CLUSTER DEVELOPMENT BASED AGRICULTURE TRANSFORMATION PLAN VISION-2025

Medicinal Plant Cluster Feasibility and Transformation Study

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

February 2020

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

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

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

Dr. Babar Ehsan Bajwa
Regional Director
CAB International

FOREWORD

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

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

ACKNOWLEDGEMENT

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

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

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

Dr. Aslam Gill
Senior Author

Citation:

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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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EXECUTIVE SUMMARY

In the current feasibility study, two medicinal plants have been identified to promote their value chain from production to trade in a cluster mode. The cluster of Ispaghol (*Plantago ovata*) is spread over the tehsils of Hasilpur, Haroonabad and Chishtian all located in Cholistan desert in Punjab. The Cumin (*Cuminum cyminum L.*) cluster is located in the districts of Kalat, Karan and Nushki in Balochistan.

The total area under Ispaghol crop in Cholistan cluster is around 1200 ha (3000 acres) and on average it is estimated that 800 tonnes of Ispaghol seed is produced from which around 200 tonnes of Ispaghol husk is produced. The country's annual requirements of Ispaghol husk is around 500 tonnes. During 2016-18, on an average, Pakistan imported 213 tonnes Ispaghol husk worth of PKR 180.3 million from India. However, Pakistan also exported 17.8 tonnes of Ispaghol valued to about PKR15.0 million during 2018.

In Cholistan, Hasilpur is hub point for trade and processing of Ispaghol. The private sector has installed about 50 small crude de-husking units in the cluster and the owners of these units are mostly resource poor. They take loan from the big dealers or traders of Ispaghol and make a verbal contract and process according to the specifications or demand of the traders. Colour of husk deteriorates to brown during the processing while the quality husk demanded is white and soft. Mixing zinc-sulphate as a whitening agent to meet the international standards for colour is one common form of adulteration; however, few other forms are also reported.

The Balochistan province is the hub of Cumin production. An average production of cumin is 2823 tonnes per year from an area of 6210 ha, both are on fast declining trends at an annual rate of 8%. Pakistan imports about 67% of its cumin requirements which amounts to annual import of 7630 tonnes (seed + powder) worth PKR 433 million. It is important to mention that Pakistan also exports around 1190 ton of cumin in whole seed and crushed form.

The key player in the value chain of cumin is broker. The brokers and large wholesalers operate in the regional markets mainly located in big cities such as Peshawar, Lahore, Karachi and Quetta. Large processors buy directly from farmers either with or without having a contract with them. However, wholesalers and farmers indicated that they are more comfortable to operate through brokers and traders. Wholesalers give their required specifications to brokers and get required quality material on negotiated price.

Farmers in both Cholistan Ispaghol and Balochistan Cumin clusters are not fully aware of the principles and technical guidance for the production techniques. Moreover, non-availability of planting materials and un-assured marketing are major constraints. Currently, the stakeholders within the cluster are not compliant with the International standards and guidelines as well as phyto-sanitary, quality and safety regulations. The post-harvest losses in these commodities plants are high (20-40%) and processing are inefficient which deteriorates the quality.

Globally, the total area under cumin was around 0.76 million ha with the production of 0.49 million tonnes during 2016-17. A huge potential of Cumin export exists. The top exporters of Cumin seeds are India, Syria, and Turkey. The top importers are Vietnam, the United States, Bangladesh, Egypt and the United Arab Emirates. USA is the main importer of Ispaghol seeds and husk and consumes annually 8,000 metric tonnes.

The major goal of this study was to suggest interventions to improve productivity and quality of the Ispaghol and Cumin. Also, to suggest measures to improve the value addition in the respective clusters. Proper incentives are proposed for sustainable development of the value chain and to boost production of value-added products from both clusters. The strategy for the development of the cluster will focus on the production of Ispaghol and Cumin on commercial scale through research-based technology package oriented on WHO guidelines on good agriculture and processing practices. The major components of the future strategy for the cluster development will be oriented to the Research and Development backstopping from the prevailing National Agricultural Research System (NARS). It will address the stakeholder's issues in a holistic way in a value chain perspective through developing improved cultivars and package of technologies for production, processing and marketing. The cluster growers of the Ispaghol and Cumin were stern towards the existing market system for their produce. To change the conventional marketing system which creates erratic and low prices is a difficult task, however based on review of literature and discussion with associated stakeholder's pragmatic interventions are suggested.

As a part of policy and strategy, it is also proposed to establish Pakistan Spices and Medicinal Plants Development Board (PSMPDB). After developing the mechanism of the PSMPDB, the strategies and activities/plans will be initiated to strengthen the current clusters of medicinal plants i.e. Ispaghol and Cumin. The activities proposed are targeted in five years' time frame with a total pooled budget for both the clusters is US$1.6 million, 73% of which will come from the public sector funding in terms of initiating research on medicinal plants, capacity building of stakeholders, incentivizing the modern processing units, and providing loans on establishing these units. It is expected that these incentives will encourage the private sector to bring the remaining 27% investment. The pooled NPV for both the clusters is US$0.574 million with an IRR of 24%. The cluster level interventions, investment and economic analysis can be seen in the Summary Sheet below.

Summary sheet of Medicinal Plant Cluster

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

1. INTRODUCTION

The Pakistan's Medicinal Plants (MPs) resource could be classified into two categories i.e. naturally occurring and cultivated. The naturally occurring can be sub-divided on the basis of production as wild plants and plants growing as weed remnants in the forests, rangelands or cultivated fields. There are a large number of wild plants used as drugs but a few are cultivated on the basis of their economic importance and medicinal uses. Ecological conditions play an important role in the production of MPs. There are about 4950 plant species exist in Pakistan and out of which only 300 species (6.1%) are identified as medicinal plant species (FAO, 2002). Whereas, Shinwari (1996) reported that there are about 6000 plant species exist in the country and out of which only 1010 species (16.8 %) are identified having medicinal value.

In Pakistan, over 50 % of the population is being cured using traditional medicines by almost 50,000 traditional herbal practitioners (Usmanghani *et.al.* 2000). There are more than 100 registered manufacturers of herbal remedies consuming most of the MPs raw material and produce 300-400 products that are sold in the local markets. The trade of MPs is monopolized by wholesale drug dealers, with the small shopkeepers, pansar stores, hakims relying on wholesalers for their supply and almost 300 plant species of medicinal herbs are being traded (Zahoor, 2004). According to a report of MINFAL, 2004 the demand/consumption of MPs raw materials by the local industry is more than 4000 tonnes per annum. Almost 90 % of the country's MPs requirement is imported for this purpose, however very small quantities are also exported. Countries such as Pakistan, China and India are exporting medicinal plants, herbal tonics, etc. National and multinational pharmaceutical companies import raw material of spices and medicinal herbs worth of about PKR 18 billion every year (MINFAL, 2004).

In the global market the medicinal plants have shown increasing demand trends due to consumer interest in natural medicine and remedies. The trade of MPs materials and their products including extracts, essential oils, phyto-pharmaceuticals, gums, spices used in medicine, tannins for pharmaceutical use, ingredients for cosmetics etc. is estimated at US$ 33 billion as calculated by Vasisht *et al.* (2016). They also analyzed that the average global export in medicinal plants was estimated at US$ 1.92 billion for 601,357 tonnes in 2000 and in year 2014 it stood at 702,813 tonnes valued at US$ 3.60 billion showing an annual average growth rate (AAGR) of 2.4% in volumes and 9.2% in values of exports during this period of fourteen years. Nearly 30% of the global trade is made up by China, India, Egypt, Morocco, Poland, Bulgaria, Albania, Chile, and Peru as an important supply source. The USA, Japan and Europe are the major consumers of the world. According to FAO, the last three decades have seen substantial growth in herb and herbal product markets across the world. The Secretariat of the Convention on Biological Diversity, global sales of herbal products have estimated at US$60000 million in 2002 (WHO, 2003). The global market for botanical and plant-derived drugs is therefore expected to increase from $19.5 billion in 2008 to $32.9 billion in 2013, an annual growth rate of 11.0% (http://www.intracen.org).

The demand for medicinal plant-based raw materials is growing at the rate of 15 to 25 percent annually. The World Health Organization (WHO), estimated the demand for medicinal plants is likely to increase from the current $14 billion a year to $5 trillion in 2050. Some developing countries with a long tradition of use of MPs are major exporting countries – China, Korea, Chile, India, Brazil and Thailand. Exports are predominantly in raw material form and only to a lesser extent finished product. With their large populations and ancient heritage of traditional herbal-based medicines, China and India are two of the world's largest markets for medicinal plants, though not necessarily the largest traders. The leading importer within Europe is Germany, because its pharmaceutical companies are major players in the world market.

In Pakistan, some of the medicinal plants are also grown particularly by small farmers to diversify their cropping system and to earn some additional income for their livelihood. Two commodities of medicinal plants include Ispaghol (*Plantago ovata*) and Cumin (*Cuminum cyminum L.*) are selected in the current cluster development feasibility study. The cluster of Ispaghol is identified in the Cholistan tehsils of **Hasilpur, Harunabad and Chistian** in Punjab whereas Cumin cluster will be comprised of **Kalat, Karan and Nushki** districts in Balochistan. The production of both commodities is very intermittent in their respective cluster. The farmers involved in the production of these commodities are not fully aware of the principles and technical guidance for the production techniques, non-availability of planting materials and assured marketing are major constraints. Ispaghol is a valuable medicinal plant worldwide used for its medicinal properties. Both dried seeds and the seed husks are used in treatment of dysentery, catarrhal conditions of the genitor-urinary tract, and inflamed membranes of the intestinal canal and effective in reducing cholesterol levels in blood. The cumin has many uses in the pharmaceutical, food and cosmetics industry. This plant is traditionally used in the treatment of dyspepsia, diarrhea, toothache, digestive disorders and to increase breast milk and as a disinfectant. Due to its flavor, cumin seed & powder can be used as an additive in various foods. The farmers who cultivate Ispaghol, respond that due to erratic climate and prices the cultivation has become a risky event. The total area under Ispaghol crop is around 3000 acres and mainly is concentrated in rainfed areas of Cholistan and Thar and the cluster areas are part of Cholistan desert. The productivity of Ispaghol was very low i.e. average around 0.6 tonnes/ha, whereas the potential lies at more than 1.0-1.5 t/ha. The process of de-husking was very obsolete and inefficient resulting in poor quality and losses of product in processing. The Balochistan province is the hub of cumin production and accounts for around 90% of the country produce. The cluster contributes more than 80% in the province overall Cumin production. The last three years data have shown that both the area and production of Balochistan province have decreased by 9% and in the cluster, both have declined by 8%. However, based on the importance of commodities in health care, precious natural resources and economic value in trade; efforts are needed to enhance their production and quality to comply international standards.

Preferably medicinal plants have to be grown as crop following Good Agricultural Collection and Processing Practices (GACP) guidelines given by WHO and WTO rules of sanitary and phyto-sanitary. There is a need to promote production and quality of Ispaghol and Cumin products in these clusters accordingly. There is burgeoning need to enhance production of these crops the cluster. These crops are providing livelihood to a significant number of people in the rural as well as urban communities. Most importantly, the international market opportunities are emerging day by day for the trade of these commodities to fetch foreign exchange for the country.

2. OBJECTIVES

It was noticed that the farmers involved in the production of Ispaghol and Cumin are not aware of the principles and technical guidance for the production of these crops according to good agricultural and processing practices techniques. It is important to mention that Pakistan's production of Ispaghol husk is around 200 ton and is substantially less (60%) than its requirement of 500 ton hence, a significant amount averaged to 213 ton each year of Ispaghol husk is imported mainly from India. Similarly, the data have shown that both the area and production of Cumin in the cluster have declined by 8%. The country has to import on average 7630 tonnes of cumin worth value of PKR 433 million each year. Hence, the major goals and objectives will to ameliorate the area, production, productivity and quality of the Ispaghol and Cumin in the clusters.

Keeping in view this scenario, the overall goals of this feasibility study is to comprehensively delineate the medicinal plants sector as a whole and specifically Ispaghol and Cumin commodities. The objectives are to develop these crops for transforming the existing value chain from production to trade into a cluster mode, in harmony with *Cluster Development Based Agriculture Transformation Plan -V2025.* The foremost objective will be to minimize the imports of these commodities. The specific objectives of the study are;

1. To identify the appropriate clusters of coriander and turmeric spices production in Pakistan
2. To conduct a detailed diagnosis and SWOT analysis of the coriander and turmeric commodities value chain in each cluster from its production to trade
3. To identify technological, institutional, infrastructure and policy gaps in the commodity clusters
4. Assess the potential of these commodities production in the identified clusters
5. Suggest strategy and plan of work to sustainably attain the commodity potentials in these clusters
6. Conduct the economic and social analysis for the successful development of these commodities and the clusters

3. METHODOLOGY

To study the various aspects of the cluster commodities, the relevant data and information were collected from a number of sources and analyzed using appropriate statistics methods. The purpose of review was to reveal the production status, processing industry and trade scenario of medicinal plants in general and Ispaghol and Cumin in specific, keeping in view the national and international scenario. The details of which is as follows;

3.1 Macro-Data

The secondary data were used for the feasibility study. Relevant secondary data were collected from various Government departments at Federal and Provincial levels and other stakeholders in the value chain such as processors, traders and exporters. The data of area, production, export and import for 10 years 2007-08 to 2016-17 of spices and especially cluster commodities on district basis was collected from 2004-05 to 2013-14. The country level data of coriander and Turmeric was also available from 2000 to 2016-17. Average Compound Annual Growth Rates (CAGR) were calculated using appropriate statistical methods. The list of macro data sources and references is given in Appendix 1.

3.2 Stakeholders Consultations

During the course of the study an extensive array of stakeholders including farmers/growers, traders, processors, researchers and extension services were consulted. The farmers of Ispaghol cluster in Punjab and Cumin cluster in Balochistan were consulted. Whereas, the other stakeholders of the value chain from researchers, extension, processing industry, traders, and exporters/importers were also consulted. The consultation was informal and was made through individual and group meetings, telephonic discussions and few questionnaires-based surveys. The list of stakeholders consulted is produced in Annexure 2.

3.3 Review of Literature

To review the literature in depth and width, various website was visited. A number of reports, articles, news papers and pamphlets were also studied. Necessary information was also collected from various journals and books. The list of citation is given in Annexure 1.

4. LITERATURE REVIEW

The cultivation of medicinal plants in the country, from agronomic point of view, there prevails sufficient opportunities to cultivate medicinal plants in various agro-ecological zones in all the provinces of Pakistan. However, it is important to mention that agronomic suitability is only meaningful if the chemical and pharmaceutical properties are acceptable as per requirements of the end users and market. In the current feasibility study two medicinal plants commodities have been identified to promote their performance keeping in view the value chain from production to trade. Accordingly, the medicinal plants sector as whole and cluster's commodities i.e. Ispaghol and Cumin are specifically reviewed in this section.

In Pakistan about 6000 medicinal plant species exist and out of which only 1010 species (16.8 %) are identified having medicinal value. Almost 90 % of country's Medicinal Plants (MPs) requirement is met through imports. Over 50 % of the population in Pakistan is being cured using traditional medicines mainly sourced from medicinal plants by almost 50,000 traditional herbal practitioners. There are more than 90 registered manufacturers of herbal medicine which consume most of the MP's material and develop 300-400 products from plant raw materials (Aslam, 2002). In this traditional medicine system most of the medicinal plants consumed are collected from wild and very few are also cultivated in some ecologies of the country by small number of farmers. Sher and Khatoon (2008) reported field studies on medicinal plants of Haramosh and Bugrote valleys in Gilgit and found 98 medicinal herbs species on the basis of folk information of medicinal uses. Local people were using these to prevent and cure various diseases such as rheumatism, asthma, diabetes, blood pressure, stomach problems, abdominal problems etc. Out of these 98 medicinal plants 21 MPs were also cultivated by the local community and 77 MPs were wild crafted. Qasima et.al. (2010) reported growth and production of five medicinal plants as crop in Quetta and Kalat districts of Balochistan. Significant differences for growth and yield were recorded at both sites. *F. vulgare* and L. *usitatissimum* produced the highest yield of 1000 kg/ha at both sites. *A. sowa* and *N. sativa* seed yield were less than 1000 kg/ha while the seed yield of *C. copticum* was less than 700 kg/ha. It was found that the sowing of these crops in highlands of Balochistan should be carried out during the months of late February or early March to avoid the seedling damage by cold or low temperatures. Results indicated that these crops have potential of cultivation and diversification of cropping systems in Balochistan. The production can be enhanced by using new high yielding varieties with proper production technology and management practices. Sarfraz et.al. (2008) evaluated cultivation potential of medicinal plants i.e. Thyme, Oregano, Rosemary and Sage in Balochistan. The MPs showed promising adaptability in cold and dry area and production potential in highland Balochistan. These crops have also been introduced among the farming communities in different agro-ecological zones of Balochistan. The studies indicated that medicinal plants have great potential for commercial scale cultivation in Balochistan subject to provision of better and sustainable marketing avenues.

In a survey of the Ziarat district Balochistan, Sarangzai et.al. (2013) elaborated the floristic composition & some folk uses of medicinal herbs. During the survey and plant collection, 90 species of different taxa belonging to 35 families are used medicinally by the local people for various ailments. This diversity was due to the difference in climate, altitude, microclimate and other topographic conditions. It was noted that over grazing of the vegetation, ruthless collection of medicinal plants has threatened their existence and more plants are becoming vulnerable due to destruction of their natural habitat. The area has great potential for promotion of medicinal plant cultivation.

Regarding the cultivation of medicinal plant, in fact, no institution has provided tangible list of MPs for their cultivation suitability based on research backstopping. Numerous individual studies and efforts have been made at the institutional level. Few of the research trial have been reported on various MPs by MINFA, PARC, PFI and other provincial departments and also had made efforts to promote it through research and development. Conservationists, are also concerned about this issue (Naim 1996). Promotion of medicinal plants cultivation will result in improved supplies of raw materials, provide an alternative to collecting plants from the wild, and will also lead to standardization. The raw material of medicinal plants is mainly harvested from forests & rangelands, only few medicinal plants are cultivated in the country. According to a survey of different herbal stores, indicated that total business of crude drug in the country is worth about Rs.120 million (Mariam, 2015). Few medicinal plants are also exported to different countries in small quantities. The prices of medicinal plants at village level are very low and villagers are generally not well informed about market prices. The market value of medicinal plants increases 3 to 5 times from village to local shops and the prices at national market may be doubled to triple of the same item. A sizeable number of medicinal plants are collected and marketed locally involving a significant portion of the population, particularly those marginalized groups, including women and children. The research work on medicinal plants by Williams and Zahoor, (1999) have also pointed out that a rich resource base of MPs is spread over a wide range of ecological zones, with estimates of numbers of plant species with medicinal properties varying from 3,200 species at the upper end of the spectrum to 1,000 at the lower end. Of these species, approximately 500 are known for their active constituents from research conducted in Pakistan and elsewhere, and around 250 to 300 species are known to have entered the herbal markets.

Globally, there is a rising trend to shift resources from allopathic to traditional healthcare systems. The global market estimates to surge US$ 5 trillion by 2050. Twelve percent of Pakistani flora is used in medicines and more than 300 medicinal plants are traded Shahzad et.al. (2012). Ten leading Dawakhanas, (Herbal manufacturers) of Pakistan annually consume more than 2 million kg of 200 medicinal plants in 1990s while its consumption increased multifold in the last two decades. According to Shinwari *et al.,* (2002) to an estimate, 22 species of medicinal plants worth Rs.14.733 million were traded in 1990 while in 2002, this value rose to more than Rs.122 million, an eight-and-a-half times increase. In 1990, about 95 species were consumed worth Rs. 36 million while in 2002, medicinal plants worth Rs. 218 million were consumed: a six-fold increase. Shinwari *et al.* (2006) published a "pictorial guide of medicinal plants of Pakistan" enlisting more than 500 species of flowering plants, being used as medicine. It has also been reported that nearly 37% (266 species) of the total of 709 endangered species are endemic to Pakistan. Endemic species may also be explored for ethno-botanical, pharmacological and pharmaceutical activities (Shinwari, 2010). Hence, there is a global need to cultivate and conserve medicinal plants. In Russia 50,000 tonnes of medicinal plants are used annually of which, 50% are cultivated. In India medicinal plants worth Rs.90 million are grown annually. European Union (EU) uses 3,000 kg of Glycerrhiza each year for which 400 tonnes plant roots are needed. In China, in the year 2000, the total output value of the pharmaceutical industry was 233 billion Yuan (28 billion US$). By the year 2010, the share of traditional Chinese medicine in the international market of herbal medicine was projected to improve to 15% from the existing 3%. Unfortunately, in Pakistan not enough emphasis has been given to the cultivation of medicinal plants (Shinwari, 2010). Recently, the Government of Pakistan through Ministry of Food Agriculture and Livestock (MINFAL) has started a project entitled as “Production of Medicinal Herbs in Collaboration with Private Sectors” (PMHPS) to promote the cultivation of medicinal herbs and spices plants as crop (Aslam, 2008). The project has focused the production of medicinal herbs on commercial scale through research-based technology package oriented to World Health Organization (WHO) guideline of good agriculture, collection and processing practices. These included appropriate selection and identification, propagation methods, cultivation techniques, harvesting and collection, quality control of raw material up to processing stage, post-harvest treatment, storage and safety. However, due to devolution of MinFA as a result of 18th amendment process no sustainable outcome have been achieved (Aslam, 2008) from this project, however, the project created awareness and published a huge literature for the guidance of various stakeholder involved in MPs sector.

