CLUSTER DEVELOPMENT BASED AGRICULTURE TRANSFORMATION PLAN VISION-2025

Grapes Cluster Feasibility and Transformation Study

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

February 2020

FOREWORD

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

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

FOREWORD

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

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

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

FOREWORD

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

Dr. Babar Ehsan Bajwa
Regional Director
CAB International

FOREWORD

This report is part of the series of studies on 33 agriculture commodities to prepare the agriculture transformation plan by incorporating regional realities at the cluster level. In the report, the clusters of various commodities 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. Internationally reputed foreign/ local consultants like Dr. Derek Byerlee, Dr. Kijiro. Otsuka and national consultant Mr. Sohail Moghal were also engaged to understand the cluster-based development approach and conducted cluster-based feasibility analysis. An EXCEL-based Model was developed which validated by our national consultants. Separate viabilities for individual technologies and products suggested in each commodity also estimated. This humongous task would not have been possible to complete without the excellent cooperation and facilities provide by CABI, the hard work of commodity specialists and our research team especially Mr. Yasar Saleem Khan and Ms. Aqsa Yasin. The true reward of our hard work is the implementation of the proposed policies, strategies and interventions to develop agriculture commodity clusters in the country.

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

ACKNOWLEDGEMENT

It is not possible to mention the names of all those who collaborated in completing this report, but my foremost gratitude goes to numerous stakeholders along the value chain who generously shared the information about Grapes 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. I am 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 to the project.

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

Dr. Muhammad Tariq
Senior Author

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DISCLAIMER

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

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LIST OF ACRONYMS

CPEC	China Pakistan Economic Corridor
CO	Community Organization
DoA	Department of Agriculture
CPM	Commission on Phyto-sanitary Measures
CAAS	Chinese Academy of Agricultural Sciences
CGIAR	Consultative Groups on International Agriculture Research
FFS	Farmer Field School
FEG	Farmer Enterprise Group
FAO	Food and Agriculture organization
GAP	Good Agriculture Practices
GI	Geographical Identification
GoP	Government of Pakistan
ISO	International Standard Organization
IPPC	International Plant Protection Convention
ARI	Agriculture Research Institute
KP	Khyber Pakhtunkhwa
MINFAL	Ministry of Food, Agriculture and Livestock
NARC	National Agriculture Research Council
NGOs	Non-Governmental Organizations
NAFTA	North America Fruit Trade Organization
OIC	Organization of Islamic Countries
PARC	Pakistan Agriculture Research Council
PKR	Pakistani Rupee
PFVA	Pakistan Fruit and Vegetable Association
R&D	Research & Development

EXECUTIVE SUMMARY

Grapes are one of the leading fruit grown globally on 7 million ha with a total production of 7.5 million tonnes. Pakistan ranks 56th in terms of production and 91st in terms of export value in the world. A positive trend has observed in global production and international trade in table grapes at 1.4% and 3.0%, respectively while the value of table grapes has been growing at 8.0% per annum during 2001-16.

Pakistan is continuously losing its competitiveness position in the global grapes sector. While the growth in grapes production in the country is lower than 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 grapes is decreasing while the value addition and export of grapes products have almost dried down.

To improve the competitiveness in grapes production and trade, the Planning Commission of Pakistan has initiated this study to analyze whole value chain of grapes, identify gaps and potentials along the chain, and suggest economically viable interventions. In order to incorporate the regional context, analyses were undertaken at cluster level of major grape producing areas in the country. To achieve these objectives, macro data related to grapes production, marketing, trade, consultation of large number of stakeholders and review of literature analyzed. An Excel spreadsheet model developed to analyze the economic feasibility of suggested interventions.

In Pakistan, Quetta, Pishin, Mastung and Kharan districts of Balochistan province are the main grape growing areas thus identified as the major cluster. However, after the recent successful cultivation in Pothwar, southern Punjab and traditional grape growing areas of Chitral, South & North Waziristan in Khyber Pakhtunkhwa has identified as the future potential grape cluster. Demand for fresh grapes is growing with the increased tourism in Pakistan as the harvesting time in Balochistan coincides with the tourism season in the country.

This study identifies various gaps in the production, processing and trading components of the value chain, specifically the technology, market structure and availability of inputs. Major gaps include poor research system, absence of improved commercial grape cultivars, packaging, management practices, cold storage facilities and reefer transportation for trading in the high-value grape market. The export of fresh and dried grape products are on a declining trend.

Performance targets are set based on global averages for yield, quality and export in order to address multilevel challenges from production to product and market development. Specific interventions are suggested keeping in view the gaps, constraints, potential and opportunities for the up gradation of grape cluster in Balochistan. Restoration of old orchards with new varieties, introduction of high-yielding and better quality grape varieties tolerant to various stresses, putting in place grape R&D programs, introducing improved management practices at all segments of value chain, incentivizing the establishment of cold chains and value addition system, promoting processing in rural areas of the cluster are some of the required interventions.

Training of farmers and stakeholders for improved production practices, value chain management, providing incentives for certification in all segments of the value chain i.e., production, logistic, and linking traders with international market by providing information (standards, price, potential buyers etc.) are also needed.

The government can initiate these interventions in collaboration with the private sector including farmers, traders and their groups/associations, donors and NGOs. A time-horizon of eight years has been set for realizing the intended outcome of the cluster development interventions. Total estimated investment of the up-gradation plan of the grape clusters in Balochistan is (US$) 8.45 million.

This cluster development plan shall pave the way for long-term economic and social payback, including increased productivity, improved quality, higher value, better income, more employment benefiting all the stakeholders of grape clusters in Balochistan. Total investment of US$ 8.69 million is required in five years for introduction of interventions at the focal points in the project mode. Out of this, 52% cost is being proposed to be borne by the government in terms of strengthening grape research, capacity building of farmers and other stakeholders along the value chain, subsidies on the establishment of pulp units, promoting processing and orchard renovation. The pooled Net Present Value (NPV) after offsetting the costs incurred and the investments done is US$10.9 million during the five year of the project.

Accounting for all the yearly value chain costs including the production, processing and marketing applied over eight years, and the investment applied in five years, the overall Internal Rate of Returns (IRR) is 38% for Balochistan cluster focal point. This clearly implies that it is worth investing in grape clusters in Balochistan, which will be beneficial for the farmers, value chain stakeholders as well saving precious foreign exchange spent on grape import. The interventions impact at various value chain segments can see in the coming table.

The impact of the proposed interventions for various value chain segments is set below in the summary sheet.

Summary sheet of Grapes clusters

Items	Balochistan
Area under cultivation in focal point (ha)	8,262
Total Production (tonnes)	41,775
Yield (tonnes/ha)	5.06
Area of the cluster (ha)	14,135
Production of the cluster (tonnes)	65,390
Area where orchards would be renovated (%)	5%
Additional production from renovated garden in 8th year (tonnes)	448
Additional returns –renovated gardens in year 8 (US$)	420.2
Yield increase –improved management practices (%)	20%
Additional production from enhanced yield (tonnes)	8,968
Additional value from improved practices (000 (US$))	7,004.0
Yield increased over five years	20%
Additional production from enhanced yield (tonnes)	8,968
Expected additional value from increased yield (000(US$))	7004.0
Reduction in post-harvest losses after intervention	10%
Enhanced marketable production-reduced PH losses (tonnes)	8,138
Additional value from reduction of losses (000(US$))	6356.2
Percentage of production to be used in pulp making	3
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$))	1,975.8
Production to be used in raisin making (percent %)	3
Total production to be used in raisin production (tonnes)	1,872
Total volume of raisin produced (tonnes)	576
Additional value from raisin processing (000 (US$))	2,133.2
Production go in improve VC and sold in domestic market (percent %)	10
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%

1. INTRODUCTION

Grapes (Vitis vinifera) are various species of woody vines in the genus Vitis, family *Vitaceae*. This family contains about 700 species most of which occur in tropical and subtropical climates, although some occur in temperate habitats. Word wide grapes are grown mostly for table purpose, raisins, juices/nectar and wines. Vinifera grapes have a thick skin, which firmly adheres to the sweet pulp. American and Muscadine grapes have a thin skin, which separates easily from the acid pulp.

Grapes are identified as a high value horticulture crop for having potential to increase self-employment opportunities for farmers, youth and can create small-scale businesses in rural areas thus enhancing the income of rural communities especially in the marginal lands where poverty levels are high.

1.1. Grape Sector in Pakistan

Area under grapes in Pakistan has increased from 12.5 thousand ha in 2001-02 to 16.3 thousand ha in 2015-16 with an annual growth rate of 2.1%. Similarly, production has also increased from 75.9 thousand tonnes to 96.5 thousand tonnes during the corresponding years producing an average annual growth of 2.1%. These increases are not very impressive because of the high growth in population at 2.1% per annum. Moreover, it has to note that growth in grape production is lower than area increase suggesting that increase in the former is contributing only through the expansion in the later while per ha yield of grapes has actually declined at 0.9% per annum. Balochistan has emerged as the major grapes producing province with grapes grown on an area of 15.2 thousand ha followed by Khyber Pakhtunkhwa (KP). The increase in area and production is highest in Balochistan at an average growth rate of 1.9% and 2.8%, respectively. The area and production of grapes has declined substantially in KP, the reasons of which need to be investigated (Table 1).

Table 1: Area and production of grapes in Pakistan (2016)

Year	KP		Balochistan		Pakistan	
	Area	Production	Area	Production	Area	Production
	(000) ha	(000) tonnes	(000) ha	(000) tonnes	(000) ha	(000) tonnes
2001-02	0.2	2.3	12.3	48.8	12.5	75.9
2002-03	0.2	2.3	12.5	50.3	12.7	77.8
2003-04	0.2	2.3	12.5	49.5	12.7	77
2004-05	0.2	2.4	12.6	48.4	15.2	78.6
2005-06	0.2	1.4	12.8	47.7	14.4	76.3
2006-07	0.2	1.3	12.8	47.5	14.3	75.9
2007-08	0.2	1.3	13.6	45.2	15.1	75.2
2008-09	0.2	1.3	15.1	74	16.6	107
2009-10	0.2	1.3	15.1	74.8	16.6	107.8
2010-11	0.2	1.4	15.1	63.3	16.7	96.5
2011-12	0.2	1.2	15.1	63.2	16.5	94.8

Year	KP		Balochistan		Pakistan	
	Area	Production	Area	Production	Area	Production
	(000) ha	(000) tonnes	(000) ha	(000) tonnes	(000) ha	(000) tonnes
2012-13	0.2	1.2	15.2	63.2	16.6	96.7
2013-14	0.2	1.1	15.1	63.3	16.4	96.5
2014-15	0.1	1.0	15.2	65.2	16.3	96.7
2015-16	0.1	1.0	15.2	65.2	16.3	96.5
Annual growth (%)	-3.2	-6.3	1.9	2.8	2.1	1.2

Source: Agriculture Statistics of Pakistan 2017-18

Currently, over 67% of Pakistan's grapes production is concentrated in Balochistan, while rest of the production is from Khyber Pakhtunkhwa, Sindh and Punjab. Being a commodity of high commercial value farmers and traders are extremely careful in handling the product at every stage of the value chain. Post-harvest losses are around 20% without including the losses during transportation at the wholesale and retail level. Fruits damaged during harvest are separated at the time of grading and are dried and sold separately.

Grapes produced in the country are consumed in the domestic market as fresh, while its export in raisin form has almost dried down over the years. Pakistan is the main importer of grapes from Afghanistan, Iran and China, while a small quantity is also exported to Afghanistan. During 2015, when grapes trade was highest, around 122.3 thousand tonnes of grapes were imported while 2.0 thousand tonnes were exported as fresh. Net trade deficit was US$120.3 million during the year, although it reduced to US$60.5 million in 2016 (Table 2). Pakistan imports about 50% of its grape requirement, i.e., its imports are almost equal to its production or import-production ratio has reached to about 100% in 2016. The trends in grape imports are increasing at an annual rate of 3.4% per annum, while the import values are expanding at about 19% annually. On the other hand, exports are highly variable and fluctuate widely.

Table 2: Import and export of grapes in Pakistan

Year	Imports		Export		Deficit	
	Quantity (tonnes)	Value (000 US$)	Quantity (tonnes)	Value (000 US$)	Quantity (tonnes)	Value (000 US$)
2001	39648	4991	284	167	39364	4824
2002	38889	4975	284	174	38605	4801
2003	54610	6394	401	237	54209	6157
2004	40346	5128	573	279	39773	4849
2005	25427	3249	413	258	25014	2991
2006	32714	3898	540	313	32174	3585
2007	62002	8330	250	132	61752	8198
2008	71099	9303	420	222	70679	9081
2009	46134	8082	185	112	45949	7970
2010	61782	10957	310	191	61472	10766
2011	50430	12589	172	108	50258	12481

Year	Imports		Export		Deficit	
	Quantity (tonnes)	Value (000 US$)	Quantity (tonnes)	Value (000 US$)	Quantity (tonnes)	Value (000 US$)
2012	45965	16290	48	25	45917	16265
2013	28046	16915	7	3	28039	16912
2014	50059	50054	3568	1590	46491	48464
2015	122309	87619	2004	786	120305	86833
2016	62549	73357	16	11	62533	73346
Growth rate (%)	**3.44**	**18.94**	**-7.99**	**-9.16**	**3.37**	**-9.16**

Source: http://www.fao.org/faostat/en/#data/TP

1.2. Global comparison with Pakistan

Global grapes production stands at 75 million tonnes during 2016-17, planted on area of 6931 thousand ha. This translates into an average yield of 10.72 tonnes/ha. Pakistan's performance in terms of yield, export-production ratio, and export price, etc. is very low. Its yield is only 38% of the world average yield. It contributes only 0.08% of the world production has negligible share in world export quantity and even no share in world grapes export value. However, its farm gate prices are far lower than the world average suggesting a great potential for export with great challenges to improve its value chain (Table 3).

