Evaluation of Sericulture Industry in Pakistan; Obstacles Progress and Way Forward

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Dedicated

to

My kind, loving and caring father, mother, sister, brother and ..tö, all Pakistani Nation

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In the name of ALLAH, the Most Gracious and the Most Merciful. Peace and blessings of ALLAH on His Prophet Muhammad ﷺ' the most perfect source of ALLAH's guidance and blessings.

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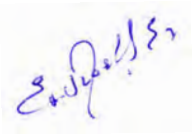
May ALLAH reward them all, to all of them

Muhammad Farooq Hyder

DECLARATION

I hereby declare that this thesis, neither as a whole nor as a part thereof, has been copied out from any source. It is further declared that I have carried out this research by myself and have completed this thesis in the basis of my personal efforts under the guidance and help of my supervisor. If any part of this thesis is proven to be copied out or earlier submitted, I shall stand by the consequences. No portion of work presented in this thesis has submitted in support of any application for any other degree or qualification in International Islamic University or any other university or institute of learning.



Muhammad Farooq Hyder

Abstract

Pakistan is blessed with plenty of resources and opportunities which are require for the progress of any economy but due to lack of awareness and unanimous policy agenda, it is still in the condition of uncertainty. Rapid increase in population and unemployment is also an alarming issue. In this scenario sericulture industry has capability to generate opportunities of livelihood in bulk. Establishment of sericulture industry requires low capital and based on the phenomena that don't ignore the standard conditions but manage it as economically as you can". Sericulture is a welfare oriented industry and its promotion is responsibility of the state. Other labor increasing countries like India, China, Bangladesh etc. have a special focus on sericulture and for its promotion different government institutes and NGO"s are working hand in hand.

In Pakistan state holds the basic but sufficient infrastructure of sericulture industry but it is not functioning in its right direction. In past sericulture was a flourishing and reliable industry in Pakistan. It was source of income generation for thousands of families.

This study attempts to make an outline of the features, benefits and feasibility of sericulture industry. This study also tries to explore the past, present and future of Pakistani sericulture industry.

Results of study indicates that cost for the establishment of silkworm rearing set up for one family is Rs. 25,000 and this is a onetime investment which could be returned back in the same season. Further results indicate that annual silk demand of Pakistan is 750 tons which is imported from other countries. If Pakistan attempts to produce this by itself than it can save the capital of Rs. 487,500,000 and this will provide employment to 112,500 people. If Pakistan targets to export an equal amount i.e. a production of 1,500 tons, the job creation will double i.e. 225,000 and a reasonable amount of revenue from export could be generated. Besides these factors development of sericulture industry has a strong and positive impact on environment.

Acronyms

MGD	:	Millennium Development Goal
WTO	:	World Trade Organization
CSB	:	Central Silk Board
BSB	:	Bangladesh Silk Board
NGO	:	Non Government Organization
KPK	:	Khyber Pakhtoon Khawa
AJK	:	Azad Jammu and Kashmir
FW&F	:	Wildlife and Fisheries
DGM&E	:	Directorate General, Monitoring and Evaluation
BSRTI	:	Bangladesh Silk Research and Training Institute
SFD	:	Sindh Forestry Department
UNDP	:	United Nations Development Program
BRAC	:	Bangladesh Rural Advancement Committee
JICA	:	Japan International Cooperation Agency
ISC	:	International Sericulture Commission
UN	:	United Nations
KII	:	Key Informant Information
FDG	:	Focus Group Discussions
SRO	:	Senior Research Officer
DFL	:	Disease Free Laying
P-1	:	Parent Verities
USSR	:	Union of Soviet Socialist Republic
SDO	:	Sericulture Development Office

Table of Contents

List of Tables

List of Chart and Figures

Chapter 1

Introduction

Pakistan is an agriculture based economy and a land of villages. About 63 percent population is living in rural areas and about 65 percent of its population depends upon agriculture either directly or indirectly. Cropped area in Pakistan is about 22.75 million hectors. However average land holding is small and more than 50 percent of the farmers have less than 2 hectares of land holdings. About 60 percent rural population is peasant and they are cultivating on someone else land (World Bank, 2010). According to the World Bank' Poverty Head Count Analysis for 2014, about 21.7 percent population lives below $ 1.25 poverty line and about 60 percent population lives below $ 2 poverty line while the rural peasant communities are even more ill-fated (World Bank, 2013-14). As mentioned earlier, 65% people are engaged in agriculture however, agriculture contributes only 21% in GDP of Pakistan (Khan, 2013). In Pakistan due to traditional farming system and old methods of cultivation, per acre yield is low and small land holdings are not sufficient to provide enough livelihood to farmers. Moreover, Pakistani farmers are unaware of advanced techniques and technology of farming. Development of mechanism for the purpose of advanced and modern farming is expensive and sometime unaffordable for low and middle class farmers (Qureshi and Arif, 1999).

Therefore, to generate the employment opportunities in bulk, to improve the living standard of poor landless rural and semi rural communities and to boost the rural development, there is need of livelihood options which can generate enough recourse but requires less amount of inputs as well as investment and depends on simple technology which could be easily taught to rural communities. In this situation, the

sericulture industry looks a feasible option for provision of livelihood to the rural communities. Sericulture is one of largest job providing industry in the world and it is providing livelihood to over 40 million people around the globe from which majority of people i.e. about 28 million belongs to China. In India sericulture activities are providing jobs to about 8.6 million people (Central Silk Board, 2013). Similarly, in Bangladesh it is providing employment to 0.86 million people (Bangladesh Silk Board, 2012).

Mulberry leaves are the major input for sericulture industry which can be grown on diverse climatic conditions and soil. Without using existing agricultural land it can be cultivated on free lands i.e. government owned free marginal lands, hills, beside the roads, streets, canals, rivers, on forestry allocated lands and free lands of railway. The cost of generating employment in this industry is very low. The skill level required for sericulture can be easily achieved by illiterate rural communities. Therefore the industry is a suitable livelihood option for rural communities of Pakistan.

This study is aimed to evaluate the scope and potential of sériculture industry and its current status in Pakistan. In this study information is collected about available infrastructure, techniques, technology and productivity of sericulture as well as the technology and requirements required to improve the productivity. In this study obstacle and hurdles facing sericulture industry in Pakistan and strategies to get rid of these constraints are also explored.

1.1. Research Objectives

(i) To Explore the Potential of Sericulture industry

(ii) To Evaluate Current Infrastructure, Input and Technology of Pakistani Sericulture

(iii)To Identify the constraints and problems faced by industry in Pakistan

(iv)To provide some suggestions for sericulture promotion

1.2. Significance of Study

Pakistan is a labour abundant country having high rate of unemployment. Therefore there is need of an industry which can tap the labour intensively. The sericulture industry is responsible for providing jobs to millions of people in India, Bangladesh and China. However, despite sharing climate and geographical conditions with India and Bangladesh, unfortunately Pakistan is far behind from its neighbouring countries in terms of generating employment from sericulture. This industry is providing millions of jobs in India and Bangladesh, but currently in Pakistan only few hundred families are practicing it as a part time occupation.

This study will examine the current status of Pakistan and under the light of study, policy guidelines regarding improvement and development of sericulture industry will be provided. This study will help to re-establish the industry and to open livelihood options for a large number of rural communities.

1.3. Contribution of the Study

In different countries of world sericulture sector is adopted progressively. Regarding these countries, enormous data covering each aspect of the industry is accessible and thousands of experimental and investigative research studies, books, publications and case studies are available.

Unfortunately, Pakistan is far behind in exploring the dynamics of this industry. Regarding advancement in research and development of Pakistani sericulture, data and literature is very scarce. Available studies are old and covered the partial sections of sericulture industry.

Though sericulture is a huge subject and examination of current and updated situation cannot be wrapped up in a small binding. In current study, sericulture is tried to examine in Pakistani perspective. This study strives to explore the maximum ingredients of industry i.e. its importance, scope, feasibility, previous history and current status of Pakistan and neighbouring sericulture countries. Finally it is attempted that this study may be supportive and also provides some background for further studies on Pakistani sericulture industry.

1.4. Outline of Study

In this study different aspects are explored and arranged in such a way that these could be understood conveniently. This study is divided into seven chapters; first chapter covers the introduction, study objectives, significance of study and contribution of study. Second chapter is about potential and importance of sericulture and its linkages with rural as well as overall development. Third chapter is review of literature and fourth is about sampling, data and methodology adopted for current study. Fifth chapter describes the results and sixth explores the strategies and feasibility for improvement in Pakistani sericulture, seventh chapter is conclusion of study.

Chapter 2

Sericulture and Development

2.1. Background

In rural areas of Pakistan opportunities for income generation are limited and most of the people are living below the poverty line. Poverty is one of the internationally recognized issue and its eradication is one of the recognized millennium development goal (MDG). For sustenance, rural people are migrating toward urban and semi urban localities. This migration is increasing the pressure on urban localities. Due to this unintended and deranged urbanization, numerous problems are occurring. To control this situation there is an immense need of rural development and this will happen with the generation of livelihood opportunities in rural areas. Rural development will reduce the poverty and will enhance the living standards of rural people and this will reduce the migration from rural to urban areas. As a result, rural immigrants will be inspired for return back, excessive urbanisation will also be reduced which will enhance governance, price hike in urban areas will also be trimmed down and the final beneficiaries will be both the rural and urban communities. Therefore it can be inferred that rural development is essential and it is the real development of any country (World Bank, 2001).

2.2. Development

Development may have different forms and can have variety of objectives. Any idea or initiative which leads to the improvement in living standards of community refers towards the term of social or economical development. In this perspective, building

up the people or community in such a way so that they can fabricate a future for themselves for a long time period is called sustainable development.

Development of any society may contain following four vital elements

I. Strengthening economic capabilities (Improvement in agricultural and non-agricultural income, industrial development and development of infrastructure.
II. Improvement in human capabilities i.e. skills, talent and potential. (Improvement in general health and educational standards)
III. Improvement of protective capabilities (Preservation of natural environment and advanced prevention measures of natural disaster)
IV. Improvement in political and policy making capabilities.

(World Bank, 1975)

Rural Development

According to the report of World Bank (1975), rural development is defined as "a strategy aiming the improvement of economic and social living conditions, focusing on a specific group of poor people in a rural area". It assists the poorest group among the people living in rural areas. Strategies for improvement in agricultural and non - agricultural development programs have direct and positive impacts on the economy, culture, tradition and people of rural areas.

Rural Development and Pakistan

In Pakistan large no of rural communities are living in miserable economic condition. Due to suitable climate, demographic and geographical conditions, Pakistan has a great scope and potential of rural development but there are many challenges and hurdles for sustainable rural development in Pakistan. So, in current circumstances it

is very much needed to explore and promote the livelihood options which need relatively small land holding and investment hence can provide the livelihood to large number of poor and deprived rural population (Ahmad *et al.*, 1999). Sericulture industry has capabilities to provide such opportunity.

2.3. Silk and Sericulture

Sericulture is practiced to produce natural silk fibre which is a protein from insect origin. It is a commercial fibre and a gift of nature to mankind, known as the Queen of textile, having 0.2 percent share in global textile market (WTO, 2006). Precious natural silk is a symbol of comfort, luxury and elegance. Silk fibre is lustres, nice looking, comfortable to wear and well for human skin. Therefore natural silk garments and products have a huge demand in global textile market (Aslam, 2005, Islam, 2011)

Sericulture is a combination of two French words "series" meaning silk and "culture" means rearing. In short rearing of silkworms for the purpose of natural raw silk production is called sericulture (Dar, 2013). Sericulture is both an art and a science of rearing silkworms. From eggs to moth; silkworm rearing is a 30 – 35 days process. This rearing process requires particular environment and can be performed in rearing rooms or in specific rearing houses (Ankita, 2005).

2.4. Sericulture and Rural Development

By nature sericulture is a labour intensive, welfare oriented, employment creating and income generating cottage industry. It is beauty of this industry that there is no limitation of age, gender or marital status and entire family especially women and children can participate in income generation activity at their home place (Hanumappa and Anatharaman, 1992). Promotion of sericulture industry is highly

supportive for environment friendly ecosystem development as well as for high economic returns. For the purpose of silkworms rearing, mulberry crop is a special feature of sericulture industry and if it is cultivated according to conditions then this can prove more remunerative than other cash crops (Kusnaman, 2004).

Establishment of sericulture can be much helpful in creation of new job opportunities and can generate supplemental income in rural areas. It is a tool with which rural economies can be developed and uplifted. Sericulture provides downstream employment in rural and semi-urban areas that's why low-income and socially under privileged groups have a great participation in silk production. Silk has great demand in higher income groups and this industry plays a vital role in flow of income from the urban rich sections of society to the rural poor. The silk goods are purchased by the urban rich and middle-class consumers and it is estimated that around 57 % of the final value of silk fabrics flows back to the primary producers in the rural areas. In simple words sericulture can play a vibrant role to check migration from rural to urban areas. (Sahu *et al*, 2011)

History of Sericulture

Historical evidences show that the nations and countries who adopted sericulture sector for the purpose of development and revenue generation; they got highly positive and long term impacts. Origin of sericulture is China and it was invented unintentionally before 5,000 years by a Chinees princess. Through famous silk route, China was first and only country who introduced silk products to the world and kept this technology secret for thousands of years. Persia became China's business partner, it buy silk products from China and resale it to Romans at excessive prices which was a big silk market at that time. With the help of silk trade, China and Persia became

wealthy and powerful countries. To avoid high cost of silk products, Roman Emperor decided to produce its own raw silk. For this purpose he sent two spies to learn the secret of silk production. After two years these spies returned back successfully along with silk technology, silkworm eggs and mulberry seeds. By this way this industry was exposed and was established all around the world. In 7th century this industry was further developed in Mediterranean countries and then in Sicily and Spain, Turks also established their own silk industry. In 12th century Italy became the silk capital of West and French government also initiated it. Sericulture was also established in England and American colonies (Mahila, 2013). During 19th century, due to several reasons i.e. high cost of western labour, world wars, conversion towards electronic and other industries, and two silkworm diseases, reduced the size and scope of western sericulture (Ishtiaque, 2013). After world war this industry has played a significant role in the economic development of some advanced nations like Japan (GUO, 1985). Sub-continent have highly favourable climate and labour conditions and sericulture was introduced here during the Greeks Christian era. During the era of Mughals it was a prosperous industry (Hashmi, 2011). Now sericulture is also getting popular in Africa and Central Asian States. (Ishtiaque, 2011)

2.5. Scope and Potential of Sericulture Industry

Sericulture industry has potential to promote the welfare of individuals as well as the whole society. Development of this industry refers to the development of a complete eco-system contain several interrelated sections. Sericulture is highly remunerative, having a high employment potential, requires low investment and low gestation period. Sericulture generates opportunities for an ideal utilization of manpower, water and land recourses which otherwise have no usage. Its technology is simple, easy to

understand and adopt (Dawangan *et al.* 2011). Other relevant potential and aspects of industry are discussed below.

Sericulture and Environment

In contrast to other industries, sericulture is environment friendly. It has a positive impact on nature and climate, therefore development of sericulture means development of atmosphere. Mulberry crop is the basic component of sericulture industry which can be cultivated on diverse environmental conditions and each type of sandy to clay soil. Cultivation of mulberry crop may be helpful for the purpose of effective utilization of barren and waste lands. Mulberry trees require less care and it can be planted on hills, government owned barren lands, beside the streets, roads, canals, rivers and free lands of railway and forest department (Hanumappa, 2011, Geetha *et al.*, 2011). All these land resources are available abundantly in about each district of Pakistan.