No doubt, that Pakistan has a rich and diverse flora of almost 5700 plant species of which around 2000 are reported to be medicinally important (Ullah, 2017). However, the current trade in medicinal plants of Pakistan is far low than the other countries like India and China. According to FAO (2002) the actual supply/demand of herbs and medicinal plants is in the range of 20,000 tonnes per annum. Another research reported, 22 species of medicinal plants worth Rs 14.733 million were traded in 1990 while in 2002, this value rose to more than Rs.122 million, an eight-fold increase.

During the consultation, stakeholders informed that the trade in herbal material is monopolized by wholesale drug dealers, with the small shopkeepers, pansar stores, hakims relying on wholesalers for their supply and more than 250 plant species of medicinal plants are being traded (Aslam, 2006). Normally cultivators and collectors of medicinal plants bring their produce to the nearest market, where it is sold to wholesalers directly or through the middlemen normally known as commission agents. Mostly dry materials are used in trade and these materials are transported to the bigger city markets to the wholesalers and from there the materials are either stored for export or sold out to retailers or supplied to the manufacturers. Sometimes, the demand comes from wholesale dealers who inform their agents for organizing the collection of the required materials. The agents contact small traders to send these items to wholesale dealers for purchase through commission agents. There are approximately 319 large wholesalers operating in the markets located in main cities such as Peshawar, Lahore, Karachi and Quetta (Aslam, 2006). Additionally, the produce markets are also located in some smaller towns, as they are close to medicinal crop cultivation areas. Most of the trade remains unorganized and informal and record keeping is poor.

According to Pakistan Forest Institute survey the species of medicinal plants sold in Peshawar herbal markets are generally obtained from District Swat, Lahore, and Afghanistan. Peshawar market also supplies some imported medicinal and aromatic plants to District Swat and Afghanistan for local uses. The market receives large quantities of herbal materials from District Swat which is then supplied to Lahore. Majority of the dealers in Lahore herbal market are trading crude herbs imported from India. Over 50% of materials traded in Lahore are of Indian origin, and this is mainly due to cross border trade via train. The Lahore herbal market acts as a hub of national trade of medicinal plants. It is not only catering to the needs of smaller markets in various cities and towns of the province of Punjab but also supplies considerable quantities of materials to the Karachi market. The market survey by PFI, (2018) also indicated that MPs/herbs in quantity of almost 5760 tonnes worth of PKR 271 million have been traded in Peshawar, Lahore, Rawalpindi and Swat markets during 2017-18. The middlemen of the medicinal plants trade usually bring the materials from District Swat to Lahore. Most of the crude MPs items traded in Karachi markets are obtained from the Lahore market. However, a few agents also bring the material directly from up-country, including District Swat. Prices of various items in Karachi market are generally 10-20% higher than Lahore, reflecting higher transportation, higher labor costs, and profits of additional middlemen. Rawalpindi is another market for medicinal and aromatic plants from District Swat. Both the Lahore and Karachi herbals markets are the major source of materials to the large national herbal pharmaceutical companies. These companies generally purchase materials through middlemen or so-called suppliers from these main markets.

The MPs products trade is very multifarious throughout the world, with each region or each country having its own prerequisites for bringing those products in the market. The classification of the products may also vary widely among the different countries. In one country an herbal substance may be classified as medicine, in another as food. In a meeting on methodologies for quality control of finished herbal products, held in Ottawa, Canada in July 2001, the entire process of production of herbal medicines, from raw materials to finished products, was reviewed (WHO 2002). It was recommended that WHO should give high priority to the development of globally applicable guidelines to promote the safety and quality of medicinal plant materials through the formulation of codes for good agricultural practices and good collection practices for medicinal plants. It was envisaged that such guidelines would help to ensure safety and quality at the first and most important stage of the production of herbal medicines. Within the overall context of quality assurance, the WHO guidelines on Good Agricultural and Collection Practices (GACP) for medicinal plants are primarily intended to provide general technical guidance on obtaining medicinal plant materials of good quality for the sustainable production of herbal products classified as medicines. They apply to the cultivation and collection of medicinal plants, including certain post-harvest operations. Raw medicinal plant materials should meet all applicable national and/or regional quality standards. The guidelines therefore may need to be adjusted according to each country's situation. Food and medicine often require different quality approaches, as the quality assurance systems used for food is HACCP (Hazard Analysis and Critical Control Point). In case of medicinal plants, the systems to be followed is that recommended by WHO, (2003) which is mainly concentrated upon Good Agriculture, Collection and Processing Practices (GACP). To comply these quality standards are the basic requirements for entering international trade particularly with developed countries markets. China, the Republic of Korea, Chile, India, Brazil and Thailand are the developing countries with a long tradition of use of medicinal plants and are also major exporting countries. Exports are predominantly in raw material form and only to a lesser extent finished product. With their large populations and ancient heritage of traditional herbal-based medicines, China and India are two of the world's largest markets for medicinal plants, though not necessarily the largest traders. The main importing countries are China, Hong Kong, US, Japan and Germany. The Germany is the leading importer within Europe because its pharmaceutical companies are major players in the world market. During last few years, the medicinal plants were predominantly exported to Germany, Switzerland, USA, and other European countries.

The Pakistan has huge potential of medicinal plants, but regrettably there are no set standards for the trade as well as the cultivation of the medicinal plants according to GACP and international standards that qualify for competitive advantages in the international market. According to a report by USAID and IFPRI (2013), Pakistan exported high value plants to different countries worth of over US$10.5 million annually in 2012, and the import of herbal material as a whole was having value US$ 130 million annually. The major supply of MPs materials was from District Swat, but its market share had declined due to its unreliability and inferior quality of the material supplied, length of the supply chain, and poor marketing strategies. According to various stakeholders, Pakistan is involved in the exports and imports of substantial amounts of MPs material with more than 70 countries. Karachi (Jodia Bazar) and Lahore (Akbari Mandi) provide main source for MPs export. The destination of exports includes Germany, USA, Middle East, Switzerland and many other countries. Export of crude herbal items to different countries is largely through individual and local exporters of Karachi and Lahore. The herbal market of Lahore acts as a main hub and receives very large quantities of imported herbs from India and more recently China. Other sources of imports include Thailand, Indonesia, Tanzania, Iran, and Afghanistan. An increasing market trend of imports has occurred, particularly from India, China, Iran and Afghanistan because of short supplies from local sources. The report of USAID and IFPRI (2013) also highlighted that the foreign trade through unconventional routes, including cross border exchanges, is often unmonitored and is part of the undocumented economy of the country. The global trade value of medicinal plants, currently it is estimated over US$ 60.0 billion and it is expected that it will grow to 5.0 trillion by the year 2050 (Karki, 2002) due to increasing trends in their demand. Trade in medicinal plants is growing in volume and in exports. It is estimated that the global trade in medicinal plants is US$ 800.0 million per year. In the United States the market is huge and worth over $500 million, whilst France and Germany are substantial markets. It is estimated that Europe, annually, imports about an average market value of US$ 1 billion from Africa and Asia. In Pakistan, national and multinational pharmaceutical companies import raw material of spices and medicinal herbs. During 1999, bill on the import of medicinal plants was worth of value US$ 31.0 million whereas it exported medicinal plants of only US$ 6.0 million (EPB, 1999). The export of medicinal herbs is not compiled separately by the Federal Bureau of Statistics. Therefore, it is difficult to record export levels or trends of export. However, the data collected from Export Promotion Bureau of Pakistan for the year 1999 indicate a huge imbalance between export and import of Pakistan regarding medicinal plants. According to data collected from leading manufactures, it has indicated that excluding crude herbs they have exported their products worth value of US$ 3-4 million. Hamdard Laboratories is one of the leading stakeholders.

According to Ali et.al. (2012) huge market demand for raw and semi-processed MPs both within and outside the country imposes considerable ecological pressure on natural habitats. The populations of many medicinal plant species are rapidly declining with increasing degradation of the natural habitat. However, due to the issues of erratic demand and irregular supply of MPs, the trade has not been able to be properly and effectively established. To ensure the potential value of medicinal plants as a livelihoods option for communities require radical shift in focus and resetting of priorities at the policy and management levels. While the IUCN (2006) through its project MACP has done a good job in helping communities realize the importance of MPs resource, it has also brought to the surface several generic issues requiring the collective attention of the public and corporate sectors and civil society.

Cultivated material is more suitable for large-scale uses. Argentina, China, Hungary, India, Poland, and Spain are examples of countries that cultivate some materials on a large scale (Mebrahtu et.al 2016). Requirements of successful commercial cultivation operations are to produce high quality drugs using low input cultivation methods while recognizing that the material has to compete on a highly competitive international market. Medicinal plants are valuable for global interest due to their employment to find out new drug resources. More than 1300 medicinal plant are directly used for health care and out of these about 90 % of the plant resources are collected through natural ways (Nalawade et al. 2003). In United States of America, 118 out of 150 prescribed drugs are prepared in industries totally relying on natural resources. Moreover, in developing countries, about 80 % of the ruler communities rely on naturally occurring medicinal plants for their primary healthcare Chen et al. (2010). More than 25 % of the herbal drugs are prepared through medicinal plants every year based upon wild resources (Hamilton 2004). In last few decades, there has been a considerable increase in the demand of medicinal wild plant for the preparation of natural drugs, metabolites and natural health products (Black et. al. 2015). The trade of medicinal plants has increased rapidly in recent decades. According to an estimate, during 2002, world trade of medicinal plants was nearly 1034 million US$. Nearly 70,000 plant species were used in medicines worldwide. The largest global markets for medicinal plants exist in China, Germany, France, Japan, Italy, UK and USA. In the United States, the trade of medicinal plants is observed with 10% increase annually and more people are attracting towards herbal medicines. Vasisht et.al. (2016) calculated from the global export data on MPs for the year 2014 is estimated at US$ 33 billion. The average global export in medicinal plants under HS 1211 for the fourteen-year period was US$ 1.92 billion for 601,357 tonnes per annum and for the year 2014 it stood at 702,813 tonnes valued at US$ 3.60 billion. Conclusion: For the studied period, an annual average growth rate (AAGR) of 2.4% in volumes and 9.2% in values of export was observed. Nearly 30% of the global trade is made up by top two countries of the import and export. China and India from Asia; Egypt and Morocco from Africa; Poland, Bulgaria and Albania from Europe; Chile and Peru from South

America are important supply sources. The USA, Japan and Europe are the major consumers of the world (https://agrihunt.com). In term of trade value, total global trade in MAPs has increased more than two and half times in past 18 years. Top export countries are China, India, Hong Kong, USA, Germany, Rep. of Korea, Canada and Poland while top destinations include USA, Hong Kong, Japan, Germany, and France, Rep. of Korea, China and Singapore Himanshu et.al (2017). The study suggests five major trade centers of MPs worldwide viz. USA, Hong Kong, Germany, Rep. of Korea and China. One of the most traded MPs based commodity is ginseng roots, its largest supplier is Canada and Hong Kong is the top destination.

In United States the trade in medicinal plants is continuously emerging with 10% annual increment and more and more people are attracted towards applications of herbal medicines. Currently, USA, China, France, Japan, UK and Italy are considered to be the largest global markets for medicinal plants. The global market for botanical and plant-derived drugs was therefore expected to increase from $19.5 billion in 2008 to $32.9 billion in 2013, an annual growth rate of 11.0%. With this growth rate, it is estimated that the annual trade in medicinal plant will reach $5 trillion by 2050 (http://afcindia.org.in). Over 80 percent of world's populations meet their healthcare needs through traditional medicines. The current level of international trade in medicinal plants is estimated to be in the order of US $ 62 billion per year and likely to grow up to US $ 5 trillion by the year 2050 with an annual growth rate of 7-15 percent. The largest global markets for medicinal and aromatic plants are China, France, Germany, Italy, Japan, Spain, UK and the US.

The WHO, 2002 has estimated the demand for medicinal plants is approximately $14 Billion per annum and the demand is growing at the rate of 15 to 25% annually. The WHO also estimates that by 2050 the trade will be up to US$ 5 Trillion. The Secretariat of the Convention on Biological Diversity values the annual global export of MPs at US$1.2 billion (based on customs value declarations — the real situation is likely to be higher, based on actual invoiced prices). Some 30 percent of the drugs sold worldwide contain compounds derived from plant material (FAO, 2005). In another report the Secretariat of the Convention on Biological Diversity, global sales of herbal products have an estimated US$ 60 000 million in 2000. As a consequence, the safety and quality of herbal medicines have become increasingly important concerns for health authorities and the public alike (FAO, 2009). There is a global need to cultivate medicinal plants (MP). In Russia 50,000 tonnes of medicinal plants are used annually of which, 50% are cultivated. In India (Lakhnow) medicinal plants worth Rs.90 million are grown annually. As such, cultivation becomes necessary when there is a demand. For example, European Union (EU) uses 3,000 kg of *Glycerrhiza* each year for which 400-ton plant roots are needed. Take the example of our neighboring country China where in the year 2000, the total output value of the pharmaceutical industry was 233 billion Yuan (28 billion US$). By the year 2010, the share of traditional Chinese medicine in the international market of herbal medicine is projected to improve to 15% from the existing 3%. Although individually small contributors to output, the importance of these MPs in total is evident from the fact that in 2006, their global trade reached US$ 60 billion (Hamilton 2006). Europe alone annually imports about US$ 1 billion in MPs from Africa and Asia. Such trade is expected to expand substantially by the year 2050 because of the increasing popularity of herbal medicines (Al-Quran, 2008). But unfortunately, in Pakistan not enough emphasis has been given to cultivation of medicinal plants (Sher, 2009) though country is blessed with an altitudinal range from 0 - 8611 m, hence having variety of climatic conditions at a given time and a number of MPs could be cultivated.

The cultivation of medicinal plants is more difficult than usually suggested in the scientific literature and governmental promotional material. While these agencies exaggerate the potential economic benefits of cultivation, they underplay the difficulties involved in the cultivation of plants which have not been domesticated. It is important that agencies and NGOs involved with the cultivation of medicinal plants fully take these difficulties into account, and take steps to remove these (Alam and Belt, 2009). The project also has some lessons for the development of value chains in general. These include: a thorough assessment of the technical and economic feasibility of the chain to be developed; understanding of the prevalent farming system which will have an impact on the performance of the chain; ability to undertake long term involvement to ensure the success of the chain. It was found that the cultivation or production of medicinal plants could play an important role in improving the livelihoods of poor or extremely poor people owning meager strips of land Alam and Belt (2009). They argue that in order to sustain growth in medicinal plant production, a fair distribution of the gross margin to the primary producers is necessary. In the value chain system examined, it was found that downstream buyers, especially manufacturers and consumers pay most of their money for intermediaries' value additive opportunistic pricing due to inherent weaknesses in the chain. It is suggested (Shahidullah and Haque, 2010) that a vertically integrated chain, with only producers and processors as commercial actors and NGO's as promoters could create an economically robust system which will benefit the many rather than the few. There exists good potential for small scale farmers to grow plants on a contract farming basis for such large firms at national and international level if some government agency play role to bridge up trade relation between both. As a result, the expanding interest in MPs, new income generating opportunities are opening up for rural populations and in particular for small-scale farmers. Medicinal plants can assist in supporting farm households with income generating activities, can provide a 'safety-net' if other anticipated incomes fail, and overall can help the rural economy by contributing to subsistence medicine and health care provision (FAO, 2005).

Ispaghol (Plantago ovata) is economically an important medicinal plant commonly cultivated in different parts of India, Pakistan and Iran and some part of Europe. It has a long history of traditional uses with healing properties. There are various applications of seed husk and its marketable products for medicine and industrial uses. The Ispaghol husk has a potential role in the treatment and prevention of gastrointestinal and bowel diseases. In Pakistan its seeds are considered as cooling and diuretic in functionality and accredited for their usefulness in healing of diarrhea, constipation and for gastric problems when decoction of dried seeds taken orally and externally (Zahoor et.al 2004). The intent of this review was to highlight the industrial uses of Ispaghol for the food products and therapeutic purposes. There is also considerable interest of local people, scientific communities and industries in the medical and food supplement application with specific health benefits. Ispaghol is a valuable herb extensively used for its medicinal properties all over the world. In Pakistan it is cultivated in Hasilpur and Chishtian tehsils of Bahawalpur Division, having very low rainfall. It also grows wild in the salt range and the desert areas of Punjab. Hasilpur is hub point for trade of Ispaghol seed and husk. Aslam, (2008) reported in details that about 50 small cottage husk processing units are working in Hasilpur. The cost of converting 40kg of Ispaghol seed into its husk involves Rs.1800 to 2000 and the price of the husk is ranging from Rs.15000-20000/40kg. The report (Aslam, 2008) emphasized that to introduce state of the art processing technology and machinery is inevitable for the prosperity of Ispaghol in its cluster. It could be designed and manufactured locally or imported from abroad. Such husk processing units are available in India. Promote improved production technology/Good Agricultural Practices to enhance production of Ispaghol. Ziaullah *et.al.* (2014) conducted experiment at Cholistan institute of desert studies (CIDS) to explore the germplasm variability among 47 accessions of *P. ovata* obtained from IABGR, PARC. Considerable variations were observed in five agro-morphological traits i.e., plant height, leaf width, length of ear, number of tillers per plant and number of seeds per ear. Among all test entries, the accession number 20555, 20671, 20666 and 20673 were found to be best in terms of all the parameters studied. These accessions may also be propagated in their original habitats to increase their productivity. Rehana et.al (2015) based on commercial and medicinal importance of Plantago ovata, concluded that the cultivation and the improvement of culture technologies of this crop at large scale is utmost necessary for need of present time. Thus, it may become a profitable agro-practice for the local people and farmers of that area in the context of developing policy for connecting crop production with the suppliers for industry. The plant has been cultivated in India and Pakistan from century ago and traditional knowledge access is an asset easy to be explored. Keeping in mind the wide industrial application as well as the increased market demands, appropriate method of cultivation and advance techniques needs to be developed to enhance the yield and the quality of seeds and to get over the traditional process of milling the seeds. On the other hand, seeds may be used for preparation of high valued commercial products. It is desirable to explore the possibilities of intensify cultivation and yield of crop other than arable land which is not suitable for the cultivation of food crops.

The medicinal and pharmaceutical application of Plantago ovata, has a high value of market demand (Modi at el.1974). In view of increasing market demand, cultivation of this plant at country level or worldwide is utmost important for uplifting the economy of a country. According to scientific report (Anon, 1982) USA is the chief importer of Ispaghol seeds and husk and consumes annually 8,000 metric tonnes which indicate the market value of this crop all over the world. This continued expansion of interest and market seems like due to natural dietary fibers. The crop has a large export demand in USA and Western Europe and about 90% of the production is exported to these countries. Ispaghol can be used in food and beverages industry as a substitute, thicker and binder such as in health drinks, beverages, ice cream, bread, biscuits, other bakery products, rice, cakes, jams, instant noodles, breakfast cereals etc., in order to improve the fiber content of the food and to increase the bulk of the food with various health benefits. The remains of seed husk around 69% (Anon, 1989) by weight of the total seed crop can be used as cattle and a bird feed with no adverse or side effects on them. Lokesh, (2014) conducted fifty demonstrations of Plantago ovata crop during two years 2009-11 at farmer’s field against traditional or farmers practice in India (Rajasthan). Grain yield of Ispaghol variety RI 89 under improved practices was 8.25 q/ha and 8.32q/ha and increased significantly by 27 and 25 per cent over farmers practice. The farmers gain an additional return of Rs 6713/- and 6050/- against an additional investment of Rs 1500/- and 2300/- during 2009-10 and 2010-11, respectively. Most of farmers welcomed the technology but availability of inputs like improved seeds, plant protection particularly seed treatment chemicals, non-shedding variety, high cost of inputs were found major constraints behind lower cost of produce just after harvest.

Processing of husk from seeds is done by grinding and then purified by sieving the mixture to separate the husk from the remainder of the seed parts or by blowing the husk away from the impurities. The traditional Ispaghol de-husking process is very dusty and low capacity The Indigenous Ispaghol machinery can process 2-3 tones Ispaghol seed per day (single shift of 10 hours) and the recovery of Ispaghol husk is about 20-25 percent and post-harvest processing is usually the most critical stage in determining the end quality of the product (Aslam, 2008). Pakistan Agricultural Research Council (PARC) of Ministry of National Food Security and Research has developed an advanced Ispaghol husk processing machinery for the first time in the country. The machinery has the capacity to process Ispaghol of up to two tonnes per day, and half ton of good quality husk per day in single shift free of chemicals and impurities. PARC scientists informed that it has the capacity to process 400 kilograms of Ispaghol per hour (PARC, 2018).