Table 3: Comparison of world vs. Pakistani grape sector 2016-17

Parameter	World	Pakistan	Share (%)
Area (000 ha)	6931	14.4	0.21
Production (000) tonne	74992	57.9	0.08
Value of production (million US$)	67876	45.2	0.07
Yield (tonne/ha)	10.72	4.0	37.51
Farm gate price (US$/tonne)	914	781	85.43
Quantity of international trade (000 tonne)	7826	0.0	0.00
Value of international trade (million US$)	7826	0.011	0.00
Export quantity as % of production	15%	0%	-
Export value as % of production value	12%	0%	-
Average export prices (US$/tonne)	905	688	76

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

1.2.1 Trends in international fresh grape production and trade

Grape production in the world is increasing at a rate of 1.4% per annum, higher than the population growth of 1.19% implying that per capita consumption of grapes is increasing globally. The increase in production is contributed entirely by the improvement in grape yield with a growth rate of 1.8% per annum, while the area under grape cultivation is declining at a rate of 0.4% per annum. This is opposite to what happened in Pakistan where increase in area contributed in higher production while per ha yield of grape have declined over the period.
More interestingly is the fact that grapes are becoming an international commodity as its export quantity and value have increased at the rate of 3% and 8% per annum, respectively. On the contrary, Pakistan's share in world's export remains dismally insignificant, highly variable, with a declining trend (Table 4).

Table 4: International grapes production and trade during 2001-16

Year	World Production			World Export		Pakistan export	
	Area (000 ha)	Production (000 tonne)	Yield (tonne/ha)	Quantities (000 tonne)	Values (m US$)	Quantities (000 tonne)	Values (m US$)
2001	7285	60862	8.4	2747	2	0.284	0.00017
2002	7341	61165	8.3	2714	3	0.284	0.00017
2003	7389	63051	8.5	3121	3	0.401	0.00024
2004	7286	67208	9.2	3064	3	0.573	0.00028
2005	7283	66976	9.2	3424	4	0.413	0.00026
2006	7312	66983	9.2	3427	4	0.54	0.00031
2007	7233	66440	9.2	3627	5	0.25	0.00013
2008	7134	66756	9.4	3809	6	0.42	0.00022
2009	7107	67976	9.6	3796	6	0.185	0.00011
2010	7010	67090	9.6	3784.1	6.2	0.31	0.00019
2011	6982	69832	10.0	3929	7	0.172	0.00011
2012	6972	69078	9.9	4051	7	0.048	0.00003
2013	7094	77002	10.9	4281	8	0.007	0.00000
2014	7021	74776	10.7	4113	8	3.568	0.00159
2015	7092	76327	10.8	4252	8	2.004	0.00079
2016	6990	74992	10.7	4451	8	0.016	0.00001
Annual growth (%)	**-0.4**	**1.4**	**1.8**	**3.0**	**8.0**	**-8.0**	**-9.2**

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

1.2.2 Trends in the trade of international grape-based products

The increase in trade in grape-based products is more spectacular. For example, the export of grape juices has increased at a rate of 1.5% per annum during 2001-16. The value of grape juices traded has almost doubled during this period. The raisin export increased at a rate of 1.4% per annum but its export values almost tripled during the period. Finally, the increase in wine export was most spectacular with an annual increase of 3.6% per annum although its value increased by about 250% (Table 5). The boost in the processing of grape products is higher than the increase in fresh grape production, suggesting that more grapes are being converted into value added products.

Pakistan was exporting 1.6 thousand tonnes raisin to the tune worth of US$ 1.5 million in 2001, which has virtually completely dried out in 2016. Pakistan has not only left fresh grape market but also untouched its processed product market.

Table 5: International trade of grape-based products during 2001-2017

Year	Grape Juice		Raisin		Wine	
	Quantity (000 tonnes)	Value (million US$)	Quantity (000 tonnes)	Value (million US$)	Quantity (million t)	Value (billion US$)
	552.6	324.6	653.1	558.1	6.6	12.7
2002	588.9	340.0	676.4	577.4	6.7	14.2
2003	617.7	405.4	685.1	673.3	7.1	17.3
2004	661.2	498.5	696.4	809.9	7.7	19.8
2005	712.4	535.7	730.1	895.7	7.9	20.7
2006	748.8	584.5	777.9	915.8	8.4	22.4
2007	841.1	770.9	830.9	1025.4	9.0	27.3
2008	833.4	962.9	778.4	1319.4	8.7	29.6
2009	678.5	746.1	794.7	1298.5	8.7	25.2
2010	771.6	770.4	818.8	1690.2	9.8	27.9
2011	896.7	1014.1	800.0	1887.9	10.5	32.3
2012	883.4	1113.6	783.4	1798.3	10.4	32.8
2013	769.6	1162.3	787.8	1794.5	10.3	34.7
2014	774.9	893.4	799.3	1764.1	10.7	34.6
2015	677.4	659.1	807.7	1571.6	11.0	31.7
2016	660.3	652.4	825.0	1562.8	10.9	32.3
Growth rates (%)	**1.51**	**6.32**	**1.36**	**8.26**	**3.60**	**6.19**

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

1.2.3 Per capita availability of grapes

Per capita annual availability of grape and its product (excluding wine) has increased globally from 3.3 kg in 2001 to 4.6 kg in 2016, about 50% improvement. In Pakistan, the grape consumption is too low at 0.51 kg per annum (2016) which has been reduced from 0.76 kg

(2001). Therefore, there is huge gap to be catching up with international grape consumption level within the country (FAOSTAT Balance Sheet).

1.2.4 Major fresh grape producing countries

More than 50 countries are involved in grape production, China is the top producer of grapes in the world with 14.7 million tonnes of production (2016) followed by Italy, USA, and France (Table 6). These countries have been characterized by different dynamics in recent years. China and Turkey in particular showed a growing trend among the key countries, while Iran, Italy and other countries showed stability or in some cases a decline in production. Pakistan ranks at 56th in the world in terms of production. Yield per ha of grape is highest in India at 21 tonnes as compared to only 4 tonnes/ha in Pakistan. China, USA, and South Africa are other high-yielding grape countries (Table 6).

Table 6: Top ten grapes producing countries of the world (2016)

Rank	Country	Production (tonnes)	Area (ha)	Yield (tonnes/ha)
1	China	14,763,000	843,407	17.59
2	Italy	8,201,914	668,087	12.27
3	USA	7,097,723	409,947	17.31
4	France	6,247,034	757,234	8.24
5	Spain	5,934,239	920,108	6.45
6	Turkey	4,000,000	435,227	9.19
7	India	2,590,000	122,000	21.22
8	Chile	2,473,588	203,127	12.17
9	Iran	2,450,021	207,329	11.81
10	South Africa	2,008,819	120,477	16.67
FAOSTAT, Trade, Crop and Livestock Products Data: http://www.fao.org/faostat/en/#data/TP				

1.2.5 Major fresh grape trading countries

Chile leads the world in grape exports with a value of US$ 1.4 billion followed by USA which exported about (US$) 916 million worth of grapes during 2016 (Table 7).

Table 7: Major exporting Countries of the world 2016

Rank	Country	Quantity (000 tonnes)	Country	Value (million US$)
1	Chile	708	Chile	1390
2	Italy	481	USA	916
3	USA	386	Italy	743
4	South Africa	305	Netherlands	708

Rank	Country	Quantity (000 tonnes)	Country	Value (million US$)
5	Peru	286	China	664
6	Netherlands	279	Peru	646
7	China	254	South Africa	436
8	Turkey	173	Spain	326
9	Spain	157	Australia	273
10	Mexico	156	India	219

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

United States of America is the largest market for imported grapes with a value of US$1.67 billion during 2016 (Table 8). Other countries who are exporters and importers as well are Netherland and China, where vineries are allowed to buy best grapes at best price from anywhere in the world.

Table 8: Major grape importing countries of the world 2016

Rank	Country	Quantity (000 tonnes)	Country	Value (million US$)
1	USA	551	USA	1671
2	Netherlands	339	Netherlands	795
3	Germany	328	Germany	683
4	United Kingdom	267	United Kingdom	652
5	China, mainland	252	China, mainland	630
6	China	236	China	460
7	Russia	193	Canada	428
8	Canada	171	Viet Nam	234
9	Thailand	148	France	210
10	France	144	Indonesia	197

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

1.2.6 Wine vs. table grape varieties

A positive trend of average price for popular wine grape varieties was observed in Napa Country during 2014-16 (Table 9). Similar increasing trend is also observed in grape prices in Pakistan. Highest quality grape is earning more than three times premium as compared to the low quality grape. In Pakistan high-price cultivars (wine-grape) are also utilized as table grapes without any premium.

Table 9: Weighted average grapes price, Napa country ((US$)/tones)

Towns	2016	Trend	2015	2014
Cabernet Sauvignon	6,829	+	6,288	5,926
Pinot Noir	2,779	+	2,713	2,604
Merlot	3,352	+	3,135	2,978
Zinfandel	3,520	+	3,390	3,333
Syrah	3,591	+	3,234	3,175
Chardonnay	2,673	+	2,592	2,497
Sauvignon Blanc	2,142	+	2,012	1,909

Source: Vintroux: 2017 Blog, Report – Sonoma and Napa Premium Wine Grape Prices 2016

Figure 1: Wine grape cultivars in Napa

It is concluded that 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 in the world and per ha yield is on the declining trend. Despite increasing import per capita consumption of grape is also decreasing while the value addition and export of grape products have almost dried down.

This above macro-level situation analysis of grape production, processing and trade demands serious attention and strategies to revive the grape sector in the country. The purpose of this study is to suggest interventions in the grape value chain to make the commodity and its products competitive in national and international markets. However, before devising such strategies, understanding the regional perspective of the grape value chain will be very important. Therefore, major grape growing clusters have been identified and characterized before suggesting strategies for the improvement of grape production, marketing, processing and trade in the country.

2. OBJECTIVE OF THE STUDY

The overall goal of the study is to suggest economically viable interventions throughout grape value chain at the grape-cluster level so that the commodity and its products can become competitive. This exercise will also contribute in *the Cluster Development Based Agriculture Transformation Plan -V2025.*

The Specific objectives of the study are:

- To identify the existing major clusters of grape production in Pakistan and identify area(s) where new grape cluster can be developed
- To characterize and conduct SWOT analysis of each grape cluster
- To identify technological, institutional, infrastructure and policy gaps in each cluster
- Assess the potential of grape production in each grape producing cluster
- Suggest technological, institutional, infrastructure and policy interventions to achieve the cluster potential
- Conduct economic and social feasibility of the suggested interventions

3. METHODOLOGY

The data and information related to the cluster characteristics, gaps, potential and needed interventions were collected from three sources:

a) **Macro-Data**: Relevant macro data was collected from various published/ unpublished reports of government and non-governmental organizations and Internet search on grape value chain (Annexure-1).

b) **Stakeholders Consultations**: Primary information was collected through meetings, consultations, key informant interviews, surveys and focus group discussions using structured tools and open-end questionnaires (Annexure-2).

c) **Literature Review**: The literature related to the functioning, gaps, and interventions in grape value chain is reviewed and synthesized (Annexure-1).

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

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

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

4. LITERATURE REVIEW

According to All Pakistan Fruit and Vegetable Exporters, Importers & Merchants Association (PFVA), fruit and vegetable exports from Balochistan can generate (US$)1billion per year (PFVA, 2017).

Although Balochistan is rich in all types of natural resources, it is also the "The Fruit Basket of Pakistan" (The Balochistan Point, 2018). Fruit production in the highlands of Balochistan is dependent on groundwater, but water has become a scarce resource. Over extraction, climate change and frequent droughts have created stiff competition for irrigation water among crops (UN&PO, 2015).

Balochistan has tremendous yield potential that can be exploited through smart planning, including adoption of more efficient irrigation technologies, establishment of crop-specific zones and reducing losses both before and after harvest. (Fresh Plaza, 2017)

There are growing concerns about the low productivity of grapes in the country as compared to develop and developing countries, especially in comparison to our neighbors like India. This signifies a need to identify factors responsible for low grape productivity. Markets for agricultural products function inefficiently. There are generally great differences between prices paid by consumers and those received by producers. It is generally perceived that marketing agents exploit producers and consumers by charging a fixed and high margin on their investment (Aujla *et al*., 2011).

Grape growing is basically an economic and resource allocation decision. An orchard planting is not only the planting of trees on a piece of land but it requires incessant care and application of necessary inputs round the year. Growers have to choose whether they should devote their limited resources including land, labor, capital and machinery to plant grapes orchard or they should exploit these resources for other fruits or crops. There is limited information on financial feasibility of long- term investment in fruit orchards in Pakistan in general and in Balochistan in particular. There is also scarcity of consistent and literal information among farmers, market traders, investors and policy makers about the investment worthiness of fruit orchards. (Khair *et al*., 2009).

Critical investments in new plant materials (plants, seedlings and seeds), agricultural technologies and efficient water use systems are not introduced in Balochistan to improve the agricultural sector in the province (Government of Bangladesh, 2011).

Naseem M, et al., 2010 argued that farmers in Balochistan are not familiar with innovative grape varieties and techniques for water conservation, while the varieties and production techniques could diversify towards sustainable agriculture in Balochistan. The water saving in the province is fundamental and crucial to the sustainability of the horticultural sector in the province. It has been proven that the right choice of efficient water use irrigation systems, methods and techniques along with low water-consumptive crops like grapes could save water and thus more land could be cultivated and the rural life in the province could be strengthened.

According to Pakistan and Golf Economist, February- 2018, if the China-Pakistan Economic Corridor (CPEC) completes on-time and Gwadar Port becomes fully operational as hub port, it will change the fortune of the most backward and the country's poorest province of Balochistan. The province is known as the country's fruit basket as it contributes 90% national production of grapes 60% of peach, pomegranate, apricot and 34% of apple and 70% of dates. The strategically located province offers access to new resources and markets and the prospect of more rapid growth. The province's geo-strategic location makes it the most attractive for transit traffic to the landlocked Central Asian Republics (CARs). The province offers lucrative opportunities to the investors to invest on fruit farms. The development of fruit farms is essential to increase fruit exports from Balochistan. Export of fruits is considered a big source of foreign exchange. Exporting of fruits from Balochistan will pave the way for eliminating the marginalization of the people of Balochistan.

