CLUSTER DEVELOPMENT BASED AGRICULTURE TRANSFORMATION PLAN VISION-2025

# The Agriculture Transformation Plan


## Planning Commission of Pakistan, Ministry of Planning, Development & Reforms

**February 2020**

# FOREWORD

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

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

# FOREWORD

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

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

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

# FOREWORD

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

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 were also engaged to understand the cluster-based development approach. An EXCEL-based Model was developed which was validated by our national consultant, Mr. Sohail Moghal. Separate viabilities for individual technologies and products suggested in each commodity are also estimated. This 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 mango 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 Director for Central and Western Asia, Dr. Babar Ehsan Bajwa and CABI team especially Mr. Yasar Saleem Khan and Miss. Aqsa Yasin for offering outstanding cooperation and support during all the stages of this project. However, I take the responsibility of any shortcoming left in the report.

**Dr. Mubarik Ali**

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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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| | |
|---|---|
| ACDF | Agriculture Cluster Development Fund |
| ADO | Agriculture Development Officer |
| AO | Agriculture Officer |
| APO | Agriculture Productivity Organization |
| ATP | Agriculture Transformation Plan |
| AZTB | Agriculture Zarai Tarkyati Bank |
| CABI | Center or Agriculture Bioscience International |
| CDF | Cluster Development Facilitator |
| CGIAR | Consultative Group of International Agriculture Research |
| EU | European Union |
| FEGs | Farmers Entrepreneur Groups |
| FO | Field Officer |
| FPMU | Federal Project Management 'unit |
| FSC&RD | Federal Seed Cortication and Registration Department |
| GAPs | Good Agriculture Practices |
| GB | Gilgit Baltistan |
| GPUs | Germ Plasm Units |
| GTZ | Gesellschaft für Technische Zusammenarbeit |
| ha | Hectare(s) |
| HWT | Hot Water Treatment |
| ICARDA | International Center for Agricultural Research in the Dry Areas |
| IFPRI | International food Policy Research Institute |
| IPM | Integrated Pest Management |
| IRR | Internal Rate of Return |
| IRRI | International Rice Research Institute |
| IWMI | International Water Management Institute |
| JICA | Japan International Cooperation Agency |
| KP | Khyber Pakhtoonkhwa |
| LCs | Letter of Credits |
| MFS&R | Ministry of Food Security and Research |
| NARC | National Agriculture Research center |
| NGOs | Non-Government Organizations |

| | |
|---|---|
| NPV | Net Present Value |
| NRSP | National Rural Support Program |
| PARC | Pakistan Agriculture Research Council |
| PBIT | Punjab Board of Investment and Trade |
| PCP | Planning Commission of Pakistan |
| PHDEC | Pakistan Horticulture Development and Export Company |
| PMU | Project Management Unit |
| PPMUs | Provincial Project Management units |
| PSDP | Public Sector Development Program |
| PSQCA | Pakistan Standards and Quality Control Authority |
| R&D | Research and Development |
| RDF | Rural Development Foundation (of Pakistan) |
| RS&M | Rapeseed and Mustard |
| SEDF | Sindh Enterprise Development Fund |
| SIDB | Small Industrial Development Board, KP |
| SMEDA | Small and Medium Enterprises Development Authority |
| SOPs | Standard Operating Procedures |
| SPS | Sanitary and Phyto-Sanitary |
| TDAP | Trade Development Authority of Pakistan |
| USAID | United States Agency for International Development |

# EXECUTIVE SUMMARY

The Vision 2025 perceives a great potential for modernizing agriculture and enhancing its competitiveness through developing and strengthening agriculture clusters. The Agriculture Transformation Plan (ATP) for Pakistan has been developed after analysing the value chains of 33 agriculture commodity clusters spread across the country. While preparing the plan, local conditions in the clusters in which these commodities are produced, marketed, processed, and traded have been incorporated. The main objective of the ATP is to convert the agriculture from a supply-driven to demand oriented sector that can compete in the national and international markets through vertical integration rather than horizontal expansion of value chain activities. This proposed strategy is to synergistically link different stakeholders along the value chain in these commodity clusters.

## 1. Constraints and Gaps

The ATP attempts to improve the following areas to make Pakistan's agriculture competitive:

- Farm productivity to enhance per ha and per animal yields,
- Post-harvest management to reduce losses,
- Export performance to improve export-production ratio,
- Value chain management to enhance quality of agriculture produce for the domestic and international markets,
- Processing of agriculture commodities as cottage industry in rural areas, and
- Improve inefficient farm operations.

Issues have been identified and targets are fixed to be realized in the proposed plan in above six areas for each of the 74 identified clusters of 33 agriculture commodities. This exercise has been carried out on the basis of the world averages available for the study parameters and analyses of gaps and potentials done through consultation with stakeholders at the cluster level.

**Farm Productivity**. In farm productivity, it was observed that per ha or per animal yields of only six out of 29 commodities in Pakistan have higher than the word average yields of the respective commodity. In addition, during 2001-17, lower growth rates in yield than the world average have been recorded in 21 out of 29 crops thus the comparative advantage in these crops are expected to further deteriorate if these trends continue in the future. Although causes of low per ha and per animal yields are identified in each commodity report, generally it is because of lack of producer's access to advance and high-yielding technologies, varieties and planting material and their ability to adopt these technologies. Water shortage has become a serious issue which affects productivity in many clusters.

**Harvest and Post-Harvest Losses**. These losses in Pakistan's agriculture, both in terms of quantity and quality are high ranging from 20-50% mainly because of poor harvest and post-harvest management. About 5-15% of these losses occur at the harvesting time; aflatoxin infestation is common in many agricultural commodities; high pesticide residue and lack of

traceability and certification are emerging issues bothering the traders which reduces the country's chance to compete in national and international markets.

**Trade Performance**. It has been analysed that out of the total 29 commodities where comparable export data is available, 16 commodities have low growth potential in both quantities and values when compared with the respective world averages. Out of 24 crops where export-production ratio data is available (others are mainly imported commodities), Pakistan has only six crops where the ratio is higher than the world average. However, except potato, the rate of increase in export-production ratio in these commodities are also either less than that at the global level or even declining overtime. Thus, Pakistan brings far less proportion of its production in international market. The causes of low or deteriorating export-production ratio root in the poor value chain development of the commodity, inefficient commercial policies and strategies and weak knowledge and link of the traders with international markets. Improving trader's link with international markets and improving the value chain of agriculture commodities can greatly enhance the export-production ratio of these commodities.

**Quality of Produce** In comparing the quality of these 33 tradeable commodities wherever relevant for international markets, it has been observed that out of the 24 commodities exported (except sugarcane), Pakistan could not earn export price equal or higher than its average export price in the world. This finding suggests that Pakistani exporters fail to meet the quality standards of the consumers demanded in the importing countries. Similarly, in domestic market, the prices of the imported commodities are found usually higher than the domestically produce product again suggesting low quality of the latter. Lack of investment on value chain development is the main cause of Pakistan's failure to get the world average export price. Sometime, failure of Pakistani traders to present the product in a manner in which importing country consumers prefer is also a cause. Many domestic consumers also complain failing to get the desired quality in the domestic market.

**Small Scale Processing**. Despite a great potential of small-scale processing of agriculture commodities, very little of agriculture produce go into such processing in rural areas. For example, most of the tomato puree is imported from China which can be processed through small-scale puree plants in rural areas. Mechanical sun drying of several fruits and vegetables, basmati rice, etc. can not only reduce post-harvest losses and improve produce quality but also add value of raw agriculture commodities and reduce seasonal price fluctuation. Small scale juice/pulp making in mango, sugarcane and many other fruits are viable business ventures in rural areas, provided processing and hygienic standards are maintained.

**Farm and Value Chain Operations**. Several farm and value chain operations conducted manually or unscientifically are too inefficient. These include planting/transplanting, harvesting, transportation, packing and drying, etc. For example, manual planting in rice not only involves muscle drudgery but also is inefficient. The open-sun drying in many fruits and rice reduces quality. Manual harvesting in many fruits is inefficient and causes huge losses and deterioration in quality. These existing practices significantly reduce Pakistan's competitiveness as it increases the value-chain costs, reduce quality, and/or delay the delivery of the produce.

## 2. Potentials

Despite these issues of competitiveness, potentials are identified to overcome these issues for all the 74 clusters of 33 assigned commodities, which are explained in each commodity report and are summarized in general terms as follows:

- Most commodity clusters lie in suitable climatic, soil, and water environment and some are also having 'market-sheds'.
- The varieties, technologies and management practices to improve productivity are either available or can readily be imported from countries having similar agriculture environments like Pakistan for local adaptation.
- The water saving technologies like laser land levelling, drip irrigation and drought resistant varieties are already available.
- Practices of progressive farmers can also be used as a guide to enhance productivity.
- Seed supply system in the public and private sectors exists that needs to be reformed to improve seed quality and expand the mandate by involving number of fruits and vegetables seed/nursery.
- Large numbers of fruits, vegetable, and ornamental nurseries exist throughout the country which can be certified with the establishment of proper mother blocks in these nurseries to supply true-to-type planting materials.
- In many commodities, management practices have been tested or being tested to reduce harvest and post-harvest losses and improve the quality of agriculture products. In most cases, these can also be borrowed from other countries.
- There is a strong network and links of commission agents and wholesalers with producers exist; who not only collect the produce but also provide finance. This network can be used to institutionalize the quality and pre-determined price-based contracts if producers and market agents are trained on how to maintain the quality.
- To improve the quality of agricultural produce, the collection centres and pack-houses are working throughout the world which can be readily adopted.
- Similarly, many small-scale agriculture processing technologies are available which can be promoted in rural areas as a cottage industry.
- Many farm and value chain operations can be replaced with available efficient operations which can reduce costs.

In view of the gaps and potentials along the value chain of identified clusters of 33 agriculture commodities, targets are fixed for each cluster in consultations with stakeholders, to be achieved through development projects in five-year period. These targets can vary from cluster to cluster of each commodity which are explained in each commodity report but generally we try to bring crop productivity, commodity export-production ratio and Pakistani export-price equal to at least to the world average levels. Where these parameter values for Pakistan are already equal or higher than the world average, we have fixed the target 10-20% higher than the existing level in consultation with stakeholders. We also assumed that the domestic demand for quality of international standards exist for 5-10% of the produce in local market. In addition, certain percentage of the produce is assumed to be processed in small scale cottage industry in rural

areas wherever such product is possible to process. Inefficient farm and value chain operations are identified and alternative viable technologies are suggested to replace these operations for the targeted level of output or on targeted area.

## 3. Interventions, Strategies and Policies

To achieve these targets, following interventions and strategies are suggested:

### 3.1. Institutional level Interventions and Strategies:

- Launch a campaign to promote social mobilization and networking for making Farmers Entrepreneur Groups (FEGs). These groups will be critical in collecting needed investment for value chain and processing infrastructure and ensure quality of output at the group level. All capacity building trainings and incentives will be channelized through these groups.
- Promotion of contract farming through FEGs by providing appropriate regulatory and arbitrary environment.
- Strengthening research system by establishing several new research and development centres, strengthening the existing ones, reforming the research system so that it can identify the emerging issues and provide solutions of these at the cluster level, strengthening international collaboration, improving the role of PARC in germplasm and technology imports and implementing research agenda at the provincial level.
- Provide financial services for the operations of small-scale processing units in rural areas by allowing group collateral through FEGs.
- Establishment of Project Management Units (PMU's) at MNFS&R and at agriculture departments of each province as well as appointing a Cluster Development Facilitator in PCP to effectively implement the ATP.

### 3.2. Production level interventions and strategies

- Capacity building of stakeholders including farmers, traders, processors, etc. on improved management practices in the value chain by introducing specialized extension. The universities, NGOs and national and international consultants will be involved in contacting the stakeholders to be trained, hosting the training, preparing broachers on various aspects and training the trainers.
- Promotion of certified nurseries to supply true-to-type, clean and healthy planting materials for renovations of gardens, provide vegetable, flower and ornament nurseries to the producers.
- Improving the availability of modern variety seed by implementing the seed sector reforms, and involving FEGs and processors in seed production.
- Strengthening of Germplasm Units (GPUs) and multiplication blocks at R&D Institutes to supply basic seed to the private sector seed companies and FEGs.

### 3.3. Marketing level interventions and strategies

- Linking farmers with markets by strengthening the marketing capacity of FEGs such as establishing the collection centres and pack-houses in rural areas, promoting contract farming and establishing information blogs on various production and marketing aspects.

- Linking traders with international markets by encouraging them to participate in international events related to the commodity such as food exhibition, trade shows, trade fairs, international workshops etc., establishing e-commerce portal and SMS-based training message schemes and organizing traders into associations.
- Improving the local output markets by encouraging the private sector to establish these markets, incentivizing collection centres and pack houses in rural areas which itself can become rural market centres, establishing small farm-level cold storage and changing other rules that restricts the investment on these markets.

### 3.4. Value Addition and Processing level interventions and strategies

- Incentivizing value addition infrastructures in rural areas such as collection centres, pack houses, farm cold storages. Good value addition practices such as washing, grading, packing etc., will be promoted by providing training on various aspects of value chain management.
- Encouraging small scale processing as cottage industry in rural areas, linking them with big industries in urban centres, providing training to FEGs on hygienic and safety standards and efficient management of these units and encouraging them to certify their processes and brand their products.
- Identify the inefficient operations along the value chain and incentivize their replacement with proper more efficient technologies.

### 3.5. Macro Policies

Following policy environment would be produced to efficiently implement the above interventions and strategies:

- Plan locally in consultation with stakeholders to address their issues in the local context.
- Change general subsidies with cluster need based support for infrastructure development and capacity building.
- Establish agriculture cluster development fund (ACDF) to sustain the ATP activities.
- Promote Pakistan products in local and foreign markets.
- Emphasize the quality products in domestic market especially in edible oils, milk, beef, juices etc.
- Import substitution by linking import permits with development work done locally.
- Stop frequent interventions in commodity prices to help investors making decisions with certainty.
- Reform the seed sector regulations to promote truth-in-labelling in seed and planting material supplies.

## 4. Investment Portfolio of ATP

The total estimated capital investment required to introduce the designed interventions in each commodity would be US$1.039 billion. The major share of total investment (59%) would go to develop value chain and processing infrastructure. This is followed by investment on planting material to renovate fruit gardens. Strengthening of research and capacity building would require about 8.8% and 8.4% of the total investment respectively. The provincial share in the total investment will be 54%, 21%, 12%, 12% and 1.2% for Punjab, Sindh, Balochistan, Khyber

Pakhtunkhwa and Gilgit-Baltistan respectively. The public sector share in the total investment would be about 40%.

About 30% of the government investment will go to subsidize the value chain and processing infrastructure. This is followed by the investment on strengthening of research and capacity building of stakeholders each claiming more than one fifth of the total investment. Providing interest free loans for one year to build the infrastructure will claim 15% of the investment. The government investment on developing links with international markets is small but very critical to promote exports of agriculture related commodities.

We believe that above incentives can induce 60% of the remaining investment in the private sector mainly on building value chain, processing infrastructure and on planting materials for restoration of orchards.

To achieve the target of promoting small scale processing in rural areas will require an investment of about US$595 million and 29% of this will go on establishing processing units and another 10% for small scale juice units to produce puree/pulp etc. Another important investment is on pack-houses/collection-centres to improve the quality of the produce to international standards requiring 14% of the total investments.

In addition to capital investment, huge operational capital would be required to run the infrastructure created by the ATP. When the ATP is fully implanted during the last year of the project, it will require US$5.7 billion to run the improved activities in the value chain. Forty-five percent of these costs will incur in Punjab, 27% in Sindh and 12%, 15% in Balochistan and KP respectively and remaining 1% in GB. This implies almost doubling the current liquidity level available to the agriculture sector.

More than capital investment and operational costs, the ATP requires huge human resources with a wide array of capacities and technical skills. These include social mobilizers, managers, accountants, trainers who can provide training on variety of value chin aspects, researchers who can identify stakeholders' issues and group themselves to provide solutions, skilled, semi-skilled, and unskilled laborer's who can operate various farm, off-farm and value chain operations. Producing such stock of human resources is a daunting task, therefore needs the support of donors and development partners in engaging the foreign and local consultants in the public and private sector.

## 5. Socioeconomic Viability

When the ATP is fully implanted, it will generate US$9.9 billion of gross revenue annually to various stakeholders mostly in rural areas. To generate this revenue US$1.039 billion of total capital investment over a period of five years and US$5.7 billion of liquidity in the hands of value chain operators during the last year of the project would be required. After accounting for all the capital and operational costs, the net cash flow from the Plan would be US$3.2 billion during the last year of the project period. These cash flows will completely vibrate the rural economy and create millions of jobs in rural area.

After discounting the net cash flow over the project period at 8.5%, the ATP activities will generate a Net Present Value (NPV) of US$1.8 billion. This has an Internal Rate of Return (IRR) at 62%, a reasonably high rate compared to any government investment can generate in the short-term of five years. The Punjab, Sindh, Balochistan, KP and GB provinces have respectively IRR at 77%, 53%, 43%, 51%, 79%, respectively.

The ATP is expected to vibrate the rural economy by enhancing agriculture productivity, improving output quality and generating foreign exchange earnings. These will produce big dividend to the stakeholders in the agriculture value chain in terms of doubling their incomes, boosting their skills and generate employment mostly in rural areas. The skill developed through the ATP will be an asset to sustain and further strengthen the agriculture growth in the future. However, to harvest these dividends, the agriculture research system has to be reformed to address the issues along the value chain, farmers have to be organized into groups and capacities of the stakeholders to produce and manage the quality products have to be built. The regulatory framework for the supply of quality inputs, monitor output quality and to promote contract farming will also be critical for the success of the ATP.

# 1. INTRODUCTION

Despite having one of the world-best alluvial soils, diversified weather condition, the best irrigation system, assiduous farmers, and proximity to high-end market in the Middle East, Central Asia, and China, the performance of the Pakistan's agricultural sector as shown by its slow growth rate in recent years[1] has been discouraging. Disconnect between researchers and agriculture stakeholders leads to slack in the use of agricultural technology resulting stagnant yields at the farm-level and little or no increase in Total Factor Productivity (TFP) at the sector level. Poor management of agriculture produce at the post–harvest level and little processing of agricultural commodities have further reduced the compatibility of the sector in international markets as depicted by the increasing trade imbalance especially since 2015 (Figure 1). All these factors also lead to low return to farmers and other stakeholders in the value chain of agricultural commodities causing wide spread poverty in rural areas. To achieve the potentials of the sector, we have to transform the agriculture from a supply-driven to demand-oriented sector so that it can produce for the markets.

The Vision 2025 sees a great potential for modernizing agriculture and enhancing its competitiveness through developing and strengthening agriculture clusters. For example, the cluster interaction of stakeholders is envisaged to improve the adoption of state-of-the-art processing techniques at the village level which can reduce post-harvest losses ranging between 25% to 40%. The Vision also sees a great potential to enhance agriculture exports by introducing modern agricultural processes in the value chain, such as grading, packing, processing, certification, traceability, etc. and such improved production and post-harvest management practices can be advanced relatively more effectively through organizing various stakeholders in agriculture-based clusters. Moreover, export prices of agricultural and livestock products can be enhanced manifolds if modern management practices such as Good Agriculture Practices (GAP) at farm-level and International Food Standards (IFS) at the processing and logistic levels are adopted and institutionalizing these standards are much more cost effective through cluster groups. The cluster interaction improves the effectiveness of any development initiatives by enhancing stakeholders' capacity through learning by seeing, overcoming the economy of scale problem that hampers small farmers' participation in the market, attracting investment from various corners, creating demand for output-based research, and encouraging as well as forcing the public sector through various networks to invest on cluster needs.

The cluster approach adopted in Vision 2025 for agriculture development suits well in Pakistani situation where large numbers of small farmers and agriculture business firms operate in close proximity to each other. Developing agro-industrial cluster shall contribute towards improving the overall efficiency of the processes from farms to markets by creating synergistic link among stakeholders which strengthens the supply chain, market intelligence and incubator services, strengthens the inflow of foreign direct investment and market access, and improves the overall

[1] The growth rate in agriculture GDP has declined from 3.3% during 2001-10 to 2.0% during 2010-18 (MNFS&R, Various issues).

technical standards. It can provide an 'Industrial Push' to the agriculture sector by overcoming technological, investment and human resource constraints in modernizing the sector.

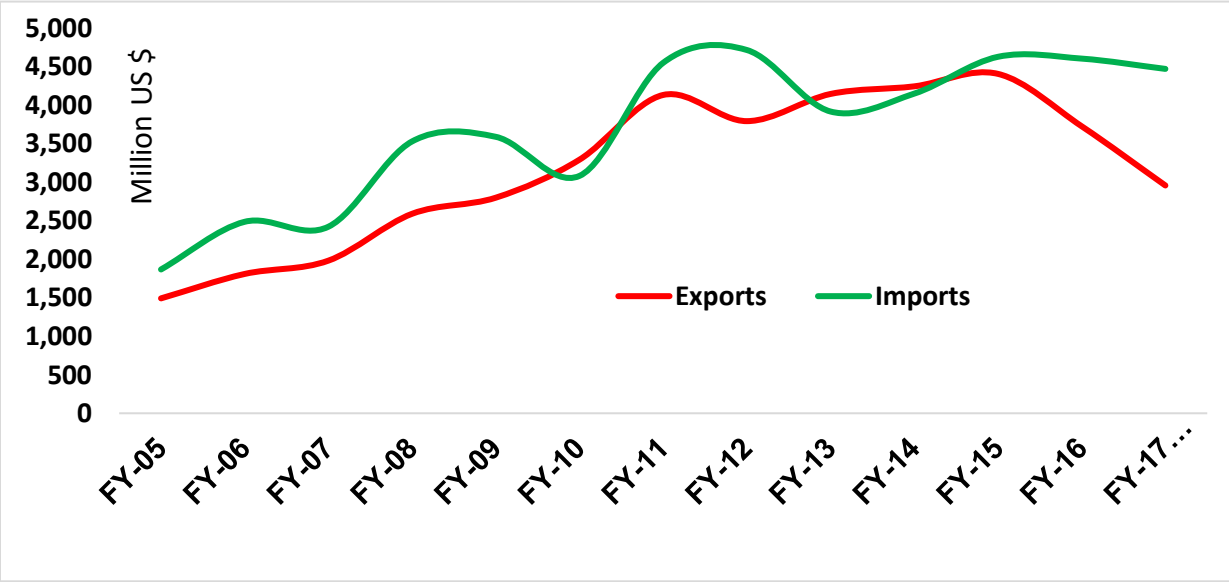


***Figure 1: Trade balance in raw agricultural commodities in Pakistan during 2005-2017.***

To apply the cluster approach in agriculture, the Planning Commission of Pakistan (PCP) sponsored a study to estimate the feasibility of Cluster-Development Based Agriculture Transformation Plan (ATP) for 33 agriculture commodities. Based on the rigorous value chain analyses of these commodities at the cluster-level, an Agriculture Transformation Plan (ATP) is prepared here for each commodity as well as at the sector level. The main emphasis of the ATP is to make the country competitive in national and international markets through vertical integration of various activities by synergistically linking different stakeholders along the value chain.

We first fixed targets to be achieved in the Plan in view of the issues and potential of the sector to become competitive identified in consultation with stakeholders. Then cluster-development based strategies and policies are prescribed to achieve these targets, investment requirements to implement these are estimated and socioeconomic viabilities and impacts of these investments are evaluated. The need of human resource capacities and reorganization of institutions, building infrastructures, and establishing linkages needed for this transformation are also identified. All these are done at the sector level as well as for the individual commodity level.

# 2. ISSUES AND TARGETS OF ATP

To enhance the competitiveness of the agriculture sector, the ATP considers following six areas for improvements:

- Enhance productivity,
- Reduce post-harvest losses,
- Improve export performance or reduce imports,
- Improve value chain to enhance quality in domestic and international markets,
- Improve processing of agriculture commodities as cottage industry in rural areas, and
- Replace inefficient farm operations.

Issues are identified and targets are fixed to be realized in the Plan in above five areas for each of the 74 identified clusters of 33 agriculture commodities. This is done based on the world averages in these parameters, analysis of gaps and potential at cluster level, and in consultation with stakeholders. These targets are summarized in Annexure 1A and 1B and explained in the following paragraphs.

## 2.1. Improve Productivity to World Average

### 2.1.1. The Issue of Low Productivity

Judging against this criterion, per ha (ha) or per animal yields of only six out of 29 commodities in Pakistan have higher than the word average yields of the respective commodity. These include potato, tobacco, mango, plums, almond, and walnuts. Among the commodities where per ha yield is higher, except potato and tobacco, other four crops have experienced negative long-term trends (2001-17) in per ha yield pointing that these crops will also soon lose their competitive edge of higher yield. In addition, during 2001-17, lower growth rates in yield than the world average have been recorded in 21 out of 29 crops thus the comparative advantage in these crops are expected to further deteriorate if these trends continue in the future.

No country can become competitive in any commodity unless its farm production sector is performing well. Thus, it is important to fix the production segment of the value chain. Our analysis in 33 agriculture commodities suggest that improved technologies such as varieties/hybrids are available from the national research system or can be imported and management practices have been documented to enhance the productivity of most field crops. In animals, rational feeds and feeding and management practices have been tested on the existing animal breeds in Pakistan to enhance per animal milk yield, reduce animal mortality rates, and improve the animal fattening growth rates. In fruits, lots of potentials exist to renovate the old, tall and bushy type gardens giving low per ha yield and low-quality produce with high-density and high yielding gardens supplying the high-quality produce demanded in the market.

The question is that if these technologies are available, why they are not being adopted? Various issues in different crops have hampered their adoptions at the farm-level which have been analyzed in each commodity report. But generally, poor capacity and laxity of the extension towards minor crops and lack of proper seed supply system has caused the slack in the adoption of modern varieties in vegetables. In some cases, if the seed supply system exists in the private sector, it is too expensive and demands high inputs like chemicals and plastics which small farmers cannot afford. In sugarcane no formal varietal dissemination system exists. In fruits certified nurseries which can supply true-to-type planting material and farmers lack of trust on new varieties are the major tumbling blocks. In animals, expensive supply of rational feeds and quality insemination material, extension departments emphasis on curative measures, investment needs for the adoption of modern practices, and lack of farmers' capacity to adopt modern management practices are the major constraints.

### 2.1.2. Target to be Achieved

Efforts should be made to introduce these technologies to the farmers to bring the per ha yield at least equal or even higher than the world average. Hence target of the TP is to stop the negative trends in productivity and bring the average per ha/animal yield of agriculture commodities closer to the world average level. Our consultation with stakeholders suggests that this is not an unrealistic target because of the favorable environment, fertile soils, available control irrigation water, and available technologies and management practices for this purpose. Although, our general target is to bring average yield closer to the world average, but actual target in each commodity may vary depending upon the potential to enhance the yield in every commodity which is limited by the availability of the technology, and other constraints imposed by the environment and policies as suggested by the stakeholders (see Annexure-1A for the yield targets to be achieved in each crop). This can generate additional revenue to the worth of US$2.76 billion to the farmers of 33 commodities analyzed.

## 2.2. Reduce Harvest and Post-Harvest Losses

### 2.2.1. Issue of High Harvest and Post-Harvest Losses

Harvest and post-operations of agricultural products cause both qualitative (in terms of change in nutrient composition, acceptability, and edibility), and quantitative losses. Loss of quantity has been more commonly recognized in developing countries, although quality deterioration is also increasingly becoming a significant factor in gaining competitiveness especially in international markets. Low quality in terms of aflatoxin infestation and high pesticide and lead residue often cause rejection of exports thus causing lots of embarrassment and economic losses to the exporters.

The losses can happen at any stage of the value chain like harvesting, threshing, drying, processing, storage, packaging, transportation, etc. Chain-wide analysis of data indicates that

overall, between 30 and 40 per cent of Pakistan's fruits and vegetables crop is lost before it reaches consumers because of poor value chain infrastructure and management practices. At orchard level the growers and pre-harvest contractors reported pre and postharvest losses in fruits in the range of 20% to 35%. It is clear that most of the quality problems within the chain occur at or around the harvest time and are related to harvesting at the incorrect maturity, under or over ripe fruit, poor grading, etc. Other major pre-harvest losses are due to severe wind storms and frostbite taking some blame. Poor handling during loading, unloading, packing and transportation to *mandis* cause injuries and damage to fruits. The product is further deteriorated by 10-15% due to poor handling in the mandis and transportation from mandi to retailer point.

In livestock, most of the post-milking losses happen during transportation due to lack of cold chain. The loss of beef quality is due to improper and filthy environment at the time of butchering and lack of cold chain during transportation. In many crops like basmati rice, mixing of various moisture content grain and improper hoarding immediate after harvest cause aflatoxin infection. Lack of facilities to reduce the temperature is the causes of post-harvest quality deterioration in many fruits.

To protect the crops from post-harvest losses, standardized technologies and operations are available in each crop depending upon the environment. Sometime the operations have to be started during production or even at nursery raising or varietal selection stage. The research system has to adapt these technologies and methods to the local conditions in which the crop is grown and handled after harvest, which normally is lacking because of poor funding for vale chain research.

Farmers' poor knowledge and skill to conduct appropriate post-harvest management operations and lack of resources to conduct these operations are largely responsible for these losses. For example, lack of proper understanding of harvesting index, improper packing and transportation, and lack of storage facilities at the farm-level in several fruits and vegetables may cause significant post-harvest losses. Mixing of various moisture content grains, especially in basmati rice and maize in Pakistan, and pilling them in humid and hot condition cause heavy infestation of aflatoxin and reduce its quality.

### 2.2.2. Targets to be Achieved in Post-Harvest losses

The post-harvest losses not only lower consumer value and the profitability of value chain actors, but also represent a substantial waste of resources used in the production and marketing processes. The higher post-harvest losses in a crop can deteriorate its competitive position even if it's' per ha yield and per unit production costs are comparable with other countries. Therefore, in an attempt to make Pakistan competitive in international market, the target is fixed to reduce post-harvest losses in quantity terms from 30-50% to 15%-5% in various crops (See Annexure-1B for the post-harvest target for each crop). It is estimated that reducing the post-harvest losses as per target for various crops can save the production value worth of about US3.3 billion in just 33 crops analyzed. In every crop and livestock product, we investigate and identify the major actions of farmers and other value chain actors that cause post-harvest losses and look at the

available technologies and interventions to reduce these losses which are explained in each commodity report and summarized in the next section.

## 2.3. Improve Export Performance or Reduce Imports

### 2.3.1. Issue of Low Export Growth from Pakistan

Globally, the exports of fruits and vegetables are mushrooming and, in most cases, we observed that growth rates in exports is much higher than that in production suggesting that increasingly these commodities are consumed somewhere else than where these are produced. At the global level, the export in the commodities analyzed in the CDBAT project has increased from US$106.0 billion in 2001 to US$320.7 billion in 2017 at an annual growth rate of 7.1% per annum.

In Pakistan, however, although exports of these commodities increased from a low base of US$281 million to US$1375 million at a rate of 10.4% per annum, but imports also increased at a fast rate from US$522 million to US$1766 million with an annual growth rate of 7.9% per annum during the period. Thus, the trade deficit in these commodities has increased from US$240 million in 2001 to US$391 million in 2017 at a rate of 3.1% per annum. The commodities that mainly contributes in trade surplus during 2017 are beef, sugar, Dates, mangoes, chilies, potatoes, tobacco and cigarettes, and citrus, while main contributors in trade deficit are tea, oilseed and cake, peas, milk, garlic, and ginger.

Looking at the export growth rates in individual commodities, negative or zero growths are observed in 11 out of twenty-nine commodities, while at the global level none of the assigned commodity has negative growth neither in export quantities nor in its values during 2001-17. Out of the total 29 commodities, 16 have growth in export quantity and value lower than the world average growth rates. Serious attention is required to halt the negative or lower growth than the world average in carrots and chilies, turnips, peas, grapes, cucumber, barley, eggplant, ginger, garlic, beef, mango, and walnut.

### 2.3.2. Issue of Low Export-Production Ratio

The export-production ratio is one of the measures for competitiveness which indicates the level of surplus availability of the crop after meeting domestic needs and the acceptability of the quality of the produce in international market. The cost effectiveness in production, value addition, storage, processing, and in all the export processes are the major determinant for making the commodity more acceptable in international markets. In addition to these economic factors, the commercial policies in the exporting country, link of the traders with international markets that help them to know what quality, quantity and the time it is demanded in various markets, and aggressiveness and effectiveness of traders in promoting the commodity are the major factors in improving the acceptability of the commodity over other competitors.

Except in major import commodities where overall physical and policy environments may not be suitable to grow the crops in the country to meet all domestic needs, it is assumed that Pakistan should obtain export-production ratio at least equal to the average of the international ratio. Failure to attain this indicates weak production system as well as lack of good economic and commercial policies, such as high production and value addition costs, weak links of the traders with international market, etc.

Based on the above criterion, out of 31 crops where national and international data is available for comparison, seven are entirely importable thus data on export-production ratio for these are not available. These are eggplant, cucumber, ginger, garlic, rapeseed and mustard, grapes, and tea. In the remaining 24 crops, only six have higher export-production ratio than the world average. These are apple, banana, dates, mango, citrus, and potato. However, except potato, the rate of increase in export-production ratios in these commodities are either less than that at the global level or even declining overtime. Thus Pakistan brings far less proportion of its production in international market. The causes of low or deteriorating export-production ratio root in the poor value chain development of the commodity, inefficient commercial policies and strategies, and weak knowledge and link of the traders with international market.

### 2.3.3. Targets to be Achieved in Export-Production Ratio

The export-production ratio is an important measure of competitiveness. The positive difference in the average export-production ratio in the world vs Pakistan in large number of agriculture commodities indicates inefficiency in trade segment of the value chain, but also huge potential of improving the quality of agricultural commodities thus their export prices to the world average. It is estimated that bringing the export-production ratio equal to the world average level or improving the ratio by 10-20% in those commodities where it is already higher than the world average in the 24 commodities analyzed can bring US$1.1 billion additional foreign exchange revenue in the country. Thus, bringing Pakistan export-production ratio near that of the world average is one of the major targets of ATP for the agriculture sector (See Annexure-1B for the specific targets fixed for every commodity to be achieved during the five years through a development project). The surplus production needed for enhanced export-production ratio is assumed to come from increased productivity and reduced post-harvest losses.

### 2.3.4. Target of Import Substitution

Import substitution is achieved by replacing imports with enhanced production due to improved productivity and reduced post-harvest losses and improving the quality of surplus production at par to the imported commodity by passing through the improved value chain infrastructure. Therefore, to compete with the importable, all the enhanced production has to be passed through proper value chain operations, like grading, washing, packaging, storage, etc., and needed value chain infrastructure like pack-house, collection center, has to be provided for this purpose. By increasing the productivity level to the average of international level, reducing post-harvest losses by one half and improving the quality of these commodities to international

standards so that they can compete with imported products, it can save the resources spent on imports by US$0.5 billion. Thus, strategies are suggested in the ATP to facilitate the import substitution, although main strategy for this purpose is to enhance productivity and reduce post-harvest losses in these crops.

## 2.4. Improve Quality to International Standards

### 2.4.1. Issue of Low Quality in International Market

The value chains of exported commodities from Pakistan are not developed to produce quality of these commodities at par to the international requirements. Moreover, certification of the agricultural commodities for various food quality standards is normally not practiced. Branding is rarely done for any agricultural commodities exported from Pakistan.

These weaknesses in the quality and presentation of exportable commodities are reflected in relative low export prices compared to the world averages which indicates poor presentation of the commodity according to the demands of the consumers in the export market. In comparing the average Pakistani export price with the average global export price, it was found out that, except sugarcane, none out of the 24 commodities exported, Pakistan could earn export price equal or higher than its average export price in the world. This suggests that Pakistani exporters failed to meet the quality demand of the consumers in the importing countries. In addition, Pakistani traders may have failed to present these commodities in the manner that consumers in those countries prefer.

### 2.4.2. Target to be Achieved in International Market

There is huge potential to improve the quality of exportable commodities. It is estimated that if we improve the quality of exportable commodities at par with international level and earn the average global export price, it can bring an additional revenue of about US$0.965 billion, more than two third of this will come from the improvement in milk and bee quality for domestic market. The investment would be required to improve the value chain of exported commodities to bring Pakistan's export quality near to the world average level which will narrow down the gap in average export price. Thus, bringing the quality of Pakistani export at par to world average has made as one of the main targets of the ATP.

In imported commodities, the difference in the world average import price vs Pakistan's average wholesale price gives the potential of improving the value chain of Pakistani origin commodity. Thus, a target is assigned to bring the quality of all additional production used in import substitution equal to the imported price of the commodity.

### 2.4.3. Issue of Low Quality in Domestic market

Similarly, demand for quality in urban centers remains unfilled I n domestic markets and producers fail to get appropriate prices of agricultural commodities. Our discussions with consumers and literature review suggest considerable domestic market size for quality in most commodities we analyzed where consumers are willing to pay price equal to the average global export price if the quality of the commodity is assured to them.

### 2.4.4. Target to be Achieved in Domestic Market

We estimate there is international level quality demand for at least 5-10% of the existing production in most commodities. Bringing the quality thus average prices of 10% of the produce can bring an additional revenue to various stakeholders in the value chain worth of US$0.97 billion in the crop sector and US$4.6 billion in milk indicating a huge potential to improve the quality of agriculture and livestock products at international standards, thus it is made as one of the targets of the ATP (See the percentage of the total production that is targeted to be brought at par in quality with international standards).

## 2.5. Enhance Processing

### 2.5.1. The Issue of Low Processing in Agriculture

Some modern value addition and processing infrastructure like modern milk processing plants, hot water treatment units in mango, tomato catchup plants, modern Dates processing plant, top of the line basmati rice processing plant of Engro, etc. have already been established in both public and private sector. However, most of these units are large scale and have contributed little in rural transformation. Non-availability of good quality produce and high costs of collecting agriculture raw materials from widely spread small scale farmers have restricted the full utilization of agro-processing units. For example, 66% of the installed capacity is closed in dairy plants and only 50% of the available capacity is utilized in dairy industry.

Despite a great potential of small scale processing of agriculture commodities, very little of agriculture produce go into such processing in rural areas. For example, most of the tomato puree is imported from China which can be processed through mall scale puree plants in rural areas, if proper processing and hygienic standards are taught to small scale processors. Mechanical sun drying of several fruits and vegetables, basmati rice, etc. can not only reduce post-harvest losses and improve quality but also add value of raw agriculture commodities and reduce seasonal price fluctuation. Small scale juice/pulp making in mango, sugarcane, and many other fruits are viable business ventures in rural areas.

One of the key benefits to adopt cluster approach in agriculture transformation is of generating stronger interaction among agro-industrial cluster stakeholders including farmers, value chain agents and processors. Such enhanced interaction broadens the availability of resources including human capacities to start village level processing activities. These activities are initially

started as cottage industry in rural areas which when mature transform into full-fledge processing industry or alternatively develop forward integration with large scale industries in urban and peri-urban centers. With the availability of requisite financial, technological and human resources through cluster interaction, the cottage industries in rural areas can also provide an industrial pull to the agriculture production sector. It can absorb some of the lower graded produce and help to reduce seasonality in the prices of the commodity.

### 2.5.2. Target to be Achieved

As agro-processing can play a significant role in absorbing the oversupply of various fruits and vegetables, engaging rural labors, and enhancing incomes in rural areas, the ATP Plan intends to identify the economically viable products which can be processed in rural areas as a cottage industry in 33 agriculture commodities. A certain percentage of the produce, decided in consultation with stakeholders, is fixed as target to be processed, and accordingly strategies are proposed to install in rural area the small-scale household level infrastructure to process the targeted produce.

## 2.6. Replace inefficient Operations

### 2.6.1. Issue of Inefficient Operations

Several farm and value chain operations conducted manually or unscientifically are too inefficient. These include imbalance input use, planting/transplanting, harvesting, transportation, packing, drying, etc.

Use of archaic management practices in crop production and value chain management is the one of the main reasons for low productivity at the farm-level and its quality in the value chain. These practices include the use of un-optimal level and combinations of inputs, missing the critical time of the crop while applying input and conducting various operations, improper harvesting methods without applying maturity index in picking, improper storage and transportation of the crop after harvesting, etc. Mannual planting in rice not only involve muscle drudgery, but also is inefficient. The covering of tender fruit bunches on trees is not practiced which is required in many fruits to protect it from rain, pests, etc. Similarly, the open-sun drying process in many fruits and rice reduce quality. These existing practices significantly reduce Pakistan's competitiveness as it increases the value chain cost, reduce quality, and/or delay the delivery of the produce.

There is little capacity in rural areas to establish and run small scale value addition and processing infrastructure. In livestock, the main focus has on curative treatment of animals, while preventive measure of animal health, nutrition and other management issues of the animal husbandry, especially on the value chain management and processing issues of the milk and beef have been completely ignored. Moreover, little capacity exists to establish and manage the certified nurseries and tissue culture labs.

### 2.6.2. Target to be Achieved

In an attempt to improve the competitiveness, the ATP identifies these operations, find mechanical/advanced alternatives, and introduce these alternatives to the farmers if these turn out to be economically viable. A certain percentage of area under inefficient technologies is targeted to be replaced with economically viable new technologies/operation which was done in the consultation of stakeholders (See last column of Annexure-1B for various operations to be mechanize and targeted area to be brought under these technologies over a period of five years). These technologies are not only cheaper but also save harvest loss, improve timeliness of the operation thus enhance yields. The benefit of every technology that will replace the old technology is explained and quantified in each commodity report.

# 3. INTERVENTIONS, STRATEGIES AND POLICIES OF ATP

Different interventions and strategies are proposed to achieve the above stated targets. Although, the detail of these strategies may vary across commodities which are briefed in the attached individual commodity summary briefs and detailed in commodity reports, some general strategies to achieve the targets set above are explained here.

## 3.1. Institutional Level interventions and Strategies

### 3.1.1. Social Mobilization & Networking

Promoting social mobilization in rural areas is a major strategy to overcome the diseconomies of scale of small farmers, ensure quality to traders, and linking them with markets. Producers will be organized into 'Farmers Enterprise Groups (FEGs)' consisting of 2-5 union councils. They would be involved in the implementation of GAP/SPS compliance. The Rural Support Program (RSP) and other NGOs will be engaged in the social mobilization. All incentives and training will be channeled through these groups.

