavours. It is found that the quality of frozen peas after undergoing of blanching was superior if a certain level of peroxidase activity remained at the end of the blanch. Total absence peroxidase indicates over blanching. Peas must be blanched until 2-6.3% of peroxidase activity is retained.

Weighing and packing

Airtight containers which are moisture-vapour-proof & cold resistant are preferred. Metal containers need not be lacquered ▪ Parchment bags or wraps enclosed in cartons may also be used for dry frozen peas. Liquid pack with 2% brine can be added to cover the product in order to produce highest quality peas

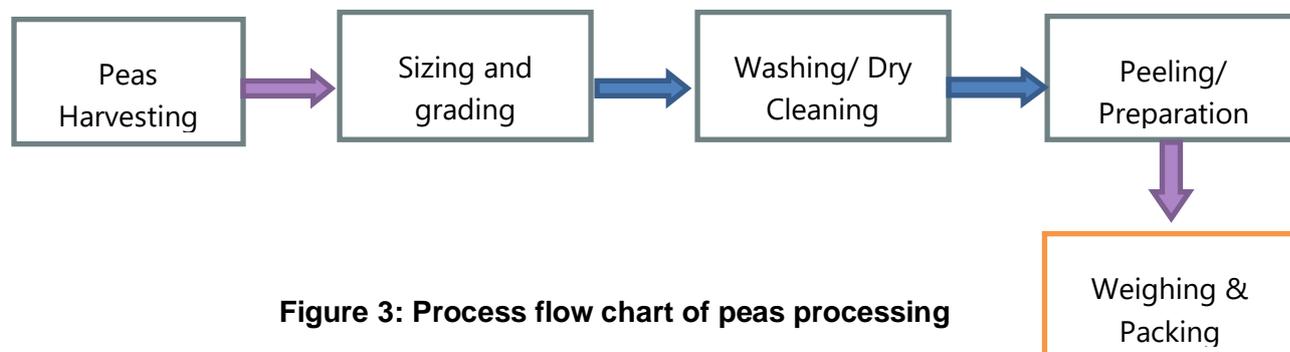


Figure 3: Process flow chart of peas processing

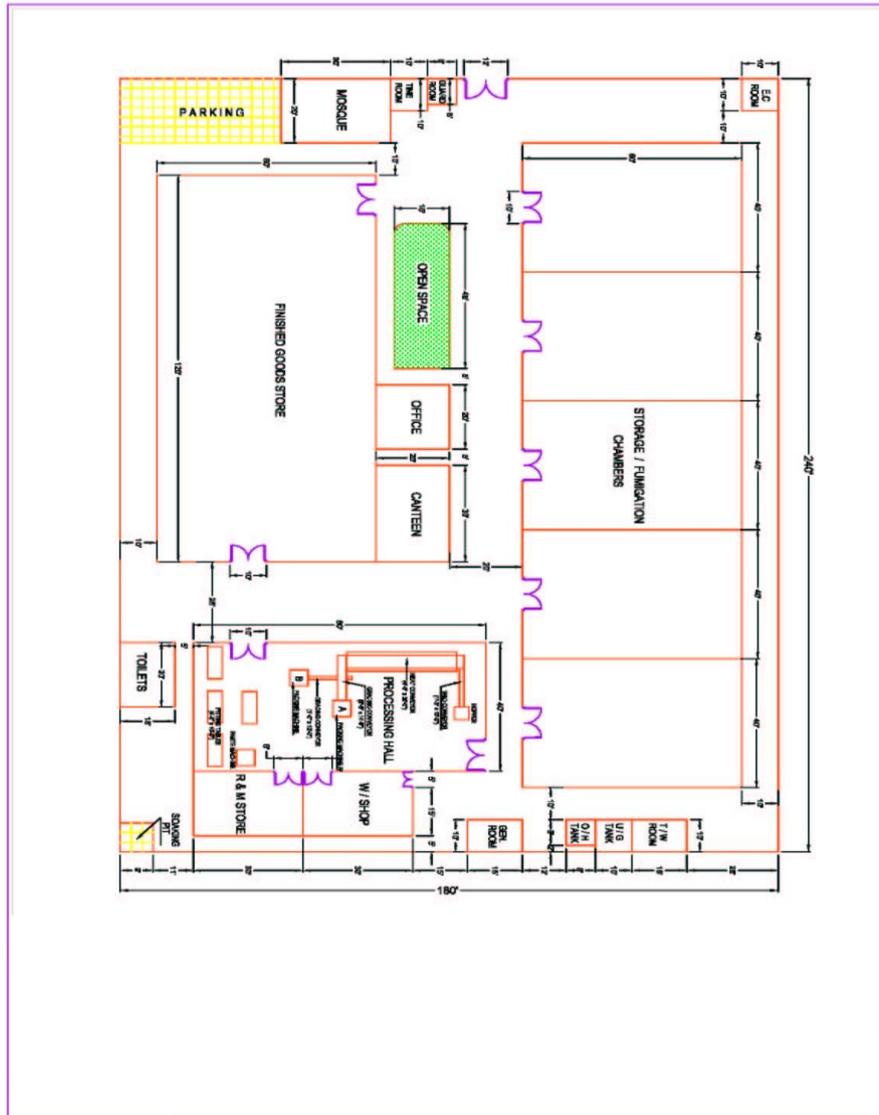


Figure 4: Map of the pack house

Machinery and Equipment

Selection of plant and machinery is the most important decision for setting up a food processing unit. All machinery and equipment used in the processing line should have proper efficiency. All the plant and machinery should be erected in such a way that the material flow is unidirectional to avoid cross contaminations. The machinery should not occupy more than 1/3rd of the total floor area for smooth operation of labour.

1. **Chain Pulley Block**
 - Capacity: 5 Ton
 - Supplier: Max Industries, India
 - Supplier Product Code: HH2050
 - Price: US \$1200
 - Power Source: Hand Pulled
2. **Motorized Conveyor for Bulk Material Handling**