The case study of the Maharashtra grape cluster is a success story in highlighting how smallholders can overcome the constraints in value chain. The role of public sector has been of crucial importance to the success of the grape cluster in India.

Although traditionally grape production in India has largely been for the domestic market in table grapes, its export sector has been growing rapidly. In 1971, Indian grapes made up only 0.1 percent of global grape exports in terms of both quantity and value. By 2005 it had rapidly increased its contribution, accounting for 1.5 percent of the quantity and 1.2 percent of the value of global grape exports (Trade, Crops and Livestock Products http://www.fao.org/faostat/en/#data/TP).

Maharashtra State has played a key and increasingly central role within the Indian grape sector. In the 1987-88 season the state produced 19.6 percent of India's total grape production, a figure that grew to 75 percent in 2002 (Naik, 2006). It also dominated the export market. In 2005, the state's largest grape production area, Nasik, accounted for 80 percent of Indian grape exports (FAO, 2008).

The specific mandate of Mahagrapes is to locate internationally acceptable quality grapes from growers; identify lucrative foreign markets; and to access and develop pre-cooling and storage facilitates using imported technology (Hall *et al.,* 2001). Mahagrapes undertook a number of activities that have helped to upgrade the Maharashtra grape cluster. As soon as it was set up it used loans (mostly from the NCDC and state government) to build pre-cooling and cold storage facilities for each cooperative (Naik, 2006). These are vital for the export of the grapes and previously were almost completely unavailable. Additionally, by marketing all the grapes under one brand name, Mahagrapes has helped to establish an international reputation for the produce (FAO, 2008).

The most important activities undertaken by Mahagrapes are in relation to the creation of a knowledge base and in aiding the implementation and application of new knowledge. One of the biggest barriers to Indian exports to Europe is a voluntary standard such as GLOBALGAP (Roy and Thorat, 2008). Especially for smallholders, acquiring information on the complex and often-changing standards involves high-fixed costs.

Finally, the cluster has played a large part in expanding exports levels of Indian grapes, and by describing the role of different actors in the supply chain, it is apparent that how success of the Maharashtra grape cluster has been driven by the interaction between all the different members of the cluster, thus achieving the benefits of clustering.

5. CLUSTERS IDENTIFICAION AND CHARACTERISTICS

5.1. Identification of Clusters

As noted earlier, major grapes production comes from Balochistan, thus it is considered as the major grape producing cluster in the country. One cluster from each province was identified.

Balochistan Grape Cluster: Grapes production is concentrated in four districts of Quetta, Pishin, Mastung and Kharan, which contribute about 96% of grapes produced in the province (Table 10).

Figure 2: Map of Balochistan showing the grapes cluster and its focal point

Among these four districts Pishin is leading producer with the highest yield in the province at 5.0 t/ha (Table 10). Pishin is the only area in Pakistan having a Viticulture Research Station in

public sector. Therefore, Pishin is selected as focal point for the cluster development where interventions are suggested for the improvement of the cluster and their impacts are quantified in this study.

Table 10: Districts wise area & production of grapes in Balochistan (2015-16)

District	Area (ha)	Production (tonnes)	Production (% of Total)	Yield (tonnes/ha)
Pishin	8262	41775	63.9	5.05
Quetta	1596	7854	12.0	4.92
Mastung	1444	7245	11.1	5.01
Zhob	482	1070	1.6	2.21
Killa Abdullah	251	714	1.1	2.84
Loralai	198	469	0.7	2.36
Nushki	291	875	1.3	3.00
Kalat	202	656	1.0	3.24
Kharan	1154	4039	6.2	3.5
Punjgoor	255	61	0.1	0.23
Others	435	632	1.0	1.45
Total	**14135**	**65390**	**100**	

Balochistan has the potential to supply grapes to Karachi, Gwadar, Punjab and Northern Region and even to China using CPEC route. Availability of land and resources in this region can boost the grapes production and economy of Pakistan.

5.2. Characterization of the Cluster

The focus in the Balochistan Cluster is to increase production of table grapes. This cluster supply grape to the urban centers of Sindh and Punjab, although potential of Khyber Pakhtunkhwa cluster can substitute the grape imported from Afghanistan. The average farm size of the grape producers in Balochistan cluster is 9 ha whereas it is 1.25 ha in KP cluster. Cultivating grapes is resource intensive and demand considerable expertise to achieve optimal yields.

The cultivation of mixed orchards in Balochistan cluster is dominant; it was found that 85% of farmers operate mixed orchards. The orchards are mainly intercropped with apples (49%), apricot and pomegranate (21%) and the remaining 15% with plums, peaches, etc., while in KP no intercropping in grape orchards is practiced. The irrigation water is pumped through tube-wells or karees water is used as source of irrigation in Balochistan while natural streams are mainly used in KP cluster. The underground water quality is poor in Balochistan while stream water quality in KP cluster is excellent. Table 11 presents a detail description of key characteristics of Balochistan grape clusters.

Table 11: Characteristics and comparison of grapes cluster

Salient Features	Balochistan Cluster (Identified Cluster)
Districts	Quetta, Pishin, Mastung & Kharan, Zhob, Nushki, Panjgoor
Focal point district/ Tehsil/Mouza	Pishin
Focal point area (ha)	8262
Focal point production (tonnes)	41,775
Area of the cluster (ha)	14,135
Production: (tonnes)	65,390
Average yield: (tonnes/ha)	4.6
Percentage of the crop area that lies in the cluster (grape area of the cluster/grape area in the country)	88%
Geographical and Environmental Factors	Sandy/silt texture
	Mountainous and flat lands
	The climate of four grape producing districts is arid. It can be termed as cool climate
	The irrigation water is extracted from ground using tube wells. The traditional Karez system is also in practice in some areas
	Poor quality of groundwater, and high costs of pumping
	Average rainfall 150–275 mm per annum
	Temperatures frequently rise above 30 °C between May and August. Dry hot days and cool nights are typical during the summer. In winters, temperature goes below zero degree Celsius, up to -10 °C particularly during nights
	Strong winds and dust storms may occur rarely during the month of May and June, causing nearly 10% reduction impact on production capacity
	Dry and hot weather during May to July
Land Holdings	Medium and large size landholding ranging from 4 to 50 ha
	Farmers Enterprise Groups are functional across the region, though no separate Grape Grower Associations
	Scarcity of labor for grape production practices, especially harvesting
Product Features	Some of the production goes for value addition in the form of Monaka and Kishmish
	Mature fruit: Deep red, light red, yellow
	No value chain exists
Variety Features	Seeded and seedless Yellow, red and green berries
	Seedless and Late maturing varieties are dominated

Salient Features	Balochistan Cluster (Identified Cluster)
Cultivars/Varieties grown	Both table and wine grown are: Haita Kishmishi Shundokhani (major share) Sahibi Shekhali autumn royal Thompson (Seedless) Red Globe (Seeded) Crimson (Seedless)
Insects and Diseases	• Powdery mildew • Downy mildew • Anthracnose
Utilization/ product formation	Grapes are utilized as fresh and dried only, not for juice, pulp and wine
Propagation/Nursery raising	• Nursery plants are usually prepared through hard wood stem cuttings from parent varieties • Cuttings are planted during December, January and transplanting is done in March, April or in August-September • Some of the farmers has own nurseries but not on commercial scale • No nursery in Public sector
Land Preparation	• After leveling of land, two ploughs • Planting is done in trenches (3-4 meter apart) and vines are spread on mud walls (low height), no proper trellising in place • Trained hired labor required for transplanting and other cultural operations
Inputs/Management Practices	• Most of the farmers use under doses of recommended quantities of fertilizers, pesticides and fungicides
Irrigation	• The major irrigation method used is flooding, 10-14 irrigations depending upon climate
Intercropping	• 85% farmers have mixed orchards with Apple, Apricot, Pomegranate, Plum etc.
Weeding	• Weeding is done manually in most of the cases and limited weedicides are used
Training/ Pruning	• Vines are spread on mud walls • Pruning is usually carried out in late winter
Harvesting & Post-Harvesting	• Fruits are harvested by hand-picking • Hired labor is used for harvesting

Salient Features	Balochistan Cluster (Identified Cluster)
	• Harvesting starts during August- September • 4-6 pickings depending upon varieties and climate
	Pre and post-harvest losses are 10% to 30%
	Very few of the fields are sold to pre-harvest contractors who makes all the harvesting arrangements
Packaging/Transportation	• The fruit is graded, packed and transported to other cities by trucks • Wooden crates and card board boxes are used for packing
Wholesaler/Retailer	• Contractors or wholesalers buy product from farmers as they have connection with the commission agents in the market. The price is offered to the farmer based on the size and variety.
	• The auction in the wholesale market is generally based on the variety and weight
	• The retailers do final grading. The average market price of grape is Rs.100 to Rs.150/kg
	• The commission agents and wholesale merchants keep record of their transactions, but reluctant to provide information about the quality and the variety sold
Marketing	• The prices are high at the commencement of the season, declining gradually as the supply increase and again increased at the end of the season
	• Mostly sold as fresh in local and national markets
	• The closest domestic markets for fresh grape are Karachi and South Punjab
New Technologies/ Infrastructure	• Cold storage facilities are not available
Packing and Value addition	• After harvesting, with or without cooling, fresh fruit is transported directly to market in Sindh, South Punjab
	• Absence of Pulp or juice processing, small proportion of production is used for Raisin and Manaka by conventional methods
Export/ domestic marketing	• Major market is Punjab and Sindh • A fraction of high-quality produce is exported to Middle East and Afghanistan
	• Potential for export of fresh grape to Gulf and China exists

Salient Features	Balochistan Cluster (Identified Cluster)
	• Grapes remain fresh for limited days. However, shelf life can be enhanced thorough cool chain
Supply Chain	• Lack of modern facilities for grape value chain
Certification	• Food safety and traceability standards such as HACCP, Euro GAP, Global Gap, IFS etc. are not practiced
	• No mechanism for organic product certification
Socioeconomic networking/ Gender involvement	• Women participation is low in the grape sector
	• A typical orchard owner earns about Rs.400,000 to Rs.600,000 rupees per ha
Subsidies/Incentives/Facilities	• No specific subsidy/incentive or facility related to this commodity • Technical assistance to farmers is not present
Socioeconomic Networks	• The role of BRSP and NRSP is important in improving grape horticulture in the province

Source: Feedback from different stakeholders and survey of secondary sources

5.3. Description of Grape Value Chain in Balochistan

In Balochistan cluster, about 87% of the harvest ultimately ends up as fresh table grapes while the remaining 13% dried and sold as raisins because of the soft skin of these grape varieties thus making it difficult to transport as fresh. About 90% producers of the area prefer to sell their produce at the farm gate to contractors due to having little or no access to market price information, lack of marketing skills and to avoid inconveniences confronted during marketing (Aujla *et al*., 2011).

5.3.1. Value Chain Analysis: Marketing Practices and Channels

The survey indicates that 30%of the farmers sell their orchards pre-harvested to contractors while the remaining 70% farmers market direct sale of the produce because direct sales benefit the producers more than contract sales. Generally, low-grade grape is marketed in Balochistan while the higher-grade grape is traded to other provinces, mostly Sindh and Punjab. The facts cannot be denied that a long chain of traders make marketing operation less efficient and more expensive, as each trader in this chain has his role and share. Packing material and transportation costs are the major components of the marketing costs. Packing of grape in 10 or 20 kg wooden crates or now in cardboard boxes is another limiting factor for effecting marketing. Mixing of poor quality grapes at the bottom and good quality on top layer of box is a normal practice. Transporting grapes in open trucks from farms to wholesale markets and then to retailers during summer further deteriorate the quality. Two most common distribution channels observed were:

- Channel I: Producers, Pre-harvest Contractors, Commission agents, Retailers, consumers
- Channel II: Producers, Wholesalers, Retailers and Consumers

5.4. SWOT Analysis

5.4.1. Overview

The SWOT analysis was carried out in focus group discussions conducted in major grape-producing areas with the consultation and participation of different stakeholders of grapes. The results are organized around the value chain functions, including inputs, production, storage, marketing; strengths, opportunities and likewise weaknesses and threats.

5.4.2. SWOT Analysis of Balochistan Cluster

Balochistan is endowed with a natural comparative advantage with respect to agro ecological conditions and access to large markets. Proximity to big urban markets, such as Karachi and the Middle East, large farm sizes, opportunities for investment in cool chains, and relatively functional provincial and national research systems are key strengths. Threats and weakens are represented by political instability and insecurity, climate change, water scarcity, and inadequate research and extension services. Despite these challenges, the grape value chain in the province is able to create substantial income for the actors associated with it, although its relative competitiveness is at threat from the producers of the neighboring countries. Table 12 presents the SWOT analyses for Balochistan grape cluster.