#### 3.1.1.1. Functioning of FEGs

The detailed structure, functions and responsibility of FEGs are given in Annexure-2. Following is the summary of FEGs structure and functions;

1. The provincial governments will provide protections to FEGs organizations through a bill passed by the provincial assemblies;[2]
2. The Board of Directors for FEGs set at provincial level will set broader rules to run and monitor FEGs, provide legal protection to any contract the FEG make with traders, processors, input suppliers, etc. and provide arbitration in case of any disagreement between the contracting parties;
3. Each FEG shall be a body corporate to the extent that it shall acquire movable and immovable property, having perpetual succession and a common seal, can sue and be sued;
4. The FEGs will gather investment resources from member farmers to establish collection centers, pack houses, and value chain improvement and processing infrastructure. Any

2 The KP government has already a bill of Farmers' Service Centers (FSC) which can be modified for FEGs. The FEGs are commodity based and cover the services for the whole value chain of the commodity, rather than just farm related services. The other provinces may like to pass similar bills.

FEGs member can contribute in the investments and obtain services from such infrastructure on cost basis. The profit of such activities will be shared among farmers proportionate to their share in the investment. The government will provide incentives to establish the business infrastructure;

5. As farmers have little capacity to run the business, therefore a trained manager will be appointed by the government in consultation with FEGs and its salary will be paid by the government. The appointed manager for fixed term will not only run the businesses established by FEGs but also train the interested member farmers to run the business when s(he) leaves the position.
6. During the probation period of one year, the loss in the business will be borne by the government;
7. The FEGs will maintain the records of production and sale and associated costs that will be helpful to analyze the loss and profit;
8. The FEGs may opt to buy and sell products as a group;
9. The organization must be linked with research and extension organizations for their capacity building and updated information;
10. The FEGs can open-up their own retailing shop with new brand for more profit;
11. The FEGs will ensure the quality of fresh and processed produce and products supplied by its members as a group;
12. The FEGs can also collaborate with stakeholders in the value chain of the commodity, including input suppliers and output market buyers, to ensure timely supplies of inputs at negotiated price;
13. The FEGs will start contract farming with traders/processors to supply pre-determined quality and quantity at specified period and price of the commodity.

#### 3.1.1.2. Incentives for Formulation of FEGs

In Pakistan, the experience of cooperative movement is believed to be not very encouraging. However, it is observed that wherever farmers see an opportunity, they do get organize in groups. Farmers groups in the marketing of milk and water users' associations in Punjab are good examples. We have to create economic and business opportunity for the farmers to make FEGs. Following are suggested for this purpose:

1. All subsidies to establish value chain and processing infrastructure including on certified nurseries should be for small size to be established in rural areas and it should be channeled through FEGs not individual farmers or entrepreneur.
2. We suggest here 20% subsidy on these infrastructures and hope that it will encourage farmers to get organize and collect remaining 80% investment cost. But it should be adjusted upward or downward depending upon the interest and response of the farmers.
3. As these infrastructures are new for farmers, we believe that lack of capacity, rather than lack of resources, is the major constraint for the investment to build and run these.

Farmers have little knowledge about the markets of the products they will process and its upward linkages with industry. Once government decide to encourage investment on certain agribusiness infrastructure, it must ensure that all necessary information is provided and training of farmers who want to invest will be arranged. Moreover, government should work with the farmers to arrange the upward linkages of the product with industries. For example, the tomato puree and apple juice the FEGs may like to process must be linked with tomato paste industry and big juice firms in urban areas who will collect these semi-finished products, further process, get it branded and take it to consumers' table in domestic and international market. This task should be assigned to the Project Management Units to be established in each province.

4. Risk is the major factor to restrict investment on these infrastructures. To overcome this factor, it is suggested that the infrastructure built in the control of FEGs should be managed by the government appoint but FEGs agreed manager, and certain level of return from the establishments should be ensured for the first year.
5. All capacity building trainings on farm management practices conducted and establishment of demonstration plots for modern technologies should be established through FEGs on the demand of FEGs and on cost sharing basis.
6. The testing and supply of new seeds/planting material of new varieties in any crop should be established through FEGs.

### 3.1.2. Strengthening Research System

**Establishing New Commodity Specific Research and Development Centers**. In most commodities reviewed in this report, the research especially on the value chain aspect of a product is non-existence or scanty. We have proposed establishing research centers based on the regional or national importance of the crop. Following research centers are proposed:

1. National Dairy Research and Development Center based in Lahore, Punjab.
2. National Beef Research and Development Center based in Karachi, Sindh.
3. National Stone Fruits Research and Development Center in Quetta, Balochistan.
4. Apple Research and Development Center (ARDC) in Quetta, Balochistan.
5. Banana Research and Development Center to be established in Thatta.
6. Chili Research and Development Center to be established in Jacobabad.
7. Dates Research and Development Center in Khairpur (DRDC).
8. Establishment of R&D Floriculture Centre in Pattoki, Punjab covering the value chain (development of new varieties of planting material, production of planting material through traditional and tissue culture means, transportation, value chain development, etc.) of fruits, flower, and ornamental nursery plant issues.
9. Establishment of National Garlic Research and Development Center at NARC.
10. Grape Research and Development Center at Agriculture Research Institute, Sariab, Quetta.
11. Onion Research and Development Center Mirpur khas, Sindh.
12. Sugarcane Research and Development Board in Sindh parallel to the Punjab Board.
13. Make functional the Tea Development Board

14. Establishment of National Tobacco Research Institute (NTRI) in Mansehra in KP
15. Tomato Research and Development Center in Thatta.
16. Spice and Medicinal Plant Research and Development Board

The national research and development center will develop new varieties, planting materials, technologies, and management practices but will have their regional office in each cluster to demonstrate and promote these technologies.

These centers should be autonomous under the Board of Directors chaired by the prominent stakeholder in the commodity and members taken from the commodity growing and processing areas in the private sector as well as a pronounced commodity scientist. The centers should collect and distribute germplasm of the commodity with various characteristics to public and private sectors in other provinces than their location, undertake research on issues related to the whole value chain, generate information about marketing of the commodity in domestic and international markets and new emerging technology trends. Target oriented research should be encouraged, and research agenda should be decided in consultation with stakeholders. Each center should develop collaborative programs with the private sector and the member of Board of Directors should help to seek private funding for research.

**Strengthening Existing Commodity Research**. In following commodities, the existing research facilities are suggested to be strengthened.

1. Barley research under the wheat program in Punjab, Sindh, and Balochistan.
2. Basmati research in the Rice Research Institute Kala Shah Kaku
3. Citrus research in Sargodha Punjab and improve its collaboration with KP.
4. Potato Research Institute (PRI) in Sahiwal.
5. Oilseed Research Institute in AARI, Faisalabad Punjab.

**Making the Research Demand Driven.** In cluster development of individual commodities, resolving emerging issues in the value chain of various clusters is very important for maintaining and improving its competitiveness. Therefore, efforts should be made to transform the research system so that it can resolve the issues of the stake holders along the value chain rather than just focusing on production aspect of the value chain. Setting up incubation centers in different agriculture universities is a step forward although it could not achieve much in resolving stakeholders' issue in agriculture centers. Punjab has made some progress in this direction by establishing Punjab Agriculture Research Board and commodity boards where private sector has been engaged, although more need to be done to make these establishments operationally effective. Other provinces should also make similar steps in more effective way. Moreover, setting up research endowment fund under commodity and provincial research boards can improve the efficiency of these boards in responding to the emerging needs of various clusters.

**Tentative Agenda of Research**. Research will be made demand driven which should benefit the stakeholders especially the grower, trader and the processors. The key priority research areas for each commodity have been identified in each commodity report through initial survey

and discussion with stakeholders and commodity experts. Such surveys should be the regular phenomenon of research center to upgrade their research agenda. These include:

- Protocols for establishing and managing high density gardens.
- Development of cluster-specific improved crop management and animal husbandry practices.
- Development of SOPs for cheap animal sheds for small farmers.
- Development of Integrated Pest Management (IPM) strategies to address the cluster specific issues of biological and sustainable control of insect, disease, and weed.
- Fungal and bacterial infection on food should be given special attention to address the aflatoxin issues on various foods especially in milk, and basmati rice.
- Protocols for the sea shipment for fresh fruits to reduce the long-distance oversea costs
- Appropriate packaging materials to reduce post-harvest losses.
- Development of appropriate transportation and packaging technologies with minimum deterioration in quality.

**Strengthening International Research Collaboration**. Pakistan has relatively weak links with international research and development organizations who have rich germplasm collections, research methodologies, and developed technologies. Pakistan can learn and gain a lot with the collaboration with these centers especially with those who have their country and regional offices in Pakistan like CABI, ICARDA, IWMI, IFPRI, and APO. The government should become official members of Consultative Group of International Agriculture Research (CGIAR) Centers so that they can become automatic recipient of technologies from these centers. Special attention should be paid to participate in their training programs, and seek germplasm from these centers, and develop collaborative research and development programs with them.

**Need Based Help from Development Partners**. Lots of donors' funding is available from development agencies, like for example, from USAID, World Bank, GTZ, JICA, etc. Mostly, funding from these agencies are supply-driven matching their own development framework. The P&D ministry at the federal level and P&D Departments at the provincial level should play an active role in communicating their own priorities with them and seek funds for example for special agriculture cluster development. For example, USAID should be asked to build special value chain and processing infrastructure, World Bank should be asked to provide liquidity needed to various stakeholders for cluster development, and JICA can play role in stakeholders' training.

**Role of Pakistan Agriculture Research (PARC)**. The role of PARC is very important in the implementation of ATP. Following role may be taken over by PARC in the implementation of ATP:

1. PARC has good experience in setting up new research stations. The proposed new research centers above can initially be established by PARC but then handed it over to the provinces within a specified period, not more than ten years.

2. PARC can also play role in identification and prioritization of various issues of different clusters along the value chain in collaboration with the provincial research institutes.
3. Lack of germplasm has been noticed a serious constraint in all fruits, vegetables, flowers and spices. PARC should devise a program to get the germplasm of various characters and distribute it to all the provincial and regional research centers in the country as well as to the private sector for their breeding work.
4. PARC should develop a mechanism to identify with the country source and import of variety/hybrid/technology for local adaptation.
5. The PARC should play a leading role in developing SOPs for tissue culture plant production in various fruits and vegetables and training of the private sector to use these SOPs. This is very important for the establishment of tissue culture labs in the private sector.
6. PARC should also regularly conduct farm and agri-business surveys at agriculture-commodity cluster level to revise the production and manufacturing margins to accurately estimate and update the feasibilities of various interventions.

### 3.1.3. Promotion of Contract Farming

Even if quality training is provided, there are always chances of breach by individual members. Usually FEGs monitor the individual farmer activities related to quality and it provide quality insurance to the processors. Once the quality is assured at group level, there is a social pressure among farmers not to breach it. This reduce the costs of the processors to monitor and collect small quantities from large number of farmers scattered all around. Moreover, the group certification and branding will reduce these costs and encourage farmers and processors to start contract farming. Other incentives to FEGs on the formulation of FEGs may also encourage to start the contract farming. The government will ensure the appropriate regulatory and arbitrary framework.

### 3.1.4. Financial Services-Financing

In estimating the feasibilities of interventions for various commodities, it was realized that capital investments on cluster upgradation infrastructure at individual commodity level will improve several operations along the value chain and will entail lots of additional operational costs to be borne by farmers and other stakeholders along the chain. It is estimated that the investments made through the ATP will induce additional operational costs for various operations worth of US$5.7 billion when these investments are fully implemented during the last year of the project. Simple capital investments on infrastructure as suggested in the plan will fall flat if arrangements are not made to enable farmers to meet these costs. However, lack of physical assets to use as collateral limits farmers' access to formal credit. Banks and NGOs working in local area like NRSP, RDF, MDF can play an essential role by providing loans to operate the value chain infrastructure. As most of the new agribusiness infrastructure is established through FEGs, it is suggested that the loans to operate these infrastructures as well as to adopt new management practices in crop production should be forwarded through FEGs which can offer group collateral for individual loans. The FEGs can also collaborate with stakeholders in the value chain of the

commodity, including input suppliers, to provide these inputs on loans to farmers. The e-credit system introduced by the Government of the Punjab may be also be helpful to improve efficiency of the loaning system.

### 2.1.1. Establishment of Agriculture Cluster Development Fund nd Project Management Unit

To implement the entire project activities there is a need to make following institutional arrangements:

1. An Agriculture Cluster Development Fund (ACDF) will be created at the Federal level in PCP and in each provincial Planning and Development (P&D) Departments to provide their respective shares in supporting the establishment of value chain and processing infrastructure, strengthening research system, capacity building of stakeholders, providing planting materials, and offering loans to various stakeholders.
2. The PCP will appoint a high-profile Cluster Development Facilitator (CDF) in its Agriculture Section who will have the following functions:
    i. Help the MFS&R to prepare PC-1s on cluster development in line with the PC-II feasibility study conducted,
    ii. Process the PC1s on cluster development in CDWP for approval,
    iii. Seek funding from donors for cluster development,
    iv. Facilitate the release of funds from federal and provincial governments, and
    v. Help the provinces and PARC to implement the cluster development projects.
    vi. Work with federal and provincial governments for the favorable regulatory framework, including promulgation of appropriate bills at the provincial and national assemblies.
3. Establish two institutional structures – One Project Management Units (PMUs) in the Ministry of National Food Security and Research (MNFS&R) called Federal (FPMU) and one PMU in each province called provincial PMUs (PPMUs). The function of each PMUs would be as follows:

**Federal PMU in the Ministry of FSS&R.** After the approval of 33 PC-II feasibility reports and Transformation Plan, the MFS$R will distribute these to all the provinces and AJK and GB governments and establish a PMU under the Board of Directors headed by the Secretary of the MFS&R. The members of the board will be taken from the private sector who are willing to contribute in the Agriculture Commodity Cluster Development Program, NGOs, technocrats, and facilitator from the PCP. The Federal PMU will have the following function:

- Ensure timely allocation in the ACDF in PSDP and its timely releases every year.
- Solicit PC-1s from the provinces on all the priority commodities for the province based on the recommendation of PC-II for each commodity. As cluster of several commodities go across provinces, the provincial agriculture departments can collaborate with other province(s) where other cluster(s) of the commodity lie to submit one integrated proposal. If provinces submit separate proposals for the commodity cluster that lies in its own

province, the Federal PUMs will prepare an integrated PC-I for the whole commodity keeping separate component for each cluster.

- Submission of the integrated PC-I to the Planning Commission of Pakistan (PCP) for approval.
- Ensure allocation of resources according to the approved PC-I to implement the Cluster Based Agriculture Transformation Plan for the commodity.
- The PCP will share 20% of the resources requirement and remaining 80% will be contributed by the province. It is expected that PC-I of 8-10 commodities will be approved every year. The resource allocation will be separate for each cluster of the commodity and PCP will transfer its share to each province according to the allocation.
- The PMU of the ministry will coordinate with PARC to implement the research component of the Plan.

**Provincial PMUs**. The provincial PMUs will also be established under the Board of Directors co-chaired by the provincial secretaries of agriculture and livestock consisting of members from the private sector willing to contribute in the cluster development program, NGOs, and technocrats. It will have the following functions:

- Coordinate with all stakeholders in the province including private sector, NGOs, banks, international and national development partners, researchers, etc. to prepare the PC-I for different commodity clusters. The clusters having higher IRR, NPV, and lower resource requirement as estimated in PC-II will be considered on priority in preparing the PC-I.
- Submission of PC-1 to the Planning Commission and get its approval.
- Ensure the creation of Agriculture Cluster Development Funds (ACDF) and allocation of the needed resources in the fund.
- Ensure the supply of funds to all stakeholders involved in the implementation of the project.
- Coordinate different agencies involved in the implementation
- Monitor the implementation of various activities in the project.
- Work with the Directorate of Extension and agriculture universities to prepare different training modules.
- Make arrangements to conduct training and capacity building programs in the private sector on competitive basis with the funding from the project.
- Coordinate with Punjab Rural Support Program and other NGOs for social mobilization and networking especially organizing the FEGs.
- Develop SOPs to select FEGs for the grant subsidy on various infrastructure development activities.
- Prepare SOPs for the release of funds to various stakeholders involved in the implementation of the project,
- Monitor the utilization of subsidies.
- Prepare E-commerce Plat Forms and e-information blogs etc.
- Engage public-sector agencies such TDAP, PHDEC, SMEDA, PBIT SIDB, Commercial Embassies/Consulates, AZTB, etc. to develop activity-specific synergies; e.g. participation

in international trade shows; promotional campaigns; technical support in feasibility studies and business plans for supply chain improvement initiatives; agribusiness certification and capacity building initiatives; establishment of domestic market buyer-seller linkages etc.

- The provincial PMUs will submit the monthly progress reports to the federal PMUs.
- The establishment of the proposed research institutes will also be undertaken by the provincial PMUs in collaboration with the research institutes in the province.

## 2.2. Production Level interventions and Strategies

### 2.2.1. Strengthening of GPUs and Multiplication Blocks at R&D Institutes

Presently, few Germplasm Units (GPUs) pertaining have been established in mango, citrus, Dates, etc. where multiplication block have been established to produce root stock and seedlings for commercial nurseries. The protocols and SOPs for GPUs and multiplication blocks have been developed and approved by Federal Seed Certification and Registration Department (FSC&RD) in only few fruits but is not being implemented in its true spirit in any fruit nurseries due to lack of dedication, capacity of the respective research institutes, and to some extend lack of timely funding.

The roles and responsibilities at the research and development (R&D) Institutes shall be clearly defined and implemented by Agriculture Research & Extension Department. FSC&RD and NARC shall provide training to the R&D staff officers and the labor working in the multiplication block for managing the health, growth and quarantine. They shall also be trained on nursery management. The R&D Institutes should provide the root stock and budding materials to only those commercial nurseries which are registered with FSC&RD.

### 2.2.2. Promotion of Certified Nurseries

Raising fruit nurseries of fruits and vegetables in Pakistan is never taken seriously. In vegetables either seed is directly sown (like in peas) or nurseries are raised at home (like in tomato, chilies, etc.). The vegetable nurseries are raised unscientifically at the farm-level producing unhealthy and low potential plant materials. No scientific protocols of raising nursery plants in fruit nurseries. Tissue culture labs for producing nurseries are found very rare. Clean and healthy nursery plants of high varietal purity are a basic requirement for high-yielding and good quality fruits products. This necessitates the establishment of certified clean nurseries in Pakistan that can produce genuine, healthy, and high-potential fruits root stock and vegetable nurseries. Establishment of certified nurseries should be an important component of the introduction of high-density garden renovation as well improved vegetable productivity programs.

Local nursery producers in each province would be encouraged to register with local FSC&RD offices by PMU through local AD/AO/FO and R&D institute to produce certified true to type

quality young fruit trees and vegetable nurseries. This would be on a voluntary basis, but would bring with its certain fringe benefits, namely:

- Registration with FSC&RD shall provide the nursery producer with a guarantee of quality and help to raise the business and reliability of the nursery
- They shall get access to the fruit propagation materials from the multiplication blocks (on a payment basis) and also access to any new varieties introduced. Non-registered nurseries will not have access to this material.
- These nurseries will become a part of the certification scheme for young fruit trees.
- Owners and staff of the registered nurseries will have access to training in improved nursery management and production practices.
- Participation in the registration and certification scheme will raise the business profile of the nursery and encourage repeat business through certified quality and increased reliability.
- Ultimately the nurserymen will attain higher prices for the production, compared to uncertified planting materials.
- Tissue culture labs are suggested to be encouraged in banana, tomato, chilies, potato, flowers and Pattoki nursery.
- In vegetable, the research institute should provide the basic seed of high-yielding varieties to vegetable nurseries and monitor its use in producing vegetable seed nurseries under healthy environment.

Price is a big factor for most farmers which drives them either to develop their own nursery or buy them from uncertified nurseries. So, we suggest that government provide incentive in the form of cost sharing of 20% so that growers can buy plants from these registered nurseries

### 2.2.3. Improving the Availability of Modern Variety Seed

The availability of good quality seed is critical for productivity enhancement as well as to meet the quality requirements of the consumers. In some clusters, appropriate seed variety for processing is not available. Existence of a mechanism to supply seed at the cluster level that caters to the volumes and quality requirements is imperative for the competitiveness in agriculture sector. We suggest the following to enhance the seed supply system at the cluster level:

- The demonstration fields of improved varieties will be stablished through FEGs.
- FEGs and extension agents will be trained on the SOPs for good quality seed production,
- The FEGs will also be eligible for receiving the basic seed from research institutes for multiplication and distribution to its members,
- The public sector will develop seed multiplication plans with FEGs.
- A criterion will be developed to select the seed producer farmers which will be followed by FEGs as well as the private seed companies.

- In some cases, like in sugarcane, the processors of the commodity will be made responsible to bear the seed production costs at least for the multiplication of the basic seed in research organizations for distribution to FEGs.
- The seed nurseries supply true-to-type nurseries of different varieties as demanded by producers will be promoted on cost-sharing basis with the government.

### 2.2.4. Capacity Building of Stakeholders on Improved Management Practices

Provision of improved extension and veterinary services especially about the value chain management will play a vital role to increase production and its quality in almost all commodities. However, currently training and extension services in the country is largely supply-driven and does not meet the needs of stakeholders, especially the value chain agents and processors. Therefore, the FEG and value chain agents will be involved to identify the key issues on which they want training, and then training would be focused on the high-priority issues identified by these groups.

The prime strategy will be building the capacity of all the key value chain stakeholders (farmers, middlemen, processors, transporters, exporters, certifying bodies, service providers, nursery people, etc.) with respect to GAPs and SPS protocols, international certifications, supply chain management, processing, etc. for the purpose of not only increasing productivity but also the quality of most agricultural commodities. The capacity building to clearly define the quality parameters and grades, identify the types of inputs needed for the defined quality and how to handle and process raw commodities into processed quality products will be built in rural areas.

Specialized capacity building programs will be initiated focusing on the training to resolve specific problem along the value chain in the cluster of a commodity. The extension experts will prepare the broachers specifying the SOPs to address the issue, while private sector will implement the training program on competitive basis with the financial support of the public sector. The public sector extension agents will monitor the implementation of the training programs. The capacity of public sector extension agents will also be built to manage relevant training programs along the value by engaging foreign and local consultants.

Number of universities and research institutes where most of the facilitator trainings shall be hosted. It is recommended that NRSP should also be involved in the training and capacity building program. Farmers participatory approach will be used through the involvement of FEGs. Foreign and local consultants would be engaged to prepare broachers on various aspects and training of trainers. Only tested practices will be demonstrated to the stakeholders. Some of the themes (not exhaustive list) which can be covered in these capacity building trainings are given in Annexure-3.

## 2.3. Marketing Level Strategies

Strategies are suggested to improve the quality of all quantities exported in various commodities and certain percentage of the total production sold in domestic market at par with the export quality. These interventions vary from commodity to commodity but generally includes incentivizing the value chain infrastructure like pack-houses, collection centers, cold storage, chillers, etc. and encouraging certification and branding of agricultural commodities.

### 2.3.1. Linking Farmers with Domestic Markets

In Pakistan, there is a particular need to create links between growers and markets. This linkage can be developed through Farmers' Enterprise Groups (FEGs) who are empowered for quality compliant demanded by traders/processors. The group monitor its members for quality compliance and ensure quality to traders. They ultimately end up setting predetermined quality-price contract farming with exporters and emerging supermarket retailers within the country. The traders and supermarket retailers also provide farmers modern inputs, methodologies, and technologies that can help them to meet the quality requirements of the contract.

Farmers can also be connected with markets by providing appropriate information on supply demand, prices, quality requirements, emerging technologies in production, value addition, processing, and marketing in major producing and consuming centers of the commodity within the country and abroad. It is suggested that farmers should be provided the information about market by establishing information blogs and ensuring easy access on these blogs to everyone interested to seek the blogs.

Small farmers usually are disconnected with the markets because of their small lot of the produce and their difficulty in bringing these lots into big agriculture markets in urban areas. The FEGs will be a great vehicle to gather small resources from farmers to build value chain infrastructures like pack-houses, collection centers, cold storage, etc. The government will also provide support on cost-sharing basis to build these infrastructures in rural areas. These pack-houses and collection centers will have all the basic facilities like grading, washing, packing, storing, etc. and farmers will be connected with financial institutions to get loans so that they can hold their produce for longer period. The idea is to bring the markets closer to the farmers, rather than farmers being exploited by the middlemen in big agriculture markets in urban areas, and making them financially independent from wholesalers.

### 2.3.2. Linking Trader with International Markets

Traders can be connected with international markets by encouraging them to participate in international events, such as food exhibition, trade shows, trade fairs, international workshops, etc. related to the commodity. Those exhibitions have to be identified which are held during the commodity production period. Also, displays at high-end stores should be part of marketing promotion so that the consumers are made aware of Pakistani products because it is the first step for that retailer to be convinced to import Pakistani product.

Key options available for participation in leading trade shows/exhibitions for both fresh, de-hydrated, and processed product should be identified Those events will be selected, which are scheduled within the season of product, so that samples of target products can also be displayed at the events for sample tasting. In this regard, collaboration with Trade Development Authority of Pakistan (TDAP), Pakistan Horticulture & Development Company (PHDEC) and Commercial Councilors in embassies with respect to identification and participation in the relevant marketing activities shall be sought. It is proposed that while visiting at expos on the side line pre-arrangements shall be made with chain stores to display Pakistani produce in a store with taste sampling so that consumer can get awareness of these products. International marketing consultants from EU and China and local marketing companies can be hired to support in this endeavor. PMUs and Agriculture Economic and Marketing departments in coordination with these companies would carry out some of the following activities:

- Mapping of countries and markets for the target products shall be carried out.
- Specific compliance, customs regulations, packaging requirements and other related prerequisites of exports to these markets shall be identified.
- Logistics viz-a-viz cost of the products shall be determined.
- Keeping in view potential international markets and compliance requirements thereof, a detailed marketing strategy with an overall aim to enhance exports to potential high-value export markets shall be designed. To ensure the maximum gain from participation, wide circulation of any lesson learned from the trip, a follow-up interview with participants six months after participation should also be arranged.

In addition to the above steps, an integrated innovative tool including e-commerce portal and SMS-based training message schemes in the training delivery mechanism will be introduced at the provincial levels. A dedicated web-portal containing information on the product supply, prices, changing quality standards, and emerging technologies in production, value addition, and processing in major mango producing markets, upcoming mango related national and international events, GAP handbooks and training modules shall be prepared to reach the audience at a larger scale. The portal shall provide an option to visitors to subscribe to training messages/tips circulated to registered subscribers on periodic basis. Participants of all trainings will be automatically registered for the SMS tips. A system shall be devised to structure periodic tips in Urdu from the GAP handbooks and training modules, which shall be circulated to beneficiaries and other subscribers on a periodic basis.

Establishing the traders' associations will also help them to be connected with international markets as collectively they can better approach these markets to meet their quantity and quality requirements.

### 2.3.3. Improving the Local Markets

The agriculture wholesale sector in Pakistan has remained underdeveloped, as the total number of ***mundis*** increased from 169 in 1962 to 233 in 2016, a growth of 64%, while the total volume of commodities increased several hundred percent. Consequently, ever more agricultural

produce needs to pass through a limited market infrastructure, which is already deteriorated due to years of neglect. Similarly, animal wholesale markets remained crowded deprived of basic facilities. Moreover, the control of these markets are monopolized by the Market Committees who has limited resources and little resort to reform the agriculture market system.

In the cluster analysis of 33 commodities, inefficiency in agriculture produce markets was observed in various forms, like asymmetric market powers of the middle men which give them an exploitative position, lack of cold storage facilities in the market places, improper packing and presentation, disconnect between producers and consumers, etc. Farmers need effective and profitable marketing outlets for their produce. Aside from reducing postharvest losses, and fair distribution of production value among various stakeholders, well-managed wholesale markets are essential for food quality control, incentivizing the promotion of high-value crops, and good public health. In many developing countries, the wholesale markets have become the development centers by offering business facilities like cold storage, value addition, processing, financing, demand projection, etc. with its strong forward link with international markets.

Although cluster approach for development of the agriculture sector adopted here will bring markets closer to the farmers by establishing collection centers and pack-house at the village level which are equipped with basic quality infrastructure like grading, washing, packing, storage, etc. and can serve as a primary market places for agriculture produce, especially quality produce, but still a large quantity of the produce is expected to pass through the traditional wholesale markets. Unless these markets are reformed, Pakistan will remain uncompetitive in international agriculture produce markets due to lack of quality and inefficiency in these markets. Following reforms are suggested to make Pakistan competitive in international markets:

- Encourage the private sector to establish agriculture produce markets as far as they can maintain the food quality and safety standards.
- Curtail political interference in the affairs of the market committees by reconstituting these and involving true stakeholders in their constitutions.
- To generate more resources for the development of public sector markets, the 1 Rupee per quantal tax be replaced by an ad valorem tax of 1% of the value of agriculture produce be replaced.
- Recognize the legal role of ‘Pharias’ and register them as legal market agents to create greater competition among them and reduce their exploitative powers.
- Encourage the establishment of small-scale storage at the farm-level and link these with the receipt-based loaning system so that farmers can hold their produce for longer period.

## 2.4. Value Addition and Processing Level Strategies

The special emphasis of the transformation Plan on strategies to add value in agriculture commodities. The cluster approach is specifically suitable for this purpose as it synergistically increases coordination among stakeholders to resolve the issues of the whole value chain. It is particularly suitable under Pakistani situation where small farmers individually cannot make

large investment needed to for value chain improvements, while large investors do not make big investments in rural areas. Following strategies are suggested to improve value addition and processing of agriculture commodities in rural areas.

### 2.4.1. Incentivizing Value Addition Infrastructures in Rural Areas

One of the key pillars of modern value chain is the presence of appropriate infrastructure such as value addition and cool chain system which has become critical for reducing post-harvest losses, promote exports earning, price stabilization in domestic market empowering growers to control as per demand supply situation and avoid quality deterioration due to short shelf life. Some value addition activities, such as Hot Water Treatment (HWT) is a quarantine prerequisite for some commodities in high-end export markets. There is also lot of potential to establish value added industry such as collection centers and pack-houses with all the facilities of grading, washing, packing, and storing, etc. on these facilities, dehydrating and drying facilities such as mango, plums, dates, and grapes, etc. It is suggested to provide 20% subsidy and interest free loan for one year on the establishment of value chain infrastructure. The strategy related to value addition is that such infrastructures will be established at the local level in small scale under the direct control of FEGs. Government will bear the 'transaction cost' to organize these groups and guarantee the appropriate use of the investment resources gathered by large number of small farmers for the purpose of establishing these infrastructures under the control of FEGs in rural areas. Any farmers can get the services of the value addition services on charge basis, and the profit can be distributed among those who contributed in the establishment of these facilities proportionate to their contribution.

To keep the cold chain intact from production to market there is need for establishing farm-level cold stores in cluster areas at the collection centers. The cold storages would be established under grant mechanism by the government with 20% subsidy on the capital cost and one-year interest free loans. It is suggested that all the export and 5-10% of the output of assigned commodity destined for high-end domestic market will be pass through the collection centers.

### 2.4.2. Encouraging Small Scale Processing as Cottage Industry

Many processed agriculture products like fruit juices, fruit pulps, dried products, pickles, jams, jelly and catchup have a high demand in both local and export markets. The local market of fruit juices, nectars and drinks has been growing at a very high rate, estimated at 7% per year. Due to increase in demand for juices many large juice companies have entered the market, supplying to the local and international markets. But there are still several opportunities where small rural-based agriculture processing can be initiated. For example, tomato puree used in tomato catchup is mainly imported. The mechanical sun-drying of grapes can help Pakistan to bring back its raisin market. Small-scale sugarcane juice in packed form can capture its year-round demand. Similarly, preparing mango pulp at village level can expand the nectar market in which it can be used.

From economic perspective the small scale processing will contribute towards reducing the postharvest losses, increasing employment opportunities in rural area and maximizing crop value for the farmers. Moreover, small scale operations will be less capital intensive, thus it will initiate rural industrialization which will also give industrial push to the agriculture sector.

It is proposed that small scale processing of 2-10 tonne per day capacity be established with FEGs with government support. It is proposed these processing infrastructure be subsidized at 20% on the capital investment and interest free loans be provided for one year. It is estimated that one small unit of fruit and vegetable processing will cost US$10-30 thousand, while its operation cost would range US$10-55 thousand for the whole season. The FEGs will gather investment resources from individual members and the profit will be shared based on the proportion of their investment.

As part of the strategy, if these units are producing semi-products, these will be linked with the big processing plants in urban areas who use their products as raw materials. If these units produce final product, they will be encouraged to get their produce branded. All these units will be encouraged to certify their processes to ensure quality of their produce. The staff engaged in processing will be trained on good processing protocols to ensure safe and hygienic produce.

### 2.4.3. Replacing inefficient Farm and Value Chain Operations

As noted earlier, many farm and value chain operations are inefficient thus increase the value chain costs. In the ATP, such operations and processes will be identified and alternatives will be provided to the stakeholders. The government will incentivize the capital costs of such replacement. These may include the planting and harvesting machines, drying and packing processes, packaging materials, etc.

## 2.5. Macro Policies

To efficiently implement the above strategies, a favorable policy environment will be necessary. Following policy shift would be required to make the cluster-based Agriculture Transformation Plan (ATP) successful:

### 2.5.1. Plan Locally in Consultation with Stakeholders

Our analysis of 76 clusters of 33 commodities suggests that these clusters are unique in terms of physical and economic environment, thus requires special technical and policy initiatives. Even general policy may be similar but its application may vary from cluster to cluster. Thus, there is a need to evaluate the cluster needs and provide resources to meet these needs. The government has to come down from macro-level to local level to understand the infrastructure, technological and financial needs of each cluster in consultation with stakeholders.

### 2.5.2. Replace General Subsidies with Cluster Need Based Support

General subsidies on inputs and output price support do not suit under cluster approach. Therefore, current practice of providing general subsidies and “export rebates” to selected commodities should be eliminated, and replaced with need-based subsidies to drive investments at the cluster level.

A particular policy shift require is the gradual removal of the fertilizer gas subsidy which goes to manufacturers of fertilizer and so gross amounts are not indicative of the actual benefit to farmers. A substantial share of fertilizer subsidy benefits fertilizer companies, and it has also promoted unbalanced use of fertilizers. The electricity subsidy on tube wells, which is the second largest Federal payment and is a direct benefit to farmers, however benefits only few farmers as approximately 80% of the tube wells in Punjab run on diesel engines and therefore no benefit from the electricity subsidy goes to the majority of the farmers. These subsidies can be replaced by the provision of subsidy on purchase of certified seeds of oilseed, pulses and horticulture crops, establishing certified nurseries, tissue culture labs, and capacity building of farmers according to the needs of each cluster. The subsidy should be bundled with extension and advisory services to support farmers’ transition from conventional/major crops to high value crops.

### 2.5.3. Establish Agriculture Cluster Development Fund (ACDF)

Cluster development is a continuous phenomenon which constantly need resources to meet the infrastructure needs. Therefore, there should be a sustained mechanism to meet different needs of various cluster. It is suggested that an Agriculture Cluster Fund (ACDF) should be established both at the Federal and Provincial Levels with their respective share of 20% and 80%. Both the government collectively subsidize the infrastructure development investment on cost-sharing basis with 80% share coming from the private investors mainly from FEGs, while remaining 20% share from ACDF. In addition, any special need for consultants, capacity building, and research initiative should also be met from ACDF. The assurance of the availability of funds for cluster development initiative will be very important for the cluster development in the country.

### 2.5.4. Promote Pakistan Products

Pakistani product like low ICUMSA (200 ppm) content of sugar, true basmati rice with high aroma content, organic stone fruits, special spices formulation, special aroma tea from Pakistan, etc. need to be promoted in national and international markets. There is lot of seasonal differences with China and European production system in many markets commodities which need to be exploited. Moreover, fruits and vegetables should be included in bilateral/multilateral trade agreements with friendly countries especially with China and try to seek help from China for improved value chain management.

### 2.5.5. Promote Quality in Domestic Market

Promotion of safe and nutritious food, especially oilseeds, milk, beef, pulses, and vegetables will not only improve consumers' health in Pakistan but will also be helpful in improving competitiveness of the agriculture sector in international markets. The provincial food authorities have already been constituted to implement food laws promulgated by the provincial assemblies. To improve the quality of food in domestic market, imposition of tariff on the import of low-quality food like oil, pulses, grain, etc. should be considered. In addition, PSQCA standards and other food laws especially correct labelling on food items, and value activities like transportation, post-harvest processing, cooking, etc. needs to be regulated to improve the quality of food consumption in the country. The enhanced quality concerns of the society and food authorities will generate demand for value chain infrastructure as well as for certification and branding in the country. The clean food at the domestic level will improve Pakistan's reputation as a clean food supplier in international market.

### 2.5.6. Import Substitution

Following policy package should be considered to reduce the high imports of low-quality oil, pulses, etc.

- The imports of the commodity where import bill is high, like edible oil, pulses, garlic, ginger, etc. and clear options for domestic production is available, policy should consider to link import permit with the development activities in the commodity at cluster level within the country. Perhaps the quantity of imports can be linked with equal quantity of the commodity procured at the local level. Alternatively, opening of LCs for imports shall be linked with R&D work of the importing firm on that commodity.

- Imposition of additional duties on the imports of foods to create space for the production of locally quality food such as RS&M, pulses, etc. should be considered. The money thus collected should be spent on the R&D activities to provide viable options for enhanced productivity and improved value chain management. Such imposition must be time bound and its impact on import substitution should be monitored.

- The procurements of the domestically produced imported items should be ensured.

- Special emphasis should be given to enhance capacity of different stakeholders to produce and market domestically produced items in competition with the imported items.

### 2.5.7. Stop Frequent Interventions in Commodity Prices

In certain commodities, like in milk, beef, potato, tomato, etc. government frequent government interventions in price and imports of the commodity has created uncertainties among investors on the value chain infrastructure. A price band, rather than one price, should be announced which should be wide enough for the private sector to comfortably operate within the band. The

government should strict hold up its intervention as far as the price remains within this band, and only intervene if the prices go beyond upper and lower band and that is also through market mechanism rather than harassing the investors.

### 2.5.8. Seed Sector Policies

Seed is one of the most critical inputs in agricultural production, as it sets the limits on the productivity of land, labor, fertilizer and water. It is commonly observed that high breeding potential of varieties is not harnessed at the farm-level due to poor quality seeds in Pakistan. A competitive seed sector can also promote agricultural business through the development of seed and related input industries. Therefore, its legal framework to supply quality seed at low cost is very important for the development of the agriculture sector in the country. Although some of the seed quality issues are resolved by engaging FEGs in the seed production system as suggestive above, following system level seed sector reforms will be important to improve the overall seed quality system in the country:

- Public sector will gradually withdraw from developing seed varieties for distribution and sales to farmers. They will develop an evolving partnership with the private sector, and let them handle final stages of seed development, multiplication, and distribution to farmers in the country.
- Varietal approval mechanism will be abandoned especially in fruits and vegetables. The system will depend upon just-truth-in-label.
- Point to point morning is unnecessary, expensive, and not accurate enough, as there can always be adulteration later in the chain. Therefore, a more effective approach is to require labeling of seeds, and have random testing of the seed at the retail level.
- The provinces, rather than FSC&RD, will be given a mandate for monitoring the seed quality.
- The protocols and SOPs for seed multiplication, appropriate processing, seed storage and transportation, etc., will be developed by the FSC&RD.
- With these SOPs developed and used in the registration of seed companies, the ultimate test of seed quality will be made at the point of retailing through truth-in-label.
- The private seed companies will provide insurance schemes along with warranties in case of emergence of pest infestation on the variety they supply.

# 3. RESOURCE REQUIREMENTS OF ATP

## 3.1. Capital Investment Requirement of ATP by Value Chain Activity

### 3.1.1. Total Capital Investment requirement

To achieve the above targets and objectives, capital investments are proposed to upgrade various value chain segments. The total estimated capital investment on the focal point of each commodity by value chain segments is shown in Annexure-4 and summarized in Table 1. The total capital investment in a focal point depends upon the size of the focal points, area to be covered by the value addition/processing facility, and per unit cost of the facility. To achieve the targets of the ATP, the total capital investment required to introduce the interventions at cluster focal points in each commodity would be US$1.039 billion. The major share of total investment (59%) would go to develop value chain and processing infrastructure. This is followed by investment on planting material to renovate fruit gardens. Strengthening of research and capacity building each would require about 8.8% and 8.4% of the total investment, respectively (Table 1).

### 3.1.2. Source of Capital Investments

Out of the total capital investment, 40% should come from government (both federal and provincial) and the remaining 60% by the private sector. The government share in the capital investment of the ATP would be in terms of:

- Strengthening or building research infrastructure,
- Capacity building of farmers and other value chain stakeholders including establishing their networks and group organizations,
- Providing subsidy on planting materials to renovate fruit gardens and establishing certified fruits and vegetable nurseries,
- Subsidy on value chain and processing infrastructure at the rural level,
- Promoting international marketing and linkages,
- Establishing Project Management Units (PMUs) to run the cluster development programs at the federal and provincial levels, and
- Providing interest free loans for one year at the start of the building value chain and processing infrastructure by the private sector.
- All investments on research and capacity building, establishing networks and farmers' organization, linking stakeholders with national and international markets, and establishing e-commerce platforms and e-information blogs, etc. would be established by the government.

***Table 1: Total investment and its sources by investment type (Million US$) required to achieve the set targets***

| Item | Government (Million US$) | Contri-bution (%) | Private (Million US$) | Contrib-ution (%) | Total (Million US$) | Contri-bution (%) |
|---|---|---|---|---|---|---|
| Research | 91.6 | 22.3 | 0.0 | 0.0 | 91.5 | 8.8 |
| Capacity building of VC stakeholders | 87.2 | 21.3 | 0.0 | 0.0 | 87.3 | 8.4 |
| Planting material, Nurseries and renovation | 40.9 | 9.9 | 131.9 | 21.1 | 172.4 | 16.7 |
| Value chain infrastructure/processing | 121.2 | 29.6 | 485.0 | 77.7 | 606.2 | 58.6 |
| International marketing and linkages | 1.9 | 0.5 | 7.7 | 1.2 | 9.6 | 0.9 |
| PMU | 5.2 | 1.3 | 0.0 | 0.0 | 5.2 | 0.5 |
| Loan | 61.6 | 15.0 | 0.0 | 0.0 | 61.6 | 6.0 |
| Total | 409.6 | 40.0 | 624.5 | 60.0 | 1039.0 | 100.0 |

About 30% of the government investment will go to subsidize the value chain and processing infrastructure. This is followed by the investment on strengthening of research and capacity building of stakeholders each claiming more than one fifth of the total investment. Providing interest free loans for one year to build the infrastructure will claim 15% of the investment. The government investment on developing links with international markets is small but very critical to promote exports of agriculture related commodities (Table 1).

We believe that above incentives if run properly can induce 60% of the remaining investment in the private sector. The major private sector investment would be on value chain and processing infrastructure. The investment on planting materials would be the second largest investment by the private sector (Table 1).

