THE NATIONAL SILK POLICY - 2020

Central Silk Board
(Ministry of Textiles, Government of India)
Bengaluru

March, 2020

THE NATIONAL SILK POLICY - 2020

(CSB Memorandum No. CSB-31/2 (63rd RCC) 2019-2020/RCS dated 5.12.2019)

Central Silk Board
(Ministry of Textiles, Government of India)
Bengaluru

March, 2020

THE NATIONAL SILK POLICY - 2020

(CSB Memorandum No. CSB-31/2 (63rdRCC)
2019-2020/RCS dated 5.12.2019)

Central Silk Board
(Ministry of Textiles, Government of India)
Bengaluru

March, 2020

PREFACE

Silk,the Queen of Textiles, is known, to mankind since 3000 BC as a mystical fibre, guarded as a State Secret of China to the present day, as an item of desire among millions of consumers and passionate fashion enthusiasts and to the future as a material of great importance well beyond merely as a textile fibre. During this amazing journey across many continents, cultures, civilizations and historical incidents of immense importance, silk has been concomitant with the lifeline of millions of people.

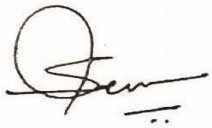
India's traditional and culture bound domestic market and an amazing diversity of silk garments that reflect geographic specificity have helped the country to achieve a leading position in seri-enterprise, producing all the five known commercial silks, *viz*., Mulberry, Tropical Tasar, Oak Tasar, Eri and Muga.The very nature of seri-enterprise with its rural-based on-farm and off-farm activities clubbed with enormous employment and income generation potentials, makes it one of the most appropriate tools for socio-economic development of a largely agrarian economy like India.

Developments in the country during the last two decades have madeseri-enterprise an ideal tool for rural employment generation and poverty alleviation.Along with are also transformational changes in the economy, associated with technologies, diversified demands, consumer profiles and global market forces, to name a few. In this background, the seri-enterprise requires a higher degree of strategic planning, revisiting the existing mechanisms as well as exploring new tools to make it sustainable as well as competitive and hence the need for a comprehensive National Silk Policy.

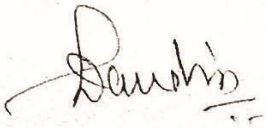
In view of the above, based on the recommendations of the Research Coordination Committee (RCC), the Central Silk Board (Ministry of Textiles, Govt. of India), Bengaluru, constituted a Committee to formulate a comprehensive National Silk Policy, vide Memorandum No. CSB-31/2 (63rd RCC) 2019-2020/RCS dated 5.12.2019. The present report is an output of intense review of existing status of seri-enterprise in a value chain mode and interactions with all stakeholders in sericulture.

The Committee places on record its gratitude to the Central Silk Board, Bengaluru, specially the Member Secretary, Shri Rajit Ranjan Okhandiar, for his interest in preparing a national policy for the sericulture sector. The guidance received from the

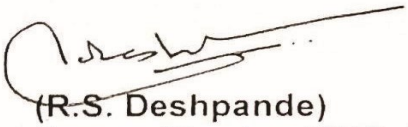
Secretary and the Joint Secretary (Silk), Ministry of Textiles, Govt. of India, New Delhi, is gratefully acknowledged. The exercise has also been a learning experience for the Team with interactions with a wide range of stakeholders. The Committee would like to thank Dr. Pankaj Tewary, Director, CSRTI, Mysore, all the Officials and former colleagues of the Central Silk Board, for their inputs and contributions.