Table 12: SWOT analyses of grape cluster in Balochistan

Parameters	Strengths	Weakness	Opportunities	Threats
Environment/ Climate Change	Well drained soils flat plains & mountainous Subtropical climate with hot weather in summer & cold in winter, make the province suitable for growing commercial varieties of grape	Wind/sand storms can impact the fruit bearing capacity of grape vines	Fresh grape is ripe and ready during July to September	Lowering water table can pose a serious threat to availability of irrigation water
	Ground water is the primary source of irrigation water	Dependence on ground water table	Drip/trickle irrigation system can be introduced	Climate change, Water scarcity, Deep water table (800-1200 feet)
Input Supplies	Growing demand for input supplies	Lack of appropriate quality fertilizer	The private sector can fill the gap by providing	Slow uptake of inputs by the farmers

Parameters	Strengths	Weakness	Opportunities	Threats
	(fertilizers &pesticides)	and micronutrients in local input market	input supplies to the growers	Research backup needed for the new varieties
	Replacement of old varieties by the high yielding exotic varieties	Lower fruit production/quality from old varieties	Scope for nursery business	
		Limited availability of certified nursery plants	Government can establish mother orchards to promote nursery business	
Cluster Interaction	Growers are concentrated in geographical location. Large orchard size	Little interaction among farmers and researchers	Possibility of learning from progressive farmers in the cluster	Lack of optimal coordination & integration of grape value chain actors
	The grape value chain has a commercial focus	Producers have little information about the quality requirements in national and international market	The margins for participants in the cluster can be increased by promoting value addition activities	
		No contract farming with defined quantities & quality parameter		
		The value chain is loosely organized with little focus on value addition		
Production Management practices	Farmers having appropriate skills in grape production. Orchard based production management is followed	Orchard management practices followed by the growers need to be further strengthened with new technologies and knowledge	Vast potential for increase in production	Sand/dust storms and wind storms may hamper the production capacity of grape
	Possibility of diversification into new improved varieties			
	Optimum level of production is	Sub-optimal and less use of	Opportunity for expanding	

Parameters	Strengths	Weakness	Opportunities	Threats
	achievable (up-to 7 tonnes/ha), present level is 4 tonnes/ha	fertilizer and pesticides	extension services in grape sector and advance production technology	
		Pre- and post-harvest losses due to lack of skills and infrastructure losses/wastages are nearly 20% of total production		
Transportation	The province is appropriately linked by road with all the major cities in the country	No environment (temperature, humidity, etc.) control during transportation	Availability of paper boxes in the market already being used in for packing grapes	
		High fuel/ transportation cost		
		No cool chain facility is available		
Marketing	High prices can be earned in local, national and international markets for quality grape products	Farmers are disconnected from high value markets	Financial support by the commission agents and wholesalers to harvesting contractors can be converted into quality based delivery contracts	Supermarkets may exclude small farmers from having access high value markets
		No grading (rather topping the good quality grapes over poor quality) by the harvest contractor		
		Auctioning in the wholesale market with visual and spot grading	Bulk selling can improve the returns for growers and small traders	
		Small capacity of farmers and traders. Absence of infrastructure to produce, handle, and market the quality products	Emerging supermarkets can introduce contract with farmers which may improve retailing quality, reduce post-harvest losses and trading margin	

Parameters	Strengths	Weakness	Opportunities	Threats
Trade/Export	Few traders/ processors are exporting grapes to other countries; mostly grape from Balochistan is traded within the country	Food safety standards and traceability (HACCP, Europe GAP, Global Gap, IFS etc.,) are major obstacles to enter into high end international markets	Growing demand for grape products in domestic markets	High cost of certifications and quality standards
		Inadequate flight services, shortage of air cargo space and inappropriate cargo handling limit the export	Better prices for higher quality grapes products in domestic/ national market	
Processing	Grapes can be consumed as fresh however a number of products can be made like resins, pulp & juices	Fresh grape grown in Balochistan has limited shelf-life	Huge demand for fresh grapes in national and international markets	Grape processing by large corporations may impact the margins of small processors
		Unavailability of modern processing units, technologies	Government may provide incentives for the import of agriculture machinery including the cold storage & drying units	
Management of wine and table cultivars for maximum profit	Wine and Table cultivars are grown in the region	There is no proper utilization of wine grape cultivars due to religious norms	Wine grapes can be exported in the form of pulp to boost the economy as the price of wine cultivars is very high in international markets. The price difference ranges from (US$) 1700 to (US$) 4000	

6. CHALLENGES FACED BY THE CLUSTER AND GAPS

There is growing concern about the low productivity of grapes in the cluster compared to develop/ developing countries, especially to our neighbors like India. The markets for agricultural commodities are inefficient; there is big difference between the prices of consumers and producers. It is generally accepted that marketers exploit producers and consumers by imposing a firm and high margin on their investments. Balochistan is the largest province but has the poorest post-harvest infrastructure and marketing. This has led to increase in post-harvest losses and transportation cost. Due to the unavailability of suitable post-harvest technologies and infrastructures, a significant amount of fresh fruit is lost at different stages of marketing. The amount of loss is influenced by several factors i.e., harvesting method, physical damage during handling and transport, physiological degradability and surplus/ glut position of produce in the market.

6.1. Climate Change

Frost and winds/storms in Balochistan cluster during flowering/blossoming season greatly impact the yield and quality of production. Climate change related impacts such as new diseases and shifts in crop cycle are also emerging issues in the cluster. Rigorous research and development efforts are needed to address these threats. Agriculture is dependent on irrigation whereas water is physically scarce in Balochistan. Grape production depends on groundwater that is being extracted unsustainably through solar tube-wells.

6.2. Constraints at Production Level

In Balochistan, most of the grape varieties cultivated by farmers originate from a narrow pool of genetic materials which have been degenerated overtime and there is very small infrastructure to replenish them. Agricultural Research Institute, Quetta is entrusted with the responsibility to carrying out research and varietal development on grapes with a small viticulture research station in Pishin. Since agriculture is now a provincial subject after the 18th amendment of the constitution the primary mandate for research lies with the provincial departments. Now more efforts and resources can be diverted to provincial research systems from the federal share. The varietal development which is a continuous requirement has all most been absent in the breeding programs of the institutions.

Certified nurseries of grapes do not exist in Balochistan in either public or private sector. With the absence of proper mother blocks it is impossible to produce certified nursery plants. Farmer's mechanism of preparing nursery is also defective as their method of selection of mother plants for propagation is unscientific. The technical assistance to the farmers is very weak regarding orchard management and other aspects. (Table 13)

Table 13: Gaps, constraints at production level

S#.	Parameter	Balochistan
1.	New germplasm	Little availability
2.	Mother nurseries	Very Few
3.	Orchard size/type	Large/specialized
	Credit facility	Negligible
4.	Certified plants	Not available
	Certified nurseries	Absent
5.	Extension services	Weak
6.	Commercial inputs	Weak
7.	Labor, inputs, trainings, cool chain, value addition	Scarce

6.3. Constraints at Processing Level

At present, fresh grape is simply graded and packed in medium to large size boxes and are sent to the major auction markets in open vehicles and trucks. Obviously, this product fetches a lower price as compared to the processed product delivered directly to super markets. Processing of fresh grape involves grading, cooling, packing and transportation in reefer containers. Technologies and necessary infrastructure for value chain is not in place. In many instances, traders skip many of the basic processing steps, and just pack a semi-graded product in rudimentary wooden or cardboard boxes, often without any labels or brand name. Processing fresh grape in common facility allows separating damaged or undersized grapes thus eliminating almost all of the postharvest losses before transportation to wholesalers. (Table 14)

Table 14: Gaps and constraints at processing level

S#.	Parameter	Balochistan
1	Processing and value addition technologies in use	Absent
2	Cool chain for grape	Absent
3	Resin making technologies	Primitive
4	Shovel ready investment projects	No
5	Supply of energy for processing	Highly variable and uncertain

However, if these technologies are available in future their uptake and adoption are not automatic and requires support, strategy and incentives. The public sector does not have to take up the entire responsibility upon itself but to seek win-win solutions by working with the private sector and NGO partners.

6.4. Constraints at Trading Level

The handling and storage of grapes is inadequate and cool chain technologies are unavailable in Balochistan. There are numerous buyers and sellers creating a competitive market environment. A license is not required for small-scale trading and beyond access to finance and there are no barriers to entry in grape trading.

Traders typically strive to achieve the highest margins by buying at the lowest price and selling at the highest price. Very little attention is paid to product differentiation and quality aspects to achieve price premiums. Communication technologies and internet services are available, workers for assistance are available on a permanent or seasonal basis and financial services to traders is being provided by both formal and informal banking institutions. (Table 15)

Table 15: Gaps and constraints at trading level

Parameter	Balochistan
Marketing channels	Traditional
E-commerce platforms	Not available
Contract farming	Very rare
Information about international market	Limited information. No public mechanism to provide this information
Export readiness	Not prepared
Link with international market	Linked on individual basis
Certifications (Phytosanitary)	No
Branding	Limited

In summary, grapes have lot of constraints and gaps at different segments of the value chain in Balochistan. Despite these gaps, there is lot of potential in this sector as has been described in the next section.

7. CLUSTER DEVELOPMENT POTENTIAL AND OPPORTUNITIES

Over the past few decades, share of Pakistan grapes market especially raisin has lost quickly by exporters. On the other hand, the share of export has risen from countries that traditionally belonged to the main producers such as China, Turkey and India as well as a group of countries who are not among the top 10 producer, such as Mexico and Peru. In other words, the main global exporters are not only the traditional producers, but also those who have recently developed the production capabilities of table grape. As a result, new actors have emerged and have changed the grape market dynamics. The new countries entering in the market are those who have made investments on improving the value chain of grapes thus giving a message for our country that if Pakistan can make investment on its grape value chain improvement it can enter into the international grape market. Initially Pakistan has to substitute its import with locally produced competitively produced grapes.

Technological developments have also facilitated global transactions, with increased number of vendors who export table grapes for higher profitability and provide consumers with products worldwide at affordable prices. Regional trade agreements such as the North American Free Trade Agreement (NAFTA) and EU Enlargement, bilateral and multilateral agreements, harmonization of sanitary and phytosanitary legislation under World Trade Organization (WTO) have also had a significant impact on business models. Reduced restrictions and lower transaction costs allow traders to design global sourcing strategies. However, to benefit from this developing situation, investment on value chain establishment is pre-condition. In this section an attempt has been made to evaluate the potential of grapes in terms of production, quality and market side of grape value chain.

7.1. Production Potential

The average global grape yield is 10.7 tonnes/ha, whereas it is 4.0 t/ha in Pakistan, thus a yield gap of 6.0 tonnes/ha or 150% exists. Our neighboring country India is producing 14 tonnes per ha grape yield. Low yields in Pakistan are due to several factors as explained in earlier sections.

7.1.1. Improved variety and management practices

Balochistan is a desert oasis with abundance of marginal and fertile land and has a potential to produce much higher grape yield. With the introduction and use of some of the existing high yielding varieties (like Superior 1, Autumn Royal, Crimson, Sultanianin- C, Vitro Black, Red Globe etc) in appropriate ecologies, a significant increase in yield (20%) can be achieved. Proper training and trellising systems of vines are also important factors in enhancing the yield and quality. Moreover, 15% yield can be further enhanced by adopting improved management practice such as balanced use of fertilizer, micronutrients, growth hormones, timely plant protection measures, scientific pruning, drip irrigation system etc. This increase in production

due to the adoption of improved high-yielding varieties and improved management practices combined can generate additional gross revenue of US$ 312.0 million in eight years.

7.1.2. Increased area in the new cluster

In the consultation process with stakeholders, the author identified that southern Punjab, Cholistan, Pothwar region of northern Punjab and southern districts in Khyber Pakhtunkhwa have lot of potential for successful cultivation of grapes. Promotion of grape cultivation (for early varieties) in Pothwar and South Punjab by National Agriculture Research Centre, Islamabad and Barani Agriculture Research Institute, Chakwal has produced encouraging results. Many farmers in these regions have already started growing grapes on commercial scale with much higher yield than in Balochistan cluster. Lot of marginal and uncultivated land is available in these areas. Land productivity of these areas is already very low due to various reasons, which can be increased manifolds by growing grape. Approximately 2000-4000 ha can easily be brought under grape cultivation in this new cluster.

Expanding grape production in the new cluster shall result in creation of 1500 new jobs at production level. The expected new jobs can be created at various levels from the area extension, renovation and extension of value chain support services. Whereas, area expansion in the existing cluster of Balochistan is not feasible.

7.1.3. Renovation of the old gardens

Varieties in old grape orchards need replacement with purpose full highly potential cultivars along with their appropriate trellising system (Head, Kniffin or Y-system) in a particular environment. The efficiency, quality and quantity of grapes are not up to the mark. In order to get the optimum yield potential, there is need to renovate these orchards in terms of training system, pruning method (Cane or spur) according to variety type(wine or table) along with improved irrigation and management systems. 5% of the old orchards would be renovation for increase grapes yield and returns.

7.1.4. Demand potential

The question is where to sell this additional production. As described earlier, Pakistan's per capita grape consumption is far lower than the world average. Moreover, the per capita availability is declining overtime because of the increasingly higher price of imported grapes. Therefore, increased production in the country can be absorbed by substituting high-price imports, increasing demand in the cities, increased tourists demand, expected growth in e-commence and improved grape processing especially grape pulp and raisins.

7.2. Improvement in Quality

One of the areas of concern in grape sector of Pakistan is low price of Pakistani grapes in the domestic market as compared to the imported ones. Similarly, there is a big gap between Pakistan export price for grapes and the price at which Pakistan imports grape. For example,

average price of one-tonne of imported grapes during 2016 was US$905 as compared to Pakistan export price of domestically produced grape of US$688 (prices derived from Table 3). The reason of this difference is obviously low quality of Pakistani grapes. Clearly, there is a big potential of improving the value chain of grapes which will improve its quality. If the quality of 10% of the domestic produce is raised to the average international quality of grapes it can get average international price. This intervention can generate US$ 4.2 million of net economic returns in the whole value chain.

Assuming one fourth of this will go to producers and remaining 75% to the middlemen in the value chain; this will generate US$ 63.0 million from Balochistan at the market level. Improved quality of grapes will need additional certification companies, packaging materials, improved transportation facilities, etc. which can generate some 2750 additional jobs mostly at the post-harvest level.

7.3. Reduction in Post-Harvest Losses

One of the major concerns of agriculture in the country is high post-harvest losses, which not only reduce quality but also makes the whole value chain of grape uncompetitive in the national and international market. These losses account for nearly 20% of wastage of grapes in Balochistan. With improved post-harvest technologies and strategies these losses can be halved and can generate estimated revenue of US$ 64.0 million at the existing grape prices.

7.4. Improved Processing

Currently, very little production of grape is being dried in the country, while internationally, the export value and quantity of dried grapes as reviewed earlier, is much higher. The technology to dried grape is very simple and the additional specific varieties for raisin making can be introduced. By employing efficient drying technologies, not only the post-harvest losses can be reduced to half (20% to 10%) but it will also result in getting the premium price of value added product. Creation of new employment opportunities in this intervention and additional revenue of US$ 30.0 million by converting 2% of the produce into raisins will also be achieved.