### 3.1.3. Provincial Share in Capital Investment

The estimated provincial capital investment needs for their respective ATP is shown in Table 2. More than half of the capital investment will happen in Punjab.

***Table 2: Provincial capital investment needs of the ATP***

| Province | Investment (Million US$) | Share (%) |
|---|---|---|
| Punjab | 559.3 | 53.8 |
| Sindh | 222.7 | 21.4 |
| Balochistan | 120.7 | 11.6 |
| KP | 123.4 | 11.9 |
| GB | 12.8 | 1.2 |
| Total | 1039 | 100 |

## 3.2. Operational Cost to be Incurred

The above investments will improve various value chain activities therefore entail additional costs to run these activities. Normally, this cost is ignored in implementing the development projects. These costs at the focal point of each commodity segregated by province is shown in Annexure-5 and at summarized at provincial and national level in Table 3. When the ATP is fully implanted during the last year of the project, it will require US$5.7 billion to run the improved activities in the value chain. Forty-five percent of these costs will incur in Punjab, 27% in Sindh, and 12% and 15% respectively in Balochistan and KP. The GB province will also need over 1% of the operational cost to implement the ATP (Table 3). These costs although incurred by the stakeholders but give a big challenge for the government to arrange such big liquidity for the implementation of ATP. This implies almost doubling the current liquidity level available to the agriculture sector.

The operational cost includes additional input cost due to the introduction of new varieties and management practices, operational costs of newly installed value chain and processing infrastructure, etc. Without ensuring the availability of these costs at the production and processing levels, all the investments may fall flat and even big incentives provided for capacity building, strengthening research, and installing new infrastructure may not bring the desired transformation in the agriculture sector. Therefore, the provision of loans on easy terms and ensuring the access of the FEGs on these loans will be very critical for the success of the ATP.

***Table 3: Operational cost (M. US$) incurred due to improvement in various operations along the value chain induced by the ATP***

| Province | Operational cost | Share (%) |
|---|---|---|
| Punjab | 2558.1 | 44.9 |
| Sindh | 1535.1 | 26.9 |
| Balochistan | 675.3 | 11.9 |
| KP | 855.1 | 15.0 |
| GB | 73.4 | 1.3 |
| Overall | 5696.9 | 100.0 |

## 3.3. Manufacturing/Value Addition Infrastructure Needs of ATP

As noted earlier, the capital investment on manufacturing/value addition infrastructure is the most important component of the ATP. It is important to know the type of infrastructure that would be needed in the ATP. The suggested infrastructures are small units at cottage level to give industrial push to the agriculture sector and play role in initiate village level transformation. The infrastructure needs are estimated for each crop cluster based on the target to be achieved as given in Annexure 1. Based on these assumptions, the commodity wise infrastructure requirement by province is given in Annexure-6:

A total of 16688 manufacturing, value addition, and farm machinery units a required to implement the cluster-based rural transformation plan. Punjab, Sindh, Balochistan, and KP will share 59.9%, 19.1%, 15.9%, and 5.1% in the total infrastructure needs to upgrade the commodity cluster in the respective province (Table 4).

***Table 4: Infrastructure required to implement the cluster upgradation plan by province***

| Infrastructure | Number of units required | | | | |
|---|---|---|---|---|---|
| | **Total** | **Punjab** | **Sindh** | **Balochistan** | **KP+GB** |
| Pack houses | 4160 | 172 | 1753 | 2214 | 21 |
| Harvesters | 1648 | 1532 | 74 | 12 | 30 |
| Planters | 3709 | 3693 | 4 | 8 | 4 |
| Driers | 1140 | 594 | 42 | 150 | 355 |
| Processing units | 1302 | 753 | 178 | 100 | 271 |
| Sugar GPS system | 4 | 1 | 1 | 1 | 1 |
| Juice/pulp/pure plants | 1437 | 864 | 330 | 161 | 82 |
| Porridge units | 12 | 7 | 0 | 5 | 0 |
| Tissue culture labs | 158 | 140 | 6 | 0 | 12 |
| Calf Fattening Units | 683 | 478 | 205 | 0 | 0 |
| Modern cattle market | 12 | 10 | 2 | 0 | 0 |
| Village level feed mills | 346 | 241 | 105 | 0 | 0 |
| Slaughter houses | 89 | 52 | 37 | 0 | 0 |
| Pasteurization Units | 598 | 385 | 213 | 0 | 0 |
| Milk product processing units | 596 | 393 | 203 | 0 | 0 |
| Oil extraction plants | 11 | 0 | 0 | 0 | 11 |
| Turbo Barn | 66 | 43 | 19 | 0 | 4 |
| Composed based LS Feed | 715 | 634 | 0 | 7 | 74 |
| Cold storage/reefers | 1 | 1 | 0 | 0 | 0 |
| Grand Total | 16688 | 9993 | 3172 | 2658 | 865 |
| Provincial share in percentage | 100 | 59.9 | 19.1 | 15.9 | 5.1 |

## 3.4. Capital Investment of ATP on Processing/Value Addition Infrastructure

We believe that capital investments on various infrastructure are critical to furnish '***industrial push***' to the agriculture sector and must be consider very seriously. The commodity wise details of capital investment on various infrastructure is given in Annexure-7, and summarized in Table 5.

To achieve the target of promoting small scale processing in rural areas will require about US$595 million, and 29% of this investment will go on establishing processing units and another 10% for small scale juice units to produce puree/pulp, etc. Another important investment is on pack-houses/collection centers which will be used to improve the quality of the produce to international standards for the domestic and international market. This will require 14% of the total investments (Table 5).

***Table 5: Capital investment on value chain and processing infrastructure***

| Infrastructure | Investment (000 US$) required | | | | | Share (%) |
|---|---|---|---|---|---|---|
| | Total | Punjab | Sindh | Balochistan | KP+GB | |
| Pack houses/collection centers | 85462 | 6000 | 27075 | 49485 | 2902 | 14.4 |
| Harvesters | 42975 | 37015 | 4580 | 60 | 1320 | 7.2 |
| Planters | 21944 | 21864 | 23 | 33 | 23 | 3.7 |
| Driers | 25597 | 10704 | 4669 | 2587 | 7637 | 4.3 |
| Processing units | 171894 | 103120 | 32574 | 4545 | 31655 | 28.9 |
| Sugar GPS system | 1244 | 622 | 311 | 0 | 311 | 0.2 |
| Juice/pulp/pure plants | 61451 | 39485 | 15260 | 2940 | 3765 | 10.3 |
| Porridge units | 82 | 48 | 0 | 34 | 0 | 0.0 |
| Tissue culture labs | 6970 | 6443 | 264 | 63 | 264 | 1.2 |
| Calf Fattening Units | 7058 | 4939 | 2118 | 0 | 0 | 1.2 |
| Modern cattle market | 18889 | 15556 | 3333 | 0 | 0 | 3.2 |
| Village level feed mills | 1281 | 893 | 389 | 0 | 0 | 0.2 |
| Slaughter houses | 9960 | 5822 | 4138 | 0 | 0 | 1.7 |
| Pasteurization Units | 39823 | 25638 | 14184 | 0 | 0 | 6.7 |
| Milk product processing units | 11735 | 7451 | 4285 | 0 | 0 | 2.0 |
| Oil extraction plants | 9743 | 0 | 0 | 0 | 9743 | 1.6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Turbo Barn | 4556 | 2968 | 1312 | 0 | 276 | 0.8 |
| Composed based LS Feed | 73863 | 63353 | 0 | 2022 | 8488 | 12.4 |
| Cold storage/reefers | 741 | 741 | 0 | 0 | 0 | 0.1 |
| Grand Total | 595267 | 351922 | 114515 | 61769 | 66385 | 100.0 |
| Provincial share (%) | 100 | 59.1 | 19.2 | 10.4 | 11.2 | |

Focusing on just infrastructure investment which is important to bring '***industrial push***', 59.9% of such investment will be needed in Punjab, 19% in Sindh, 10% in Balochistan, and 11% in KP/GB (Table 5).

## 3.5. Human Resource Requirements

Lots of skilled and unskilled labor would be required to implement the project. The most critical of these would be:

- Social mobilizers who can organize FEGs by explaining producers and other stakeholders engaged about the objective, purposes, and functioning of these groups.
- Managers, accountants, etc. who can run the value chain and processing infrastructure under FEGs in transparent manner so that stakeholders can trustfully invest their resources on these infrastructures.
- Trainers who can provide skilled training on various aspects of farm and post-harvest management operations (Annexure-3).
- Researchers who can correctly identify the cluster development issues along the value chain, and group themselves to provide its viable solutions quickly will also be critical in the successful implementation of the ATP.
- To produce skilled researchers and trainers, foreign and local consultant in the public and private sector needs to be engaged.
- Financiers who can supply loans after identifying the needs in various value chain operations in different clusters.
- Skilled, semi-skilled, and unskilled laborers who can operate various farm, off-farm, value chain and processing operations generated through implementation of the ATP.

Training these human resources will be the most critical for the success of the ATP. Therefore, it is suggested that foreign and local consultant in the public and private sector should be engaged through provincial PMUs to create these human resources as quickly as possible. For this purpose, the provincial PMUs should have a special division for "Human Resource Development".

# 4. SOCIOECONOMIC VIABILITY AND IMPACT OF THE ATP

## 4.1. Socioeconomic Viability

It is worth noting here that the process of estimating the economic viability of ATP here does not simply count the direct investment costs on capital and materials, but also include costs of various processes to reach to the final goals of the Plan. These processes involve in the implementation of ATP include research reforms, capacity building, social mobilization of stakeholders, and linking the stakeholders with national and international markets. With the estimates of the investment and operational cost requirements of direct as well indirect interventions, we are able to estimate the socioeconomic viability of the ATP at each cluster focal-point and commodity levels of all the 33 assigned agriculture commodities. These estimates are arranged by province so that economic viability can be estimated by province and the results are summarized in Table 6. The estimates of Net Present Value and Internal Rate of Return (IRR) can also be seen in Annexure 8.

When the ATP is fully implanted, it will generate US$9.9 billion of gross revenue to various stakeholders mostly in rural areas. To generate this revenue US$1.03 billion of total capital investment over a period of five years and US$5.7 billion of liquidity during the last year of the project would be required. After accounting for all the capital and operational cost, the net cash flow from the Plan would be US$3.2 billion during the last year of the project period. About one half of the gross revenue and net cash flow will come from Punjab. These cash flows will completely vibrate the rural economy and create millions of job in rural area.

***Table 6: Economic viability of ATP by province***

| Province | Million US$ | | | | | IRR |
|---|---|---|---|---|---|---|
| | Gross revenue[1] | Operational costs[1] | Capital investments[2] | Net Cash Flow [1] | NPV[3] | |
| Punjab | 4745.5 | 2558.1 | 559.3 | 1628.1 | 970.0 | 77% |
| Sindh | 2188.1 | 1535.1 | 222.7 | 430.3 | 247.9 | 53% |
| Balochistan | 1073.5 | 675.3 | 120.7 | 277.5 | 147.7 | 43% |
| KP | 1760.5 | 855.1 | 123.4 | 782.0 | 395.1 | 51% |
| GB | 173.8 | 73.4 | 12.8 | 87.6 | 47.5 | 79% |
| Overall | 9941.4 | 5696.9 | 1039.0 | 3205.5 | 1808.3 | 62% |

[1]These estimates are only for the last year of the project when ATP would have been completely implemented, and these are undiscounted values.
[2] The capital investment is taken as total and this is also undiscounted.
[3] This is the sum of the discounted value over the project period using 8.5% discount rate.

After accounting all capital and operational costs, and discounting the net cash flow over the project period at 8.5%, the ATP activities will generate a Net Present value of US$1.8 billion. This has an Internal rate of Return at 62%, much higher than any government investment can generate in the short-term of five years. The Punjab and GB provinces have the highest, while Balochistan has the lowest IRR (Table 6).

## 4.2. Impact of the ATP

Overall objective of the Agriculture Transformation Plan (ATP) is to improve competitiveness of the agriculture sector in national and international markets by enhancing agriculture productivity, and improving the quality of outputs. This will have the following impacts on rural economy:

1. The Farmers Entrepreneur Groups (FEGs) will be vehicle for any future change in rural areas especially in introducing new technologies and processes in production, value addition, and processing. Initially, these groups will be used to introduce simple technological innovation which can be built for more sophisticated technologies. These group when properly trained can bring the industrial revolution in the country.
2. Increased agriculture productivity is expected to not only enhance income of the farmers but also generate employments of skilled and semi-skilled workers for the crop management and harvesting of additional output. In many clusters these operations are done by women or children thus benefit the neglected segment of the society.
3. Additional production from enhanced productivity and reduced post-harvest losses will create additional demand for transportation and storage services in the country.
4. Improved value addition and processing activities will vibrate the rural economy through enhanced income and additional employment, and by creating skilled labor in rural areas. Experience from China and far eastern countries suggest that many of value addition and processing activities in rural areas engage women labor in secured environment.
5. Improved quality of outputs will enhance export-production ratio and average export prices, thus generate additional foreign exchange from the export or save foreign exchange being spent on imports.
6. The demand for equipment and machine to be used in value addition and processing activities may help to establish the manufacturing industries for these in the country. This will also create employment for skilled and semi-skilled labor in peri-urban areas of the country.
7. The research system will reorient towards resolving the issues of stakeholders at the cluster level, which will be a big asset to sustain and enhance growth in the agriculture sector.
8. The extension system will also shift from generalized extension to specialized extension and will have experience to engage the private sector in implementing the specialized extension activities.
9. A large number of trainers will be trained under ATP to help farmers in identifying and resolving their issues. This force can be utilized to continue the rural transformation process even after the first phase of ATP is completed.

10. The collaboration with international research and development organizations and inter and intra-institute collaboration within the country will be enhanced to resolve stakeholders' issues which will be an asset to further innovation process into the future.
11. The improved links of traders with international markets will help to quickly adjust the quality of exports according to the changing demands of the importers.

# 5. AGRICULTURAL COMMODITY UPGRADATION PLAN

In the following pages, brief summaries of each commodity report are presented. The performance of each commodity at national level in comparison with international level in terms of trends in area, production, per ha yields and international trade are presented. In the summary reports, cluster of each commodity are prescribed and major constraints to compete in each commodity value chain in national and international markets are identified. Then major strategies and policies to overcome these constraints are suggested. The investment requirements at various segments of the value chain to overcome these strategies are quantified, and socioeconomic viabilities of these investments are estimated. These investments and resource requirements, their returns, and socioeconomic viabilities at each cluster levels are summarized in a 'Summary Sheet' at the end of each commodity report.

# 1. Almond

Almond production in Pakistan is found to plummet at a rate of 1.6% per annum during 2001-16 mainly because of the deterioration in its productivity, although area also disappeared in KP. This resulted in increasing imports, and the trade deficit in almond of the country has ballooned over the period. On the other hand, globally both area and per ha yield is on the rise indicating Pakistan's deteriorating competitiveness in international almond market. The rising global market of almond which has reached to US$5.17 billion in 2016, however, has created a great opportunity for Pakistan to expand its export.

In Pakistan, almond is grown on 10 thousand has producing 22 thousand tonnes of almond. The Western Balochistan districts of Loralai, Zhob, and Killa Saifullah are recognized as the main almond growing cluster in the country with Loralai as its focal point. After analyzing the end-to-end value chain of almond in the cluster, the foremost challenge identified are:

- Climate change, resulting in serious shortage of irrigation water.
- Policy neglect,
- Low productivity of old gardens
- Archaic garden management
- Poor harvest and post-harvest practices
- Poor capacity of farmers to undertake proper varietal selection and harvesting methods.

The interventions proposed to overcome these constraints and to improve the competitive are:

- Renovation of existing orchards with late blooming high yield varieties;
- Diffusion of improved orchard management practices by mobilizing agri. advisory services;
- Improved value chain by adopting improved fruit picking, grading, sorting, packaging, etc.
- Promoting the installation of almond shelling and oil extraction units, and
- Promote certified nurseries in the cluster,

Indirect system level interventions would be strengthening R&D, and capacity building of stakeholders on harvesting, and post-harvest management. These interventions are estimated to increase per ha yield of renovated gardens by 50%, non-renovated gardens by 10%, and reduce post-harvest losses from 20% to 10%. A total of seven almond shelling units would be required to shell 50% of the total almond produce and one oil extraction plant would be needed to extract oil from 6% additional almonds into processing on modern lines. Six certified nurseries would be required to renovate 25% of the existing gardens with improved late blooming varieties.

Total estimated investment required for the Almond Upgradation Plan in the focal point of the existing cluster in Balochistan is US$9.5 million, out of this 40% is to be borne by the public sector. Net present value of the Almond Upgradation Plan after deducting all costs and investments is positive at US$56 million, whereas the Internal Rate of Returns (IRR) for the Plan is 136% (see attached Summary Sheet). The upgradation plan also includes policy recommendations and strategies to implement to the plan. Strengthening of research, organizing farmers into groups, and capacity building of stakeholders will be the key for the success of the upgradation plan.

## Summary Sheet of Almond Cluster

| Information | Cluster Loralai |
|---|---|
| Area of cluster focal point (ha) | 4,557 |
| Production (Tonnes) | 10,195 |
| Yield of the cluster (tonne/ha) | 2.24 |
| Annual yield growth without intervention (%) | -2.91% |
| Percent area renovated in 5 years | 20% |
| Total orchards areas renovated in 5 years (ha) | 1,139 |
| Increase in yield due to orchards renovated (%) | 50% |
| Increase in production due to orchards renovated (tonnes) | 3,017 |
| Expected additional value of production due to orchards renovated (M. US$) | 6.704 |
| Increase in yield due to improvement in management practices (tonne/ha) | 0.19 |
| Increase in production due to improvement in management practices (tonnes) | 879 |
| Additional value of production due to improved management practices (M. US$) | 1.953 |
| Reduction in post-harvest losses after intervention (%) | 20.0% |
| Increased in production due to reduced post-harvest losses (tonnes) | 1,099 |
| Expected additional value of production due to reduction of losses (M. US$) | 2.442 |
| Additional production that will be processed (%) | 50.00% |
| Production to be processed drying/processing (tonnes) | 2,347 |
| Total volume of palm oil produced (tonnes) | 44 |
| Additional income through enhanced processing (M. US$) | 17.38 |
| Total number of Almond oil units required | 2 |
| Total number of Shelled Almond units required | 7 |
| Total investment required for processing (M. US$) | 1.226 |
| **Investments (M. US$)** | |
| Almond R&D Program | 1.111 |
| Capacity Building of Farmers' Organization for improved management practices | 0.298 |
| Orchard renovation cost-plants and drip irrigation | 4.527 |
| Investments required on establishment of certified almond nurseries | 1.679 |
| Investments required on almond oil processing units | 0.066 |
| Investment on almond shelling | 0.876 |
| Value chain level training | 0.200 |
| Government Loans (One-year interest free) | 0.818 |
| **Total investments** | **9.540** |
| **Source of Investment (M. US$)** | |
| Public Investment (US$ Million) | **3.850** |
| Private Investment (US$ Million) | **5.691** |
| **Overall benefits and rate of return** | |
| Total increase in production due to all the yield increasing interventions (tonnes) | **4,995** |
| Expected additional value of production due to all interventions (M. US$) | **23.428** |
| Additional operational cost due to improvement in value chain during 5th year (M. US$) | **5.390** |
| Total net benefits of all the interventions in 5th year (after offsetting all costs) (M. US$) | **18.038** |
| NPV (M.US$) | **56.311** |
| Internal Rate of Return | **136%** |

# 2. Apple

Pakistan cultivates apple on 95.3 ha and producing 670 thousand tonnes of apples. Despite the good rate of growth in per ha yield and production of apple in Pakistan the country remains uncompetitive in apple value chain in national and international markets as reflected by 58% lower per ha yield than world average, increasing overtime imports, lower export-production ratio and 24% lower export prices than the world average. In 2016-17, although Pakistan exported a small quantity of apple, it remained a net importer by spending US$27.3 million of foreign exchange.

The Balochistan and KP provinces are the main apple producing areas of Pakistan, although Azad Kashmir and GB also contribute considerable volume in national production. On the basis of production data, two main apple growing clusters are identified in Balochistan, i.e., Central Cluster with Quetta as its focal point, and Northern Cluster with Killa Saifullah as its focal point.

The existing apple industry of Pakistan is facing multi-dimensional challenges from production to harvesting and marketing. On production side, water scarcity and low per unit area yield are the main challenges while, on marketing side, value chain and cold chain and processing segments are missing. Moreover, high harvest and post-harvest losses further deteriorate the competitiveness of the apple value chain in the country.

The interventions proposed to overcome these constraints & to enhance the competitive are:

- Renovation of 15% gardens with new varieties and higher plants density with drip irrigation;
- Maintaining high yield growth in Qilla Saifullah and improving yield growth in Central Balochistan cluster on non-renovated gardens through improved management practices;
- Introducing appropriate harvesting and post-harvesting technique;
- Encouraging appropriate value chain infrastructure like collection center & pack-houses;
- Incentivizing apple processing as a cottage industry;

Indirect system level interventions include strengthening the R&D system by establishing Apple R&D Institute at Quetta, organizing the producers into Farmers Entrepreneur Groups (FEGs), training of stakeholders for quality production and value chain management and processing, and establishing certified nurseries. A total of 17 certified nurseries will be needed to provide improved seedling to renovate 15% of the total apple area. Twenty-six collection centers, and 102 pack houses will be needed to improve value chain of all the enhanced production which will substitute imports. Similarly, 38 juice processing units at processing level will be required to process 10% of the total production into juices, and seven chillers will be needed to transport the juice from village to towns where it will be packed, branded & traded.

It is expected that these interventions will increase the per ha yield by 100% on renovated and 30% on non-renovated gardens, reduce post-harvest losses from 30% to 15%, and enhance the value chain of all new production to international level. The total investment needed for the upgradation plan is US$46.5 million which will generate pooled NPV of US$153.7 million. The overall Internal Rate of IRR from both the clusters is to tune of 47.6%. The key of the success of the plan is to strengthen the apple related R&D, formation of FEGs with proper empowerment to resolve the apple related issues at the local level; incentivizing for the establishment of collection center and pack houses and capacity building of stakeholders on value chain management.

***Summary Sheet of Apple Clusters***

| Information | C. Cluster | N. Cluster | Overall |
|---|---|---|---|
| Area of cluster focal point (ha) | 1,471 | 24,950 | 26,421 |
| Production (Tonnes) | 13,312 | 261,975 | 275,287 |
| Yield of the cluster (tonne/ha) | 9.05 | 10.50 | 10.42 |
| Area of the cluster (ha) | 16,859 | 34,790 | 51,649 |
| Production of the cluster (tonne) | 155,007 | 332,144 | 487,151 |
| Annual yield growth without intervention (%) | 4.90% | 1.83% | |
| Total apple orchards areas renovated in 5 years (ha) | 221 | 3,743 | 3,963 |
| Increase in production due to orchards renovated (tonnes) | 2,921 | 45,417 | 48,338 |
| Additional production value - orchards renovated (M. US$) | 1.545 | 24.025 | 25.570 |
| Increase in yield - improved management practices (tonne/ha) | 3.97 | 1.82 | 2.90 |
| Increase in production -improved management practices (tonnes) | 5,843 | 45,417 | 51,260 |
| Additional production value-improved practices (M. US$) | 3.090 | 24.025 | 27.116 |
| Increased in production - reduced post-harvest losses (tonnes) | 3,442 | 52,045 | 55,486 |
| Additional production value from reduced losses (M. US$) | 1.820 | 27.531 | 29.352 |
| Production to be processed drying/processing (tonnes) | 2,639 | 19,950 | 22589 |
| Total volume of apple juice produced (tonnes) | 1,885 | 14,250 | 16,135 |
| Additional income from juice processing (M. US$) | 2.262 | 17.100 | 19.362 |
| Present expected apple imports without intervention (tonnes) | - | 39,675 | 39,675 |
| Import substitution in 5$^{th}$ year (% of total production) | 47.83% | 35.29% | 36.03% |
| Import substitution on fifth year (tonnes) | 12,206 | 142,878 | 155,084 |
| Value of import substitution on the 5$^{th}$ year (M. US$) | 106.799 | 98.453 | 205.251 |
| Total cottage level juice making units required | 5 | 33 | 38 |
| Total number of certified nurseries required | 1 | 16 | **17** |
| Total collection centers required | 1 | 25 | 26 |
| Total pack-houses required | 8 | 94 | 102 |
| **Investments (M. US$)** | | | |
| Improving research infrastructure and operation | 0.500 | 0.500 | 1.000 |
| Capacity Building and FEGs for improved practices | 0.054 | 0.924 | 0.979 |
| Investments required on orchard renovation | 1.221 | 20.711 | 21.932 |
| Investment required on certified nursery establishment | 0.028 | 0.468 | 0.496 |
| Investments on establishing CC and FEGs | 0.074 | 1.852 | 1.926 |
| Investments required on pack house | 1.281 | 15.057 | 16.338 |
| Investments on processing/juice making interventions | 0.241 | 1.590 | 1.831 |
| Government loans on private investment | 0.167 | 1.831 | 1.999 |
| **Total investment required over five year** | **3.567** | **42.934** | **46.501** |
| Total public sector investments | 1.291 | 11.191 | 12.482 |
| Total private sector investment | 2.276 | 31.743 | 34.019 |
| **Overall benefits and rate of return (M. US$)** | | | |
| Increased production from all interventions (tonnes) | 12,206 | 142,878 | 155,084 |
| Additional production value due to all interventions | 6.457 | 75.582 | 82.039 |
| Gross revenue due to all intervention in 8th year | 12.967 | 142.404 | 155.371 |
| Operational cost due to all interventions | 4.541 | 57.623 | 62.165 |
| Net cash flow | 8.425 | 84.781 | 93.206 |
| NPV | 16.96 | 136.77 | 153.74 |
| Internal Rate of Return | 71.02% | 45.95% | 47.63% |

# 3. Apricot

In Pakistan, apricot is cultivated on 42 thousand ha which produce 302 thousand tonnes of apricot (including the production from GB) with an average yield of 7.2 tonnes per ha compared to its global production of 4.2 million tonnes in 2017 on an area of 0.5 million ha with an average yield of 7.7 tonnes per ha.

Pakistan seems to be losing its comparative as well as competitive position compared to the world market while its apricot production during 2001-17 has been growing at a rate of only 1.0% per annum compared to 2.5% at the global level. Due to the slow growth in production, Pakistan's rank in the world apricot producing countries has slipped from 5$^{th}$ position in 2001 to 6$^{th}$ in 2017. Moreover, as growth in per ha yield in apricot is insignificant in Pakistan compared to over 1.2% growth in the world average yield, Pakistan's has also significantly lost its competitive position. In addition, Pakistan did not benefit from the fast-expanding international apricot market which has reached to US$0.8 billion in 2017. Its export price is 30% lower than the world export price for apricot suggesting issues in the apricot value chain.

GB and Balochistan are the main apricot growing regions in Pakistan. Two apricot growing clusters are identified in this study for detailed analysis: These are: i) Northern GB cluster with Skardu as focal point, and ii) southern Balochistan clusters with Killa Saifullah as its focal point. Several performance gaps in the value chain of apricot specifically in the technology, market structure and availability of inputs included lack of improved commercial apricot cultivars, high postharvest losses, lack of good quality processing and packaging technologies, and absence of international standards for export.

Specific interventions have been proposed to narrow these gaps which include:

- Renovations of old gardens on 30% of the existing area
- Incentivizing of processing infrastructure to reduce pot-harvest losses, and
- Improved quality management of processed apricot.

The indirect interventions include strengthening of research and capacity building of stakeholders on quality management during and after harvesting and processing. Currently, only 5% of the production is mechanically dried which is proposed to enhance to 50%. This is important to reduce post-harvest losses. For this purpose, 372 mechanical sun-drier needs to be established in both the clusters.

These interventions are expected to increase per ha yield of renovated gardens by 50% and save 50% post-harvest losses. The total investment needed for the apricot upgradation plan is US$ 26.8million, about 42% of which will be borne by the government. This will generate pooled NPV of US$26.8 million, and overall Internal Rate of IRR from both the clusters of 22.7%. See Summary Sheet attached for the detailed intervention impacts and economic analysis of the upgradation plan for the focal point of each cluster. The key of the success of the plan is to strengthen the apple related R&D, incentivizing the mechanical driers, and capacity building of stakeholders on value chain management.

**Summary Sheet of Apricot cluster**

| Parameter | GB | Balochistan | Overall |
|---|---|---|---|
| Area of cluster focal point (ha) | 944 | 15278 | 16222 |
| Production focal point (tonnes) | 10328 | 104570 | 114898 |
| Yield of the cluster focal point (tonne/ha) | 10.9 | 6.8 | 7.1 |
| Area of the cluster (ha) | 12,750 | 15,278 | 28,028 |
| Production of the cluster (tonnes) | 15,230 | 104,570 | 119,800 |
| Yield of the cluster (tonne/ha) | 6.86 | 6.84 | 4.27 |
| Annual yield growth without intervention (%) | 0.13% | 0.08% | 0.11% |
| Percent area renovated in 4 years | 30% | 30% | 30.00% |
| Total orchards areas renovated in 5 years (ha) | 666 | 4,583 | 5,250 |
| Increase in yield due to orchards renovated (%) | 50% | 50% | 50.00% |
| Added production due to orchards renovation (tonnes) | 267 | 1,833 | 2,100 |
| Additional value of production - orchards renovation (US$) | 106,608 | 826,845 | 933,453 |
| Raw production to be dried for high-end domestic and export markets (tonne) | 6,982 | 30,881 | 37,864 |
| Dried apricot produced (tonne) | 1,164 | 5,147 | 6,311 |
| Dried apricot to be exported (tonne) | 116 | 515 | 631 |
| Revenue from dried apricots in premium domestic market (US$) | 3,782,103 | 12,867,181 | 15,194,629 |
| Revenue from the export of dried apricots (US$) | 58,186 | 12,867,181 | 12,925,367 |
| Total number of dryers required | 68 | 304 | **372** |
| Total investment on processing (US$) | 1217956 | 5444978 | 6662933 |
| **Investments (000 US$)** | | | |
| Strengthening of research (US$) | 500.0 | 500.0 | 1000.0 |
| Capacity Building for improved management (US$) | 32.9 | 32.9 | 65.8 |
| Renovation of existing orchard area (US$) | 2332.1 | 16041.9 | 18374.0 |
| Investment on drying units | 1218.0 | 5445.0 | 6662.9 |
| Government loans on private investment | 134.0 | 598.9 | 732.9 |
| **Total investment required year (US$)** | **4216.9** | **22618.7** | **26835.6** |
| Public sector investments, including loans and subsidies | 1554.6 | 6362.0 | 7916.6 |
| Total private sector investment | 3298.5 | 19596.8 | 22895.3 |
| Production level investments | 1376.9 | 5429.2 | 6806.1 |
| Processing level investments | 2840.0 | 17189.5 | 20029.5 |
| **Overall benefits and rate of return (000 US$)** | | | |
| **Total increase in production due to all the yield increasing interventions (tonnes)** | **267** | **1,833** | **2,100** |
| **Expected additional value of production due to all interventions (000 US$)** | **2,492** | **13,951** | **16,444** |
| **Total operational costs (000 US$)** | **771** | **3,448** | **4,219** |
| **Net cash flow after deducting all costs (000 US$)** | **1,721** | **10,503** | **12,225** |
| **NPV (000 US$)** | **1,878** | **12,152** | **14,030** |
| **Internal Rate of Return** | **22.2%** | **22.8%** | **22.7%** |

# 4. Banana

Banana in Pakistan is produced on about 30 thousand ha supply about 135 thousand tonnes of banana production compared to the global banana production of 114 million tonnes from 5.6 million ha. Pakistan is losing its competitiveness in the international market as its area under cultivation and per ha yield both are on declining trend. As a result, per capita consumption and exports of banana are also on the declining. Pakistan gets only 22% of the world average yield in banana while its exports get 86% of the world average export price. Since 2001, the global export of banana is expanding at an annual rate of 6.5% per annum (in value terms), and Pakistan did not benefit from this global expanding market as its export-production ratio remained lower than the world average, despite the fact that exporters can purchase banana from farmers at a lower farmgate prices than the world average.

Central & lower Sindh with Thatta as its focal point and Upper Sindh with Khairpur as its focal points are identified as the main banana growing clusters in Pakistan. Several performance gaps in the production, processing and trading components of the value chain, specifically with the technology, market structure and availability of inputs include the lack of improved banana germplasm, commercial cultivars to produce high quality marketable fruit and the absence of packaging, commercial tissue culture labs, cold storage and refrigerated transport for trading in the high-value fresh banana market.

Following interventions along the banana value chain have been proposed to narrow these gaps:

- Renovate the 20% of the existing area with the introduction of latest high-yielding banana varieties and high-density plantation;
- Improved management practices through enhanced capacity of producers
- Disease free and tissue culture-based plantation;
- Establishing collection centers with along with mobile pack-houses.

The indirect interventions include strengthening the research and extensions system, capacity building of stakeholders especially producers to manage the quality value chain, and linking stakeholders with international markets. Three tissue culture labs would be required to renovate the 20% existing area with modern plantation. A total of 16 banana making units will be required to process one percent of banana into chips, and 23 collection centers with basic value chain facilities would be required to pass through 50% of the total banana production to be exported and 10% of the production destined for high-end domestic market. It is expected that with the direct and indirect interventions, the per ha yield on renovated gardens will increase by 100%, and on the remaining gardens by 50% due to improved management practices. Post-harvest losses will be reduced from 30% to 10%, and export-production ratio will be enhanced from 28% to 50%. Moreover, average export prices will be improved by 16%.

Total investments required for the banana upgradation plan in both the clusters would be US$11.45 million, 42% of which will be borne by the government. The estimated discounted NPV over the period of seven years is US$11.0 million which will produce 42.2% overall Internal Rate of Return (IRR) for the focal points of both the clusters. See below attached Summary Sheet for the intervention impacts and economic analysis for focal point of each cluster.

**Summary Sheet of Banana**

| | C. Lower Sindh | Upper Sindh | Total |
|---|---|---|---|
| Area under cultivation in focal point (ha) | 5,176 | 5,161 | 10,337 |
| Total Production (tonnes) | 20,229 | 22,064 | 42,293 |
| Yield (tonne/ha) | 3.91 | 4.28 | 4.09 |
| Area of the cluster (ha) | 17120 | 7680 | 24,800 |
| Production of the cluster (tonne) | 63190 | 33200 | 96,390 |
| Area on which orchards would be renovated per year | 1,553 | 1,032 | |
| Additional production from renovated gardens (tonnes) | 1,168 | 854 | 2,022 |
| Expected returns from renovated garden in 7th year (US$) | 524,315 | 383,359 | 907,674 |
| Additional production from improved practices (tonnes) | 9,731 | 10,673 | 20,404 |
| Additional value from improved practices in 7th year (US$) | 3,191,821 | 3,500,608 | 6,692,429 |
| Enhanced production due to reduced post-harvest losses (tonnes) | 6,072 | 6,574 | 12,647 |
| Additional value from reduction of losses in 7th year (US$) | 1,991,696 | 2,156,375 | 4,148,071 |
| Production to be processed (tonnes) | 364.3 | 788.9 | 1,153.3 |
| Total volume of chips produced (tonnes) | 72.9 | 157.8 | 230.7 |
| Expected additional value of Chips In 7th year (US$) | 437,202 | 946,701 | 1,383,903 |
| Total expected volume of to be exported in 7th year (tonne) | 8,088 | 8,757 | 16,845 |
| Increase in Exports in 7th year (US$) | 978,676 | 1,059,595 | 2,038,271 |
| Domestic production to receive improved VC operation (tonnes) | 911 | 986 | 1,897 |
| Increase in value due to value chain improvement in 7th year both in domestic and international market (US$) | 749,145 | 811,086 | 1,560,231 |
| Banana chips making units | 6 | 10 | 16 |
| Tissue culture labs | | | 3 |
| Collection Centers | 9 | 14 | 23 |
| **Investments (000US$)** | | | |
| Investments required on strengthening research | 740.7 | 740.7 | 1481.5 |
| Investment on capacity building of stakeholders | 547.7 | 546.1 | 1093.9 |
| Investments required on orchard renovation | 1886.4 | 1253.9 | 3140.3 |
| Tissue culture lab establishment costs | 132.0 | 132.0 | 264.0 |
| Investments required on processing level interventions | 177.8 | 296.3 | 474.1 |
| Investments on collection centers | 1698.4 | 2642.0 | 4340.4 |
| Linking stakeholders with markets, e-commerce platform, etc. | 50.0 | 50.0 | 100.0 |
| Government loans | 215.8 | 337.9 | 553.7 |
| **Total investments** | **5448.7** | **5998.9** | **11447.7** |
| Public Investment (US$ Million) | 2.293 | 2.500 | 4.793 |
| Private Investment (US$ Million) | 3.156 | 3.499 | 6.655 |
| **Economic Analysis** | | | |
| **Gross revenue from all Interventions in 7th year (US$)** | **7,872,854** | **8,857,725** | **16,730,579** |
| **Value Chain Operational Costs in Year 7 (US$)** | **3,879,685** | **4,344,812** | **8,224,497** |
| **Net cash flow after deducting all in 7th year (US$)** | **3,993,169** | **4,464,195** | **8,457,365** |
| **NPV (US$)** | **5,562,461** | **5,437,980** | **11,000,441** |
| **IRR** | **45.9%** | **39.0%** | **42.2%** |

# 5. Barely

In Pakistan, barley is cultivated on an area of about 60 thousand ha with a production of 57.9 thousand tonnes giving less than one third of the world average yield. Internationally, around 141 million tonnes of barley is produced from 48 million ha. In the backdrop of international stagnation in barley production, Pakistan's production is on the steep decline suggesting country's consistent deterioration in its relative position in world barley production. Moreover, the continuous decline in barley yield also affected its competitiveness in international market. As a result, the country has turned from an exporter to an importer of barley currently costing US$11.75 million in 2016-17, and the imports are on the steep rise. The producers' prices of the barley grains are higher than the world average suggesting that its local production is no more competitive internationally. Moreover, it does not meet the quality standards for processing thus very little production goes into the processing compared to an increasing global trend for barley processing.

Barley production in Pakistan is concentrated in Punjab and Balochistan each contributing over one third of the barley area and production of the country. Layyah and Muzaffargarh districts in Punjab and Turbat and Awaran districts in Balochistan are the two main barley clusters. Performance gaps in barley production, market, and processing components of value chain are:

- Lack of improved cultivars specially to meet the processing requirements;
- Use of primitive production technology in production, and
- Disconnect between barley producers, traders, and processors.

In order to address multilevel challenges from production to product, suggested interventions are:

- Increasing 100% yield on 50% of the current barley area by introducing latest high-yielding 2-row barley varieties and management practices;
- Incentivizing private sector to invest in barley processing sector to channel 10% of barley production into barley porridge and flour; and
- Improving value chain of barley to compete its quality with the imported barley.

Indirect interventions include strengthening the existing barley research programs, capacity building of farmers to produce quality barley, and linking barley producers and traders with Murree Brewery so that 90% of barley produce can be channeled into barley brewery. A total of 12 processing units would be required to process 10% of barley into porridge and barley powder in the focal points of both the clusters.

The total estimated investment of this cluster development/upgradation plan is US$0.89 million for both the clusters focal points. Out of the total investment, however, the major investment of 93.5% will come from the public sector in terms of strengthening the R&D system, and providing incentives to promote processing technologies in barley clusters. The discounted Net Present Value (NPV) over the project period after discounting all costs is estimated at US$0.395 million while the average Internal Rate of Return (IRR) is 29% for the focal points of both the clusters (See attached Summary Sheet for cluster focal point and activity-based investment and economic analysis).

**Summary Sheet of Barley Cluster**

| Information | Punjab | Balochistan | Total |
|---|---|---|---|
| Area under cultivation in barley focal point (ha) | 6,400 | 4,000 | 10,400 |
| Total barley Production of focal point district (tonnes) | 5,600 | 4,500 | 10,100 |
| Default yield (tonne/ha) | 0.88 | 1.13 | 0.97 |
| Area of the cluster (ha) | 14200 | 7400 | 21,600 |
| Production of the cluster (tonnes) | 11800 | 9100 | 20,900 |
| Additional production from improved varieties in 5th year (tonnes) | 2,690 | 1,604 | 4,293 |
| Additional value from improved varieties in 5th year (US$) | 618,609 | 368,887 | 987,496 |
| Production through improved value chain in 5th year (tonnes) | 3765 | 2495 | 6,260 |
| Value of the improved value chain in 5th year (US$) | 161,914 | 107,280 | 269,194 |
| Percentage of production for processing | 10% | 10% | 10% |
| Raw production of barley used in processing in 5th year (tonnes) | 269.0 | 160.4 | 429 |
| Barley porridge production in subsequent years (tonnes) | 147.9 | 88.2 | 236 |
| Additional value from barley porridge (US$) | 164,365 | 98,014 | 262,378 |
| Total barley flour production (tonnes) | 126.4 | 75.4 | 202 |
| Additional value from Barley flour (US$) | 93,638 | 55,838 | 149,476 |
| Total Value from increased barley flour processing (US$) | 258,003 | 153,852 | 411,854 |
| Barley Porridge Production Units required | 7 | 5 | 12 |
| **Investments (000 US$)** | | | |
| Investment on R&D establishment | 200.0 | 150.0 | 350.0 |
| Investments required on extension services | 100.0 | 70.0 | 170.0 |
| Investments required on stakeholder interaction | 140.0 | 140.0 | 280.0 |
| Investment on processing | 48.0 | 34.3 | 82.2 |
| Loans on processing infrastructure | 5.5 | 3.9 | 9.5 |
| Total investments | 493.5 | 394.3 | 8877.2 |
| **Source of Investment** | | | |
| Public Investment (US$ Million) | 0.455 | 0.371 | 0.826 |
| Private Investment (US$ Million) | 0.038 | 0.027 | 0.066 |
| **Economic Analysis** | | | |
| Gross revenue of all interventions (US$ Million) | 1.039 | 630.0 | 1668.5 |
| Total operational cost during the 5th year (US$ Million) | 0.635 | 345.5 | 980.1 |
| Net cash flow during the 5th year (US$ Million) | 0.404 | 284.5 | 688.5 |
| NPV (US$) | 0.256 | 138.9 | 394.7 |
| **IRR** | **33%** | **25%** | **29%** |

# 6. Basmati Rice

Fine quality basmati rice varieties exhibiting special features of elongated grain, fragrance and light delicious taste are popular from the Pak-Punjab '*Kalar*' tract. The annual growth trend in area, production and yield of basmati rice during 2000-17 in Punjab are (-) 0.54, 0.60 and 1.14 percent, respectively. Despite significant improvement in per ha yield during the 2000s, Pakistan has lost its competitiveness edge in basmati as indicated by its plummeting shares in total basmati export from 46% in 2006 to less than 10% in 2017, which was conveniently picked up by its competitor India. This declining competitiveness is due to number of factors that favored India than Pakistan during the period including stronger technological innovations which gave higher productivity growth in basmati that have more elongated kernel size without aroma, lower production costs due to high input subsidies, aggressive marketing tactics, and show casing of cooked dishes like 'Biriyani' instead of 'Murgh Palao', etc.