Sericulture and Employment Generation

Sericulture is a cluster of many on-farm and non-farm activities and has a strong relationship of many backward and forward linkages. It contains different type of interrelated sections that provide source of livelihood to many layers of people and generates a high number of employments in the areas like silk seed production, rearing, yarn reeling, dying, twisting, weaving and traders of silk products (Ishtiaque, 2013). As described in chapter 1 that this industry is one of largest employment providers industry and millions of people earn livelihood through this industry. It is estimated that 1 ton of silk yarn can be produced from 25 acres of land and this volume normally provide full time employment to 30 families with 5 persons per family (Lao, 2006). In silkworm rearing, both men and women can contribute and

play an important role. Sericulture industry is classified as an appropriate tool for poverty alleviation; it generates vibrancy in rural economies and creates opportunities of livelihood generation for poor and deprived class. For the purpose to promote deprived class of society this low cost industry is very much helpful. This profitable cottage industry requires low capital and investment and it is highly suitable for small home entrepreneur and provide livelihood to a bulk of rural population. It is helpful for keeping rural population employed and to prevent migration to big cities (Geetha, 2011).

Sericulture and Women Empowerment

Women empowerment is very important to share the earning burden of male family members. Sericulture provides sustainable activity for poor, small and marginal farmers, agricultural labor and women in particular. Due to its nature, sericulture activities are a perfect choice for women. It is preferable for women because it fits easily into their daily routine and provides them additional income. Women could be the primary contributor to the industry by taking care of the silk crop but these women are neglected by considering them as secondary contributor. Women, at present have no access to information and technology. There is need to consider them as an active partner in sericulture industry and awareness, training, different promotions and aid should be given to them through rural development programs. Women should be registered and assisted under a risk management fund and in case of illness, diseases, drought, flood and other unforeseen natural calamities (Geetha *et al.*, 2011).

In the countries where sericulture is practiced, studies indicate that 60 percent activities i.e. from pre-cocoon to post-cocoons production are carried out by women. In India 4.5 – 5.0 million women are employed as full time worker in silk production

chain. To meet the increasing demand of exports and handloom industry, tremendous opportunities for women are also increasing. In world different donors and United Nations Agencies have special focus on women empowerment. To attain attention of external donors and funding agencies, CSB and Indian state departments have a special emphasis on sericulture and women oriented development programs (Lakshmi, 2007).

Sericulture and New Emerging Areas

Sericulture have many interrelated sections, all have value addition and product diversification. Silk production process has several traditional and non-traditional areas. Along with cocoon production and its further processing areas like silk fibre reeling, dying, twisting and weaving its raw material and bi-products have many non-traditional usages. In non-traditional areas raw material and bi-products are used in medicine and different medical applications like artificial skin, artificial blood vessels, artificial boons and stitching threads. It is also used in different cosmetic products like liquid silk, facial masks, derma lotion etc. Silkworm pupa is utilized in making soaps and for extraction of oils having vitamins E and K. Silk products are also used for interior home decor, handicrafts, wall papers and lampshades etc (Aslam, 2005).

On the other side mulberry plantation has multidimensional benefits. Along with causing healthy impacts on climate, mulberry products like its leaves are feed of silkworm, fish and mini livestock, its shoots are used for baskets and interior, mulberry hull is also precious and used in sports appliance and waste wood is used for fire, mulberry fruit have also a huge commercial scope and used in medicine, juice and jam.

To confront the natural risk progressive countries are converting their traditional

methods into advanced and multi-dimensional moods i.e. "mulberry-food-herd", mulberry-food-chicken" and mulberry-food-vegetables" as suggested by (Ding, 2008) and multi-levelled circulation mode of "silkworm-livestock-biogas-fish" in which these three industries support each other and also support ecological gains, which can help to improve overall economic efficiency (Gao, 2011).

Chapter 3

Literature Review

Review of literature is divided into four sections; first section is review of global silk industry, second section is review of Pakistan silk industry, third section is comparison of Pakistan and its neighbour countries i.e. India and Bangladesh and fourth section comprises on initiatives taken by States and contribution of NGO's for the promotion of sericulture.

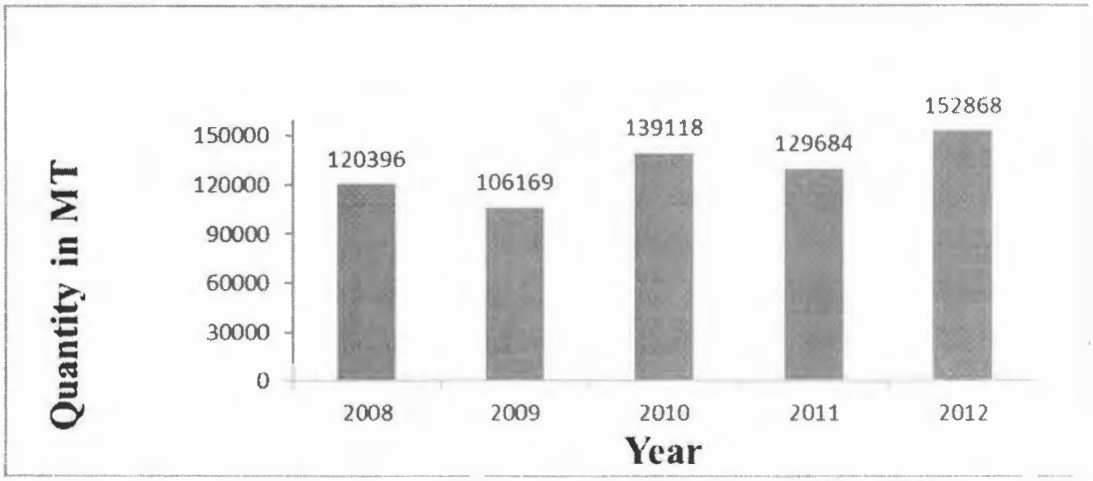
3.1. Appraisal of Global Silk Industry

For sericulture development, most of countries have a clear vision and well-set infrastructure. Currently, sericulture is flourishing in labour rich countries. In these countries for the purpose of economic uplifting, policy makers have special focus on this industry. Currently, about 30 countries are producing silk while the major producers are in Asia having about 95 percent share in mulberry silk and almost 100 percent share in non-mulberry silk production. Countries having advanced technology and major share in silk production are China, India, Uzbekistan, Brazil, Japan, Republic of Korea, Thailand, Vietnam, DPR Korea and Iran etc. Some other countries like Bangladesh, Egypt, Bulgaria, Turkey and Nigeria etc. are also producing a small quantity of cocoons. Major silk consumers are USA, France, Italy, Japan, India, China, Switzerland, United Kingdom, Germany, Korea, Vietnam and UAE etc.

Sericulture is labour intensive and about 28 million workers are engaged in this industry in China, about 8.6 million people in India, about 0.86 million in Bangladesh. Thai land handmade silk cloth is considered a very precious commodity in world and about 0.35 million silkworm rears, fibre reelers and cloth

weavers are getting employment (International Sericulture Commission, 2014) After 2nd world war Japan confer special consideration to sericulture and till the era of 1970 Japan was at no. 1 position in silk production. After 1970 Japan changed its industrial route and China gave special attention to this sector and became the no 1 producer of natural silk. (GUO, 1985)

Chart – 1: World Silk Production (Metric Ton)



(Source: CSB, 2013)

With the passage of time worldwide demand of silk is increasing day by day and the silk production countries have a special focus to enhance the production. In 2008 total world silk production was about 120,396 metric tons. China and India are the major silk producers and domestic productions of these two countries have major impacts on the overall production of world. In 2009 China's total silk production was decreased from 98,620 metric tons to 84,000 metric tons, on the other hand Indian silk production increased from 18,370 metric tons to 19,690 metric tons but due to a major decrease in China's production, total world silk production was also decreased and was 106,169 metric tons. In 2010, China and India showed the great improvement in production and produced about 115,000 and 21,000 metric tons respectively and as a result total production was also increased from about 106,169 to 139,000 metric tons.

In 2011, Indian silk production increased about 2000 metric tons but production of China decreased about 10,000 metric tons and total world production was about 129,600 metric tons. In 2012, China showed a significant progress and produced about 126,000 metric tons as a result total world silk production in 2012 was about 152,800 metric tons.

Table – 1: Global Silk Production (Metric Ton)

Country	**2008**	**2009**	**2010**	**2011**	**2012**
Brazil	1177	811	770	558	614
Bulgaria	7.5	6.3	9.4	6	8.5
China	98620	84000	115000	104000	126000
Colombia	0.6	0.6	0.6	0.6	0.6
Egypt	3	3	0.3	0.7	0.7
India	18370	19690	21005	23060	23679
Indonesia	37	19	20	20	20
Iran	180	82	75	120	123
Japan	96	72	54	42	30
North Korea	-	-	-	300	300
South Korea	3	3	3	3	1.5
Philippines	1	1	1	1	0.89
Syria	0.4	0.6	0.6	0.5	0.5
Thailand	1100	665	655	655	655
Tunisia	0.08	0.04	0.12	3	3.95
Turkey	15	20	18	22	22
Uzbekistan	770.5	780	940	940	940
Vietnam	-	-	550	500	450
Madagascar	15	16	16	16	18
Total	**120,396**	**106,169**	**139,118**	**129,684**	**152,868**

(Source: CSB, 2013)

If we compare total cocoons production of world from 2008 to 2012, a significant increase in total production can be observed from 120,000 to 153,000 metric tons. China is the largest silk producer in world having 80 percent share in global silk industry. Annual cocoon production of China is about 126,000 metric tons. India is at second place producing about 23,700 metric ton cocoons which is almost 15% share

in global silk production (CSB, 2013). In Latin America, Brazil is a major producer but with the passage of time its annual production is decreasing and current annual silk production of Brazil is about 600 metric tons. Thailand has specialty in hand woven silk cloth and producing about 655 metric ton cocoons annually. In Central Asian states Uzbekistan is a major cocoon producer having annual production of 940 metric ton. Vietnam is also producing about 450 – 500 metric ton cocoons.

Improvement in Technology

Advanced countries in silk production have separate and specific research and educations centers. These countries are making continuous improvement and advancement in sericulture technology. Sericulture department of these countries have strong relationship with their farmers and for more benefits quick transfer of advance technology to their farmers is assured firmly.

Leading silk producing countries have shown a significant progress in the technology of silk seed by adopting advanced methods. Several silk seed types and recess are reared in these countries. For quality production they are using silk seed varieties having the combination of bi-voltine x hybrid silk seed and getting about 40 – 65 kg's of cocoons from a 16 onus packet of silk seed. Their multi-voltine silk seed varieties are able to produce crops throughout the year and capable for rearing in both spring and autumn season thus farmers remain busy for entire year. Along with quality silk seed farmers are well trained and they have proper and standardized rearing rooms and rearing equipments (Sohn, 2011).

3.2. Review of Sericulture Industry In Pakistan

In Pakistan Sericulture industry is governed by Forestry Department. Unfortunately, proper attention is not given to this industry and it is still an industry of nomads (Ishfaq, 2005). Before and after independence sericulture was practiced in different areas of Pakistan. After independence migrants came from India were well-aware of this art. Jammu and Kashmir has its own dynamic silk history. In 1947 sericulture department was established as a wing of forestry department. It was initiated in Taxila (Punjab) in 1947, in KPK it was started in1952, in Baluchistan it was started in 1959 and in Sindh it was started in 1975, subsequently it was expanded to forest localities where mulberry plantation was in abundance. Sericulture remained a flourishing entrepreneur in Pakistan till the era of 90's. At that time it was very much supportive occupation for the poor sericulturests involved in silkworm rearing. Now a day's activities of this welfare – oriented industry in Pakistan are decreasing and shrinking day by day. As a result reeling and weaving sector is also going towards disaster. After decline of this industry huge number of reeling units are closed and remaining are also struggling. The main reasons are; lack of attention and interest of state, low quality of silk seed, high mortality rate of silkworms, inappropriate rearing sheds and lack of advancement in policies, research and technology and high rate of fluctuation in cocoon prices (Ishfaq, 2005). Annual demand of cocoons for our domestic reeling industry is about 750 metric tons which is imported from China, Iran, and Afghanistan. (Sabir, 1997).

Efficiency and Productivity

In Pakistan efficiency and productivity regarding cocoon yield is very low and uncertainty level is high. There are various factors driving low productivity. In

contrast with other countries, Pakistan silk seed is old and uni-volatile, which is capable for rearing only one time a year i.e. in spring season. (Ashfaq *.et.al*, 2006). Ahmed *et all* argues that most of farmers involves in sericulture are illiterate, raring sheds are not proper, lack of extension services and technical guidelines, dependence on government forests for mulberry leaves, problems of peak season leaves shortage, lack of advancement in research and technology, supply of poor quality silkworm seed and improper processing, management and marketing services are the major hurdles in silk industry of Pakistan (Ahmad *et al.*, 1999). For further progress in sericulture sector, researchers suggest that there is need of increase in mulberry cultivation, providing credit to farmers, use of modern technology and training, advertisement, publicity and promotions, coordination between relevant NGO's and government authorities and finally a corruption free administration (Ishtiaque, 2013).

Sericulture Development Plan in Punjab

Punjab has the major share and infrastructure in Pakistani sericulture industry. To strengthen the sericulture in rural areas Forestry, Wildlife and Fisheries (FW&F) department government of Punjab commenced the project titled "Development of sericulture activities in Punjab (2006-2010)", to achieve project objectives; an amount of Rs. 66.073 million was allocated. Main objective of this project was the promotion of sericulture industry for the purpose of employment generation in rural areas of Punjab. To fulfill this purpose project was divided into two parts. First phase was about mori-culture from which establishment of mulberry nursery on 58 acres and mulberry plantation on 1,300 acres was planned and in second phase establishment of infrastructure for the production of 3,000 packets of good quality silk seed was aimed. For this purpose, 200 packets of silk seed were imported from Bulgaria. Different

types of apparatus, equipment and machinery was also purchased. Construction and renovation of silk seed testing, hibernation and production laboratories and office buildings were also the part of plane.

After project completion date, for analysis of project outcomes an evaluation study was conducted by "Directorate General, Monitoring and Evaluation, Planning and Development Department, Government of Punjab and report was released in April, 2011. According to the report project was failed to produce the promised impacts and main reasons were poor quality of imported silk seed, inappropriate training and non-professional behavior of project execution officials. In quantitative terms, certain objectives such as moriculture, construction work, purchase of vehicles and machinery has been attained partially but real impacts i.e. production of good quality silk seed socio-economic uplift of poor rural people could not be achieved (Hashmi, 2011).

Sericulture of Azad Jammu and Kashmir

In past silkworm rearing was a very supportive occupation in Pakistani administrated Kashmir. In 1970s cocoons crop provided such amount of income which was enough to buy the wheat of entire year for 6-8 members' family and one month of silkworm rearing generated more income than wheat crop which took seven months. In 1990s sericulture in AJK was at its peak. At that time government used to distribute millions of mulberry saplings, fertilisers and high quality silk seed free of cost. In AJK cocoon production was 90 to 100 tonnes before 2005 earthquake. Earthquake was a major shock for cottage industry and it damaged a bigger part of AJK sericulture infrastructure. Due to this devastating incident wide range of government facilities including a research centre, seven rearing halls, eleven offices and hundreds of homes

were destroyed. In affected areas, egg production and silk worm rearing are ceased which affected the livelihood of thousands of peoples. Overall silk seed production has dropped by more than three quarters since the disaster. Due to lack of budget sericulture facilities have yet to rebuild.