 - Supplier: AMC System Technology (Suzhou) Co., Ltd
 - Model No. – AMCRL006



- Dimension (L*W*H) – Customized
 - Voltage – 110V/220V/380V
 - Power – 1500 W or Customized
 - Capacity – 1500kg or customized
 - Price – US \$1300
3. **Hydraulic Pallet lift (manual)**
- Supplier: Baoding Dali Hoisting Machinery Co. Ltd
 - Model No. – PDL -3T hand Pallet
 - Price – US \$250
4. **Box Strapping Machine**
- Supplier: Henan Bedo Machinery Equipment Co. Ltd
 - Model No. – BD-001
 - Voltage – 220V
 - Power – 50 KW
 - Price – US \$250
5. **Electronic Weighing Machine**
- Supplier: Yuvo
 - Model No. – 730
 - Voltage – 220V
 - Capacity – 1500kg
 - Price – US \$900
6. **Shrink Wrapping Machine**
- Supplier: Ruian Yongxin Machinery Factory
 - Model No. – BTH 450 + BM500L
 - Dimension (L*W*H) – 3850*1500*1300mm
 - Voltage – 220V/380V
 - Power – 50Hz
 - Price – US \$3000
7. **Grading and Sorting Table**
- Supplier: Tianjin Sure International Trading Co. Ltd
 - Model No. – Sure -CBM
 - Dimension – 1000 - 10000mm
 - Voltage – Customized
 - Power – 0.18 – 2.5KW
 - Price – US \$ 3000
8. **Platform Type Scales**
- Supplier: Sanghai Uni-weigh System (Tech)Co. Ltd
 - Price – US \$ 1700
9. **Tray Wrapping Machine**
- Supplier: Shandong China Coal Group Ltd
 - Model No. – HW450
 - Dimension – 540*680*200mm
 - Voltage – 220V
 - Power – 270W
 - Price – US \$ 1800
10. **Hot Air Dryer**
- Supplier: Henan Xingyang Mining Machinery Manufactory
 - Model No. – ZT
 - Dimension – Depends on the model
 - Voltage – 380V