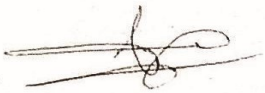
(S. Ayyappan)
Former Secretary, DARE &
DG, ICAR, New Delhi
Chairman



(S.B. Dandin)
Former Vice Chancellor
UHS, Bagalkot
Member

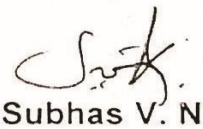


(R.S. Deshpande)
Former Director, ISEC, Bengaluru
Member

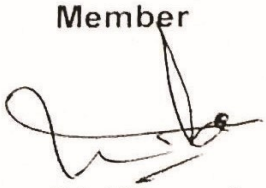


(K.K. Shetty)
Former Joint Secretary (Tech.)
CSB, Bengaluru
Member

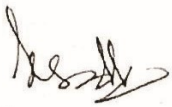
(R.K. Mishra)
Director (Tech.), CSB, Bengaluru
Member



(Subhas V. Naik)
Director, CSTRI, CSB, Bengaluru
Member

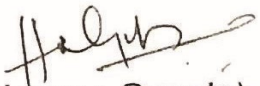


(K. Vijayan)
Scientist-D, CSB, Bengaluru
Member



(K. Sathyanarayana)
Scientist-D, CSB, Bengaluru
Member Convenor

(P. Kumaresan)
Scientist-D, CSB, Bengaluru
Co-opted Member



(H. Rudranna Gowda)
Scientist-D, CSB, Bengaluru
Co-opted Member

Place: Bengaluru
Date: March 20, 2020

TABLE OF CONTENTS

THE NATIONAL SILK POLICY - 2020

(CSB Memorandum No. CSB-31/2 (63rdRCC) 2019-2020/RCS dated 5.12.2019)

1. Executive Summary

Sericulture is a unique domain of agriculture combining both botanical aspects of tree cultivation and zoological aspects of silkworm rearing. The globally acclaimed Indian silk brand comprises both mulberry and vanya with tasar, muga, eri components, providing for a wide canvass of economic activity and large stakeholder participation. Raw silk production increased from the annual level of 18,370 MT in 2008-09 to 35,468 MT in 2018-19, registering a CAGRof 6.16%, with significant contribution to the country's economy through employment potential and foreign exchange earnings. The outlook based on the growth in production of raw silk in the long-term Plan (2029-30) is 60,000MT, also in line with the SDGs.

Considering the emerging challenges in terms of climate change, natural resources degradation, biotic and abiotic stresses, rural to urban migration & market vagaries, as also opportunities in the global markets & new technologies, an analysis of the sector was undertaken. Thegoal of the National Silk Policy, 2020 (NSP-2020) is a globally benchmarked sustainable silk enterprise, through climate smart sericulture and remunerative post cocoon management, as a preferred agricultural practice. The strategy is based on seven pillars of on farm improvements in mulberry and vanya, resilience from weather to market, enhanced efficiencies in non-farm operations, capacity building, partnerships, gender equity and global competitiveness, with the 'Advantage India' perspective.

The vision is 'A globally competitive and resilient silk sector meeting the needs of the presentand future generations', with a Mission of 'Smart sericulture and technology-oriented post cocoon management with enhanced innovations and investments, for socio-economic development of the farmers and remunerative silk industry' in a value chain approach.

The document dwells on possibilities of horizontal expansion and integration with other farming practices, research priorities in mulberry and vanya in the pre-cocoon sector; and up scaling of reeling units, wet processing and weaving, improved machines for vanya yarn, product diversification, indigenous machinery, by-product utilisation in the post cocoon sector. Smart sericulture is projected as the way forward, incorporating aspects of water, energy, effluent treatment, diversification, artificial intelligence and IoT in sericulture.

Aspects of quality control and certification, standards, exports, brand promotion, product mix of vanya silk, seri-tourism, Intellectual Property Management and related aspects have been emphasised. Among the fiscal measures, rationalisation of duty structure, FDI, Stakeholder Innovation Fund, Venture Capital, Institutional Credit Support, Price Insurance and stabilisation, as also tapping funds under CSR have been dealt with.

Regarding the Human Resource, issues pertaining to manpower requirements, capacity building and training, extension mechanisms, community-led institutions, resource persons, para-professionals, technical consultants, federating seri-clusters, delivery mechanisms and formal education have been addressed. In order to strategize the document, aspects of returns on investment, factors influencing production, partnerships and convergence, initiatives with regard to Desks dealing with Policy implementation and Trade, corporatisation of sericulture have been analysed and suggestions made.