In the international market the quality demanded requires to comply with food safety and quality through certification of ISO 9001:2000 standards. There is also demanded to maintain quality assurance to ensure that the product is in conformity with CGMP (current good manufacturing procedures), SSOP (sanitary standard operation procedures), HACCP and ISO standards (http://www.satnampsyllium.com/). According to http://www.psylliums.com, the U.S. currently imports and consumes approximately 8,000 metric tonnes of Ispaghol husk annually. In India, Gujarat state contributes 35 percent of production of husk in the world. A continued expansion of this market seems likely due to the high level of interest in natural dietary fibers. India dominates the world market in the production and export of psyllium. India provides approximately 80 percent of the psyllium available in the world market. India is the largest producer of Ispaghol and exports seed and husk worth Rs 25 million annually. Husks and Industrial Powders are exported in countries such as U.S.A., U.K., France, Germany, Japan, Indonesia, Canada Mexico Sweden, Spain, Norway, Italy, Australia Denmark, Korea, Pakistan and Gulf countries and some other small countries. Main share of U.S.A. is 60% of world demand. About 90% of the gross production of Ispaghol in India is exported, with nearly 93% of the export being of husk. The largest buyer of Ispaghol from India is the United States, accounting for around 75% of the total husk exports from India. Germany is the largest single importer of seed. Seeds and husks of Ispaghol are also used widely in pharmacology as laxatives. Interest in Ispaghol has risen primarily due to its use in high fiber breakfast cereals and from claims that it is effective in reducing cholesterol. The World Health Organization (WHO) has estimated that more than 80% of world population in developing countries depends primarily on herbal medicine for basic healthcare (Meena *at. el.* 2015) and India ranks first in Ispaghol production (98%) and the sole supplier of seeds and husk in the international market

According to SAGP (2016), Ispaghol is grown in Umerkot, Jamshoro, Mirpurkhas and other districts of Sindh and crop remains in the field for four months in winter season. There is no regular and complete crop statistics of Ispaghol. However, as per unofficial data, in 2014, Ispaghol was cultivated on 3200 acres in Umerkot, Samaro, Kunri and Pithoro talukas, which rose to 5000 acres in 2015. This crop could better grow in Sindh as a cash crop, under water shortage conditions. Pakistan imports a large quantity of Ispaghol from neighboring and other countries. There is ever-increasing demand of Ispaghol husk in the country. As against significant economic importance of Ispaghol in Sindh, its full potential has not been realized because of lack of required technology and investment in Ispaghol production, processing and value-addition. There are no mechanical threshing and cleaning units near the plantation areas. Therefore, there is need to conduct detailed feasibility study on all aspects for the development of Ispaghol crop and its supply and value chain development in Sindh.

Cumin (*Cuminum cyminum*) is an annual herbaceous spice cum medicinal plant. The total area under cumin is around 0.76 million ha with the production of 0.49 million tonnes during 2016 - 17. A total volume of 0.119 million tonnes of cumin was exported from India in 2016 – 17 (Verma *at. el.* 2018). Cumin seeds are used in cooking and the oil is used to flavor food and scent cosmetics. In system of medicine, dried cumin seeds are used for therapeutic purposes. It is known for its activities like enhancing appetite, taste perception, digestion, vision, strength and lactation. It is used to treat diseases like fever, loss of appetite, diarrhea, vomiting, abdominal distension, edema and puerperal disorders. The typical pleasant aroma of the seeds is due to their volatile oil content, the principal constituent of which is cumin-aldehyde. Cumin is believed to be native of Mediterranean region, mainly cultivated in India, Egypt, Libya, Iran, Pakistan, Mexico and Japan. Cumin has been cultivated in few countries such as India, Pakistan, Turkey, Iran, Egypt and Spain. It is one of the oldest and economically most important spices. White cumin grows wild in mountainous areas of various countries such as Iran, Turkmenistan, Afghanistan and Pakistan. Cumin is growing in Balochistan on an area of 6048 ha with the production of 2745 tonnes in districts Kalat, Kharan, Noshki, Chaghi, Quetta, Mastung, Pishin and Killah Saifullah. Leading districts are Kalat 2000 hec, Kharan 1698 and Noshki 1055 he.

The world production of cumin in 2012 was estimated to be around 300 thousand tonnes. India is the largest producer and Cumin seed contributing 73% to the global production. Other major producing countries of cumin are Syria, Turkey Iran and china. As per the production data for 2012, India's share is 73% to global production, while that of Syria, Turkey, China and Iran has been 16%, 4%, 4% and 3% respectively. Global Cumin Seed production is around 200-215 thousand tonnes and the major producers are India 77%, Turkey 9%, Syria 5% and others 9% (Egypt, Pakistan etc.). The total area under cumin is around 0.76 million ha with the production of 0.49 million tonnes during 2016 - 17. In total, around 300,000 tonnes of cumin per year are produced worldwide (https://atlas.media.mit.edu). The top exporters of Cumin seeds are India ($283M), Syria ($46.1M), Turkey ($27.8M), the United Arab Emirates ($13M) and Afghanistan ($11.9M). The top importers are Vietnam ($92.4M), the United States ($41M), Bangladesh ($32.9M), Egypt ($20M) and the United Arab Emirates ($17.8M).

According to Javid and Raissi (2017), Cumin is mainly cultivated in India, China, Saudi Arabia and neighboring countries of the Mediterranean. This crop has many uses in the pharmaceutical, food and cosmetics industry. Due to its flavor, cumin seed powder can be used as an additive in various foods, and it is the second most popular spice in the world. This plant is traditionally used in the treatment of dyspepsia, diarrhea, toothache, digestive disorders and to increase breast milk and as a disinfectant. Cumin seeds contain 2 to 5% essential oils, and the composition of it depends on many factors including the time of harvest, method of extraction, type of cultivar, geographical origin and storage conditions. According to Nadeem and Riaz (2012), the most important chemical component of cumin fruits is essential oil content, ranging from 2.5% to 4.5% which is pale to colorless depending on age and regional variations. Cumin is native from the east Mediterranean to East India.

In consultation meeting cumin farmers, they reported to intercrop cumin with onion crop. During a study in Iran, Rezvani et al. (2014), found that planting of cumin in fall season produced the greater seed and essential oil yield compared with spring. The superiority of fall planting to enhance cumin seed yield production over all other treatments was attributed to more control of disease. Even though seed yield of cumin was reduced by intercropping system due to lower density of cumin in intercropping system, the advantages of intercropping system for seed yield formation were verified by greater values of LER. Additionally, decreasing of infected plants percentage under this system demonstrated a potential of intercropping to control of disease. They concluded that using ecological management such as intercropping system and selection of best planting time could be an effective approach to reducing of cumin injury caused by diseases. In a study on cumin sowing date Tahmneh and Ghavidel (2011) recorded the highest seed yield between different dates of planting was obtained from 27 December treatment equal to 1487.9 Kg/ha. It was also the highest one between different levels of irrigation was obtained from complete irrigation (I1 treatment) equal to 1128.43 kg/ha. Also, according to interaction effects, the highest seed yield was obtained from treatment of planting date of 27th December and complete irrigation equal to 1876.26 kg/ha. So, according to the results of this experiment planting at end of each year and complete irrigation led to high performance of cumin plant.

The current world market value of the herbal medicine trade stands at US$71 billion and is expected to increase to about US$120 billion by 2024. The potential to generate extra revenue from the medicinal plant industry if it could leverage its endowment in forest resources to cultivate on a commercial scale, medicinal plants for the world market (https://www.businessghana.com).

The various review reports have concluded that research and development in medicinal plants is an overlooked sector in Pakistan. There are a number of opportunities to expand and effectively utilize this sector through research, development, conducive government policies and regulations, public awareness and adopting good agricultural and collection practices according to guidelines provided by WHO and FAO. It will help in mass production of MPs with sustainably establish a medicinal plant industry sector to support the economy. There are a number of other studies on the cultivation of MPs, however, in the country overall cultivations, processing and trade of medicinal plants is facing a number of constraints, which mainly results in reducing their competitiveness in global markets. These constraints have to be alleviated for the prosperity of the MP sector as whole and clusters under study explicitly: -

• Poor agricultural, cultivation, Harvest, Post-harvest and collection practices.

• Lack of research on development of certified and registered high-yielding varieties.

• Inefficient processing techniques leading to low yields and poor-quality products

• Poor quality control procedures

• Snags in marketing system and lack of local market for primary processed products

• Lack of access to latest technologies and market information.

5. CLUSTER IDENTIFICATION AND CHARACTERIZATION

Keeping in view the clusters development strategy, Ispaghol (*Plantago ovata*) and Cumin (*Cuminum cyminum L.*) are selected commodities for the cluster development. Ispaghol cluster can be developed in Cholistan, Punjab (Hasalpur, Harunabad and Chistian tehsils) and Cumin cluster in Balochistan (Kalat, Karan, and Nushki districts). It is important to mention that due to lack of official system for collection of data on area and production, most of the data used in the cluster specification are based on referred data and consultative survey. Following is the details specifications of the clusters for Ispaghol in Cholistan, Punjab and Cumin in Balochistan.

5.1. Specifications of Cluster

5.1.1. Ispaghol (Plantago ovata)

The cluster under study is located in the Cholistan eco-regions of the Punjab encircled on 3 Tehsils adjacent with each other i.e. **Hasilpur** (district Bahawalpur), **Haroonabad** and **Chistian** (district Bahawalnagar). The cluster is located between 71-73°- 41´ East longitudes and 29°-20´ North latitudes with a mean sea level of about 384 ft. The climate of the cluster area is predominately desert in nature which is called the Cholistan. The climate of cluster is extremely hot and dry in summer and cold and dry in winter. Dust storms are frequent during summer months. The annual precipitation is 125-200 mm which usually occurs during monsoon months of July and August. Average rainfall is less as the district is located at the tail end of monsoon region. The winter rains are received in the month of January and sometimes in February. However, during the consultative meetings farmers told that due to climate change the rains are usually occurring in March/April and damage Ispaghol crop very adversely. The farmers are gradually declining the area under Ispaghol and crop is shifting towards Sindh province in the other end of the Cholistan desert.

In the consultative process with various stakeholders of Ispaghol, information was collected about cultivation, harvesting, threshing, processing and marketing of the product. Majority of the farmers in the cluster areas were having small holdings and they are owner of small landholding and almost 75% of the farmers informed to have land holding size of 5-10 acres. Most of the growers of Ispaghol belong to choona area, tail of Fateh canal and Cholistan deserts. Farmers were not well aware about the modern production technologies regarding cultivation of *Plantago ovate*. Most of the farmers were poor and were reluctant to take the risk of cultivation of Plantago ovata by buying new seed even of good quality and to follow technical guidance. It may be mainly due to the fact that farmers claim that there is no activity of agriculture extension in the areas about the awareness of cultivating of Ispaghol. Farmers grow this crop under the area where no other winter crop could be grown due to shortage of water.

The crop is cultivated on marginal, light, well drained sandy loam to loamy soils. The water standing in the field for longer time damages the crop. The optimum sowing time is from the month of November to December. The seed use varied among farmers from 2-4 kg/acre but majority reported 2.5 kg/acre. All the sowing is done using seed broadcasting method and majority of the farmers (more than 95%) were using seed for sowing kept from previous crop. One moderate irrigation is applied by some farmers. Majority of the farmers informed to use no chemical fertilizer to Ispaghol crop whereas some progressive farmers were using I bag DAP and one bag urea per acre. Ispaghol is a Rabi crop. Ispaghol remains in the field for 4-5 months and is harvested in manually in months of March-April. It was observed that 90% farmer's seed yield varies according to soil and climate conditions and inputs used. The seed yield obtained by the farmers varied between 500 to 850 kg/ha, however most of the farmers were getting on average around 650 kg/ha. Major threat to the crop was incidence of rainfall at the time of seed formation. The grain shattering in case of over ripening of the crop also resulted in seed yield losses. There is no storage facility or technique to store Ispaghol seed. Farmers take their produce to Hasilpur grain market (ghalla mandi), because it is the hub point for trade of Ispaghol seed and husk. According to almost all stakeholders, the productivity as well as quality of the Ispaghol is not being achieved and the existing potentials is not harnessed due to lack of better varieties, improved production technology, poor marketing, processing and negative impact of climate change. The farmers also informed that in the cluster areas farmers are somewhat reluctant to cultivate Ispaghol crop due to climate change, because now un-usual rains occur at the time of its harvest which damage the crop very severely. On the other hand, in case of drought conditions, the seed shattering is a problem. Farmers also informed that the crop is now shifting to the parts of Sindh province as there is water scarcity and less rains. During consultation the stakeholders of Ispaghol processors has emphasized that it is more important is to establish crop in the area with improved varieties suitable to climate change to save their business. The introduction of new de-husking processing units is their second priority.

Figure 1: Ispaghol (Plantago ovate) Cluster in Cholistan Punjab

5.1.2. Cumin (Cuminum cyminum L.) Cluster)

Keeping in view the pivotal position of Balochistan in cultivation of cumin due to suitable climatic conditions, the main cumin cluster identified will be comprised of three (03) districts i.e. **Kalat, Karan, and Nushki**. Based on data from 2013-16, about 79.1% (5000 Ha) of total cumin area in the Balochistan is occupied by this cluster and the cluster contributes about 77.7% (2195 tonnes) towards the total production of Balochistan. The average productivity of cumin in the cluster is about 0.46 tonnes/ha. Cumin in the cluster is grown as rabi crop and it is adopted well in sub-tropical climate. The geographical location of the cluster district Kalat lies between 65°49'50"-67°27'56" East longitudes and 27°55'55"-29°37'43" North latitudes with aerial distance of 810 Km. The climate of the district is mild in the summer and extremely cold in the winter. The total mean rainfall is 193 mm. Karan district of this cluster lies between 64°41'46"-66°09'47" East longitudes and 27°59'17"-29°20'59" North latitudes with aerial distance 910km. It is consisting of 02 Tehsils and 7 Union Councils. The climate is dry and dust storms are common throughout the year. During the summer season, the days are hot and nights are very pleasant and cool. The winter is dry and cold. The annual average rainfall in the district is 104 mm and the average minimum temperature was 2.4°C in January and the maximum temperature 42.5°C in July. Nushki district in the cluster lies between 65°07'42"- 66°18'45" East longitudes and 29°01'51"-29°52'37"North latitudes with 810km aerial distance. It is consisting of 1Tehsil and 10 Union Councils. The climate of the district ranges from extreme hot in summer to severe cold in winter. The rainfall is irregular and scanty. The cluster is equipped with three main sources of irrigation including tube wells, dug wells and Karezes/ spring are commonly used in the district. Privately owned tube wells are maintained by the owners themselves, whereas, the government owned tube-wells are maintained by the Irrigation Department. Majority of the crop cultivation area is irrigated by means of tube wells which make 70% of the total irrigation sources followed by wells sharing around 25%, Karezes/ springs contribute only 3-4% of irrigation in the districts. The crop is best suited for sandy soil and it is prevailing in the cluster.

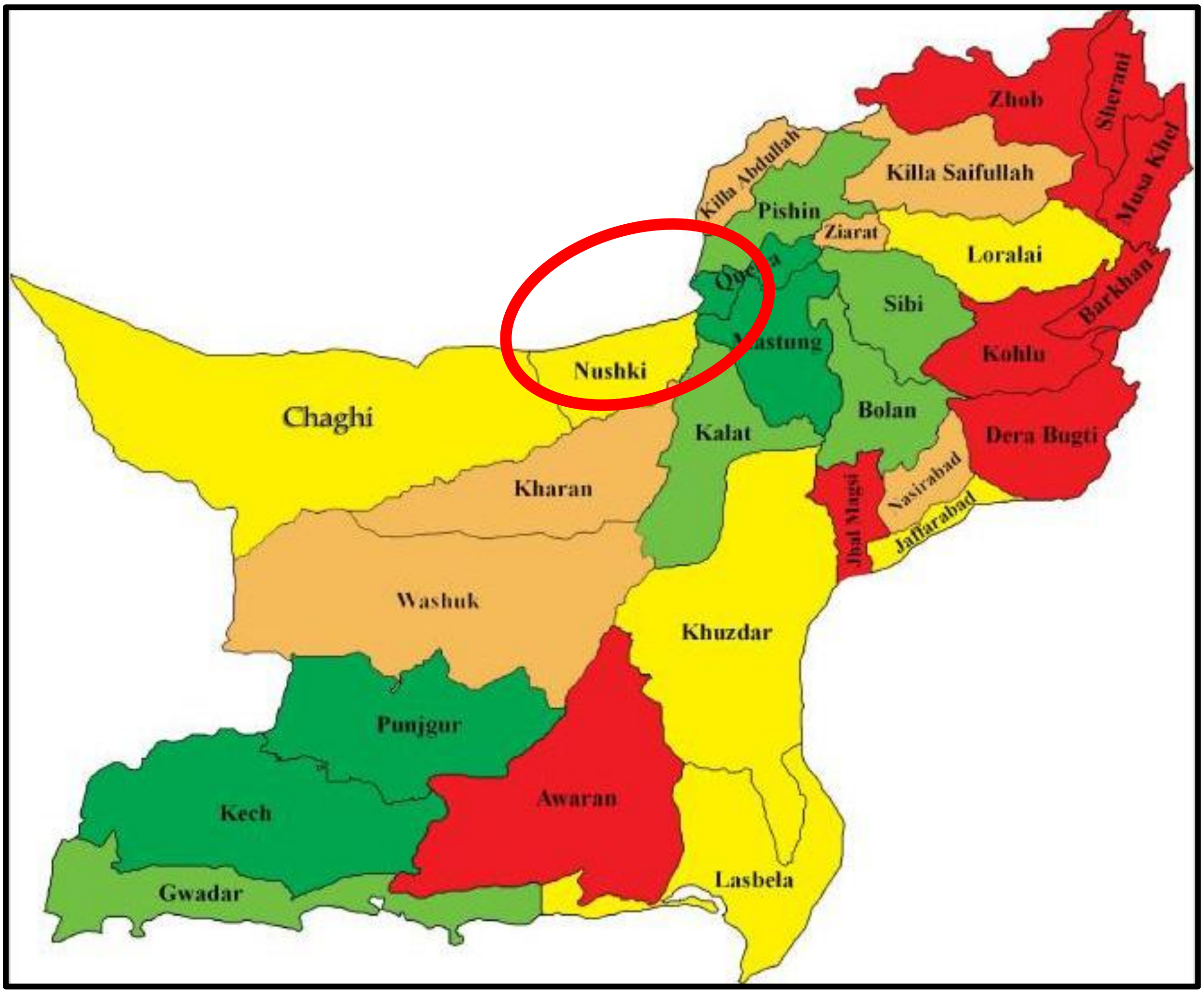

Figure 2: Cumin (*Cuminum cyminum L.*) Cluster Balochistan

In the cluster only, a few influential landowners possess large agricultural land. Overall, the land owners have a piece of land for cultivation, which is generally 10-15 ha. Large holding owners give their land on lease or on contract for cultivation. The harvest is shared equally between the contractors and landowners. Small land owners cultivate their own land with the help of their family members. Women and children also assist their male members in harvesting and cutting of the crops. Some land owners hire labor on a permanent basis for cultivation. Almost all the farmers in the cluster were sowing cumin using broadcast method. The cumin in cluster areas is also commonly intercropped with onion. The farmers reported to use 15-20 kg seed rate per ha. In the cluster, farmers generally sow cumin crop in October-November and crop takes about 4-5 months to reach maturity. The most common varieties under cultivation are un-approved named as local, Irani and local black. Fertilizer applied in case of irrigated crop are DAP 2 bags+ 1 bag SOP+ 1 bags Urea, while in case of rain fed crop no fertilizer is applied. Irrigation interval for irrigated cumin crop is 7-10 days. Weeding is done manually once during crop season. The major problematic disease reported by farmers was Fusarium wilt. Harvesting of cumin seeds starts in the month of end February-March. Farmers have experienced hat cumin crop is highly sensitive to rain, if it occurs during harvesting time (February to March) quality will be badly affected besides quantity damage due to fungal diseases.

According to farmers the average yield of cumin generally obtained is around 550 kg per ha. The agricultural department representative reported that the cumin yield of 800-1000 kg per ha could be obtained in ideal conditions adopting good agricultural practices. The currently prevailing price of cumin reported by farmers was ten thousand per 40kg, however, it varies from time to time. The majority of the farm produce is directly sold into the hands of brokers/dalal/beopari/ contractors or intermediaries, who are all middlemen with different nomenclatures at various locations.

In the current "Cluster" development approach, it has been realized that the cultivation and processing of Ispaghol and Cumin based on GACP guidelines is imperative to upgrade the quality of the product conforming international quality norms for better marketability. The clusters will provide incentives for sustainable development of both crop and bring improvements in the chain from production to trade and also help to boost quality of the product and value addition at farm level as well other segments of value chain.

5.2. Cluster Characterization

5.2.1. Ispaghol Cluster

Ispaghol (*Plantago ovata*) is a valuable herb extensively used for its medicinal properties all over the world. Both dried seeds and the seed husks are demulcent, emollient and laxative and are used in treatment of dysentery, catarrhal conditions of the genitor-urinary tract, and inflamed membranes of the intestinal canal and effective in reducing cholesterol levels in blood. Ispaghol is an important medicinal plant and is cultivated as a minor cash crop in the cluster areas of Cholistan i.e. Hasilpur, Haroonabad and Chishtian. During consultative meeting with farmers it was revealed that most of the farmers (75%) cultivating Ispaghol in the cluster areas were having small holdings of 5-10 acres, about 15% were having 11-20 acres and only 10% farmers were having 25-50 acres or more land. In the cluster almost 93.9% farmers were owner and only 5.8% were tenants and only 0.3% were owner cum tenant.