- Price – US \$ 8,000
- 11. Washer**
- Supplier: Zhengzhou Azeous Machinery Co. Ltd
 - Model No. – AUSNW
 - Dimension (L*W*H) – 3800*760*1200mm
 - Voltage – 380v/50hz/3phase
 - Power – 3.5KW
 - Capacity – 500kg – 4000kg/hr
 - Price – US \$ 7000
- 12. Small Cold Store**
- Supplier: Taizhou Nimbus Machinery Co. Ltd
 - Price – US \$3400

Pack house project summary

Plant capacity	10 Tonnes per day; 900 tonnes annually
No. of shifts	One (8 hours per shift) per day
Working days in a year	90

Capital Costs

Land and building

For building and civil work about 6,000 sq. feet of land will be required for this project and built up area required will be 1500 sq. ft. consisting of production hall, washing, packaging, storage etc. The cost of building and civil work would be US\$**16000** at a rate of US\$10/square feet assuming land will be leased in the project.

Plant and Machinery

The cost of plant & machinery is estimated at US\$ **58100** including installation and commissioning. The installed production capacity will be 10 tonnes per day. The cost estimates for plant & machinery has been worked out based on the cost figures available from recent orders paced for similar items in the recent past, duly updated to cover the price escalation in the intervening period. These costs are given in the following tables:

Plant and Machinery

S. No.	Particulars	Qty.	Rate (US\$)
1.	Solar generator	1	5000
2.	Chain Pulley Block	1	1200
3.	Motorized conveyor for bulk material handling	1	1300
4.	Hydraulic pallet lift manual	1	250
5.	Box strapping machine	1	250
6.	Electronic weighing machines (1500Kg.)	1	900
7.	Shrink Wrapping Machine	1	4000
8.	Grading & Sorting Table	1	3000



9.	Inspection Tables	3	300
10.	Platform Type Scales (30kg)	2	1700
11.	Platform Type Scales with Printer (15 kg)	10	150
12.	Platform type scales (120 kg)	5	100
13.	UPS for above Machines	5	200
14.	Tray Wrapping Machine	1	1800
15.	Hot Air Dryer – for Removing water applied Externally	1	8000
16.	Waxing Unit	1	2500
17.	Washer	1	7000
18.	Packaging machine, Pouch sealing machine	1	170
19.	Cold Storage	1	7000
20.	PU Building for Pack house (1000 sq. ft.)	1	10000
21.	Ethylene Generator 3 nos. (Sure Ripe)	1	200
22.	Ethy-gen II Concentrate (45 cases)	1	200
23.	Gastech. Air Sampling Kit Unit 1 no. 1	1	180
24.	Ethylene Monitoring Tube - 1 Box	1	180
25.	Carbon di-oxide Monitoring Unit	1	400
26.	1 0.04 0.04 30 Additional Dryers for Removing Moisture - 1MT Per Day	1	120
27.	Pallets and Bins		2000
	Total		58100

Misc. Fixed Asset Costs

US\$ **18580** has been estimated under the heading of miscellaneous fixed assets. The details of electrical installations for power distribution have been considered commensurate with the power load and process control requirements. Other miscellaneous fixed assets including furniture, office machinery & equipment, equipment for water supply, office stationery, telephone and refreshment, workshop, fire-fighting equipment, etc. will be provided on a lump sum basis as per information available with the consultants for similar assets. The details of miscellaneous fixed assets and their associated costs are being shown in table below:

Miscellaneous fixed asset cost

S. No.	Particulars	Qty.	Rate (US\$)
1.	Office Equipment	1	1000
2.	Furniture and Fixture	1	1000
3.	Miscellaneous Accessories	1	2000
4.	Vegetable Display Crate	50	200
5.	Display Board	5	60