A glimpse of the factor share in the projected silk production by 2030 in both pre-cocoon and post-cocoon domains brings out the critical points of intervention. While factors/interventions comprising resources, technology, infrastructure, finance/credit, policy and skill account for 60% in pre-cocoon activities and 40% in the post-cocoon area in the mulberry sector, the projected figures in the vanya sector are 55% and 45%, respectively. While technology, infrastructure, finance/credit and policy receive a higher weightage in mulberry, the resources and skill sets need greater attention in the vanya sector. To become globally competitive, India would need to focus on consolidating domestic industry for scale efficiency; incentivizing quality products such as cocoon and raw silk; and addressing target exports of silk goods to selective markets based on comparative advantage. The aspirations of the stakeholders and the policy prescriptions are presented, indicative of the action points that the State Departments of Sericulture would need to consider for formulating a strategy for wholesome sericulture development.

Considering the pivotal role being played by the Central Silk Board in the seri-sector of the country and in the context of the present new Silk policy, the CSB would need to reorient the mechanisms for addressing the emerging needs of the sector and incorporate innovative approaches for an efficient seri-enterprise in the country. Suggestions with regard to Governance, Human capital management, Centre for Germplasm exchange, Intellectual Property & Business Management Cell, evolving into a new generation Indian Council of Sericulture Research & Education (ICSRE), as also relocation of the CSB Headquarters for logistical ease and operational efficiency, have been made in the context of institutional reforms.

While new risks impacting the economies have emerged globally, opportunities are also beckoning for quality textiles like silk, with new range apparels, non-textile applications, high value by-product utilisation and diversification, with the tripod approach of ‘Foresight-Innovations-Partnerships’. Exploring the globe for market opportunities, apart from addressing the domestic traditional markets, assumes significance in view of major countries in silk witnessing upheavals and non-conventional and niche markets opening up across the world. This also requires synergistic as well as disruptive approaches, involving collaboration with new players, be it research institutions, engineers, fashion designers and corporate. Celebration of silk as queen of fabrics must be sustainable, inclusive, remunerative, and equitable with all the stakeholders in the value chain.

2. Preamble

Sericulture is a unique domain of agriculture combining both botanical aspects of tree cultivation and zoological aspects of silkworm rearing. The silk sector also has a unique stakeholder profile with both biologists and engineers in the research portfolio, farmers, reelers, weavers, traders and so on in the value chain, that are addressed in the present comprehensive policy document.

The overall goal of the National Silk Policy, 2020 (NSP-2020) is a globally benchmarked sustainable silk enterprise, through climate smart sericulture and remunerative post cocoon management, as a preferred agricultural practice. The strategy is based on seven pillars of on-farm improvements in mulberry and *vanya*, resilience from weather to market, enhanced efficiencies in non-farm operations, capacity building, partnerships, gender equity and global competitiveness. With sericulturists at the core of the policy, the seven principles would guide the actions of various stakeholders, as also by the public trust doctrine for meeting the vision and mission set for the Indian silk sector.

- ***Noting*** that India has a traditional comprehensive sericulture as well as seri-enterprise and being on the concurrent list, seeks a strong Centre-State coordination;
- ***Recognizing*** that both mulberry and *vanya*silk have contributed to the sector in the modern times;
- ***Defining*** the complete silk value chain from farm-to-fabric as an enterprise, both in global and the national contexts;
- ***Considering*** that seri-enterprise has emerged as an important area of employment generation;
- ***Acknowledging*** that the sector contributes significantly to the economic wealth of the country;
- ***Perceiving*** that the sericulture is an important source of fibre, diverse practices including nutrition, livelihoods and income generation;
- ***Realising*** its potential in employment& income generation in both rural and urban areas, particularly for women and the disadvantaged;
- ***Observing*** that the sector contributes significantly to the export earnings of the country in niche global markets;
- ***Appreciating*** that government needs to focus on governance of important matters and private sector, must assume a greater role;
- ***Accepting*** the emerging challenges of climate change, labour involvement and market vagaries;
- ***Knowing*** the global and national trends and issues with regard to fibres in general and silk in particular*;*
- ***Bearing*** in mind the nation's commitments to international agreements and arrangements;

The NSP, 2020 is based on the following vision, mission and strategy for the silk sector of the country, as a **model** policy that could be customised by the States:

Vision
'A globally competitive and resilient silk sector meeting the needs of the present and future generations'.