Almost a decade ago in AJK, Due to timely rains farmers were used to cultivate maize in summer and wheat in winter but now because of change in climate and rain patterns farmers are not even getting fodder for their cattle. Over all rainfall is decreased and has become more erratic and due to shortage of water farmers can no longer rely on growing grain, fruit and vegetables. Uncertain weather in Himalayan region is forcing more farmers into poverty and it has forced the farmers to look the other ways of earning mainly short-cycle crops like silkworm rearing. AJK officials believe that if it does get back on its feet than it can make a real financial difference to poor communities and a 30 days activity can provide a life line to the farmers whose crops production is decreasing. Due to past experience farmers of AJK are passionate about silkworm rearing but due to earthquake disaster farmers do not have proper rearing rooms. Previously farmers had mud houses with larger rooms and halls which are ideal for silkworm rearing but new one are constructed with the help of donors which are consists of two rooms and made of concrete with tin roofs. These are too small and hot and not fit for rearing that's why majority of farmers are half-hearted because they want to rear more packets but not able to cultivate even a single packet. In AJK sericulture is neglected and budget allocation for sericulture promotion is inadequate. Revival of silk industry can provide the alternate source of income to AJK farmers, including positive effects on environment it can also reduce the pressure on the region's fast declining forests (Shad, 2013).

Khyber Pakhtun Khawa (KPK)

In Past sericulture has been very much supportive occupation for the poor people of Khyber Pakhtun Khawa. Mulberry plantation was in abundance and thousands of families were able to avail the part time income generation activity. But now in KPK sericulture activities are story of past. However there is a positive sign that provincial government of Khyber Pakhtun Khawa announced that Departments of Social Welfare, Agriculture, livestock, fisheries and sericulture are reactivated in a new ideology. For the purpose of poverty alleviation, loans and funds will be provided to women in different household schemes. Initiative of employment schemes for women so that the trend of shoulder to shoulder business with their male counterparts can be promoted. For women empowerment projects for enhancing the capabilities and skills in sewing, tailoring, embroidery, flower making, keeping of livestock, bees and silk worms are in the pipe line (Pakistan News, 2014). In Kalash valley about 12 families are involved in silkworm rearing. Total production of dry cocoons in the valley is about 45 to 50 kg, generating a total net income of Rs. 60000 (Ajaz, undated).

3.3. Brief Comparison of Pakistan and Neighboring Countries

In world raw silk production, China has a major share and contributing about 80 percent of world total production; India is at second place and contributing about 15 percent. In China about 7400,000 hector are under mulberry plantation and cocoon production is about115000 metric tons (CSB, 2013).

Table – 2: Comparison of Pakistan and Neighboring Countries

	India	Bangladesh	Pakistan
Area under Mulberry Plantation (Hectors)	282,244	5,238	About 1000*
Annual Cocoon production (MT)	23,060	518	10-12 *
Labour Employment	8.6 million	0.85 million	Few hundred Families
Annual Revenue ($)	$ 491 million	NA	NA
Per Packet Productivity (Kg)	45-65	35-50	>10
Organisational Structure Bangladesh Silk Board (BSB) Bangladesh Silk Research and Training Institute (BSRTI) Central Silk Board (CSB)	CSB Under Ministry of Textile	BSB BSRTI Under Ministry of Textile	Under Forest Department
Reeling Units	Silk Factories Filature/Cottage basins 26631 Charka 28014 Multi end 407	Filature/Cottage Basin Over 1000 Multi end 72	About 8-10 reeling units **
No of NGO's Involvement	Over 75	Over 35	Nil

*This data was recorded in 1997 by Sabir, it decreased over time but currently no updated information is available

** In the era of 90's, there was over 100 reeling units in Changa Manga but currently just about 10 reeling units are in operation in Changa Manga.

Currently in Pakistan sericulture industry is facing several types of hurdles and providing livelihood to only few hundred families. This is the reality that potential of sericulture is not appropriately explored and the production of this industry is not more than 1 percent than its actual potential (Sabir, 1997).

In near past sericulture activities were performed massively in different areas of Pakistan and it was a fruitful business but now it is nearly diminished. According to Sabir (1997), in Punjab there were about 9000 households engaged in sericulture sector. Most of the sericulturists' relied on government forests for mulberry leaves. Mulberry plantation on government land was about 18,660 acres from which 1053 acres of plantation was bush type. On private land about 225 acres were under bush type mulberry plantation. Regarding production about 12,500 packets were reared and about 300 metric ton cocoons were being produced annually which was not sufficient

to meet domestic demand and almost equal quantity was being imported every year. According to Ahmad *et al* (1999) there was a huge variation in per packet average yield of cocoons and with the passage of time sericulture activities and its profit is decreasing but now, most of the sericulturists have left their profession and author could allocate only few hundred families in Punjab and Azad Jammu and Kashmire . Bangladesh Silk Board was established in 1978 but at the time of independence government of East Pakistan, established sericulture industry under the control of small industries and established 12 Silk nurseries, 20 expansion centres, 1 silk factory and 1 silk training and research Institute. Now in Bangladesh this sector is making a consistent growth (Islam *et al*, 2010).

According to BSB (2013) about 5,238 hectors are under mulberry cultivation, annual cocoon production is about 518 metric ton, no of spinners are about 9,435, no of silk factories are 80 and no of silk hand looms are 10,000, no of silk power looms are 1,272 and against a demand of 200 about 52 metric ton raw silk fibre is being produced every year. In terms of employment generation, NGO sector is also contributing to promote this industry in Bangladesh as a result about 92,000 families are generating income from this industry.

Sericulture industry is rated as second largest employer in India. Due to its strange nature, for the purpose of ideal growth and development of rural India, Indian planners recognized sericulture as one of the best suited occupations (Dar, 2013). Natural silk have five different varieties which are produced by different types of silkworms. These different varieties of silkworms eat different types of plant leaves. Other silk producing countries of world are mostly producing mulberry silk. Climate of India allow producing all commercially traded varieties of natural silk namely,

Mulberry, Oak Tasar, Tropical Tasar, Eri and Muga.

In India sericulture is being practiced in over 59,000 villages of 23 states and area under mulberry cultivation is 282,244 hectors. About 958,000 families are engaged with this industry and it is providing employment to approximately 8.56 million people in rural and semi-rural areas of India.

Currently in world, India is second largest producer as well as the biggest consumer of silk. Domestic cocoon production in India is around 23,000 MTs and domestic demand is over 27,000 MTs, rest is being imported mainly from China. In India there is a large domestic market of silk goods and about 85 % silk products are produced and sold in domestic market. However India is exporting approximately 15 % of its all types of silk products (including value-added items) and generating about $491 million foreign exchange annually (Central Silk Board, 2013).

In last few decades Indian silk industry make an impressive growth. Indian sericulture replaced the old varieties of multi-voltine with multivoltine x bivoltine and bivoltine x hybrids. This change in technology increased the per packet cocoon yield. Average cocoons yield in past was 25 KGs / 100 dfls but due to change of technology yield increased to current range of 55 – 65 KGs / 100 dfls. Although Indian sericulture has achieved good production quantity but quality still remains inferior to Chinese breeds which are bivoltine (Gangopadhyay, 2012).

3.4. Government and NGO's Contribution in Sericulture

As mentioned previously that it is a welfare oriented cottage industry that's why mechanism for sericulture industry establishment and development is responsibility of state. Currently in world, sericulture sector is flourishing in several countries. To promote this sector these countries are putting special emphasis and intentions and

established separate directorates and research centres.

To uplift this sector several non-governmental organizations (NGOs) are also working in different third world countries. These international donor agencies and NGOs i.e. World Bank, United Nations Development Program (UNDP), Japan International Cooperation Agency (JICA), Bangladesh Rural Advancement Committee (BRAC) etc. are also providing technical and financial support to the local NGOs and relevant government departments. In some progressive countries, there are various successful case studies of NGO programs regarding sericulture development. In India, with the collaboration and funding of CSB, World Bank and some other donors agencies, NGOs are working on various developmental programs of sericulture (Eswarapa, 2011). BRAC an international NGO has almost 60 percent share in Bangladesh total silk production.

After Second World War, in 1948 International Sericulture Commission (ISC) was established and registered under United Nations (UN). The aim of ISC was "to encourage and promote the development and improvement from the technical, scientific and economic points of all the activities dealing with sericulture in general (including moriculture, egg production and raw silk reeling)." Currently 15 silk producing countries and several collective groups and organizations are the member of ISC. ISC provides consultancy, support and trainings to member and non member countries as well as collective and individual members. It collaborates with fashion, pharmaceutical, cosmetic industries and other related sectors. ISC provide opportunities and scholarships to the students and researcher of sericulture sector (ISC, 2014)

Case Study of BRAC

Bangladesh Rural Advancement Committee (BRAC) is a Bangladesh based NGO established in 1972. Including Pakistan, BRAC is working in 14 countries of world. If measured by number of employees and no of people approached and helped by BRAC, then it may be considered as one of largest non-governmental organization in the world. Through different developmental programs BRAC is providing employment to over 100,000 people and almost 70 percent of whom are women. Approximately 126 million poor people are helped by BRAC in form of providing credit and technical assistance. Annual revenue of the non-profit organization is US $ 422,139,409 and unique feature of the organization is that its programs are 70-80% self-funded.

In 1978 BRAC initiated its sericulture project and considered as pioneer in Bangladesh silk-farming industry. This project evolved into an enterprise when it established its own mulberry plantations and silkworm rearing farms, where temperate climate is being provided to silkworms as these are sensitive to erratic weather. Currently BRAC has 13 cocoon production centres and 2 silkworm rearing centres. BRAC is purchasing cocoons from the farmers and producing silk yarn. In beginning, sericulture project was providing silk seed and loans for the purpose of land lease for mulberry plantation. In this way, a credible source of secure investment and income generation is established and a cycle of microfinance, investment, return and repayment was established.

Silk production has four distinct steps: mulberry cultivation, silkworm rearing, yarn production from the cocoons and weaving of yarn to produce fabric. Initially BRAC sericulture developed a mechanism for all these steps and mainly focuses on women

to fill these positions. Currently BRAC is using hand looms but to increase quality and production it has a plane to convert toward mechanical looms so that good quality silk fabric could be obtained at faster rate. Production of silk garments and its export is also under consideration. BRAC Sericulture strikes a balance between silk production and its marketing. In this way BRAC as well as its workers are earning sufficient amount and this is also helpful for BRAC in order to self-sustain and support the BRAC's development programs.(BRAC, 2014)

This review regarding sericulture tried to describe the importance of industry and also explains the emphasis and focus of neighbouring countries for sericulture promotion.

Chapter 4

Data and Methodology

This research is qualitative and descriptive. Primary data was collected from different localities of Pakistan through Key Informant Interviews (KII's) and Focus Group Discussions (FGD's). These KII's and FGD's were conducted with related stakeholders of sericulture sector. To understand the real picture available record sheets were also collected form sericulture department. For analyses, understanding and elaboration of research objectives, secondary data is collected from various reports, articles, magazines and publications.

To know farmers opinion, KIIs and FGDs was conducted through a structured questionnaire. This questionnaire is designed to know their previous experiences and current status. Interviews were conducted from those farmers who have at least 20 – 30 years of silkworm rearing experience because in Pakistan sericulturists having more than 20 years of experience are more familiar with sericulture and its benefits. To know the view of sericulture experts and officials interviews were conducted from various localities of Pakistan.

4.1. Data

For primary data collection KIIs and FGDs were conducted as mentioned below

	KIIs	**FGDs**
Sericulture officials	25	3
Sericulture Experts	5	0
Farmers	100	5
Reelers	5	0
Total	**130**	**8**

4.2. Sampling

For this study 25 KII's were conducted from 10 localities of Pakistan i.e. Lahore, Kasur (Changa Manga), Sargodha, Mandi Bahauddin, Sra-e-alamgir, Multan, Faisalabad, Chechawatni, Peshawar and Muzafarabad. To know the farmers opinion 100 KII's were also conducted through convenient sampling format from 6 localities where in past silk worm rearing activities were performed massively and also performed currently but on little extent. These localities are Changa Manga, Chechawatni, Faisalabad, Mandi Baha-ud-din, Sra-e-alamgir and Muzafarabad. In comparison with past there are very few farmers who are still engaged in rearing activities. Out of 100 questionnaires, 40 interviews were conducted from Changa-Manga, 20 from Chechawatni, 15 from Faisalabad and 10 from Mandibaha-ud-din, 5 from Sra-e-alamgir and 10 from Muzafarabad. This ratio of interviews is due to least availability of respondents.

For the analysis of all objectives descriptive statistical tools are used and elaborated with the help of tables.

List of KII Respondents (Sericulture Officials)

Department of Sericulture, Punjab, Ravi Road, Lahore

Shakil Khan	Senior Research Officer
Mian Muslim	Ex-Senior Research Officer, Entomologist
Ghulam Sabir	Ex-Deputy Director
Choudhary Younas	Chief Accountant
Farooq Bhatti	Assistant Director

Changa Manga

Muhammad Ajmal	Sericulture Inspector
Latif Dogar	Extension In charge
Tariq Sab	Extension In charge
Umar Farooq	Field Officer
Saif Bhatti	Forest Muhafiz
Haji Ghulam Hussain Hamdami	Ex Reeler & Cocoon Trader
Muhammad Aslam	Reeling Factory Owner

Gut wala Faisalabad

Ghulzar Bhatti	Incharge
Abd-ur-Raheem	Supervisor

Agriculture University, Faisalabad

Fatima Mustfa	Lecturer

Chechawatni

Choudhary Sarwar	Assistant Director
Mian Ramzan	Sericulture Inspector

Kmalea

Khadam Hussain	Sericulture Inspector

Sargodha

Choudhary Ehsan Elahi	Assistant Director

Sarai-e-Alamgir

Ghulam Murtaza	Sericulture inspector

Daffer

Imran	Sericulture Inspector

Department of Sericulture, KPK

Raj Muhammad	Deputy Director

Department of Sericulture, AJK

Sardar Muhammad Shafiq Khan	Director General
Muhammad Rizwanullah Khan	Entomologist
Muhammad Iqbal Mughal	Sericulture Inspector
Muhammad Rashid	In charge

Chapter 5

Results

Results are descriptive and classified in four sections, first section elaborates the standard technical aspects and its actual status in Pakistan, second section elaborates the Past depiction and reasons and constraints behind the decline of Pakistani sericulture, third is about scope and potential of Pakistan sericulture industry and fourth is about infrastructure of Pakistan sericulture industry.

5.1. Practical Experiment for Understanding of Technical Aspect

In silk production process various factors are involved. These factors i.e. quality of silk seed, silkworm feed, rearing conditions, techniques and technology etc have direct effect on cocoon yield. To understand the standard requirements and status of Pakistan regarding these factors, an experiment of silkworm rearing was conducted by the author during 18 February – 28 March 2012. For experiment purpose, silk seed packets and rearing equipment was obtained from sericulture demonstration centre Srai-Alamgir, weather technical assistance and guideline was provided by Mian Muslim, retired senior research officer (SRO) Department of Sericulture Punjab.Ddifferent varieties of mulberry plants were obtained from Sericulture Extension Centre Changa Manga and Sra-e-Alamgir. For further analysis and investigation several sessions were conducted with experts and data from secondary sources is also taken in account.