Pulping is another option for improving the value chain and to get more price of the production. Purposeful grape orchards are required having special varieties for pulping and juice making.

7.5. International Standards

To improve the quality and price of grape to international level, adoption of international quality standards at each segment of the value chain is the requirement. IPPC - the International Plant Protection Convention - is the international treaty under which common standards are developed for pest control in plants and plant products across international borders. The Commission on Phytosanitary Measures (CPM) is the governing body of the IPPC and it has adopted a number of International Standards for Phytosanitary Measures (ISPMs) that provide

guidance to contracting parties in meeting the aims and obligations of the Convention.[1]In addition, each country has its own specific standards for each crop.

[1]Adopted International Standards for Phytosanitary Measures (ISPMs). https://www.ippc.int/en/core-activities/standards-setting/ispms/#publications

8. UPGRADATION PLAN, POLICIES AND STRATEGIES

8.1. Plan

The purpose of the whole exercise is to develop a research-based cluster development plan for grapes to achieve the following targets.

- Increase yields by 25% from the current base, over eight years
- Reduce postharvest losses by half from the current benchmarks i.e. 20%
- Improve the cottage level processing of grapes from almost nil to at least 5% of the total production
- Increase the value chain of grapes so that at least 10% of the domestic production gets the average international export prices

8.2. Policy Reforms

At the policy level, input subsidies like on water and fertilizer should be gradually shifted towards subsidies on technology promotion and capacity building of all stakeholders along the value chain. The subsidies and incentives should be specific for every cluster and result oriented. Moreover, investment incentives for processing industries, storage and cool chain should be carefully targeted on need basis of each cluster. Doubling import duties on value-added agricultural products and removing subsidies on inputs should recover revenues lost through these measures. Moreover, a nationwide program should be developed, in which all rural districts can compete for Cluster Development Grants to specialize in specific high-value crops for export. Another policy recommendation is to include grapes in bilateral/multilateral trade agreements with friendly countries (OIC, Arab League & China).

At the local level, supporting farmers to organize themselves as marketing groups, such as *Farmers Enterprise* Group *(FEGs)* would be a key element of the strategy for achieving economies of scale for access to inputs, finance, technology, and market information. Therefore, it is proposed that incentives should be linked with FEGs. These groups are trained to produce quality grapes and other stakeholders on managing value chain for quality grape production. This will enable the FEGs to ensure quality to traders thus reduce the certification costs. Special loans should be provided on concessional terms to each FEG to allow them to market their grapes under special brand name, help various stakeholders in adopting best practices, hold trade fairs, competitions, and arrange various training events etc. Farmers will have the administrative control of these FEGs, while the farmers and the group will share initial administrative costs.

A common intervention recommended is to form a national Grape Association or the Grape Association of Pakistan (GAP). This entity should have a website of its own and work to promote best practices, share knowledge, technology and lobby with government for enabling policies on behalf of its members. GAP should also develop Apps for marketing and represent grape growers and traders in international fairs and events.

8.3. Strategy for Balochistan

The Balochistan is much better streamlined on the production side. For example, grapes are grown in commercial orchards in Balochistan, where farmers are going through a transition from subsistence to the commercial farming. Still there is lot of room for improvement. The recommended strategies for interventions related to production and orchard management, market segmentation and other value-added measures, which need to be undertaken to get maximum value from the grape clusters.

8.3.1. Production Level Strategies

The production strategy for the Balochistan would focus on increasing the grape yield by 25% from the current base of 4.3 tonne/ha to 5.3 t/ha. Following strategies shall be adopted for this purpose:

- The investment will be made to establish a National Grape Research and Development (NGRDI) Institute.
- Potential of available high-yielding varieties, will be demonstrated to farmers and help them to adopt these varieties. Under this strategy, advance germplasm from China, Turkey and other countries will also be imported, tested and multiplied at the government facilities.
- Private nurseries will be registered under certification regime that will propagate improved seedlings for distribution to farmers in the medium term plan. A mother-block of each registered variety would be established in every certified nursery.
- Nurserymen will be trained to supply high-quality disease free nurseries to the farmers.
- Technical and financial assistance will be provided to private nurseries and orchard owners to upgrade production systems and get their farms *International Standards for Phyto-sanitary Measures (ISPMs)*.
- In Balochistan, a key production constraint highlighted earlier is water scarcity and the threat of prolonged droughts. To address this problem, it is important to select high-yielding drought-resistant varieties along with high efficiency irrigation system.

The following specific programs to implement above strategies are proposed:

a) *Grape Research and Development Institute*. A strong R&D program encompassing all aspects of value chain will be established under NGRDI. The breeding in the NGRDI can initially focus on the selection of high yielding materials from a wide array of germplasm collected, but later it can undertake long-term breeding work in developing new varieties. In addition, farm management practices, value chain management practices, processing of grape into various products, information collection and provision to various stakeholders, policy issues, etc. will be covered user the R&D program of NGRDI.

b) *Importing high quality germplasm*. The Balochistan and Khyber Pakhtunkhwa cluster need infusion of new germplasm, having specific traits to suit the prevailing conditions in these clusters, such as tolerance to drought/ diseases and processing specific cultivars. Such germplasm can be imported from China, Turkey, Spain and USA (California). Bilateral and multilateral agencies can be approached, such as Consultative Groups on International Agriculture Research (CGIAR), FAO or the Chinese Academy of Agricultural Sciences (CAAS) as well as Pakistan's missions overseas, for assistance in accessing the require germplasm.

c) *Distribution of new varieties*. Parent blocks will be established at the government nurseries and commercial nurseries will be incentivized to set up mother blocks and multiply certified plants for sale to farmers under the truth-in-label rules.

d) Training Program.

International consultants will be engaged by the FG to spell out requirements at production, processing, transportation, storage, and marketing levels and provide training of trainers who in turn will train farmers, processors, traders, exporters, etc. to adopt the GP, ISPMs, etc. standards. Following training programs will be especially started:

- *GAP Training to farmer.* Farmers will be trained how to identify, produce, and maintain the quality of grapes by providing hand-on training on GAP. At least100 farmers will be provided hands-on training in Baluchistan and 50 farmers will be trained in Khyber Pakhtunkhwa and in new cluster. One of the key objectives of this intervention shall be to reduce the postharvest losses by50 % from the current level.

- *Appropriate training in nursery and orchard management*. The ISPMs certified nurseries shall be used for field demonstration and training, where other good agricultural practices (GAP) will also be adopted.

- *Training on value chain management.* At least 20 stakeholders from Balochistan and 10 from Khyber Pakhtunkhwa will be trained to maintain the quality of grapes while it moves in the value chain, especially in transportation, storage, and wholesaling.

e) *Promoting proper orchards certification under International Standards for Phyto-sanitary Measures (ISPMs)*. Commercial nurseries are available in both the clusters, but they are seldom certified under ISPMs, which is why exporters find it difficult to export grapes. Initially, at least 10 ISPMs certified commercial nurseries in Baluchistan,

3 in new cluster, and one in Khyber Pakhtunkhwa will be established in the focus district on cost sharing basis with nursery owners bearing 70% of the cost.

8.3.2. Processing and Value Addition Level Strategies

Processing and value addition are missing steps in both the grape clusters. Therefore, the strategy would be: a) establishing collection center where farmers can bring their produce and conduct necessary value addition and marketing activities, b) establishing cool chains at the collection center, c) incentives to establish drying and pulp making activities at the collection center.

In Pakistan all fresh fruit and vegetables are traditionally traded and marketed in open retail shops and on small pushcarts and grapes have no exception. The global trend is supermarkets, where highly perishable items are displayed under controlled environment. Therefore, it is important to establish cool chains, especially for grapes to avoid losses, extend shelf life and preserve freshness and obtain a higher price. The plan includes the following interventions.

a) *Incentivizing the private sector to establish collection centers*.

   At least three collection centers will be incentivized to be established under FEGs, which will be equipped with cooling, sorting, grading, branding and packing technologies. In these centers, proper cooling, sorting, grading and packaging machines will be available. The farmers can use any of this facility at charge. The centers will be established on 50/50 cost sharing basis under the control of FEGs although the government could provide initially administrative staff for the center.

b) *Promoting grape processing.* After proper sorting and grading at the collection center at least 6% of the fresh grapes will turn out to be bruised or under-sized. As the size of this low quality produce at the collection center will be good enough for the processing unit to be established at the center. The small scale processing, like drying and pulp making units depending upon the need and demand will be established at the collection centers under the supervision of FEGs. The drying and pulp making equipment are very simple and can be used for drying and pulp making of different fruits, such as apricots, plum etc., some drying equipment may also be used for vegetables. Under this plan, the best drying and pulp making technologies will be identified and demonstration units will be distributed to FEGS. The feasibility of grapes drying or raisin making is elaborated in Annexure-3.

c) *Holding competition and rewards for Processors*. Special competition will be held and rewards will be awarded for outstanding processors of dried and fresh grapes into pulp making. These competitions will be held at district-level and then concluded at the cluster level.

8.3.3. Marketing and Trading Level Strategies

Following strategies will be adopted to promote efficient grape trading:

a) *Promote Trading at Collection Centers*. Rather than bringing produce at far-flung wholesale markets by the farmers where he is ill-treated by the wholesalers and commission agents, it will be encouraged that farmers will trade grapes at the collection center. In these centers, the wholesalers, commission agents and supermarkets will be invited to come and bid the grape based on its quality. Then it will be the responsibility of the traders to transport it using appropriate means like refers truck that takes the product to designated markets.

b) *Branding 'Balochistan Grape'*. Balochistan especially Chamman Grape, is well known in Pakistan and this could be a good brand name. Each grape growing district may develop its own brands if they feel they can sell some special product from the district. Under the cluster development plan, experts will be hired to develop strategy for branding of grape and its products.

c) *Certifications for IPPC, Phytosanitary, Organic, Fair trade, and Geographical Indication* can also be pursued as other value-added strategies. GI can be used on products that have a specific geographic origin and possess qualities or a reputation that are intrinsically due to that place of origin.

d) Establishing a Grape Association of Pakistan. A common intervention proposed is to establish a Grape Association of Pakistan. This should be a joint activity for all the clusters with an interactive website and marketing apps.

9. BENEFITS AND COSTS OF CLUSTERING

9.1. Proposed interventions

Following seven key interventions have been proposed for transformation of grapes sector of Pakistan.

- renovation of old orchards
- improvement in grapes yield by introducing high yielding varieties
- improvement in grapes yield by improved management practices
- reduction in grapes post-harvest losses
- value addition by production of grapes pulp
- value addition by production of raisins
- improvement in value chain to enhance grapes price in domestic markets

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

The resources required for the implementation of the proposed interventions package includes; 1: additional operational costs of improved grapes production, value chain development, and processing, 2: sector development investments like R&D by government, 3: fixed capital investment in machinery, etc. by government and private sector. The whole analysis has been based on incremental costs and benefits of the proposed interventions.

The detailed feasibility of raisin production unit is separately estimated and explained in Annexure-3. For each cluster, the number of raisin making and pulp production units required was estimated based on the estimated grapes quantities that will be processed and average capacities of the units. Total investment and operational costs of processing in each cluster were incorporated in the main feasibility model. In the following section, we just explained the feasibility of the whole package of interventions.

9.2. Current Situation

The study has considered 8,262 ha of area under grapes production in the focal point of Balochistan grapes cluster which is currently producing 41,775 tonnes of grapes per year.

Current yield in the cluster is 5.06 tonnes/ha; growing at 0.89% per annum. Table 16 shows the cluster's current production performance.

Table 16: Balochistan Cluster – Current Production Situation

Grapes Cluster in Balochistan – Current Situation	
Area under cultivation in cluster (ha)	8,262
Total Production (tonnes)	41,775
Production yield (tonnes/ ha)	5.06
Annual yield growth without intervention	0.89%
Farm gate price of grapes ((US$)/ tonne)	781

Grapes production and its value at the current farm gate price in the next eight years in a no-intervention scenario are given in Table 17.

Table 17: Balochistan Cluster – Grapes Production in No-Intervention Scenario

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Default yield (tonnes/ha)	5.06	5.15	5.19	5.24	5.28	5.33	5.38	5.43
Annual expected production without intervention (tonnes)		42,519	42,897	43,279	43,664	44,053	44,445	44,840
Total value of production at farm gate (US$)		***33,207,023***	***33,502,565***	***33,800,738***	***34,101,565***	***34,405,069***	***34,711,274***	***35,020,204***

9.3. Benefits of the Proposed Interventions

9.3.1. Benefit 1 - Increase in Production Yield by Grapes Orchards Renovation

Grapes orchards will be renovated on certain share of the cultivated area to have higher yields. Orchards will be renovated in terms of training system, pruning method (Cane or spur) according to variety type (wine or table) along with improved fertigation and management practices. R&D will be initiated to ensure to demonstrate success of these practices. The renovation of these orchards will start from the first year and will contribute till fifth year. There will be a gestation period of three years which means that the first crop will be harvested in the fourth year and the crop cultivated in fifth year will be harvested in eighth year. It is estimated that the new orchards will have double the yield of the existing varieties. It is assumed that renovated orchards will be established on 5% of the cultivated areas. This will be done over a period of five years which means that 1% area will be added in each year from first year to fifth year. Based on these assumptions, the value of increased grapes production at the new improved price of US$ 781 per tonne is shown in the following Table 18.

Table 18: Increased Grapes Yield by Renovated Orchards

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Area for orchard renovation (%)	1.0%	1.0%	1.0%	1.0%	1.0%			
Area on which orchards would be renovated per year (ha/y)	83	83	83	83	83			
Production from increased yield (tonne)				433	437	441	444	448
Expected additional returns (000 US$)				405.61	409.22	412.86	416.54	420.24

9.3.2. Benefit 2 – Increase in Yield by Introducing High Yielding Varieties

Some of the existing high yielding varieties (like Superior 1, Autumn Royal, Crimson, Sultanianin- C, Vitro Black, and Red Globe etc.) will be introduced in appropriate ecologies to have higher yields. It is expected that these practices will lead to increase the yield by 25%. It is assumed that farmers will gradually adopt new practices and variety; thus 25% yield increase in the cluster will also be gradual at a rate of 4.0% per year starting from the second year. Based on these assumptions the value of increased grapes production at the existing rate of US$ 781 per tonne is shown in the following Table 19.