Farmers were not well aware about the good agricultural practices (GAP) of cultivation of Ispaghol. Majority of the farmers are resource poor and do not want to take any risk of investment on crop due to its sensitive nature to environment. Farmers also reported about non-availability of good quality seed and technical guidance. There is no activity of Agriculture extension about the awareness of cultivating of Ispaghol according to GAP. Farmers grow this crop under the area where no other winter crop can grow due to shortage of water. Ispaghol is a rain-fed Rabi crop which remains in the field for 140-150 days. The crop is grown in marginal, light, well drained sandy loam to loamy soils. It requires a cold climate and dry sunny weather. The optimum sowing time is from the month of November to December. The seed rate ranges from 2 – 4 kg/acre but majority of the farmers use 2.5 kg/ac, seeds rate. All farmers use broadcasting method of sowing. A moderate or light irrigation is applied by few farmers. However, majority (90%) farmers expressed that crop yield varied depending on soil type, climate conditions and inputs. Average seed yield reported by most of the farmers varied from 6 – 10 mond per acre (almost 550 to 1000 kg/ha). The growers of Ispaghol reported to have no storage facility or technique to store seed. They keep/store seed for next crop or some domestic use rest of the produce take to grain market (ghalla mandi), Hasilpur for selling on the prevailing price. Farmers reported that the rate of 2016-17 varied between PKR 3500 – 6000 per mond depending on the selling time and quality of produce. The detail characterization of the cluster can be seen in Annexure 3A.

5.2.2. Cumin Cluster

Cumin is native from the east Mediterranean to East India and is mainly cultivated in India, China, Saudi Arabia and neighboring countries of the Mediterranean. This crop has many uses in the pharmaceutical, food and cosmetics industry. Due to its flavor, cumin seed powder can be used as an additive in various foods. This plant is traditionally used in the treatment of dyspepsia, diarrhea, toothache, digestive disorders and to increase breast milk and as a disinfectant. Cumin seeds contain 2 to 5% essential oils, and the composition of it depends on many factors including the time of harvest, method of extraction, type of cultivar, geographical origin and storage conditions. The most important chemical component of cumin fruits is essential oil content, ranging from 2.5% to 4.5% which is pale to colorless depending on age and regional variations.

The secondary data of cumin crop regarding area and production in the cluster district was available for 03 years only from 2013-16 and collected from Directorate of Crops Reporting Services, Agriculture Department, Balochistan, Quetta. The data have been analyzed for Compound Annual Growth Rate (CAGR) analysis using statistical methods. The data indicated that the cumin crop in the cluster has shown decrease in its area and production by 8% in 2013-16 compared to 2013-14. However, the productivity of cumin remained unchanged over time. It may be inferred from the data that efforts are needed in the value chain to enhance the cumin cultivation and boost the area, production and productivity to stabilize and sustain cumin in the cluster. The detail characterization of the cluster can be seen in Annexure 3A.

5.3. Value Chain Analysis

5.3.1. Ispaghol Cluster

Hasilpur is hub point for trade of Ispaghol seed and husk. In the cluster there were about 50 small crude units are working in Hasilpur which are involved in the de-husking process of Ispaghol. Most of the owners of the de-husking processing unit's owner are resource poor. They take loan from the big dealers or traders of Ispaghol and make a verbal contract. The processors told that they processors according to specifications or demand of the traders. Regarding the quality aspect of processing, the processors do not do or know much and concerns about de-husking of Ispaghol. They are forced to mixed flour of rice and the poly (By-product of Ispaghol) to increase the weight on the demand of traders. Husk making process is very crude method. Processers have old and crude machines. Cleaning of seed is very laborious method and is done by crude unit which is locally called as "Chamba" and almost 50% labor and time is consumed on cleaning process. There are about twenty steps involved in the husk making process, Color of husk become brown due to long process. The quality standard of husk is white and soft. It was observed that people are mixing zinc-sulphate as a whitening agent to meet the international standards. Different forms of rice adulteration were also reported.

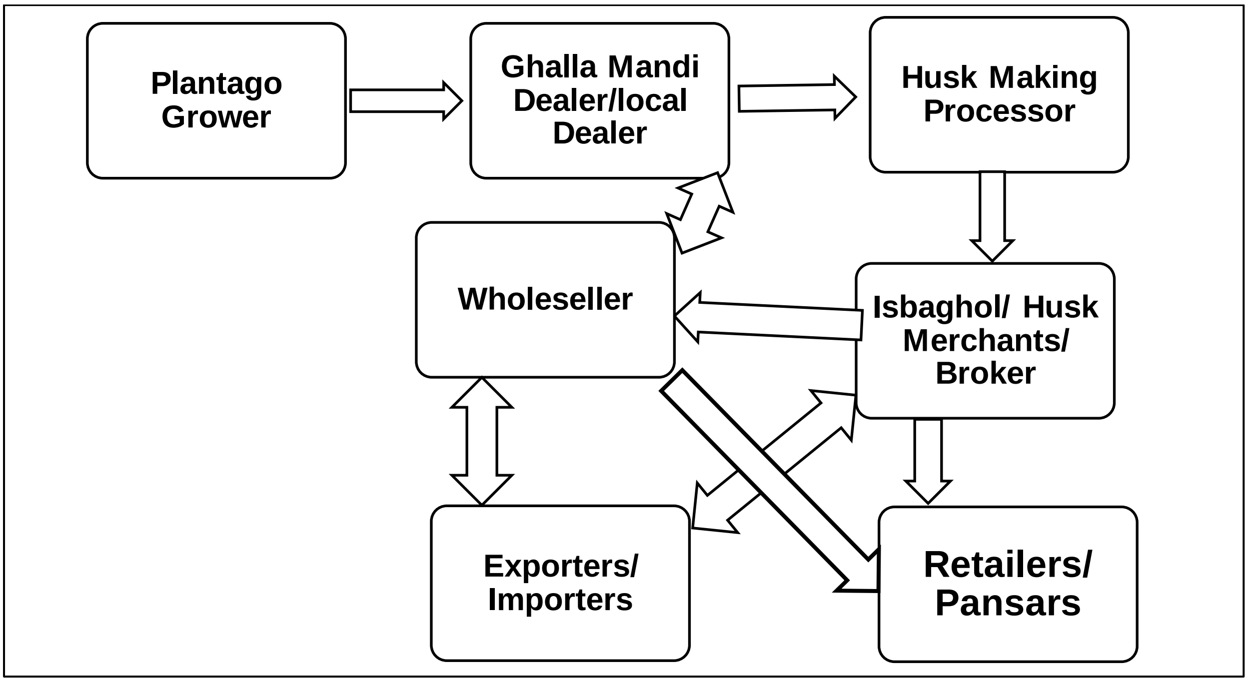

Figure 3: Ispaghol Value Chain with Backward and Forward Linkages

5.3.2. Cumin Cluster

The value chain of cumin comprises a multitude grower, local dealers/ commission agents, local market wholesalers. These local market stakeholders are directly or through brokers are linked with big cities market wholesalers, processors and exporters / importers. There are a large number of retailers who are functioning all over the country. In this value chain in its first segment growers of cumin bring their produce to the nearest market, where it is sold to wholesalers directly or through the middlemen normally known as commission agents. These materials are transported to the bigger city markets to the wholesalers and from there the materials are either stored for export or sold out to retailers or supplied to the processors. The key players among all the value chain are brokers. Sometimes, the demand comes from wholesale dealers who inform their agents/brokers for organizing the quantity of the required materials. The agents contact small traders to send these items to wholesale dealers for purchase through brokers. The brokers and large wholesalers operating in the regional markets mainly located in big cities such as Peshawar, Lahore, Karachi and Quetta. Additionally, the produce markets (Mandi) are also located in some smaller towns, as they are close to crop cultivation or collection areas. In the consultative meeting with large processors to buy directly from farmers or contract growing mechanisms, stakeholders explained that they are more comfortable to operate through brokers and traders. They give their required specifications to brokers and get required quality material on negotiated price.

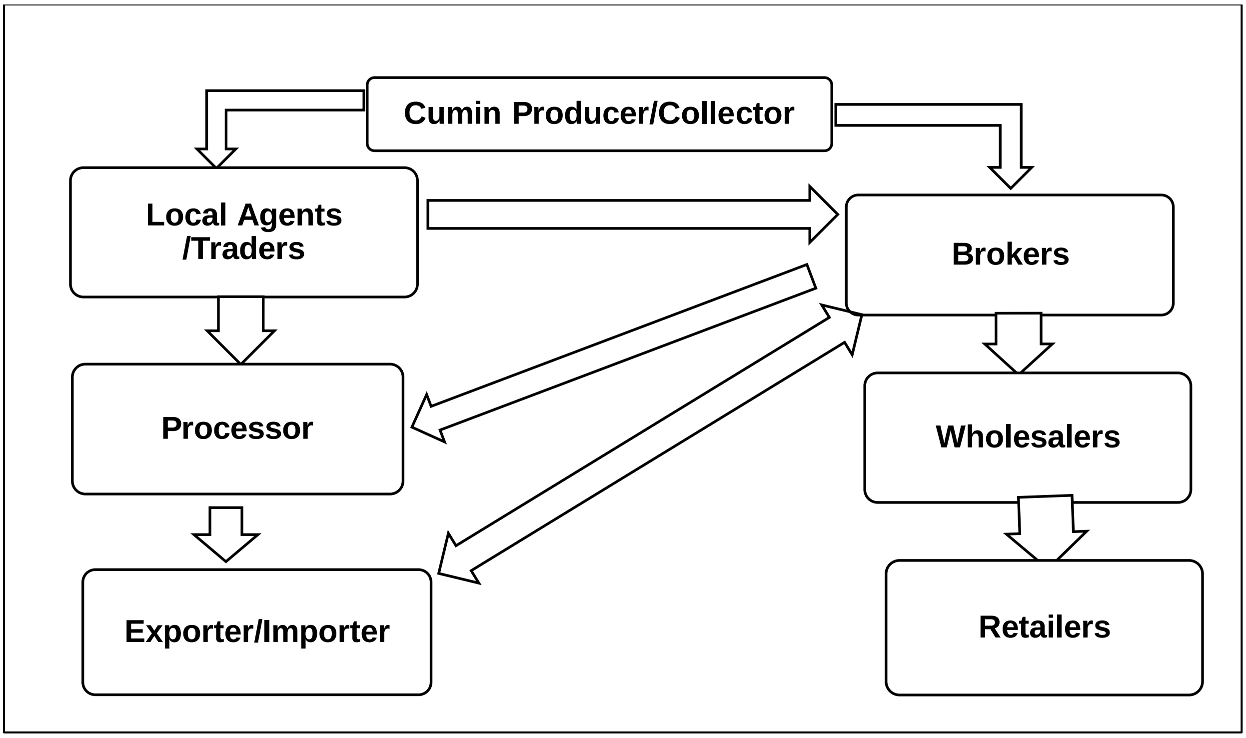

Figure 4: Cumin Value Chain with Backward and Forward Linkages

5.4. SWOT Analysis

5.4.1. Ispaghol Cluster

The strength of the Ispaghol cluster is that it is producing a commodity, that a well-known and widely used in Medicare systems and is a need of every household, hence its product demand is ever lasting. It is a high value medicinal crop produced in the cluster. Cluster is the only and leading producer of Ispaghol as well as the cluster have a well-established market system within cluster of Ispaghol. The de-husking of Ispaghol in the cluster is done by local processor families who have long been involved in making Ispaghol husk and located within the cluster. The arid to semi-arid climatic conditions of the cluster are highly suitable for Ispaghol cultivation. The crop is produced with very little chemical interventions of fertilizers and pesticides, hence closer to an organic nature produce. There exists a lot of potential for improving husk making process and value addition in the Ispaghol product because Ispaghol have a vast demand within the country and in the world market

In the cluster, one of the weakness identified is the husk making system and process. It is very indigenous, obsolete, laborious and not economically effective. It results into a very poor-quality husk product. On the other hand, the workers involved in husk making process are prone to respiratory and other diseases. There is lack of proper cleaning and storage facilities of seed and husk. The other weakness in the cluster is that majority of the farmers are resource poor and do not practice proper agronomic practices due to high cost of inputs. As the more than 80% crop is rainfed, hence farmers leave the crop on the mercy of nature and put less efforts on agronomic practices. Rainfall at the time of flowering and harvest of crop result low yields and huge post-harvest losses. Farmers do not have facilities to safe the crop from high humidity as it damages Ispaghol seed badly. Another weakness in the cluster is the price of the produce at the time of crop harvest is very volatile and discriminating by the market forces. Similarly, there is lack of facilities for proper by-products such as Ispaghol cake and product value addition.

In spite of all the weaknesses, there prevails huge scope and opportunity of achieving high yield than existing yields of Ispaghol through adopting good agricultural practices. The agricultural extension and research department need to provide backstopping through improved varieties and other cultural practices. There also exists opportunity to provide training to the farmers regarding storage of Ispaghol seeds and husk prior to market. There is immense need and scope of developing and promoting the use of improved processing, state of the art de-husking machines for farmers and processors. PARC could target newly designed de-husking machine to popularize in the cluster. There is also an opportunity and scope prevail for improving and put new interventions in marketing system. The farmers are also willing and there is scope of promoting contract growing with various stakeholders in the value chain.

It is important to mention that during consultation farmers informed that Ispaghol crop face a threat and high risk to crop in case of rains and humidity at the time of harvest. Cluster farmers told that the climate is a threat as it is changing and rains at the time of flowering and harvest has compelled them to abstain the cultivation of Ispaghol in the cluster area. Due to lack of proper variety, the shattering results in yield losses to a large extent due to drought that also appear in some years due to climate change. Farmers of the cluster also told that due to climatic change scenario the Ispaghol crop cultivation is being eliminated from traditional areas/cluster and is shifting towards the Sindh areas. The cluster farmers very much worried about the Fusarium wilt disease and feel of threat epidemics if not controlled timely and properly. In farmer’s opinion, lower and erratic price are aggravating the overall threats to Ispaghol crop in the cluster.

Overall in the cluster, the comparative advantage in producing materials for export, as well as for the domestic market, has not been fully explored. This is largely due to the fact that at present, there is no clearly definable sector, resulting in the absence of a coordinated approach as well as of clear and result-oriented policies. The detail SWOT analysis of the cluster can be seen in Annexure 4A.

5.4.2. Cumin Clusters

The detail SWOT analysis of the cluster can be seen in Annexure 4A.

5.4.2.1. Strengths

The strength of the cluster is that the farmers of the cluster have a long experience to cultivate cumin, hence are well aware of the crop behavior. The cluster environment is very much suitable for the growth and development of cumin because crop requires less water and colder for its better growth with ideal temperature of 20ºC to 30ºC. A vast area is available to promote cultivation of cumin as a sole crop. Local cumin variety is having very good flavor and taste. Processors and exporters give a lot of preference to this variety due to its potential exportability

5.4.2.2. Weaknesses

One of the weak points noted in the cluster is that the farmers have shown trends to cultivate cumin intercrop with onion as a dwindled crop. Farmers give more importance to onion crop than cumin, due to which productivity of cumin have decreased over time. On the other hand farmers feel at weak end that marketing of cumin is in the hands of private enterprise. The role of the middle man is significant due to the limited commercial and marketing knowledge of the producers. Farmers have only option to sell the crop to the middleman rather than to take it to Jacobabad and Sukkur, markets. The other weak point in the cluster is the lack of proper cleaning and storage technology and infrastructure facilities in the cluster because the farmers are mostly resource poor.

5.4.2.3. Opportunities

However, there exists an opportunity and need to promote cumin as a main crop adopting good agricultural practices rather than intercropping with other crops. Opportunity prevails to introduce new improved high yielding and disease resistant varieties in the cluster for a massive adoption and ameliorate the cumin production. Simultaneously, it is also an opportunity to protect and improve local or traditional variety of cumin through research to obtain high yields keeping flavor and taste at original level. There prevails a huge scope to promote contract growing and processing facilities in the cluster. As well as improve marketing system through providing marketing system.

5.4.2.4. Threats

The major variety grown in the cluster is known as “local variety”, no doubt that the local variety have novel taste but is very low yielding and is economically less feasible to grow. Due to this low yield the major threat is from the Indian cumin product that is being available at much lower price. Hence processors feel it a threat to local produce and stressed to improve “local variety” towards high yields or introduce a variety in the cluster with similar characteristics of novel taste with high yields. Similarly, the resistant variety and management practices are required to control the Fusarium wilt disease which seems to a threat of epidemics. The threat of drought conditions is also mounting as there appear frequently events of drought in the cluster due to climate change. Currently there is very meager to no backstopping from research and extension services to tackle various issues of R&D from public sector organizations. The most threatening issue in the cluster is the discriminating marketing system.

6. CHALLENGES FACED BY THE CLUSTERS

6.1. Climate Change

The both clusters have faced the severe impacts of climate change. In the Ispaghol cluster, it rarely rains at the time of grain formation and harvest time (March-April), but due to climate change it frequently raining at this time. As a result, the crop is damaged badly causing huge economic loss. The farmers are forced to quit cultivation of this crop in the cluster. On the other hand, in the cumin cluster of Balochistan, critical drought conditions have resulted into decrease in area and production of cumin. New diseases and shifts in crop cycle are also emerging issues in the wake of climate change impacts. Important to mention that no efforts so far have been taken to address these by research system at federal as well provincial level.

6.2. Constraints at Production Level

The unavailability of good quality registered seeds, disease free, true to type planting material are limiting factors in improving productivity of Ispaghol and Cumin in the cluster. There is lack of backstopping of research-based package of technology tailored according to the needs of various soil types and changing climatic conditions of the clusters. The farmers are not aware of modern cultivation techniques and there is needed for practical training and extension education for the cultivation of Ispaghol and Cumin following WHO guidelines.

6.3. Constraints at Processing Level

However, in the current state of affairs the capacity of producers to meet the quality specifications demanded by processors and exporters could not be possible due to lack of facilities. There is need to furnish the capacity of the producers by providing facilities and technology of post-harvest management, cleaning, grading and proper storage of the produce.

6.4. Constraints at Marketing Level

Currently in the cluster stakeholders within the cluster are not compliant with the International standards and guidelines designated by World Health Organizations (WHO) generally called as Good Agriculture and Processing Practices (GACP) as well as phyto-sanitary, quality and safety regulations. It is important to mention that in future the identification of new export markets and the expansion of existing markets will depend on adoption of these standards and regulation. In case of marketing of the Ispaghol and Cumin products from the cluster, the market information utilized currently are primarily price orientated which has flaws which does not consider the product quality, grade, volumes traded, consignment size, origin and the prices are disseminated without analysis.

7. POTENTIALS OF CLUSTER

7.1. Ispaghol Production, Demand, Supply, and Quality

Regarding the area and production data at national level no data is available in the official documents at provincial as well as federal level. A varied data was documented in literature. According to PARC (2018) report, Ispaghol is grown on 1200 ha in Cholistan deserts. Regarding production status of Ispaghol in the cluster it has been reported that about 800 tonnes of Ispaghol is produced annually (PMHPS, MINFA 2008). The Minister (Ex) of National Food Security & Research in his interview to Nation newspaper, said that Ispaghol is a medicinal plant and is pre-dominantly grown in Cholistan (Bahawalpur Division, Punjab part) on 1200 ha (3000 acres). The estimated production of Ispaghol seed (Table 1) is around 800 tonnes per annum and from it almost 200 tonnes of Ispaghol husk is produced (PFI, 2018). The productivity of Ispaghol calculated on the basis of available data was 0.67 tonnes per ha. The productivity of Ispaghol in India is on average 0.9 tonnes/ha. In Cholistan, Hasilpur is the only center for husk making (de-husking of Ispaghol seed)

Table 1: Ispaghol Seed Production, Demand and Supply in Pakistan

Total Estimated Area Under Ispaghol (Ha)	1200	
Total Estimated Production tonne	800	
Estimated Productivity (Tonnes/Ha)	0.67	
Total Requirement of the Country (Tonnes)	2000	
Deficit (tonnes)	1200	
Ispaghol Husk Production, Demand and Supply in Pakistan		
Existing Supply Sources	**Husk tonne**	**Value PKR Million**
Estimated Average Husk Production from Local Ecologies	200	169.25
Average Husk Imported from India (2016 to 2018)	213	180.25
Total Husk Available (Local + Imports)	413	349.51
Estimated Consumption (from Industrial Stakeholders)	500	423.13
Export of Ispaghol Husk (2018)	17.7	14.98
Source: Pakistan Forest Institute (PFI), Peshawar. Department of Plant Protection (DPP), Karachi		

It has been informed by the Ispaghol traders and processors that during last one and a half decade there is an increasing trend in the demand of Ispaghol husk in the country due to a greater number of branded product marketing of Ispaghol and there are around 750 traders and exporters of Ispaghol. The major Ispaghol husk branded stakeholders are;

- Hamdard Laboratories.
- Herbion Pvt. Ltd.
- Hashmi Ispaghol.
- Qarshi Industries Pvt. Ltd.
- Tayyebi Dawakana.
- Marhaba Laboratories.
- The Vitamins Company Pvt. Ltd.
- Konpal Ispaghol and few others etc.