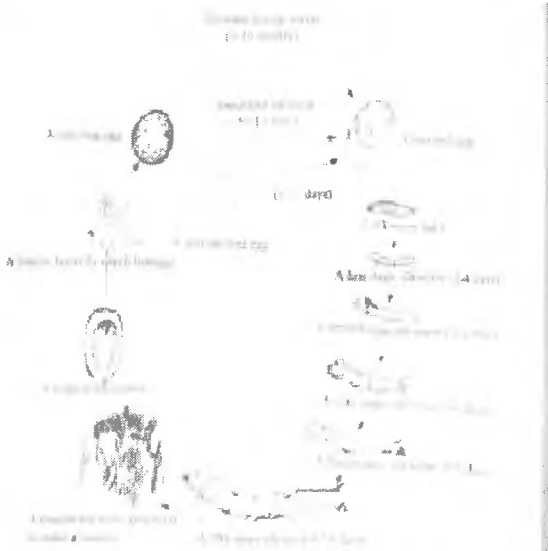
Findings of below section are incorporation of authors personal experiment, field observations and standard criteria set by the experts.

Silk Production Process and Silkworm Life Cycle

To understand the impacts and importance of silk production factors, overview of silk production process is essential. Mulberry silk is generated by silkworm named bombyx mori. This is a domesticated insect and cannot fly or exist in wild.

Silkworm larval life can be divided into five stages i.e., ova, larvae, pupa, imago and adult moth. These development stages complete one generation. After hatching from eggs, larvae

modify four moults and during each moult larvae remove its old skin and produce new and larger one. In stage – 1 newly laid eggs have a creamy yellow colour and after few days fertile eggs change into gray colour. To preserve them, eggs are kept in



Figuer 1: Silkworm Life cycle and silk production process
Source: www.nzdl.org gsdlmod

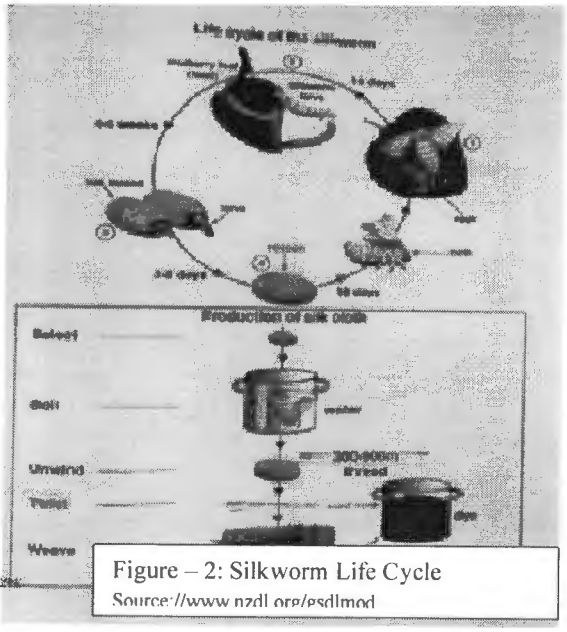


Figure – 2: Silkworm Life Cycle
Source://www.nzdl.org/gsdlmod

cool place but not so cool that they freeze. Silkworm life cycle starts with hatching silkworm eggs, ideal temperature for hatching is 75 F°– 82 F° or 24 C° – 27 C° and required humidity is about 70– 85%. Hatching process completes in 4 – 7 days, allow all eggs to hatch. In second stage, black colour tiny creatures are transferred in separate flat trays and chopped fresh mulberry leaves are served. Hunger of

silkworms never ends and they eat the leaves with eagerness and grow rapidly. As they grow they are transferred to larger trays and feed with larger leaves, after four days first moult will occur. In third stage, for the protection of pupa silkworm spins a white or creamy yellow cocoon around it. For the production of raw silk these cocoons dried in sunshine due to heat larva inside the cocoons are died after 2 – 3 days, after drying these cocoons are being put in hot but not boiled water. Hot water removes the sericin from the fibre and fibre on cocoon is ready for unwind. Length of fibre depends on the quality of cocoon and it ranges from 300-1200 meters. Several unwinding cocoon fibres are twisted together and after twisting, fibre is ready for dying and weaving. For further silk seed production quality cocoons are picked separately and allow larva to complete its life cycle. Larva completes final moult inside the cocoon and changed into brown pupa. Further changes inside the pupa convert it into moth. After compilation an adult creamy white moth appears from the cocoon. Females are larger than males, male moths move and start whipping their wings and seek the females. After meeting with female male moth die and female lays about 300 – 500 eggs within 24 hours and also dies. Keep in mind that during rearing process everything must kept clean.

5.1.1. Rearing Requirements and Conditions

For ideal growth of silkworms and for better cocoon production, uniform and maximum hatching, aappropriate temperature, humidity, light and ventilation, disinfection of rearing room, care during moulting and mounting stages and adoption of precautionary measures to avoid the disease and mortality are basic components. In Pakistan most of the farmers are less aware about the importance of above mentioned factors. These farmers have not sufficient or well organized rearing

structure that they can control and maintain the standard rearing conditions.

Climate and Temperature

Rapid climate changes and untimely rains have bad impacts on cocoon yield. To avoid uncertain conditions standardised rearing rooms are essential.

Pakistan is situated in sub-tropical zone where climate and temperature vary from place to place. In Pakistan temperature surges to over 30 C° in summer and drops below 20 C° during winter and rainy season. Similarly, season to season wide fluctuations in temperature and humidity are also an issue. For illustration, in summer during night time, when temperature goes up, to bring it in standard level, all windows should be opened so that cooler air from outside blow freely in the room. When sun rises and outside temperature goes high then windows should be closed. Similarly during colder seasons windows and doors should kept closed during night time and when temperature goes up in day time then should be open to allow warm air to get in. During colder months in winter, temperature can be maintained with the help of artificial heating in room, i.e. with the help of electric room heaters or smokeless charcoal fire. In the same way during dry season, humidity can be maintained with the help of wet cloth, sand or room air cooler.

In Pakistan due lack of standard rooms, sericulturists relay on natural season and able to get only 1 or 2 crops. During season uneven fluctuation in temperature impacts on the yield. If sericulturists build proper rearing rooms which can adjust the diverse climatic conditions, better yield and more crops could be obtained.

Disinfection

Before rearing of silkworms rearing house and appliances is essential and should be disinfected with formalin. It will help to prevent possible disease infections from

previous silkworm crops. For the purpose of effective disinfection appliances should be kept inside the rearing house. Walls, doors, windows and appliances should be sprayed with 2 percent formalin solution at the rate of 6–7 liters per 100 sq. meter. After spray, room should be air tightens for 24 hours and after that it should be opened with full ventilation of air for 24 hours.

Table – 3: Rearing Room Disinfection

Proper disinfection	Partially Apply	In Some Extent	Do not Apply
14 %	37 %	40 %	9 %

Pakistani sericulturists are not much aware about the benefits of disinfection. Due to lack of standard rearing rooms and information, 9 percent farmers do not apply the disinfection, 40 percent apply in some extent and 37 percent partially apply the requirements while 14 percent apply the proper disinfection methods.

Moulting Techniques

In silkworm rearing, moulting is also an important factor. During larval growth phase silkworm moults himself four times. After achieving the maximum growth in one stage or instar, the worm stops to eat leaves, fix himself to his base and go into sleep mood, after wakeup silkworm removes his existing skin and put on a new skin. In start the new skin is thin and elastic and allows him for further growth for next stage. With the growth this skin gradually starts to become harder and inelastic. In first moulting it takes about 20, in second and third it takes about 25 hours and in final moult it takes about 30 hours. For ensuring successful crop it is important that worms should moult uniformly. When the worms show the moulting signs attention should be paid for cleaning and drying the bed. As much as bed dries, more and more worms will settle. Worms should not be disturbed during moult stage and cleaning and

shifting during moult stage is not a good practice. During moult rearing rooms should be kept ventilated. Feed supply should start when 90 percent of worms came out of moult.

Table – 4: Moulting Techniques

Fully Aware about Moulting	Sufficient Knowledge and Experience	Less Knowledge and Experience
81 %	13 %	6 %

In Pakistan 81 percent sericulturists are well aware about moulting techniques, 13 percent have sufficient knowledge and experience and 6 percent have less experience about moulting techniques.

Mounting Techniques

After fourth moult silkworms stop feeding and ready for mounting. These ripe worms should be picked in time so that these worms can spin the cocoons successfully. Early (immature) or delayed (over matured) picking of worms can affect the yield. The perfect time is when worms show the sign of maturity i.e. translucent body colour and active raising of heads. Majority of worms mount in 24 hours but it take almost 2 days. Mounting should be done in ventilated rooms where worms can mount without any disturbance of interruption and noise. Mounting is normally done on racks and proper space on racks is also very important. To avoid the double cocoons, 40 – 45 worms per sq. feet space are required.

Silkworms spin cocoons in two or three days and after spinning these worms turn into pupas. Cocoons should be harvested in sixth day of mounting when cocoon shell dried sufficiently.

Table – 5: Mounting Techniques

Fully Aware about Mounting	Sufficient Knowledge and Experience	Less Knowledge and Experience
76 %	17 %	7%

In Pakistan 76 percent sericulturists are well aware about mounting techniques, 17 percent have sufficient knowledge and experience and 7 percent have less experience about mounting techniques.

Mortality

Disease problem in silkworm rearing is a serious issue and a long debate. To avoid diseases it is a general rule that it is easier to prevent the occurrence than trying to cure them when they occur. Therefore, measures discussed here for silkworm rearing can help a lot for prevention of diseases.

Table – 6: Mortality Ratio

100 % Mortality Ratio	95 % Mortality Ratio	90 % Mortality Ratio
90 %	7 %	3 %

In study area mortality ratio is very high. Due to weak and poor quality, silk seed have less resistance. About 90 percent farmers responded that during first five stages i.e. from hatching to fourth instars silkworms remain healthy and grow well. When silk worms enter in final stage they start to change their colour and swelling start to appear on their body. After these symptoms silkworms start to die and before reaching mounting stage almost 100 percent worms die and there is no way to do any treatment. Due to this farmers are highly disappointed because when all efforts and

inputs are done and time for fruit appears then there efforts became fruitless. About 7 percent farmers responded that although they got small amount of yield but quality of cocoon was very poor and about 3 percent responded that they got average quality of cocoon yield.

Training

With the passage of time, advanced countries in sericulture sector had made a significant improvement in silk production process. In these countries, related departments and NGOs have a close link with sericulture staff and farmers. These farmers and sericulture staff are updated by relevant departments through trainings, workshops and seminars.

During survey almost 100 percent farmers and sericulture field staff responded that since long time not even a single training or any awareness campaign is initiated for them.

5.1.2. Silkworm Feed

For silkworm feed various factors like quality of leaves, feeding pattern, leaves availability and preservation and feed quantity required for silkworms are discussed.

Leaves Availability

In Pakistan rearing activities are mostly performed near forest localities. In past mulberry leaves in forest localities were in abundance but now due to massive cutting of forest especially mulberry trees, availability of leaves is a serious issue. In past a huge quantity of local tree type mulberry plants were available in forest localities but now in spite of local tree type variety, imported bush type varieties planted in government sericulture fields.

Regarding quality and availability of leaves farmers and sericulture staff have almost same opinion. Currently due to less no of silkworms rearing activities, shortage of mulberry leaves is not serious issue but for the promotion of sericulture, enhancement in mulberry cultivation is as important as provision of quality silk seed. Sericulture officials expressed that although in past there was a huge area under mulberry plantation but due to massive rearing activities availability of leaves in peak season was a big issue but now area under mulberry plantation is decreased but rearing activities are also decreased.

Currently issuance of leaves permit is not a serious issue and department issue permit without any cost to those farmers who purchase silk seed from sericulture department or want to rear silk worms.

Quality Of Leaves

For better growth of silkworms, leaves quality is also a major factor. For feeding purpose, leaves considered best having more moisture, protein, sugars and carbohydrates and less ash and fiber. These look juicy and dark green in shade and can be obtained only from well managed mulberry fields. Proper application of manures and fertilizers and timely and correct way of irrigation is necessary for better growth of mulberry field. Less mature or over mature, yellowish leaves affect the quality of cocoons.

Regarding quality of leaves farmers and sericulture staff have almost same opinion. Regarding leaves quality about 91 percent farmers responded that for the production of quality cocoons, leaves of local tree type variety are more beneficial than the leaves of bush type varieties. About 5 percent responded that there is no difference between both varieties and 4 percent respond that they don't know about it. When it was

discussed with sericulture staff about 76 percent responds that the leaves of local tree type variety are long lasting and have more rich nutrients. About 10 percent responds that there is no difference and about 14 percent responds that difference exists but can be filled through proper application of fertilizer. Pakistan has different varieties of mulberry leaves and through proper management; provision of quality leaves is not a big issue.

Table – 7: Quality of Leaves

Variety	**Farmers Opinion**		**Officials Opinion**
Local Tree Type Variety Has Batter Results	91%		76 %
Imported Bush Type Variety Has Batter Results	5%		10 %
	Do not Know	4%	Difference Exists 14 %

Feeding Pattern And Quantity

Due to climatic factors quality of leaves also vary from season to season. In hot and dry season leaves grow faster but also dry quickly and at that time due to short life in rearing bed 5 or even 6 feeds per day are required. In rainy season leaves grow and mature faster and contain more moisture having long life in rearing bed and three to four feeds are sufficient. But due to more moisture in leaves, rearing bed humidity increases which are controlled with the help of feeding most mature leaves having less moisture, providing more space and shifting worms from one tray to other. In cold season mulberry growth is comparatively slow and leaves also mature slowly but these leaves have better keeping quality, better feed value and optimum moisture level and 4 feeds per day are sufficient.

For ideal growth of silkworms, 4 to 5 feedings in a day is essential. In traditional

methods where fewer trays are used in rearing results into overcrowding and only about 400-500 Kg of leaves are utilized which is not sufficient for maximum growth. Recommended feed pattern for 16 onus silk seed packet contains 40,000 worms are given below. In terms of leaves consumption this feeding pattern seems more expensive but it will enhance the quality as well as quantity of cocoon production.

Table – 8: Feed Quantity

	Feed Quantity	Feed Quantity
Age of Silkworms	**Multivoltine× New Bivoltine hybrid**	**Bivoltine× Bivoltine hybrid**
1st Instar/Stage	2 – 3 Kg	2 – 4 Kg
2nd Instar/Stage	6 – 8 Kg	8 – 10 Kg
3rd Instar/Stage	25 – 35 Kg	35 – 45 Kg
4th Instar/Stage	75 – 85 Kg	105 – 130 Kg
5th Instar/Stage	600 – 630 Kg	700 – 730 Kg
Total	700 – 760 Kg	850 – 969 Kg

Leaves Preservation

Production of high nutritious and juicy leaves is very important but preservation of these leaves till these are consumed is also an important factor. In dry and hot days loss of moisture affects the edibility as well as the palatability of leaves. Areas where temperature generally remains higher, the leaves shrink and dry up faster and lose their nutrients. To prevent the withering, fresh leaves from plant should be collected in wet cloth or in bamboo baskets lined inside and covered with wet cloth. Sprinkling water on the leaves covered with cloth at convenient intervals keeps leaves fresh for a longer time and worms eat them keenly. Directly wet leaves carrying water drops should be avoided strictly and if found water droplets on leaves then those should be wiped out because this would lead towards diseases. In rainy season situation is quite

opposite and to remove the excess moisture, leaves should be spread out on the Floor thinly.

5.1.3. Rearing Process

For silkworm rearing, rearing rooms, rearing equipment and other interrelated sections like rearing bed spacing, moulting and mounting are also important.

Rearing Rooms

For silkworm rearing, first requirement is of quite suitable room of house having adequate number of windows for cross ventilation. It is also important that room should be air tight reasonably for disinfection when required. Roof of the room should be high up to 10 feet so that fluctuations in temperature outside the room cannot affect very much on the internal temperature of room. Although such ideal conditions could not be fulfilled by every farmer as they are usually poor and cannot afford. But it should be the target to have separate rearing rooms fulfilling maximum conditions. Government and NGO's can assist farmers through subsidies and loans on easy terms.