6.	Fire Fighting	1	70
7.	Computer with Accessories	2	1000
8.	ERP System	1	10000
9.	Water Treatment Plant – 500 litres per hour	1	1000
10.	Loading Tempo	1	250
11.	Electrical and water pipes Installation	1	2000
	Total		18580

Pre-Operative Expenses

Expenses incurred prior to commencement of commercial production are covered under this head that total US\$ **31700**. Pre-operative expenses include establishment cost, rent, taxes, traveling expenses and other miscellaneous expenses. It has been assumed that the funds from various sources shall be available, as required. Based on the project implementation schedule, the expected completion peas of various activities and the estimated phasing of cash requirements, interest during construction has been computed. Other expenses, under this head have been estimated on a block basis, based on information available for similar projects.

Pre-Operative Expenses

Sr. No.	Particular (for 1 year)	Amount (US\$)
1.	Interest up to production @ 16% on term loan amount of US\$ 180723 (30% of total project cost)	28916
2.	Electricity charges during construction period	1200
3.	Marketing Launch Expenses	1000
4.	Technology Know-how and consultancy fees	3000
5.	Training expenses	1500
6.	Travelling Expenses	1000
	Total	36616

Cost of Raw Material

Based on a processing capacity of 10 tonnes per day taking into account and 90 days of working per year, the annual raw material consumption of the pack house is 900 tonnes. The cost of fresh peas based on its average selling price as determined through interview with randomly selected farmers and converting it into US\$ (with conversion rate of one US\$=135) is \$440/ton. Adding US\$20 per ton transportation cost from the field to pack house, the raw material cost for pack house would be US\$540.



Cost of raw material

Particulars	Rate per ton (US\$) for the raw Peas at the wholesale/ pack house	Qty. (Tonnes) per season	Raw material cost (US\$)
Peas	460	900	414000

Land Lease Charge

Required land is 6,000 sq. ft. which has been considered on lease @ US\$200 per annum for first three years and @ US\$200 for the fourth year and subsequently @ 5% increase every year.

Land lease charges

S. No.	Year	Lease charges Per annum (US\$)
1.	1 st year	200
2.	2 nd year	200
3.	3 rd year	210
4.	4 th year	220
5.	5 th year	231
	Total	1061

Electricity and Water Consumption Charges

The unit cost of electricity has been considered @ PKR.20.70/ unit assuming that the entire power requirement is met from the grid. A power supply of 60 KVA is deemed appropriate. The expense on water supply, treatment and distribution has been suitably considered, based on the tariff by water and sanitation agency (WASA) for per month consumption of water tariff of @ 92.82 PKR/thousand gallons. Water requirements are approximately 500 gallons per day.

Electricity and water consumption charges

S. No.	Description	Amount Per Annum (US\$)
1.	Power Consumption	2000
2.	Water Consumption	200
	Total	2200

Human Resource Cost

One pack house manager, one accountant for six months, one supervisor for six months' technical staff Salaries & wages (including benefits) for different categories of employees have been considered based on present day expenses being incurred by other industries in the vicinity. The breakdown of manpower and incidence of salaries & wages are detailed in the table Salary & Wages. Salary & wages are increased @ 5% every year



Salary and wages

Sr. No.	Description	Requirement	Salary/month (US\$)	Salary/annum (US\$)
1.	Pack house manager	1	550	6600
2.	Accountant	1	320	3840
3.	Supervisor	1	300	3600
4.	Skilled Workers	2	500	6000
5.	Driver	1	300	3600
6.	Security Guard	1	225	2700
	Total		2195	26340

Cost of Project

Sr. No.	Particular	Value (US\$)
	Fixed costs	
	Plant and Machinery	58100
	Misc. Fixed Assets	18580
	Pre-operative expenses	36616
	Operating costs	
1.	Cost of raw material	414000
2.	Land lease charges	1061
3.	Electricity and water consumption	2200
	Salary and wages (For 180 days)	26340
	Margin Money for Working Capital	1500
	Contingencies 5% of Fixed Assets	929
	Total variable costs	559326