These branded manufactures are currently exporting some quantity of Ispaghol husk in the international market (IMHSC 2003-04) especially Iran and Middle Eastern countries. Based on the review of literature and consultation with traders and processors it is estimated that the annual consumption of Ispaghol husk in the country is around 500 tonnes per annum and a small quantity is also exported to Iran and the Middle East countries. During the consultative meeting with traders in the Akbari Mandi Lahore, which is the largest market of the country from where the crude drugs are forwarded to almost all cities of the country. The traders of Akbari Mandi reported that a quantity of 135-ton worth value of PKR 16.2 million is on average annual trade of Ispaghol in Akbari Mandi Lahore. It is important to mention that Pakistan's production (200 ton) in the country is substantially less (60%) than its requirement (500 ton) hence, a significant amount averaged to 213 ton each year of Ispaghol husk is imported mainly from India.

In the international market the quality demanded requires to comply with food safety and quality through certification of ISO 9001:2000 standards. There is also demanded to maintain quality assurance to ensure that the product is in conformity with CGMP (Current Good Manufacturing Procedures), SSOP (Sanitary Standard Operation Procedures), HACCP and ISO standards. For processing of Ispaghol products as per the GMP (hygienic) norms need complete infrastructure with different processing unit from raw material storage up to packaging and dispatch.

7.2. Ispaghol (Demand with Special Emphasis on Quality)

There prevails a huge potential of Ispaghol exportability in the international market. The stakeholders involved have very clearly indicated that in case of good quality product of Ispaghol is produced and processed properly in the country they can double the exports. The crop has a large exportability potential because there is huge demand of Ispaghol in USA and Western Europe and about 90% of the production is exported to these countries. Similarly, it is indicated in the scientific report (2015), that USA is the chief importer of Ispaghol seeds and husk and consumes annually 8,000 metric tonnes. This is a good indicator to estimate the market value of this crop all over the world. There is continued expansion of interest and market seems like due to natural dietary fibers. Currently, India is the largest producer and the main supplier of Ispaghol seed and husk to the world market (ACTA Universitatis Cibiniensis – Technical Series Vol. LXVII 2015).

The export quality standard of husk is white and soft. The current practice of mixing Zinc sulphate as a whitening agent to meet the international standard and adulteration practice hinder the export of the Ispaghol. To harness the potential exportability, it is inevitable to enhance the productivity and quality of Ispaghol at farm level by adopting GAP and later on maintain the quality at processing level.

Currently, the indigenous Ispaghol processing machinery can process 2-3 tones Ispaghol seed per day (single shift of 10 hours) and the recovery of Ispaghol husk is about 20 percent (PARC 2018). The traders have expressed that the resultant product is of poor quality to meet the international market standards. The traditional Ispaghol de-husking process is very dusty and low capacity. Traders demanded that the harvested produce should be prevented from any contamination, degradation and/ or damage at any stage of processing**.** Pakistan Agricultural Research Council (PARC) has developed an advanced Ispaghol husk processing machinery for the first time in the country. The machinery has the capacity to process Ispaghol of up to two tonnes per day, and half ton of good quality husk per day in single shift free of chemicals and impurities. PARC has demonstrated Ispaghol machinery to farmers, processors, multinational companies, chamber of commerce, line departments and parliamentarians. Scientists informed that it has the capacity to process 400 kilograms of Ispaghol per hour and expressed that the farmers of south Punjab, Sindh, Cholistan and Thar will benefit from the Ispaghol machinery. PARC also requested the M/o NFS&R to announce subsidy and special package to encourage farmers to cultivate Ispaghol. In the consultative meeting with processors and traders discussed about the intervention of new processing machinery by PARC could help to enhance the exportability of the Ispaghol substantially at one hand and simultaneously the imports of Ispaghol would be reduced significantly.

India is the main competitor and dominates the world market in the production and export of Ispaghol. India provides approximately 80 percent of the Ispaghol available in the world market. India is the largest producer of Ispaghol and exports seed and husk worth Rs 25 million annually. Ispaghol, Husks and Industrial powders are exported in countries such as U.S.A., U.K., France, Germany, Japan, Indonesia, Canada Mexico Sweden, Spain, Norway, Italy, Australia Denmark, Korea, Gulf countries and some other small countries. India is the main supplier of Ispaghol and its products. Main share of U.S.A. is 60% of world demand. Others countries share are 25% and share of domestic market of India is 15% of world demand. About 90% of the gross production of Ispaghol in India is exported, with nearly 93% of the export being of husk. Present export level of Ispaghol with over 60% of total imports. The largest buyer of Ispaghol is the United States that imports around 75% of the total husk exports from India. Germany is the largest single importer of seed. In India, Gujarat contributes 35% of world production of Ispaghol husk.

7.3. Cumin Production, Demand, Supply, and Quality

The cumin is a medicinal plant with a distinctive flavor and strong aroma due to its abundant oil content. It is also used in traditional medicine to treat a variety of diseases. The cumin plant is native from East Mediterranean to South Asia belonging to the family Apiaceae. It is cultivated in North Africa, Middle East, China, Uzbekistan, Tajikistan, Iran, Turkey, Morocco, Egypt, Syria, Mexico, Chile, India and Pakistan. Cumin is predominantly grown/cultivated in Balochistan province only. In literature review, there were reports of very small quantity of cumin is also supplied from Astore vally (Gilgit Baltistan) and Chitral (KP) areas but no area and production data are available. Pakistan Forest Institute (PFI, 2017) reported that on average the total production of cumin in the country is about 3219 tonnes and almost of the total 88% cumin is produced in Balochistan (Table 2). According to Crops Reporting Services 2015-16, in Balochistan, cumin is mainly cultivated in its district i.e. Kalat, Karan and Nushki which are also included in the cluster of cumin in the current feasibility study. In Balochistan, an average production of cumin is 2823 tonnes per year from an area of 6210 ha (average 2013-16). The cumin productivity in Balochistan is 0.455 ton/ha.

In net shell, Pakistan produces cumin worth to fulfil its almost 33% requirements and rest 67% is imported. On average (2012-17), a considerable quantity (7630 ton) of cumin has been imported mainly from Afghanistan, China, Ethiopia, India, Iran, Myanmar and Syria. (NFS&R, 206-17). It is important to mention that Pakistan also exports around 1190 ton of cumin in whole seed and crushed form.

Table 2: Cumin Production, Demand and Supply in Pakistan

Existing Supply Sources	Quantity (Tonnes)
Average Production from Local Ecologies	3219.0
Export of Seed Cumin Whole 9 Years Average (2006-17)	874.0
Export of Seed Cumin Crushed 5 Years Average (2012-17)	315.6
Import of Seed Cumin Whole 9 Years Average (2006-17)	7581.6
Import of Seed Cumin Crushed 5 Years Average (2012-17)	48.2
Average Total Exports (Whole + Crushed)	*1189.6*
Average Total Imports (Whole + Crushed)	*7629.8*
Net Supply {Imports (*Whole + Crushed) + Local Production}* – Exports *(whole + crushed)*	9659.2
Sources: *Directorate of Crops Reporting Services Agriculture Department, Quetta*. *Fruits, Vegetables and Condiments Statistics of Pakistan, M/o NFS&R, Economic Wing*. Pakistan Forest Institute (PFI), Peshawar (2017)	

The cluster of cumin identified in Balochistan is comprised of districts, Kalat, Karan and Noshki. Based on data from 2013-16, about 79.1% (4912 Ha) of total cumin area in the Balochistan is occupied by this cluster and the cluster contributes about 77.7% (2195 tonnes) towards the total production of Balochistan. The average productivity of cumin in the cluster is about 0.46 tonnes/ha. This cluster is well known for its cumin cultivation. The cluster is producing and supplying cumin since long. The secondary data of cumin crop regarding area and production in the cluster district was collected from Directorate of Crops Reporting Services Agriculture Department, Quetta, the data available was for 03 years only from 2013-14 to 2015-16 (Table 3).

Table 3: Cumin Production in the Cluster

Cumin Cluster over Years	Area Ha	Production Tonnes	Productivity T/Ha
2013-14	5632	2508	0.45
2014-15	4753	2121	0.45
2015-16	4350	1955	0.45
Average	***4912***	***2195***	***0.45***
CAGR	**-8%**	**-8%**	**0%**

Cluster Districts	2013-14			2014-15			2015-16		
	Area (Ha)	Production (Tonnes)	Productivity (Tonnes/Ha)	Area (Ha)	Production (Tonnes)	Productivity (Tonnes/Ha)	Area (Ha)	Production (Tonnes)	Productivity (Tonnes/Ha)
Balochistan	**7147**	**3247**	**0.454**	**6048**	**2745**	**0.454**	**5435**	**2485**	0.457
Kalat	2250	867	0.385	2000	787	0.394	1610	630	0.391
Karan	2030	912	0.449	1698	764	0.450	1681	756	0.450
Nushki	1352	729	0.539	1055	570	0.540	1059	569	0.537
Total of Cluster	**5632**	**2508**	**0.46**	**4753**	**2121**	**0.461**	**4350**	**1955**	**0.459**

Sources: *Directorate of Crops Reporting Services Agriculture Department, Quetta*.

The data have been analyzed for Compound Annual Growth Rate (SAGR) analysis using statistical methods. The data indicated that the cumin crop in the cluster has shown decrease in both area and production by 8% in 2015-16 compared to 2013-14 however, the productivity remained stagnant. It clearly shows that cumin in the cluster have threat to be squeezed in its area under cultivation. The farmers expressed that due to erratic prices drought the area and production have decreased. The other farmers expressed that majority of the farmers have shifted to intercrop of cumin in onion crop and less care is given to cumin than onion.

7.4. Cumin Existing Exports and Imports of Pakistan

The seed cumin has been traded in the international market since time immemorial. Pakistan has been involved in the export and import of seed cumin and is right there in the international market. Pakistan is more of a net importing country of cumin however, it also exports small amount of seed cumin. The export/import data from 2008-09 to 2016-17 was analyzed. It showed that on average, during this period, country exported 874 tonnes of cumin worth of 198.7 million PKR. The exports varied between 1990.6 tonnes to 54.4 tonnes. The compound annual growth rate (CAGR) analysis showed that the exports of cumin decreased in terms of quantity by 31% in 2016-17 compared to 2008-09, whereas in same period in terms of value (PKR) decrease was 24%. It is important to mention that the export of processed cumin showed a significant increase with CAGR of 7% in 2016-17 compared to 2012-13 in terms of quantity and 36% in terms of value. CAGR analysis clearly depicts that spices processing industry is playing a pivotal role and seemingly the enhancement of exportability of cumin is vector towards processing of cumin (Table 4).

Table 4: Cumin Existing Exports of Pakistan

Years	Export of Seed Cumin Whole		Export of Seed Cumin Crushed	
	Quantity Tonnes	Value Million PKR	Quantity Tonnes	Value Million PKR
2008-09	1619.0	274.4	0	0
2009-10	1468.4	294.1	0	0
2010-11	1517.3	422.6	0	0
2011-12	1690.6	429.3	0	0
2012-13	925.9	191.8	241	42.1
2013-14	412.6	89.6	203.6	39.4
2014-15	84.6	25.3	418.5	131.8
2015-16	93.3	38.2	393.9	123.6
2016-17	54.4	22.9	321.1	145.2
9-year Av	***874.0***	***198.7***	***315.6***	***96.4***
CAGR	**-31%**	**-24%**	**7%**	**36%**
Fruits, Vegetables and Condiments Statistics of Pakistan, M/o NFS&R, Economic Wing				

The analysis of the cumin imports data from 2008-09 to 2016-17 (Table 5) have showed that the imports varied between 3988.6 tonnes to 9128.1 ton in this period. However, the CAGR analysis indicate that there is decrease in imports by 3% in terms of quantity and 10% in terms of value (PKR) in 2016-17 compared to 2008-09. It was worth to note that there is drastic decrease in the import of processed cumin with CAGR by 24% both in terms of quantity and value both during this period. It clearly indicates that the spices processing industry is developing in the country because on the other hand the exports of processed cumin have increased significantly. The import – export ratio has shown that in average, Pakistan imports cumin almost 88% more than it exports.

Table 5: Cumin Existing Imports of Pakistan

Year	Import of Seed Cumin Whole		Import of Seed Cumin Crushed	
	Quantity tonnes	Value Million PKR	Quantity Tonnes	Value Million PKR
2008-09	9919.9	274.4	0	0
2009-10	7415.4	250.8	0	0
2010-11	3988.6	127.6	0	0
2011-12	7291.4	284.8	0	0
2012-13	6164.8	323.6	106.5	3.8
2013-14	9128.1	676.4	77.4	6.9
2014-15	8157.8	658.9	16.5	1.3
2015-16	8796.5	654.8	14.0	0.96
2016-17	7371.5	622.7	26.6	0.95
Average	***7581.6***	***430.4***	***48.2***	***2.8***
CAGR	**-3%**	**10%**	**-24%**	**-24%**
Source: Fruits, Vegetables and Condiments Statistics of Pakistan, M/o NFS&R, Economic Wing				

7.5. Cumin Existing and Potential Demand with Special Emphasis on Quality demanded in the International Market

Globally, the total area under cumin was around 0.76 million ha with the production of 0.49 million tonnes during 2016 – 17 whereas, in 2012 it was estimated to be around 0.30 million tonnes. India is the largest producer and Cumin seed contributing 73% to the global production. Other major producing countries of cumin are Syria, Turkey Iran and china. As per the production data for 2012, India's share is 73% to global production, while that of Syria, Turkey, China and Iran has been 16%, 4%, 4% and 3% respectively. According to (https://atlas.media.mit.edu), the top exporters of Cumin seeds are India ($283M), Syria ($46.1M), Turkey ($27.8M), the United Arab Emirates ($13M) and Afghanistan ($11.9M). The top importers are Vietnam ($92.4M), the United States ($41M), Bangladesh ($32.9M), Egypt ($20M) and the United Arab Emirates ($17.8M).

According to the specifications of the standard for Cumin CXS 327-2017, the quality of cumin required in the international markets, the salient standards are as follow;

- This Standard applies to cumin offered for direct consumption, as an ingredient in food processing, or for repackaging if required. It excludes cumin intended for industrial processing.

- Cumin is the product prepared from "seeds1" of *Cuminum cyminum* L. of the Apiaceae family having reached appropriate degree of development for processing; and processed in an appropriate manner, undergoing operations such as cleaning, drying, grinding and sifting.

- Cumin (whole, cracked or ground) must not contain more than 10% moisture.

- Cumin shall have a characteristic aroma and flavor which can vary depending on geo-climatic factors/conditions. Cumin shall be free from any foreign odor or flavor and especially from mustiness. Cumin shall have a characteristic color varying from light grey to dark brown.

- Whole cumin may be classified in three classes/grades according to physical and chemical requirements i.e. I, II and III. When ungraded, the provisions for Class/Grade III requirements apply as the minimum requirements.

- Whole cumin shall comply with the physical requirements specified as;

    a. Extraneous vegetable matter content, maximum, % mass fraction (1-3%)
    b. Foreign matter2 content, maximum, % mass fraction (0.1-0.5%)
    c. Mould visible, maximum, % mass fraction (1%)
    d. Proportion of damaged/defective fruits, maximum, % mass Fraction (5%)
    e. Dead insects, insect fragments, rodent contamination max % mass fraction (0.1-0.5%). Insect-damaged matter, maximum, % mass fraction (0.5-1%) and zero live insects
    f. Mammalian excreta (1 mg/kg)
- Whole, cracked and ground cumin shall comply with the chemical requirements specified
    a. Total ash, % mass fraction (dry basis), Maximum (8.5-12%)
    b. Acid-insoluble ash, % mass fraction (dry basis), maximum (1.5-4.0%)
    c. Volatile oils, 2.0-1.5 ml/100 g (dry basis), Minimum.
- The products covered by the provisions of this Standard shall be labelled in accordance with the *General Standard for the Labelling of Prepackaged Foods* (CXS 1-1985).
- The products covered by this Standard shall comply with the maximum levels of the *General Standard for Contaminants and Toxins in Food and Feed* (CXS 193-1995).
- The products covered by this Standard shall comply with the maximum residue limits for pesticides established by the Codex Alimentarius Commission.
- A lot sample that fails to meet one or more of the applicable quality requirements, as set out in Section above (except those based-on sample averages), should be considered as a "defective"

8. PLAN, POLICIES AND STRATEGIES

8.1. Targets

Keeping in view the responses of the stakeholders, based on lesson learnt from literature reviewed and future scenario of Ispaghol and Cumin plants trade growth in the international market, the following are the salient goals and targets for the development of Ispaghol cluster in Punjab and Cumin cluster in Balochistan.

i. The production of Ispaghol and Cumin will be promoted on commercial scale through research-based technology package oriented on WHO guidelines on good agriculture and processing practices. The emphasis will be to increase productivity of both the commodities. This goal may be achieved by;
   a. Increase yield by 50% over 5 years through R&D backstopping
   b. Harvest and Post-harvest losses to be reduced from 40% to 10% in case of Ispaghol and 20% to 10% in case of Cumin, through mechanization i.e. providing de-husking machines in case of Ispaghol
   c. Convert 50% of total cluster commodity produce to clean product by providing mechanized cleaning/processing
   d. Import substitution to reduce imports by 25% in 5 years

ii. Development, multiplication and registration of improved high yielding varieties of Ispaghol and Cumin.

iii. Promote new production technologies based on Good Agricultural Practices (GAP)
   a. The National Agricultural Research System (NARS) in the country at federal and provincial level will be given this task of R&D to evaluate the available germplasm and production technologies in the cluster areas and within in next 1-2 years suitable varieties and technologies of Ispaghol and Cumin may be made available for the cultivation of the cluster farmers at a large scale.

iv. Promote post-harvest technologies such as cleaning, storage and packaging and training of all stakeholders in the chain from production to trade.

v. Promote contract growing for better marketing of the produce.

vi. Promote and encourage set up of new processing units for de-husking of Ispaghol in private sector
   a. De-husking units designed by PARC or imported plants will be targeted. The economic feasibility of these plants can be seen in Annexure 5.

vii. Develop and promote marketing information and guiding system for farmers and traders in both clusters

To ensure economic benefit to farmer communities from growing of Ispaghol and Cumin so that they can develop a stake, pragmatic backstopping from R&D and suitable training on sustainable cultivars, along with technology package, harvest, storage and post- harvest processing prior to marketing of their products are needed. Such a strategy will encourage economic participation of product producers in the growth and development of allied industries as well as will be helpful in poverty alleviation and will boost up the sustained supply of quality raw material to industry.

8.2. Policy Reforms

As a policy reform, a common intervention is recommended for both the Spices and Medicinal Plant clusters under feasibility studies. To deal with the problems of all stakeholders of the sector and successful execution of the Cluster Development Based Agriculture Transformation Plan for spices and medicinal plants, the mechanics suggested in its first step includes the establishment of Pakistan Spices and Medicinal Plants Development Board (PSMPDB). It will provide an umbrella infrastructure as a strategy of execution and policy interventions implementation. The cost of establishing this board is divided over all the clusters (both spices and medicinal plants) under study on basis of the area under each commodity. After sorting and finalizing the mechanics of the PSMPDB in order, under this parasol the strategies and activities/plans will be initiated to strengthen the current clusters of medicinal plants i.e. Ispaghol and Cumin.

8.3. Strategies

8.3.1. Production Level Strategies

The yield levels of both Ispaghol and Cumin clusters will be increased by 50% from the current base, over five years, following strategies are suggested:

- **a)** Strengthen and persuade National Research System (NARS) to enhance its focused research and development activities to provide backstopping on issues of coriander and turmeric in respective clusters.
- **b)** The NARS will be also entrusted upon to establish in each cluster for adaptive research, such as evaluate and introduce new hybrids, varieties, machines, management models, etc.
- **c)** The NARS and provincial extension departments will identify the coriander and turmeric o R&D issues and seek grants from government or fund research from its own resources.
- **d)** Promote Good Agricultural Practices (GAP) at the farm level,
- **e)** Promote certified and registered seeds through vibrant system at public and private sector.

8.3.2. Harvest and Post-harvest level strategies

To reduce post-harvest losses by 20 % to 10% in case of Cumin and 40% to 10%in case of Ispaghol clusters. Following strategies are suggested at the farm-level:

- **a)** Introduce and promote mechanical harvesting of Ispaghol and Cumin and train the farmers to harvest respective crop at appropriate maturity stage.
- **b)** Promote cleaning of Ispaghol and Cumin using appropriate equipment at farm level.
- **c)** Introduce proper methods and technology for the storage of the respective produce

8.3.3. Processing and Value Addition Strategies

To promote the processing of Ispaghol regarding its de-husking in the cluster following strategy is suggested.

a) Promote state-of-the-art and efficient technology of Ispaghol de-husking and cleaning. For this purpose, machines/equipment and technology could be imported from China and later could be fabricated locally.
b) Promote cleaning of the Cumin using mechanical cleaners at farm level to enhance quality and price of the produce.
c) There is need to enhance the productivity of both Ispaghol and Cumin clusters as it will help to save significant foreign exchange in the form of import substitute.