Two clusters for basmati rice can be clearly identified: i) *Katcha* (polished) rice-Cluster-I supplying white rice with its focal district of Sheikhupura; and ii) Pacca (*Saila*) rice-Cluster-II supplying parboiled rice with focal district of Hafizabad. Major performance gaps in production, marketing and processing components of value chain in these clusters include:

- Fast loosing competitiveness due to slow technological innovations in all component of the value chain from production, marketing and processing;
- Low yield due to low potential of old basmati varieties and poor management practices;
- Shortage of planting labor;
- Infection of aflatoxin on basmati grains during harvesting and post-harvest storage;
- Narrow diversification of basmati products; and
- Low efficiency in Saila processing technologies.

Six interventions are suggested to improve the efficiency of basmati value chain and enhance its competitiveness which include: i) gradual shifting to mechanical rice transplanting on 15% of the basmati area --- needed for increasing plant population which is expected to increase per ha yield by 15%; ii) diffusion of high yielding varieties in the area --- needed to replace the low-yielding varieties like basmati-386, Supra, Supri etc. which is expected to increase yield by 7-20%; iii) introducing improved crop management practices which will further enhance yield by 7%; iv) shifting to rice combine harvesters --- needed to control harvest losses from 13% to 7% and address the problem of burning of rice straw; v) introduction of paddy drying at farm level --- to improve the quality of paddy and its byproducts; vi) converting 90% of rice barn into bran oil in cluster-I and increasing production of parboiled/Saila rice from 50% to 80% in cluster-II --- to diversify rice value chain as well as addressing increasing demand of Saila rice in Pakistan and abroad. For these interventions, 3605 transplanters, 1352 combined rice harvesters, 590 mechanical sun-driers would be required in both clusters, and 3 bran oil plants would be needed in Cluster-I.

These Interventions would require US$73.8 million for both the clusters, which will generate an overall NPV of US$16.1 and an IRR of 28% for both the clusters. The activity-wise investment and cluster level economic analysis can be seen in the attached Summary Sheet below.

**Summary Sheet of Basmati Rice**

| Information | Basmati-Katcha | Basmati-Saila | Overall |
|---|---|---|---|
| Area of the cluster (ha) | 472.77 | 203.55 | 676320 |
| Production of the cluster (tonne) | 832.93 | 406.98 | 1239910 |
| Yield of the cluster (kg/ha) | 1761.8 | 2042.9 | 1833.3 |
| Area of cluster focal point (ha) | 158,230 | 104,410 | 262,640.0 |
| Production of the focal point (Tonnes) | 289,840 | 213,300 | 503,140.0 |
| Yield of the focal point (tonne/ha) | 23.48 | 21.4 | 44.8 |
| Yield increase due to mechanization in planting (tonne/ha) | 0.29 | 0.32 | 0.6 |
| Added production from mechanized planting (tonnes) | 11503 | 8466 | 19,969.5 |
| Additional value due to mechanized planting (M. US$) | 4.34 | 4 | 7.9 |
| Additional production due to improved varieties (tonnes) | 10736 | 27,090 | 37,827 |
| Additional production value - improved varieties (M. US$) | 4.05 | 11.5 | 15.6 |
| Additional production – Improved management practice (tonnes) | 21473 | 22,575 | 44,049 |
| Additional production value – improved practices (M. US$) | 8.10 | 10 | 17.7 |
| Enhanced production (saved)- reduced PH losses (tonnes) | 22431 | 18,169 | 40,599 |
| Additional production value – reduced PH losses (M. US$) | 8.46 | 12.72 | 21.2 |
| Added value of production from improved quality (M. US$) | 15.57 | 14 | 29.8 |
| Additional value from bran oil (M. US$) | 0.52 | 5.6 | 6.1 |
| Number of transplanter required | 2172 | 1433 | **3,605** |
| Harvester required | 814.6 | 537.5 | **1,352.1** |
| Dryer required | 348 | 242 | **590** |
| Processing unit required for rice bran oil | 3.0 | | 3.0 |
| Investment on strengthening Basmati research (Mill US$) | 1.852 | 1.852 | 3.704 |
| Investments on mechanical transplanter (Mil US$) | 13.033 | 8.600 | 21.633 |
| Farmers training for good practices (Million US$) | 0.484 | 0.361 | 0.845 |
| Investment on driers (Million US$) | 6.265 | 4.350 | 10.615 |
| Investment on combined rice harvester (Million US$) | 15.477 | 10.213 | 25.690 |
| Investment on new installing Saila rice plant (Million US$) | | 1.107 | 1.107 |
| Investment on bran oil extraction (Million US$) | 0.202 | | 0.202 |
| Investment on organizing FEGs with collection centers (M. US$) | 1.500 | 1.000 | 2.500 |
| Investment on strengthening international links (M. US$) | 0.500 | 0.500 | 1.000 |
| Government loans (M. US$) | 3.847 | 2.670 | 6.517 |
| **Total Investment** | **43.2** | **30.7** | **73.8** |
| Public sector investment (M. US$) | 15.2 | 11.2 | 26.4 |
| Private sector investment (M. US$) | 28.0 | 19.4 | 47.4 |
| Increase in production from all interventions (exportable)(tonnes) | 66144 | 76300 | 142,445 |
| Value of increased production at international prices (M. US$) | 72.8 | 83.9 | 156.7 |
| Gross revenue from all Interventions (US$) | 48.6 | 57.3 | 105.9 |
| Total operational costs of the Interventions (Million US$) | 22.0 | 30.1 | 52.2 |
| Net cash flow from all interventions (M. US$) | 26.58 | 27.13 | 53.71 |
| **NPV (M.US$)** | 6.6 | 9.5 | 16.1 |
| **Internal Rate of Return (%)** | 23.7% | 32.8% | 28% |

# 7. Beef

Pakistan is one of the largest beef producing countries of the world by slaughtering about 12 million animals and producing 1.88 million metric tonnes of beef annually which claims about 2.89% share in the total world beef production of US$ 270 billion. The major buffalo beef countries are India, Pakistan and China, while major cattle beef producing countries are USA, Brazil and China.

While animal slaughtered and beef production in the country are growing at a quite high rate of over 4% per annum, the country has performed very poorly in the international market. Great opportunities in the beef sector are emerging in the domestic and international markets as beef prices in these markets remained largely high and increasing overtime. In addition, the value of beef, beef related products and large ruminant live animal exports internationally have reached to over US$40 billion and growing at an annual rate of 8% per annum during 2008-17. Pakistan can benefit from its geographical proximity with big beef market like China where, relatively low-price beef is demanded. However, Pakistani share in the world beef market valued at US$70 billion remained less than 0.1%, its exports only 0.2% of its production while globally 9% of the production is traded, and its beef export price is only 70% of the world average. Moreover, the country is generally uncompetitive in international market because of its higher farmgate prices than the world average and its lower beef value chain development as suggested by lower export prices than the world average.

Three main beef producing clusters are: 1. South Eastern Punjab and North Western Sindh with Rahim Yar Khan as its focal point, 2. Southern Western Sindh with Umarkot as its focal point, and 3. Western Punjab with Bhakkar as its focal point. Several performance gaps and constraints in the production, processing and trading components of the beef value chain in these clusters are:

- High mortality of calves;
- Poor growth rate of animals;
- Insufficient monitoring and control mechanism for FMD;
- Inefficient marketing channels;
- Lack of cold chain infrastructure for trading the beef to high end markets;
- Ineffective research & development on beef value chain without involving the private sector;
- On the export side the beef sector faces irregular supply, lack of traceability and halal branding, inability to tailor the supply to market demands, and poor market linkages; and
- On environment side, the beef production may not only be a threat for the environment but poor regulatory framework is also impacting the health of the people and restricting its export.

In order to address these challenges policies, following interventions are suggested to enhance the competitiveness of the beef sector:

- Reduce calf mortality from 20% to 5% by promoting efficient feeding practices,
- Improving the growth rate of animals from the current rate of 192 g/day to 516 g/day with improved animal management practices.

- Enhanced export-production ratio from 0.2% to 10% through improved value chain like modernized slaughtering and linking stakeholders with markets.
- Improved quality of beef for domestic and international markets by improved value chain.

The indirect interventions include reforming the current regulatory framework covering the laws related to food safety & quality, pricing & taxation and investment; strengthening of output oriented research in beef value chain; organization of stakeholders and provision of training to produce quality beef and manage its value chain efficiently; efficient management of FMD with proper monitoring and control mechanism in place, and strengthening linkages of stakeholders with national and international markets.

A total of 683 calf fattening units, 346 village level small feed mills, 89 village level small but modernized slaughter houses, and 12 modernized cattle markets would be required to efficiently implement the beef upgradation plan in the focal points of all the three clusters.

All direct and indirect interventions would need a total of US$57.2 million, out of which 40% would come from the public sector It is estimated that these cluster interventions will require a total of US$57.22 million investment spent over five-year project period. About 40% of this investment will come from the public sector in terms of strengthening the beef value chain research, capacity building of stakeholders to follow good animal management practices and handle quality beef value chain, incentivizing the value chain and processing infrastructure like calf fattening units, modernized abattoirs, establishing the feed mills, and modernize the cattle markets, and providing interest free loans for the first year of establishing these infrastructures. These investments will encourage the private sector to bring the remaining 60% investment to upgrade the beef value chain at the focal points of beef clusters.

The project will generate a Net Present Value (NPV) of US$244 million after deducting all costs over the five-year project period and an overall Internal Rate of Return (IRR) of 123% in all the focal points of the three clusters. The cluster level information on activity wise investment, its impact, and economic analysis can be seen in the attached Summary Sheet attached below.

The keys for the success of the cluster development upgradation plan are the organization of stakeholders at local level to resolve the production, processing, and marketing issues in groups on daily basis, establishment of a vibrant beef research system with the involvement of the private sector to resolve issues along the value chain, and capacity building of stakeholders to produce and manage the quality beef. Enforcing regulations related to beef quality would also be critical to ensure consumers the quality they demand.

**Summary Sheet of Beef cluster**

| Item | Cluster 1 | Cluster 2 | Cluster 3 | Overall |
|---|---|---|---|---|
| Animals for slaughter in the focal point (No.) | 403,407 | 146,538 | 164,366 | 714,311 |
| Production of beef (tonnes) | 32,908 | 11,954 | 13,408 | 58,270 |
| Default Beef yield per animal per day (gm) | 192.49 | 192.49 | 192.49 | 577 |
| Number of calves saved after intervention | 125,056 | 95,749 | 67,888 | 220,805 |
| Gain in weight of saved calves (tonne) | 13,819 | 10,580 | 7,909 | 24,399 |
| Additional value from saved calves (M. US$) | 38.488 | 29.469 | 22.028 | 33.978 |
| Additional production from enhanced yield (tonne) | 17,713 | 10,952 | 8,181 | 14,333 |
| Additional value from increased yield (M. US$) | 49.335 | 30.503 | 22.787 | 79.837 |
| Total additional volume of to be exported (tonnes) | 6,612 | 3,389 | 3,012 | |
| Additional value from enhanced exports (M. US$) | 27.770 | 14.236 | 12.649 | |
| Additional value from improved value chain-export (M. US$) | 6.142 | 3.149 | 2.798 | |
| Quantity produced for high-end domestic market (tonne) | 2,699 | 1,383 | 1,229 | 5311 |
| Revenue from value addition-domestic market (M. US$) | 8.476 | 2.388 | 2.122 | 12.985 |
| Animal fattening units required | 333 | 205 | 145 | 683 |
| No. of animals to be fattened | 256218 | 156939 | 176806 | 589962 |
| Feed mill required to feed fattening (No.) | 167 | 106 | 36 | 302 |
| No. of animals to be slaughtered in modern abattoirs | 130574 | 220291 | 12422 | 363288 |
| No. of Slaughter houses required | 22 | 37 | 30 | 89 |
| Modernized cattle markets (number) | 5 | 2 | 5 | 12 |
| **Investment (M. US$)** | | | | |
| Investments on research strengthening | 2.593 | 2.593 | 0.000 | 5.185 |
| Investment on capacity building of stakeholders | 5.185 | 8.392 | 8.392 | 21.969 |
| Investment on calf fattening unit | 3.441 | 3.441 | 3.441 | 10.323 |
| Investment on village level feed mills | 0.593 | 0.593 | 0.593 | 1.778 |
| Investment on village level modern slaughter houses | 2.460 | 4.138 | 3.362 | 9.960 |
| Investments on establishment of cattle markets | 7.778 | 3.333 | 7.778 | 18.889 |
| Investment on export promotion | 0.050 | 0.050 | 0.050 | 0.150 |
| Interest free loans for one year | 0.747 | 0.940 | 0.850 | 2.537 |
| Total investments | 22.88 | 17.09 | 17.26 | 57.22 |
| **Economic Analysis (M. US$)** | | | | |
| Total increase in production (tonnes) | 31,532 | 21,532 | 16,090 | 38,732 |
| Increase in gross revenue (undiscounted) in 5th year | 130.211 | 79.743 | 62.384 | 272.338 |
| Increase in operational costs | 77.431 | 44.792 | 35.024 | 157.247 |
| Net cash flow after deducting all costs during the 5th year | 52.780 | 34.951 | 27.360 | 115.091 |
| NPV | 79.148 | 45.794 | 32.749 | 244.086 |
| Internal Rate of Return (%) | 143.11% | 111.53% | 103.23% | 123.00% |

# 8. Brinjal

The total area under brinjal cultivation in Pakistan is 8.48 thousand ha with production of 84.69 thousand tonnes and average yield of 10 t/ha as compared to globally brinjal area of 1.8 million ha producing over 50 million tonnes of brinjal annually with an average yield of 28.6 tonne per ha. Pakistan is losing its position in the world brinjal market as its production and productivity has been stagnated while the world brinjal production is growing at 2.8% per annum because of the improvement in its productivity as well as area under brinjal cultivation. Therefore, Pakistan has left far behind the world in terms of per ha yield of brinjal. It is producing only one third of the world average per ha yield and only 2% of the top world brinjal producing countries. Pakistan is not contributing anything in the brinjal export market despite its farmgate price is far lower than the world average.

Brinjal cultivation in Pakistan is relatively scattered throughout the country, although only Punjab province contributes 53% in brinjal area and 65% in its total production of the country. Two main brinjal growing cluster in Punjab are: Central Punjab Cluster with Faisalabad as its focal point, and Southern Punjab Cluster with Rahim Yar Khan district as its focal point. Several performance gaps in brinjal production and marketing are.

- Lack of improved cultivars;
- Primitive production technology;
- High pest pressure and low quality of the produce.

Specific interventions suggested to achieve narrow these gaps include:

- Improvement in management practices;
- Area to be brought under insect net to save the crop from borers infestation and free from insecticide sprays; and
- Improvement in the value chain by setting pack houses in each cluster.

By improving the management practices, it is expected to increase brinjal per ha yield by 20% in open fields, and 40% in fields under net, and increase its price to the international level due to improvement in value chain. To pass the 10% of the total produce for domestic high-end market, eight pack houses would be required to be established in the focal points of both clusters.

The total estimated investment of this cluster development/upgradation plan is $1.79 million for both the clusters. About 65% of the investment will have to be shoulder by the government in terms of strengthening brinjal research, improving extension services and capacity building of producers, incentivizing the establishment of pack houses, and providing loans to establish these pack-houses. Accounting for all the yearly value chain costs including the production, value addition and marketing costs applied over five years, the pooled Internal Rate of Return (IRR) for both the clusters is 23%. The Net Present Value (NPV) for both the clusters is positive at US$0.22 million. The activity wise break down of investment and economic analysis at cluster level can be seen in the attached Summary Sheet below.

**Summary Sheet of Brinjal cluster**

| Information | South Punjab | Central Punjab | Overall |
|---|---|---|---|
| Area of the cluster (ha) | 1426 | 1655 | 3081 |
| Production of the cluster (tonne) | 17003 | 20881 | 37884 |
| Current yield of the cluster (kg/ha) | 11.9 | 12.6 | 12.3 |
| Area of cluster focal point (ha) | 473 | 500 | 973 |
| Production of the focal point (Tonnes) | 5,260 | 6,200 | 11,460 |
| Yield of the focal point (tonne/ha) | 11 | 12.4 | 11.8 |
| Added in production - improved practices (tonnes) | 534 | 629 | 1163 |
| Added value –improved practices (M.US$) | 0.1 | 0.09 | 0.2 |
| Added in production due to added area in net (tonnes) | 427 | 503 | 930.6 |
| Added produce value – added area in net (M. US$) | 0.06 | 0.1 | 0.1 |
| Added value through pack-house (Mil US$) | 0.87 | 1.32 | 2.2 |
| Production level investment (M. US$) | 0.3 | 0.35 | 0.6 |
| Number of Pack house required | 4.0 | 4.00 | 8.0 |
| Total investment required | 0.3 | 0.25 | 0.5 |
| per unit operating cost of value addition (US$/tonne) | 123.0 | 123.03 | 246.1 |
| **Investments (M. US$)** | | | |
| Investment on strengthening R&D | 0.200 | 0.200 | 0.400 |
| Investments on interaction capacity building and | 0.050 | 0.150 | 0.200 |
| Investments required on pack-houses | 0.252 | 0.252 | 0.503 |
| Interest free loans | 0.006 | 0.028 | 0.033 |
| **Total investments (US$)** | **0.507** | **0.629** | **1.136** |
| Total public sector investments | 0.3 | 0.4 | 0.7 |
| Total private sector investment | 0.2 | 0.2 | 0.4 |
| **Economic Analysis** | | | |
| **Increase in production due to all interventions (tonnes)** | **961** | **1,133** | **5,219** |
| **Gross revenue (undiscounted) in 5th year** | **0.49** | **0.70** | **1.20** |
| **Additional operation costs in 5th year** | **0.25** | **0.32** | **0.57** |
| **Net cash flow (undiscounted) in 5th year** | **0.25** | **0.38** | **0.63** |
| **NPV** | **0.08** | **0.15** | **0.22** |
| **IRR** | **20%** | **24%** | **23%** |

# 9. Carrots and Turnip

Pakistan cultivates carrots and turnip on about 29 thousand ha and produces 491 thousand tonnes with an average per ha yield of 17.2 tonne as compared to the global area of the crop at 1.17 million ha with 42.7 million tonne of fresh carrot and turnips. Pakistan's performance in carrots and turnip is disappointing as its production and yield trends have negative trends since 2001. Pakistan now gets less than one half of the world average yield. These trends have turned Pakistan from a net exporter to a net importer of carrots and turnip.

In Pakistan, four major carrot and turnip clusters are: Upper KP with Swat as its focal point, Central KP with Buner as its focal point, Central Punjab with Sheikhupura as its focal point, and Central Baluchistan with Killa Saifullah as its focal point.

Several performance gaps in technology, inputs, and market structure of carrots and turnip are:

- Lack of improved commercial carrot and turnips cultivars;
- Conventional cultural practices;
- Improper post-harvest practices for trading in the high-value fresh carrot and turnips market.
- Lack of quality standards to help Pakistan to realize the true potential of this sector; and
- Poor international market linkages; and

The suggested interventions to upgrade the VC and improve the competitiveness are:

- Introduction of new high yielding varieties from other clusters and/or imported from other countries having similar environment like Pakistan,
- Improvement of farmer's cultural practices by introducing mechanical planters on 25% and harvesters on 20% of cluster focal point area;
- Incentivizing VC infrastructure like pack houses, etc., to improve post-harvest handling, and
- Encouraging IQF units in the private sector.

Indirect interventions will include strengthening of research on carrot and turnip value chain, promote producers and other stakeholders' organizations, linking them with markets, and build their capacities. These interventions are expected to increase productivity by 25-30%, reduce production cost, improve quality for the domestic and international markets, and increase export-production ratio up to 5%. A total of 17 pack-houses would be introduced to improve the quality of the produce for export and 10% of the domestic market to international standards. Moreover, 8 harvesters and 8 planters would be required for the targeted areas.

Total investment required for the upgradation plan for carrots and turnips would be US$4.37 million, out of this 45% will be borne by the government in terms of strengthening carrots and turnip research, capacity building of farmers and other stakeholders along the value chain, subsidies on the establishment of pack house, and providing interest free loans. These incentives will induce the remaining 55% investment in the private sector worth of US$2.42 million. After discounting all the investments and operational costs, the upgradation plan would generate pooled Net Present Value of US$3.36 million during the five year of the project. The overall Internal Rate of Returns (IRR) from all the cluster focal points is estimated to be 53%. The cluster level investment and return information can be seen in the Summary Sheet attached below.

**Summary Sheet of Carrots and Turnip Cluster**

| Information | Upper KP | Central KP | Central Punjab | Baloch-istan | Overall |
|---|---|---|---|---|---|
| Area of cluster focal point (ha) | 430 | 325 | 1307 | 1060 | 2062 |
| Production (Tonnes) | 8250 | 6012 | 27548 | 18726 | 41810 |
| Yield of the cluster (tonne/ha) | 19.19 | 18.50 | 21.08 | 17.67 | 20.3 |
| Area of the cluster (ha) | 764 | 1,558 | 6,999 | 2,216 | 11537 |
| Production of the cluster (tonne) | 12,075 | 25,674 | 126,217 | 38,630 | 202596 |
| Yield growth without intervention | 0.65% | 0.65% | -0.45% | 0.12% | |
| Increase production due to improved varieties (tonnes) | 2130 | 1552 | 6733 | 4710 | 10416 |
| Additional value of production (000US$) | 355.4 | 259.0 | 962.8 | 1150.4 | 1577.3 |
| Area under mechanized harvesting | 0 | 0 | 235 | 191 | 426.06 |
| production increased due mechanized (tonnes) | | | 337 | 235 | 572 |
| Added value of production due mechanized planting and better crop standing (US$) | 0 | 0 | 48,143 | 57,519 | 105662 |
| Increase in quantity of export on fifth year (tonnes) | 533 | 388 | 1712 | 0 | 2633 |
| Increase in value of export on the fifth year (US$) | 198844 | 144903 | 639162 | 0 | 982909 |
| Production through improved value chain (tonnes) | 266 | 194 | 856 | 0 | 1316 |
| Expected additional value from exports (US$) | 76516 | 87130 | 261917 | 0 | 425562 |
| Total additional value of production (US$) | 119564 | 87130 | 400291 | 0 | 606985 |
| Total number of pack house required | 4 | 4 | 9 | 0 | **17** |
| Number of harvesters required | - | - | 4 | 4 | **8** |
| Total number of planters required | - | - | 4 | 4 | **8** |
| Investments strengthening of R&D (000US$) | 148.1 | 111.1 | 444.4 | 444.4 | **1,148.1** |
| Investments required for value chain (000US$) | 557.1 | 557.1 | 1253.5 | 0 | **2,367.8** |
| Investments required on marketing/export level interventions (000US$) | 148.1 | 111.1 | 370.4 | 0.0 | 629.6 |
| Investment required on harvester (000US$) | | | 2.2 | 9.9 | **12.1** |
| Investment required on planter (000US$) | | | 9.9 | 9.9 | **19.8** |
| Total investment over five year (000US$) | 914.7 | 779.3 | 2219.7 | 456.6 | 4370.3 |
| Public sector investment (000US$) | 350.5 | 244.8 | 910.9 | 446.9 | 1953.0 |
| Private sector investment (000US$) | 564.2 | 534.6 | 1308.8 | 9.7 | 2417.3 |
| **Economic Analysis (000 US$)** | | | | | |
| **Total production increased 5th year (tonnes)** | **2130** | **1552** | **7070** | **4945** | **15698** |
| **Gross revenue (undiscounted) in 5th year** | **673.9** | **491.1** | **2050.5** | **1207.9** | **4423.3** |
| **Additional operation costs in 5th year** | **84.7** | **58.8** | **207.0** | **36.6** | **387.1** |
| **Net cash flow (undiscounted) in 5th year** | **589.2** | **432.2** | **1843.5** | **1171.3** | **2864.9** |
| **NPV (M.US$)** | **241.4** | **84.5** | **1318.3** | **1729.4** | **241.4** |
| **Internal Rate of Return** | **24.21%** | **15.21%** | **41.68%** | **176%** | **51%** |

# 10. Cherries

Pakistan produces six thousand tonnes of cherry on 2.5 thousand ha with an average yield of 2.4 tonnes per ha compared to the world production of3.6 million tonnes in 2016 on 0.6 million ha with an average per ha yield of 3.6 tonnes per ha. Pakistan has made a good start in cherry production since 2001. Starting from a low base, expansion in area under cherry and its production is higher than the world average growth rates, but its per ha yield remains about 60% lower than the world average and the gap is widening because of 27% slower growth in per ha yield than the world average over the period of 2000s. Moreover, cherry production in Pakistan has been contributing almost nil in international cherry market. Whatever little is exported, the export price earned by Pakistani export is only 56% of the world average export price because of the lack of proper value chain.

Gilgit-Baltistan (GB) and Balochistan are the main cherry growing regions of Pakistan. Two clusters of cherry are: i) Northern Cluster in Gilgit-Baltistan province with Hunza as its focal point; ii) Southern cluster in Balochistan with Ziarat being its focal point.

Performance gaps in technology, market structure and input availability across these clusters are:

- Access to improved commercial cherry cultivars to produce high quality fruit;
- Absence of post-harvest technologies, such as packaging, cold storage and refrigerated transport for trading in the high-value fresh cherry market.
- The water shortage especially in the northern cluster is keeping cheery yield very low.

In order to bridge these gaps, from production to product and market development, following interventions have been proposed for both the clusters:

- Renovation of old low-density gardens with modern varieties, high density gardens with improved management practices;
- Ten percent and five percent of the produce to be cold process for domestic and international market, respectively which will not only reduce losses but also enhance quality of cherry in the domestic and international markets resulting higher profit of all value chain actors.
- Ten percent of the domestic production to be mechanical sun-dried for export market which will not only reduce post-harvest losses but also enhance stakeholders' income significantly.

Indirect interventions include strengthening of cheery value chain research, building capacities of the stakeholders to produce quality cherry and manage improved value chain and processing infrastructure. A total of six cold chambers and six mechanical sun-dryers would be required to treat the targeted quantities of cherry to enhance it quality for domestic and international market.

The estimated capital investment for the upgradation of both the clusters is US$2.47 million. These investments are focused on increasing production, reducing postharvest losses and increasing value-added processing, targeting premium domestic and export markets. This will generate an NPV worth of US$ 9.3 million in different segments of the cherry value chain in both clusters, producing an IRR of 62%. The cluster level details of these costs and estimated economic returns from these investments are summarized in the attached summary sheet. Strengthening of research, provision of improved germplasm, and capacity building of stakeholders will be the keys for the success of the program.

***Summary Sheet for Cherry***

| Information | BL | GB | Overall |
|---|---|---|---|
| Area of cluster focal point (ha) | 452 | 159 | 611 |
| Production (Tonnes) | 905 | 705 | 1,610 |
| Yield of the cluster (tonne/ha) | 2.00 | 4.43 | 2.64 |
| Area of the cluster (ha) | 1,065 | 1,364 | 2,429 |
| Production of the cluster (tonne) | 1,981 | 3,897 | 5,878 |
| Annual yield growth without intervention (%) | 0.97% | 1.33% | 1.15% |
| Percent area renovated in 4 years | 30% | 30% | 15% |
| Total orchards areas renovated in 5 years (ha) | 320 | 409 | 729 |
| Increase in yield due to orchards renovated (%) | 100% | 75% | 100% |
| Increase in production due to orchards renovated (tonnes) | 648 | 987 | 1,636 |
| Additional production value from renovated area (M. US$) | 1.296 | 1.481 | 2.777 |
| Production to be processed for domestic market (tonnes) | 281 | 538 | 818 |
| Income from enhanced value addition - domestic market (000 US$) | 842.6 | 1,612.7 | 2455.3 |
| Production that will be cold processed for export market (%) | 10% | 10% | 10% |
| Production to be processed for export market (tonnes) | 140 | 269 | 409 |
| Income from enhanced value addition for export (US$) | 607,821 | 1,163,298 | 1,771,120 |
| Production to be dried (tonnes) | 47 | 90 | 136.4 |
| Income from drying for export and domestic market (US$) | 327,691 | 671,961 | 999,652 |
| Total number of cold stores required | 2 | 4 | 6 |
| Total number of dryers required | 2 | 4 | 6 |
| Investment on strengthening research | 100000 | 100000 | |
| Investment on capacity building of FEGs | 7888 | 101037 | 179,926 |
| Investment on renovation of orchard area (US$) | 639000 | 818400 | 1,457,400 |
| Investment on cold processing plants (US$) | 170000 | 340000 | 510,000 |
| Investment on 23 drying units | 20000 | 40000 | 60,000 |
| Government loans on private investment | 20900 | 41800 | 62,700 |
| Total investment required year (000 US$) | 1,028.79 | 1,441.2 | 2,470.0 |
| Public investment (000 US$) | 365.59 | 482.5 | 848.1 |
| Private investment (000 US$) | 663.2 | 958.7 | 1,621.9 |
| Economic Analysis | | | |
| Total increase in production due to all the yield increasing interventions (tonnes) | 648 | 987 | 1,636 |
| **Gross revenue (undiscounted) in 5th year** | 3,075 | 4,929 | 8,004 |
| **Additional operation costs in 5th year** | 934 | 1,763 | 2,697 |
| **Net cash flow (undiscounted) in 5th year** | 2,140 | 3,166 | 5,306 |
| NPV (000 US$) | 3,364.8 | 6,029.4 | 9,394.1 |
| Internal Rate of Return | 53.96% | 68.73% | 62.56% |

# 11. Chilies

Pakistan cultivate chili on about 158 thousand ha and produces 143 thousand tonnes of dry chilies. The average chili yield per ha in Pakistan is 2.27 tonnes compared to the world average of 2.48 tonne. During 2001-16, Pakistan chili production has been increasing at the rate of 1.7% per annum, compared to its population growth of 2.1% implying that unless the domestic production rate is increased, Pakistan's chili export will shrink and the country even has to import to meet the domestic needs. Moreover, expansion in chili production and improvement in per ha chili yield in Pakistan is much lower than that in the world. Thus, the country is losing its comparative and competitive position in international market. Moreover, the growth in Pakistan's exports have been stagnated and it earns lower price compared to the world average export price.

Chili cultivation in Pakistan is concentrated in one cluster comprising of two districts of Sindh viz Kunri and Mirpur Khas, with Kunri tehsil as its focal point. Following performance constraints are observed in the production, processing and trading components of chili value chain:

- Climate change related impacts like high infestation of aflatoxin and increased maturity time.
- Lack of improved commercial chili cultivars/hybrids to produce for the high-quality market,
- Poor quality seed and seedling reduces the potential of existing varieties.
- Inappropriate use of inputs and fungicide increases production cost & lower product quality,
- Heavy infestation of aflatoxin caused by mishandling the produce at post-harvest stage, &
- Lack of appropriate processing technologies at local level.

Following interventions are suggested to improve the competitiveness of chili production.

- Twenty percent subsidy on the introduction of improved chili hybrid & variety seeds,
- Introduction of improved management practices,
- Capacity building of farmers and other stakeholders on proper harvesting, packing, etc.
- Twenty percent subsidy on the establishment of improved value chain infrastructure like mechanical sun-drying and pack houses;
- Promote best practices such as globally accepted phytosanitary standards and certification.

Indirect interventions include Improving technical and institutional capacities of R&D, organize producers into FEGs to promote contract farming for the purpose of ensuring quality, promote branding and linking traders with potential markets. A total of 36 mechanical sun-drying units and 04 pack houses would be required to improve the quality to international standards of all exported and 5% of the chili in domestic market. It is estimated that these interventions will improve the productivity of chili by 30%, reduce post-harvest losses from30% to 15%, and improve export-production ratio from 3% to 10%.

Total estimated investment for these interventions at the focal points of Sindh cluster is US$15.22 million, out of this 55% will be borne by the government. Accounting for all the fixed investment and variable costs including the production, processing and marketing cost over the period of five years, the total NPV is expected to be $5.7 million within the five year of project life and the estimated Internal Rate of Return (IRR) is 34%. The details of the investment for different interventions and their various impacts can be seen in the attached Summary Sheet.

**Summary Sheet of Chili Cluster**

| | Kunri Cluster |
|---|---|
| Area under cultivation in focal point (ha) | **13,812** |
| Total Production (tonne) | **40,168** |
| Yield (tonne/ha) | 2.91 |
| Area of the cluster (ha) | **28,377** |
| Production of the cluster (tonne) | **75,290** |
| Additional production from enhanced yield –Improved management practices(tonne) | 13,209 |
| Additional value from increased yield in 5th year – Improved practices (US$) | **9,906,865** |
| Enhanced marketable production due to reduced PH losses (tonnes) | 8,586 |
| Additional value from less reduction in 5th year (US$) | **6,439,462** |
| Total volume of dry chili produced (tonne) | 3,291 |
| Additional value of dry chili in 5th year (US$) | **5,486,565** |
| Total expected volume of to be exported (tonne) | 4,608 |
| Expected additional value from exports in 5th year (US$) | **8,257,165** |
| Enhanced value of production due to improved value chain-international market in 5th year (US$) | **7,876,693** |
| Chili mechanical drying units required | 36 |
| No. of pack houses required | 4 |
| Investments on chili research center (US$) | **4000000** |
| Investment on capacity building/ stakeholders training (US$) | **2250844** |
| Investment on improved seed | **3273956** |
| Investments on processing level interventions (US$) | **3750319** |
| Investment on value chain infrastructure (one pack-house each year) | **1000000** |
| Investments on Marketing/Export level interventions (US$) | **400000** |
| Loans on value chain infrastructures | **546287** |
| **Total investments (US$)** | **15221406** |
| Public Investment (US$ Million) | 8.482 |
| Private Investment (US$ Million) | 6.739 |
| **Economic Analysis** | |
| **Total production increase in 5th year (tonnes)** | **21795** |
| **Gross revenue (undiscounted) in 5th year** | 37,966,751 |
| **Additional operation costs in 5th year** | **24,666,485** |
| **Net cash flow (undiscounted) in 5th year** | **12,481,777** |
| **NPV (US$)** | **5,742,661** |
| **IRR** | **34%** |

# 12. Citrus

In Pakistan, citrus occupies around 194 thousand ha which produces around 2.4 million tonnes of citrus with an average yield of 12.4 tonnes per ha as compared to its global area of 6.4 million ha producing 106.7 million tonnes of citrus with the yield of 16.6 tonnes. During 2017, the value of global citrus related exports has reached US$15 billion, while Pakistan earned US$180 million from the exports. About 40% of the world export earnings come from citrus juice, while for Pakistani this ratio is only 11%. Pakistan's citrus production during 2001-16 has been expanding at a rate of 1.58% per annum compared to the world average of 1.8%, thus the country has lost its relative position from 11$^{th}$ to 12$^{th}$ among the citrus producing countries. However, during this period, Pakistan expanded its export at a rate of over 17% per. This high growth, however, is not sustainable because of slower growth in citrus production than its population and per ha yield than that in the world, and low quality of the produce and percentage of citrus that is processed.

Ninety-five percent of citrus production, 86% of which is kinoo variety, comes from Central Northern Punjab with Sargodha being its focal point. Following are the gaps in citrus production, processing, marketing, and export segments of value chain.

- Primitive management practices such as flooded irrigation unscientific pruning, etc.,
- Non-availability of healthy planting materials of diversified improved varieties,
- High diseases infestation,
- Improper packaging and transportation, inadequate storage facility, and limited processing,
- Poor quality of the produce especially excessive seed numbers in the fruit and citrus canker,
- Dependence on only one variety which supply produce for very limited time
- non-compliance of SPS protocols, and lack of certification and branding.
- Dysfunctional citrus innovation system to address the emerging issues for quality demand, and

Following are the suggested interventions along the value chain to narrow down these gaps:

- Twenty percent gardens to be renovation with high-density plantation,
- Introduction of improved management practices,
- Incentivizing the establishment of cold chain infrastructure and collection centers,
- Linking stakeholders with market and encouraging certification of production practices.

Indirect interventions include strengthening of research, social mobilization of farmers into FEGs, and capacity building of stakeholders. A total of 490 small farm-level cold storages and 74 collection centers will be established in rural areas. It is estimated that these interventions will increase productivity by 25% on the renovated and 10% on the non-renovated gardens, reduce post-harvest losses from 35% to 15%, increase export-production ratio from 17% to 20%, and improve the quality to international standards of all exports and 5% of the domestic supply.

The total estimated investment of the citrus up-gradation plan is US$79.7 million. About 31% of this will come from government. Accounting for all the value chain costs in five years, the estimated NPV of the plan is US$474 million and the IRR of 145%. The details of the investment on various interventions and their various impacts can be seen in the attached Summary Sheet.

**Summary Sheet of Citrus cluster**

| Information | Punjab Cluster |
|---|---|
| Area of cluster focal point (ha) | 88,398 |
| Production of the cluster focal point (Tonnes) | 1,115,787 |
| Yield of the cluster focal point (tonne/ha) | 12.62 |
| Annual yield growth without intervention (%) | 1.2% |
| Area on which certified gardens will be established (ha) | 3,536 |
| Additional production from renovation of garden in 8th year (000 tonnes) | 188.5 |
| Expected additional value from renovation of garden (000 US$) | 39,204 |
| Increase in production due to improvement in management practices (000 tonnes) | 119.4 |
| Additional value of production due to improved management practices (000 US$) | 24838.7 |
| Increased in production due to reduced post-harvest losses (000 tonnes) | 277.0 |
| Expected additional value of production due to reduction of losses (000 US$) | 57625.7 |
| Enhanced volume of citrus to be exported due to improved international linkages (000 tonnes) | 55.2 |
| Added value from enhanced exports-production ratio (US$) | 24337.8 |
| Expected additional value from exports with improvement in export-quality (000 US$) | 30714.7 |
| Production with improved value chain in the domestic and international market (000 tonnes) | 149.2 |
| Additional production value - improvement in VC intervention (domestic and int'l)– (US$) | 77344.3 |
| No of Collection center required | 74 |
| No. of small farm-level cold storage required | 490 |
| Investments on strengthening of research (US$) | 1,851.9 |
| Investment on training of farmers for Global Gap | 155.556 |
| Investment on capacity building value chain agents | 13,333 |
| Investments required on promotion of Export (US$) | 537.037 |
| Investment on PMU | 1,721.0 |
| Government loans | 4613.0 |
| Investment on new garden | 12,938.8 |
| Certified citrus nursery establishments | 457.4 |
| Certification of production practices (000 US$) | 1,437.4 |
| Infrastructural Cost of cold storage (000 US$) | 40499.6 |
| Infrastructure cost on value addition-Collection Centers (000 US$) | 13964.6 |
| Total investment required over five year (000 US$) | 79725.9 |
| Total public sector investments, including loans and subsidies (000 US$) | 24653.5 |
| Total private sector investment (000 US$) | 55072.4 |
| Economic Analysis | |
| Total increase in production due to all the yield increasing interventions (000tonnes) | 628.3 |
| Expected Gross Revenue due to all interventions in the 5th year (000 US$) | 199049.7 |
| Additional operational cost due to all intervention in the 5th year (000 US$) | **48,707.3** |
| Net cash flow from all Cluster Development Interventions (000 US$) | **145,970** |
| NPV (000 US$) | **474,013** |
| Internal Rate of Return | **145.35%** |

# 13. Cucumber

Global cucumber is cultivated on 2.27 million ha and producing around 83.7 million tonnes of cucumber with an average per ha yield of 37 tonnes. Pakistan cultivates the crop on 4.6 thousand ha producing 61 thousand tonnes of cucumber with an average yield of 13.2 tonne. Pakistan imports cucumber equivalent to 20% of its production and its yield in the country is only 36% of the world average yield. Although growth rate in cucumber production is higher than the population growth in the country as well as growth in the global production but to make the Pakistani cucumber competitive in national and international markets lot more needs to be done.

Cucumber in Pakistan is grown in all provinces but concentrated in two clusters: one in Southern Punjab with Pakpattan as its focal point and the other in Eastern Balochistan with Khuzdar as its focal point. Following are the gaps in the cucumber value chain including its production and marketing segments:

- Lack of improved commercial cucumber cultivars,
- Poor management practices to produce high quality marketable fruit, and
- Absence of packaging and proper transport for trading in the high-value fresh cucumber market

These interventions include introducing high-yielding cucumber varieties/ hybrids for open field and for protected cucumber production, improvement in value chain for export.

Following are the suggested interventions to narrow down these gaps:

- Introduction of high-yielding cucumber varieties/hybrids for open field and for protected cucumber production,
- Introduce improved management practices especially protected cultivation through demonstration
- Encourage the establishment of certified cucumber nurseries
- Improvement in value chain for export through encouraging the establishment of pack houses in Punjab clusters and capacity building of stakeholders in both the clusters.

The indirect interventions include strengthening of cucumber research and capacity building of producers through demonstrations. A total of three pack houses would be required in the Pakpattan focal point of Southern Punjab to improve the value chain of 35% production that can compete with the imported cucumber and improve its price from US$ 170 to US$190 per tonne. It is estimated that these interventions will increase productivity by 10% and reduce post-harvest losses from 10% to 5%.

The total estimated investment of this cluster development/upgradation plan is US$0.93 million for both the clusters. Out of this (53%) born by the government in terms of strengthening the value chain research on cucumber, capacity building of stakeholders, subsidy on pack houses and interest free loans for the value chain infrastructure. Accounting for all the yearly value chain costs including the production, value addition and marketing costs, the estimated Internal Rate of Return (IRR) for both the clusters is 29%. The pooled Net Present Value (NPV) for both the clusters is positive at US$0.3164 million. The activity and cluster level investments and economic analysis of the investment can be seen in the attached Summary Sheet below.