Table – 9: Type of Rearing Rooms

Standard Rearing Rooms	Tarries or Open Rearing Rooms	Close Rooms having less Ventilation and Light facilities
17 %	28 %	55 %

Currently in Pakistan sericulture is a part time activity and due to bad production results most of the farmers do not rear with keen interest. These farmers are poor and they do not have enough rooms so that they can spare proper room for rearing. Results shows that 17 percent farmers have standard rearing rooms, 28 percent use their

tarries or open ended rearing rooms and 55 percent have close rooms but these rooms have not proper arrangement of ventilation or light.

Rearing Beds and Spacing

This is another integral part for successful silkworm rearing process. Proper space for silkworms is a necessary pre-requisite. If there is less space and silkworms are overcrowded in the rearing bed then it will not permit free and complete growth. Overcrowding results into poorer yield and reduce average weight of cocoons. It is observed that farmers are rearing one packet of 16 onus or 40,000 of silkworms in 10-12 bamboo circular trays of 4-5 feet diameter which is not enough.

Different space measurements are required for the instars in their different stages of development. Following spacing should be adopted for 100 DFL (Disease free laying) or one packet of 16 onus contains 40,000 silkworms.

Table – 10: Spacing Schedule

Age of silkworms	Area required To Begin with	Area required At the End
1st Instar/Stage	4 Square Feet	14 Square Feet
2nd Instar/Stage	15 Square Feet	45 Square Feet
3rd Instar/Stage	45 Square Feet	90 Square Feet
4th Instar/Stage	90 Square Feet	180 Square Feet
5th Instar/Stage	180 Square Feet	360 Square Feet

Above measurements in terms of bamboo trays may be stated as follows.

Table – 11: Spacing Schedule

Age of silkworms	Trays of 3.5 diameter		Trays of 4.5 diameter	
Instar/Stages	In Start	Increase to	In Start	Increase to
1st Instar	2	2	1	1
2nd Instar	2	5	1	3
3rd Instar	5	10	3	6
4th Instar	10	20	6	12
5th Instar	20	40	12	25

Spacing as indicated in above table permits maximum growth and silkworms get proper airing and abundant supply of feed.

Table – 12: Rearing Beds Types

Type	Traditional Bamboos	Char-Pai	Tables	Rearing Stands
Description	55 %	38 %	6 %	1 %

In Pakistan for the purpose of rearing, in spite of using standard rearing beds and trays sericulturists use different traditional rearing beds i.e. Char-pai, Bamboos and Tables etc. These beds may also be beneficial if used according to standard spacing patterns. During survey it was revealed that about 55 percent farmers are using Bamboos, about 38 percent are using char-pais and 6 percent are using tables. Standard rearing stands take less space and provide good production results but in Pakistan only 1 percent is using proper rearing stands.

Production Observations

In silkworm rearing, cocoon production is measured against one packet of silk seed and it is considered as a basic tool to measure the success or failure of farmer's efforts. There can be variation in the weight of silk seed packets but a standard silk seed packet having average

weight of 16 onuses and consists of 40,000 eggs. Sericulture department recommends that if a family consists of 5 – 6 members then they should rear at least 2 packets at a time and 3 – 4 packets in a season. Almost 100 percent farmers responded that they can easily rear 2 – 3 packets in a season.

Table – 15: Cocoon Production Remarks

Production (KG)	15 – 20	20 – 25	25 – 30	>30
Remarks	Breakeven	Average	Normal/Good	Attractive

In current circumstances, per packet cocoons production in Pakistan is very low. Production ranges from 15 – 20 Kg is considered essential and this could be meet the breakeven point of farmer's efforts. Per packet production ranges from 20 – 25 Kg is considered as an average production, production ranges from 25 – 30 Kg is considered normal and to some extent considered as good production. More than 30 Kg cocoons production which is not difficult and attainable is considered as an attractive production. In past Pakistani farmers can easily produce more than 30 Kg of cocoons. Farmers reported that due to good quality of silk seed they were able to produce more than 40 KG of cocoons. Some Pakistani parent (P-1) varieties prepared by Mian Muslim like S-1, PFI-1 and PFI-2 gave a record production of over 50 KG of cocoons.

In Past, regarding per packet cocoon production, satisfaction level of farmers was high and about 84 percent responded that due to good quality of silk seed they were able to get an average of 30-35 kg cocoons.

Table – 16: Per Packet Production in 2013

Production (KG)	0 – 5	5 – 8	>8
Results	85 %	13 %	2 %

Currently 100 percent farmers are dissatisfied with production results. During rearing season 2013, about 12 percent responded that against one packet of silk seed they got less than 5 kg cocoons, about 3 percent replied that their production is about 5-8 Kg and about 85 percent responded that they was not able to get any yield and their cocoon production was 0 and all of their silkworms died during 4th stage.

Table – 17: Cocoon Rates

Nature	In Punjab	In AJK
Wet	Rs. 550 – 700	RS. 350 – 500
Dry	Rs. 1500 – 2000	RS. 1350 – 1500

Cocoons are classified in terms of wet and dry cocoons. After drying, weight of cocoon drops to 1/3 of wet i.e. after drying, weight of 10 kg wet cocoons drops to approximately 3 – 3.75 kg, rate of cocoons also increase with this ratio. In Past when this industry was a charming and profitable industry for farmers, per kg rate of good quality wet cocoons was about Rs. 200 – 250 and dry cocoons was about Rs. 600 – 800, but due to good production results and high value of money these rates were very much satisfactory. Currently per kg rate of good quality wet cocoons ranges from Rs. 650 – 800 and rate of dry cocoons ranges from Rs. 1,850-2,100.

Currently in Pakistan AJK silk seed varieties are considered more reliable than any other local variety and department of AJK assured that if standard rearing requirements are fulfilled than AJK silk seed varieties are capable to produce up to 20 – 25 kg of wet cocoons. According to this estimation, farmers or families who will rear 2 packets of silk seed can earn up to Rs 25,000 – 30,000 in one month. This

amount can support the farmers in a handsome way.

Rearing Experience, Hope and Willingness of Sericulturists

Currently due to ill production results sericulture is not an attractive industry that's why new and young lot of farmers are not interested in rearing. In past due to good profit and production results, passionate rearing activities were performed by the farmers. Due to pleasant past experience, old lot of sericulturists are still in a hope and attached with rearing activities. This is the reason that current sericulturists are old and very much experienced.

Table – 18: Rearing Experience

Experience (Years)	20 – 30	30 – 40	>40
Percentage	35 %	45%	20%

In this perspective about 35 percent farmers from the sample have 20 – 30 years of experience, about 45 percent have 30 – 40 years of experience and about 20 percent have more than 40 years of experience. Farmers attached with sericulture in past are very much interested to adopt it again. They are interested because they know the economy and benefits of sericulture. But availability of quality silk seed and sufficient plantation of mulberry is the basic demand of these farmers. All respondents want to attach and continue the sericulture and all of them attributed that sericulture is simple and requires minor cost. It provide additional source of income and suites with their way of life.

5.2. Past Depiction, Reasons and Constraints Behind the Decline of Pakistani Sericulture

Pakistan sericulture industry faced different ups and downs, till 1995 it was a growing industry and thousands of families were engaged with this industry. After that it started going towards decline, it struggled till 2000 and after that a quick decline is observed. Before knowing the reasons behind the decline of Pakistan sericulture industry it is important to review the prior historical picture of industry when it was growing and a flourishing business.

5.2.1. Past Depiction of Pakistani Sericulture

About two decades ago, sericulture was a fruitful and charming occupation in Pakistan for poor and deprived. In Kashmir, Gilgat and Bultistan and four provinces silkworm rearing was supporting thousands of families. About 35000 families of Pakistan were engaged with this part time activity from which about 15,000 families were from Punjab. There was hundreds of reeling units in Changa Manga, Lahore, Chechawatni, Multan, Hyderabad, Karachi, and Swat etc. Quality of domestic cocoons was considered better and superior then imported cocoons of neighbouring countries like India, Bangladesh, Sri Lanka and Central Asian states. At that time against a domestic demand of 500 metric tons, domestic production of cocoon was about 300 metric tons. In Pakistan during 1980 – 1990, domestic demand of silk seed packets was about 45,000 packets. This huge demand of silk seed was fulfilled by government sericulture department and private companies.

Demand and Quality of Silk Seed

In past Quality of Pakistani bi-voltine silk seed was considered much better and superior than imported silk seeds. Packets of both domestic and imported silk seed were available and had a great production results. At that time different domestically prepared varieties of silk seed were provided by sericulture department. There was a great demand of domestic and imported silk seed packets. Quality of domestic silk seed was very high and at that time domestic seed production was less than demand and farmers were ready to obtain the silk seed at any cost. To enlist their name for silk seed packets, huge lines of farmers chase staff of sericulture department; these farmers offer more money of silk seed packet than the government rate and also use their departmental and political references and links.

Varieties of imported silk seed were also available which was provided by private silk fibre reeling groups. Along with other providers Gulmerg Silk Company, which was headed by Sheikh Rasheed Ahmad had a big share in imported silk seed providers. At that time Korean silk seed variety named "DPR" which is considered best for production and was provided by Gulmerg Silk Company and other groups. At that time for cocoon production about 20,000 packets of imported silk seed was being distributed by reeling groups.

Rearing Benefits

Sericulturists remember the good time of industry and narrate that in the past, two to three months activity of silkworm rearing provide them life line to meet their essential needs. Silkworm rearing supports them to purchase wheat of whole family for entire year or as educational or marriage expenses of their children, construction or repair of houses, to clear the lone or to buy the cattle. Sericulturists of Changa Manga and

Checha Watni forests further elaborated that in near past there was a tradition and culture of these forests. In rearing season these jungles were filled with thousands of sericulturists and there was a great hustle and bustle in these jungles. Rearing season brings happiness, pleasure and enthusiasm with it and sericulturists pick leaves and reared the worms with eagerness and hope to fulfil planned activities by them for future. After completion of rearing season, season of marriages started there and sericulturists elaborated that rearing of two packets of silk seed made them able to buy two tola (25 grams) of gold. But now sericulturists are living in miserable conditions and are compelled to leave this industry. Due to downfall of industry thousands of sericulturists have left their profession and now they are in search of some other economic opportunities.

In Past, farmers use to wait for rearing season because it meet and fulfil their different type of financial needs. At that time after completion of rearing season sericulturists earn sufficient amount and performed several economic activities. The interviews with sericulturists revealed following utilization of the revenue they generated in the past.

Table – 13: Rearing Benefits

Benefits	**Results**
Marriage Expenses	25 %
Purchase of Wheat	30 %
Purchased Cattle	9 %
Domestic and Educational Expenses	16 %
Clear the Loans	12 %
Construction and Repairing of Homes	8 %

For example, after rearing season, season of marriages start in sericulturist's community and 25 percent sericulturists responded that they meet their marriage expenses through income generated by silkworm rearing, 30 percent responded that they use income for purchasing of wheat for entire family, 9 percent purchased cattle for further income generation, 16 percent use sericulture income to meet domestic and educational expenses of their children, 12 percent use silkworm rearing income to clear loans and 8 percent use this income for construction or repairing of their homes. People engaged with this industry in past are still in a hope for the good time and revival of industry. In current circumstances respondents attributed that sericulture is an additional source of income and it can be attractive and very much helpful as it provide them a reasonable amount of revenue.

5.2.2. Reasons of Decline

Behind sericulture industry decline in Pakistan several reasons and factors are involved which are mentioned below.

Lack of Interest by Government

For the promotion of sericulture, Pakistan has a lot of potential but unfortunately there is total negligence and no clear road map. Sericulture department in Pakistan is working in all provinces, sericulture extension centres exists in district levels and government is spending a huge annual budget. However, instead of than consuming this budget on development of sericulture, the budget is consumed on salaries and allowances of sericulture officials. It is observed that these sericulture officials do not

have any vision or interest in the promotion of sericulture and progress graph is decreasing day by day. The ratio of development to operational expenditure and the ratio of revenue to budget of sericulture industries are both close to zero.

Destruction of Pakistani Parent (P-1) Silk Seed Varieties

Silk seed is obtained from pure parental lines which are called P-1 and preparation of P-1 is a complex, long and difficult process and takes almost 8 to 10 years. Mian Muslim a committed and hardworking man who served sericulture department as a senior research officer (SRO) and retired in 1999, introduced 11 different varieties of P-1 i.e. PAK-1, PAK-2, PAK-3, PAK-4, M-101, M-103, M-104, M-107, S-1, PFI-1, PFI-2. In respect of quality and quantity for cocoon production these varieties have out class results. These Parent varieties were prepared accordingly and suitable for different climatic zones of Pakistan and were capable to produce more than 40 – 50 Kg of cocoons.

But it is a sad and miserable fact that after his retirement, in spite of preservation and further improvement in these parent varieties, sericulture research department mixed-up and has destroyed all these parent varieties. Now, Pakistan does not even a single parent variety and there is a high mortality rate in old, mixed and poor quality silk seed. In sericulture development plan from 2006 to 2011, Pakistan has imported silk seed from Bulgaria, but this seed was not able to produce the desired results. It is observed that after fourth sleep, mortality rate of silkworms is very high. Farmers reported that despite of all efforts, inputs and hard work when their silk worms grow up to cocoon stage almost all silkworms die without providing yield. This high mortality has caused disappointment in the professionals and they are bound to leave

their profession. However, if the mortality could be controlled, the sericulturists are eagerly willing to jump back into profession.

Decrease in Mulberry Areas

In near past there was a huge stock of tree type mulberry (Desi Toot) plantation on government forests. In Punjab, Changa Manga, Chechawatini and Guttwala/Faisalabad were considered as main places of mulberry plantation. Changa Manga forest was established during British rule in 1866. About 11,000 acre area was allotted for this purpose. At that time tree type mulberry was planted in about 5,000 acres. This plantation was a huge source of mulberry leaves for silkworms feed. The author visit to these forests revealed that the forests once having countless mulberry trees is now converted into treeless ground. Unfortunately forest department could not preserve the mulberry as well as other types of precious trees. Due to negligence of forest department these precious trees were stolen by timber mafia. The forest Changa Manga no longer exists and the name refers only to a plane ground without trees. Situation of Chechawatni and Guttwala/Faisalabad forests is not many different and these are also approaching to toward their end.

Dissolution of USSR

In December 1991, Union of Soviet Socialist Republic (USSR) was dissoluted into 15 countries. To support the economies of newly established Central Asian Muslim states, government of Pakistan opened duty free route for trade. Due to long-lasting war, these countries have a huge stock of silk cocoons. These states started export of these cocoons on very cheap prices and Pakistan became a big cocoon market for these Central Asian states. Due to downfall in cocoon prices demand of local cocoons

declined. Due to reduction in prices, profit margin decreased and local sericulturists lost their interest in silkworm rearing. Although at that time people engaged in cocoon reeling industry earned a lot, but it left very bad consequences for the production of domestic cocoons.

Before dissolution of USSR, Gulmerg silk company and some other realers were distribute almost 25,000 packets of imported silk seed per season. Reduction in prices of imported cocoons attracted the reelers to purchase imported cocoons, due to this overall production of cocoons decreased drastically.

After stability these central Asian States invented new markets for their cocoons and prices of imported cocoons increased again. At that time Pakistan's domestic cocoons reeling industry was under attack. Due to increase in the prices of imported cocoons profit margin of reeling units started to shrink. Due to less production of domestic cocoons and high prices of imported cocoons these reeling units start facing shortage of cocoons supply and gradually these reeling units start closing.