Table 19: Increase in Yield by Introducing High Yielding Varieties

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Yield increased over 5 years **(%)**		5.00	10.00	15.00	20.00	20.00	20.00	20.00
Increase in yield after intervention (Tonnes/ha)		0.26	0.52	0.79	1.06	1.07	1.08	1.09
Additional production from increased yield (tonnes)		2,126	4,290	6,492	8,733	8,811	8,889	8,968
Expected additional returns at farm gate price (000 US$)		1660	3350	5070	6820	6881	6942	7004

9.3.3. Benefit 3 - Increase in Production Yield by Improved Farm Management Practices

Improved management practices, and R&D in grapes cultivation will lead to increase in crop production yield. Introduction of proper training and trellising systems of vines will also be important factors in enhancing the yield and quality. Yield can even be further enhanced by adopting improved management practices such as balanced use of fertilizers, micronutrients, growth hormones, timely plant protection measures, scientific pruning, drip irrigation system etc. It is estimated that these efforts in Balochistan cluster will increase the grapes yield by 10% over a period of five years. It is assumed that farmers will gradually adopt new practices

and variety; thus yield increase in the cluster will also be gradual at a rate of 2.5% per year starting from the second year. Based on these assumptions, the value of increased grapes production at the existing rate of US$ 781 per tonne is shown in the following Table.

Table 20: Balochistan Cluster - Increased Grapes Value by Increased Production Yield

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Current Yield without interventions		5.15	5.19	5.24	5.28	5.33	5.38	5.43
Yield increase over four years **(%)**		2.50	5.00	7.50	10.00	10.00	10.00	10.00
Increase in yield (tonnes/ha)		0.13	0.26	0.39	0.53	0.53	0.54	0.54
Additional production from enhanced yield (tonnes)		1,063	2,145	3,246	4,366	4,405	4,444	4,484
Expected additional value (US$)		**830,176**	**1,675,128**	**2,535,055**	**3,410,156**	**3,440,507**	**3,471,127**	**3,502,020**

9.3.4. Benefit 4 – Reduction in Post-Harvest Losses

Grape faces the issue of high post-harvest losses up to 25%. Farmers will be trained on modern harvesting practices. Proper harvesting baskets will be introduced to the harvesters. It has been estimated that with proposed improved farm management and post-harvest practices, these losses can be reduced to 10%. This will lead to increasing the value of the grapes crop for the farmer and the downstream players in the value chain. It has been assumed that reduction in post-harvest losses will occur from the second year of interventions when the results of improved value chain management practices will be realized. Again the adoption of these practices will be gradual by the farmers, thus a linear gradual reduction in losses at a rate of 3.75% per year has been assumed. Based on these assumptions, the value of increased grapes production in Balochistan cluster at the existing rate of US$ 781 per tonne is shown in Table 21.

Table 21: Balochistan Cluster – Increased Grapes Production by Reducing Post-Harvest Losses

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Post-harvest losses after intervention (**%**)	3.75	7.50	11.25	15.0	15.0	15.0	15.0
Increased marketable Production due to reduced losses (Tonnes)	1,674	3,539	5,648	7,925	7,996	8,067	8,138
Expected additional value (US$)	1308	2764	4411	6189	6245	6300	6356

9.3.5. Benefit 5 – Value Addition into Grapes Pulp

Grapes can be processed into different value added products like grapes pulp. It has been estimated that 3% of the total production from the cluster will be processed into grapes pulp which can be currently sold to the juice manufacturers in the local market. It is assumed that 3% conversion into pulp will be achieved in four years at a linear rate of 0.75% per year. Conversion factor of grapes into pulp has been considered to be 95%. It is estimated that 18 plants will be required in the whole cluster to process 3% grapes into pulp by fifth year. Grapes pulp making plants will be provided to farmers at 30% subsidy rates to those farmers who organize themselves into Farmers Enterprise Groups (FEG) and deposit in advance 70% of the plant cost. The government will incentivize the grapes pulp manufacturing. This intervention will add value to the grapes production from the cluster. Projected values of this value addition activity at a grapes pulp price of US$ 1,111 per tonne is shown in table 22.

Table 22: Balochistan Cluster - Value Addition by Grapes Pulp Production

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Production to be processed into pulp (%)	0.75	1.50	2.25	3.00	3.00	3.00	3.00
Grapes converted into Pulp (tonnes)	347	761	1,257	1,823	1,839	1,855	1,872
Total volume of Pulp produced (tonnes)	330	723	1,194	1,732	1,747	1,763	1,778
Expected additional value (US$)	366.69	803.16	1326.47	1924.02	1941.14	1958.42	1975.85

9.3.6. Benefit 6 - Value Addition into Raisins

Grapes can be dried to produce value added raisins. It has been estimated that 3% of the total production from the cluster will be processed into raisins which can be currently sold to the consumers in the local market. It is assumed that 3% conversion into raisin will be achieved in four years at a linear rate of 0.75% per year. Conversion factor of grapes into raisin has been considered to be 30.8%. It is estimated that 50 plants will be required in the whole cluster to process 3% grapes into raisin by fifth year. Raisin making plants will be provided to farmers at 30% subsidy rates to those farmers who organize themselves into Farmers Enterprise Groups (FEG) and deposit in advance 70% of the plant cost. The government will incentivize the raisin making units. This intervention will add value to the grapes production from the cluster see (Annex 4). Projected values of value addition interventions at average raisin price of US$ 3,704 per tonne are shown in table 23.

Table 23: Balochistan Cluster - Value Addition by Raisin Production

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Production to be processed into raisin (%)	0.75	1.50	2.25	3.00	3.00	3.00	3.00
Grapes converted into raisins (tonnes)	347	761	1,257	1,823	1,839	1,855	1,872
Total volume of raisins produced (tonnes)	107	234	387	561	566	571	576
Expected additional value (US$)	395.9	867.1	1432.1	2077.2	2095.7	2114.4	2133.2

9.3.7. Benefit 7 – Increased Price in Domestic Market

The improved value chain activities as highlighted in the post-harvest section and improved interaction with international market as highlighted in the previous section will improve the quality and price of grapes in the national market. For the domestic market, it is assumed that 10% of the total production from the cluster will be sold at par with the export market price. This will be achieved in four years with the addition of 2.5% each year. Benefits from this intervention over four years are shown in the following table 24.

Table 24: Balochistan Cluster – Additional Value by Price Increase in Local Markets

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
% of domestic production to be evaluated at international prices (%)	2.50	5.00	7.50	10.00	10.00	10.00	10.00
Domestic production that will receive improved value chain operation (tonnes)	1,158	2,709	4,189	6,076	6,130	6,184	6,240
Total expected additional value (US$)	**3,590**	**7,862**	**12,985**	**18,835**	**19,003**	**19,172**	**19,342**

9.3.8. Total Benefits Summary

Summary of the value of the benefits of the proposed interventions is shown in Table 25.

Table 25: Balochistan Cluster - Summary of the Value of Benefits of Interventions

Benefits Value (US$)	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Value of Orchard Renovation	-	-	*405,609*	*409,219*	*412,861*	*416,535*	*420,242*
Value of Increased Yield by Good Practices	1660.35	3350.26	5070.11	6820.31	6881.01	6942.26	7004.04
Value of Reduced Post-Harvest Losses	1307.53	2763.96	4411.00	6189.43	6244.52	6300.10	6356.17

Value of Grapes Pulp	366.7	803.2	1326.5	1924.0	1941.1	1958.4	1975.8
Value of Raisins	395.89	867.11	1432.08	2077.21	2095.70	2114.35	2133.17
Value of Improved Prices	3,590	7,862	12,985	18,835	19,003	19,172	19,342
Total Value	3734.0	7792.3	12658.3	17439.0	17594.2	17750.8	17908.8

9.4. Enhanced Costs of the Proposed Interventions

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

9.4.1. Value Chain Improvement Costs

The proposed sector transformation plan includes interventions both for on-farm and off-farm activities. Improvement entails spending more money for carrying out those activities on modern lines.

9.4.2. Orchard Renovation Costs

Existing costs and the proposed incremental increases for different cost heads are shown in the following tables 26.

Table 26: Balochistan Cluster – Orchard Renovation Costs

Cost Head	Cost (US$)
Cost of orchard renovation (US$/ha) – (labor and metal rods)	229
Cost of new orchard during gestation period (US$/ha/year)	1,000
Management Cost of New Orchard in Fruiting (US$/ha)	4,369

Based on the above values, the cost projections of the grapes orchards renovation are shown in the following Table 27.

Table 27: Balochistan Cluster – Total Orchard Renovation Costs

Benefits Value (US$)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Incremental Area for renovation (ha)	83	83	83	83	83			
Orchard Renovation cost (US$) **(A)**	18,902	18,902	18,902	18,902	18,902			
Acreage in gestation period (ha)	83	165	248	330	330	248	165	83
Management Cost (000 US$) **(B)**	82.62	165.24	247.86	330.48	330.48	247.86	165.24	82.62

New acreage in fruiting (ha)				83	83	83	83	83
Management Cost during fruiting (000 US$) **(C)**				63.04	63.04	63.04	63.04	63.04
Total Cost of Renovated Orchards (000 US$) (A+B+C)	101.52	184.14	266.76	742.75	742.75	641.22	558.60	475.98

The assumed per unit costs for various operations are given in Table 28.

Table 28: Balochistan Cluster – Value Chain Costs and Proposed Incremental Increases Cost Head

	Cost	Incremental Increase
Production Inputs and Harvest (land preparation, inputs, labor, etc.) (US$/ha)	3,606	32%
Transportation and Storage (US$/tonne)	56	100%
Initial Cost of Grading and packaging (US$/tonne)	50	0%
Operational Cost of Grading & Packaging (US$/tonne)	200	0%
Operational Cost of Pulp Making (US$/tonne pulp)	991	0%
Operational Cost of Raisin Making (US$/tonne raisin)	3,191	0%

Based on the above unit costs, total value chain costs for the entire cluster were calculated. It was assumed that costs will be incurred from the second year of implementation. Total planned increase in cost was distributed over four years as per the interventions in those years. Value chain costs projections are shown in Table 29.

Table 29: Balochistan Cluster – Value Chain Improvement Operational Costs

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Cost of Renovated Orchards	101.52	184.14	266.76	412.42	412.42	310.90	228.28	145.66
Production Inputs and Harvest (000 US$/ha)	1260	2521	3782	5042	6303	6303	6303	6303
Transportation and Storage (000 US$/tonne)		16.08	70.45	174.54	337.55	340.55	343.58	346.64
Grading and packaging (000 US$/tonne)	-	173.70	380.44	628.33	911.38	919.49	927.67	935.93
Grapes Pulp making (000 US$/tonne)	-	327.19	716.63	1183.57	1716.74	1732.02	1747.43	1762.98

Raisin making (000 US$/tonne)	-	341	747	1233	1789	1805	1821	1837
Total Cost (000 US$)	1362	3563	5963	8675	11471	11412	11372	1133

9.4.3. Cluster Development Operational Costs

Balochistan grapes cluster has huge growth potential by virtue of its diverse agro ecological conditions. A mega program will be launched that will include establishment of research centers, import of new germplasm, strengthening of breed programs and nursery programs in the region, development of economically sustainable production technology package and establishment of demonstration plots and training of farmers for improved production practices. The interventions package will also include programs for reduction of post-harvest losses and production of value added products like grapes pulp and raisins.

Grapes marketing will be facilitated by providing one-window operation for quality and quarantine certification, provision of market information on standards, prices and market segments, sponsoring international tours for high potential exporters, holding competition and rewards for exporters. Grapes exporters association will be established under umbrella of PFVA with a website and marketing apps.

The proposed budget for cluster development interventions in Balochistan will be US$ 8.45 million). About 70% of this investment should be provided by the federal government, by establishing a Cluster Development Fund (CDF) under PSDP. The remaining 30% should come from the provincial budgets. Details are provided in the following Table 30.

Table 30: Balochistan Cluster - Inputs and Infrastructure Needs for Cluster Development

Cluster-1			
S#	**Cluster Strategy**	**Interventions**	**Implementing Agency**
1	**Production level strategies** *(To increase yield by 100%)*	Establishment of research centers	PARC, Provincial Agricultural R&D Department, Agri. Extension Dept. Balochistan
		Import of new germplasm	
		Strengthening the breeding program and nurseries of grape in the region	
		Development of economical and sustainable production technology package	
		Establishment of demonstration plots and training of farmers for improved production practices	
2	**Processing & Value addition strategies** *(To process 3% of the fresh produce into pulp and raisins)*	Reduction of post-harvest losses	PARC, Provincial Agricultural R&D Department, Agri. Extension Dept. Balochistan
		Making of pulp and raisin	

3	**Marketing & Trading level strategies** *(Increase the export to production ratio to world average of 10% in five years; Improve the quality and export price up to international standard)*	One window operation for quality and quarantine certification	PARC, Provincial Agricultural R&D Department, Agri. Extension Dept. Balochistan
		Provision of market information on standards, price and potential customer segments	
		Sponsor international tours for high potential exporters	
		Holding of competition and rewards for exporters	
		Provide incentives for adopting best practice and certification regimes	
		Establish a Grapes exporters association under umbrella of PFVA with a website and marketing apps	
		Train the stakeholders to adopt ISPMs as per IPPC	

This proposed cluster development cost will be spent in a period of four years starting from year 1. Yearly distribution of these costs will be driven by the interventions planned for that year. For example, the processing cost will be driven by the number of grapes pulping and raisin production units that will be required each year to meet the set production target. For production level strategies, it is assumed that 40% of this cost of production level strategies and marketing/trading level strategies will be spent in year 1, 30% in year 2 and 15% each in year 3 and year 4. With these assumptions, the cost distribution is shown in Table 31.