8.3.4. Marketing and Trading Level Strategies

Following strategies are suggested at the marketing and trading level:

i. To minimize marketing costs and increase in producer profit.

ii. Efficiency in the distribution and delivery of the produce.

iii. Promote contract farming between exporters and farmers with obligations to supply specific quality and quantity of Ispaghol and Cumin at intended period with agreed price in the contract.

iv. Provision of technical advice to the cluster farmers in the field from production to harvest of the crop – an opportunity for exposure to new technology and best practices

v. Provide market information to the cluster area farmers

9. CLUSTER FEASIBILITY ANALYSIS

This section describes the costs associated with cluster development strategies presented above regarding Ispaghol and Cumin. It also identifies resources and requisite inputs for achieving all the targets fixed in the previous section. To develop cluster feasibility, the analysis for economic returns keeping costs and investments was performed using CABI model. The criterion of Internal Rate of Return (IRR) was applied to measure the rate of returns of the investment for the development of Ispaghol cluster in Cholistan and Cumin cluster in Balochistan. An economic and social impact analysis has also been conducted that evaluates the benefits of the cluster development interventions on two target commodities. The details of each cluster's economic feasibility analysis are given as follows;

9.1. Benefit and Cost of Clustering Ispaghol in Cholistan

In case of Ispaghol cluster, various assumptions were made to run CABI model for economic analysis and those were as follow;

- Increase yield of Ispaghol and Cumin by 15% over 5 years through R&D backstopping
- Harvest and Post-harvest losses to be reduced from 40% to 10% in case of Ispaghol and from 20% to 10% in case of cumin through mechanization i.e. harvesting, threshing and storage
- Convert 50% of total cluster commodity produce to clean product by providing mechanized cleaners
- Promotion of machines/plants in case of Ispaghol de-husking
- All the mechanization will by sharing cost basis 50:50
- The cost of establishing "Pakistan Spices and Medicinal Plants Development Board" is divided over all the clusters under study on basis of the area under each commodity

The expected benefits by implementing the proposed interventions have been based on certain assumptions which have been decided in discussion with Ispaghol sector stakeholders in the value chain from production to markets and exports. These will help to improve value chain to minimize imports on one hand and also will enhance exports as well as stabilize the price of Ispaghol in the domestic market. Expected benefits have been calculated with reference to the baseline situation of the cluster. Based on the assumptions, the value addition by implementing these interventions has been calculated in a five-year timeframe. The resources required for the implementation of the proposed interventions package includes;

i) Additional operational costs of improved Coriander production, value chain development, and processing

ii) Sector development investments like R&D by government

iii) Fixed capitals, machinery, etc. that by government and private sector

The whole analysis has been based on incremental costs and benefits of the proposed interventions.

9.2. Current Situation

The current situation of Cholistan cluster's Ispaghol area and production is given in table 6. The consultations with various stakeholders envisaged that both area and production of the cluster remained stagnant rather in real terms it is declining over time. From an area of 1200 ha, the Ispaghol grain production of 800 tonnes is obtained. The productivity of the Ispaghol cluster is 0.67 tonnes/ha.

Table 6: Ispaghol Cluster in Cholistan – Current Situation

	Inputs	Year 1	Year 2	Year 3	Year 4	Year 5
Area under cultivation in focal point (ha)	**1,200**	-	-	-	-	-
Total Production tonne	**800**	-	-	-	-	-
Default yield (tonne/ha)	0.67	-	0.67	0.67	0.67	0.67

The Ispaghol production and its value at the current wholesale price in the next five years in a no-intervention scenario depicted almost stagnation situation in productivity and prices details are shown in Table 7. The annual yield growth without interventions over time is at CAGR 0%. The low performance of the cluster over time are because of the climate change impact and lack of improved varieties and technology packages.

Table 7: Ispaghol Cluster – Ispaghol Production in No-Intervention Scenario

	Inputs		Year 1	Year 2	Year 3	Year 4	Year 5
Annual yield growth without intervention	**0%**						
Annual expected production (t) without intervention at wholesale level				800	800	800	800
Wholesale price of April 2019 (USD/ton)	**1,070**			***0.856***	***0.856***	***0.856***	***0.856***

9.3. Clustering Ispaghol in Cholistan: Benefits of the Proposed Interventions

Benefit 1 - Increase in Productivity by 15% over 5 years

As a result of pragmatic backstopping from the research and development, new varieties of Ispaghol in the current scenario of climate change will be made available from federal and provincial R&D system. These new varieties along with technology package will be directly tested and demonstrated under farmers' condition starting from the first year and continue until the fifth year of the project. Farmers will be allowed to select the best material for cultivation. The improved management practices demonstrated on farmer's field will include Good Agricultural Practices (GAP). It is assessed that these efforts in Cholistan cluster will increase the Ispaghol performance both horizontally as well as vertically resulting in increase of production by 50% over a period of five years. However, it is assumed that farmers will gradually adopt GAP and variety thus yield increase in the cluster will also be gradual at a rate of 12.5% per year starting from the second year. Based on these assumptions, the value of increased Ispaghol production at the existing rate of US$ 1070 per ton is shown in **Error! Reference source not found.**8.

Table 8: Ispaghol Cluster – Production Increase by 15% over 5 Years

	Inputs		Year 2	Year 3	Year 4	Year 5
Yield increased over five years	15%	12.5%	3.75%	7.50%	11.25%	15.00%
Increase in yield due to yield improvement (tonne/ha)			0.08	0.17	0.25	0.33
Additional production from enhanced yield tonne			100	200	300	400
Expected additional value from increased yield (Mil US$)			**0.11**	**0.21**	**0.32**	**0.43**

Benefit 2 – Reduction in Post-Harvest Losses

The cause of harvest and post-harvest losses in case of Ispaghol crop and produce are mainly due to climate change i.e. occurrence of rainfall at the time of harvesting. The crop is harvested and threshed for grains manually in the field and high moisture damage the standing crop and grains. In the farmer's envision the losses are around 40% and in sever bad weather losses may go even high. To reduce these losses, the farmers will be trained on the aspect of mechanical harvesting and threshing and proper storage techniques in the field. It has been estimated that with these proposed improved farm management and post-harvest practices, these losses can be reduced from 40% to less than 10%. This will lead to increasing the value of the Ispaghol for the farmer and the downstream players in the value chain. The adoption of these practices will be gradual by the farmers, thus a linear gradual reduction in losses at a rate of 7.5% per year has been presumed. Based on these assumptions, the value of increased Ispaghol production in Cholistan cluster at the existing rate of US$ 1070 per ton, worth of US$ 0.30 million will be saved as additional value from the reduction of post-harvest losses in five years, the details are shown in **Error! Reference s ource not found.**9.

Table 9: Ispaghol Cluster – Post-Harvest Losses to be Reduced from 40% to 10%

	Inputs		Year 2	Year 3	Year 4	Year 5
Current post harvest Losses (30%-40%)	**40%**					
Post-harvest losses after intervention	**10%**	7.5%	7.5%	15.0%	22.5%	30.0%
Enhanced marketable production due to reduced PH losses tonne			62.25	129.0	200.25	276.00
Expected additional value from reduction of losses (Mil US$) at farm gate price			0.07	0.14	0.21	0.30

Benefit 3 – Value Addition through Cleaned Ispaghol at Farm Level

The improper cleaning of Ispaghol at farm level is not acceptable to traders, as it is containing a huge quantity of trash, hence the wholesalers purchase produce at lower prices. The cleaning of Ispaghol at farm level will be promoted through providing proper cleaners to add value to the produce for better quality and price. Based on these assumptions, the value of increased Ispaghol production in the cluster at the existing cleaned coriander rate of US$ 1600 per ton and it is expected that as a result of clean produce, about 0.31 million US$ will be gained as an additional value from the cluster (Table 10).

Table 10: Ispaghol Cluster – Convert 50% of total Ispaghol to Clean Ispaghol

	Inputs		Year 2	Year 3	Year 4	Year 5
Current % Cleaning		1%				
Additional percentage of Cleaning to be covered within 5 years = % of Fresh tonne	**50%**	12.25%	12.3%	24.5%	36.8%	49.0%
Total volume of Cleaned Ispaghol tonne			109	242	401	586
Price of Cleaned Ispaghol April 2019 (US$/ton)	**1,600**					
Expected additional value from cleaned (Mil US$)			0.06	0.13	0.21	0.31

Benefit 4 – Import Substitution (Reduce Imports)

Pakistan is a net importer of Ispaghol husk because the production and quality of husk produced in the country is not of remarkable quality. The above-mentioned interventions along with improvements in de-husking process plant to be promoted in the cluster will reduce imports gradually and overall in five years. It is anticipated that an imports substitution value will help to save foreign exchange of US$ 0.42 million. The details of benefits from Ispaghol import substitution in shape of reduction in imports is detailed in Table 11. The complete feasibility of the de-husking plant can be seen in Annexure 5.

Table 11: Ispaghol Cluster – Import Substitution (Reduce Imports by 25% in 5 Years)

	Inputs		Year 1	Year 2	Year 3	Year 4	Year 5
Additional production that can substitute import tonne				92.3	189.0	290.3	396.0
Current imports tonne	800						
Expected growth in import	**-3%**						
Expected imports tonne				752.0	729	708	686
Percentage of import quantity substituted				12%	26%	41%	58%
Value of imports							
Value of the production which can substitute import value (Mil US$)				0.2	0.4	0.6	0.8
Current import value (Mil US$)	**3.2**						
Expected increase import value	**10%**					-	
Expected import value (Mil US$)				3.83	4.21	4.63	5.09
Percentage of import value substituted				3%	5%	7%	8%
Foreign exchange saved (Mil. US$)				**0.10**	**0.20**	**0.31**	**0.42**

9.4. Cluster Total Investments, Costs and Economic Returns (After interventions)

The proposed intervention (both for on-farm and off-farm activities) will require cost of producing, processing, and value addition to produce quality Ispaghol in the cluster. Improvement necessitates spending more money for carrying out those activities by adopting new varieties, GAPs and mechanization practices for enhancing production, better processing and quality of the Ispaghol in the cluster. Overall a total investment costing an amount of US$ 0.99 million (about PKR 138.6 million) spread over first four years will be invested. Whereas the net economic benefits after offsetting the direct value chain costs during the last year of the project would be US$ 0.575 million over five years. The existing costs and investments made with the proposed incremental increases for different cost heads are detailed in **Error! Reference source not found.**12.

Table 12: Ispaghol Cluster – Total Investments, Costs and Economic Returns (After interventions)

	Inputs		Year 1	Year 2	Year 3	Year 4	Year 5
Economic Returns after interventions							
Expected Gross Returns from Cluster Development Interventions			***-***	***0.16***	***0.33***	***0.52***	***0.73***
Cost Heads Different cost heads							
Cost of Production Inputs and Harvest: Total Cost (Mil US$)	**50**		22%	43%	65%	86%	22%
Increase in cost due to improved production management practices	**86%**	22%		0.013	0.026	0.039	0.051
Cost of processing (US$/ton)	185		-	0.02	0.04	0.07	0.11
Total value chain costs/ha/year (Mil US$)			*0.01*	*0.04*	*0.08*	*0.03*	*0.07*
Net Economic Returns when costs are offset							
Net economic benefits after offsetting the direct value chain costs (Mil US$)			-	0.124	0.260	0.410	0.626
Cluster Investments (Total investments made the investments spread over first four years)							
Investment on R&D establishment (Mil us$)	0.44		0.44				
Capacity building of stakeholdesr (Mil US$)	**0.15**		0.06	0.04	0.02	0.02	-
Investments required on processing/value chain level interventions (Mil US$)	**0.170**		0.04	0.04	0.04	0.04	
Loan	**0.019**		0.00	0.00	0.00	0.00	-
Total investments (Mil US$)	0.78		0.55	0.09	0.07	0.07	-
Net cash flow (Mil US$)			-0.551	0.032	0.191	0.341	0.626

9.5. Economic Viability of Ispaghol Cluster Development Plan

After calculating the benefits and the costs of the proposed interventions, the economic viability of the proposition has been considered in terms of project's PV and IRR for the Cholistan Ispaghol cluster. Discounted cash flow analysis has been carried out using an annual discount rate of 8.5%. The results shown in **Error! Reference source not found.**9.8 h ave depicted a positive present value of net benefits (NPV) of US$ 0.331 million and having IRR of 27%. It clearly indicates that the interventions package proposed for uplift and transformation of Cholistan Ispaghol cluster is economically very much feasible, sound and viable proposal.

Table 13: Ispaghol Cluster – NPV of Economic Returns and IRR

	Inputs		Year 1	Year 2	Year 3	Year 4	Year 5
Discount Rate	**8.5%**						
Present Value of Net Benefits (NPV)	0.331						
Internal Rate of Return	**27%**						

9.6. Ispaghol Processing Plant

Keeping in view the quality and safety parameters of international standards, it is inevitable that proper state-of-the-art processing plant for de-husking of Ispaghol should be introduced and promoted in the Cholistan Ispaghol cluster. In consultation with processing stakeholders and PARC engineers the Ispaghol de-husking processing plant has identified. The specifications and other details of this processing plant are given in annexure – 7. The plant's total investments, costs and economic returns were analyzed in detail and are produced in annexure – 7. The analysis of the parameters depicted that the Internal Rate of Return of the processing plant is estimated at **87**%, which is significantly higher than the bank return rate of 16%. Hence, the project is deemed financially viable. The NPV of the project is positive (US$ **227,684**) at a discount factor of 16% during the first 5 years of operation considered.

9.7. Benefit and Cost of Clustering Cumin in Balochistan: Current Situation

In the Cumin cluster of Balochistan, the current level of Cumin area and production is given in table 9.9. The consultations with various stakeholders and official data have visualized that both area and production of the Cumin cluster have shown consistent declining trends over time. From an area of 4912 ha, the Cumin produce of 2195 tonnes is achieved. The productivity of the Cumin cluster is 0.45 tonnes/ha.

Table 14: Cumin Cluster Balochistan – Current Situation

	Inputs		Year 1	Year 2	Year 3	Year 4	Year 5
Area under cultivation in focal point (ha)	**4,912**						
Total Production (t)	**2,195**						
Default yield (t/ha)	0.45			0.38	0.35	0.32	0.29

The Cumin production and its value at the current wholesale price in the next five years in a no-intervention scenario have also shown decline in productivity as shown in Table 14-15. The annual yield growth without interventions over time is at –8%. The low performance of the cluster over time is because of the climate change impact of severe drought conditions prevailing in the cluster and lack of improved varieties and technology packages.

Table 15: Cumin Cluster Balochistan – Production in No-Intervention Scenario

	Inputs		Year 1	Year 2	Year 3	Year 4	Year 5
Annual yield growth without intervention (%)	**-8%**						
Annual expected production (t) without intervention at wholesale level				1,844	1,696	1,561	1,436
Wholesale price April 2019 (US$/ton)	**1,550**			***2.858***	***2.629***	***2.419***	***2.225***

9.8. Clustering Cumin in Balochistan: Benefits of the Proposed Interventions

Benefit 1 - Increase in Production by 50% over 5 years

As a result of pragmatic backstopping from the research and development, new varieties of Cumin in the wake of drought tolerance will be made available from federal and provincial R&D system. These new varieties along with technology package will be directly tested and demonstrated under farmers' condition starting from the first year and continue until the fifth year of the project. Farmers will be allowed to select the best material for cultivation. The improved management practices demonstrated on farmer's field will include Good Agricultural Practices (GAP). It is assessed that these efforts in Balochistan Cumin cluster will increase its performance both horizontally as well as vertically resulting in increase of production by 50% over a period of five years. However, it is assumed that farmers will gradually adopt the GAP and variety thus yield increase in the cluster will also be gradual at a rate of 3.75% per year starting from the second year. Based on these assumptions, the value of increased Cumin production at the existing rate of US$ 1550 per ton is shown in **Error! Reference source not found.**16.

Table 16: Cumin Cluster Balochistan – Production Increase by 50% over 5 Years

	Inputs		Year 1	Year 2	Year 3	Year 4	Year 5
Yield increased over five years	**15%**	3.75%		3.75%	7.50%	11.25 %	15.00 %
Increase in yield due to yield improvement (tonne/ha)				0.05	0.09	0.12	0.15
Additional production from enhanced yield tonne				230	424	585	718
Expected additional value from increased yield (Mil US$)				**0.36**	**0.66**	**0.91**	**1.11**

Benefit 2 – Reduction in Post-Harvest Losses

The Cumin crop is harvested and threshed for grains manually in the field. In general, the farmers foresee that the losses in traditional practices are around 20% and in severe drought the losses may go even high due to more shattering of grains. To reduce these losses, the farmers will be trained on the aspect of mechanical harvesting and threshing and proper storage techniques in the field. It has been estimated that with these proposed improved farm management and post-harvest practices, these losses can be reduced from 20% to less than 10%. This will lead to increasing the value of the Cumin for various stakeholders in the value chain. The adoption of these practices will be gradual by the farmers, thus a linear gradual reduction in losses at a rate of 2.5% per year has been assumed. Based on these assumptions, the value of increased Cumin production in Balochistan cluster at the existing rate of US$ 1550 per ton, worth of US$ 0.26 million will be saved as additional value from the reduction of post-harvest losses in five years, the details are shown in **Error! Reference source not found.**17

Table 17: Cumin Cluster – Post-Harvest Losses to be Reduced from 20% to 10%

	Inputs		Year 1	Year 2	Year 3	Year 4	Year 5
Current post harvest Losses	**20%**						
Post-harvest losses after intervention	**10%**	2.5%		2.5%	5.0%	7.5%	10.0%
Enhanced marketable production due to reduced PH losses tonne				47.82	91.18	130.21	165.11
Expected additional value from reduction of losses (Mil US$) at farm gate price				**0.07**	**0.14**	**0.20**	**0.26**

Benefit 3 – Value Addition through Cleaned Cumin at Farm Level

The improper cleaning of Cumin at farm level is not acceptable to traders, as it is containing a huge quantity of trash, hence the wholesalers purchase produce at lower prices. The cleaning of Cumin at farm level will be promoted through providing proper cleaners to add value to the produce for better quality and price. Based on these assumptions, the value of increased Cumin production in the cluster at the existing cleaned Cumin rate of US$ 1700 per ton and it is expected that as a result of clean produce, about 0.14 million US$ (PKR 25.2 million) will be gained as an additional value from the cluster (Table – 18).

Table 18: Cumin Cluster – Convert 50% of total Cumin to Clean Cumin

	Inputs		Year 1	Year 2	Year 3	Year 4	Year 5
Current cleaning 1%							
Additional percentage of Cleaning to be covered within 5 years = % of Fresh (t)	**50%**	12.50 %		12.5%	25.0%	37.5%	50.0%
Total volume of Cleaned Cumin tonne				245	479	700	908
Price of Cleaned Cumin (US$/t)	**1,700**						
Expected additional value from cleaned (Mil US$)				0.04	0.07	0.10	0.14

Benefit 4 – Import Substitution (Reduce Imports

Currently, Pakistan imports around 7582 tonnes of Cumin each year because its production in the country is substantially less than consumption. The above-mentioned interventions will help to be reduce imports gradually and overall in five years. It is anticipated that an imports substitution value will help to save foreign exchange of US$ 5.09 million. The details of expected import value from Cumin import substitution in shape of reduction in imports is detailed in Table 19.

Table 19: Cumin Cluster – Import Substitution (Reduce Imports by 25% in 5 Years)

	Inputs		Year 1	Year 2	Year 3	Year 4	Year 5
Additional production that can substitute import tonne				117.0	218.4	305.8	380.5
Current imports tonne	7,582						
Expected growth in import quantity	**-6%**						
Expected imports tonne				7127.1	6913	6706	6505
Percentage of import quantity substituted				2%	3%	5%	6%
Value of imports							
Value of the production which can substitute import value (Mil US$)				0.18	0.34	0.47	0.59
Current value of imports (Mil US$)	**3.2**						
Expected in import value	**10%**						
Expected import value (Mil US$)				3.83	4.21	4.63	5.09
Percentage of import value substituted				5%	8%	10%	12%

9.9. Cumin Cluster Total Investments, Costs and Economic Returns (After interventions)

The proposed intervention (both for on-farm and off-farm activities) will require cost of producing, processing, and value addition to produce quality Cumin in the cluster. Improvement necessitates spending more money for carrying out those activities by adopting new varieties, GAPs and mechanization practices for enhancing production, better processing and quality of the Cumin in the cluster. Overall a total investment costing an amount of US$ 0.82 million spread over five years will be invested. Whereas the net economic benefits after offsetting the direct value chain costs were calculated worth of US$ .5 million during the 5th year. The existing costs and investments made with the proposed incremental increases for different cost heads economic returns are detailed in **Error! Reference source not found.**20.