5.2.3 Constraints Behind the Progress of Pakistani Sericulture

To know the constraints behind is need to compare infrastructure and policies of other progressive silk producing countries in the region. To promote sericulture industry in their countries, governments of these neighbouring countries like China, India and Bangladesh have clear focus and intentions. These countries have developed special mechanisms for sericulture development.

Lack of Awareness

There is lack of awareness about sericulture in Pakistan in many regards. First the government and policy makers are not aware of the potential of this sector, therefore

there is no promotion policy. Secondly the sericulturists and relevant government officials are unaware of the technology, training and techniques.

Lack of Specialized Persons

Development of specialized persons for this industry is an important element. Top silk producing countries in region like China, India and Bangladesh are promoting general as well as specialized education in different fields of sericulture sector which is provided from school up to university level. This strategy has helped them to produce a huge lot of specialized persons for sericulture sector. In Pakistan there is not any institute or research centre which is focusing on development of sericulture specialists so it is major reason behind failure of Pakistani sericulture industry

Lack of Separate Governing Institutions

Advanced silk production countries in the region have established separate directorates of sericulture. For example, Central Silk Board (CSB) in India looks over the matters related to sericulture similarly, Bangladesh Silk Board (BSB) in Bangladesh takes care of the industry. For the promotion of industry separate research and extension wings are working like Bangladesh Silk Research and Training Institute (BSRTI). Indian Research and Development board for sericulture is playing a significant role for improvement in silk seed as well as mulberry varieties.

In Pakistan, there is serious deficiency in this regard. Sericulture department is working as a wing of forestry department which has only marginal interest in the industry and there is a barrier between policy making and implementation of these policies. There is no check and balance and no regulatory authority which can check the progress of sericulture department. There are no specialized persons in sericulture

research and extension centres and due to ban on new hiring high number of posts are vacant in the department.

Lack of Interest by NGOs

Due to welfare oriented nature of sericulture industry, several NGO's are also playing a remarkable role in different countries of world. These NGO's are contributing in terms of funding in the areas of extension, training, micro-financing, research and technology. With the help of non-governmental organizations, sericulture is providing 8.6 million jobs in India and 0.86 million in Bangladesh, but in Pakistan, this figure does not even touches a thousand. In Pakistan, for the sake of rural development, poverty eradication, livelihood generation, women empowerment and environment protection, hundreds of local and international NGO's are working. Sericulture is an industry which provides plate form to fulfil all these objectives but unfortunately there is not even a single NGO which is contributing for sericulture development in Pakistan.

Climate Diversity and Sick Production

Change in climate also has impact on silk production. Currently in Pakistan due to climate change summer season is prolonged and winter is shortened, intensity in weather is increased by many times than past, overall duration of rains are decreased, schedule of rainy season and timely rains are disturbed badly, occurrence of uncertain and heavy rainfalls are increased. These uncertain changes in climate have a deep impact on silkworm rearing and there is need of adopting coping strategies and preventive measures.

5.3. Scope and Potential of Pakistani Sericulture Industry

To explore scope and potential of Pakistani sericulture industry this section is classified into three sub sections; first section will explore demand of silk seed, cocoons and silk yarn, second will explore climatic scope and conditions and third will explore potential of employment generation opportunities through sericulture industry.

Demand of Silk Seed, Cocoons and Yarn

In Past 90's, domestic cocoon production was about 300-350 MT and domestic demand of silk seed was about 45,000 packets (Sabir, 1997) but now there is a huge gap between domestic cocoon's production and demand. Regarding silk seed, there is large-scale demand of quality silk seed packets, in Pakistan and Afghanistan that's why there is huge scope of silkworm eggs production. Farmers consider that if a packet of silk seed having a guaranteed production capacity of more than 35KG and pr Kg rate of produced cocoons ranges from Rs. 700-800 then it is affordable for them to pay the cost of silk seed packet up to Rs. 1,500 – 2,000. Recent figures shows that about 250 tons of silk yarn worth Rs. 500 million is imported every year from China, Japan, India, Thailand, Korea and Brazil (AJK, 2004).

Employment Opportunities

Pakistan is a labour intensive country and socioeconomic characteristics of Pakistani rural and semi rural families are well-matched with the requirements of sericulture sector. However, in Pakistan only few thousand people are engaged part time with this industry and these are decreasing day by day.

In past about 15,000 rural families of Punjab and more than 35,000 families of Pakistan were engaged in sericulture activities. Currently in Punjab 0.9 million youth is added up annually from rural areas and they need opportunities for livelihood.

According to experts, sericulture has potential to provide employment opportunities to 25 percent rural population in Punjab and have a potential to bring huge foreign exchange in country. If government provide ample support and guideline then over 200,000 rural families of Punjab and a huge no of families from Pakistan are ready to jump towards sericulture sector (Jmali, 2010).

It is estimated that 1 ton of silk yarn can be produced from 25 acres of land and this volume normally provide full time employment to 30 families (5 persons per family) (Lao, 2006). In Pakistan domestic cocoon demand is about 750 metric ton but domestic production is less than 1 percent of total demand (Sabir, 1997). To fill this gap, Pakistan is importing cocoons and silk yarn from Central Asian States, Afghanistan, Iran and China. If we go with this reference and If Pakistan attempts to produce for its domestic demand, i.e. 750 tons, an employment of 112,500 would generate and annual revenue of about Rs. 487,500,000 (750 ×1,000 ×650) would be saved and thousands of people will get jobs in reeling, twisting, dying, weaving and other related activities. If Pakistan targets to export an equal amount i.e. a production of 1500 tons, the job creation will double and reasonable amount of revenue from export could be generated.

Most important thing is that it is not a first time experiment because in past sericulture was a well known and established industry in several areas of Pakistan. That's why we can say that, climate, culture, social and demographic values of Pakistan are very much supportive for this sector and offcourse sericulture can flourish here easily.

Climatic Scope and Conditions

Pakistan is an agricultural country, situated in a sub-tropical region. Climatic conditions of all Pakistani provinces are suitable for mulberry cultivation and

silkworm rearing. (Sabir, 1997) For ideal growth of silkworms atmospheric temperature and humidity have a great impact. For silkworm rearing 24" to 27"C temperature and 70% to 90% humidity conditions are considered ideal. Pakistan is in the sub-tropical zone and the temperature shoots up to over 30'C in summer and drops below 20'C during winter and rainy season. Similarly, season to season fluctuations in humidity are also an issue. That's why sericulturists should try to bring rearing room environmental conditions as close as possible. Areas where natural climatic conditions remain same more crops can be reared with the help of multi volatile silkworms. However, climate of Pakistan is much supportive for the production of bi-volatile silkworm and according to Mian Muslim quality and quantity of 3 – 5 crops of bi-volatile are equal to 7 – 9 crops of multi-volatine.

Climate Diversity and Silk Production

For silkworm rearing temperature and humidity level can be maintained artificially but In Pakistan, sericulturists are poor and they have less recourses and information about temperature and humidity maintenance. However, Pakistan has diverse climate conditions and different climatic zones which could result in continuous supply of silk throughout the year. Fowling table gives the rearing season for different regions in Pakistan, the table shows that the difference of climate could easily ensure the smooth supply of silk throughout the year. Furthermore, if standardised rearing sheds are constructed, one can get multiple crops from the same region.

Table – 14: Rearing Months in Pakistan

Province	Spring	Crops	Autumn	Crops	Total
Punjab	20 February – 15 April	3 – 4	20 September – 15 November	1 – 2	4 – 6
Sindh	05 February – 10 April	2 – 3	25 September – 20 November	1 – 2	3 – 5
KPK	February – September	5 – 7			5 – 7
AJK	15 March – 15 August	4 – 5			4 – 5
Baluchistan	March – May	3 – 4			3 – 4

In Punjab suitable time period for rearing in spring season is from 20 February to 15 April and it is feasible for 3 – 4 crops. In autumn, season is feasible from 20 September to 15 November and 1 – 2 crops can be rear. In autumn night time temperature drops down and can be maintained artificially.

In Sindh duration of hot season is long because it starts early and ends late. In spring natural feasible time period for rearing in Sindh is from 05 February to 10 April and in autumn it starts from 25 September to 20 November. On average 3 – 5 crops can be rear annually in natural environment.

Climate of KPK is also very much suitable for rearing. In KPK rearing feasibility is different from other provinces. Rearing season from D.I.Khan to Kohat is February to April, Peshawer to Swabi is end of February to mid of May, Mansehra to Swat is mid of March to Start of June and in Gilgat, Chitral and Kalash valley it remains feasible till the end of August.

In different areas of AJK feasible rearing season is mid of March to mid of August. Similarly in Baluchistan 2 – 4 crops can be reared annually.

5.4 Infrastructure of Pakistan Sericulture Industry

In this section existing infrastructure of Pakistan sericulture industry is explored and classified in two parts. First part is about institutional infrastructure from which province wise hierarchy of sericulture department is explored, second is about physical infrastructure from which silkworm rearing, reeling and weaving areas and cocoon markets are identified.

5.4.1 Institutional Infrastructure

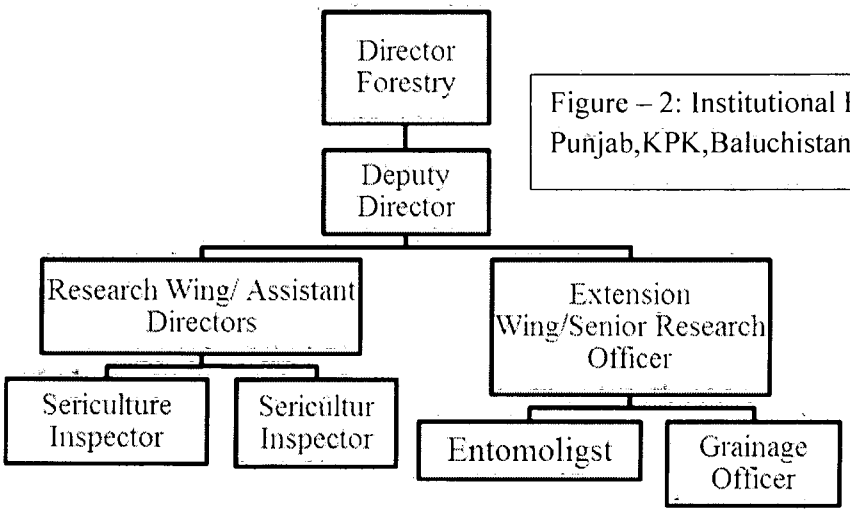


Figure – 2: Institutional Hierarchy of Punjab,KPK,Baluchistan and Sindh

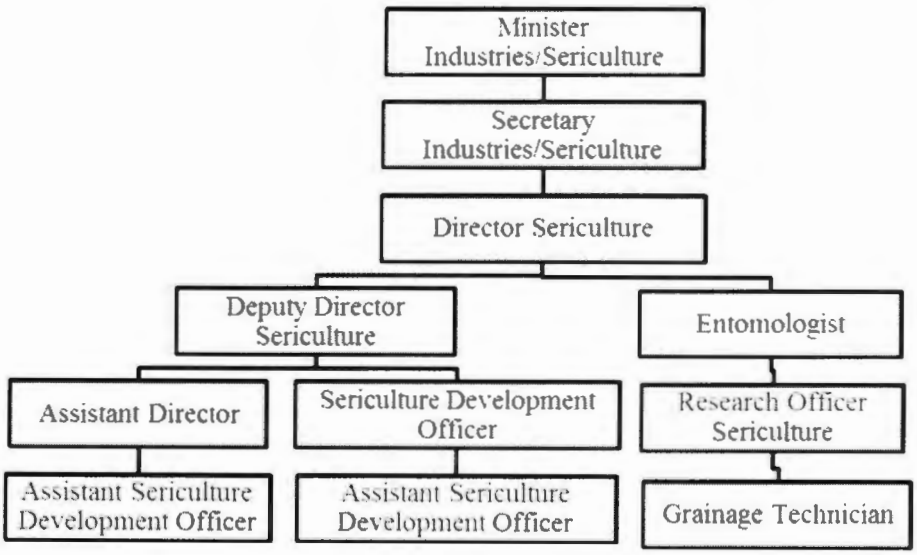
The institutional infrastructure for three provinces i.e. Punjab, Sindh and Baluchistan is same and it is governed by forestry department, whereas KPK and AJK government have different hierarchy of infrastructure. KPK sericulture is under ministry of non timber forest products while AJK sericulture is under ministry of industries and have a separate directorate.

In Punjab, Sindh and Baluchistan sericulture department is administrated by deputy director sericulture. Two further wings i.e. Research and Extension are working under deputy director sericulture. Responsibilities of Research wing are research,

innovation, production and preservation of quality silk seed and mulberry varieties. Research wing is managed by senior research officer (SRO). Extension wing perform the responsibilities of promotion, plantation and management of mulberry cultivation and distribution of silk seed and collection of cocoons for further silk seed generation. Assistant directors at divisional level are responsible for it. In these divisions several sericulture extension centres are working and sericulture inspectors are the in-charges of these extension centres. Sericulture inspectors are responsible to provide training to the farmers about silkworm rearing and also responsible for distribution of silk seed, mulberry cuttings for cultivation and issuance of permits for picking of leaves from department owned mulberry fields. In Punjab cocoon collection laboratory is working in Mitha Twana in district Khushab and silk seed production laboratory is working in Murree.

Structure of AJK Sericulture

Figure – 3: AJK Institutional Hierarchy



Initially sericulture department AJK was a functional unit of Industries Department AJK but after December 2000 separate Directorate of Sericulture was established which is working as an attached department having secretary industries. Head office of AJK sericulture department is near Agricultural complex Gojra Fort, Muzafarabad which is administrated by director sericulture. Extension and Research wings performed duties under deputy director sericulture and entomologist respectively. In research wing under entomologist, research officer and grainage technician performed duties. At district level extension centres are managed by assistant directors, sericulture development officers (SDO's) and assistant sericulture development officers respectively.

5.4.2 Physical Infrastructure

In physical infrastructure discussion is about available silk seed varieties, moriculture and mulberry varieties and province wise classification of sericulture extension centres, silkworm rearing and cocoon reeling areas.

Silk Seed

In Punjab silk seed production laboratory Murree has production capacity of approximately 5,000 silk seed packets, while in AJK before 2005 earthquake production capacity was about 4,000 packets but due to huge damage this capacity is decreased up to 1600 packets therefore current total silk seed production capacity of Pakistan is about 6,600 packets.

Table – 19: Silk Seed Production Capacity

Silk Seed Production Laboratory Murree / Punjab	Silk Seed Production Laboratory Muzafarabad / AJK	Total
5,000	16,00	6,600

Currently in Pakistan three bi-voltine varieties of silk seed are used for rearing, i.e.

1:- Mixed and old varieties of Punjab

2:- Imported Bulgarian variety

3:- Variety of AJK

Mixed and Old Variety of Punjab

In past Punjab has 11 different parent (P-1) varieties but unfortunately these precious varieties are destroyed due to departmental negligence. Due to carelessness of laboratory staff during seed production process these parent varieties are mixed up with each other. Now seed of these mixed varieties is considered flop because it is old, having less resistance against diseases and have very poor production results.

Table – 20: Punjab Silk Seed Varieties

PAK-1	PAK-2	PAK-3	PAK-4	M-101	M-103	M-104	M-107	S-1	PFI-1	PFI-2

Imported Bulgarian Variety

Under the sericulture development plan 2006-2011, Punjab sericulture department imported variety of Bulgarian silk seed. This variety was imported for the purpose of further silk seed production. But this variety was not able to produce desired results.