Mission
'Smart sericulture and technology-oriented post cocoon management with enhanced innovations and investments, for socio-economic development of the farmers and remunerative silk industry'.

Strategy

The document has been prepared duly considering the Resources, Technology, Infrastructure, Finance and Skill sets in the sector, with action points for the future and hence, the Policy encompasses the Strategy for Indian Silk - 2030.

2.1 Global Perspective

China and India together contribute 97% of the silk produced in the world. Uzbekistan contribute just 1%, whereas contribution from other countries like Brazil, Thailand, Vietnam, North Korea, Iran, etc. is meagre to the tune of 2%. The global production details for the last six years are computed in Table 1 and a brief comparison of mulberry Seri-enterprise of China and India is presented in Table 2.

In India, sericulture is practised by over 1.2 million families, with 9.2 million people engaged in various activities of silk production chain in rural and semi-urban areas. Of these, a sizeable number of stakeholders belong to the economically weaker sections of society, especially women with a participation rate of around 55%.

2.2 Sustainable Development Goals and Silk Sector

Sericulture programmes and activities are in line with or meeting at least eight SDGs for 2030,*viz.*, 1. No poverty; 2. Good health and well-being; 5. Gender equality; 8. Decent work and economic growth; 9. Industry, Innovation and Infrastructure; 12. Responsible consumption and production; 13. Climate action; and 15. Life on land.

2.3 Status of Seri-enterprise and Trend analysis over Plan periods

Raw silk production trends in the country over the Plan periods (Table 3) indicateincrease in annual production from 18,370 MT in 2008-09 to 35,468 MT in 2018-19, registering a CAGR of 6.16%. The bivoltine raw silk production registered growth from 1,250 MT in 2008-09 to 6,987 MT during 2018-19, with a CAGR of 16.93%. Similarly, Tasar, Eri and Muga silk production also achieved growth with CAGRs of 15.64%, 11.74% and 6.31%, respectively, in the same period. Mulberry silk production in the country continues to dominate the sector with a share of 71% followed by Eri (20%), Tasar (8%) and Muga (1%). Productivity trend analysis indicates that in spite of fall in area under mulberry, productivity levels of cocoons and conversion efficiency to raw silk increased over plan periods, an evidence for

vertical growth (Table 4). Further, Table 5 indicates the state-wise production of rawsilk which gives a direction to explore potential for different sectors of sericulture.

Exports & Imports: Along with the recorded growth rates, demand for silk is also increasing, that is met through imports from China. However, the imports in the last decade are coming down substantially from 8,392 MT during 2008-09 to 2,785 MT during 2018-19, due to increased production of import substitute bivoltine silk in the country. Over 55,000 farmers have shown keen interest in producing bivoltine cocoon rather than crossbreed cocoon, during this period.

The status on exports and imports of silk and silk goods is tabulated below, that largely comprise raw silk, silk yarn, fabrics & made-ups, readymade garments, carpets & silk waste.

(Rs in Crores)

Particulars	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Exports	2892	2864	2353	2304	2481	2830	2496	2093	1649	2032
Imports	1839	1749	1676	1727	1357	1358	1389	1438	1652	1497

With reference to import/export of silk, there is trade distortion due to the decline in the exports as well as imports. In order to increase the export of silk and its allied products following could be imperative.