Table 20: Cumin Cluster – Total Investments, Costs and Economic Returns (After interventions)

	Inputs		Year 1	Year 2	Year 3	Year 4	Year 5
Expected Gross Returns from Cluster Development Interventions			***-***	***0.22***	***0.41***	***0.58***	***0.73***
Cost Heads Different cost heads							
Total Costs/ha for in (US$)	450	20%		5%	10%	15%	20%
Cost of Production Inputs and Harvest: Total Cost (Mil US$)	210	5%	0.04	0.05	0.10	0.15	0.21
Cost of processing (US$/ton)	15.0		-	0.02	0.01	0.01	0.01
Total value chain costs/ha/year (Mil US$)			0.06	0.07	0.12	0.17	0.22
Net Economic Returns Economic returns when costs are offset							
Net economic benefits after offsetting the direct value chain costs (Mil US$)				0.148	0.292	0.409	0.505
Cluster Investments Total investments made the investments spread over first four years							
Investment on R&D establishment (Mil us$)	0.59		0.59				
Investments required on production level interventions (Mil US$)	**0.15**		0	0	0	0	-
Investments required on processing/value chain level interventions (Mil US$)	**0.074**		0.03	0.02	0.01	0.01	-
Loans	**0.008**		0.003	0.002	0.001	0.001	-
Total investments (US$)	0.82		0.68	0.07	0.03	0.03	

9.10. Economic Viability of Cumin Cluster Development Plan

After calculating the benefits and the costs of the proposed interventions, the economic viability of the proposal has been considered in terms of project's PV and IRR for the Cumin cluster in Balochistan. The discounted cash flow analysis has been carried out using an annual discount rate of 8.5%. The results shown in **Error! Reference source not found.**21 h ave depicted a positive Net Present Value of US$ 0.244 million over the period of five having an IRR of 21%. It clearly indicates that the interventions package proposed for uplift and transformation of Cumin Cluster Balochistan is economically feasible and viable scheme.

Table 21: Cumin Cluster – PV of Economic Returns and IRR

	Inputs	Year 1	Year 2	Year 3	Year 4	Year 5
Discount Rate	**8.5%**					
Net cash flow (undiscounted)		-0.68	0.08	0.26	0.37	0.50
Present Value of Economic Benefits (million US$)	-0.244					
Internal Rate of Return	**21%**					

10. PROGRAMS AND PLANS

In light of consultations with various stakeholders, it was evident that there were constraints of capacity, funds, awareness, unfavorable climate and less socio-economic benefits due to erratic prices of the produce resulted in overall declining in the area and productivity of the Ispaghol and cumin commodities in the cluster areas under study. It has been also observed that various research and extension institutions have been carrying out work in the cluster areas but all were in an isolated / sole effort without considering the segments of the value chain products from production, processing, trade and export point of view that impinge the sustainable development of the Ispaghol and Cumin over time. There was harmony among all stakeholders that the both clusters under study have enormous potential and could be revamped through a pragmatic and holistic approach. Imperatively required is placing all the stakeholders in order through awareness of their responsibilities and obligations within the cluster in which the public and private sectors play complementary roles. The coordination between relevant government ministries and other national, international and private sector organization have a role to play in development and promotion of the Ispaghol and Cumin in the specified clusters in all the segments of their value chain.

The interventions analyzed for both the commodities (Ispaghol and Cumin) will be executed on commercial scale through research-based technology package oriented on WHO guidelines on good agriculture and processing practices. The activities proposed are target in five years' time frame with a total budget of PKR 241 million (almost PKR 48.2 million each year). The major programs and plans will be target for both the cluster development with focus oriented to:

1) To develop research-based package of technology to comply with WHO guidelines on GACP.
2) Implementation of WHO guidelines on Good Agriculture and processing Practices (GACP) at the level of farmers, processors and traders
3) Development and registration of Ispaghol and Cumin varieties.
4) Multiplication of registered seed on farmer's field for prompt dissemination.
5) Promote contract growing for better marketing of the produce.
6) Encourage set up of new processing units for de-husking of Ispaghol in private sector
7) Promote post-harvest technologies such as cleaning, grading, storage and packaging.
8) Training of all stakeholders in the chain from production to trade.

10.1. Research and Development

In the current feasibility study on cluster development of Ispaghol and Cumin, the low yields and quality aspects will be addressed by the prevailing National Agricultural Research System of the country through developing improved cultivars and package of technologies. The main tasks/activities suggested are detailed in Table – 10.1;

Activity – 1

Development of improved varieties of Ispaghol and Cumin and their multiplication

Activity – 2

Develop and promote of Good Agricultural and Processing Practices technologies based on research endeavors. (Adopting Farmers Field School (FFS) methodology)

Activity – 3

Demonstration, training and dissemination of technologies to the farmers. (Adopting Farmers Field School (FFS) methodology)

Activity – 4

Harvest and post-harvest management and product storage training to the farmers. (Adopting Farmers Field School (FFS) methodology)

Activity – 5

Provision of cleaning and drying machines/equipment to the cluster farmers on cost sharing basis (50:50).

Activity – 6

Provision of mechanized de-husking of Ispaghol to cluster farmers on cost sharing basis (50:50).

Table 22: Research and Development

Programs and Plans for Ispaghol and Cumin Clusters				
Suggested Actions/Activities	**Responsible Organization**	**Funds Allocation PKR million**	**Funds Source**	**Time Frame**
Development of improved varieties of Ispaghol and Cumin and their multiplication	PARC and NARS Coordinated programs in Provinces and FSC&RD	40.0	Projects for ALP, PARC HEC, R&D PSF, ALP PSDP Province Research	1-5 years
Develop and promote of Good Agricultural and Processing Practices technologies based on research endeavors. (Adopting Farmers Field School (FFS) methodology)	Provincial Governments Research Departments	35.0	Project for ALP, PARC HEC, R&D PSF, ALP PSDP Province Research	1-5 years
Demonstration, training and dissemination of technologies to the farmers (Adopting Farmers Field School	Provincial Extension Departments	20.0	Project of ALP, PARC HEC, R&D PSF, ALP	1-5 years

(FFS) methodology)			PSDP Province Research	
Harvest and post-harvest management and product storage training to the farmers (Adopting Farmers Field School (FFS) methodology	Provincial Extension Departments	20.0	Project for ALP, PARC HEC, R&D PSF, ALP PSDP Province Research	1-5 years
Provision of cleaning and drying machines/equipment to the cluster farmers on cost sharing basis.	Provincial Extension Departments or Collaborating agencies	45.0	Project for ALP, PARC HEC, R&D PSF, ALP PSDP Province Research	1-5 years
Provision of mechanized de-husking to the cluster farmers on cost sharing basis.	Provincial Extension Departments or Collaborating agencies	55.0	Project or ALP, PARC HEC, R&D PSF, ALP PSDP PARB	1-5 years
TOTAL		**215.0**		5 years

10.2. Improvements in Marketing System

The cluster growers of the Ispaghol and Cumin were stern towards the existing market system for their produce. The low and erratic prices was the major concerns. To change the indigenous and conventional marketing is a difficult task, however based on review of literature and discussion with associated stakeholders following interventions and activities may be suggested.

Activity – 1

Direct Marketing of the Cluster Products

The intervention of direct marketing of produce by the farmers directly to the processor or exporters without any involvement of marketing forces through contract growing was also discussed with the concerned stakeholders. No doubt, that direct marketing enables producers, processor and other bulk buyers such as exporters to economize on transportation cost and improve price realization. However, in the current state of affairs the capacity of producers to meet the quality specifications demanded by processors and exporters could not be possible due to lack of facilities. There is need to furnish the capacity of the producers by providing facilities and technology of post-harvest management, cleaning, grading and proper storage of the produce. It may offer incentive to the large-scale buyers such as processors and exporters to purchase directly from producers in the clusters. In the clusters after achieving the status of high productivity and post-harvest management skills, the measures and steps will be taken to promote and encourage producers and other stakeholders to buy produce directly without the involvement of middleman. The project executing authorities have to play a vital and helping role to bridge up this gap.

Activity – 2

Contract Growing

Contract growing of Ispaghol and Cumin under a "buy-back" agreement between cluster farmers and an entrepreneur, trader, processor and manufacturer. The option was also discussed with stakeholders and they were reluctant to go for such an agreement for contract growing. The only encouraging response was from Hamdard Laboratories Pakistan (HLP). The representatives of HLP extended their full cooperation to provide their services for training programs for farmers to implement WHO guidelines for good cultivation practices. HLP were also keen to develop marketing plan where the growers and other stakeholder could create demand-based marketing. The matter was also consulted with some other agencies that are involved in agribusiness aspects with the farmers. The ENGRO fertilizer's agribusiness project captioned as "Rahbar" is executing contract growing mechanism with rice and wheat farming system in Sindh and Punjab. The chief of this project agreed to work with farmers of the cluster in contract growing mode and will also provide technical guidance and input supply to contracted farmers. The project authorities have to play an efficient and vibrant role to strengthen the producer and buyer relationship and also motivate other stakeholders and exporters to enter in the contract growing model of marketing in the cluster.

10.3. Marketing Information System

Marketing information system is an effective and efficient tool for the growers to take decision about the selling of the produce, its price and where to sell. In this regard to provide market information to the cluster area farmers activity suggested along with budget are given in Table – 10.2.

i. In collaboration with provincial departments i.e. Agriculture Marketing Information Service (AMIS), Directorate of Agriculture (Economics & Marketing) Punjab and Sindh Agriculture, Supply & Price Department, and also Agriculture Department Balochistan, the information on cluster crops may up loaded on their web portal and upgrade it regularly.
ii. A bulletin on the cluster crops related activities may be published monthly. All the operational and marketing information may be included in the bulletin.

Table 23: Improvements in Marketing System

Programs and Plans for Ispaghol and Cumin Clusters				
Suggested Actions/Activities	**Responsible Organization**	**Funds Allocation PKR million**	**Funds Source**	**Time Frame**
Direct Marketing of the Cluster Products	Public/Private Sector	6.0	Project + Private agency	1-5 years
Contract Growing	Public/Private Sector	6.0	Project + Private agency	1-5 years
Marketing information system	Provincial Extension Departments	14.0	Project or ALP, PARC HEC, R&D PSF, ALP PSDP PARB Sindh Research	1-5 years
TOTAL		**26.0**		5 years

11. ANNEXURES

Annexure-1. Literature Cited and Data Sources

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Annexure 2. List of Stakeholders Consulted

1	Dr.Hk. Abdul Hannan	Hamdard Laboratories, Karachi	Director R&D
2	Muhammad Imtiaz	Hamdard Laboratories, Karachi	Director Q.O.D.
3	Saleemuddin Ahmed	Hamdard Industrial Complex, Karachi	Dy. Director Purchase
4	Tahir Mustafa	Hamdard Industrial Complex, Karachi	General Manager
5	Muhammad Muslim (Resource person for survey)	Pakistan Forest Institute, Peshawar	Botanist Incharge
6	Imtiaz Ahmed	Pakistan Forest Institute, Peshawar	Asst. Botanist
7	A Sattar Ghanghro	Agriculture Extension Sindh	Dy. Director
8	Mohsan Mangi	Division Head, Agribusiness	Engro Fertilizer Karachi
9	Dr. M. Umair	Agronomy Lead	Engro Fertilizer Sindh
10	Tehmina Asif	Manager	Insta Foods, Lahore
11	M. Raffiq	Wholesale Dealer (0315-3059876) (Group meeting)	Cumin & Coriander
12	Mian Nadeem	Wholesale Dealer	Chanagamanga Kasur
13	Malik Yaqoob	Turmeric Farmer + Dealer/Boiler	Mandi Usmanwal, Kasur
14	Aman Ullaha	Commission Agent/Farmer (0333-7501685)	Cumin & Coriander Shahdadkot Sindh
15	Babu Eshaq	Jodia Bazar, Karachi	Cumin & Coriander Broker
16	M. Nadeem	Data Traders Hyderabad (Group meeting)	Cumin & Coriander Commission Agent
17	Haji M Younas	Al-Madina Traders Hydderabad (Group meeting)	Commission Agent
18	M. Asghar	Asghar and Company Sukhar	Cumin & Coriander Wholesale Dealer
19	Munawar Lal Seith	Shan Traders Sukhar (Group meeting)	Cumin & Coriander Wholesale Dealer
20	Riaz Kainth	AARI, Faisalabad	Coriander Scientist
21	Nazia Ahmad	ZAIQA Food Industries	Manager QA / R&D
22	Fahad Patel	Shan Foods Private Limited	Manager Procurement
23	Dr. Shahid Masood	PARC	Ex Member Crops
24	Dr. Tariq Rafiq	IBPGR, NARC	Senior Scientist
25	M. Hafeez Ullah	M/o NFS&R Economic Wing	Research Officer
26	M. Naeem Bhatti	Bhatti Traders Akbari Mandi Lahore	Exporter/Importer
27	Amdad Ali	Gharaewala, Kasur	Turmeric Grower
28	Mian Anwar	Chanagmanga Kasur	Turmeric dealer
29	Abdul Razzaq	Chack No. 14 F Cholistan	Ispaghol Farmer
30	Sheikh Nasir	Cholistan	Ispaghol Farmer
31	Malik Yousaf	AZRI Bahawalpur	Director
32	Zafar Iqbal	Yazman mandi	Ispaghol Farmer
33	Arshad	Cholistan Bahalpur	Ispaghol Farmer
34	Hafiz Mujeeb	Water Management (Resource person for Survey	Okara, Kasur
35	M. Javid Targar	Haroonabad	Ispaghol Farmer
36	M. Bashir (Resource Person for survey)	Director Agriculture Department	Coriander & Cumin

37	Group Meeting	PARC team, AMD Team, Shan Foods, Zaiqa Foods, Pakistan Agricultural Coalition, Pakistan Mercantile Exchange.	Karachi
38	Group Meeting	Focal Person Sulman Yasin (0321-1110104) Changa Manga Mandi	Attended by more than 20 Turmeric concerned stakeholders
39	Group Meeting	Focal Person Malik Sabbir Ahmed (0321-6590175) Hasilpur Mandi	Attended by more than 5 Ispaghol concerned stakeholders

Annexure – 3A Characterization of Ispaghol (Plantago ovata) Cluster

Product	Ispaghol (Whole) and Ispaghol Husk
Districts/Tehsils	Hasilpur, Harunabad, Chistian Tehsils (Choona at tail of Fateh canal is area in tehsil Hasilpur with mainly Ispaghol cultivation)
Area of the cluster: (Ha)	1200 -1300
Production: (Tonnes)	About 800-1000
Average yield: (Tonnes/Ha)	0.5 – 0.6
%age of the Total Cropped Area	0.16 – 0.21
Geographical and Environmental Factor	• Predominately desert in nature • The annual precipitation is 125-200 mm which usually occurs during monsoon months of July and August. • Average annual temperature 26°C with the highest in June at 36 °C, and lowest in January 14 °C. • Marginal, light, well drained (Ispaghol crop is damaged in standing water) sandy loam to loamy soils. • 71-73°- 41´ and 29°-20´ with a mean sea level of about 384 ft.
Growers/Farmers	• Majority of the farmers are owner • 75% have 5-10 acres. • Majority illiterate farmers and are not well aware about the modern production technologies regarding cultivation of Plantago ovate. • Most of the farmers are resource poor • Reluctant to take the risk of cultivation of Ispaghol and invest to buy new seed even of good quality and to follow technical guidance because crop is sensitive to climatic factors
Product Feature	• Both dried seeds and husk help in sooths and soften irritated tissues and also promotes evacuation of the bowel. • Seed is reddish or blackish white in color. • Seed taste is non-saltish, mucilaginous or tasteless. • Husk is pinkish white in color
Variety Feature	• No variety is registered with any public sector organizations • The name of the variety is not known to the farmers. • The variety have reddish-brown flowers • The variety is prone to shattering in case of over-ripening conditions. • The variety is prone to Fusarium wilt disease
Planting Time	• Mostly the farmers plant in October - November
Inputs/Management Practices	• Land preparations with 2 ploughing followed by planking. • Seed rate used is 2-4 kg/acre • Method of seedling is broadcasting • Majority of the farmers use seed from previous crop.

	• Few farmers apply 1-2 moderate irrigations. • Erratic climatic increases the risk of investing money on the recommended Nitrogen and phosphorus. • Some farmers who have irrigation facility apply 25 kg N and 25 kg $P_2 0_5$ at sowing time • Few farmers also apply 25kg N at 2nd irrigation. • Few farmers reported to perform hand weeding
Harvesting	• March-April. • Method of harvesting is manual • Drying is mostly sun-drying • Crop is very sensitive to high moisture conditions • Farmer prefer to sell the crop rather to store. • Proper storage facilities are lacking
Packaging/Transportation	• Packed in 50 kg gunny bags or fertilizer empty bags and transport in Truck. • No branding at farmer field
Wholesaler/Retailer	• Hasilpur is hub point for trade of seed and husk • All the trader and commission agents are located in this main market
New Technologies /Infrastructure	• None of the farmers use improved production technology/Good Agricultural Practices to enhance production of Ispaghol
	• No state-of-the-art processing technology and machinery is available for Ispaghol de-husking. • De-husking is done by using crude and inefficient methods • There are reported hue losses and poor-quality product in de-husking
Supply Chain	• Growers sell to local dealers who sell to husk processors. Husk merchants buy it from processor who sell it to exporters and retailers. • Proper drying, grading and packaging is done retailer and branded product dealers • About 50 small cottage husk processing units in Hasilpur mostly family labor oriented. • Mostly the owners of the processing units are very poor. They take loan from the big dealers in the market which have monopoly in the trade. • Verbally contracts are made between processors and dealers/traders • On the demand of dealers/traders, the de-husking processors mix flour of rice and the poly (by-product of Ispaghol) to increase the weight of husk
Certification	Not Certified.
Socioeconomic networking/ Gender involvement	• Family members including women are involved in various cultivation and harvesting events. • In de-husking process family labor is also involved
Subsidies/Incentives/Facilities	Not Available
Socioeconomic Networks	Not Available

Annexure – 3B Characterization of Cumin Cluster

Product	Cumin/ Zeera Safaid (Have Medicinal Value as well used as Spices)
Districts	Kalat, Karan, Nushki
Area of the cluster: (Ha)	Total of three districts = 4350 – 5632 Each district varies = 1450 - 2000
Production: tonne	Av of three districts = 2000 – 2500 Each district varies = 650-850
Average yield: (tonne/ha)	0.46
% age of the total cropped area in the cluster	10 -12 %
Geographical and Environmental Factor	• **Kalat** district lies between 65°49'50"-67°27'56" East longitudes and 27°55'55"-29°37'43" North latitudes • Consisting of 3Tehsils and 18 Union Councils. • Location of Kalat is at 810 km (aerial distance). • The climate of the district is mild in the summer and extremely cold in the winter. • The total mean rainfall 193 mm. • **Kharan** district lies between 64°41'46"-66°09'47" East longitudes and 27°59'17"-29°20'59" North latitudes • Consisting of 2Tehsils and 7 Union Councils. • Location of Kharan is at 910 km (aerial distance). • The climate is dry and dust storms are common throughout the year. • During the summer season, the days are hot and nights are very pleasant and cool. • The winter is dry and cold. • The annual average rainfall in the district is 104 mm • Average minimum temperature was 2.4°C in January • Maximum temperature 42.5°C in July. • **Nushki** district lies between 65°07'42"- 66°18'45" East longitudes and 29°01'51"-29°52'37"North latitudes • Consisting of 1Tehsil and 10 Union Councils. • Location of Nushki is at 810 km (aerial distance). • The climate of the district ranges from extreme hot in summer to severe cold in winter. • The rainfall is irregular and scanty. • Three main sources of irrigation including tube wells, dug wells and Karezes/spring are commonly used • Privately owned tube wells are maintained by the owners • The government owned tube-wells are maintained by the Irrigation Department. • Majority of the crop cultivation area is irrigated by means of tube wells which make 70% of the total irrigation sources, followed by wells sharing around 25%, Karezes/ springs contribute only 3-4% of irrigation.
Growers	• Only a few influential landowners possess large

	agricultural land. • Overall, landholding is 5-15 ha • Large holding owners give their land on lease or on contract for cultivation. • The harvest is shared equally between the contractors and landowners. • Small land owners cultivate their own land with the help of their family members. • Women and children also assist their male members in harvesting and cutting of the crops. • Some land owners hire labor on a permanent basis for cultivation.
Product Feature	• Cumin is a small annual and herbaceous plant • Flowers in white or pink color • Spindle-shaped fruits in green and gray color which produces highly nutritional oleaginous seeds. • Cumin seeds have distinct flavor due to 2 to 5% essential oils
Variety Feature	Local, Irani and Local Black
Planting Time	Rabi crop sown in October-November
Inputs/Management Practices	• Farmers have reported to apply fertilizer to their irrigated crop @ per acre (DAP 2 bags+ 1 bag SOP+ 1 bags Urea). • In case of rainfed crop generally no fertilizer is applied. • The irrigation interval for irrigated cumin crop is 7-10 days. • Weeding is done manual almost once during crop season. • Sowing is done by broadcast method • Intercropping with onion is a common practice
Harvesting	End February-March
Packaging/Transportation	In gunny bags transported in mini trucks to market if required
Wholesaler/Retailer	The majority of the farm produce is directly sold into the hands of brokers/dalal/beopari/ contractors or intermediaries, who are all middlemen with different nomenclatures at various locations.
New Technologies/ Infrastructure	Good Agricultural Practices and new improved varieties
Supply Chain	• Farmers to commission agent to wholesale dealers in Karachi. • Sale of standing crop to commission agent is also practiced
Certification	No certification
Socioeconomic networking/ Gender involvement	Most of the cultural practices are carried out by family members
Subsidies/Incentives/Facilities	No such facility prevails
Socioeconomic Networks	Not reported by stakeholders