Experts and farmers declared that this variety have less resistance and production and considered a flop variety because it is not reliable and mortality rate in it is very high.

AJK Varieties

Department of sericulture claims that AJK sericulture department have different type of 23 parent silk seed varieties and under standardised conditions these varieties are capable of producing about 25 kilogram wet cocoons. In Past varieties of AJK silk seed was considered good, but due to lack of advancement, innovation and technology, production results of these varieties are also dropped down but it is better than other two and capable for further improvement.

Table – 21: AJK Silk Seed Varieties

PTK-1	PTK-2	JAM-119	KP-1	KP-2	KP-3	KP-4	#106	#112	#113	#115	#124
OWC-1	K-1	JAM-120	K-2	Y3-6	Y5-6	8-J	SJ	C-102	J-101	#133	

Moriculture

Cultivation of mulberry is called moriculture. In this section available mulberry varieties and their characteristics are discussed. Genetically mulberry belongs to Morus family. Morus has many species and varieties but in Pakistan Morus-alba, Morus albalen, Morus laevigata and M. laetifolia are mostly used for rearing purposes. Morus laevigata and M. laetifolia are more nutritious, broad and succulent leaves with more protein contents which have positive impact over cocoon production as more than 70 percent of the proteins in the cocoon are derived from mulberry leaves.

Mulberry is mainly propagated by grafting, cutting, seed sowing and tissue culture

etc. Proper time of plantation for rooted plants is December - January while for cutting plantation it is from February to middle of March.

In Pakistan available mulberry varieties can be classified into three general categories i.e., Tree Type Variety (Desi Toot), Bush Type Variety (Imported) and Grafted Variety.

Tree Type Variety

This local variety is also known as "Desi Toot". With comparison to other imported varieties this local type of Pakistani variety has different features which make it unique from other varieties. It does not require more care and can be grow under diverse environmental conditions. Leaves of this variety have more protein with comparatively richer nutrients. Silkworms eat leaves of this variety spin a good and fine quality of cocoons and these cocoons have more weight than others. Shoots of this variety are more strong and flexible. Plants of this local variety grow into a huge and big tree and produce a strong and demanding timber, although this feature is considered as a drawback also because leaves picking from a huge tree is difficult for women and children.

Grafted Variety

In Grafted varieties morus laevigata and morus laetifolia are more useful and produce thick, nutritious and broad leaves along with edible fruit. This fruit is also used in dry fruit, jams, jellies and ethno medical purposes. The seeds produced by these varieties are not fertile and cuttings have poor rooting ability. Therefore to propagate these varieties through normal vegetative methods like cuttings or layering cannot be practiced. In this case bud and cleft grafting is the procedural protocol for its

propagation. Phyto-hormones can also be used to promote vegetative propagation (AJK, 2005).

Bush Type Variety

Sericulture department have introduced several imported bush type varieties like "Japan-early, Japan-late, Ever-green, Latifonia, Punjab-1, Punjab-2, and different varieties of China, Korea and Sri Lanka. Early sprouting, fast growing and easy picking of leaves are three main features of these bush type varieties. In bush type after picking of leaves, plants are covered again and leaves mature for feed in 2 to2/12 months. Sprouting of these varieties starts early and due to availability of leaves, silkworms can be rear on desired time. These varieties are bush type that's why women and children can pick leaves easily. For good quality of cocoons production, best feed combination suggested by experts is that during first three sleeps, leaves of bush type can be used and after fourth sleep leaves of local mulberry variety should be used.

Area Under Mulberry Plantation

Area under mulberry plantation is decreasing day by day and there is a strong need for re-plantation and preservation of existing jungles. In spite of local tree type mulberry plantation, department is promoting imported bush type plantation.

Table – 22: Area under Mulberry Plantation (Hectors)

Punjab	Sindh	AJK	KPK	Baluchistan	Total
600 – 800	150 – 200	100 – 150	-	-	850 – 1150

Currently in Punjab area under bush type mulberry plantation is about 600 – 800 hectors, in Sindh it is about 150 – 200 hectors, in AJK it is about 100 – 150 hectors. Although in KPK and Baluchistan there is not specific area allocation for mulberry plantation but recently in KPK, Non Timber Forest Product Department is developing mulberry nurseries for experiment purpose.

Sericulture Extension Centres And Silkworm Rearing Areas

Previously sericulture activities were being performed massively in different areas and cities of Pakistan. Province wise localities of sericulture extension centres and silkworm rearing areas are mentioned below.

Punjab

In Punjab sericulture head office is situated on Ravi Road Lahore and sericulture extension centres are working at district level. Areas where silkworm rearing activities were performed massively in past and also familiar currently are Changa Manga, Qasor, Faisalabad, Chechawatni, Samundri, Sarei-Alamgir, Khushab, Daffar, Mona, Gujranwala, Mandi baha-ud-din, Toba Tak Singh, Jhal Chakian, Kamalia, Rajana, Jhang, Gujrat, Multan, Jaranwala, Head Faqrean, Rawalpindi, Sangla Hill, Qadir Abad, Taxila, Kassowal, etc. In these areas land for mulberry plantation is also allotted to the department extension centres which is not sufficient and cannot fulfil the demand as needed.

AJK

Sericulture industry is an old and substantial source of income for poor rural people of AJK. Climate and soil of Azad Kashmir has great heterogeneity and diversification. Muzafarabad Bagh, Poonch and Sudhnoti districts are hilly one whereas Kotli, Bhimber and Mirpur are partially hilly and partially plain. Conditions of Azad

Kashmir are highly favourable for silkworm rearing in both spring and autumn seasons. Rural people of AJK have very less opportunities of employment and rearing season is a real economic hope for these people. Earthquake in 2005 impacted badly on AJK sericulture. It has damaged the infrastructure and seized rearing and silk seed production activities. Due to earthquake AJK filature unit is totally destroyed and in affected areas livelihood of about 900 families attached with sericulture was affected badly.

To adjoin more benefits, AJK sericulture department is promoting Morus Laevigata and Morus Laetifolia and have 6 mulberry nurseries in Afzalpur, Dhamal, Gorah, and Patikka with capacity to produce about 0.6 million mulberry saplings annually. Although at a little extent AJK sericulture department has strengthen itself in different disciplines of research and technology however it is still far behind from standard requirements. Department of sericulture AJK have capacity for the development, multiplication and maintenance of pure lines of silkworms. In all districts of AJK, department have 14 seed cocoon production and egg preservation centres. Annual silk seed production capacity for commercial purposes is about 1,600 packets which are distributed in spring and autumn. These packets are supplied to government and private sector in different areas of Pakistan. Per packet cocoon production capacity of AJK silk seed is about 10 – 20 Kg which is not satisfactory and considered very low than advanced countries. Department of sericulture, Muzafarabad also planted about 68,500 mulberry saplings in 477 educational institutes of AJK.

KPK

In KPK sericulture department head office is located at Peshawar and sericulture extension centres are located in different districts. In past sericulture activities were

performed massively in the areas of districts Dera Ismail Khan, Peshawar, Mardan, Swabi, Katlang, Swat, Mengora, Matta, Char Bagh, Dir, Garam Chashma, Hari pur, Lond Khar, Kohat, Para Chanar, Bannu, Miran Shah, Wazerastan, Gilgat Bultistan, Chitral and Kalash valley etc. But now in KPK silkworm rearing activities are story of past and people are going to forgot it.

Sindh

Directorate sericulture office, Hyderabad is a center point for Sindh sericulture having 62 acres of mulberry nurseries. In Sindh sericulture was initiated on experimental basis in 1975 at Miani forest. After successful experiment it is now extended to Ghotki, Sanghar, Sukkhar, Tharparker, Mirpur Mathelo, Khipro, Naukot and Hyderabad districts. Silkworm breeding center is working at the Miani forest. This centre provides technical know-how and distributes silk seed to the sericulture extension centers. In Sindh imported and local silk seed varieties are used for silkworm rearing. Two to four crops can be harvested during spring and autumn seasons. But now due to low production sericulturists are not anymore interested in rearing and these rearing activities are shrinking down to very few localities.

Sindh Forestry Department (SFD) has produced more than 10,000 Kg of cocoons during period of last two decades (SFD, 2007). Provincial secretary for forest, wildlife and environment stressed the need for development of sericulture as an independent industry like China, Japan, India, Russia and Korea. (Dawn, 2001)

Balochistan

Several areas of Baluchistan are suitable for sericulture and in past department of sericulture, Baluchistan executed and conducted several successful experiments in

Ziarat and Kallat agencies. Currently sericulture department exists but not functional in a sense of silkworm rearing.

Cocoon Markets And Reeling, Weaving Units

In past Changa Manga, Chechawatni, Multan, Peshawar and Muzafarabad etc were the main cocoon markets but now due to limited activities cocoon markets are also reduced. Now during season minimum amount of cocoon trading activities are seen in Changa Manga. In past there was hundreds of operational reeling units in Changa Manga, Multan, Karachi, Mazafarabad, Peshawar and Swat valley. In spite of selling cocoons a huge number of farmers were preferred to reel their cocoons. These cocoons were reeled with the help of traditional 'Hand type Charkha' and 'electric motor machines' and with the help of this farmers can earn 30 – 40 % more money. Along with home based reeling there was a separate silk reeling industry in Pakistan and thousands of people were engaged with this industry. But unfortunately with the passage of time due to shortage of cocoons availability majority of reeling units are closed and now there are few operational reeling units working in Changa Manga, Multan and Karachi. In past department of sericulture, Muzafarabad has its own silk reeling filature unit having advanced technology characteristics but in 2005 earthquake it was damaged and after that no one paid any attention to get it repaired. So the results indicate that promotion of sericulture industry in Pakistan is not a difficult task and just need a little intention and commitment. It is also proved that promotion of sericulture requires very low capital but it is much supportive for employment generation in bulk.

Chapter 6

Strategies and Feasibility for Improvement in Pakistani Sericulture Industry

For improvement of sericulture industry in Pakistan huge level of sincere efforts are needed. Dedicated and visionary approach, revision of policies, improvement in currently available infrastructure and strengthening it up to its requirements regarding international standards are necessary steps which are needed to initiate.

To stand the industry on its feet a clear vision, a clear road-map and a firm determination to achieve this vision should be a fundamental agenda. It's a game of years and there may be several short, mid and long term policies to give it an exemplary and glorious future. These Development strategies may be leaded from top to bottom but can be executed from bottom to top.

6.1. Short Term Strategies

For a smooth start to run this industry several short term strategies may be initiated.

Improvement in Production of Good Quality Silk Seed

Motivation of existing sericulturists for rearing of silkworms is an initial point and it can be done by ensuring them a reasonable per packet cocoons production. This assurance can be granted to them if a reliable and good quality silk seed should be distributed among them. As mentioned previously that Pakistani silk seed is not reliable and not capable to give the desired production. For better quality silk seed production available options are improvement in AJK silk seed and import of recommended and reliable bi-voltine and hybrid silk seed varieties which can be used for further production. For this purpose new pure lines of silkworms should be

introduced while existing pure-lines of silkworms should be maintained and improved.

Issue of high cost of imported silk seed also exists here because local silk seed packets have low cost i.e. Rs. 250 – 350 but it has a low quality and unreliable production results. On the other side imported silk seed packets have the high prices i.e. Rs. 3,500 – 5,000 which is unaffordable for poor sericulturists. Due to previous experiences without any certain assurance, farmers will also feel hesitation and risk to purchase costly silk seed packets. To overcome this situation it is necessary that imported silk seed should be provided on subsidised prices. With help of this imported silk seed further silk seed may be prepared on our local silk seed production laboratories. This will not only reduce burden of imported silk seed but will also generate employment opportunities.

Preparation of Standard Rearing Beds

Rearing beds for silkworms have a great impact on production. Normally farmers ignore importance of proper spacing and standard rearing beds and relay on traditional and old ways for rearing, improper humidity and airing, this finally has bad effects on productivity. Preparation of standard rearing beds is not a difficult or costly task and can be prepare with the help of cheap and available material which is capable to put healthy impacts on production.

Training and Awareness Programs for Sericulture Staff and Farmers

Farmers should be aware about standard methods of rearing process i.e. about proper hatching techniques, maintenance of temperature and humidity, spacing, feeding, cleaning, moulting, mounting and harvest of cocoons etc. All these have a great

impact on production results. For awareness of farmers, trainings, seminars and workshops are essential and should be conducted in a continuous series.

It is important that there should be a strong relationship between sericulture field staff and farmers. During rearing season consistent field visits of sericulture staff is also essential. To attain good production results, standard and scientific awareness and training of farmers and sericulture staff is an important requisite. Farmers should be trained in all matters of silkworm rearing like preparation of rearing houses, hatching, rearing, feeding, diseases of silkworms and drying of cocoon etc. Sericulture staff should be trained such a way so that they may guide farmers regarding all matters of silkworm rearing. Collection and preservation of quality cocoons for the production of further silk seed packets (parental and commercial) is a sensitive matter and field staff should be well aware about it. It will enable smooth supply of silk seed for next rearing.

Expansion of Mulberry Areas

To initiate sericulture development project available mulberry stock in Changa Manga, Chechawatni and Faisalabad can be helpful but it is a hard fact that availability of mulberry leaves is a serious issue. Currently in Pakistan area under mulberry cultivation is very less and not sufficient for enormous level of silkworm rearing. Cultivation of mulberry trees could be done on government free lands i.e. beside the streets, roads, railway tracks, canals, hilly areas and area assigned for forests. This kind of areas is abundantly available in all provinces of Pakistan. This will impact dually i.e., besides increase in the supply of leaves this will also bring positive and healthy impacts on economy and environment. The bush type mulberry

plants mature in two years, therefore if the initiation is taken today, enough leanes should be available after two years.

6.2. Medium - Term Strategies

Initiation of Interrelated Sections

Sericulture industry has a no of interrelated sections and initiation of these interrelated sections can bring huge value addition.

For example silk cocoon is a delicate commodity and it cannot be stored for a long time. It is observed that if farmers get reeled their cocoons by themselves then they can keep their silk yarn for longer period and can earn 30-40% additional price as compared to cocoons. Solar reeling units which are also being used and adopted by other countries may be much helpful in Pakistani circumstances. Therefore, training of farmers in cocoon reeling on portable reeling machines is essential. Promotion of direct linkages between reares, reelers, twisters, and weavers is also important.

Exclusive Women Oriented Skills Development Programs

In Pakistan rural women do not have sufficient opportunities for livelihood generation. Promotion of different cottage based industries may be helpful and these can grant income generation opportunities for these women at their home. This will help women to share the burden of their breadwinner.

Sericulture activities are compatible and easily match with routine activities performed by these women at their homes. In advanced sericulture countries, during all procedures i.e. from silkworm rearing to reeling, dying, twisting and weaving, women are playing a primary and dynamic and key role. In Pakistan development of sericulture industry infrastructure in such a way which appreciates and favours women participation may help a lot to bring out women and their families from

poverty line. This may promote women and help them to come in main stream. This may be done through initiation of women skills development programs and through creation of women development fund which may provide them subsidies and micro credits. Sericulture promotion campaign like India with the slogan "Sericulture and Silk for the women by the women" is also needed to promote in Pakistan. India has advantage that large platforms of well organized women self help groups / associations / networks are working who are always ready to receive new ideas and execute these ideas. Such types of programs are also needed in Pakistan.