Project Income Statement

Revenues	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue (US\$)						
Quantity of peas that goes in value addition or capacity of pack house (tonne)		900	900	900	900	900
Price of the value added peas(US\$/ton)		526	526	526	526	526
Total revenues after processing (US\$)		473400	473400	473400	473400	473400
Direct variable vosts						
Raw material price (US\$/TON) plus transportation		423	423	423	423	423
Raw material cost (us\$)		380700	380700	380700	380700	0
Packing costs (@PKR20 per 25 kg box)		5333	5333	5333	5333	5333
Labor cost		48360	48360	48360	48360	48360
Electricity and water		4200	4200	4200	4200	4200
Maintinance (1% of the machinery, equipment and furniture cost)		1393	1393	1393	1393	1393
Land lease charges (5%) increment on annual	200	200	210	221	232	243
Marketing (US\$2/ton)		1800	1800	1800	1800	1800
Transportation cost from pack-house to market and port		14975	14975	14975	14975	14975
Office administration		370	370	370	370	370
Total variable cost		457755	457765	457775	457786	77098
Gross profit		15645	15635	15625	15614	396302
Indirect fixed cost						
Machinery	-139280					
Licensing and regulatory fee	-150	0	0	0	0	
Total	-139430	0	0	0	0	
Grand total cost	-139430	457755	457765	457775	457786	77098
Net profit (Net cash flow)	-139430	15645	15635	15625	15614	396302
NPV with 8.5% discount rate		161,593				
IRR		30%				

Project Viability

The Internal Rate of Return of the project is estimated at **53%**, which is significantly higher than the bank return rate of 16%. Hence, the project is deemed financially viable. The NPV of the project is positive (US\$ **307,378**) at a discount factor of 16% during the first 5 years of operation considered. This implies that the project generates sufficient funds to cover all its cost, including loan repayments and interest payments during the period. This also indicates that the project is financially viable over the long term.



Annexure 5: Feasibility for Planter

Operating efficiency @0.5acre per hr (ha per hr)	0.20					
Per day efficiency @8 hrs work everyday (ha)	1.0					
Working days in a year	30					
Area planter in a seasons (ha)	30					
Revenues		Year 1	Year 2	Year 3	Year 4	Year 5
Revenue (US\$)						
Increase in per ha yield (%)	5%		1.04	1.04	1.03	1.03
Total increase in production for the whole season (tonne)			31.29	31.13	30.98	30.82
Price of wholesale (US\$/ton)			519	519	519	519
Increase in revenue due to improved yield (US\$)			16241	16158	16076	15994
Direct variable costs						
Cost of manual planting (US\$/ha)			110	110	110	110
Cost of mechanical planting (US\$/ha)			31	31	31	31
Saving in cost (US\$/ha)			78	78	78	78
Total saving in cost during the season (US\$)			2353	2353	2353	2353
Variable Cost						
Maintinance (2% of the machinery cost)			50	50	50	50
Depreciation			198	198	198	198
Land lease charges (5%) increment on annual		50	53	55	58	61
Fuel consumption charges 22.23L/ha @124 Rs including price of mobil oil	22.23	124	0	0	0	0
Total variable cost			-2053	-2050	-2047	-2044
Gross profit			18294	18208	18123	18038
Indirect fixed cost						
Machinery		- 2481.48				
Total		-2481	0	0	0	0
Grand total cost		-2481	-2053	-2050	-2047	-2044
Net profit (Net cash flow)		-2481	18294	18208	18123	18038
NPV	8.5%		52,582			
IRR			737%			
Additional operating cost			-2053	-2050	-2047	-2044
per (ha) operating cost			- 68.421	-68	-68	-68
Total area to be planted			243	486	728	971
planter required			8.1	16.2	24.3	32.4
Approximate number of drills			8	16	24	32
Cost of transplanter for the whole cluster (US\$)			19852	39704	59556	79407