- Zeroing the import of mulberry raw silk, which is a major import item (80% of the total imports)
- Adopting country-specific strategies &promotional activities to increase export of readymade garments/made-ups to the major importing countries
- Adopting a specific raw silk production strategy in capturing at least 25-30% of the mulberry raw silk export to the global market (other than China), once India attains self-sufficiency in quality bivoltine raw silk production

Employment: The employment generation in seri-enterprise grew at 3.5% per annum from 6.30 million persons in 2008-09 to 9.2 million persons in 2018-19.

(lakh persons)

Particulars	IX Plan	X Plan	XI Plan	XII Plan	2017-18	2018-19	2019-20 (anticipated)
Employment	55.00	60.03	75.60	85.10	86.04	91.78	95.00

2030 Goals: The contribution of seri-enterprise to the country's economy is also evidenced by the employment potential and foreign exchange earnings.The outlook based on the growth in production of raw silk in the long-term Plan (2029-30) is 60,000MT. This growth is envisaged with the expectation of a better price scenario in the global and domestic market and enhancing the productivity and quality through R&D efforts.

2.4 SWOC analysis

India is the second largest producer and largest consumer of silk in the world with all the commercially exploited silks.Thepercentages of Gross Value contribution to India's GDP by the textile industry and theseri-enterpriseare around 2.29% & 0.17%, respectively (Table 6). Further, increasing per capita consumption of silk during 2012 to 2014 in terms of quantity and value suggests scope for expanding the silk production base (Table 7).

Economic viability of mulberry silkworm rearing in recent times has been established with net profit of Rs 1.89 lakhs and Rs 2.36 lakhs per ha per year in South India, for cross breed and bivotline hybrids, respectively (Table 8). Further, the comparative crop economics brings out the superiority of sericulture in terms of net returns among the farming practices (Table 9). Detailed SWOC analysis (Table 10) brings out the potentials of the silk sector in India.

2.5 Value Chain

The 'Silk Value Chain' concept considers the manner in which value is added along the chain, both to the product/service and the stakeholders involved. It has a greater appeal from the sustainability perspective, as it explicitly refers to internal and external stakeholders in the value-creation process, *viz*., production, processing and marketing, along with linkages amongst different nodes, as seen from the progressive income in the illustrative mulberry culture in South India (Table 11). Considering these, an analysis of the gaps in revenue sharing contributing to the value chain is made in the present document.

2.6. Advantage India

The changing global trends in silk production warrant India to strategize development of sericulture and seri-enterprise, to meet supply requirements of silk by way of both vertical and horizontal expansion. Realizing the opportunity, the Ministry of Textiles, Govt. of India through the Central Silk Board, has enabled the momentum in the last two decades with growth rates of over 10% in 2018 in spite of competition from manmade fibres and spurious silk products. The focus areas have been research & development, networking & regulating quality silkworm egg supply, transfer of technologies & innovations by incentivizing investments at grassroots level, appropriate policy actions, inculcating quality parameters in all areas of the production processes and promoting Brand 'Indian Silk'. In the backdrop of ever-increasing domestic demand and continued opportunities in the global market, India has thepotential to exponentially expand the enterprise by enhancing quality and scale of production.

3. Need for National Silk Policy

In the silk sector, unlike other textiles, the production process involves a series of both on-farm and off-farm activities,similar to agriculture and animal husbandry, as also industrial domains. The agricultural activities are farm-based and hence seasonal and time bound. The animal husbandry activities require specific skill sets in insect rearing, handling and disease control and so on, that are continuous

operations. Hence, seri-enterprise requires a higher degree of strategic planning, meticulous implementation and effective monitoring. It also involves the interest of over 9.2 million people, mostly from rural areas, dependent on the sector for their livelihoods and earnings.Along with a proper positioning in the economy, the existing regulatory mechanisms regarding dumping of raw silk by China and other countries with Most Favoured Nation (MFN) status need to be revisited.Impacts of price fluctuations need to be analysed and stabilized through coordinated actions amongst the stakeholders. In view of these, it has become necessary to have a comprehensive National Policy on Silk.

As indicated in the Preamble, the NSP-2020 is based on the following vision, mission and strategy for the silk sector of the country, as a model policy that could be customised by the States.