Appreciation of NGOs Participation

For promotion of silk industry participation of NGOs is key and crucial point. In silk advanced countries there are several successful NGOs playing role in sericulture promotion. Case study of BRAC sericulture, mentioned in literature review is an excellent example. For promotion of industry, public private partnership in pre and post-cocoon sector and contract farming with NGOs and related corporations may be helpful. These NGOs can be helpful in terms of mobilizing the communities and societies, motivating and mobilizing people to participate and practice silkworm rearing activities, creation and development of basic infrastructure, mechanization of this infrastructure and establishment of channels between farmers, sericulture department, and other stack holders of industry. To initiate it help and assistance of International Sericulture Commission (ISC) can also get.

Development of Standard Rearing Rooms

To obtain good production, standard rearing houses which may provide proper spacing, temperature, humidity, air and ventilation are necessary. Standard rearing rooms can be established in economical manner i.e. mud rooms having proper cross

ventilation, temperature and humidity control mechanism. Benefits of rooms prepared by mud are that these are cheap in cost and are most effective for environment control because these are naturally cool in summer and hot in winter. These rearing rooms can be used for multipurpose for example after rearing season these can be used as a reeling room or as a shed of mini livestock or poultry. For construction of these rearing rooms government, NGOs or other related donor agencies can provide technical guideline, funds and subsidies.

Establishment of Friendly Marketing System

Establishment of friendly marketing system and services in farming and non-farming sector where suppliers and buyers feel confidence and can easily trade their silk products having no barriers and they don't have fear of extra surcharges is essential.

Establishment of Separate Directorate and Research Centres

Like other countries where sericulture is a flourishing industry, establishment of separate directorate and research centres for Pakistani sericulture industry is essential and very much needed. As sited earlier, in all the countries having good production of silk, separate and independent silk promotion departments and research centres are present.

Promotion of Educational Infrastructure

In neighbouring countries research and studies in sericulture is encouraged and promoted. From school to university level sericulture is treated as a separate subject. By this way huge amount of sericulture specialists are generated. Such type of educational infrastructure development is also needed in Pakistan.

6.3. Long -Term Strategies

Plans for long term strategies should be prepared in such a way that these should maximize utilization of resources and ensure maximum level of value addition.

Expansion of Interrelated Industries

To confront with natural risks, strategies for risk management and prevention system in terms of prices and diseases are also important. Advanced countries in sericulture are diverting themselves from traditional methods towards three-dimensional mods like "mulberry-food-herd", mulberry-food-chicken" or mulberry-food-vegetables" and multi levelled circulation mode of "silkworm-livestock-biogas-fish" in which these interrelated industries support each other and also support ecological benefits which help to improve the overall economic efficiency.

Finally these short, medium and long term strategies could be implemented smoothly and for the growth of industry these could provide a strong, reliable and consistent base.

6.4. Feasibility

Establishment of sericulture is not a complex job its requirements are simple and could be managed easily and in a cheap manner. For rearing of one packet of silkworms, one time investment required is not more than Rs. 25,000. F ollowing are some basic feasibility requirements

Inputs:-

Silk Seed

AJK variety = Rs. 350 Imported variety = Rs. 3500

Mulberry Cultivation

Leaves production depends upon the variety of mulberry and on type of plantation

whether this plantation is comprises of cutting or root plants. Cuttings plantation of bush type variety provides leaves after two and half years of plantation and root plants start to provide leaves from second year of planting. Leaves production duration of tree type varieties is longer and it takes about 3-4 years.

Rearing Equipment

Preparation of rearing equipment is not so expensive and it is a onetime investment. Cost of equipment can be measured according to local rates and can be adjusted in economical ways. In rearing equipment preparation of rearing bamboos and trays are expensive elements and for one packet about 76 trays are required. Other rearing equipment required is listed below.

Table – 23: Rearing Equipment

Thermometer	Rearing Trays	Rearing Stands	Knife	Muddi/ Wood Stand	Axe/Kulhari/Toka	Leaves Frame
Hydrometer	Heater/Angethe	Farmalin	Chuna	Humidity Sheets	Leaves Baskit	Shoot Cutter

Sericulture feasibility could be surmised that "establishment of sericulture is based on the phenomena that don't ignore the standard conditions but manage it as economically as you can".

Chapter 7

Conclusion

To conclude we can say that presently sericulture industry in Pakistan is becoming a fairy tale of past. For the purpose of improvement of agricultural labour, small and marginal farmers and overall rural development, sericulture can play a vital role. A clear vision improved and well planned management; marketing and advanced technology system can lead the sericulture towards its right direction. Illustrations of sericulture progressing countries like China, India, Bangladesh etc are evident that this industry is much viable for rural development. From the discussion it is proved that sericulture was once a profitable business for rural communities in Pakistan also but due to some unavoidable circumstance and negligence this industry is in difficult time. But at the same time there is hope that people are still willing to part of this industry if find some relief in provision of quality silk seed, mulberry leaves, appropriate training and rearing sheds.

From discussion it can be inferred that multi prong strategy is required for development of sericulture industry and there is need of input from Government as well as from NGO sector. From test case of India, Bangladesh and other silk producing countries of world it is evident that for development of sericulture sector both government and NGOs are working hand in hand. Although areas of operations are different but collaboration of both government and NGOs, sericulture sector can progress. Government can emphasis on research and development side in way of plantation of mulberry and development of silk seed varieties, where NGO sector can provide initial investment, training, marketing and mobilization of community to take part in sericulture activities. As it is one of such cottage industry which requires

minimum investment and everyone from child to elder including women can participate in it so it can be really helpful to achieve target of rural development which includes poverty elevation, livelihood generation and women empowerment etc. It is evident that there is also great potential in Pakistan for sericulture industry and there is need to adopt BARC model in Pakistan. Culture, climate and demographic conditions of indo-pak subcontinent are same so it can be inferred that sericulture industry can be helpful in achieving targets of rural development.

Finally it can be stated that promotion of sericulture industry from grass-root level has potential to provide us some practical and basic guide lines towards the establishment of Islamic Financial System (IFS).

Below are some steps required to achieve this trance.

- Precise sericulture development plane
- Budget allocation and investment for sericulture development plane
- Plantation of different mulberry varieties on government and private free lands
- Construction of standard individual and community rearing rooms
- Research and development of high production silk seed
- For skills enhancement, training and awareness of sericulture industry stockholders
- Experimental research for testing and improvement of available AJK silk seed.
- Import of quality silk seed for further research
- Consistency and devotion for the implementation of sericulture promotion projects

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Respondent's Profile

Province _____ District _____ Tehsil _____

Village _____ Settlement _____ Contact No _____

Address _____

Household Profile

Name_____

Father Name _____

Education _____

Sericulture Experience_____

Age _____

Marital Status _____

Cast _____ _____

Gender _____

Relation Ship with Household Head * _____

Type of Family *_____

Total Family Members _____

Male _____ _____Female _____

Children ≤ 5 years _____

Name of Household Head:

Male _____

Female _____

Major Occupation _____

Total Monthly Family Earning

_____

Agriculture status

1. Have You owned Agriculture Land

A. Yes	B. NO

2. If, yes. No of Canals_____

3. Cropping Pattern _____

4. Annual Income _____

5. Land Under Mulberry cultivation (Canals) _____

6. Mulberry Verity _____

7. Mulberry Type

A	B	C
Bush	Tree	Other _____

8. Do You Practice Intercropping in Mulberry field

A. Yes	B. NO

9. Which Crops You Intercrop in Mulberry

_____

Income _____

Facilities

Education	Type	Distance(Km)
Primary	_____	_____
High	_____	_____
College	_____	_____
University	_____	_____
Vocational	_____	_____
Institute	_____	_____
Health facility	_____	_____
	a. Govt b. Pvt	

house Structure

Roof		
Floor		
Walls		
Latrine	In side home	Outside home
	Flush	Without flush

a. Cemented b. Taped c. Mud/Clay d. Bricks e. Mix f. Linter g. T-r

ID	NAME	S *	Education **	Vocational Education	Marital Status	Relation With Head	Spouse Code	Father Code	Mother Code	Primary Occupation Annexure	Earnings	Other Earnings / Sources	Un paid worker / Hours	Sericulture Experience level
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														

Sex 1. Male 2. Female **Education** * Give codes from 1 -21

Type of Family 1. Joint 2. Separate

***Expertise.** A. Hatching, B. Feed /Leaves (a. Piking b. Cleaning c. Cutting d. Feeding) C. Bed cleaning D. Silk worm shifting E. Montage and Cocoon Piking F. Drying G. Boiling H. Reeling I. Weaving)

Marital Status 1. Married **2.** Single **3.**Divorced **4.** Widow/ widower **5.** Poly Married **6.** Separated **7.** Other

Relation with Head 1. Head **2.** Wife/ Husband **3.** Child **4.** Grandchild **5.** Nice/ Nephew **6.** Father/Mother **7.** Sister/Brother **8.** Grand Father/Mother **9.** Son/Daughter in Law **10.** Brother/Sister in Law **11.** Father/Mother in Law **12.** Other Relationship _____

Silk Seed

1. From where you obtained / purchased silk seed

A	B	C	D
Forest/ Sericulture Department	Private Source	Own Produced	Other (Specify) _____

2. Other Silk seed Provision Options

A	B	C	d

3. Type of the Silk Seed _____

4. What was the Quality of the Silk Seed

A	B	C	D
V. Good	Good	Average	Poor

5. Range the per packet cocoon production in Kg's

A	B	C	D
Good (KG)	Average	Poor (KG)	Loss (KG)

6. At which rate you can afford Good Quality silk seed Rs._____

Silk Farming Experience

1. From how many years you or your family is involved in sericulture activities (Years) _____

2. Is there any time ever when sericulture was your sole occupation

A. Yes	B. NO

3. If Yes , When _____

4. How much Household Members of your family are involved in Silk Farming _____

5. Details

Member ID	Experience	Expertise*	Time hours

6. Does Sericulture activities contribute to improve your family income / status

A. Yes	B. NO

7. Do you think sericulture activities are beneficial

A. Yes	B. NO

8. How

_____

_____

9. For which purpose You practice sericulture

A	B	C	D	E
Marriage	Clear loan	Buy Cattle	Education expenses	Sustain living

f. Other _____

Cocoon Production

1. No of Packets you got and Reared in last season _____

2. Will you rear in coming season (spring 2014)

A. Yes	B. NO

3. If Yes
No of Packets you will rear
_____

4. At which rate you got silk seed in last season
Rs./packet_____

5. From how much years you are getting Silk Seed from the mentioned source _____

6. No of Crops you reared in last season _____

7. Time Period

1st Crop	_____To _____
2nd Crop	_____To _____
3rd Crop	_____To _____
4th Crop	_____To _____

8. Total Production in Kg's _____

	Production in Kg's	Quality of Cocoons *	Production remarks **
1st Crop			
2nd Crop			
3rd Crop			
4th Crop			

*A. High, b. Average, c. Low
** a. Good b. Average c. Poor d. Loss

9. Reasons of

	Good Production	Bad Production
1st crop		
2nd crop		
3rd crop		
4th crop		

10. About how much days you dry the cocoons _____

11. Have you sold the Produced cocoons

A. Yes	B. NO

12. If yes to whom

A	B	C	D
Realer	Trader	Depart ment	Other

14. Do you satisfy with Rate

A. Yes	B. NO

15. if No, which Rate is considerable

Dry (RS)	Wet (Wet)

16. Was Middle Man involved in deal

A. Yes	B. NO

17. Should Middle Man involve in deal

A. Yes	B. NO

18. Why reason
_____
_____

19. What is the distance of Cocoon market (Km) _____

20. Cost

Transportation	Other

21. What are the current Marketing facilities _____

22. Do You Satisfy with Marketing facilities

A. Yes	B. NO

23. Suggestions _____
_____

Technical Efficiency

Rearing shed

1. Type of Rearing Shed

A	B	C	D
Char-pai	Table	Rearing stands	Other _____

2. Size of Raring Shed Sq. feet

_____

3. Do you maintain Temperature in your Rearing Shed

A. Yes	B. NO

4. How do You maintain Temperature_____

5. Do you maintain Humidity in Rearing Shed

A. Yes	B. NO

6. How do You maintain Humidity

_____

7. Which type of equipment you have

A	B	C	D

8. Do You know benefits of temperature and humidity maintenance

A. Yes	B. NO

9. Do You have awareness of disinfectants

A. Yes	B. NO

10. Do You disinfectant the rearing room before rearing

A. Yes	B. NO

11. How You Disinfectant the Rearing Area

_____

12. Which Disinfectants You use _____

13. From where You got Disinfectants

_____

14. At which cost

_____

15. Type of rearing room

Flore	walls	Roof

a. Cemented b. Taped c. Bricks d. Mud/Clay e. Mix f. Linter g. T-r

16. Which type of Hatching technique You Adopt

_____

17. How you maintain the Temperature for Hatching

_____

18. About how many days you complete Hatching process_____

19. What is the Hatching _____%age

20. Is Sleeping period same or differ

A.	B
Same	Differ

21. If Differ then how you manage the feed

_____

22. At which stage you feel that mortality ratio is high

_____

23. which Diseases attack and at which stage

	Diseases	stage
A		
B		
C		

24. How do you identify the infected silkworms'

_____

25. How do you treat the infected silkworms'

_____

26. Other Reasons of Mortality

_____

_____

27. Which copping strategies you adopt to avoid diseases

_____

28. After how much days you clean the bed

_____

29. Which Montage Method You Adopt_____

30. How you dry cocoons Total rearing Time period in days _____

Silkworm Feed

1. From Where You got Mulberry Leaves

A	B	C	D
Govt Forest	Private	Own garden	Other ____

2. If Government Forest then what is per packet rate _____

3. What is the Procedure to obtain leaves Permit _____

4. Against one Permit how much leaves can pick Kg_____

5. Against one Permit how much packets can reared No_____

6. What is the status of leaves supply during season

A	B	C	D
Abundant	Enough	Short	Scare

7. In the case of leaves shortage what you do _____

8. What are the impacts of feed shortage

On Production	On Quality
_____	_____
_____	_____
_____	_____

9. Other problems for obtaining Leaves

_____

10. What is the behavior of forestry officials

A	B	C	D
Very Cooperative	Cooperative	Less Cooperative	Not Cooperative

11. Per packet leaves consumption in Kg's

	KG
Before 1st sleep	
Before 2nd sleep	
Before 3rd sleep	
Before 4th sleep	
After 4th sleep	

12. Total consúmption _____

Sericulture Department

1. Which type of facilities sericulture extension department provide to you

A	B	C

2. In case of any problems during silk farming, the officials of sericulture extension are helpful

A. Yes	B. NO

3. Do you have contacted with Seri Inspector

A. Yes	B. NO

4. Does Sericulture inspector visit during Raring Season

A. Yes	B. NO

5. If yes, No of visits

_____

6. Have you been received any technical information/guidance from the extension officer

A. Yes	B. NO

7. If yes
Are you satisfied with the quality of training and extension services

A. Yes	B. NO

8. Have you got training from Seri Department on sericulture activities

A. Yes	B. NO

9. Does any NGO provide you any training or facility

A. Yes	B. NO

10. If yes, How many Family members got Training

_____

Opinion about Past Experience

About how much years you or your family is rearing silk worms _____

From which year you or your family is rearing silk worms _____

Year Wise Cocoon Production

Year	No of Packets in a season	Per Packet Cocoon Production (Kg)	Rate of Cocoon	Quality of Cocoons	Type of Silk Seed
2014					
2013					
2012					
2011					
2010					
2009					
2008					
2007					

Best Production Year _____	Reasons	Benefits/ Loses	Remarks
Worst Production Year _____			

Reasons of Decline _____

Suggestions for Improvement _____

Required Conditions for Improvement _____

Hopes and Participation Availability _____