**Summary Sheet of Cucumber Cluster**

| Information | Southern Punjab (Pakpattan) | Baluchistan Cluster (Khuzdar) | Overall |
|---|---|---|---|
| Area of the cluster (ha) | 1265 | 621 | 1886 |
| Production of the cluster (tonnes) | 34757 | 4555 | 39312 |
| Current yield of the cluster (tonne/ha) | 27.5 | 7.3 | 20.8 |
| Area of cluster focal point (ha) | 174 | 284 | 458 |
| Production of the focal point (Tonnes) | 8,346 | 2,074 | 10,420 |
| Added production- improved practices (tonnes) | 5754 | 1824 | 7578 |
| Added value - improved practices (US$) | 980306 | 310050 | 1290355 |
| Saved production - reduce Ph losses (tonnes) | 2206 | 319 | 2525 |
| Added value - reduced Ph losses (US$) | 375784 | 54259 | 430043 |
| Added value – improved VC operation (US$) | 281,605 | 6,703 | 288,308 |
| **Added value – All Interventions** | **1,637,694** | **371,011** | **2,008,706** |
| Total added production-all interventions (tonnes) | 7,960 | 2,143 | 10,103 |
| Added value – all interventions in the 5th (US$) | 1,356,089 | 364,309 | 1,720,398 |
| Added production cost- Input & harvest (US$) | 747,507 | 184,431 | **931,937** |
| Added VA cost (washing, grading, etc.): (US$) | 328,300 | 140,362 | **468,662** |
| Added transportation, marketing, storage cost:(US$) | 11,348 | 1,676 | **13,024** |
| Investments required on R&D interventions (US$) | 300,000 | 50,000 | 350,000 |
| Promotion of protected cultivation | 15,000 | 15,000 | 30,000 |
| Investments on value addition-pack house (US$) | 411,600 | - | 411,600 |
| Government loan on private investment (US$) | 45,276 | - | 45,276 |
| Investment on certified nurseries (US$) | 20,000 | 5,000 | 25,000 |
| Stakeholders training (US$) | 50,000 | 20,000 | 70,000 |
| **Total investment required over five year (US$)** | 841,876 | 110,000 | 931,876 |
| Public sector investment (US$) | 444,596 | 58,000 | 502,596 |
| Private sector investment (US$) | 397,280 | 32,000 | 429,280 |
| Production level investments | 385000 | **90,000** | **475,000** |
| Value chain level investments and processing | 456876 | **0** | **456,876** |
| **Overall benefits and rate of return** | | | |
| **Total production increase in 5th year (tonnes)** | **7,960** | **2,143** | **10,103** |
| **Gross revenue (undiscounted) in 5th year** | **1,637,694** | **371,011** | **2,008,706** |
| **Additional operation costs in 5th year** | **1,087,155** | **-326,468** | **760,687** |
| **Net cash flow (undiscounted) in 5th year** | **550,540** | **44,543** | **595,083** |
| **NPV (US$)** | 240234.2 | 44542.96 | 316403 |
| **Internal Rate of Return** | 25% | 72% | 29% |

# 14. Dates

Pakistan produces about 541 thousand tonnes of Dates from 98 thousand ha with an average yield of 5.5 tonnes per ha compared to the global production of around 8.2 million tonnes from more than 1.3 million ha with an average yield of 6.1 tonne. In Pakistan the yield has declined at the rate 2.1% per annum vis-à-vis improvement in international average yield at the rate of 0.4% during 2001-16, bringing Pakistani yield lower than the world average. Trade in Dates from Pakistan seems performed relatively well, which has improved the trade balance of Pakistan at quite a high rate of around 11% per annum. Such a high growth in trade, however, is not sustainable because of its declining per ha yield, quality issues in its value chain as export fetches only 60% of the world average export price, and reduced possibility of trade with India. Expansion in export along with declining production has reduced its per capita consumption by 42%.

Dates cultivation is concentrated in three clusters: Sindh, Balochistan, and Southern Punjab clusters with Khairpur, Turbat & Panjgur, Muzaffargarh as their respective focal points. Following are the gaps in Dates value chain along its production, processing and marketing segments:

- Weak research and extension capacities,
- Absence of the mechanism to replace old with new high-yielding varieties
- Lack of nurseries with certified mother-blocks,
- Traditional management practices like spathes selection, pollination, non-covering of fruit bunches during rainy season, bunch-pruning, etc.
- Improper value chain practices for harvesting, packing, etc. and lack of value chain segments including farm-level cold storage,
- Dates drying under the open sky and lack of processing infrastructure at village level.

Following are the suggested interventions to narrow down these gaps:

- Renovation of 20% old gardens with high-density quality producing dates orchard,
- Capacity building of farmers for adopting improved orchard management practices;
- Reducing post-harvest losses by promoting improved VC practices & introducing pack houses;
- Shifting to solar tunnel Dates drying;

The indirect interventions include strengthening of Dates research in each cluster, organizing farmers into FEGs, and capacity building of stakeholders. To improve the quality of all exportable Dates and 10% of the produce for domestic market, a total of 3760 dryers and 214 pack-houses units, and to renovate 20% old Dates gardens 80 certified nurseries would be needed in all focal points. It is estimated these interventions will increase productivity on renovated gardens by 35-80% in different clusters and 25% on the non-renovated gardens, reduce post-harvest losses from 20-39% to 10-15%, and increase export from zero to 20% from Punjab cluster, and 40% to 50% from Balochistan cluster.

In order to implement these interventions at the focal points, total project investments needed are US$108.144 million, 28% of which will come from the government. The pooled NPV is estimated at US$ 145.56 million. The overall IRR for all the clusters is 34.27%. The activity and cluster level investments and economic analysis can be seen in the attached Summary Sheet below.

**Summary Sheet of Dates clusters**

| Information | Punjab | Sindh | Balochistan | Overall |
|---|---|---|---|---|
| Area of cluster focal point (ha) | 3,297 | 28,479 | 43,588 | 75,364 |
| Production (Tonnes) | 25,549 | 237,106 | 185,629 | 448,284 |
| Yield of the cluster (tonne/ha) | 7.75 | 8.33 | 4.26 | 5.95 |
| Area of the cluster (ha) | 5,439 | 35,940 | 46,716 | 88,095 |
| Production of the cluster (tonnes) | 42,454 | 332,144 | 207,614 | 582,212 |
| Annual yield growth without intervention (%) | 0.63% | 1.58% | -0.27% | 0.65% |
| Percent area renovated in 5 years | 20% | 20% | 20% | 20.00% |
| Total orchards areas renovated in 5 years (ha) | 659 | 5,696 | 8,718 | 15,073 |
| Yield increase due to orchards renovated (%) | 50% | 35% | 80% | 55% |
| Added production from renovated garden in 5th year (tonnes) | 2,719 | 19,418 | 28,897 | 51,034 |
| Added value - orchards renovation in 5th year (000US$) | 1,208.6 | 8,630.1 | 14,983.6 | 24,822.3 |
| Added production –improved practice 5th year (tonnes) | 6,590 | 64,107 | 45,775 | 116,472 |
| Additional value of production - improved practices (000 US$) | 2,928.7 | 28,492.2 | 23,735.1 | 55156.1 |
| Increased in production - reduced PH losses in 5th yr (tonnes) | 5,476 | 36,092 | 51,056 | 92,623 |
| Additional value – reduced PH losses in 5th yr (000 US$) | 2,433.5 | 16,040.9 | 26,473,3 | 44,947.8 |
| Added income - enhanced processing in 5th year (000 US$) | 2,176.6 | 23,545.1 | 38,866.1 | 64,587.8 |
| Total dryer required (number) | 137 | 1646 | 1977 | **3760** |
| Total pack houses required (Number) | 7 | 84 | 123 | **214** |
| **Investments (000 US$)** | | | | |
| Investment on strengthening research infrastructure | 200.0 | 1000.0 | 800.0 | 2000.0 |
| Investment on capacity building of stakeholders (US$) | 67.2 | 580.1 | 887.9 | 1535.2 |
| Investments on orchard renovation (US$) | 1564.7 | 13515.2 | 21296.9 | 36376.8 |
| Investment on certified nursery establishment (US$) | 161.5 | 1211.1 | 1857.0 | 3229.6 |
| Investments on pack house (US$) | 806.6 | 9679.3 | 14173.3 | 24659.2 |
| Investment on solar dates dryers | 1223.3 | 14697.0 | 17652.4 | 33572.6 |
| Investments on Marketing/Export level interventions | 37.0 | 37.0 | 37.0 | 74.1 |
| Government loans on private investment | 233.4 | 2803.3 | 3660.0 | 6696.7 |
| Total investments | 4293.6 | 43523.1 | 60364.5 | 108181.2 |
| Public sector investment | 1259.2 | 12211.3 | 16351.2 | 29821.7 |
| Total private sector investment | 3034.4 | 31311.7 | 44013.3 | 78359.5 |
| Production level investments | 1959.7 | 16016.4 | 24397.9 | 42374.0 |
| Processing level investments | 1490.3 | 17790.3 | 21756.3 | 41036.9 |
| Investments for VC infrastructure (US$) | 2029.9 | 24376.3 | 31825.7 | 58231.8 |
| **Economic Analysis** | | | | |
| Total production increase in 10th year (tonnes) | 14,785 | 119,617 | 125,728 | 260,129 |
| Gross revenue (undiscounted) in 10th year | 10195.0 | 92365.9 | 129966.2 | 232527.0 |
| Additional operation costs in 10th year | 6131.4 | 54142.4 | 81702.3 | 141976.1 |
| Net cash flow (undiscounted) in 10th year | 4063.6 | 38223.5 | 48263.9 | 90550.9 |
| NPV (M.US$) | 4697.8 | 68525.5 | 72338.7 | 145532.1 |
| Internal Rate of Return | 25.90% | 37.26% | 32.57% | 34.26% |

# 15. Flowers

Flowers has been one of the most dynamic and fast-growing industry in the past two decades all over the world with the major paradigm shift of production centers from developed to developing countries. Enhanced incomes, change in life style of people and enhanced use of cut flowers for special occasions have been the main driving forces behind the increased demand especially of high-quality flowers. The sector employs millions of people worldwide. International trade of flowers which has been growing at over 5% per annum since 2001, has reached at US$ 8.6 billion in 2017. Pakistan has remained shied of benefiting from the booming flower industry internationally as it has not attempted to build necessary infrastructure to meet these demands. As a result, it has lagged far behind the global averages in flower yields, quality, price and exports.

Two flower clusters i.e. Rose (cut flowers and loose petals) and Gladiolus can be clearly noticed as they are the dominant flowers in the country, and Pattoki is the common focal point for both. Following are the gaps in the production, infrastructure, technology, market structure and availability of quality support services segments of flower value chain:

- Lack of improved appropriate planting material to produce high quality flowers,
- Inappropriate management practices such as peat material, soil treatment, pest control, etc.
- Absence of handling preservatives, packaging materials, and cold chain to deliver flowers for high-end domestic and export markets,
- Lack of branding and attractive packaging, and
- Disconnect with international market

Following interventions are suggested to bridge these gaps:

- Establishment of Pattoki Floriculture Centre in rose cluster with common facility centre to small flower farmers by incentivizing a large number of all types of flower farms who agree to adhere to international requirements. The Centre will also serve as Flower Auction Center.
- Capacity building of producers on improved management practices such as use of improved packaging materials, peat material, and preservative solutions for consumers' attraction.
- Incentivize improved production infrastructure like protected cultivation, green house, etc.
- Incentivizing improved value chain infrastructure like cold chain to preserve the freshness.

Indirect interventions include strengthening of flower research, social mobilization of producers by organizing Farmers' Entrepreneur Groups (FEGs) to solve common problem especially implementing quality standards, and capacity building of stakeholders along the value chain. To increase flower export from 0.4% to 0.5% of total production, and to improve the quality of 5% domestic production to international standard, at least two tissue culture lab, 100 small green houses and 40 small farm-level cold storage would be required in the focal points of both clusters. It is estimated that these interventions would increase flower productivity by 20%, reduce post-harvest losses from 35% to 25%, and enhance export to 0.8% from each cluster. Total estimated investment of the cluster development plan is US$25.04 million, out of which 42% will come from the government. Accounting for all value chain costs and investment, the estimated pooled NPV is US$125.0 million, and IRR at 41%. The activity level investments and economic analysis by cluster focal points can be seen below.

**Summary Sheet for Flowers**

| Item | Rose | Gladiolus | Overall |
|---|---|---|---|
| Area of cluster focal point (ha) | 1,200 | 1,200 | 2,400 |
| Production (Tonnes) | 16,302 | 16,302 | 32,604 |
| Yield of the cluster (tonne/ha) | 14 | 14 | 14 |
| Production from improved practices during 5th year (tonnes) | 3,260 | 3,260 | 6,521 |
| Gross revenue from improved management practices (US$) | 4,830,222 | 3,777,499 | 8,607,722 |
| Saved production from reduced post-harvest losses (tonnes) | 1,956 | 1,956 | 3,912 |
| Value of saved production - reduced PH losses (US$) | 2,898,133 | 2,266,500 | 5,164,633 |
| Added export due to improved value chain in 5th year (tonnes) | 86 | 108 | 194 |
| Value of increase export during 5th year (US$) | 381,097 | 305,715 | 686,812 |
| Production through improved VC in 5th year - domestic market (tonnes) | 1,076 | 1,076 | 2,152 |
| Value of production of improved VC in 5th year-domestic market (US$) | 5,144,806 | 3,057,153 | 8,201,959 |
| Number of floriculture center | 1 | - | 1 |
| Total number of small green houses required | 50 | 50 | 100 |
| Number of small cold storage required | 20 | 20 | 40 |
| Number of tissue culture labs | 1 | 1 | 2 |
| **Total Investments (000 US$)** | | | |
| Research & Development Level Interventions | 2259.3 | 1814.8 | 4074.1 |
| Capacity building of stakeholders | 88.4 | 30.1 | 118.5 |
| Tissue culture labs | 298.9 | 156.7 | 455.6 |
| Floriculture Center | 740.7 | - | 740.7 |
| VC infrastructure (Cold storage, green house) | 8888.9 | 8148.1 | 17037.0 |
| Processing infrastructure (Dehydration plant) | 88.9 | - | 88.9 |
| Loan | 1020.4 | 259.3 | 1279.7 |
| Marketing/Export level interventions | 333.3 | 913.5 | 1246.9 |
| Total public sector investments and subsidies | 6030.8 | 4471.3 | 10502.1 |
| Total private sector investment | 7688.0 | 6851.3 | 14539.3 |
| Production level investments | 2646.6 | 2001.6 | 4648.1 |
| Value chain level investments and processing | 9998.2 | 9061.7 | 19059.9 |
| Marketing and export level investments | 333.3 | 259.3 | 592.6 |
| **Floriculture Center** | 740.7 | - | 740.7 |
| **Overall benefits and rate of return (M. US$)** | | | |
| Total increase in production – all intervention in 5th year (tonnes) | 5,217 | 5,217 | 10,433 |
| Total investments (US$) | 13.719 | 11.323 | 25.041 |
| Gross revenue due to all interventions in 5th year | 13.254 | 9.407 | 22.661 |
| Increase in operational cost during the 5th year | 0.541 | 2.351 | 2.892 |
| Net cash flow after in 5th year (undiscounted) | 12.231 | 6.575 | 18.806 |
| **NPV** | 10.545 | 2.720 | 13.265 |
| **Internal Rate of Return** | 52% | 25% | 41% |

# 16. Garlic

The garlic in Pakistan is cultivated on 8.1 thousand ha producing 70.9 thousand tonnes with an average yield of 8.8 tonnes per ha while globally its production has reached to 28.2 million tonnes from 1.58 million ha with an average yield of 17.8 tonnes per ha. The production in the country is expanding at the rate of 0.74% per annum, much lower than population growth of 2.1% as well as global rate of 5.8%. This implies that unless the domestic production rate is improved, the country has to increasingly rely on imports which is already expanding at an alarming rate of 14% per annum and had reached to US$68 million in 2017. The yield of garlic in Pakistan is less than one half of the world average and it is improving at only 0.60% compared to the average global improvement rate at 3.6%, implying that Pakistan is losing its competitive position in the domestic and international markets. Moreover, Pakistan did not benefit from the global garlic market which is fast expanding at 11% per annum rate and has reached to US$3.1 billion in 2017.

Although garlic is grown throughout the country, but four garlic clusters can clearly be identified: Northern Punjab Cluster with Sialkot, Central KP Cluster with Kohat, Northern Balochistan cluster with Hernai and Southern Sindh Cluster with Mirpur Khas as their respective focal points. Following are the gaps in garlic value chain specifically with seed technology, farm mechanization, availability of inputs, post-harvest management, processing and market structures:

- Various impact of climate change in different clusters,
- Little or no research on optimal management practices in garlic,
- Non-availability of new high-yielding varieties, thus cultivation of old varieties by farmers,
- Unrestricted imports,
- Suboptimal and imbalance use of input and primitive management practices,
- Shortage of labor at planting and harvesting time and lack of mechanization for these operations,
- Lack of community actions, and

Following interventions are suggested at the focal points of each cluster to bridge these gaps:

- Promotion of high yielding varieties developed by NARC and provincial research system,
- Capacity building of producers to introduce improved management practices,
- Introducing garlic planter and harvester on 25% on total area in each cluster,
- Incentivizing value addition functions like sorting, grading, packaging, and storage.

Indirect interventions include strengthening of research on garlic value chain, organization of producers in FEGs and promote contract farming, impose import duties to counter high input subsidies in neighboring countries, and capacity building of stakeholders on improved value chain management. To introduce farm mechanization on 25% of the cluster focal point area, 16 planters and 40 harvesters would be required, and to store 10% of the production, 16 village level store houses would be needed. It is estimated that these interventions will increase garlic productivity by 25%, reduce post-harvest losses from 20% to 10%, reduce plan harvesting costs, and improve the quality of the produce. The total estimated investment of this cluster development/up-gradation plan is about US$5.84 million for all the cluster focal points, about 82% of which will be borne by the public sector which will produce an IRR for all the cluster focal points of 105%.

**Summary Sheet of Garlic Cluster**

| Information | Central KP | Northern Punjab | Northern Balochistan | Souther n Sindh | Overall |
|---|---|---|---|---|---|
| Area of the focal point (ha) | 502 | 368 | 650 | 296 | 1816 |
| Production of the focal point (tonnes) | 5347 | 2822 | 5811 | 1558 | 15538 |
| Area under cultivation (ha) | 1,034 | 873 | 734 | 593 | 3,234 |
| Total garlic production (tonnes) | 12,489 | 7,151 | 6,635 | 3121 | 29,396 |
| Default yield (tonne/ha) | 12.08 | 8.19 | 9.04 | 5.26 | 9.1 |
| Additional production - improved variety (tonnes) | 2572 | 2207 | 2157 | 959 | 7896 |
| Additional value of production - improved variety (000US$) | 1429.1 | 1226.2 | 1198.4 | 88.8 | 3942.4 |
| Increase in production – Improved practices (tonnes) | 643.1 | 367.9 | 359.5 | 159.8 | 1,530.3 |
| Additional value of production- improve practice (000 US$) | 357.3 | 204.4 | 199.7 | 88.8 | 850.2 |
| Saving in production – Lower postharvest losses (tonnes) | 7,535 | 5,726 | 2,611 | 2895 | 18767 |
| Additional value - lower Ph losses (M. US$) | 3.362 | 2.417 | 0.704 | 1.033 | 7.516 |
| Saving in sowing cost due to planter (US$) | 43,158 | 32,386 | 1,792 | 13,374 | 90,710 |
| Saving in harvesting cost due to harvester (US$) | 6,562 | 8,856 | 1,792 | 550 | 17,761 |
| No. of planters required | 4 | 4 | 4 | 4 | **16** |
| No. of harvesters required | 12 | 12 | 8 | 8 | **40** |
| **Investments** | | | | | |
| Strengthening research (000 US$) | 888.3 | 750.0 | 630.5 | 509.4 | 2778.2 |
| Farmers training (000 US$) | 200.0 | 200.0 | 200.0 | 200.0 | 800.0 |
| Training of VC stakeholders (000US$) | 200.0 | 200.0 | 200.0 | 200.0 | 800.0 |
| Farm mechanization) (000 US$) | 109.9 | 109.9 | 80.9 | 80.9 | 381.6 |
| Farm level storage (000 US$) | 240.4 | 240.4 | 240.4 | 240.4 | 961.5 |
| **Total investments (000 US$)** | **1677.0** | **1538.7** | **1387.2** | **1239.6** | **5842.5** |
| Total public sector investments, including loans and subsidies | 1.397 | 1.259 | 1.130 | 0.983 | 4.768 |
| Total private sector investment | 0.280 | 0.280 | 0.257 | 0.257 | 1.074 |
| Production level investments | 1.088 | 0.950 | 0.831 | 0.709 | 3.578 |
| Value chain level investments and processing | 0.589 | 0.589 | 0.557 | 0.530 | 2.264 |
| **Economic Analysis (M. US$)** | | | | | |
| **Total production increase (tonnes)** | 10,791 | 8,334 | 5,159 | 4,027 | 28,311 |
| **Gross revenue (undiscounted)** | **5.221** | **3.907** | **2.123** | **1.676** | **12.927** |
| **Additional operation costs** | **0.465** | **0.286** | **0.239** | **0.187** | **1.177** |
| **Net cash flow (undiscounted)** | **4.645** | **3.527** | **1.805** | **1.425** | **11.402** |
| **NPV (US$)** | **6.603** | **4.694** | **2.479** | **1.541** | **13.186** |
| **Internal Rate of Return** | **154.0%** | **129.2%** | **98.4%** | **69.0%** | **104.9%** |

# 17. Ginger

Global production of ginger was recorded at 3.0 million tonnes from 327 thousand ha with an average yield of 8.2 tonnes per ha in 2017. In Pakistan, due to the laxity of policy makers on the improvement of ginger value chain, the ginger production in Pakistan has dried down, and the country now completely relies on its import by spending over US$70 million. The per ha yield of ginger as reported in Agricultural Statistics of Pakistan is only 5.5% of the world average. Moreover, yield improvement in Pakistan is relatively slow, if any, while world average ginger yield has been improving at the rate of 5.4% per annum. The export of processed ginger from Pakistan which is mainly re-export does not compensate its high imports. As a result, the trade deficit is ballooning overtime because of the increasing preference of the consumers towards ginger consumption, dwindled ginger supply from domestic source, and increase in import prices.

Currently no ginger producing cluster is found in the country. However, keeping in view the required soil and climatic conditions for the cultivation of ginger in mind, district Mansehra can be a potential cluster for future ginger cultivation. Future are the constraints at the production, processing and marketing of ginger value chain to the establish future ginger cluster.

- High soil pH level with low rainfall throughout the production period, and unavailability of suitable varieties for these environments,
- Lack of local level drying facilities at the farm level,
- Unrestricted imports from neighboring countries who produce ginger under highly input subsidy regime, and
- Poor marketing mechanism to ensure reasonable prices to ginger producers.

To start from somewhere, the whole Mansehra district should be surveyed by the GIS team to find out the suitable area for ginger cultivation. The team believes that the district has enough suitable land for ginger cultivation to replace at least 25% ginger imports in the country. With an average yield level of 7.0 tonnes per ha, this will require 3548 ha under ginger cultivation. For this purpose, following intervention, strategies and policies are proposed:

- Capacity building of farmers and other stakeholders to produce and market quality ginger to the satisfaction of consumers,
- Provide subsidy on ginger cultivation at the rate of US$300 per ha,
- Establish collection centers and ensure guaranteed price, and
- Promotion of ginger drying at the farm-level once its cultivation is established.

The indirect interventions include initiating a strong research program on ginger that should import germplasm from countries having similar environment and test it at wider scale throughout the country. We also propose to put certain tariff on the import of ginger to neutralize input subsidies in ginger exporting countries and use the money to promote ginger cultivation in Pakistan. Two collection centers in the ginger cluster area should be established from where direct marketing with importers can be made. To start drying of 10% produce once its cultivation is started on full swing on 3548 ha, 22 drying units have to be established to promote value addition in ginger.

The estimated cost of investment for these interventions would be around $7.2 million, out of which about 87% will be borne by the public sector. The detail of these investments and economic analysis of the plan can be seen in the attached Summary Sheet.

**Summary Sheet of Ginger cluster**

| Item | Value |
|---|---|
| World average yield (tonnes/ha) | 7.0 |
| Current import of ginger (tonne) | 79110 |
| Current value of import (Million US$) | 74.1 |
| Growth rate in import (% per annum) | 4.5% |
| Future expected demand and import of ginger during the 5th year (tonne) | 98782 |
| Value of the future import after 5 years (with constant import price) (M. US$) | 88.5 |
| Percentage Demand to be Fulfilled | 25% |
| Additional area required to fulfill the 25% demand in 5th year (ha) | 3548 |
| Additional production during the 5th year (tonnes) | 24696 |
| Expected economic return from expansion in area (M. US$) | 8.1 |
| Percentage of production assumed to be locally dried/processed | 10% |
| Production to be dried during the 5th year (tonne) | 1235 |
| Value of the processed ginger (M. US$) | 2.47 |
| Total number of drier required (Number) | 22 |
| Total collection centers to be established | 2 |
| Investment on conducting GIS Survey to identify appropriate area for ginger (US$) | 100,000 |
| Investment on strengthening of research (US$) | 814,815 |
| subsidy to promote ginger cultivation @US$300 per ha (US$) | 5,066,965 |
| Investment on capacity building of stakeholders (Farmers, processors, etc.) | 400,000 |
| Establishing Collection Center, guaranteed price, etc.) | 266,667 |
| Investment on value addition (drying units) (US$) | 510,122 |
| Government loans | 63,765 |
| Total public sector investment (subsidies, research, capacity building, etc. (US$) | 6,600,903 |
| Private sector investment (US$) | 621,431 |
| **Economic Analysis** | |
| Gross revenue of the two suggested interventions during the 5th (M. US$) | 10.6 |
| Total operating costs of the interventions during 5th year (M. US$) | 5.4 |
| Total investments (M. US$) | 7.2 |
| NPV (M. US$) | 1.46 |
| Internal Rate of Return (IRR) (%) | 29% |
| Saving in foreign exchange (25% of the expected import value during the 5th year) (M. US$) | 22.1 |

# 18. Grapes

Pakistan cultivate grapes on about 14.4 thousand ha and produces 58 thousand tonnes of grapes with an average per ha yield of 4.0 tonnes and ranks 56th in terms of production and 91st in terms of export value in the world. Globally it is produced on 6.9 million ha and produces about 75 million tonnes of grapes with an average yield of 10.7 tonnes. Pakistan is continuously losing its competitiveness position in the global grape sector. While the growth in grape production in the country is lower than that at the international level and per ha yield is on the declining trend. Per ha yield of grapes in Pakistan is only 37% of the world average yield. Despite increasing import, per capita consumption of grape is decreasing while the value addition and export of grape products have almost dried down.

In Pakistan, the main grape growing cluster consists of Quetta, Pishin, Mastung and Kharan districts of Balochistan province with Pishin as its focal point. Following are the gaps in grapes value chain specifically with the technology, market structure and availability of input:

- Climate change,
- Weak research,
- Lack of improved commercial grapes cultivars to produce high quality marketable fruit,
- Poor management practices,
- Absence of packaging, cold storage and reefer transportation for trading in the high-value fresh grapes market.

To bridge these gaps, following strategies are suggested for the focal point of grape cluster:

- Renovation of old gardens with new varieties tolerant to various stresses imported from countries having similar environments like Pakistan,
- Introduction of new high-yielding and better-quality grapes varieties,
- Introducing improved management practices,
- Incentivizing the establishment of cold chains and value addition system, and
- Promoting processing especially dried grapes and pulping in rural areas of the cluster,

The indirect interventions at the system level would be strengthening the grape value chain research, training of farmers for improved production practices and other stakeholders for improved value chain management, and promoting certification regimes in all segments of the value, and linking traders with international market. To renovate 5% of the grape garden, one certified nursery would be required. To make pulp and raisin from 3% of the grape production for each, a total of 16 pulping units and 45 raising units would be required. If 10% of the production is passed through the cold chain for preserving the quality of grapes, 100 small cool chambers at the village level would be required and five reefer truck would be needed to transport the grapes from farm to market. It is estimated that these interventions will increase productivity by 100% on the renovated gardens and 20% on the non-renovated gardens, reduce post-harvest losses from 25% to 10%, and improve the quality of value-added product to international standard.

The estimated cost of investment for these interventions would be around $8.69 million, out of which about 52% will be borne by the public sector. The detail of these investments and economic analysis of the plan can be seen in the attached Summary Sheet. The success of the plan will depend on strengthening of the grape VC research, building capacities of the stakeholders, and organizing grape farmers into groups so that they can address quality issues together.

**Summary sheet of Grapes clusters**

| Item | Balochistan Cluster |
|---|---|
| Area under cultivation in focal point (ha) | 8,262 |
| Total Production (tonnes) | 41,775 |
| Yield (tonne/ha) | 5.06 |
| Area of the cluster (ha) | 14,135 |
| Production of the cluster (tonnes) | **65,390** |
| Additional production from renovated garden in 8th year (tonnes) | 448 |
| Additional returns –renovated gardens in year 8 (US$) | 420.2 |
| Additional production from enhanced yield (tonnes) | 8,968 |
| Additional value from improved practices (000 US$) | **7,004.0** |
| Additional production from enhanced yield (tonnes) | 8,968 |
| Expected additional value from increased yield (000US$) | 7004.0 |
| Enhanced marketable production-reduced PH losses (ton) | 8,138 |
| Additional value from reduction of losses (000US$) | 6356.2 |
| Total production to be used in pulp production (tonnes) | 1,872 |
| Total volume of pulp produced (tonnes) | 1,778 |
| Additional value from pulp processing (000 US$) | **1,975.8** |
| Production to be used in raisin making (%) | **3%** |
| Total production to be used in raisin production (tonnes) | 1,872 |
| Total volume of raisin produced (tonnes) | 576 |
| Additional value from raisin processing (000 US$) | **2,133.2** |
| Production that will pass through improved value chain (tonnes) | 6,240 |
| Additional value from improved VC - Local market (US$) | 19,342 |
| No of pulping units required | 16 |
| No of Raisin making units required | 45 |
| No of cold chamber required | 100 |
| No of reefers required | 5 |
| Investment on Grapes Research Center (000 US$) | 1111.1 |
| Operation of the Research Center (000 US$) | 1481.5 |
| Investment on capacity building (000 US$) | 516.4 |
| Investment on orchard renovation (000 US$) | 1905.4 |
| Investment on pulping units (000 US$) | 85.6 |
| Investment on raisin Making Unit (000 US$) | 730.1 |
| Investment on farm-level cold chambers (000US$) | 370.4 |
| Investment on Reefers (000 US$) | 1851.9 |
| Loan for one-year free interest (000 US$) | 349.4 |
| **Total Investment (000 US$)** | **8,688.0** |
| Public Investment (000 US$) | 4527.9 |
| Private Investment (000US$) | 4160.1 |
| **Total production increase in 8th year (tonnes)** | 26,523 |
| **Gross revenue (undiscounted) in 8th year** | 17,908.8 |
| **Additional operation costs in 8th year** | 11,332.5 |
| **Net cash flow (undiscounted) in 8th year** | 6,576.3 |
| **NPV** | **10,869** |
| **IRR** | 38% |

# 19. Mango

In Pakistan, total mango area is around 169 thousand ha with the production of 1.7 million tonnes while its global production is over 48 million tonnes from 5.7 million ha. The growth rates in mango production at national and international levels are respectively 4.1%, and 4.4% per annum. Pakistan's average per ha yield is higher than the world average with variation across regions.

During the 2000s, growth in mango production in Pakistan has been mainly from the expansion in its area, while per ha yield has been declined during the period, and the deceleration has accelerated during 2011-16. This decline along with poor value chain infrastructure development have resulted a gradual deterioration in its competitive position resulting a shrink in its export-production ratio. Moreover, despite some recent improvements in mango value chain, the country earns the lowest per unit price among the leading mango exporting countries of the world.

Pakistan's mango industry is mainly located in two clusters: i) Punjab Chaunsa Cluster of Central Southern Punjab with Multan as its focal point; and ii) Sindh Sindhri Cluster of Western southern Sindh with Mirpur Khas as its focal point. Following are the gaps in mango value chain:

- Weak mango research and extensions system,
- Old bushy type and tall mango gardens with low yield potential,
- lack of supply of high-yielding and true to type planting material,
- Weak farmers' capacity to understand modern management practices;
- Poor post-harvest handling practices like storing, packaging, transportation, etc.
- Non-compliance of international quality standards,
- Weak VC infrastructure like collection centers, cold storages, HW treatment plants, etc., and
- Limited processing facilities.

To bridge these gaps, following strategies are suggested for the focal points of mango clusters:

- Capacity building of stakeholders along the value chain including farmers, nursery men, traders, trainers, and processors,
- Improving service delivery system,
- Promoting high-density gardens supported by certified nurseries and multiplication blocks.
- Incentivizing the establishment of pack-houses, farm-level cold storage, and hot-water treatment plants in rural areas at the FEG levels; and
- Incentivize the small-scale mango pulp plants in Punjab cluster.

The system level interventions are social networking of farmers in FEGs and other stakeholders, strengthening the research and extension system, and capacity building of all stakeholders along the value chain. To renovate 20% mango gardens would require the support of 14 certified nurseries. To improve the value chain of all the export and 5% of the produce for domestic market, 32 collection centres/pack houses would be required. To convert 1% of the mango production into pure from the focal point of Punjab, 9 processing units would be required.

The total estimated investment of this up-gradation plan for the focal points of both the clusters is US$123 million, out of which about 28% will be provided by the government. Accounting for all the yearly value chain costs and investments, the estimated the pooled NPV is US$577 million with an IRR of 97%. The detail of these investments and economic analysis of the plan at cluster focal points can be seen in the attached Summary Sheet below.

**Summary Sheet of Mango Clusters**

| Information | Punjab | Sindh | Overall |
|---|---|---|---|
| Area of cluster focal point (ha) | 50,281 | 29,503 | 79,784 |
| Production (Tonnes) | 658,007 | 190,074 | 848,081 |
| Yield of the cluster (tonnes/ha) | 13.09 | 6.44 | 10.63 |
| Area of the cluster (ha) | 95280 | 37310 | 132,590 |
| Production of the cluster (tonnes) | 1059690 | 250190 | 1,309,880 |
| Area on which certified gardens is established (ha) | 10,056 | 5,901 | 15,957 |
| Area matured for fruiting every year (ha) | 10,056 | 5,901 | 15,957 |
| Additional production from increased yield (tonnes) | 67,244 | 15,724 | 82,968 |
| Expected additional value at farm gate price (M. US$) | 33.689 | 7.877 | 41.566 |
| Increase in production - improvement in management (tonnes) | 42,027 | 29,483 | 71,510 |
| Additional value of production - improved practices (US$) | 21.056 | 14.771 | 35.827 |
| Increased production - reduced post-harvest losses (tonnes) | 90,779 | 24,176 | 114,955 |
| Additional value of production - reduction of losses (M. US$) | 45.480 | 12.112 | 57.592 |
| Total production that will have improved value chain (tonnes) | 79421 | 18,806 | 98227 |
| Value of production - improvement in value chain (M. US$) | 67.622 | 15.957 | 83.580 |
| Number of processing units required | 9 | 0 | 9 |
| Number of certified nurseries | 9 | 5 | 14 |
| Volume of pulp/puree produced (tonnes) | 7489 | 0 | 7489 |
| Number of collection center required | 25 | 7 | 32 |
| Number of cold storages required | 56 | 14 | 70 |
| **Investments (M. US$$)** | | | |
| Investments on Research & Development | 0.241 | 0.159 | 0.400 |
| Investment for training of farmers for Global Gap | 0.125 | 0.050 | 0.176 |
| Investment for training of value chain agents | 0.057 | 0.038 | 0.095 |
| Investment on PMU | 1.721 | 1.721 | 3.442 |
| Government loans | 6.782 | 1.710 | 8.492 |
| Investment on new plants for garden renovation | 20.671 | 12.129 | 32.800 |
| Certified mango nursery establishments | 0.061 | 0.061 | 0.121 |
| Certification of production processes | 0.712 | 0.803 | 1.516 |
| Value chain infrastructure | 60.623 | 14.685 | 75.308 |
| Pulping/puree Units | 0.256 | 0.000 | 0.256 |
| Total investment required over five year | 91.478 | 31.557 | 123.035 |
| Total public sector investment (M. US$) | 24.502 | 8.759 | 33.261 |
| Total private sector investment (M. US$) | 66.975 | 22.798 | 89.773 |
| Economic Analysis (M. US$) | | | |
| Total production increase in 10th year (tonne) | 200,050 | 69,383 | 269,433 |
| Gross revenue (undiscounted) in 10th year | 187.953 | 55.779 | 243.731 |
| Additional operation costs in 9th year | 31.616 | 8.107 | 39.724 |
| Net cash flow (undiscounted) in 10th year | 187.953 | 55.779 | 243.731 |
| NPV (M.US$) | 435.175 | 142.180 | 577.355 |
| Internal Rate of Return | 96.57% | 98.57% | 97.07% |

# 20. Medicinal Herbs

Two cluster of medicinal plants can be distinctly classified: i) the cluster of Ispaghol is spread over the tehsils of **Hasilpur, Haroon Abad and Chishtian** all located in Cholistan desert in Punjab and Hasilpur is the focal point of this cluster, and ii) the Cumin cluster located in the districts of **Kalat, Karan and Nushki in** Baluchistan.

The total area under Ispaghol crop in Cholistan cluster is around 1200 ha producing on an average of 800 tonnes of Ispaghol seed from which around 200 tonnes of Ispaghol husk is produced. The country's annual requirements of Ispaghol husk is around 500 tonnes. During 2016-18, on an average, Pakistan imported 213 tonnes Ispaghol husk worth of US$1.80 million from India. However, Pakistan also exported 17.8 tonnes of Ispaghol valued to about US$0.15 million during.

An average production of cumin is 2823 tonnes per year from an area of 6210 ha, both are on fast declining trends at an annual rate of 8%. Globally, during 2016-17, total area under cumin is around 0.76 million ha with the production of 0.49 million tonnes. Pakistan imports about 67% of its cumin requirements which amounts to annual import of 7630 tonnes (seed + powder) worth PKR 433 million. It is important to mention that Pakistan also exports around 1190 tonnes of cumin in whole seed and crushed form.

Following are the major gaps in different segments of the value chain of medicinal plants:

- Farmers' lack of awareness about scientific techniques of crop cultivation
- Non-availability of planting materials, and
- Highly fluctuating markets and unassured marketing.
- Non-compliance of stakeholders within the International standards and guidelines as well as Phyto-sanitary, quality and safety regulations.
- Poor post-harvest management causing high losses up to 20-40%, and
- Inefficient husking, cleaning and processing.

Following strategies are suggested for each cluster to improve their competitiveness.

- Establishment of Pakistan Spices and Medicinal Plants Development Board (PSMPDB).
- Provision of research-based technology package following the FAO guidelines on good agriculture and processing practices,
- Capacity building of stakeholders,
- Incentivizing the value chain infrastructure like pack house to properly clean and pack the produce.

The PSMPDB will promote output-oriented research system through the involvement of stakeholders. A total of four pack houses in each cluster will be needed for properly drying, cleaning and packing of 50% of total produce. It is estimated that with these interventions, the per ha yield will be enhanced by 15% in both the cluster and post-harvest losses will be reduced from 20% to 10%. The total investment required for the upgradation plan is estimated at US$1.6 million. After accounting for all the additional cost in production and processing as well as investments made over the period of five years, the discounted NPV for both the focal points of the respective cluster would be US$0.57 million with an IRR of 24.0%. The detail of these investments and economic analysis of the plan at cluster level can be seen in the attached Summary Sheet below.

**Summary sheet of Medicinal Plant Cluster**

| | Cumin cluster | Ispaghol cluster | Overall |
|---|---|---|---|
| Area of cluster focal point (ha) | 4,912 | 1200 | 6,112 |
| Production (Tonnes) | 2,195 | 800 | 2,995 |
| Yield of the cluster (tonne/ha) | 0.45 | 0.67 | 0.49 |
| Additional production from enhanced yield (tonnes) | 215.4 | 120.0 | 335.4 |
| Additional value from increased yield (Mil US$) | 333.8 | 128.4 | 462.2 |
| Enhanced marketable production due to reduced PH losses (tonnes) | 165 | 276 | 441 |
| Expected additional value from reduction of losses (000 US$) | 256 | 295 | 551 |
| Additional production that can substitute import (tonnes) | 380.47 | 396.00 | 776.47 |
| Expected imports after five year (tonnes) | 6,504.69 | 686 | 7,191 |
| Value of the production which can substitute (000US$) | 589.73 | 423.72 | 1,013.45 |
| Current value of imports (000US$) | 3,188.1 | 3,188.1 | 3,188.1 |
| Expected import value after five year (000US$) | 5092.11 | 5092.11 | 10,184.22 |
| Percentage of import value substituted | 12% | 8% | 10% |
| Total public sector investments | 1.43 | 1.45 | |
| No of pack house required | | 4 | |
| Investment on R&D establishment (000US$) | 0.59 | 0.44 | 1.04 |
| Investments on capacity building (000 US$) | 0.15 | 0.15 | 0.30 |
| Investments on processing level interventions (Mil US$) | 0.07 | 0.17 | 0.24 |
| Government Loan | 0.01 | 0.02 | 0.03 |
| Total investments (US$) | 0.82 | 0.78 | 1.60 |
| Total public sector investments, including loans and subsidies | 0.65 | 0.53 | 1.17 |
| Total private sector investment | 0.18 | 0.25 | 0.43 |
| Economic Analysis (000 US$) | | | |
| Total increase in production due to all the yield increasing interventions (tonnes) | 380 | 396 | 776.47 |
| Expected gross revenue from all interventions during 5th year | 725.9 | 734.3 | 1,460.27 |
| Added operational costs during the 5th year (undiscounted) | 221.1 | 108.3 | 380.88 |
| Net cash flow (undiscounted) during 5th year | 504.8 | 626.0 | 1,130.8 |
| NPV | 243.9 | 330.7 | 574.67 |
| Internal Rate of Return (%) | 21% | 27% | 24.0% |

# 21. Milk

Pakistan is one of the largest milk producing country of the world by producing over 57 million tonnes of milk annually from 24 million cows and buffaloes with an average annual yield of 1.62 tonnes per animal, which is only 62% of the world average yield. During 2016, 779 million tonnes of fresh milk was produced globally from 340 million milking cows and buffaloes with an average annual yield of 2.33 tonnes per animal. The milk production (from buffalo and cow) in Pakistan during the 2000s increased at the rate of 3.5% per annum, much higher than the world average growth thus improving Pakistan's comparative position from 5$^{th}$ in 2001 to 3$^{rd}$ in 2017.

However, all of the increase in production in Pakistan was due to the expansion in animal stock, while at the global level per animal yield also improved. This along with the poor development in the milk value chain infrastructure in the country has reduced its competitive position in the domestic and international markets, resulting in ballooning trade deficit from just US$5 million in 2001 to US$119 million in 2017. Moreover, the diversity in the milk processed products in Pakistan remained narrow at around ghee production only, while the production and consumption of processed milk and dairy products (except yogurt) remained limited. Clearly, Pakistan is missing a great opportunity of benefiting from the fast-expanding international milk and milk related product trade which has reached to US$64 billion in 2017. In addition, despite reasonable growth in milk production in the country, the real prices of milk after discounting for inflation, has been increasing suggesting that there is a demand pressure and an unmet milk demand in the country.