Table 31: Balochistan Cluster – Cluster Development Investments Cost (000 US$) Projections

Investment (US$)	Year 1	Year 2	Year 3	Year 4	Year 5
Establishment of Grapes Research Center	1,111	-	-	-	-
Cost of the research Center for 4 years	-	370.37	370.37	370.37	370.37
Extension program-training, demonstration, etc.	103.28	103.28	103.28	103.28	103.28
Orchard Renovation (plants & materials	381.09	381.09	381.09	381.09	381.09
Pulping Units	64,203	85,604	85,604	107,005	-
Raisin making units	146.01	162.24	194.68	227.13	-
Farm Level Cold Chambers	148.15	111.11	55.56	37.04	18.52
Reefers	126.4	105.2	70.6	64.0	12.8
Total	**2,821.0**	**1,874.4**	**1,538.9**	**1,475.1**	**978.6**

9.5. Economic Viability of Cluster Development Plan

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

NPV and IRR. Discounted cash flow analysis has been carried out using an annual discount rate of 8.5%. Calculations and results are shown in Table 32.

Table 32: Balochistan cluster - Economic Viability of Proposed Interventions Package

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Total Benefits of the Interventions (US$)	-	3734.043	7792.344	12658.25	17439.03	17594.24	17750.82	17908.81
Total operational cost of the Interventions (000 US$)	-1362	-3563	-5963	-8675	-11471	-11412	-11372	-11332
Total investment cost of the interventions (000 US$)	-2,821	-1,874	-1,539	-1,475	-978	-	-	-
Net Cash Flows (000 US$)	-4,183	-1,704	290	2,508	4,989	6,182	6,379	6,576
NPV (US$)					**10,868,599**			
IRR					**38%**			

A positive NPV of US$ 10.9 million indicates that the interventions package proposed for uplift and transformation of Balochistan grapes cluster is an economically viable proposition.

9.6. Conclusion

In conclusion, the overall economic, social and environmental impact of the cluster development program shall be positive, sustainable and long lasting. Accounting for all the fixed and variable costs including the production, processing and marketing cost, the estimated Internal Rate of Return (IRR) for Balochistan is 38%, which is based on respective investment costs in each region and the present value of resulting revenues over the period of eight years. These estimated IRR signify the fact that cluster development interventions are likely to positively impact not only the existing output of grape clusters, but also likely to add additional value increasing the overall potential of the grape value chain across the country.

10. PROGRAMS AND PLANS

This report presented an overview of the potential of grape sector in Pakistan, identified the grape clusters as part of the V2025 of GoP and discussed the gaps and constraints of identified potential grape clusters in Balochistan. Recommendations for cluster development in both the regions; and estimated the economic and social impact of the cluster development interventions that shall set new frame conditions at production, processing, and marketing level of grape value chain. In support of the strategies and interventions proposed in earlier chapters of this report the following programs/plans are recommended to further strengthen the interventions and to creating greater opportunities for participation and learning.

10.1. Program for Organization and Networking of Stakeholders

The following program (Table 33) suggestions are proposed for organization of stakeholders at different levels of value chain.

Table 33: Program for organization and networking of stakeholders

S#.	Area of Action	Purpose	Institutions to be involved	Priority
1	Form Grape Farmer Enterprise Groups (FEGs) at grassroots level. 2 FEGs in total with each having a membership of at least 50 farmers. Balochistan has 8 grapes producing districts, and thus 1 FEGs per district	Organization of grapes farming community for collective action	Village Organizations (VOs), LSOs, NGOs, DoA Balochistan, Balochistan Rural Support Program	Short to medium term (1 to 2 years)
2	Form Grape Processors and Traders Association at market/business level. At least 4 processors should be initially involved for Pulping, raisin and packing. Two in each cluster	Improve coordination between the stakeholders of grapes value chain	DoA Balochistan, NGOs, Private Sector	Short to medium term (1 to 2 years)

10.2. Program for Research Reform

The following program (Table 34) suggests indicative areas for further research to strengthen the grape clusters are proposed along with the estimated cost.

Table 34: Program for research reforms

S#.	Identification of Areas for Further Research	Research Purpose/ Priority	Indicative Research Institutions
1.	• Identify suitable cultivars for grape growing areas • Develop strategy for quickly distributing improved saplings	Grapes production improvement (Short to medium term (1 to 2 years)	ARI, Quetta, PARC, DoA Balochistan
2.	• Develop training modules • Develop formats for Farmer Field Schools (FFS) for on-farm training of grapes producers	Improve orchard management and On-farm Processing Skills (Short to medium term (1 to 2 years)	ARI, Quetta, PARC, DoA Balochistan
3.	Survey for identification of target group of 4 processors	Product diversification from processed grapes (Short to medium term (1 to 2 years)	ARI, Quetta, PARC, DoA Balochistan
4.	• Consultation with processors to assess interest in establishing a raisin Processor Association • Scoping survey to identify new products and potential buyers	Create market Linkages for quality processed grapes (Domestic and Export) Medium to long Term (2 to 5 years)	ARI, Quetta, PARC, DoA Balochistan
5.	• Identify suitable fresh fruit buyers to link with premium markets through a market survey • Consultation to decide on implementation strategy for wholesale markets or individual traders	Medium to long Term (2 to 5 years)	ARI, Quetta, PARC, DoA Balochistan
6.	Research into climate change related negative impacts such as new diseases and shifts in crop cycle	Investigating climate related negative impacts on horticulture Medium to Long term (2 to 5 years)	ARI, Quetta, PARC, DoA Balochistan

11. Annexure

Annexure-1: Data and Literature Reviewed

1. Anonymous. 2017. 'Balochistan's fruits, veg exports can fetch $1 billion a year'. The News International. Accessed online from https://www.thenews.com.pk/print/240162-Balochistans-fruits-veg-exports-can-fetch-1-billion-a-year
2. Aujla, K. M., Shah, N. A., Ishaq, M., & Fraooq, A., 2011. Postharvest losses and marketing of grapes in Pakistan. Sarhad Journal, 27(3), 485-490.
3. **FAO** (Food and agriculture Organization)**.**2008. Grape Exports with GLOBALGAP Certification: Case Study of Mahindra & Mahindra Initiative in India.
4. FAOSTAT (Food and Agriculture Organization Statistics Production, Crops http://www.fao.org/faostat/en/#data/QC
5. FAOSTAT, (Food and Agriculture Organization Statistics). Trade, Crops and Livestock Products http://www.fao.org/faostat/en/#data/TP
6. Fresh Plaza (2017). Pakistan and CPEC: The Untapped Potential of Balochistan: http://www.freshplaza.com/article/2186547/the-untapped-potential-of-balochistan/
7. Government of Balochistan. 2012. Agriculture Statistics of Balochistan, 2011. Department of Agriculture, Government of Balochistan, Quetta.
8. Hall, A., G. Bockett, T. Sivamohan, M.V.K. & Clark, N. S.,2001. Why Research Partnerships Really Matter: Innovation Theory, Institutional Arrangements and Implications for Developing New Technology for the Poor. World Development 29(5): 783–797.
9. Khair, S. M., Maqsood, A., & Ehsanullah, K., 2009. Profitability analysis of grapes orchards in Pishin: an ex-post analysis. Sarhad Journal of Agriculture, 25(1), 103-111.
10. MNFS&R (Ministry of Food Security and Research). 2018. Agriculture Statistics of Pakistan 2017-18., Economic Wing, MNFS&R, Government of Pakistan, Islamabad.
11. Naik, G.,2006. Bridging the Knowledge Gap in Competitive Agriculture: Grapes in India. In Chandra, V., ed. Technology, Adaptation and Exports: How Some Developing Countries Got it Right. pp. 243–274. The World Bank. Washington, D.C.
12. Naseem M, Khan W, & Akram M, 2010. The water use efficiency techniques and strategy in horticulture sector of Balochistan I: 34-37
13. Pakistan and Gulf Economist. 2018. CPEC and Gawader Port making Balochistan progress. http://www.pakistaneconomist.com/2018/02/19/cpec-gwadar-port-making-balochistan-progress/
14. Roy, D. & Thorat, A.2008. Success in High-Value Horticultural Export Markets for Small Farmers: The Case of Mahagrapes in India. *World Development* 36(10): 1874–1890.
15. Samad S (2018). The Fruit Basket of Pakistan: The Balochistan Point, http://thebalochistanpoint.com/balochistan-the-fruit-basket-of-pakistan/

16. UN&PO (Unrepresented Nations and People's Organizations). 2015. Balochistan: Severe Water Shortage Due to Climate Change and Pakistani Actions: https://unpo.org/article/18690

17. Vintroux: 2017 Blog, Report – Sonoma and Napa Premium Wine Grape Prices 2016 https://vineyardandwinerysales.com/blog/2017-report-sonoma-napa-premium-wine-grape-prices-2016/

Annexure-2: Stakeholders Consulted

The following stakeholders were consulted during this feasibility study exercise

S#	Name	Title	Location	Contact
1.	Aqeel Feroze	Assistant Horticulturist	BARI, Chakwal	0302-7302043
2.	Riaz Alam	Sr. Scientific Officer	HRI, NARC	0333-5967294
3.	Shaukat Rasool	Trader/ Farmer	Chakwal	0346-2020829
4.	Iftikhar Ahmad	Farmer	Attock	0344-9628112
5.	Khadim Hussain	Farmer	FatehJanga	0335-5457591
6.	Basharat Raja	Farmer	Dharabi	0345-5537352
7.	Juma Khan	Director	ARI, Balochistan	0300-3831462
8.	Waseem Baran	Horticulture	Balochistan	03337810705

Annexure-3: Feasibility Study of Raisin Production Unit

Project Concept

Grape is one of the most popular and most commonly consumed fruits. Seeded and seedless varieties of this fruit occur in many colors including green, red, black, yellow and pink. Grapes are grown in temperate climates across the world. This fruit offers a wealth of health benefits due to their high nutrients. Grapes are high in antioxidants and other beneficial plant compounds which may protect against chronic health conditions, such as diabetes, cancer and heart disease.

Besides direct consumption as fresh fruit, grapes are also processed into value added products like dried grapes (raisin, sultanas and currants), grapes juice and grape based alcoholic beverages. Grapes drying can be carried out using simple processing technology, and can be produced at cottage/farm level with small to moderate capital investment affordable for subsistence farmers. Drying can process grapes into dried product which has an extended shelf life. During peak production days of the season, the perishable fresh produce not absorbed by the fresh fruit market can be converted into value added raisin of extended shelf life. Grape drying is one of the most important methods to prolong its shelf-life and reducing economic losses.

Potential Market

Dried grape is commonly known as ‘Kishmish’ in the local market. It is a popular product that is readily available in the local market on general items stores. It is used as an additive in variety of local sweet dishes like Kheer, Halwas, etc. and multiple bakery products. Another important use of raisins is as a raw material different types of medicines. It is an important ingredient of the medicines developed by the local Hakeems which use natural herbal raw materials. High nutritious value of raisins is the key factor for this.

Along with the local market, there is a large export market of raisins as well. Pakistan, currently, is not an important player in the international market of raisins. An undeveloped local grapes sector, lack of the requisite knowledge to develop a high quality raisin and lack of international marketing linkages are the key factors hindering Pakistan’s entrance into this large growing market. It can be expected that by establishing small raisin production units, it will be possible to not only meet the local demand but also sell this product in the international markets.

Raisin Production Process

Process Flow

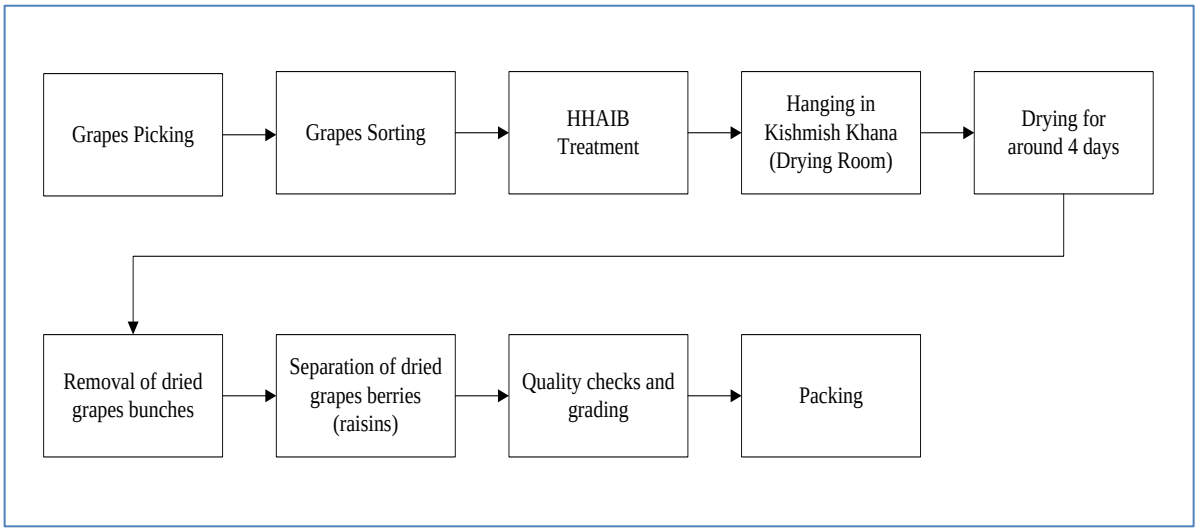
Grapes can be processed into raisins for longer shelf-life as well as dehydrated grapes, which can be used for wines or juice production. To preserve and prolong shelf life of the valuable horticulture produce, grapes are dried by adopting different drying methods. Drying is the most commonly used method for the production of grapes value-added products. To convert into raisin, grapes can be dried by simply spreading in the sun, the cheapest method involving zero capital outlay for equipment. However, to produce good quality raisins, grapes need wax removing treatment by HHAIB (High Humidity Hot Air Impingement Blanching) technique and dried in shade, instead of drying directly in the open sun.