3.1 Vision

'A globally competitive and resilient silk sector meeting the needs of the present and future generations'.

3.2 Mission

'Smart sericulture and technology-oriented post cocoon management with enhanced innovations and investments, for socio-economic development of the farmers and remunerative seri-enterprise'.

3.3 Objectives

- Enhancing silk production and improving quality to meet the domestic demand and exports
- Meeting infrastructure requirements in both public and private sectors
- Supporting modernization and technological upgradation of various segments of the seri-enterprise, to increase its competitiveness
- Promoting Human and Institutional Development (HID) for better synergy and synchronization, besides providing a platform for technology dissemination and adoption
- Augmenting investment and providing support on both fiscal and non-fiscal areas
- Addressing fiscal anomalies & policy limitations and provide the required eco-system in order to ensure balanced growth of the seri-enterprise

3.4 Approach

The approach for formulating National Silk Policy includes literature consultation such as Annual reports, Plan documents and existing Acts & Rules, with meetings of the Committee during December, 2019 to March, 2020 (Annexure 1). Consultations with Experts, feedback from the field across entire silk value chain, meetings with stakeholders, NGOs, Government representatives, Central Silk Board Scientists, Subject Matter Specialists, Traders, Exporters, etc.during the meetings held at New Delhi on 26 November, 2019; and Bangalore on 23 December, 2019,provided material for analysis and formulation of the policy (Annexure 2)**.** While national issues and strategies are presented in the document, NSP-2020 is intended to be a

model for the Departments of Sericulture of State Government for customization and adoption as per local needs and requirements.

4. Policy

Definition of problem: Silk is reflected in the concurrent list under seventh schedule of the Indian Constitution and there is no comprehensive National Policy for seri-enterprise at present. This provides opportunities for the Departments of Union and State governments dealing with sericulture development to complementefforts at formulating a policy towards a sustainable seri-enterprise. Central Silk Board representing Union Government with its major mandates of policy initiatives, R&D, leadership role in quality silkworm seed production and frontline technology demonstration, could contribute significantly towards coordination and priority setting for enhanced production, productivity and quality of silk in the country. It is also relevant to mention the research investment on agriculture in India that is about 0.4% of the agriculture GDP,while it is about 0.215 in sericulture (Tables 12 & 13). Hence, there is a need to focus on higher R&D investment in sericulture on the lines of agriculture.

The State Sericulture Departments play a critical role in extension and implementation of developmental activities in the field, primarily suiting to the needs and requirements of the region. However, there is still a great scope for the private sector participation in technology dissemination, area expansion, seed production, chawki rearing and developmental programmes in pre and post cocoon areas. The Government could play the role of facilitator and policy regulator, while the private sector undertakes the commercial activities, resulting in an ideal public-private partnership in the silk value chain.

Challenges- Issues and concerns: Indian seri-enterprise is facing severalchallenges with regard to supply-demand gaps of quality silk in both domestic and export on one hand, and expanding the production base and modernisation to be globally competitive, on the other.Some of the key issues and concerns that emerged during the meetings with stakeholders and developmental agencies are as follows:

- Urbanization and industrialization in traditional sericulture areas, leading to shrinkage of traditional mulberry cultivation areas
- Drought, depleting water table and climate change
- Gaps in adoption of improved technologies and reducing interest of youth
- Stagnation in growth of silk exports,increasing input costs and preference of blended /synthetics over pure silk products
- Inconsistency in supply of high-quality silk in bulk quantity to meet the requirements of industry and exporters
- Poor credit flow and low investment in sericulture sector
- Isolated practice of sericulture & lack of group approach and low mechanisation

- Weak extension machinery in both the States and Centre
- Low production base &productivity and limited crops in northern zone