In Pakistan, five major milk producing clusters can be identified: 1. Western Punjab and North Western Sindh with Rahim Yar Khan as its focal point; 2. Southern Western Sindh with Umarkot as its focal point, 3. Northern Southern Punjab with Bhakkar as its focal point; 4. Peri-urban Sindh with Karachi as its focal point; and 5. Peri-urban Punjab with Lahore as its focal point. Following are the performance gaps along the milk value chain:

- Price capping, duty-free import of milk and whey powders, and dairy farming not being treated as agriculture,
- Lack of value chain research,
- Poor genetic potential of dairy animals,
- Sub-optimal animal nutrition, and animal husbandry management practices,
- High adulteration and aflatoxin levels, lack of standards, compliance and traceability issues,
- Little awareness of consumers about milk quality,
- Lack of value chain infrastructure,
- Inefficient milk marketing system,
- Underutilization of large-scale processing capacity, and
- Primitive household level processing technology and little support to modernize it.

To bridge these gaps, following strategies are suggested to improve the competitiveness of milk value chain:

- De-capping of milk prices,
- Revamping milk quality related regulation and discouraging free imports of processed milk and milk products

- Encouraging value chain and processing infrastructure like milk community collection centres, milk pasteurization facilities, and khoya, ghee and cheese making facilities at rural level,

Indirect interventions are strengthening dairy value chain research, organizing farmers into FEGs, capacity building of stakeholders along the value chain to manage the quality milk production and processing, promoting contract farming, providing financial services for dairy farmers and processors, and establishment of advisory platform. We propose to pasteurize 50% of the total milk production during the five years project, although it would require big awareness campaign against using open source milk from Dhodhi and implement strict regulatory framework against adulteration, For this purpose a total of 598 small scale pasteurization units would be required. To channel the additional 5% of milk going into each milk processing products, it is estimated that 140 khoya processing, 140 cheese processing, 284 Ghee making, and 32 whole powdered making small scale units would be required to be install at the village level under FEGs. These infrastructures will be incentivized through 20% subsidies and interest free loans for the first year of the instalment. The above strategies would also increase per animal yield by 10% through better animal husbandry practices achieved by enhancing the capacity of producers

The total investment required for the cluster development interventions in all the focal points of five clusters would be US$120.6 million. About 65% of the total investment will be borne by the government in terms of strengthening the dairy research, capacity building of stakeholders, incentivizing the establishment of value chain and processing infrastructure, and providing interest free loans to establish these infrastructures. It is expected these incentives will encourage the private sector to bring the remaining 35% investment by the private sector in establishing the value chain and processing infrastructure.

The Upgradation Plan will generate a pooled Net Present Value (NPV) of US$89.5 over the project period with an Internal Rate of Return (IRR) of 54%. These costs and returns are related to the focal points of each cluster. The detail of these investments and economic analysis of the plan at cluster level can be seen in the attached Summary Sheet below.

**Summary sheet of Milk Clusters**

| | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 | Total |
|---|---|---|---|---|---|---|
| Total lactating animals (000 number) | 645.7 | 234.6 | 263.1 | 555.9 | 537.0 | 2,236.3 |
| Total production per lactation (tonnes) | 739.4 | 260.1 | 2928 | 644.9 | 623.1 | 2,560.4 |
| Yield (tonnes/lactation) | 1.15 | 1.11 | 1.11 | 1.16 | 1.16 | 1.14 |
| Additional production –improved management (000 tonnes) | 194.3 | 82.0 | 92.3 | 169.4 | 163.7 | 701.8 |
| Additional value –improved management (M. US$) | 86 | 38 | 34 | 75 | 79 | 312 |
| Additional fresh milk to be pasteurized (000 tonnes) | 485.7 | 177.7 | 200.1 | 423.6 | 409.3 | 1,696.4 |
| Additional value of milk pasteurization (M. US$) | 43.2 | 16.3 | 14.8 | 37.7 | 39.4 | 151 |
| Total volume of cheese (tonne) | 10,721 | 3,923 | 4,416 | 9,351 | 9,036 | 37,448 |
| Additional value from cheese (M. US$) | 39.7 | 14.5 | 16.4 | 34.6 | 26.8 | 132 |
| Khoya to be produced (tonnes) | 12,142 | 4,443 | 5,001 | 10,590 | 10,234 | 42,410 |
| Additional value from Khoya (M.US$) | 54.0 | 19.7 | 22.2 | 47.1 | 45.5 | 188 |
| Total volume of Ghee produced (tonnes) | 6,071 | 1,333 | 2,501 | 4,236 | 3,070 | 17,211 |
| Expected additional value from Ghee (M. US$) | 54.0 | 11.8 | 22.2 | 37.7 | 27.3 | 153 |
| Volume of whole milk powder produced (tonnes) | 7,625 | 2,790 | 3,141 | 6,650 | 6,427 | 26,633 |
| Additional value of whole milk powder (M. US$) | 22.9 | 8.4 | 9.4 | 20.0 | 19.3 | 80 |
| Pasteurization units required | 170 | 64 | 71 | 149 | 144 | 598 |
| Khoya making units required | 38 | 16 | 18 | 34 | 34 | 140 |
| Cheese making units required | 38 | 16 | 18 | 34 | 34 | 140 |
| Ghee making units required | 99 | 23 | 43 | 68 | 51 | 284 |
| Whole powder milk units required | 8 | 4 | 4 | 8 | 8 | 32 |
| **Investments (M. US$)** | | | | | | |
| Strengthening of milk research | 10.50 | 6.00 | 6.00 | 1.10 | 3.00 | 26.60 |
| Capacity building | 6.09 | 7.41 | 7.41 | 7.41 | 7.41 | 35.72 |
| Processing interventions | 14.44 | 5.64 | 6.24 | 12.83 | 12.40 | 51.56 |
| Market strategies | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 1.11 |
| Government loans | 1.59 | 0.62 | 0.69 | 1.41 | 1.36 | 5.67 |
| **Total investments** | **32.84** | **19.89** | **20.56** | **22.97** | **24.40** | **120.66** |
| Public Investment | 21.112 | 15.201 | 15.387 | 12.528 | 14.297 | 78.53 |
| Private Investment | 11.73 | 4.69 | 5.17 | 10.44 | 10.10 | 42.14 |
| **Economic Analysis of all interventions (Upgradation Plan) (M. US$)** | | | | | | |
| **Production increase in 5th year (tonnes)** | **194,273** | **82,021** | **92,331** | **169,439** | **163,737** | **701,802** |
| **Gross revenue in 5th year** | **300** | **108** | **119** | **252** | **237** | **1,017** |
| **Added operation cost in 5th year** | **264.9** | **90.8** | **101.4** | **226.0** | **207.2** | **890.4** |
| **Net cash flow in 5th year (undiscounted)** | **33.6** | **16.7** | **16.8** | **26.1** | **29.3** | **122.5** |
| **NPV** | **24.9** | **11.0** | **9.5** | **18.6** | **25.5** | **89.5** |
| **IRR** | **55%** | **44%** | **38%** | **56%** | **71%** | **54%** |

# 22. Onion

Pakistan with 138 thousand ha and 1.8 million tonnes of onion production stands at respectively 6th and 9th position in terms of onion area and production. Worldwide onion is cultivated on about 5.2 million ha producing 9.8 million tonnes of production, which give an average yield of 19 tonnes per ha. The slower growth in per ha onion yield has made the country getting 29 lower yield than the world average. A wide gap in average world and Pakistani export price has stayed overtime suggesting that Pakistani has overtime failed to improve onion value chain to meet international onion quality standards.

Three major onion growing clusters can be identified: i) Sindh Onion Cluster with Mirpurkhas as its focal point, ii) KP onion Cluster with Swat as its focal point, and iii) Balochistan Onion cluster with Nasirabad as its focal point. Several performance gaps in the production, processing and trading components of onion value chain are:

- Lack of improved commercial onion cultivars to produce high quality marketable fruit,
- Absence of packaging, storage and packaging materials and improved transportation facilities,
- Poor marketing system,
- Lack of finance to bear production and marketing costs with improved technologies, and
- Lack of guidance regarding onion export.

To bridge these gaps and enhance the competitiveness of onion production in Pakistan, following strategies and interventions are suggested at the focal point of each cluster.

- Introduction of latest varieties and technologies in production and value chain management,
- Incentivizing pack-houses to improve value chain
- Incentivizing onion dried processing,
- Promoting branding and presentation of onion.

The system level interventions include improving technical and institutional capacities of R&D to solve stakeholders' issues along onion value chain, organizing farmers into FEGs so that incentives can be channeled through these groups and they can assure quality as a group, providing training to FEGs and other stakeholders along the value chain to manage quality onion production, linking stakeholders with markets, and creating enabling policy environment for export. To improve value chain of the 10% produce for domestic market in Sindh and 5% in other two clusters, it is estimated that 18 pack houses would be required, and to process 0.5% onion processing 14 driers would be required. It is estimated that these interventions would improve productivity on onion by 15% in Sindh, 10% in Balochistan, and 5% in Swat clusters, reduce post-harvest losses from 30-20% in Sindh and Balochistan, and 30-25% in Swat cluster, and increase exports from 25 to 10% in all clusters.

The estimated total investment for the upgradation plan is US$6.92 million, out of which about 79% shall come from the public sector. Accounting for all the yearly value chain costs including the production, processing and marketing costs, the NPV of the investments over the period of five years would be US$12.21 million, the estimated overall IRR is 84.6%. These costs and returns are related to the focal points of each cluster. The detail of these investments and economic analysis of the plan at cluster level can be seen in the attached Summary Sheet below.

**Summary Sheet of Onion cluster**

| | Sindh | Balochistan | Swat | Total |
|---|---|---|---|---|
| Area under cultivation in focal point (ha) | 9,103 | 3120 | 3745 | 15,968 |
| Total Production (tonnes) | 116,071 | 59,280 | 100,792 | 276,143 |
| Yield (tonne/ha) | 12.75 | 19.0 | 26.9 | 17.29 |
| Area of the cluster (ha) | 37700 | 7600 | 8400 | 53,700 |
| Production of the cluster (tonnes) | 497700 | 147100 | 171700 | 816,500 |
| Added production from enhanced yield in 5th yr (tonnes) | 17,411 | 5928 | 5,032 | 28,371 |
| Additional production value – improved practices in 5th year (M. US$) | 4.439 | 1.511 | 1.283 | 7.234 |
| Saved production due to reduced losses (tonnes) | 13,348 | 6,521 | 5,284 | 25,153 |
| Added value from reduced losses in 5th yr. (M. US$) | 3.403 | 1.662 | 1.347 | 6.414 |
| Production to be processed (tonnes) | 734 | 359 | 555 | 1,648 |
| Total volume of dry produced (tonnes) | 117 | 57 | 89 | 264 |
| Value of added dried product in 5th year (M. US$) | 0.211 | 0.103 | 0.160 | 0.475 |
| Volume to be exported in 5th year (tonnes) | 11,732 | 5,731 | 8,865 | 26,328 |
| Added value from added export in 5th year (M. US$) | 3.344 | 1.633 | 2.527 | 7.504 |
| Added value due to improved value chain in 5th year-domestic & international market (M. US$) | 3.584 | 1.216 | 1.882 | 6.682 |
| Drier units required | 6 | 4 | 4 | 14 |
| Pack houses needed | 10 | 3 | 5 | 18 |
| **Investments (M. US$)** | | | | |
| Investments on R&D | 0.741 | 0.519 | 0.593 | 0.741 |
| Capacity building of stakeholders | 1.483 | 0.508 | 0.610 | 1.483 |
| Investments on processing infrastructure | 0.178 | 0.119 | 0.119 | 0.178 |
| Investments on value addition infrastructure | 0.741 | 0.222 | 0.370 | 0.741 |
| Investment on linking farmers with markets | 0.222 | 0.074 | 0.222 | 0.222 |
| Loans | 0.063 | 0.039 | 0.056 | 0.063 |
| Total Investment | 3.471 | 1.481 | 1.970 | 3.471 |
| Government investment | 2.736 | 1.208 | 1.579 | 2.736 |
| Private | 0.735 | 0.273 | 0.391 | 0.735 |
| Production level | 2.224 | 1.027 | 1.203 | 2.224 |
| Processing and value addition | 1.024 | 0.380 | 0.545 | 1.024 |
| Marketing | 0.222 | 0.074 | 0.222 | 0.222 |
| **Economic Analysis (M. US$)** | | | | |
| Total production increase in 5th year (tonnes) | 30,759 | 12,449 | 10,316 | 53,523 |
| Gross revenue (undiscounted) in 5th year | 14.982 | 6.127 | 7.199 | 28.308 |
| Additional operation costs in 5th year | 8.372 | 3.122 | 3.778 | 15.273 |
| Net cash flow (undiscounted) in 5th year | 6.610 | 3.005 | 3.420 | 13.035 |
| NPV (US$) | 5.940 | 3.104 | 3.172 | 12.217 |
| **IRR** | **81.9%** | **99.0%** | **79.2%** | **84.8%** |

# 23. Pattoki Nursery

Due to the varied agro-climatic conditions and relatively low cost of nursery plants production, Pakistan has immense opportunities not only to meet the local demands of both traditional and exotic species and varieties of fruits, floriculture, and ornamental nursery plants but also a high potential for export. Most of the nursery planting material produced in Pakistan, however, is sold locally and very few seedlings/nursery plants are exported because of the lack of following standards.

Two main nurseries clusters observed in Pakistan are:1) Pattoki Flower and Ornamental Plant Nursery cluster concentrated in Pattoki town of Kasur district of Punjab abbreviated as PFON, 2) Fruits Plant Nursery Cluster concentrated around Peshawar and Mardan districts of KP abbreviated as Mardan Fruit Plant Nursery MFPN. Several performance gaps in the production and marketing components of nursery value chain are:

- No research capacity on nursery plant business,
- Lack of certified seed, germplasm, and planting material of high-quality for multiplication,
- Low capacity of nursery men to manage nurseries on scientific grounds,
- Absence of modern technologies, such as hardening process, appropriate pit material, etc.
- Lack of technological assistance,
- Use of inappropriate packaging material and transport means for trading in the high-value nursery planting-material markets causing high post-harvest losses.
- Limited land for expansion and lack of capital to modernize capital.

To bridge these gaps and enhance the competitiveness of onion production in Pakistan, following strategies and interventions are suggested at the focal point of each cluster.

- Renovation of 10% of nurseries by introducing vertical nursery production through various structure, and growing of multiple species,
- Introducing modern technologies like tissue culture plant production, growth hormone, etc.
- Production of certified nursery plants through tissue culture, and
- Promotion of cold chain in marketing.

At the system level research on nursery plant industry will be initiated in collaboration with the private sector and stakeholders especially of nurserymen will be enhanced. Pakistan Certified Nursery Center (PCNC) would be established with its substation in both the Clusters and awareness programs will be launched To improve the quality of nursery plants and reduce the post-harvest losses, 6 tissue culture labs and at least two cold storage and reefer would be needed. These measures is estimated to increase the productivity of nursery plants from the same land up to 30%, reduce post-harvest losses by one half, increase the export of nursery plants to 1%, and improve the quality of all the exported and 10% of the domestic supply at par to international standard.

To estimated cost to implement the upgradation plan would be US$6.21 million and bout 25% of this will come from the government. The net present value (NPV) of investment from both the clusters would be US$7.1 million which will generate an Internal Rate of Return (IRR) of 21%. The detail of these investments and economic analysis of the plan at focal points of each cluster can be seen in the attached Summary Sheet below.

**Summary Sheet od Pattoki Nursery**

| Information | PFON cluster | MFPN cluster | Overall |
|---|---|---|---|
| Area of cluster focal point (ha) | 1,870 | 1,350 | 3,220 |
| Production (tonnes) | 23,143 | 15,592 | 38,735 |
| Yield of the cluster (tonne/ha) | 12.38 | 11.55 | 12.03 |
| Growth in yield without intervention (%) | 0.04% | 0.04% | 0.04% |
| Percent area to be renovated in 5 years | 10% | 10% | 15% |
| Nursery area to be renovated (ha/y) | 37 | 27 | 64 |
| Increase in yield - renovation of gardens (%) | 25% | 30% | 100% |
| Added production - renovation of garden (tonnes) | 580 | 469 | 1,049 |
| Additional value - renovation (000 US$) | 278.49 | 304.90 | 583.39 |
| Yield improvement - improved practices (1000 pl/ha) | 3.72 | | 1.86 |
| Added production - improved practices (1000plants) | 6,962 | 4,691 | 11,653 |
| Additional value – improved practice (M. US$) | 2.033 | 2.735 | 4.768 |
| Reduction in post-harvest storage losses (%) | 10.0% | 10.0% | 10.0% |
| Enhanced production - reduced losses (1000plants) | 3,075 | 2,080 | 5,155 |
| Additional value - reduced storage losses (M. US$) | 0.898 | 1.212 | 2.110 |
| Plants in modern container packaged (1000 plants) | 1,184 | 1,029 | 2213 |
| Additional value from container packaging (M. US$) | 0.301 | 4.578 | 4.879 |
| Current Exports | 0.20% | 0.40% | 0.300% |
| Increased in export in 5 yr. (% of production) | 1.0% | 2.0% | 11.83% |
| Total volume to be exported (1000 plants) | 338 | 458 | 796 |
| Additional value from enhanced export (000 US$) | 63.59 | 30.65 | 94.24 |
| Additional value from improved VC (000 US$) | 260.46 | 181.29 | 441.74 |
| Total number of tissue culture labs required | 3 | 3 | 6 |
| Total number of containers required | 1 | 1 | 2 |
| **Investments Required (M. US$)** | | | |
| Capacity building and FEGs for improved practices | 0.121 | 87.7 | 209.1 |
| Total investment on nursery renovation | 0.028 | 20.0 | 47.7 |
| Containers and tissue culture labs | 1.449 | 1449.3 | 2898.6 |
| Investments on cold chain (storage, reefer, etc.) | 0.725 | 724.6 | 1449.3 |
| Investments on marketing/export | 0.725 | 724.6 | 1449.3 |
| Government loans on private investment | 0.080 | 79.7 | 159.4 |
| **Total investment required over five year** | **3.127** | **3085.9** | **6213.6** |
| **Source of investment (M. US$)** | | | |
| Public investments including loans & subsidies | 0.786 | 751.1 | 1537.5 |
| Private sector investment | 2.341 | 2335.0 | 4676.1 |
| **Type of investment (M. US$)** | | | |
| Production level investments | 1.477 | 1469.4 | 2946.6 |
| Processing and value addition level investments | 0.804 | 804.3 | 1608.7 |
| Marketing level | 0.725 | 724.6 | 1449.3 |
| **Overall benefits return (M. US$)** | | | |
| Total increase in production due to all the yield (000 tonnes) | 10.618 | 7.239 | 17.857 |
| Additional value of production due to all interventions | 3.875 | 9.156 | 13.031 |
| Added operational costs | 2.335 | 1.554 | 3.889 |
| Net cash flow | 1.239 | 3.023 | 4.263 |
| NPV | 0.962 | 6.110 | 7.071 |
| Internal Rate of Return | 21.16% | 70.61% | 21.16% |

# 24. Peas

In Pakistan, Peas are cultivated on around 23.6 thousand ha producing 149 thousand tonnes of peas with 6.3 tonnes per ha yield. Globally, it is grown on 2.6 million ha which supplies 19.9 million tonnes of peas with an average yield of 7.7 tonnes. Despite fast expansion in Peas production, Pakistan could not benefit from its fats expanding global market at 4.6% per annum rate during 2001-16, which has reached at US$2.6 billion. 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 farm gate price is only 20% of the world average suggesting serious problems in the value chain of Peas.

In Pakistan, peas are grown in all provinces but two clusters of peas can be identified: one in Upper KP with Swat as its focal point and the other in Central Punjab with Sheikhupura as its focal point. Several performance gaps in the production, processing and trading components of peas value chain are:

- Rainfall at the sowing time in Punjab and at harvest time in KP affect production,
- Weak research especially on crop management and value chain issues,
- Lack of improved commercial peas cultivars which are mainly imported from India,
- Sub optimal management practices,
- Improper post-harvest practices for trading in the high-value fresh peas market, and
- Limited value addition and processing

To bridge these gaps following strategies are suggested at the focal point of each cluster:

- 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 practices,
- Improvement of post-harvest handling practices including grading, packaging and transportation, and
- Establishing value chain improvement infrastructure like pack houses, etc.

Indirect system level interventions include strengthening research on peas varietal development and value chain issues, building capacities of producers, and organizing Farmers' Entrepreneur Groups (FEGs). The introduction of these interventions is expected to increase per ha yield by 20%, and increase export-production ratio by 5%. It is estimated that 6 pack houses would be required to improve the quality of all peas for export and 10% of the peas for domestic market.

The estimated total investment required to implement the upgradation plan would be US$4.18 million, 46% of which will be shared by the public sector. Accounting for all the investments and operational costs, the overall NPV of the net return would US$5.09 million over a period of five years with the pooled IRR of 68%. The detail of these investments and economic analysis of the plan at the focal point of each cluster can be seen in the attached Summary Sheet below.

**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 (tonne/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 (tonnes) | 1821 | 4809 | 6631 |
| Expected additional value of production (US$) | 733970 | 2496105 | 3230076 |
| Increase in production due mechanized planting (tonnes) | | 301 | 301 |
| Value of production due mechanized planting (US$) | 0 | 156,007 | 156007 |
| Increase in quantity of export on fifth year (tonnes) | 546 | 1443 | 1989 |
| Increase in value of export on the fifth year (US$) | 287396 | 758931 | 1046327 |
| Production that will pass through improved value chain (tonnes) | 546 | 0 | 546 |
| Value from exports with improvement in value chain (US$) | 310890 | 0 | 310890 |
| Value of production due to improvement in value chain (US$) | 243685 | 0 | 243685 |
| Total number of pack house required | 3 | 3 | **6** |
| Total cost of machinery for value addition on the pack house | 139280 | 139280 | **278560** |
| Total cost of machinery for planter (US$) | - | 64,519 | **64519** |
| **Investments (M. US$)** | | | |
| Investments required on R&D level interventions | 0.370 | 0.741 | 1.111 |
| Investment on IFQ units | 0.000 | 1.000 | 1.000 |
| Investments required for value chain improvement | 0.279 | 1.000 | 1.279 |
| Investments required on Marketing/Export level interventions | 0.296 | 0.519 | 0.815 |
| Investment required on planter | 0.000 | 0.199 | 0.199 |
| Total investment required over five year | 0.976 | 3.208 | 4.184 |
| Public investment | 0.516 | 1.389 | 1.905 |
| Private investment | 0.460 | 1.819 | 2.279 |
| **Economic Analysis (M. US$)** | | | |
| **Increase in production due to all the yield increasing (tonnes)** | **1821** | **5110** | **6931** |
| **Gross revenue (undiscounted) in 5th year** | **1.576** | **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%** |

# 25. Plums

Plums in Pakistan is grown on 7.12 thousand ha producing 55.6 thousand tonnes of plum with an average per ha yield of 7.8 tonnes. Globally it is cultivated on 2.6 million ha and annual production of 11.8 million tonnes giving an average yield of 4.49. Although higher yield than the world average, its production in Pakistan has been in serious trouble as it has plummeted at 2.45% per annum rate since 2001. With the increasing population in the country, the per capita consumption of very full of nutrition fruit has also been on a sharp decline. Contrary to this, the global plum production is increasing at annual 2.0% per annum, thus Pakistan's comparative position has drifted from 23$^{rd}$ to 28$^{th}$ among plum growing countries.

Two plums growing clusters in the country are in Balochistan and KP with Kallat and Peshawar as their respective focal points. The existing plums industry of Pakistan is facing multi-dimensional challenges from production to harvesting and marketing, which are:

- Water scarcity in Balochistan,
- Old and low yield potential plum trees and low-plant density,
- Old-fashioned garden management practices,
- Improper harvesting and poor fruit handling,
- Lack of updated information on plum in national and international markets,
- Non-existence of post-harvest cooling for the removal of field heat, and
- Lack of cold chain and cold storage.
- Little or no processing on commercial basis.

The interventions proposed to overcome these constraints and to enhance the competitive are

- Renovation of 20% and 40% of Balochistan and KP gardens, respectively with the plants of improved varieties,
- Capacity building of farmers and value chain stakeholders on proper harvesting and value chain management techniques,
- Establishing certified nurseries,
- Introducing proper value chain infrastructure to uplift plum quality, and
- Introduction of plum drying by using solar-cum-gas fired dryers for making prunes.

Indirect system level interventions will include initiating the R&D system in collaboration with the private sector, organizing producers into FEGs, training of stakeholders for value chain management and processing, and linking them with markets. It is estimated that these interventions can enhance plums productivity by 50% on renovated and 25% on non-renovated gardens, reduce post-harvest losses from 20% to 15% and boost export-production ratio to 5%. A total of 2 certified nurseries to supply certified plants, 6 collection centers to improve the quality of all exported and 5% of plum in domestic market to international standard, and 95 dryers will be needed to process 15% of plum production. The total investment needed for the upgradation plan is US$8.8 million, 66% of which will come from the government. The pooled NPV is US$15.47 million with IRR at 57.7%. The detail of economic analysis of the plan at the focal point of each cluster can be seen in the attached Summary Sheet below.

**Summary Sheet of Plums Clusters**

| Information | Balochistan | KP | Overall |
|---|---|---|---|
| Area of cluster focal point (ha) | 852 | 382 | 1,234 |
| Production (Tonnes) | 10,574 | 4,425 | 14,999 |
| Yield of the cluster (tonne/ha) | 12.41 | 11.58 | 12.15 |
| Area of the cluster (ha) | 2,634 | 1,447 | 4,081 |
| Production of the cluster (tonne) | 25,538 | 13,706 | 39,244 |
| Increase in production due to orchards renovated (tonnes) | 908 | 724 | 1,632 |
| Additional value of production - orchards renovated (000 US$) | 605.53 | 482.52 | 1,088.05 |
| Increase in production due to improvement in management (tonnes) | 1,817 | 543 | 2,359 |
| Value of production due to improved management (000 US$) | 1,211.05 | 361.89 | 1,572.94 |
| Increased in production due to reduced post-harvest losses (tonnes) | 596 | 240 | 836 |
| Additional value of production - reduction of PH losses (US$) | 397,393 | 159,959 | 557,352 |
| Production to be processed drying/processing (tonnes) | 1,878 | 756 | 2633 |
| Additional income through enhanced processing (M. US$) | 2.253 | 0.907 | 3.160 |
| Present expected import without intervention (tonnes) | 626 | 252 | 878 |
| Additional value from exports with improvement (M. US$) | 1.657 | 0.667 | 2.324 |
| Value of production due to improvement in value chain (M. US$) | 1.890 | 0.761 | 2.651 |
| Total number of dryers required | 76 | 19 | **95** |
| No. of certified nurseries required | 1 | 1 | **2** |
| Total collection centers required | 4 | 2 | **6** |
| **Investments (M. US$)** | | | |
| Improvement in research infrastructure | 2.250 | 2.500 | 4.750 |
| Capacity Building of farmers and stakeholders | 0.126 | 0.028 | 0.155 |
| Orchard renovation-plants and drip | 0.826 | 0.741 | 1.567 |
| Investments on establishment certified nurseries | 0.029 | 0.029 | 0.058 |
| Investment on farmers organization and value addition | 0.533 | 0.267 | 0.800 |
| Investments required on solar-cum-gas fired drying | 1.008 | 0.253 | 1.261 |
| Investment on export promotion activities | 0.037 | 0.037 | 0.074 |
| Free of interest loans for one-year period | 0.119 | 0.029 | 0.148 |
| **Total investments** | **4.929** | **3.884** | **8.813** |
| Public sector investments | 2.982 | 2.823 | 5.805 |
| Private sector investment | 1.947 | 1.061 | 3.008 |
| Economic Analysis (M. US$) | | | |
| Total increase in production due to all the yield increasing (tonnes) | 3,321 | 1,507 | 4,828 |
| Gross revenue (undiscounted) in 8th year | 8.014 | 3.339 | 11.353 |
| Additional operation costs in 8th year | 2.985 | 1.316 | 4.302 |
| Net cash flow after offsetting costs in 5th year (Undiscounted) | 5.029 | 2.023 | 7.051 |
| NPV | 1.255 | 3.011 | 15.556 |
| **Internal Rate of Return** | 76.49% | 32.34% | 57.72% |

# 26. Potato

The potato has become the Pakistan's fastest growing staple food crop as strong gains in its cultivated area and per ha yields have been achieved since independence. During 206, potato in Pakistan is grown on 177.8 thousand ha producing a total 3.8 million tonnes with an average yield of 22.5 tonnes. The total world potato production is estimated at 388 million tonnes on an area of 19 million ha with an average yield of 20.0 tonnes per ha. The export-production ratio at global level is 15% while the ratio is only 10% despite the country's proximity with big markets.

In Pakistan, three major potato clusters can be identified: Central-South Punjab with Okara as its focal point, Central Punjab with Chiniot as its focal point, and GB with Hunza as its focal point. Several performance gaps in technology, inputs, and market structure of potato are:

- Weak research to resolve the issue of stakeholders along the value chain
- Poor infrastructure and training for the supply of certified potato seed,
- Lack of improved value chain operations,
- Little group action among farmers to supply potato according to the market demands.
- Poor links with international market, and
- Less than optimal size of the processing industry especially as a cottage industry.

The suggested interventions to upgrade the value chain and improve the competitiveness are:

- Introduction of new high yielding varieties and crop management practices,
- Promote the supply of tissue culture seeds production in Central-South Punjab on 5% area and in Central Punjab potato clusters to 10% area,
- Improvement in on-farm seed production by training of farmers on proper rouging,
- Training of farmers and value chain agents to use improved value chain operations like washing, grading, packing, transportation, etc.,
- Increase in potato processing from 5% to 9% in Punjab cluster.

Indirect interventions will include strengthening the research system on potato value chain, links with international markets to enhance export, and supply of varieties for processing. It is estimated that the supply of tissue culture seed will increase yield by 5% and 10% in Central-South and Central Punjab, while Improved management practices in GB will increase yield by 10% in the focal point of these clusters. A further 15% yield enhancement is expected due to the use of improved on-farm produced seed as a result of better rouging. Better links of stakeholders with markets will increase export-production ratio from 15% to 20-25% in Punjab clusters. It is also expected that improved value chain operation will enhance the quality of all exports and 5% of the domestic produce to international standards. A total 144 tissue culture labs would be required in the Punjab clusters. Moreover, 121 chips units would be needed to encouraging the potato-based processing as cottage industry for targeted production. The estimated cost of investment for these interventions would be around $17.05 million, out of which about 50% will be borne by the public sector. After counting for all the operational costs and investments, the NPV of the upgradation plan would be US$7.5 with an IRR of 33%. The detail of these investments and economic analysis of the plan for each focal point of the clusters can be seen in the attached Summary Sheet.

**Summary Sheet of Potato cluster**

| *Item* | Punjab A | Punjab B | GB | Total |
|---|---|---|---|---|
| Area under cultivation in focal point (ha) | 54,073 | 9,449 | 2,473 | 65,995 |
| Total Production (000 t) | 1.270 | 0.202 | 0.035 | 1.507 |
| Default yield (tonne/ha) | 23.48 | 21.36 | 14.28 | 22.83 |
| Area of the cluster (ha) | 124167 | 16636 | 9116 | 149,919 |
| Production of the cluster (000tonnes) | 2.870 | 0.355 | 0.128 | 3.354 |
| Production from enhanced yield (tonnes) | 0 | 0 | 3712 | 3,712 |
| Additional value from increased yield in (US$) | | | 687,449 | 687,449 |
| Area to be brought under the use of TC seed (ha) | 2,163 | 756 | 493 | 3,412 |
| Tissue culture seed to be produced with (tonnes) | 6,489 | 2,268 | 1,479 | 10,235 |
| Increased production with use of tissue culture seed (tonnes) | 5,605 | 1,782 | 740 | 8,127 |
| Added value with tissue culture seed (M. US$) | 0.0664 | 0.0211 | 0.0137 | 0.1013 |
| Acreage to be covered under rouging in year 5 (ha) | 8,111 | 1,417 | 371 | 9,899 |
| Total area for which rouged seed would be used (ha) | 40,555 | 7,087 | 1,855 | 49,496 |
| Increase in production due to use of rouged seed (tonnes) | 52,551 | 8,353 | 2,784 | 63,688 |
| Additional value of improved seed (M. US$) | 6.228 | 0.990 | 0.516 | 7.734 |
| Total expected volume of potato to be exported (tonnes) | 72,975 | 23,289 | - | 96,264 |
| Expected additional value of Export (M. US$) | 5.727 | 1.828 | 0.000 | 7.555 |
| Domestic production into improved value chain (tonnes) | 72,975 | 18,631 | 4,436 | 96,042 |
| Value due to improved VC operations (M. US$) | 8.9030 | 2.2730 | 0.5412 | 11.7171 |
| Additional potato production for processing (ton) | 29,078 | 9,244 | - | 38,322 |
| Additional value to farmers in year 5 (M. US$) | 0.3339 | 0.1061 | 0.00 | 0.4400 |
| Quantities of Potato Chips Produced (tonnes) | 7,269 | 2,311 | - | 9,580 |
| Value of Potato chips produced in year 5 (US$) | 18.847 | 5.992 | 0.00 | 24.838 |
| **Investments (M. US$)** | | | | |
| Renovating the existing R&D establishment | 4.000 | 0.500 | 0.050 | 4.550 |
| Investment on R&D establishment | - | - | 0.050 | 0.050 |
| Imports and testing of processing varieties | 0.800 | 0.134 | 0.009 | 0.943 |
| Training and demonstration for rouging | 0.203 | 0.035 | - | 0.238 |
| Tissue culture SOPs of service providers | 0.250 | 0.100 | - | 0.350 |
| Potato growers' associations and shed houses | 3.000 | 0.250 | 0.100 | 3.350 |
| Establishment of tissue culture labs | 1.427 | 0.370 | 0.106 | 1.902 |
| Renovation of existing tissue culture labs | 0.019 | 0.012 | 0.015 | 0.046 |
| Investment on processing | 1.794 | 0.605 | - | 2.399 |
| Improving international links | 1.500 | 0.500 | - | 2.000 |
| Training of stakeholders along the value chain | 0.500 | 0.200 | - | 0.700 |
| Interest free loan | 0.389 | 0.118 | 0.014 | 0.521 |
| **Total Investment** | **13.882** | **2.825** | **0.344** | **17.050** |
| Public Investment | 6.661 | 1.210 | 0.113 | 7.984 |
| Private Investment | 6.832 | 1.497 | 0.217 | 8.545 |
| **Economic Analysis of all interventions (Upgradation Plan) (M. US$)** | | | | |
| Total production increase in 5th year (tonnes) | 58,156 | 10,135 | 7,236 | 75,527 |
| Gross revenue (undiscounted) in 5th year | 40.105 | 11.210 | 1.758 | 53.073 |
| Additional operation costs in 5th year | 27.261 | 9.321 | 1.394 | 37.975 |
| Net cash flow (undiscounted) in 5th year | 12.845 | 1.889 | 0.364 | 15.098 |
| NPV | 6.928 | 0.314 | 0.269 | 7.512 |
| **IRR** | 36% | 15% | 53% | 33% |

# 27. Rapeseed and Mustard

Globally, during 2016-17, rapeseed and mustard (RS&M) was grown on around 35 million ha (the contribution of rapeseed is about 2.6%) producing a total grain of 76.8 million tonnes with an average yield of 2.17 tonnes per ha. In Pakistan during the same year, rapeseed (mustard for grain purpose in Pakistan is insignificant) was grown on 228 thousand ha producing a total grain production of 209 thousand tonnes with an average yield of 920 kg per ha. While the average oil extraction rate of mustard seed is around 32-38%, rapeseed grain can provide only 17-18% oil. However, mustard oilcake is preferred by buffalo, which is one of the main animals raised for milk production in Pakistan and farmers big source of livelihood.

Rapeseed production in Pakistan did not perform very well during the 2000s. Despite steep increase in the demand thus rise in prices of edible oils in the country, the RS&M productivity remains far lower than the world average. There has been a marginal improvement in per ha rapeseed yield, but this improvement is far lower than the world average growth. Thus, Pakistan is not only losing its relative position in RS&M in the world market but also its competitiveness because of low yield and high production costs. As a result, there is a steep increase in the import of edible oil in general and RS&M grain for oil and oilcake for animal feed in particular costing the country over US$2 billion.

Four clusters of RS&M can be identified: Southern Punjab with Yazaman as its cluster point, Northern Punjab wit Chakwal as its focal point, Sindh with Kot Ghulam Muhammed as its focal point, and Baluchistan with Usta Muhammad as its focal point. Main performance gaps in technology, inputs, and market segments of RS&M value chain are:

- Non-availability of varieties suitable for the cluster's eco-system, and high seed costs,
- Weak research and extension to address the value chain issues,
- Non-availability of quality inputs,
- Lack of implementation of regulations related to oil quality, and
- Unrestricted imports of low quality which has crowd out the high-quality canola oil,
- Small RS&M farm size weaken the links between huge processing industry and farmers,
- Low processing efficiency,
- Unlike competing crop of wheat, no protection against variation in canola prices, and
- Lack of capacity building of stakeholders on quality production, storage, and processing.

To improve the competitiveness of RS&M, following interventions are suggested at different segments of the value chain in the focal point of each cluster:

- Replace 50% area with modern varieties by supplying canola seed at subsidized rate,
- Capacity building of stakeholders to produce, store, and process quality oil grains and oils through demonstration and training,
- Increasing the share of solvent extraction from 53% to 70% by replacing the traditional oil extraction 'Kohloose' with the modern small solvent oil extraction plants, and
- Improving marketing system for RS&M by establishing collection center at union council level in the focal point of each cluster.

- The system level interventions will include strengthening R&E to resolve the value chain issues of RS&M, implementing the quality control regulations to create space for high-quality canola oils along with consumers' quality-oil awareness program, linking the imports of edible oil with the cluster-level investment as well as with the procurement of domestically produced canola, and organizing farmers into Farmers Entrepreneur Groups (FEGs). These

interventions are expected to enhance RS$M productivity by 15-20%, reduce post-harvest losses from 5% to 2%, and improve the extraction efficiency from 10.5% to 17.5%. To achieve the target of increased share of solvent oil extraction as set above, 27 modern oil extraction units would be required.

To implement these intervention, total investment required in all the focal points of each cluster would be US$5.2 million, 72% of which shall come from the government. The pooled Present Net Value (NPV) of all the net cash flows during the whole project period of five years for all the cluster focal points is US$1.93 million. This investment plan for development of clusters looks lucrative, because IRR for all the focal points of all clusters will be 31%. The detail of these investments and economic analysis of the plan for each focal point of the clusters can be seen in the attached Summary Sheet.

**Summary Sheet of RS&M**

| Item | Kot Ghulam Muhammad | Yazman | Chakwal | Usta Muhammad | Total |
|---|---|---|---|---|---|
| Area under cultivation in focal point (ha) | 3,446 | 8,262 | 11,176 | 3,017 | 25,901 |
| Total Production of focal point (tonnes) | 3,473 | 11,748 | 10,941 | 2,042 | 28,204 |
| Yield of focal point (tonne/ha) | 1.01 | 1.42 | 0.98 | 0.68 | 1.09 |
| Additional production-improved practices (tonnes) | 712 | 1807 | 2243 | 417 | 5,179 |
| Additional value-improved practices (000 US$) | 369.25 | 936.8 | 1,163.2 | 216.0 | 2,685.3 |
| Enhanced production-reduced PH losses (tonnes) | 128 | 416 | 404 | 75 | 1,023 |
| Additional value-reduced losses (000 US$) | 66.5 | 215.5 | 209.4 | 38.9 | 530.2 |
| Production increase-improved variety (tonnes) | 356 | 1,204 | 1,122 | 260 | 2,943 |
| Enhanced value of production-improved variety (000 US$) | 195.8 | 662.5 | 616.9 | 143.2 | 1,618.4 |
| **Mechanical Oil Extraction** | | | | | |
| Production converted (tonnes) | 664 | 540 | 523 | 213 | 1,938 |
| Oil extraction unit required (number) | 8 | 7 | 7 | 5 | 27 |
| Additional oil production (tonnes) | 46 | 38 | 37 | 15 | 136 |
| Value of increased oil production (000 US$) | 61.936 | 50.4 | 48.8 | 19.8 | 180.99 |
| Additional oilseed cake production (tonnes) | 531 | 324 | 314 | 128 | 1,296 |
| Incremental value of oilseed cake (US$) | 7,865 | 4,796 | 4,646 | 1,890 | 19,197 |
| Enhanced value oilseed cake (US$) | 69,801 | 55,154 | 53,425 | 21,736 | 200,116 |
| **Investments (000 US$)** | | | | | |
| Strengthening research | 50,000 | 200,000 | 300,000 | 40,000 | 590,000 |
| Capacity building for improved practices | 33,184 | 79,560 | 107,621 | 29,053 | 249,417 |
| Demonstration & demand management | 205,556 | 505,185 | 708,889 | 40,074 | 1,459,704 |
| Oil Extraction Machinery | 90,115 | 78,851 | 78,851 | 56,322 | 304,139 |
| Improvement in marketing | 22,333 | 53,333 | 72,407 | 19,519 | 167,593 |
| Seed replacement | 319,074 | 765,000 | 1,034,815 | 279,352 | 2,398,241 |
| Government loans on private investment | 9,913 | 8,674 | 8,674 | 6,195 | 33,455 |
| **Total Investment** | **730.2** | **1,690.6** | **2311.3** | **470.5** | **5202.5** |
| Public Investment | 493.6 | 1,223.4 | 1,681.1 | 393.4 | 3,791.5 |
| Private Investment | 236.5 | 467.2 | 630.2 | 77.1 | 1,411.1 |
| **Economic Analysis of all interventions (Upgradation Plan) (000 US$)** | | | | | |
| Increase in production-All interventions (ton) | 1,196 | 3,427 | 3,769 | 752 | 9,144 |
| Gross revenue from all interventions(un-dis.) | 701.3 | 1869.8 | 2043.0 | 419.9 | 5034.0 |
| Total Value Chain operational costs (Un-dis.) | 263.9 | 487.7 | 553.5 | 157.8 | 1463.0 |
| Net cash flow (undiscounted) | 437.4 | 1382.1 | 1489.5 | 262.0 | 3571.1 |
| NPV (US$) | 166.9 | 1016.4 | 681.1 | 62.3 | 1926.7 |
| IRR | 23% | 42% | 26% | 17% | 31% |

# 28. Spices

Pakistan is at the 6th position in the production of minor spices (excluding chili, onion, ginger, and garlic) with over 18 thousand ha of land and 53 thousand tonnes of production having an average per ha yield of 2.9 tonnes, which is 20% higher than the world average. Internationally, the minor spices group is grown on 1.15 million ha with production of 2.81 million tonnes. The international export market of spices has reached to about US$1.8 billion, and its value has been growing at the rate of 10% per annum in during 2001-17.