Before starting the drying process, the thin layer of the wax naturally present on the surface of the fruit has to be removed; otherwise drying process takes much longer time; thereby decreasing the throughput. The results of R&D work show that drying rate of the treated samples significantly increases compared to that of the untreated samples. The wax layer present on the fruit surface hinders in drying by deterring removal of the moisture from the grapes.

Removal of wax, prior to starting the grapes drying process, can be achieved by different pretreatments. Use of chemicals and blanching with hot water has been the commonly adopted practices. Due to risk of chemical residue in the finished product, nutrients loss and low yield, both the pretreatments should be avoided for better quality and high recovery of dried grapes. Another pretreatment known as HHAIB leads to lower drying time, high quality finished product with minimum processing loss. HHAIB not only significantly decreases the drying time but also effectively inhibits enzymatic browning and results in desirable green–yellow or green raisins. HHAIB at 110C for 90 seconds; followed by air drying at 60C are proposed as the most favorable conditions for drying grapes.

The grapes are picked and sorted manually to remove any unripe or rotten pieces. The bunches are loaded on trays and passed through HHAIB treatment. The treated bunches are hung in the Kishmish Khana (drying room) under shade. A flow of air is continued in the room to replace the saturated air with fresh air. Drying process is carried out for around four days after which the hung bunches are removed. Dried grapes berries (raisins) are removed manually, checked for quality and may also be graded according to size. The final product is packed in polyethylene bags and marketed.

Dried Grapes (Raisins) Production Process Flow



Project Cost

Total project cost of the proposed raisin production unit is PKR 2.19 million. Major items of project cost are listed in.

Project Cost Details

Cost Item	Cost (PKR)
Building & Civil Works	316,000
Machinery & Equipment	980,000
Office Equipment & Furniture	31,000
Pre-operating expenses	135,400
Capital Investment	**1,462,400**
Working Capital	727,799
Total Project Cost	**2,190,199**

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

Land and Building

It is assumed that the proposed raisin production facility will be established by a grapes farmer who has land available in his orchard. The proposed production unit will be established within the grapes orchard of the farmer. The farmer will construct the proposed 'Kismish Khana' (drying room) for producing raisin by drying the fresh grapes produced in his orchard. It is assumed that electricity and water connections will be available on the selected site for this construction. Thus, the costs of electricity and water connections have not been included in the project cost. In case, these facilities are not available at the selected location, the costs of obtaining the connections of these two utilities will have to be added in the project cost.

The dimensions of the drying rooms will be 18 feet long, 12 feet wide and 18 feet high. Construction will be done on an area of 216 sq. feet at a unit cost of PKR 1000/ sq ft. Total construction cost will be PKR 216,000. A small office will be built at a cost of PKR 100,000 that will make the total cost of building to be PKR 316,000.

Machinery and Equipment

The feasibility study of raisin production unit has been based on locally available machinery and equipment. This has been done to keep the capital cost of the project lower to keep it within the reach of smaller investors in rural areas. Total cost of the required machinery and equipment is PKR 980 million. Machinery and equipment details are shown.

Processing Machinery and Equipment Cost

Sr. No	Name of the Machine	No.	Unit Cost (PKR)	Total Cost (PKR)
1.	Steam Generator (0.5 tonne/hr)	1	600,000	600,000
2.	HHAIB Chamber (500 kg)	1	250,000	250,000
3.	Grapes Bunches Hanging Structure	1	80,000	80,000
4.	Miscellaneous	1	50,000	50,000
Total				**980,000**

Other Project Cost Items

- Office equipment and furniture has been included at a total cost of PKR 31,000.
- Pre-operating expenses are those expenses which have to be incurred before the business becomes operational. The costs included under this head are those of business registration/licensing, machinery transport, machinery erection and commissioning, personnel, routine administration and project's promotion. Pre-operating costs have been worked out to be PKR 135,400.
- Working capital calculation includes the cost of half month supply of grapes, one month cost of electricity bill, packing material and staff salaries. Machinery spares equal to 1% of machinery cost and petty cash of PKR 100,000 have also been included in the working capital. With these assumptions, total working capital requirement has been calculated to be PKR 727,799.

Revenues and Costs

Revenues

Revenues will be generated by selling raisins in bulk packaging of polyethylene bags of 5 kg capacity. The capacity of the unit is driven by the capacity of Kishmish Khana which has a loading capacity of 1.4 tonnes of fresh grapes. One batch of grapes will take four days to attain the desired moisture level in the raisins. This means that the effective capacity of Kishmish Khani will be 7.5 batches per month of fresh grapes. The production will be carried out for four months during the year to process 42 tonnes of fresh grapes (7.5 x 4 x 1.4). It is assumed that

the project will operate at this capacity from first year. At a raisin yield of 30.8%, the proposed unit will produce 12.94 tonnes of raisins per year.

The selling price of raisin in the market in the export market has been assumed to be PKR 500 per kg for feasibility calculations. At this selling price, project's revenues for the first year will be PKR 6.468 million. No growth in selling price has been assumed over the five-year period. Revenue calculations for five years are shown in.

Revenue Calculations

	Year 1	Year 2	Year 3	Year 4	Year 5
Production (kg)	12,936	12,936	12,936	12,936	12,936
Price (PKR/kg)	500	500	500	500	500
Revenues (PKR)	6,468,000	6,468,000	6,468,000	6,468,000	6,468,000

Grapes Cost

Fresh grapes constitute the major cost of raisin production. At the assumed capacities total requirement of fresh grapes is 42 tonnes per year. Grapes price has been assumed to be PKR 105 per kg. At this rate, total annual cost of grapes will be PKR 4.41 million. No growth has been assumed in the cost of grapes. With these assumptions, grapes cost for five years is shown in.

Grapes Cost Calculations

	Year 1	Year 2	Year 3	Year 4	Year 5
Raisin Production (kg)	12,936	12,936	12,936	12,936	12,936
Raisin yield	30.8%				
Grapes Requirement per year (kg)	42,000	42,000	42,000	42,000	42,000
Grapes Unit Cost (PKR/kg)	105.0	105.0	105.0	105.0	105.0
Grapes Cost (PKR)	**4,410,000**	**4,410,000**	**4,410,000**	**4,410,000**	**4,410,000**

Other Costs

- Raisins will be packed in 5 kg polyethylene bags. The cost of one poly bag pack has been assumed to be PKR 10. At this rate, total cost of packing raisin production was calculated to be PKR 25,872. Packing cost has been assumed to remain constant for five years.

- Electricity cost has been worked out on the basis of an electricity connection of 2 KVA. Electricity cost for the first year has been calculated to be PKR 75,710.

- Plant maintenance cost has been assumed to be 1% of machinery cost. Maintenance cost during the first year has been calculated to be PKR 9,800.

- Marketing cost includes the cost of product awareness and promotion in the consumer and industrial markets. It has been assumed to be PKR 10,000 per month. Marketing cost during first year is calculated to be PKR 120,000.

- Administration cost includes the cost of travelling, office stationery, telephone and refreshment. Administration cost during first year of operations is calculated as PKR 94,800 No inflationary factor has been considered during five years.

- Depreciation cost has been calculated using straight line method. A life of twenty years has been assumed for building, ten years for machinery and equipment and five years for office equipment. Pre-operating expenses have been amortized over a period of five years.

Human Resource Cost

The proposed raisin making unit will need small workforce; including a production supervisor, nine workers and a security guard. The activities of production management, administration, bookkeeping and marketing will be carried out by the entrepreneur himself/herself. Human resource requirements and the associated costs are shown in.

Human Resource Cost

Designation	No.	Salary (PKR/month)	Total (PKR/month)	No. of Months	Salary per Year (PKR)
Production Supervisor	1	20,000	20,000	4	80,000
Workers	9	15,000	135,000	4	540,000
Watchman	1	15,000	15,000	4	60,000
Total Staff	**11**		**170,000**		**680,000**

Projected Financial Statements

Projected Profit & Loss Statement

Projected Income Statement

	Year 1	Year 2	Year 3	Year 4	Year 5
Revenues	**6,468,000**	**6,468,000**	**6,468,000**	**6,468,000**	**6,468,000**
Direct Costs					
Grapes	4,410,000	4,410,000	4,410,000	4,410,000	4,410,000
Packing Cost	25,872	25,872	25,872	25,872	25,872
Direct Labor	620,000	620,000	620,000	620,000	620,000
Direct Electricity	44,006	44,006	44,006	44,006	44,006
Maintenance	9,800	9,800	9,800	9,800	9,800
Total Direct Cost	**5,129,082**	**5,129,082**	**5,129,082**	**5,129,082**	**5,129,082**
Gross Profit	**1,338,918**	**1,338,918**	**1,338,918**	**1,338,918**	**1,338,918**
Indirect Costs					
Building Lease	-	-	-	-	-
Indirect Labor	60,000	60,000	60,000	60,000	60,000
Fixed Electricity	31,704	31,704	31,704	31,704	31,704
Depreciation	120,000	120,000	120,000	120,000	120,000
Amortization	27,080	27,080	27,080	27,080	27,080
Marketing	120,000	120,000	120,000	120,000	120,000
Office Administration	94,800	100,800	100,800	100,800	100,800
Licensing/Regulatory Fee	8,000	8,000	8,000	8,000	8,000
Total Indirect Costs	**461,584**	**467,584**	**467,584**	**467,584**	**467,584**
Net Profit	**877,334**	**871,334**	**871,334**	**871,334**	**871,334**

Projected Balance Sheet

ASSETS	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Current Assets						
Cash	100,000	1,213,005	2,238,989	3,256,862	4,274,709	5,292,527
Raw material	553,406					
Advance Processing Charges	64,593					
Accounts Receivables		539,000	539,000	539,000	539,000	539,000
Spare Parts inventory	9,800	10,290	10,805	11,345	11,912	12,508
Total Current Assets	**727,799**	**1,762,295**	**2,788,793**	**3,807,207**	**4,825,620**	**5,844,034**
Fixed Assets						
Land	-	-	-	-	-	-
Building & Civil Works	316,000	300,200	284,400	268,600	252,800	237,000
Processing Machinery	980,000	882,000	784,000	686,000	588,000	490,000
Utility Machinery	-	-	-	-	-	-
Laboratory Equipment	-	-	-	-	-	-
Office Equipment & Furniture	31,000	24,800	18,600	12,400	6,200	-
Net Fixed Assets	**1,327,000**	**1,207,000**	**1,087,000**	**967,000**	**847,000**	**727,000**
Other Assets						
Pre-operating Expenses	135,400	108,320	81,240	54,160	27,080	-
Contingencies						
Total Other Assets	**135,400**	**108,320**	**81,240**	**54,160**	**27,080**	**-**
TOTAL ASSETS	**2,190,199**	**3,077,615**	**3,957,033**	**4,828,367**	**5,699,700**	**6,571,034**
LIABILITIES	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Current Liabilities						
Accounts Payables		10,082	18,167	18,167	18,167	18,167
Short term loan						
Other Current Liabilities						
Total Current Liabilities	**-**	**10,082**	**18,167**	**18,167**	**18,167**	**18,167**
Long Term Liabilities						
Lease payable						
Long term debt	-	-	-	-	-	-
Long term debt	**-**	**-**	**-**	**-**	**-**	**-**
Equity						
Paid up Capital	2,190,199	2,190,199	2,190,199	2,190,199	2,190,199	2,190,199
Retained Earnings		877,334	1,748,667	2,620,001	3,491,334	4,362,668
Total Equity	**2,190,199**	**3,067,532**	**3,938,866**	**4,810,200**	**5,681,533**	**6,552,867**
TOTAL LIABILITIES	**2,190,199**	**3,077,615**	**3,957,033**	**4,828,367**	**5,699,700**	**6,571,034**

Projected Cash Flow Statement

Projected Cash Flow Statement

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Operating Activities						
Net Income		**877,334**	**871,334**	**871,334**	**871,334**	**871,334**
Depreciation		120,000	120,000	120,000	120,000	120,000
Amortization		27,080	27,080	27,080	27,080	27,080
Change in raw material inventories	(553,406)	553,406	-	-	-	-
Change in advance processing charges	(64,593)	64,593				
Change in spares inventory	(9,800)	(490)	(515)	(540)	(567)	(596)
Change in Accounts Receivables		(539,000)	-	-	-	-
Change in Accounts Payables		10,082	8,085	-	-	-
Cash from operations	**(627,799)**	**1,113,005**	**1,025,984**	**1,017,873**	**1,017,846**	**1,017,818**
Financing Activities						
Short term debt principle repayment						
Long term debt principle repayment		-	-	-	-	-
Addition to short term debt						
Additions to long term debt	-					
Issuance of shares	2,190,199					
Net cash from financing activities	**2,190,199**	-	-	-	-	-
Investing Activities						
Capital Expenditure	(1,462,400)					
Cash from investing activities	**(1,462,400)**	-	-	-	-	-
Net Cash	**100,000**	**1,113,005**	**1,025,984**	**1,017,873**	**1,017,846**	**1,017,818**
Cash balance brought forward	-	100,000	1,213,005	2,238,989	3,256,862	4,274,709
Cash investment in securities		-	-	-	-	-
Cash available for appropriation	100,000	1,213,005	2,238,989	3,256,862	4,274,709	5,292,527
Dividend	-	-	-	-	-	-
Cash carried forward	**100,000**	**1,213,005**	**2,238,989**	**3,256,862**	**4,274,709**	**5,292,527**

Financial Feasibility

The proposed project of raisin making unit is found to be financially viable with a positive NPV of PKR 1.14 million. NPV, IRR and payback period are shown in.

Financial Feasibility Indicators

NPV (PKR)	1,139,725
IRR	38.71%
Payback (years)	2.51

Profitability Ratios

	Amount (PKR)	Percent
Sales	6,468,000	100.0%
Direct Costs	5,129,082	79.3%
Gross Profit	1,338,918	20.7%
Indirect Costs	461,584	7.1%
Net Profit	877,334	13.6%

11.2.