4.1 On Farm

4.1.1. Area expansion

In spite of various strides in R&D, the vertical growth has certain limitations andhence the need to utilize uncultivated lands,*viz.,* denuded forest and wastelands, problematic soils, etc. This could be done through mulberry tree cultivation and raising saline, drought and shade-tolerant mulberry genotypes, to meet the horizontal expansion target of about 30%. A customised policy framework to expand sericulture activities in the potential non-traditional states like Maharashtra, Madhya Pradesh; and hilly states such as Uttarakhand, Uttar Pradesh and North East, besides shifting the production bases of traditional states to new areas is essential. SILKS (Sericulture Information Linked Knowledge System) portal, additional fund mobilization through convergence of Agro-forestry Schemes of MoEF&CC, etc., special allocation under ongoing convergence schemes of Govt. of India,*viz.,* RKVY, MGNREGA, TRIFED, etc., are suggested for both mulberry and vanya sectoRs

One District-One Product: For this purpose, in line with the Govt. of India's initiative of 'One District-One Product', concerted efforts will be made to identify 50 most potential, but unexplored districts in the country, in close coordination with the District administration & the Departments of Sericulture of States for overall development of sericulture sector. This would have a cluster approach for local products as well as value chain mode for sustainable and remunerative sericulture.

4.1.2. R&D in Mulberry

The emerging challenges in sericulture are climate change, degradation of natural resources of water and soil, energy concerns, rural to urban migration, market vagaries and related aspects, that need to be addressed in a knowledge-skill mode. In order to remain globally competitive and bring a shift from cross breeds to improved cross breeds and to bivoltine, continuous development of silkworm breeds including exchange of genetic material,factoring opportunities in new sciences, focus on low-cost pre-fabricated rearing houses, enhancing efficiencies at different stages to achieve 'smart sericulture' will be the focal points of intervention. Various dimensions of basic, applied, strategic and participatory research need to be adopted for the purpose, through collaborative, consortium and multidisciplinary approaches. Foresight-Innovation-Partnerships is the tripod approach for an accelerated pace in 'new sericulture', that calls for an integrated and problem-solving approach.A few illustrative priority areas of research for the next ten years are as follows:

- Barcoding of all germplasm material related to sericulture
- Integration of weather forecasting techniques with sericulture activities
- Developing climate-resilient host plants and silkworms
- IoT in sericulture
- Machines/equipment for cost reduction
- Non-invasive cocoon/silk/fabric sorting/ testing

- Utilisation of seri-by-products and non-textiles application of silk

On the lines of IT/BT sectors, initiatives to establish incubation centreswith organic institutional mechanisms of resources/benefits-sharingmust be taken up, for enabled partnerships in new S&T areas like nanotechnology, smart textiles, etc.

Mulberry varieties suited to different agro-climatic conditions,*viz.*, irrigated conditions of Southern India **(**G4**:** 60-65 MT/ha/yr); Eastern region (C 2038: 50-55 MT/ha/yr); hilly areas (Tr 23: 25-30 MT/ha/yr); besides PPR-1 for Northern region with 80-90% rooting ability and MSG2 and AGB8 under stress conditions are in various stages of evaluation/popularization. These varieties need to be further evaluated expeditiously for release for commercial use, to expand mulberry sericulture to hitherto uncultivated areas. New agronomic practices would also need to be developed for tree cultivation in view of extended drought conditions and positive feedback in southern India at farmers' level, along with mechanization of cultivation, pruning, shoot harvesting and intercultural operations.

Improved silkworm breeds with higher phenotypic plasticity/p roductivity and suitable to different zones, such as G11xG19, Gen3 x SK6, B. con1 x B. con4; improved cross breeds, *viz.*, S8 x CSR16 with higher shell ratio of 23.75%; SSB5 x SSB6 with higher yield potential of 70-75kg/100 dfls; N21 x N56; a double hybrid tolerant to higher temperature; MV1 x S8, a productive hybrid with superior fibre quality and higher shell ratio (20-21%) with gradable silk; M6DPC x (SK6xSK7) with 45-50 kg/100 dfls yield potential in East and North-East India at various levels of trials will need to be validated. Field trials shall also include new races developed by other State institutes and universities.