Pakistan has done fairly good in capturing international export market of minor spices, however, its farm-level performance has not been very impressive as its production is growing at much lower rate than the world average, and that is only because of the expansion in area rather than in per ha yield. In this scenario, Pakistan will not only lose its comparative but also competitive position. If production is not increased at enhanced rate especially by improving per ha yield, it has to increasingly rely on the imports for raw material to produce branded spices or its farm-level prices will further increase which are already higher than the world average.

In Pakistan, two product clusters of coriander and turmeric can be recognized. The turmeric cluster mainly consists of Kasur districts in Punjab, while coriander cluster is further divided into two sub-cluster: Sindh Coriander Cluster with Larkana as its focal point and Balochistan Coriander Cluster with Nasirabad district as its focal point.

Following are the major gaps in different segments of the value chain of spices.

- Stereotype traditional management practices,
- Lack of awareness about and resources to adopt good agricultural practices,
- Poor backstopping from research and extension services,
- Use of traditional or obsolete technologies in cleaning, drying and grading,
- Lack of branding of processed product,
- Lack of group actions resulting the supply in small lots with low and non-uniform quality.

Following strategies are suggested for the focal points of each cluster to improve their competitiveness.

- Introducing new varieties and management practices,
- Capacity building of stakeholders for improved value chain management, and
- Introducing mechanical coriander and turmeric cleaner.

Indirect interventions include improving technical and institutional capacities of R&D and organizing producers into Spices Entrepreneur Groups (SEGs). It is estimated that these interventions will improve the productivity of minor spices by 20% and reduce post-harvest losses from 20% to 10%. A total of 268 mechanical cleaner would be required to improve the quality of 30% of the coriander produce and 20% of the turmeric produce to international standards.

Total estimated investment for these interventions is US$8.23 million, out of this 34% will be borne by the government. Accounting for all the fixed and variable costs over the period of five years, the total NPV of the upgradation plan is expected to be $1.27 million within the five year of project life and the overall estimated Internal Rate of Return (IRR) at 22%. The details of the investment on various interventions and their impacts can be seen in the attached Summary Sheet.

**Summary Sheet of Spices cluster**

| Coriander cluster | Coriander cluster | | Turmeric | Overall |
|---|---|---|---|---|
| **Information** | **Sindh** | **Balochistan** | **Punjab** | **Overall** |
| Area of cluster focal point (ha) | 275 | 770 | 4,102 | 1,045 |
| Production (Tonnes) | 136 | 426 | 54,673 | 562 |
| Yield of the cluster (tonne/ha) | 0.49 | 0.55 | 13 | 0.54 |
| Annual yield growth without intervention (%) | 2.0% | 2.0% | 3.0% | 2.33% |
| Increase in production – improved farm practices (tonnes) | 30 | 94 | 12,665 | 12,789 |
| Expected additional value of production due to improved management practices (000 US$) | 19.5 | 61.1 | 1,519.8 | 1,600.4 |
| Increased in production - reduced post-harvest losses (tonnes) | 18 | 56 | 7,599 | 7,673.70 |
| Added production value – reduced PH losses (000 US$) | 11.7 | 36.7 | 911.9 | 960.3 |
| Total volume to be value added (tonnes) | 59 | 186 | 16,718 | 16,964.01 |
| Added value from value addition/processing (000 US$) | 32.691 | 102.4 | 6,018.6 | 6,153.7 |
| Present expected import without intervention (tonnes) | 16,747 | 16,747 | 1,440 | 34,933 |
| Import substitution during fifth year (tonnes) | 48 | 150 | 1,440 | 1,638 |
| Import substitution on fifth year (%) | 0.3% | 1% | 100% | 5% |
| Number of cleaner required/processor | 4 | 12 | 252 | 268 |
| Machinery cost for value addition/processing (000 US$) | 14.0 | 42.0 | 6519.7 | 6,575.7 |
| Annual capacity of the cleaner (tonne) | 15 | 15 | 180 | 210 |
| Investment on R&D establishment (000 US$) | 22.22 | 66.67 | 555.56 | 644.44 |
| Investments required on training, extension, etc. (000 US$) | 14.81 | 44.44 | 222.22 | 281.48 |
| Investments on processing/value addition (000 US$) | 14.00 | 42.00 | 6519.74 | 6575.74 |
| Government loans on private investment | 1.54 | 4.62 | 717.17 | 723.33 |
| Total investment required over five year (000 US$) | 52.58 | 157.73 | 8014.69 | 8225.00 |
| Public sector investments (000 US$) | 41.4 | 124.1 | 2621.1 | 2786.6 |
| Total private sector investment (000 US$) | 11.2 | 33.6 | 5393.6 | 5438.4 |
| Production level investments (000 US$) | 37.0 | 111.1 | 777.8 | 925.9 |
| Processing level investments (000 US$) | 15.5 | 46.6 | 7236.9 | 7299.1 |
| **Economic Analysis** | | | | |
| Increase in production due to all interventions (tonnes) | 48 | 150 | 20,265 | 20,463 |
| Additional gross revenue due to all interventions (000 US$) | 63.9 | 200.2 | 8,450.4 | 8,714.5 |
| Added operational costs in the 5th year (000 US$) | 35.2 | 102.9 | 3,910.7 | 4,048.8 |
| Net cash flow in 5th year (after offsetting all costs (000 US$) | 28.7 | 97.3 | 4,484.1 | 4,610.2 |
| NPV (M.US$) | 2.6 | 28.2 | 1,241.1 | 1,271.9 |
| Internal Rate of Return | **11.8%** | **20.4%** | **22.7%** | **22.6%** |

# 29. Sugarcane

In 2016, globally sugarcane was grown on 26.5 million ha producing 1861 million tonnes of sugarcane with an average yield of 70 tonnes per ha. Pakistan ranks 5th among the world's sugarcane producing countries. Globally during 2001-16, the production and export of all types of sugar has increased at 3% per annum rate, the latter to reach to the level of US$38.4 billion. The export of refined sugar from Pakistan has been expanding at the rate of 22%, although from a small base, and surpassed to $474 million in 2018. Globally, the rate of increase in centrifugal sugar is much higher than refined sugar but Pakistan has never tried to explore this market.

Four sugarcane-growing clusters can be identified in Pakistan. These are Central Punjab with Faisalabad as its focal point, Southern Punjab with Rahim Yar Khan, Southern Sind with Hyderabad, and Southern KP with Mardan as its focal point. Following are the performance gaps along the sugarcane production, transportation, & processing components of its value chain:

- Non-responsive R&D system and insufficient germplasm with varying characters,
- Lack of system to quickly take approved varieties to farmers,
- Inefficient management practices like irrigation, pest management, and harvesting,
- Inefficient sugarcane delivery system from field to sugar mills
- Asymmetric sugar mills market power vis-a viz., sugarcane producers and
- Limited diversification of sugarcane value chain.

To bridge these gaps and enhance the competitiveness sugarcane value chain, following interventions along the value chain are suggested at the focal point of each cluster:

- Introduce improved management practices, especially mechanized harvesting,
- Develop efficient seed distribution system in collaboration with sugar mills,
- Introduction of GPS-based pre-determined sugarcane delivery system from field to mills,
- Establishing collection centers owned by farmers' group near production centers,
- Encouraging juice processing on commercial but small scale as cottage industry, and
- Promotion of livestock feed manufacturing from molasses.

Indirect system level interventions will include strengthening the responsive R&D system in collaboration with private sector, importing germplasm, organizing producers into FEGs, and training of stakeholders for value chain management and processing. It is estimated that these interventions will enhance productivity by 6-12% in various clusters, reduce post-harvest losses from 16% to 10%, and improve recovery rate from 9.5% to 10.65%. A total of 248 harvesters will be needed to bring 15% area under mechanical harvesting, 1237 juice making units to increase the juice processing from 1% to 2%, 66 molasses base feed centers to increase the 1% of molasses used in livestock feeding to 5%, and 382 collection centers owned by farmers group will be needed to improve farmers bargaining power in sugarcane marketing.

The total estimated investment for the upgradation plan is US$167.2 million, 38% of which will come from the government. The pooled NPV for the 5-year period is US$118 million with an IRR 36.9%. The detail of these investments and their impacts, and economic analysis of the plan at the focal point of each cluster can be seen in the attached Summary Sheet below.

**Summary Sheet of Sugarcane Clusters**

| Information | FSD | RYK | HYD | MRD | Overall |
|---|---|---|---|---|---|
| Area of cluster focal point (000 ha) | 113 | 193 | 123 | 29 | 458 |
| Production (000 tonnes) | 6413 | 15009 | 8253 | 1485 | 31160 |
| Yield of the cluster (tonne/ha) | 56.75 | 77.77 | 67.10 | 51.21 | 68.03 |
| Area of the cluster (000 ha) | 252 | 237 | 354 | 53 | 896 |
| Production of the cluster (000 tonnes) | 12103 | 17025 | 23290 | 2755 | 55173 |
| Increase production - improved practices (000 tonnes) | 704.3 | 989.1 | 515.3 | 226.9 | 2435.6 |
| Added value - improved practices (000 US$) | 20448.5 | 28714.7 | 1496.0 | 6587.9 | 70710.7 |
| Saved production-mechanized harvesting (000 tonnes) | 34.9 | 78.6 | 41.0 | 9.5 | 164.0 |
| Additional sugarcane value – Mechanized Harvesting (000 US$) | 1012.2 | 2282.8 | 1189.3 | 276.7 | 4761.0 |
| Enhanced production-reduce delivery losses (000 tonnes) | 315.2 | 710.9 | 370.3 | 86.2 | 1482.6 |
| Additional value - reduce delivery losses (000 US$) | 9151 | 20638 | 10752 | 2501 | 43042 |
| Additional production of sugar - enhanced recovery rate (000 tonnes) | 19.4 | 31.3 | 16.3 | 6.1 | 73.2 |
| Additional value - enhanced recovery (000 US$) | 6264.4 | 10109.5 | 526.7 | 197.9 | 23619.8 |
| Added value of molasses (000 US$) | 2235.2 | 3780.8 | 2626.3 | 611.0 | 9253.4 |
| Additional income from juice (000 US$) | 22061 | 49754 | 25921 | 6031 | 103767 |
| Total number of juice machine required | 202 | 434 | 236 | 72 | 944 |
| Harvesters required | 59 | 100 | 64 | 15 | 238 |
| No. of molasses processing units | 17 | 28 | 20 | 4 | 69 |
| No. of collection centers required | 94 | 161 | 103 | 24 | 382 |
| **Investments (000 US$)** | | | | | |
| Strengthening of research | 5000.0 | 1800.0 | 1800.0 | 1100.0 | 9700.0 |
| Stakeholder training | 2845.9 | 486.1 | 3097.8 | 730.4 | 7160.1 |
| Organization FEG & Collection Centers | 11837.0 | 2027.4 | 12970.4 | 3022.2 | 29857.0 |
| Distribution of modern seed | 1883.3 | 321.7 | 2050.0 | 483.3 | 4738.3 |
| Investment on GPS system | 311.1 | 311.1 | 311.1 | 311.1 | 1244.4 |
| Mechanical harvesting | 4111.0 | 7125.7 | 4522.1 | 1233.3 | 16992.0 |
| Investments on juice machines | 12431 | 26559 | 14449 | 3303 | 56741 |
| Investment on molasses units | 1104.5 | 1863.8 | 1311.6 | 276.1 | 4556.0 |
| Government loans | 3642.9 | 4123.8 | 2368.3 | 589.2 | 10724.2 |
| **Total investments** | **43167** | **70135** | **42880** | **11048** | **167230** |
| Public sector investments | 19331 | 25228 | 16029 | 4532 | 65120 |
| Private sector investment | 23836 | 44907 | 26851 | 6516 | 102110 |
| **Economic Analysis of all interventions (Upgradation Plan) (M. US$)** | | | | | |
| **Increase in sugar production (000tonnes)** | 108.9 | 179.2 | 93.4 | 33.6 | 415.0 |
| **Value of additional sugar production** | 35.1 | 57.8 | 30.1 | 10.8 | 133.9 |
| **Gross revenue (undiscounted) in 5th year** | 61.2 | 115.3 | 60.7 | 18.0 | 255.2 |
| **Additional operation costs in 5th year** | 31.5 | 60.0 | 33.6 | 8.5 | 133.6 |
| **Net cash flow (undiscounted) in 5th year** | 29.6 | 55.3 | 27.2 | 9.5 | 121.6 |
| **NPV** | 13.9 | 36.2 | 11.2 | 6.1 | 118.2 |
| **Internal Rate of Return** | 31% | 45% | 28% | 45% | 36.95% |

# 30. Tea

In Pakistan, tea is cultivated at an area of about 100 ha only in promontories of District Mansehra under Unilever Brother Support with production of about 4 tonnes having an average yield of 4 tonnes of green leaves per ha. Pakistan's per ha yield is only 40% of the world average, while the Tea processing companies are paying about double the price to farmers than the world average. Pakistan ranked 1st among tea importers with importing bill worth US$549.6 million.

In Pakistan, the main tea-growing cluster consists of Mansehra, Batagram, Swat and Shangla with Mansehra as their focal point. Following are the gaps in production, processing and the tea value chain

- Low productivity,
- Prolong gestation period,
- High processing cost,
- Lack of government interest and co-ordination between government and private sector,
- Inefficient agriculture research in solving the sector's issues like providing appropriate varieties and technologies tolerant to the changing climate,
- Absence of soil mapping

These constraints are the tumbling blocks in the achievement of tea self-sufficiency goal in Pakistan. Following interventions are suggested to improve the competitiveness of tea production:

- Development of new suitable lands confined to tea cultivation on 20% subsidy (tea can be viable only if it is grown on 10,000 ha,
- Introduce improved management practices,
- Reduction in processing cost by providing gas connection, and
- Value addition and branding.

Indirect interventions include strengthening of tea value chain research, and building producers capacities. It is expected that with 20% subsidy, new suitable 9900 ha of lands will be developed confined for tea cultivation. Improved management practices and new tea varieties can enhance per ha yield by 100%. Moreover, branding of new production will enhance by 30% so that the processors can afford the higher price to the producers.

The estimated capital investment for the upgradation plan is US$4.62 million, out of which 22% will be paid by the government. It is expected that incentives offered by the government on land development will encourage the private sector to come forward and find the suitable land for the development of tea cultivation. If government ensures the gas connection and provide interest free loans for one year, the private sector is expected to invest on processing infrastructure as well.

The upgradation plan will generate a positive NPV of US$31.3 million, and it has quite a high IRR of 37%. The detail benefits and costs of various interventions can be seen in the attached summary sheet.

**Summary sheet of Tea Cluster**

| Information | KP |
|---|---|
| Area of cluster focal point (ha) | 100 |
| Production (Tonnes) | 400 |
| Yield of the cluster (tonne/ha) | 4 |
| Area of the cluster (000 ha) | 100 |
| Production of the cluster (000 tonnes) | 400 |
| New area | 9,900 |
| New acreage in gestation period before commercial production | 2,475 |
| New acreage in production after completing gestation period (ha) | 9,900 |
| New production (tonnes) | 15,840 |
| Value of new production in MUS$ | 50,686,720 |
| Increase in yield due to improvement in management practices (tonne/ha) | 0.8 |
| Increase in production due to improvement in management practices (tonnes) | 80 |
| Expected additional value of production due to improved management practices (US$) | 256,000 |
| Original processing cost (US$/t) | 369 |
| Reduction in processing cost (%) | 30 |
| New processing cost (UST/t) | 258 |
| Return from reduction in processing cost | 1,771,808 |
| Actual production to be branded (tonnes) | 25,503 |
| Increase in total value of the banded product (US$) | 24483225.6 |
| **Investment (US$)** | |
| Investments on research | 66667 |
| Investments on the development of new area for tea cultivation | 3624133 |
| Investments on reduction in processing cost (US$) | 740741 |
| Investment on promotion of good agricultural practices (US$) | 37037 |
| Investment on infrastructure improvement | 74074 |
| Investment on certification | 74074 |
| Interest free loan on gas infrastructure development | 8148 |
| Total investments (US$) | 4,624,874 |
| Public sector investment | 1014456 |
| Private sector investment | 4624874 |
| **Overall benefits and rate of return** | |
| Total production increase in 8th year (tonnes) | 15920 |
| Value of increased production at current prices (US$) - import substitution | 50942720 |
| Gross revenue (undiscounted) in 8$^{th}$ year | 64270073 |
| Additional operation costs in 8th year | 19081935 |
| Net cash flow (undiscounted) in 8th year | 45,188,138 |
| NPV (M.US$) | 31298533 |
| Internal Rate of Return | 37% |

# 31. Tobacco

Pakistan cultivated tobacco on 47.7 thousand ha and produced 113.4 thousand tonnes of tobacco leaves with an average per ha yield of 2.37 tonnes. Globally, it is grown on 3.53 million ha producing more than 6.50 million tonnes of tobacco leaves and giving 1.84 tonnes per ha. Despite higher tobacco yield in Pakistan than the world average, a significant potential for improvement exists as it is far lower than the world top tobacco yield achievers.

Pakistan performed relatively better as its production increased at a rate of 1.90% per annum, higher than the world average, mainly because of the improvement in per ha yield. The production of Flue Cured Virginia (FCV) type tobacco mainly used in cigarettes manufacturing, however, expanded at much lower rate at 0.64% per annum, thus cigarette production in the country was also limited to this rate, which is much lower than the population growth in the country.

During 2016, the world trade of tobacco and cigarettes has reached to US$11.1 and 23.9 billion, respectively, which as combined is expanding at a rate of 4.92% per annum. Pakistan did not benefit from this expansion. While global cigarette-tobacco export ratio is between 30-35%, Pakistan share of cigarettes in tobacco export is only 10%. Moreover, the cigarettes export is highly variable across the year. This also implies that Pakistan tobacco production in the country although has performed relatively well, but the performance of cigarette manufacturing and its export was poor and it failed to establish its international markets.

The main cluster of FCV cultivation in Pakistan consists of Swabi and Mardan district of KP with some tehsils of these districts as its focal points. Following performance gaps are observed in the production, processing and trading components of tobacco value chain:

- Non-existence of R&D in the public sector on issues of public interest,
- Potential of improving management practices, like optimal timing of input use and harvesting, pre- & post-curing grading of tobacco leave,
- Social and economic discouragement (through taxes and duties),
- Export mainly of raw tobacco rather than processed cigarettes, and
- Inefficient tobacco curing system.

Following interventions are suggested to improve the competitiveness of tobacco production.

- Introducing improved management practices,
- Improvement in harvesting methods,
- Shifting from conventional curing to Turbo-Barn Curing

The Indirect interventions will include initiating R&D program on issues of public interest, farmers training especially on priming based tobacco harvesting method and optimal input use, improved processing by switching to Turbo Barn curing method. A total of 11 Turbo Barn Curing will be required to convert 100% tobacco area on the system. It is estimated that by introducing above interventions per ha yield will increase by 7.5% and the composition of harvested leaves will improve. The total investments on cluster development would require US$17.58 Million, 56% of which will come from the public sector. The NPV of the investments over the period of five years would be US$2.183 million, the estimated overall IRR is 20.36%.

**Summary Sheet of Tobacco cluster**

| Tobacco cluster | Tobacco cluster |
|---|---|
| Area of cluster focal point (ha) | 10,522 |
| Production (Tonnes) | 30,000 |
| Yield of the cluster (tonne/ha) | 2.85 |
| Annual yield growth without intervention (%) | 0.74% |
| Percent area renovated in 5 years | 0% |
| Increase in yield due to improvement in management practices (tonne/ha) | 0.23 |
| Increase in production due to improvement in management practices (tonnes) | 2,472 |
| Additional value of production due to improved practices (M. US$) | 4 |
| Enhanced availability of quality leaf after harvest (tonnes) | 1,680 |
| New price due to improvement in quality | 1,850 |
| Expected value of additional yield due to better leaf composition (Mil US$) | 0.15 |
| **Intervention (Shifting from Conventional Curing to Turbo-Barn Curing)** | |
| Shifting to turbo-barn curing method (100% in 5 years) | 1.00 |
| Total volume of better quality tobacco leave (tonnes) | 35,277 |
| Average Cost saving due to improved curing (US$/tonne) | 2,194,061 |
| Expected value of curing cost saved due to better curing (M. US$) | 2.19 |
| Average wholesale price of cigarettes in the country (US$/tonne) | 12,000 |
| Additional cigarettes produced from additional supply of tobacco (tonnes) | 617.94 |
| Percentage of additional cigarette for export (%) | 30% |
| Additional cigarettes available for export (tonnes) | 185.38 |
| Additional value of export (US$) | 1.20 |
| **Investments** | |
| Investment on R&D including information dissemination (Mil US$) | 5 |
| Farmers' Capacity Building (Crop Management esp. Harvesting) (Million US$) | 2 |
| Shifting turbo-barn curing (M. US$) | 10 |
| Interest free loans | 1 |
| Total investments (US$) | 17.58 |
| **Overall benefits and rate of return** | |
| **Increase in production due to all the yield increasing interventions (tonnes)** | **4,152** |
| **Gross revenue (undiscounted) in 5th year** | **9.1** |
| **Additional operation costs in 5th year** | **8.81** |
| **Net cash flow (undiscounted) in 5th year** | **7.810** |
| **Public sector investment** | **9.78** |
| **Private sector investment** | **7.79** |
| **NPV (M.US$)** | **2.183** |
| **Internal Rate of Return** | **20.36%** |

# 32. Tomato

In Pakistan, total area under tomato cultivation is around 60.5 thousand ha with the production of 569 thousand tonnes giving an average yield of 9.51 tonnes per ha. Global tomato is cultivated on 4.8 million ha and producing around 182.3 million tonnes of tomato with an average per ha yield of 37.6 tonnes. Pakistan losing its comparative advantage as it's per ha yield of tomato remains stagnant while international yield is continuously improving during the period. Pakistan gets only 25% of the world average yield. On the other hand, demand for tomato and its products in the country is expanding at a very high rate of 7.3% per annum, much higher than the increase in its domestic production causing trade deficit. The country fails to play a significant role in international export markets, and benefit from a fast-increasing export of fresh tomato and its products, which has reached to over US$13 billion in 2017. Pakistan earns only 28% of the world average export price

In Pakistan, the main tomato-growing cluster consists of Sindh, KP and Balochistan province with Thatta, Qilla Saifullah and Swat as their focal points, respectively. Following are the gaps in production, processing and trading components of the tomato value chain:

- Water shortage and high temperature due to climate change,
- Weak research especially on harvest, post-harvest, and value chain issues.
- Lack of improved tomato open pollinated germplasm, and improved commercial cultivars and local hybrids to produce high quality marketable tomato fruit suitable separately for table consumption and processing,
- Non-availability of certified seed, high cost of hybrids, non-availability of healthy nurseries,
- Lack of value chain development for trading in the high-value fresh market, and
- Absence of tomato processing infrastructure for the primary processing at the village level.

Following interventions along the tomato value chain have been proposed to narrow these gaps

- Introduction of new varieties and hybrids obtained from other provinces or imported from other countries having similar environment like Pakistan,
- Promotion of best value chain practices like proper picking, handling, transportation, packing, and grading, etc.
- Establishing value chain infrastructure like tomato pack houses, etc.
- Incentivizing tomato processing especially tomato puree and tomato powder, etc.

Indirect interventions include strengthening of tomato value chain research, organizing FEGs and building stakeholders capacities. Twenty tomato puree making units and twenty-four collection centers would be required to process 1-5% of tomato in various clusters, and 24% collection centers would be needed to improve the quality of 10% of domestic produce and all exported tomato at par to international quality level. It is estimated that these interventions will improve productivity by 25-30%, reduce post-harvest losses by about one third, and enhance export-production ratio up to 10%. The estimated capital investment for the upgradation plan is US$12.4 million. This will generate an NPV worth of US$ 14.42 million, out of which 55% shall be paid by the government. and producing an IRR of 75%. The investment and economic analysis for the three focal points of the clusters are summarized in the attached summary sheet.

**Summary Sheet of Tomato cluster**

| Current Situation | Balochistan | Sindh | KP | Total |
|---|---|---|---|---|
| Area under cultivation in focal point (ha) | 3830 | 9879 | 5090 | 14,969 |
| Total Production (tonnes) | 41910 | 73275 | 52400 | 125,675 |
| Default yield (tonne/ha) | 13.28 | 20.69 | 11.43 | 8.40 |
| Area of the cluster (ha) | 7785 | 22,199 | 7427 | 37,411 |
| Production of the cluster (tonnes) | 95660 | 166,965 | 74570 | 337,195 |
| Additional production from enhanced yield (tonnes) | 26,064 | 19,346 | 19,727 | 65,137 |
| Additional value from increased yield (US$) | 4,331,768 | 3,215,372 | 3,278,703 | 10,825,843 |
| Marketable production due to reduced PH losses (tonnes) | 22,588 | 19,346 | 12,823 | 54,758 |
| Additional value from reduction of losses (US$) | 3,754,199 | 3,215,372 | 2,131,157 | 9,100,728 |
| Total volume of puree produced (tonnes) | 461 | 1,973 | 34 | 2,469 |
| Expected additional value from dry (US$) | 253,442 | 1,085,333 | 86,020 | 1,424,795 |
| Total expected volume to be exported (tonnes) | 5,503 | 10,517 | 8,907 | 24,926 |
| Expected additional value from enhanced exports | 2,101,972 | 4,017,381 | 3,402,378 | 9,521,731 |
| Additional value due to value chain intervention(US$) | 3,402,470 | 3,831,145 | 3,244,652 | 10,478,267 |
| Total Value Chain Costs in year 5 (US$) | 9,044,705 | 9,775,840 | 7,435,968 | 26,256,513 |
| No of puree plant and drying units required | 3 | 11 | 6 | 20 |
| No. of collection centers needed | 7 | 9 | 8 | 24 |
| **Investments (000 US$)** | | | | |
| Improvement in Research System | 724.6 | 1087.0 | 324.6 | 2136.2 |
| Training of farmers and stakeholders | 1631.9 | 874.6 | 1435.1 | 3941.5 |
| Certified nursery establishment | 50.0 | 30.0 | 50.0 | 130.0 |
| Investments required on processing | 155.6 | - | 222.2 | 948.1 |
| Investments on -Collection center | 1321.0 | 1698.4 | 1509.7 | 4529.1 |
| Linking stakeholders with markets | 50.0 | - | 50.0 | 130.0 |
| Interest free loans | 169.8 | 260.9 | 199.2 | 629.9 |
| **Total investments** | 4102.8 | 4551.2 | 3790.8 | 12444.8 |
| **Source of Investment (M. US$)** | | | | |
| Public Investment (US$ Million) | 2.882 | 2.712 | 2.365 | 7.959 |
| Private Investment (US$ Million) | 1.221 | 1.839 | 1.426 | 4.486 |
| **Economic Analysis (M. US$)** | | | | |
| Total increase in production due to all interventions | 48,652 | 38,693 | 32,550 | 119,895 |
| Gross revenue (undiscounted) in 5th year | 13.844 | 15.365 | 12.143 | 41.351 |
| Additional operation costs in 5th year | 90.447 | 9.776 | 7.436 | 107.659 |
| Net cash flow (undiscounted) in 5th year | 4.799 | 5.589 | 4.707 | 15.095 |
| NPV (US$) | 4.211 | 5.519 | 4.692 | 14.422 |
| IRR | 65% | 80% | 79% | 75% |

# 33. Walnut

Pakistan produces about 21.6 thousand tonnes of walnuts from 3.12 thousand ha with an average per ha yield of 6.9 tonnes compared to the global production of around 3.46 million from on about one million ha with the yield of 3.1 tonnes Although in Pakistan current per ha yield is double than the world average, but it has been on a steep declining trend at 2.0% per annum rate during the 2000s period. Increase in walnut area in Pakistan has not been sufficient to compensate the loss in production due to the declining yield, causing the squeeze in its production at a rate of 1.0% per annum. In contrast, the walnut production at global level has been expanding at the fast rate of over 7% per annum both due to expansion in area and improvement in yield. Moreover, its global export in 2017 has reached to US$3.4 billion, which has been growing at a rate of 8.0% per annum during 2001-17.

Gilgit-Baltistan (GB) and (KP) are the main walnuts growing regions of Pakistan. Two clusters of walnuts are: i) GB province with Diamer as its focal point; ii) KP cluster with Swat being its focal point.

Performance gaps in technology, market structure and input availability across these clusters are

- Old, low productive gardens and lack quality and uniformity,
- Lack of access to improved commercial walnuts cultivars suitable to environment and can produce high quality fruit;
- Weak research capacity especially in GB Cluster,
- Lack of collective action and little market intelligence cause market glut,
- Traditional management practices;
- Lack of refrigeration after harvest lose its nutritious quality,
- Little simple value addition on modern lines like kernel separation, oil extraction

In order to bridge these gaps, from production to product and market development, following interventions have been proposed for both the clusters:

- Renovation of 30% old low-density gardens with modern varieties, high density gardens with improved management practices;
- Encourage deshelling and walnut oil processing units

Indirect interventions include strengthening of walnut value chain research, establishments of certified walnut nurseries, organizing farmers into groups, and capacity building to manage improved value chain and processing infrastructure. To improve the quality of all exportable walnuts and 10% of the produce for domestic market, a total of 189 deshelling units would be required; to enhance processing on 5% of the total area, 50 oil processing plants would be needed, and two certified nurseries should be established to renovate 30% old walnuts gardens in all focal points. It is estimated these interventions will increase productivity on renovated gardens by 30%.

In order to implement these interventions at the focal points, total project investments needed are US$33.6 million, 29% of which will come from the government. The pooled NPV is estimated at US$310.7 million. The overall IRR for all the clusters is 165%. The activity and cluster level investments and economic analysis can be seen in the attached Summary Sheet below.

**Summary sheet of Walnut Cluster**

| Information | KP Midland | GB Highland | Overall |
|---|---|---|---|
| Area of the cluster (ha) | 630 | 422 | 1,052 |
| Production of the cluster (tonnes) | 6,328 | 2,875 | 9,203 |
| Yield of the cluster (tonne/ha) | 9.82 | 6.81 | 8.75 |
| Annual yield growth without intervention (%) | 0.40% | 0.40% | 0.40% |
| Percent area renovated in 4 years | 30% | 30% | 30.00% |
| Area on which orchards would be renovated (ha) | 189 | 127 | 316 |
| Increase in yield due to orchards renovated (%) | 30% | 30% | 30.00% |
| Increase in production - orchards renovation (tonnes) | 612 | 278 | 890 |
| Additional value - Orchards renovated (000 US$) | 703.6 | 319.7 | 1,023.3 |
| Walnut shelled (tonnes) | 3,552 | 1,614 | 5,166 |
| Value of processed walnuts in 5th year. (M. US$) | 248.7 | 113.0 | 361.70 |
| Walnut oil produced in the 5th year (tonnes) | 13 | 6 | 19 |
| Value Walnut oil processed (000 US$) | 332.89 | 151.24 | 484.13 |
| Total number of deshelling units required | 130 | 59 | **189** |
| Total number of plants required | 35 | 15 | **50** |
| Investment on strengthening research (US$) | 500,000 | 500,000 | **1,000,000** |
| Investment on capacity building trainings (US$) | 38,889 | 26,049 | **64,938** |
| Investment on renovation of existing garden (US$) | 661,500 | 443,100 | **1,104,600** |
| Investment on establishment of certified walnut nurseries (US$) | 52,136 | 52,136 | **104,273** |
| Investment on deshelling (US$) | 15,223,000 | 6,917,750 | **22,140,750** |
| Investment on oil extraction | 4,270,000 | 1,830,000 | **6,100,000** |
| Government loans on private investment | 2,144,230 | 962,253 | **3,106,483** |
| Public Investment (M. US$) | 6.72 | 3.34 | **10.06** |
| Private Investment (M. US$) | 16.17 | 7.39 | |
| ***Total Investments (US$ '000)*** | 22,890 | 10,731 | **33,621** |
| Public sector investments (000 US$) | 6,724 | 3,337 | 10,061.3 |
| Total private sector investment | 16,165 | 7,394 | 23,559.7 |
| Production level investment (000 US$) | 1,213,636 | 995,236 | 2,208,873 |
| Processing and value addition infrastructure (000 US$) | 21,637,230 | 9,710,003 | 31,347,233 |
| **Overall benefits and rate of return** | | | |
| **Total increase in production due to all the yield increasing interventions (tonnes)** | **612** | **278** | **890** |
| ***Total operating costs in the 8th year (US$ '000)*** | 97,898 | 44,502 | 142,400 |
| **Net cash flow (undiscounted) in 8th year *(US$ '000)*** | **147336** | **66972** | **214308** |
| **NPV (M. US$)** | **214.086** | **96.692** | **310.778** |
| **Internal Rate of Return** | **182.64%** | **143.05%** | **165.87%** |

12.

# 6. ANNEXURES

## Annexure-1A. Targets to be Achieved in Production Segment

| Commodity | Renovation of garden | | Non-renovated garden/field | | |
|---|---|---|---|---|---|
| | Area covered (%) | Yield increase (%) | Introduction of new variety Adoption rate (% of area) | Yield increase (%) | Yield increase due to improved management practices (%) |
| Almond | 25 | 50 | - | - | 10% |
| Apple | 15 | 100 | - | - | 15% in cluster 1 and 30% in clusters 2 |
| Apricot | 30 | 50 | - | - | - |
| Banana | 30% in lower Sindh and 20% in Upper Sindh | 100 | - | - | 50 |
| Barely | - | - | 50% in Punjab 40% in BL | 100% in Punjab 90% in Balochistan | - |
| Basmati Rice | - | - | 50% in Katcha and 60% in Saila | 7% in katcha and 20% in Saila | 7% in katcha and 10% in Saila |
| Beef | - | - | - | - | - |
| Carrots & Turnip | - | - | 7 | 45 | - |
| Cherries | 30 | 100% in BL and 75% in GB | - | - | - |
| Chilies | - | - | - | 30 | |
| Citrus | 20 | 75 | | | 10 |

| | | | | | |
|---|---|---|---|---|---|
| Cucumber | - | - | - | 15% in cluster 1 and 40% in cluster 2 | |
| Dates | 20 | 50% in Punjab, 35 in Sindh and 8% in Balochistan | | | 25 |
| Egg Plant | - | - | 40 | 20 | 40 |
| Flower | - | - | | - | 20 |
| Garlic | - | - | 20% in KP and 30% in Punjab Sindh and BL | - | 5 |
| Ginger | - | - | | - | |
| Grapes | 5 | 100 | - | - | 20 |
| Mango | 20 | 40 | - | | 5% in Punjab and 15% in Sindh |
| Medicinal Herbs | - | - | - | 15 | |
| Milk | - | - | - | | 25% in cluster 1, 4 and in 5 and 30% in 2, 3 cluster |
| Onion | - | - | - | | 15% in Sindh, 10% in BL and 5% in SWAT cluster |
| Pattoki Nursery | 10 | 25% in flower nursery and 30% in fruits cluster | - | - | 30 |
| Peas | | | - | - | 20 |

| | | | | | |
|---|---|---|---|---|---|
| Plums | 20% in BL and 40% in KP | 50 | - | - | 25 |
| Potato | - | - | | | 10% in GB cluster |
| Rapeseed and Mustard | - | - | 50 | 15% in Yazman 20% in Kot GM, Chakwal and U. Muhammad | |
| Spices | - | - | 20 | | 20% in coriander in Sindh and turmeric cluster |
| Sugarcane | - | - | - | - | 10% in Punjab, 6% in RYK, HYD and 12% in MRD |
| Tea | - | - | - | - | 100 |
| Tobacco | - | - | - | - | 7.5 |
| Tomato | - | - | - | - | 305 in BL and KP 25% in Sindh |
| Walnut | 30 | 30 | - | - | - |

## Annexure-1B. Targets in Value Chain Segment

| Commodity | Reduced post-harvest losses (%) | | Enhance export-production ratio (%) | | Improved/Mechanized production and value chain operations | | Name and percentage of production to be processed |
|---|---|---|---|---|---|---|---|
| | | | | | Name of the operation | Area/production covered under practice (%) | |
| | Current (%) | Target (%) | Current ratio | Improved ratio | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Almond | 20 | 10 | - | - | - | - | 1. Shelled almond increase from 10% to 50%, 2. Almond oil increased from 1% to 7% |
| Apple | 30 | 15 | - | - | Pack house | All additional Production to pass through pack houses | Increase apple juice processing from 5% and 10% in Cluster 1 and 2 |
| Apricot | - | - | - | 10% of the dried product | Dry Apricot | 30% of production in BL cluster and 50% in GB | |
| Banana | 30 | 10 | 27 | 50 | Improved value chain operations | 10% of the produce | Making banana chips from 1% in Lower Sindh and 2% in Upper Sindh |
| Barely | - | - | - | - | | | 10% production to be used in barley porridge |
| Basmati Rice | 13 | 5 | 16 | 21 | 1. Mechanical harvesting 2. Sun drying | From 20% to 100% under M. harvesting 2. From 20% to 90% solar drying of Katcha rice | 80% of the pddy into bran oil |
| Beef | - | - | 0.2 | 10 | Improved butchering | All export and 5% of domestic produce | - |
| Carrots and Turnip | - | - | 0.02 | 5 | Pack house | 2.5% in pass through value addition | |
| Cherries | - | - | | | Dried and cold processing | 10% production to be dried and another 15% cold processed | |
| Chilies | 30 | 15 | 3 | 10 | | | 5% production used in modern processing |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Citrus | 35 | 15 | 16.6 | 19.92 | Pack house | Pack house treatment increase from 20% to 50% | |
| Cucumber | 10 | 5 | | | Pack house | 35% in Punjab and 5% in Balochistan | - |
| Dates | 27 | 12 | 40 | 40% in Sindh and 50% in BL | Pack house and Solar Drying | All export and 10% of domestic produce | - |
| Egg Plant | | | | | Pack house | Southern Punjab, 15% in Central Punjab | - |
| Flower | 35 | 25 | 0.40% in rose cluster | 0.50% in gladiolus and 0.80% in rose cluster | Pack house and cold chain | All export and 5% of local produce | - |
| Garlic | 20 | 10 | - | - | Harvesting | 25% | - |
| Ginger | | | - | - | Drying | 10% | |
| Grapes | 25 | 10 | - | - | Improved value chain operations | 10% of the produce | 3% in pulp and 35 in raisin |
| Mango | 30 | 20 | 5.1 | 8.1 | Improved value chain process | 5% of production | 1% in pulp in Punjab |
| Medicinal Herbs | 30 | 10 | - | - | Mechanical cleaning | 50% of cumin and ispagol | - |
| Milk | 20 | 10 | - | - | | | 26% production used in various LS products |
| Onion | 30 | 22 | 2 | 10 | Improved value chain management | 10% in Sindh, and 5% in Balochistan and Swat | 0.5% production used in processing |
| Pattoki Nursery | 20 | 10 | 0.2 in flower cluster and 0.4 in fruit cluster | 1% in flower cluster and 2% in fruit cluster | Pack house | All exports | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Peas | | | 0.13 | 5 | 1. Mechanical transplanting 2. Pack house processing | 1. 5% of area under M. Transplanting in Cluster 2. 5% and 10% of production pack house in Cluster 1 and 2 | - |
| Plums | 20 | 15 | 0.04 | 5 | | | 15% production to be dried |
| Potato | | | 15 | 20% in Punjab A and 25% in Punjab Balochistan cluster | 1. Tissue culture seed coverage 2. Improved seed production | 1. 5% in Punjab A, 10% in Punjab B, and 20% in GB 2. 15% of area in all clusters | 5% in potato chips making |
| Rapeseed and Mustard | 5 | 2 | - | - | Mechanical solvent extraction | 30% | |
| Spices | 20 | 10 | - | - | Mechanical cleaning | 30% in coriander and 20% in turmeric | |
| Sugarcane | 14 | 10 | - | - | | | increase from 1% to 2% in juice processing |
| Tea | | | - | - | | | |
| Tobacco | | | - | - | Turbo barn | 100% | |
| Tomato | 30 | 10 | 0.94 | 10 | Pack house | 5% of production | 1% in BL, 5% in Sindh and 0.5% in SWAT for tomato puree |
| Walnut | - | - | - | - | Deshelling | 10% | 5% in walnut oil |

# Annexure-2. Formulation of Farmers Entrepreneur Groups

## 1.1. Purpose and Objectives of the FEG

The intend of formulating FEGs is to overcome the financial and capacity constraints to develop small scale agribusiness activities in rural areas. The FEGs are conceived with a view of organizing and empowering small farmers at a platform where technical and financial supports are available to strengthen the value chain of various agriculture commodities. The representatives of allied sectors of the Agriculture Department are kept under one roof and to provide one window services to the farmers in real sense. Furthermore, facilitation of farmers with all major inputs for agriculture commodity production, value chain, and processing are made available. Farmers will be trained to develop small agribusinesses for value chain improvement and processing of the commodities produced in their area.

The basic concept of FEGs program is to provide a platform to the farming community and enabling them to collectively resolve their issues of common interest along the value chain of the commodity they produce, through developing linkages with Government Line Agencies (GLA), private sector and NGOs. The purpose is to explore new investment opportunities along the value chin of agriculture commodities they produce, arrange investments and enhancement of capacities not only to efficiently perform various functions at the farm level but also undertake value chain and processing businesses as a group. It is a volunteer, public private partnership program.

## 1.2. Composition of FEGs

Three bodies responsible for planning and execution of FEG activities are:

### 1.2.1. General Body (GB) and Executive Body (EB)

#### *1.2.1.1. Composition*

- The FEG may be constituted by combing 2-5 union councils more concentrated in producing an agriculture commodity or related commodities,
- All members of FEGs will constitute General Body (GB). The GB may consist of 200-1000 members.
- Executive Body (EB) will be elected through proportionate representation of members at Union council level at least 5 members from each Union Council should come through election from the General Body to form the EB.
- Total membership of EB may range from 15-25 Nos. based on the total number of members in the centers.