Annexure – 4A SWOT Analysis of Ispaghol SWOT Cluster

Cluster	Cholistan: Tehsils Hasilpur, Harunabad, Chistian in Punjab
Products	Ispaghol (Whole) and Ispaghol Husk
Strength	❖ Ispaghol is a well-known and widely used in Medicare systems and is a need of every household ❖ It is a high value medicinal crop produced in the cluster ❖ Cluster is the only and leading producer of Ispaghol ❖ The cluster have a well-established market system within cluster of Ispaghol ❖ Local processor families have long been involved in making Ispaghol husk and located within the cluster ❖ The arid to semi-arid climatic conditions are highly suitable for Ispaghol cultivation ❖ There exists a lot of potential for improving husk making process and value addition in the Ispaghol product ❖ Ispaghol have a vast demand within the country and in the world market
Weakness	❖ Husk making system and process is very indigenous, obsolete, laborious and not economically effective. ❖ Very poor-quality husk product ❖ The workers involved in husk making process are prone to respiratory and other diseases ❖ Lack of proper cleaning and storage facilities ❖ Farmers are resource poor and do not practice proper agronomic practices due to high cost of inputs. ❖ As the more than 80% crop is rainfed, hence farmers leave the crop on the mercy of nature and put less efforts on agronomic practices. ❖ Rainfall at the time of flowering and harvest of crop result low yields and huge post-harvest losses ❖ Farmers do not have facilities to safe the crop from high humidity as it damages Ispaghol seed badly ❖ Price of the produce at the time of crop harvest is very volatile and discriminating by the market forces ❖ Lack of facilities for proper by-products such as Ispaghol cake and product value addition
Opportunity	❖ Scope of achieving high yield than prevailing through adopting good agricu practices ❖ Scope for agricultural extension and research department to provide backstop through improved varieties and other cultural practices ❖ Scope of promoting contract growing ❖ Scope of developing and promoting the use of improved processing state of the art de-husking machines for farmers and processors ❖ Scope for improving and new interventions in marketing system ❖ Scope exists to provide training to the farmers regarding storage of Ispaghol s and husk prior to market
Threat	❖ Ispaghol is a high risky crop in case of rains and humidity at the time of harvest. ❖ Farmers told that the climate of the cluster is changing and rains at the time of flowering and harvest has compelled them to abstain the cultivation of Ispaghol in the cluster area

	❖ Due to lack of proper variety the shattering results in yield losses to a large extent due to drought that also appear in some years due to climate change ❖ Farmers of the cluster area told that due to climatic change scenario the Ispaghol crop is eliminated from these areas and is shifting to Sindh areas. ❖ Fusarium wilt disease epidemics if not controlled timely ❖ Lower and erratic price are aggravating the threats to Ispaghol crop

Annexure: 4B SWOT Analysis of Cumin Cluster

Cluster	Balochistan (Kalat, Karan, Nushki districts)
Products	Cumin/Zeera Safaid
Strength	❖ Farmers have long experience to cultivate cumin ❖ The cluster environment is very much suitable for the growth and development of cumin ❖ A vast area is available to promote cultivation of cumin as a sole crop ❖ Local Zera variety is having very good flavor and taste. Processors and exporters give a lot of preference to this variety.
Weakness	❖ Trends to cultivate cumin intercrop with onion as a dwindled crop, farmers put more importance to onion crop than cumin ❖ Marketing is in the hands of private enterprise. The role of the middle man is significant due to the limited commercial and marketing knowledge of the producers. For them it is convenient to sell the crop to the middle man rather to take it to Jacobabad and Sukkar, markets. ❖ Lack of cleaning and storage technology and infrastructure facilities ❖ Resource poor farmers
Opportunity	❖ To promote cumin as a main crop adopting good agricultural practices. ❖ Introduction of new improved high yielding varieties. ❖ Protect and improve local or traditional variety of cumin through research to obtain high yields keeping flavor and taste at original level. ❖ Promote contract growing and processing facilities in the cluster ❖ Improve marketing system
Threat	❖ Fusaruim wilt disease epidemics if not controlled timely ❖ Drought conditions that appear frequently due to climate change ❖ Discriminating marketing system ❖ Very meager to no backstopping from research and extension services from public sector ❖ The local variety have novel taste but due to low yield, economically less feasible to grow as Indian cumin product is available at much lower price.

Annexure – 5

Feasibility Study of Ispaghol (Psyllium) De-husking Processing Plant

The husk of Ispaghol is actually the coating of mucilage around the seed. It is considered as pure fiber and is used for the production of various products. Pakistan imports a large quantity of Ispaghol husk from neighbouring and other countries due to absence of state-of-the-art de-husking plant in the cluster as well as country. Hence, in the current Ispaghol cluster development approach, Ispaghol de-husking plants will be introduced and promoted. The plants will be equipped with advanced balancing equipment essential for ensuring product quality and production efficiency. The plant will be installed at a capacity of 180 tonnes per year for the de-husking of Ispaghol and designed to allow free flow in the sequence of processing activities without the need for backtracking. The building will be completely sealed with cemented floors and wired windows to prevent the entry of rodents and insects, ensuring a clean and hygienic environment. The exterior and interior of the plant will be inspected for hygiene and pest control.

Objective:

The objective of this study is to estimate feasibility of the Ispaghol de-husking Processing Plant for the future investors so that following functions in the value chain can be incorporated:

- Cleaning, fumigation, sterilization, de-husking and packing after harvesting, loading and shipment, etc.

The Features and Process of Ispaghol De-husking Plant

Seed cleaning:

Raw Ispaghol seeds are cleaned by a mechanical process through various processing stages in which no chemical products are used. We will use a strict ten-step seed cleaning process followed by denaturing the seed. All phases can be cleaned with 200 kg of Psyllium seed per hour.

De-Husking:

The process for de-husking, Ispaghol seeds are to obtain high yields of pure and high-quality husk. These processes include milling intact seeds in a mill which causes the shell to be shattered by collision under conditions where the shell is broken and separated from the undelivered portion of the Ispaghol seeds without it to substantial breakage and size reductions part does not come from the shell. De-husking system with automatic feeding, where 1 unit will be placed parallel to 18 grinders, in which the grinders will have a diameter of 36 “. The magnets are arranged in the required places. Our proposed unit can produce 200 kg of semi-finished mixture per hour.

Husk Cleaning and Winnowing:

The husk is then passed through gravity separators for further purification before the custom packages. This process is called winnowing.

Fumigation:

The plant will be equipped with a system of fumigation chamber built according to the specifications and instructions of the experts. The dosage of the fumigant and the treatment will take place according to the requirements of the importing country and the needs of our customers. Both the raw Ispaghol seeds and the final husk products will be fumigated according to the specified standards acceptable to national and international markets.

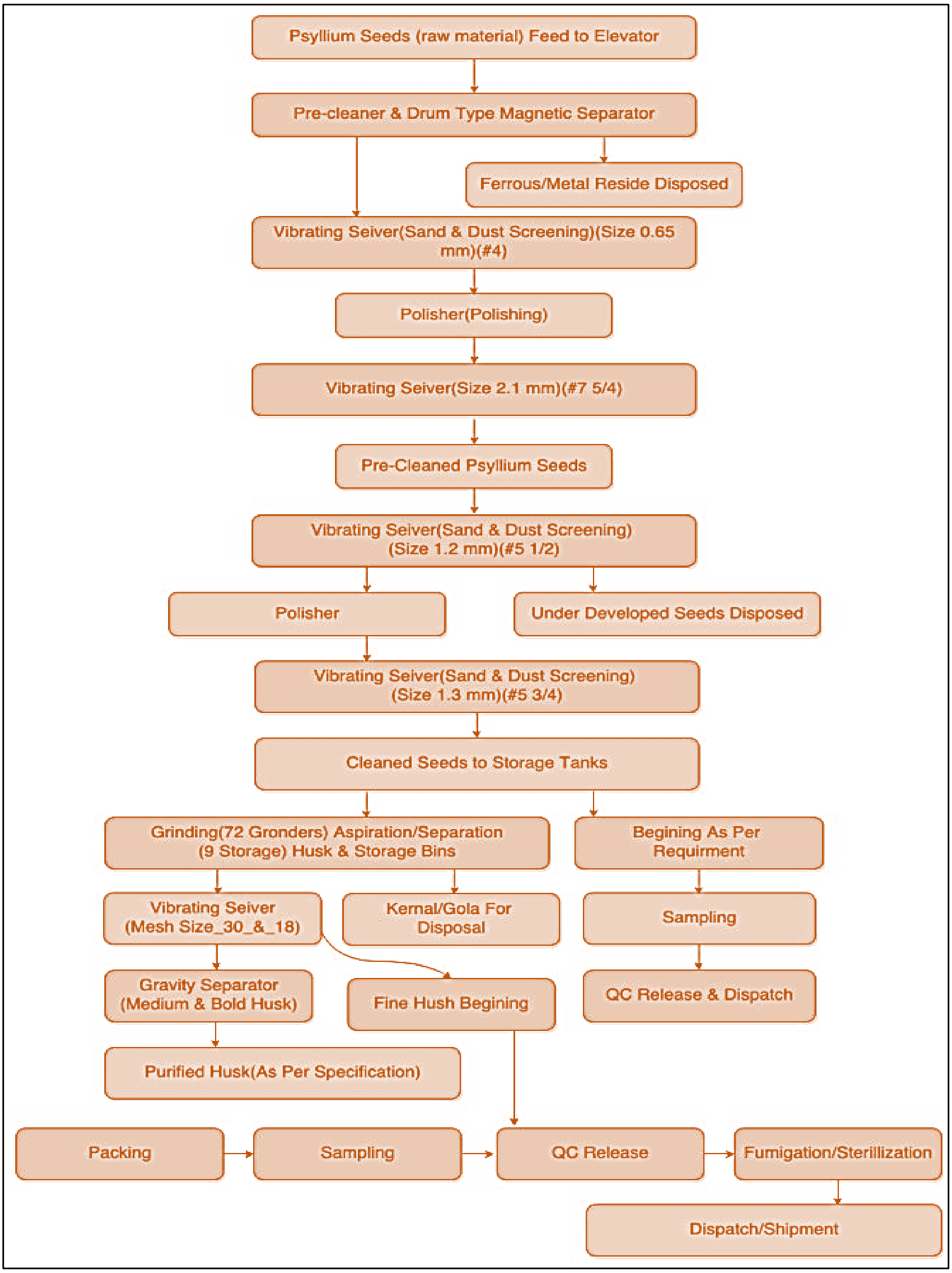
Sterilization:

Treatments of the final product with ethylene oxide, methyl bromide, and gamma ray irradiation will be provided through the contract structures based on specific customer requirements.

Package:

The goal of this study is to provide high quality in flexible and cost-effective packaging solutions under sanitary control while ensuring that product is safe for the consumers during transport and storage. Typical types of packaging which will be possible in the plant for packing are:

- Paper bags: HDPE Laminated paper bags with inner poly-liner 15 kg/bag, Content Net Wt. **25** kg/bag.
    - PP Woven Bags: laminated PP woven bags with an inside poly-liner. Content Net Wt. 25 kg/bag, 40 kg, /bag.
    - Fibre Drums: Fibre Paper drum and silver-plated ring with inner poly-liner. Content Net Wt. 25-50 kg/drum.
    - Plastic Container: Plastic White container (tubs) with lead and white coated handle. Content Net Wt. 9.1 kg/tub.
    - PET JAR: We can provide 50g, 100g, and 250g. PET JAR pack by covered poly bag and bulk in Carton pack.
    - Sachets & Lined Carton: 10g. Sachets and 50g, 100g, 120g, 250g. Lined carton and bulk in Carton pack.


Psyllium Seeds (raw material) Feed to Elevator
Pre-cleaner & Drum Type Magnetic Separator
Ferrous/Metal Reside Disposed
Vibrating Seiver(Sand & Dust Screening)(Size 0.65 mm)(#4)
Polisher(Polishing)
Vibrating Seiver(Size 2.1 mm)(#7 5/4)
Pre-Cleaned Psyllium Seeds
Vibrating Seiver(Sand & Dust Screening) (Size 1.2 mm)(#5 1/2)
Polisher
Under Developed Seeds Disposed
Vibrating Seiver(Sand & Dust Screening) (Size 1.3 mm)(#5 3/4)
Cleaned Seeds to Storage Tanks
Grinding(72 Gronders) Aspiration/Separation (9 Storage) Husk & Storage Bins
Begining As Per Requirment
Vibrating Seiver (Mesh Size_30_&_18)
Kernal/Gola For Disposal
Sampling
Gravity Separator (Medium & Bold Husk)
Fine Hush Begining
QC Release & Dispatch
Purified Husk(As Per Specification)
Packing
Sampling
QC Release
Fumigation/Sterillization
Dispatch/Shipment

Process Flow Chart of Ispaghol (Psyllium) Processing Plant

Specification of the Ispaghol De-husking Processing Plant:

First Step: **Seed Cleaning Units**
Second Step: **Store & Grinding Units**
Third Step: **Husk Units**

Vendor: Suzhou CMT Engineering Company Limited, Jiangsu, China
ISO 9001, ISO 20000 certified company

Ispaghol De-husking Process Plant Specification

No.	Name		Power (kw)	Quantity (set)
1	High efficiency vibrating sifter	80*100	0.5	1
2	Elevator		3	4
3	Gravity de-stoner		1	2
4	Scourer	40*150	5.5	1
5	Magnetic separator	150		5
6	Low pressure blower	3.0	6	2
7	De-husking machine		24	8
8	Elevator		3	4
9	Classify machine	100*200	1.5	4
10	Auto packing machine	25A	3.25	1
11	De-dust collector			1set
12	Low pressure blower	5.5	5.5	1

Capacity: 2t/day
Power: 140KW
Dimension: 40*9*5m

Main Technical Parameter of De-husking Machine

Diameter	400(mm)
Power	2.2 kw
Capacity	200kg/h

Ispaghol Processing Plant Ispaghol Cleaning Plant

Ispaghol Processing Plant

Plant and Machinery:

The cost of plant & machinery is estimated at US$ 17170 including installation and commissioning. The installed production capacity will be 1 ton per day. The cost estimates for plant & machinery has been worked out based on the cost figures available from recent orders paced for similar items in the recent past, duly updated to cover the price escalation in the intervening period. These costs are given in the following tables:

Plant and Machinery

S. No.	Particulars	Qty.	Rate (US$)
1.	Psyllium De-husking Processing Plant	1	6000
2.	Solar generator	1	3000
3.	Packaging machine, Pouch sealing machine	1	170
4.	PU Building for Processing Unit Installation (800 sq. ft.)	1	8000
	Total		**17170**

Misc. Fixed Asset Costs:

US$ 7320 has been estimated under the heading of miscellaneous fixed assets. The details of electrical installations for power distribution have been considered commensurate with the power load and process control requirements. Other miscellaneous fixed assets including furniture, office machinery & equipment, equipment for water supply, office stationery, telephone and refreshment, workshop, fire-fighting equipment, etc. will be provided on a lump sum basis as per information available with the consultants for similar assets. The details of miscellaneous fixed assets and their associated costs are been shown in table below:

Miscellaneous fixed asset cost

S. No.	Particulars	Qty.	Rate (US$)
1.	Office Equipment	1	1000
2.	Furniture and Fixture	1	1000
3.	Miscellaneous Accessories	1	1000
4.	Fire Fighting	1	70
5.	Computer with Accessories	2	1000
6.	Water Treatment Plant – 500 litres per hour	1	1000
7.	Loading Tempo	1	250
8.	Electrical Installation	1	2000
	Total		**7320**

Pre-Operative Expenses:

Expenses incurred prior to commencement of commercial production are covered under this head that total US$ 18092**.** Pre-operative expenses include establishment cost, rent, taxes, traveling expenses and other miscellaneous expenses. It has been assumed that the funds from various sources shall be available, as required. Based on the project implementation schedule, the expected completion dates of various activities and the estimated phasing of cash requirements, interest during construction has been computed. Other expenses, under this head have been estimated on a block basis, based on information available for similar projects.

Pre-Operative Expenses

Sr. No.	Particular (for 1 year)	Amount (US$)
1.	Interest up to production @ 16% on term loan amount of US$ 78696 **(30% of total project cost)**	12592
2.	Electricity charges during construction period	1000
3.	Marketing Launch Expenses	500
4.	Technology Know-how and consultancy fees	2000
5.	Training expenses	1000
6.	Travelling Expenses	1000
	Total	**18092**

Cost of Raw Material:

Based on a processing capacity of 2 ton per day considering and 90 days of working per year, the annual raw material consumption of the pack house is 180 tonnes. The cost of raw Ispaghol based on its average selling price as determined through interview with randomly selected farmers and converting it into US$ (with conversion rate of one US$=135) is $1100/ton. Adding US$20 per ton transportation cost from the field to pack house, the raw material cost for pack house would be US$1120.

Cost of raw material

Particulars	Rate per ton (US$) for the raw Ispaghol at the wholesale	Qty. (Tonnes) per season	Raw material cost (US$)
Ispaghol	**1120**	**180**	**201600**

Land Lease Charge:

Required land is 5,000 sq. ft. which has been considered on lease @ US$200 per annum for first three years and @ US$220 for the fourth year and subsequently @5% increase every year.

Land Lease Charges

S. No.	Year	Lease Charges Per Annum (US$)
1.	1st year	200
2.	2nd year	200
3.	3rd year	210
4.	4th year	221
5.	5th year	232
	Total	**1063**

Electricity and Water Consumption Charges:

The unit cost of electricity has been considered @ PKR.20.70/ unit assuming that the entire power requirement is met from the grid. A power supply of 2.2 Kw is deemed appropriate. The expense on water supply, treatment and distribution has been suitably considered, based on the tariff by water and sanitation agency (WASA) for per month consumption of water tariff of @ 92.82 PKR/thousand gallons. Water requirements are approximately 100 gallons per day.

Electricity and water consumption charges

S. No.	Description	Amount Per Annum (US$)
1.	Power Consumption	2000
2.	Water Consumption	100
	Total	**2100**

Human Resource Cost

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

Salary and wages

Sr. No.	Description	Requirement	Salary/month (US$)	Salary/annum (US$)
1.	Plant Manager	1	500	6000
2.	Accountant	1	300	3600
3.	Supervisor	2	740	8880
4.	Skilled Workers	2	400	2400
5.	Driver	1	200	2400
6.	Security Guard	1	200	2400
	Total		**2340**	**25680**

Cost of Project

Particular	Value (US$)
Fixed Costs	
Plant and Machinery	17170
Misc. Fixed Assets	7320
Pre-operative expenses	18092
Operating Costs	
Cost of raw material	201600
Land lease charges	1083
Electricity and water consumption	2100
Salary and wages	25680
Packaging Cost	5400

Marketing Cost	1800
Margin Money for Working Capital	1500
Contingencies 5% of Fixed Assets	366
Total Variable Costs	**274911**

Project Income Statement

Revenues		**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Revenue (US$)							
Quantity of Ispaghol that goes in value addition (t)			180	180	180	180	180
Price of the value added Ispaghol (US$/ton)			1400	1500	1500	1500	1500
Total revenues (US$)			252000	270000	270000	270000	270000
Direct variable costs							
Raw material price (US$/TON)			1100	1100	1100	1100	1100
Raw material cost (us$)			198000	198000	198000	198000	0
Packing costs (@PKR20 per 20 kg box)			1600	1600	1600	1600	
Labour cost			25680	25680	25680	25680	
Electricity and water			2100	2100	2100	2100	
Maintenance (1% of the machinery, equipment and furniture cost)			426	426	426	426	
Land lease charges (10%) increment on annual		200	200	210	221	232	
Marketing (US$10/ton)			1800	1800	1800	1800	
Office administration			370	370	370	370	
Total variable cost			231276	231286	231297	231308	1100
Gross profit			20724	38714	38703	38692	268900
Indirect fixed cost							
Machinery		-42582					
Licensing and regulatory fee		-150	0	0	0	0	
Total		-42732	0	0	0	0	
Grand total cost		-42732	231276	231286	231297	231308	0
Net profit (Net cash flow)		-42732	20724	38714	38703	38692	270000
Net Profit Value (NPV)	8.50%		**227,684**				
Internal Rate of Return (IRR)	**87%**						

Project Viability:

The Internal Rate of Return of the project is estimated at 87%, which is significantly higher than the bank return rate of 16%. Hence, the project is deemed financially viable. The NPV of the project is positive (US$ 227,684) at a discount factor of 16% during the first 5 years of operation considered. This implies that the project generates sufficient funds to cover all its cost, including loan repayments and interest payments during the period. The analysis details have vividly demonstrated that the Ispaghol de-husking plant for the cluster is financially workable and sustainable over the long term.