#### *1.2.1.2. Eligibility/qualification of EB member*

- Any person not less than 18 years old of age, having his own agricultural land, poultry farm, diary-farm, fish farm, involved in agribusiness activities, a tenant or having casual farm agricultural activities and an entrepreneur having an establish record of engaging

in agriculture business activities shall be eligible for membership of Farm Entrepreneur Group (FEG)

- Should not be defaulter of any financial institution.
- Willing and able to give time to serve the cause of FEG. ¬ Physically not handicapped.
- Willing to contribute financial resource for the establishment of value chain and processing infrastructure in the rural areas they belong once such investment is approved by the EB and GB.

#### *1.2.1.3. Responsibilities of EB*

- To keep the list of voters' (or members of the GB) up to date.
- To hold election for the selection of Management Committee(s).
- To approve the policy matters of the FEGs.
- To resolve the conflict between the members of the Management Committee.
- To approve the expenditure and balance sheet of all financial and physical activities of the previous season and to plan, prepare and approve the budget of activities of the coming season.
- The EB meeting will be held before the start of each season i.e. during February and August each year.
- To terminate the membership/portfolio of any member of the Management Committee who violates deliberately the rules, regulations and norms of the FEG or remain absent in three consecutive meetings of Management Committee without any valid reason.
- Enter into Contract Farming deals with traders, processors, etc. with pre-defined quantity, quality, time, and price and ensure the quality of the product,
- Arrange monitoring mechanism to ensure the quality of the produce to traders,
- Undertake certification and branding of agriculture produce if those activities offer opportunity for the members,
- Enter the deal with input suppliers and arrange the bulk purchase of inputs if that is more profitable,
- Enter the deal with credit institutions to ensure its members the credit they need and provide group collaterals.
- Approve investment projects for the development of value chin and processing infrastructure for agriculture commodities,
- Encourage members to contribute funds for such investments and ensure the safety of these funds,
- Decide the distribution of dividends from investments projects run by the FEG,
- Demand audit report from Management Committee to be discussed and decision to be taken on any issue for implementation,
- Approve the recommendation of experts for implementation, arrange trainings for its MC members to undertake special investment projects.

### 1.2.2. Management Committee (MC)

#### *1.2.1. Composition*

- The Executive Body will elect an overall Management Committee as well as the Management Committee for each investment project the FEG intends to undertake through proper election procedure.

- The Management Committee should consist of President, Vice President, General Secretary, Finance Secretary and Information Secretary

### *1.2.2. Eligibility/qualification for MC membership*

- Should come through election.
- Should be a farmer of the concerned area (whether landowner, tenant or contractual farmer).
- Should not be sentenced (imprisoned) for more than 6 months in any criminal or civil court. Age should not be less than 20 years & not physically handicapped.
- Should not be defaulter of any financial institutions.
- Should be educated preferably up to matric.
- Willing and able to give time to affairs of the FEG.
- Each member of the committee will have a card mentioning his position.
- The Agriculture Officer concerned will be the ex- officio member of this committee. He will work as cashier for the 1st four years or till such time that membership reaches one thousand. He will jointly maintain the record. During 5th year the trained member will maintain the record by himself and the A/O will work as facilitator

### *1.2.3. Responsibilities of the management committee*

- Maintenance of all records of FEG in a transparent way which is easily accessible to each member.
- Budget planning and its approval from Executive Body.
- Progress and balance sheet preparation and approval from General body.
- Procurement of basic seed from Agriculture Research, University, FSI and Agriculture Extension Farms etc.
- Procurement of C-1 from the registered growers.
- Arrangement of Seed Certification process through Federal Seed Certification and Registration Department.
- Obtaining agencies of fertilizer and pesticides for FEG.
- Procurement of fertilizer and pesticides for FEG.
- Linkages with line Agencies and Market.
- Arrangement of sale of surplus produce of farmers' members in the market outside the Agency.
- Arrangement for farmers training in Seed Technology.
- Arrangement of farmers' exchange visits.
- Arrangement of cleaning, transportation of seed, storing and purchase of gunny bags etc.
- Distribution of Basic Seed and signing of TOP with seed producing growers.
- Distribution/sale of C-1 seed to the registered members of the FEG.
- Mobilization of the farmers' enrolment and increasing membership in the FEG.
- Selection of seed producing growers' fields for seed production.
- Arrangement of crop visits by technical experts

## 1.3. Functioning of the FEGs

These FEGs have the authority that they take any action or investment for the betterment of their members. The FEGs is responsible to provide the services to the registered member by paying an enrolment fee and a membership fee, as may be described.

The FEGs are profit oriented system of running agriculture production activities efficiently and creating small scale businesses in rural areas where management of the farm and businesses activities is by the farmers and for the farmers. The purpose is not only to integrate the services provided by various agriculture related departments and institutions but also to improve coordination and linkages with the private sector providing various services, financial organizations, donor and development agencies, and across FEGs. Another purpose is to bring the government closer to its stakeholders, so that its policies become more relevant to their needs and thus more effective.

## 1.4. Activities of the FEG

The main activities to be under taken by the FEG, in order to achieve the above-mentioned objectives, are detailed hereafter. All activities will be conducted on a demand basis, and will be organized and managed by the FEG members themselves through Management Committee, and the Agricultural Officer in the area will play a role as Technical Advisor.

The list of common activities may be extended according to the needs and willingness of the members/farmers (majority vote in case of difference in opinion). However, the main activities of the Centers are listed below:

### 1.4.1. Seed/seedling production

- Seed, seedling and propagating material production will be carried out by the FEG through its members with the support and coordination of the Seed and Nursery Industries (SNI) in the province.
- The Agriculture Extension Department of the province will provide basic seed and propagating material duly declared as basic by the Seed Certification and Registration Department, at mutually agreed price. For further multiplication the FEG will sell the same to the seed growers' member at reasonable prices approved by the Management Committee.
- The Certified-1 seed/seedling production by the seed growers will be procured by the FEG as per agreement TOR to be signed between the Management Committee and Seed Growers. The C-1 after cleaning will be stored by the FEG and will be sold to registered members of the FEG at a price fixed by the MC. Seed Procured by FEG either from Extension Department, SNI, Research stations or seed growers will be cleaned at each FEG through the seed cleaner provided to them by the Government or purchased by the FEGs.

### 1.4.2. Input supply and output delivery

- The FEG will make deal with input supplier to buy inputs in bulk at negotiated prices for its members,
- The FEG may establish collection centers/pack houses where basic facilities of grading, washing, packing, storing etc. will be available.
- Enter marketing negotiations with traders to supply the produce of demanded quality so that the members can fetch better prices for their produces and traders can get the desired quality.

### 1.4.3. Prioritizing activities

- The Management Committee will hold fortnightly meetings to chalk out strategy for functions and activities.
- The Agriculture Extension and Research will assist FEG in preparing/program for seasonal activities in accordance with local needs.
- Representatives/experts of the sister departments/line agencies i.e. Agriculture Research, Agriculture Engineering, Livestock and Dairy Development, etc. will provide technical support to FEGs on need basis.

### 1.4.4. Linking farmers with markets

- The members of the MCs will be trained to plan, execute, and monitor various investment activities.
- Exposure visits of the M.C will be arranged to different markets and value chain and processing infrastructures.
- Information blogs will be established regarding updated commodity and input prices in different Pakistani markets for various quality standards, technologies being used in various farm and value chain operations, and quality standards demanded in international markets along with their standards.
- When linkages of the FEG is created and strengthened with other markets then the surplus produce can be sold in other markets by making bargain with the parties/dealers of those markets.
- FEGs will arrange contract farming with pre-determined quantity and quality to be delivered at particular time at pre-determined price.

### 1.4.5. Promote Value Addition and Processing

Value addition and primary processing of agriculture commodities in rural areas can not only enhance the income of rural population and create employment for the skilled and semi-skilled labor but also stabilize the prices of agriculture produce. The FEGs will play a major role to grab any opportunity in the value addition and processing of the agriculture raw material. For this purpose, the EBs of FEGs will play the following role:

1. Identify the value addition and processing opportunity by engaging consultants who will work out the detailed feasibility on the identified opportunity by the EB. The detailed of technology/machine to be needed, market analysis and risk involved will also be identified.

2. Estimate the investment requirements needed to establish the value addition and processing infrastructure,
3. Get it approved from EB as well as from the GB.
4. Give equal opportunity to all FEG members to participate in the investment plan.
5. Approve the management committee for each investment to be approved.
6. Develop proper mechanism to implement and monitor the project,
7. Estimate the cost of the services to be provided to each member from the establishment, and
8. Develop mechanism for the distribution of the dividend proportionate to the investment made by each member.

## 1.5. Board of Directors for FEGs at the Provincial Level

A board of Directors (BoD) will be constituted at the provincial level through a provincial bill passed by national assembly to provide legal cover to FEGs and legal protection to any contract made FEGs with traders/processors, financiers, etc., and support and monitor their activities. The BoD may be headed by the provincial Secretary of provincial Planning and Development Department and may constitute the DGs/Directors of all the concerned institutes (research, extension, water management, Investment Board, etc.), private sector input supplier, market agents, traders, financiers, and 5 elected Chairmen of FEGs in the province. The Board should have following functions and roles:

- Prescribe procedure for the establishment a Centre;
- Effective supervision and coordination of FEGs at the local levels,
- Coordination with national and international organizations to meet the technological and financial needs of FEGs;
- Developing a system if necessary of acquiring partnership of private organizations for the management and funding of any FEGs;
- Convince the government to provide specialized subsidy to meet the need of each FEG,
- Develop mechanisms to channel the utilization of these subsidies and monitor the equitable use of these by FEGS members,
- Help FEGs to identify new business opportunities (around the commodity the group is formulated,
- Arrange training of FEG members to establish and run the new businesses under FEGs.

# Annexure-3. Themes of Capacity Building

## Farmers

- Pruning and Canopy Management,
- Replacement of old with new high-density gardens
- Good Agricultural Practices (GAP) practices
- ICM/IPM techniques for sustainable pest management
- Balance & timely use of fertilizer including micronutrients and plant growth regulators
- Soil management
- Harvesting techniques
- Post-harvest management at farm like stacking, packaging, grading, de-sapping, etc.

## Processors and Exporters

- WTO
- Tariff and Trade
- Custom Laws
- Food safety standards
- Phyto-sanitary requirements
- Grading and HWT process
- Packing
- Labelling and branding
- Product presentation techniques
- Food safety standards

## Nursery Men/Women

The nursery owners and operators of the fruit nurseries will be given training to produce certified true-to-type healthy nursery plants. The training modules have already been developed by NARC and its implementation would be imparted by R&D Institutes. First master trainers will be trained who will train the nursery staff practically on the nursery. This training is likely to include the following topics:

- Efficient nursery propagation techniques and management
- Pitt material selection and management
- Improved plant husbandry at nursery stage
- Record keeping of nursery activities, especially budding and grafting maps
- Plant protection and plant hygiene
- Financial monitoring – income and expenditure recording
- Marketing and linkage with clients
- Packing and labelling of trees
- Registration of nursery with FSCRD and meeting its requirements
- Design and printing of fruit nursery catalogue in order to develop a broader client base and advertise the benefits of certified fruit trees

# Annexure-4. Total Investment needs by commodity and value chain segment to implement the upgradation plan

| Sr. No. | Commodity | Government Funding (Million US$) | | | | | | | | Private Sector Funding (M. US$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Research | Capacity Building/ training | Subsidy on planting material, Nurseries & renovation | Subsidy on VC infrastructure/processing | Marketing | PMU | Loan | Total public sector | Planting material, Nurseries and renovation | Value chain infrastructure/ processing | Marketing | Total Private | Govt+ Private |
| 1 | Almond | 1.11 | 0.298 | 1.24 | 0.25 | 0.00 | 0.00 | 0.86 | 3.76 | 4.97 | 1.01 | 0.00 | 5.97 | 10.08 |
| 2 | Dates | 0.71 | 1.535 | 7.92 | 11.67 | 0.00 | 0.00 | 6.70 | 29.82 | 31.69 | 46.67 | 0.00 | 78.36 | 108.18 |
| 3 | Plums | 4.75 | 0.155 | 0.32 | 0.41 | 0.01 | 0.00 | 0.15 | 5.80 | 1.30 | 1.65 | 0.06 | 3.01 | 8.81 |
| 4 | Apple | 1.00 | 0.979 | 4.49 | 6.22 | 0.00 | 0.00 | 3.41 | 16.09 | 17.94 | 24.89 | 0.00 | 42.83 | 58.93 |
| 5 | Banana | 1.48 | 1.094 | 0.63 | 1.02 | 0.02 | 0.00 | 0.55 | 4.79 | 2.51 | 4.06 | 0.08 | 6.65 | 11.45 |
| 6 | Tomato | 2.14 | 3.941 | 0.03 | 1.10 | 0.03 | 0.00 | 0.63 | 7.86 | 0.10 | 4.38 | 0.10 | 4.59 | 12.44 |
| 7 | Chilies | 4.00 | 2.251 | 0.65 | 0.95 | 0.08 | 0.00 | 0.55 | 8.48 | 2.62 | 3.80 | 0.32 | 6.74 | 15.22 |
| 8 | Onion | 1.85 | 2.602 | 0.00 | 0.35 | 0.10 | 0.00 | 0.20 | 5.11 | 0.00 | 1.40 | 0.41 | 1.81 | 6.92 |
| 9 | Carrots & Turnips | 1.15 | 0.000 | 0.00 | 0.48 | 0.13 | 0.00 | 0.20 | 1.95 | 0.00 | 1.91 | 0.50 | 2.42 | 4.37 |
| 10 | Peas | 1.11 | 0.000 | 0.00 | 0.41 | 0.16 | 0.00 | 0.22 | 1.90 | 0.00 | 1.63 | 0.65 | 2.28 | 4.18 |
| 11 | B. Rice | 3.70 | 3.345 | 0.00 | 11.85 | 0.20 | 0.00 | 6.52 | 25.62 | 0.00 | 47.40 | 0.80 | 48.20 | 73.81 |
| 12 | Grapes | 2.59 | 0.516 | 0.38 | 0.66 | 0.00 | 0.00 | 0.38 | 4.53 | 1.52 | 2.64 | 0.00 | 4.16 | 8.69 |
| 13 | Cucumber | 0.35 | 0.070 | 0.01 | 0.08 | 0.00 | 0.00 | 0.05 | 0.56 | 0.04 | 0.33 | 0.00 | 0.37 | 0.93 |
| 14 | Barley | 0.35 | 0.450 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 | 0.83 | 0.00 | 0.07 | 0.00 | 0.07 | 0.89 |
| 15 | Egg Plant | 0.40 | 0.200 | 0.00 | 0.10 | 0.00 | 0.00 | 0.03 | 0.73 | 0.00 | 0.40 | 0.00 | 0.40 | 1.14 |
| 16 | Tobacco | 5.00 | 1.715 | 0.00 | 1.95 | 0.00 | 0.00 | 1.12 | 9.78 | 0.00 | 7.79 | 0.00 | 7.79 | 17.58 |
| 17 | Milk | 26.60 | 35.720 | 0.00 | 10.31 | 0.22 | 0.00 | 5.67 | 78.53 | 0.00 | 41.25 | 0.89 | 42.14 | 120.66 |
| 18 | Beef | 5.19 | 12.593 | 0.00 | 7.44 | 0.03 | 0.00 | 2.10 | 27.35 | 0.00 | 29.75 | 0.12 | 29.87 | 57.22 |
| 19 | Ginger | 0.10 | 1.215 | 1.01 | 0.16 | 0.00 | 0.00 | 0.06 | 2.55 | 4.05 | 0.65 | 0.00 | 4.70 | 7.26 |
| 20 | Garlic | 2.78 | 1.600 | 0.00 | 0.27 | 0.00 | 0.00 | 0.12 | 4.77 | 0.00 | 1.07 | 0.00 | 1.07 | 5.84 |
| 21 | Sugarcane | 9.70 | 11.535 | 7.63 | 25.53 | 0.00 | 0.00 | 10.7 | 65.12 | 0.00 | 102.11 | 0.00 | 102.11 | 167.23 |
| 22 | Potato | 4.55 | 1.297 | 0.88 | 0.86 | 0.40 | 0.00 | 0.52 | 8.50 | 3.50 | 3.44 | 1.60 | 8.55 | 17.05 |
| 23 | RS&M | 0.59 | 1.709 | 0.48 | 0.06 | 0.03 | 0.00 | 0.03 | 2.91 | 1.92 | 0.24 | 0.13 | 2.30 | 5.20 |
| 24 | Spices | 0.64 | 0.281 | 0.00 | 1.32 | 0.00 | 0.00 | 0.72 | 2.96 | 0.00 | 5.26 | 0.00 | 5.26 | 8.23 |
| 25 | M. Herbs | 1.18 | 0.000 | 0.33 | 0.05 | 0.00 | 0.00 | 0.03 | 1.58 | 1.30 | 0.20 | 0.00 | 1.50 | 3.08 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Cherries | 0.20 | 0.180 | 0.29 | 0.11 | 0.00 | 0.00 | 0.06 | 0.85 | 1.17 | 0.46 | 0.00 | 1.62 | 2.47 |
| 27 | Apricot | 1.00 | 0.066 | 3.67 | 1.45 | 0.00 | 0.00 | 0.13 | 6.33 | 14.70 | 5.81 | 0.00 | 20.51 | 26.84 |
| 28 | Walnut | 1.00 | 0.065 | 0.24 | 5.65 | 0.00 | 0.00 | 3.11 | 10.06 | 0.97 | 22.59 | 0.00 | 23.56 | 33.62 |
| 29 | Citrus | 1.85 | 1.163 | 2.88 | 10.89 | 0.00 | 1.72 | 6.15 | 24.65 | 11.50 | 43.57 | 0.00 | 55.07 | 79.73 |
| 30 | Mango | 0.40 | 0.270 | 6.89 | 15.11 | 0.09 | 3.44 | 8.49 | 34.68 | 27.55 | 60.43 | 0.34 | 88.32 | 123.01 |
| 31 | P. Nursery | 0.00 | 0.209 | 0.01 | 0.87 | 0.29 | 0.00 | 0.16 | 1.54 | 0.04 | 3.48 | 1.16 | 4.68 | 6.21 |
| 32 | Flower | 4.07 | 0.119 | 0.00 | 3.66 | 0.12 | 0.00 | 1.93 | 9.91 | 0.00 | 14.66 | 0.47 | 15.13 | 25.04 |
| 33 | Tea | 0.06 | 0.000 | 0.91 | 0.00 | 0.00 | 0.00 | 0.01 | 0.98 | 3.64 | 0.00 | 0.00 | 3.64 | 4.62 |
| | **Total** | **91.61** | **87.17** | **40.89** | **121.25** | **1.91** | **5.16** | **61.60** | **410.89** | **133.04** | **485.00** | **7.65** | **625.69** | **1036.93** |

# Annexure-5. Resource requirement of the ATP (capital investment & operational cost -Mill US$) by commodity focal point

| Commodity | | Punjab | | Sindh | | Balochistan | | KP/GB | | Overall | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Name of the focal points | OP Costs | Invest-ment | OP. Costs | Invest-ment | OP Costs | Invest-ment | OP. Costs | Invest-ment | OP. Costs | Invest-ment |
| Almond | Loralai | | | | | 5.1 | 10.1 | | | 29.21 | 10.1 |
| Apple | Qilla Saifullah | | | | | 4.5 | 3.6 | | | 387 | 46.5 |
| | Quetta | | | | | | | 57.62 | 42.93 | | |
| Apricot | Qilla Saifullah | | | | | 3.5 | 22.6 | | | 41.68 | 26.84 |
| | Hunza | | | | | | | 0.78 | 4217 | | |
| Banana | Upper Sindh | | | 4.3 | 6 | | | | | 42.12 | 11.4 |
| | Lower Sindh | | | 3.9 | 5.4 | | | | | | |
| Barely | Layyah | 0.63 | 0.49 | | | | | | | 2.98 | 0.89 |
| | Khuzdar | | | | | 0.3 | 0.4 | | | | |
| Basmati Rice | Sheikhupura | 17.4 | 43.2 | | | | | | | 105.6 | 73.8 |
| | Hafiz Abad | 26.58 | 43.16 | | | | | | | | |
| Beef | Umarkot | | | 44.8 | 22.875 | | | | | 441 | 57.22 |
| | Rahim Yar Khan | 77.4 | 22.9 | | | | | | | | |
| | Bhakkar | 35 | 17.3 | 44.8 | 17.1 | | | | | | |
| Carrots and Turnip | Swat | | | | | | | 0.08 | 0.91 | 0.83 | 4.43 |
| | Buner | | | | | | | 0.06 | 0.78 | | |
| | Sheikhupura | 0.2 | 2.2 | | | | | | | | |
| | Killa Saifullah | | | | | 0.04 | 0.46 | | | | |
| Cherries | Hunza | | | | | | | 1.76 | 1.44 | 17.11 | 2.47 |
| | Ziarat | | | | | 0.9 | 10.3 | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Chilies | | | | 24.7 | 15.2 | | | | | 60 | 15.22 |
| Citrus | | 45.2 | 79.7 | | | | | | | 265 | 79.7 |
| Cucumber | Khuzdar | | | | | 0.33 | 0.09 | | | 3.19 | 0.93 |
| | Pakpattan | 1.1 | 0.8 | | | | | | | | |
| Dates | Turbat and Panjgoor | | | | | 81.7 | 60.36 | | | 1055 | 103 |
| | Khairpur | | | 54.1 | 43.5 | | | | | | |
| Egg Plant | Faisalabad | 0.3 | 0.6 | | | | | | | 1.336105 | 1.13 |
| | RY Khan | 0.2 | 0.5 | | | | | | | | |
| Flower | Rose | 0.5 | 13.7 | | | | | | | 7.22 | 25.04 |
| | Gladiolus | 2.4 | 11.3 | | | | | | | | |
| Garlic | Sialkot | 0.3 | 1.5 | | | | | | | 3.23 | 5.8 |
| | Kohat | | | | | | | 0.46 | 1.68 | | |
| | Mirpur Khas | | | 0.2 | 1.2 | | | | | | |
| | Harnai | | | | | 0.24 | 1.39 | | | | |
| Ginger | | | | | | | | 14.21 | 7.26 | 33 | 7.26 |
| Grapes | Pishin | | | | | 11.33 | 8.69 | | | 65 | 8.69 |
| Mango | Multan and Muzaffargarh | 31.6 | 91.4 | | | | | | | 302 | 124 |
| | Hyderabad | | | 8.1 | 31.6 | | | | | | |
| Medicinal Herbs | | | | | | 0.22 | 0.82 | | | 1.09 | 1.6 |
| | | | | 0.2 | 0.8 | | | | | | |
| Milk | Rahim Yar Khan | 264.9 | 32.8 | | | | | | | 2163 | 120.7 |
| | Umarkot | | | 90.8 | 19.9 | | | | | | |
| | Bhakkar | 101.4 | 20.6 | | | | | | | | |
| | Lahore | 207.2 | 24.4 | | | | | | | | |
| | Karachi | | | 226 | 23 | | | | | | |
| Onion | Mirpurkhas | | | 8.4 | 3.5 | | | | | 51.9 | 6.92 |
| | Qilla Saifullah | | | | | 3.12 | 1.48 | | | | |
| | Swat | | | | | | | 3.78 | 1.97 | | |
| Pattoki Nursery | | 2.3 | 3.1 | | | | | | | 17.13 | 6.21 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1.55 | 3.09 | | |
| Peas | Sheikhupura | 1.1 | 3.2 | | | | | | | 3.75 | 4.18 |
| | Swat | | | | | | | 0.43 | 0.98 | | |
| Plums | Kallat | | | | | 2.99 | 4.93 | | | 23.6 | 8.8 |
| | Peshawar | | | | | | | 1.32 | 3.88 | | |
| Potato | Okara | 27.3 | 13.9 | | | | | | | 92 | 17 |
| | Chiniot | 9.3 | 2.8 | | | | | | | | |
| | Ghizer and Astore | | | | | | | 1.4 | 0.3 | | |
| Rapeseed and Mustard | Yazman | 0.5 | 1.7 | | | | | | | 3.84 | 5.2 |
| | Kot Ghulam.M | | | 0.3 | 0.7 | | | | | | |
| | Usta Muhammad | | | | | 0.16 | 0.47 | | | | |
| | Chakwal | 0.6 | 2.3 | | | | | | | | |
| Spices | Kasur | 4.9 | 8 | | | | | | | 0.33 | 0.21 |
| | Larkana | | | 0.04 | 0.1 | | | | | | |
| | Nasirabad, | | | | | 0.1 | 0.16 | | | | |
| Sugarcane | FSD | 31.5 | 43.2 | | | | | | | 326 | 167 |
| | RYK | 60 | 70.1 | | | | | | | | |
| | HYD | | | 33.6 | 42.9 | | | | | | |
| | MRD | | | | | | | 8.5 | 11.05 | | |
| Tea | Mensehra | | | | | | | 19.08 | 4.62 | 76 | 4.62 |
| Tobacco | Mardan and Swabi | | | | | | | 0.29 | 17.58 | 0.737 | 17.5 |
| Tomato | Qilla Saifullah | | | | | 9.8 | 4.6 | | | 59 | 7.96 |
| | Thatta | | | 9 | 4.1 | | | | | | |
| | Swat | | | | | | | 7.44 | 3.79 | | |
| Walnut | Diame | | | | | | | 97.9 | 22.89 | | |
| | SWAT | | | | | | | 44.5 | 10.73 | | |
| **Overall** | | 949 | 554 | 553 | 237 | 124. | 130 | 261. | 4352 | 5680. | 972 |

# Annexure-6. Infrastructure requirement of the upgradation plan by province

| Commodity name | Unit/Plant/Pack house | Units required | | | | Total required units |
|---|---|---|---|---|---|---|
| | | Punjab | Sind | Balochistan | KP | |
| **Almond** | Processing Almond Oil | | | 1 | | 1 |
| | Almond De-Shelling Plant | | | 7 | | 7 |
| **Dates** | Pack house for Solar Tunnel Date Dryers | 173 | 5648 | 5374 | | 11195 |
| | Pack house for Fresh and Dry Dates | 9 | 178 | 163 | | 350 |
| **Plums** | Plum Drier | | | 76 | 19 | 95 |
| **Apple** | Juice Making | | | 79 | | 79 |
| | Apple pack house | | | 170 | | 170 |
| **Banana** | Banana Chips Units | | 16 | | | 16 |
| **Tomato** | Pack house | | 9 | 7 | 8 | 24 |
| | Tomato puree | | 11 | 3 | 6 | 20 |
| **Chilies** | Chilies Solar Drying Unit | | 36 | | | 36 |
| **Onion** | Dried Onion Manufacturing Units | | 6 | 4 | 4 | 14 |
| **Carrots and Turnips** | Harvester | 4 | | 4 | | 8 |
| | Planter | 4 | | 4 | | 8 |
| | Pack house | 9 | | | 8 | 17 |
| **Peas** | Planter | 26 | | | | 26 |
| | Pack house | | | | 3 | 3 |
| **Basmati Rice** | Mechanical Rice Transplanting | 3605 | | | | 3605 |
| | Harvester | 1352 | | | | 1352 |
| | Dryer | 590 | | | | 590 |
| | Bran oil | 3 | | | | 3 |
| **Grapes** | Pulp Making Units | | | 16 | 4 | 20 |
| | Raisin Making Units | | | 45 | 10 | 55 |
| **Cucumber** | Pack house | 3.00 | | | | 3 |
| **Barley** | Barley Porridge Production Units | 7.00 | | 5 | | 12 |
| **Egg Plant** | Pack house | 8 | | | | 8 |
| **Tobacco** | Turbo Barn | | | | 11 | 11 |
| **Milk** | Pasteurization Units | 385 | 213 | | | 598 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Cheese Making Units | 90 | 50 | | | 140 |
| | Khoya Making Units | 90 | 50 | | | 140 |
| | Ghee Making Units | 226 | 124 | | | 350 |
| | Milk Powder Making Units | 20 | 12 | | | 32 |
| **Beef** | Calf Fattening Units | 478 | 205 | | | 683 |
| | Village Level Feed mills | 241 | 105 | | | 346 |
| | Slaughter houses | 52 | 37 | | | 89 |
| **Ginger** | Dry units | | | | 22 | 22 |
| | Collection centre | | | | 2 | 2 |
| **Garlic** | Planter | 4 | 4 | 4 | 4 | 16 |
| | Harvester | 12 | 8 | 8 | 12 | 40 |
| **Sugarcane** | Juice plant | 636 | 236 | | 72 | 944 |
| | Harvester | 159 | 64 | | 15 | 238 |
| | Composed based LS Feed | 45 | 20 | | 4 | 69 |
| **Potato** | Potato chips unit | 115 | | | 6 | 121 |
| | Tissue lab | 136 | | | 8 | 144 |
| **R&M** | RSM Oil Expulsion Units | 50 | | | | 50 |
| **Spices** | Coriander processing Unit | | 3 | 12 | | 15 |
| | Turmeric processing Unit | | 252 | | | 252 |
| **Medicinal Herbs** | Pack house | 4 | | | | 4 |
| **Cherries** | Cold processing Unit | | | 9 | | 9 |
| | Drying processing Unit | | | 35 | | 35 |
| **Apricot** | Dryer | | | 300 | | 300 |
| **Walnut** | Oil extraction units | | | | 60 | 60 |
| **Citrus** | Cold storage | 139 | | | | 139 |
| **Mango** | Hot water treatment center | 22 | | | | 22 |
| | Mango collection center | 32 | | | | 32 |
| | Mango pulp/puree | 10 | 4 | | | 14 |
| | Mango cold storage | 70 | | | | 70 |
| **Pattoki Nursery** | Tissue culture lab | 3 | | | 3 | 6 |
| | Reefer containers | 1 | | | 1 | 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Floriculture centre | 1 | 0 | 0 | 0 | 1 |
| | Cold storage/Green houses | 120 | | | | 120 |
| **Flower** | Tissue culture labs | 1 | | | | 1 |
| **Tea** | | 0 | 0 | 0 | 0 | 0 |

# Annexure-7. Investment (Million US$) for the Infrastructure Development by Province

| Commodity name | Unit/Plant/Pack house | Punjab | Sindh | Balochistan | KP | Total Investment |
|---|---|---|---|---|---|---|
| **Almond** | Processing Almond Oil | 0.000 | 0.000 | 0.031 | 0.000 | 0.031 |
| | Almond De-Shelling Plant | 0.000 | 0.000 | 1.225 | 0.000 | 1.225 |
| **Dates** | Pack house for Solar Tunnel Date Dryers | 1.276 | 41.645 | 39.624 | 0.000 | 82.544 |
| | Pack house for Fresh and Dry Dates | 1.465 | 28.966 | 26.525 | 0.000 | 56.956 |
| **Plums** | Plum Drier | 0.000 | 0.000 | 1.008 | 0.253 | 1.261 |
| **Apple** | Juice Making | 0.000 | 0.000 | 3.807 | 0.000 | 3.807 |
| | Apple pack house | 0.000 | 0.000 | 27.159 | 0.000 | 27.159 |
| **Banana** | Banana Chips Units | 0.000 | 0.474 | 0.000 | 0.000 | 0.474 |
| **Tomato** | Pack house | 0.000 | 1.698 | 1.321 | 1.510 | 4.529 |
| | Tomato puree | 0.000 | 0.570 | 0.156 | 0.311 | 1.037 |
| **Chilies** | Chilies Solar Drying Unit | 0.000 | 3.750 | 0.000 | 0.000 | 3.750 |
| **Onion** | Dried Onion Manufacturing Units | 0.000 | 0.178 | 0.119 | 0.119 | 0.415 |
| **Carrots and Turnips** | Harvester | 0.002 | 0.000 | 0.002 | 0.000 | 0.004 |
| | Planter | 0.010 | 0.000 | 0.010 | 0.000 | 0.020 |
| | Pack house | 1.254 | 0.000 | 0.000 | 1.114 | 2.368 |
| **Peas** | Planter | 0.065 | 0.000 | 0.000 | 0.000 | 0.065 |
| | Pack house | 0.000 | 0.000 | 0.000 | 0.418 | 0.418 |
| **Basmati Rice** | Mechanical Rice Transplanting | 21.633 | 0.000 | 0.000 | 0.000 | 21.633 |
| | Harvester | 25.690 | 0.000 | 0.000 | 0.000 | 25.690 |
| | Dryer | 10.615 | 0.000 | 0.000 | 0.000 | 10.615 |
| | Bran oil | 0.202 | 0.000 | 0.000 | 0.000 | 0.202 |
| **Grapes** | Pulp Making Units | 0.000 | 0.000 | 0.342 | 0.086 | 0.428 |
| | Raisin Making Units | 0.000 | 0.000 | 0.730 | 0.162 | 0.892 |
| **Cucumber** | Pack house | 0.412 | 0.000 | 0.000 | 0.000 | 0.412 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Barley** | Barley Porridge Production Units | 0.048 | 0.000 | 0.034 | 0.000 | 0.082 |
| **Egg Plant** | Pack house | 0.504 | 0.000 | 0.000 | 0.000 | 0.504 |
| **Tobacco** | Turbo Barn | 0.000 | 0.000 | 0.000 | 0.010 | 0.010 |
| **Milk** | Pasteurization Units | 16.255 | 8.993 | 0.000 | 0.000 | 25.249 |
| | Cheese Making Units | 0.670 | 0.372 | 0.000 | 0.000 | 1.042 |
| | Khoya Making Units | 0.164 | 0.091 | 0.000 | 0.000 | 0.256 |
| | Ghee Making Units | 1.339 | 0.735 | 0.000 | 0.000 | 2.074 |
| | Milk Powder Making Units | 4.444 | 2.667 | 0.000 | 0.000 | 7.111 |
| **Beef** | Calf Fattening Units | 4.939 | 2.118 | 0.000 | 0.000 | 7.057 |
| | Village Level Feed mills | 0.893 | 0.389 | 0.000 | 0.000 | 1.282 |
| | Slaughter houses | 5.816 | 4.138 | 0.000 | 0.000 | 9.954 |
| **Ginger** | Dry units | 0.000 | 0.000 | 0.000 | 0.499 | 0.499 |
| | Collection centre | | | | 0.311 | 0.311 |
| **Garlic** | Planter | 0.012 | 0.012 | 0.012 | 0.012 | 0.048 |
| | Harvester | 0.060 | 0.040 | 0.040 | 0.060 | 0.200 |
| **Sugarcane** | Juice plant | 29.173 | 10.825 | 0.000 | 3.303 | 43.301 |
| | Harvester | 10.886 | 4.412 | 0.000 | 1.028 | 16.326 |
| | Composed based LS Feed | 3.106 | 1.381 | 0.000 | 0.276 | 4.763 |
| **Potato** | Potato chips unit | 2.399 | 0.000 | 0.000 | 0.125 | 2.525 |
| | Tissue lab | 1.797 | 0.000 | 0.000 | 0.106 | 1.902 |
| **R&M** | RSM Oil Expulsion Units | 0.563 | 0.000 | 0.000 | 0.000 | 0.563 |
| **Spices** | Coriander processing Unit | 0.000 | 0.011 | 0.042 | 0.000 | 0.053 |
| | Turmeric processing Unit | 0.000 | 6.520 | 0.000 | 0.000 | 6.520 |
| **Medicinal Herbs** | Pack house | 0.181 | 0.000 | 0.000 | 0.000 | 0.181 |
| **Cherries** | Cold processing Unit | 0.000 | 0.000 | 0.855 | 0.000 | 0.855 |
| | Drying processing Unit | 0.000 | 0.000 | 0.350 | 0.000 | 0.350 |
| **Apricot** | Dryer | 0.000 | 0.000 | 3.000 | 0.000 | 3.000 |
| **Walnut** | Oil extraction units | 0.000 | 0.000 | 0.000 | 3.600 | 3.600 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Citrus** | Cold storage | 124.748 | 0.000 | 0.000 | 0.000 | 124.748 |
| **Mango** | Hot water treatment center | 6.815 | 0.000 | 0.000 | 0.000 | 6.815 |
| | Mango collection center | 5.446 | 0.000 | 0.000 | 0.000 | 5.446 |
| | Mango pulp/puree | 0.000 | 0.460 | 0.000 | 0.000 | 0.460 |
| | Mango cold storage | 63.047 | 0.000 | 0.000 | 0.000 | 63.047 |
| **Pattoki Nursery** | Tissue culture lab | 1.449 | 0.000 | 0.000 | 1.449 | 2.89 |
| | Reefer containers | 0.72 | | | 0.72 | 1.449 |
| **Flower** | Floriculture centre | 0.74 | | | | 0.74 |
| | Tissue culture labs | 0.455 | | | | 0.455 |
| | Cold storage/Green houses | 17.03 | | | | 17.03 |

# Annexure-8. Economic Viability of ATP by commodity clusters

| Commodity | | Punjab | | Sindh | | Balochistan | | KP/GB | | Overall | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Name of the focal points | NPV (M. US$) | IRR | NPV (M. US$) | IRR (%) | NPV (M. US$) | IRR | NPV (M. US$) | IRR | NPV (M. US$) | IRR |
| Almond | Loralai | | | | | 56.3 | 136% | | | 56.3 | 136% |
| Apple | Qilla Saifullah | | | | | 17 | 71% | | | 153 | 47.6% |
| | Quetta | | | | | 137 | 46% | | | | |
| Apricot | Qilla Saifullah | | | | | 12.2 | 23% | | | 14030 | 22.7% |
| | Hunza | | | | | | | 1.9 | 23% | | |
| Banana | Upper Sindh | | | 5.4 | 39% | | | | | 11.00 | 42.2% |
| | Lower Sindh | | | 5.6 | 46% | | | | | | |
| Barely | Layyah | 0.3 | 33% | | | | | | | 0.39 | 29% |
| | Khuzdar | | | | | 0.14 | 25% | | | | |
| Basmati Rice | Sheikhupura | 6.6 | 24% | | | | | | | 16.1 | 28% |
| | Hafiz Abad | 9.5 | 24% | | | | | | | | |
| Beef | Umarkot | | | | | | | | | 244 | 123% |
| | Rahim Yar Khan | 79.1 | 143% | | | | | | | | |
| | Bhakkar | 32.7 | 103% | 45.8 | 112% | | | | | | |
| Carrots and Turnip | Swat | | | | | | | 0.3 | 29% | 3.36 | 53% |
| | Buner | | | | | | | 0.1 | 13% | | |
| | Sheikhupura | 1.3 | 42% | | | | | | | | |
| | Qilla Saifullah | | | | | 1.7 | 176% | | | | |
| Cherries | Hunza | | | | | | | 6 | 69% | 9.39 | 62% |
| | Ziarat | | | | | 3.4 | 54% | | | | |
| Chilies | | | | 5.74 | 34% | | | | | 5.74 | 34% |
| Citrus | | 474 | 145% | | | | | | | 474 | 145% |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cucumber | Khuzdar | | | | | 0.1 | 72% | | | 0.31 | 29% |
| | Pakpattan | 0.24 | 25% | | | | | | | | |
| Dates | Turbat and Panjgoor | | | | | 72.3 | 32.60% | | | 146 | 34% |
| | Khairpur | | | 68.5 | 37.30% | | | | | | |
| Egg Plant | Faisalabad | 0.1 | 24% | | | | | | | 0.22 | 23% |
| | RY Khan | 0.1 | 20% | | | | | | | | |
| Flower | Rose | 10.5 | 52% | | | | | | | 13.26 | 41% |
| | Gladiolus | 11.3 | 25% | | | | | | | | |
| Garlic | Sialkot | 4.7 | 129% | | | | | | | 13.18 | 104% |
| | Kohat | | | | | | | 6.6 | 154% | | |
| | Mirpur Khas | | | 2 | 69% | | | | | | |
| | Harnai | | | | | 2.5 | 98% | | | | |
| Ginger | Potential cluster in Mansherah, KP | | | | | | | 1.5 | 29% | 1.5 | 29% |
| Grapes | Pishin | | | | | 10.9 | 38% | | | 10.9 | 38% |
| Mango | Multan and Muzaffargarh | 435.2 | 97% | | | | | | | 577 | 97% |
| | Hyderabad | | | 142.2 | 99% | | | | | | |
| Medicinal Herbs | Cumin (Balochistan) | | | | | 0.24 | 21% | | | 0.574 | 24.0% |
| | Ispaghol (Sindh) | | | 0.33 | 27% | | | | | | |
| Milk | Rahim Yar Khan | 24.9 | 55% | | | | | | | 89.5 | 54% |
| | Umarkot | | | 11 | 44% | | | | | | |
| | Bhakkar | 9.5 | 38% | | | | | | | | |
| | Lahore | 25.5 | 71% | | | | | | | | |
| | Karachi | | | 18.6 | 56% | | | | | | |
| Onion | Mirpurkhas | | | 5.9 | 82% | | | | | 12.21 | 84.8% |
| | Qilla Saifullah | | | | | 3.2 | 79% | | | | |
| | Swat | | | | | | | 3.2 | 79% | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pattoki Nursery | | 1 | 21% | | | | | | | 7.07 | 21% |
| | | | | | | | | 6.1 | 71% | | |
| Peas | Sheikhupura | 4.1 | 69% | | | | | | | 5.08 | 68% |
| | Swat | | | | | | | 1 | 64% | | |
| Plums | Kallat | | | | | 12.5 | 76.20% | | | 15.4 | 58% |
| | Peshawar | | | | | | | 3 | 32.30% | | |
| Potato | Okara | 6.6 | 34% | | | | | | | 7.08 | 31% |
| | Chiniot | 0.22 | 13% | | | | | | | | |
| | Ghizer and Astore | | | | | | | 0.3 | 49% | | |
| Rapeseed and Mustard | Yazman | 1 | 42% | | | | | | | 1.92 | 31% |
| | Kot Ghulam.M | | | 0.17 | 23% | | | | | | |
| | Usta Muhammad | | | | | 0.1 | 17% | | | | |
| | Chakwal | 0.7 | 26% | | | | | | | | |
| Spices | Kasur | 1.2 | 23% | | | | | | | 1.27 | 22.6% |
| | Larkana | | | 0.003 | 12% | | | | | | |
| | Nasirabad, | | | | | 0 | 20% | | | | |
| Sugarcane | FSD | 13.9 | 31% | | | | | | | 118 | 36.9% |
| | RYK | 36.2 | 45% | | | | | | | | |
| | HYD | | | 11.2 | 28% | | | | | | |
| | MRD | | | | | | | 6.1 | 45% | | |
| Tea | Mensehra | | | | | | | 31.3 | 37% | 31.3 | 37% |
| Tobacco | Mardan and Swabi | | | | | | | 2.2 | 20.40% | 2.2 | 20% |
| Tomato | Qilla Saifullah | | | | | 4.2 | 65% | | | 144 | 75% |
| | Thatta | | | 5.5 | 80 | | | | | | |
| | Swat | | | | | | | 4.7 | 79% | | |
| Walnut | Diame | | | | | | | 214.1 | 183% | 310 | 165% |
| | SWAT | | | | | | | 96.7 | 143% | | |