Unexplored potentials of biotechnologymust also be harnessed with regard to drought tolerance and disease resistance. Illustrative aspects include trials of NPV tolerant silkworm strains such as MASN4, MASN6 & MASN7 and thermal tolerant breeds, identification of genes associated with silk quality especially neatness and fibre size deviation in polyvoltine silkworms, sensitive diagnostic tools and so on.

INM approaches including balanced fertilizer use, effective recycling of seri-farm residue and new bio fertilizers using native microbes, suitable rainwater harvesting and water conservation techniques such as trenching, mulching, drip/drum kit irrigation methods, etc. would need to be adopted for efficient sericulture.Suitable strategies shall alsobe developed for the effective control of important pests anddiseases, *viz.* root rot and leaf webber, etc. of mulberry.

4.1.3. R&D in Vanya

Over the years, mulberry has received greater R&D attention due to its larger share and the vanya sector akin to green sericulture, now needs to be addressed in a similar manner.Also, the potential in non-traditional states shall also be explored due to its unique advantages. As for example, in case oftasar food plants, while 6.83 MT of biomass is produced per ha per year, 2.7 MT/ha/yr of wood is utilized for energy and soil organic carbon sequestration through litter on the ground amounts to 2.4 MT CO_2/ha/yr. Further, the carbon sequestration potential of *Terminalia arjuna* amounts

to 9.54 MT/ha/yr, suggesting the potential for claiming carbon credits. In view of its high employment generation and sustainability dimensions with low use of inorganic fertilizers, insecticides and pesticides, potential to produce organic silk, lesser competition from China and so on, greater R&D efforts in the vanya sector would pay higher dividends.

It is also to be recognised that as per IPCC projections, climate change with extreme weather conditions would impact both the tree & the insect and the disease dynamics, resulting in instability in host plant and cocoon crop production. This would require increased adaptation and mitigation research, capacitybuilding and suitable policy initiatives. New strides in geospatial technology, molecular biology, biotechnology, nanotechnology and information technology provide new opportunities for productivity enhancement.

Host-Plant improvement*:* Identification of high rooting, early sprouting and fast growing genotypes to reduce gestation period, development of dwarf and bushy genotypes to maximize leaf yield, tolerance towards biotic and abiotic stresses, packages of practices for *Lagerstroemia speciosa,* Integrated Nutrient Management (INM), Integrated Pest Management (IPM), evaluation of HF08-high yielding *Kesseru*accession, perennial species of eri food plants, multi-cropping, intercropping and related aspects are some of the areas of future research.

Vanya silkworm breed improvement*:* Field trials of high fecundity Dabatasar eco-race line CTR-14; high yielding muga silkworm breeds, CMR1& CMR2;eri silkworm hybrid, YP x GBZ and GBS x GBZ; popularization of tasar breed, BDR-10; eri breed, C2; developing thermo tolerant and disease resistant lines, need immediate attention.

Conservation of Eco-races*:* Approaches includepreparation and adoption of integrated strategy to arrest the decline of biological diversity, simultaneous *in-situ* and *ex-situ* conservation of eco-races, integration of vanya with agroand social forestry, cryopreservation of semen and artificial insemination technique for vanya silkworm.

Conservation of indigenous germplasm of vanya silkworms and host plants:

Export &Import of Germplasm and Silkworm eggs

In all the sericulturally advanced countries, import and export of silkworm eggs is a part of development activities. Exchange of genetic material (germplasm) for mulberry improvement programmes being a scientific activity, has a set of rules as per the terms and conditions stipulated by both the partner countries including the quarantine and Material Transfer Agreement (MTA). There, however have been requests for exchange of silkworm eggs for commercial purposes in the recent past. Since India is exporting silk reeling machineries and other associated accessories, the importing countries also plan for export of silkworm eggs into India. Similarly, some of the South African countries are approaching CSB for getting silk worm eggs exported to the country. In view of large-scale expansion to reach the envisaged targets of meeting requirement of bivoltine raw silk, it becomes necessary to import eggs. While permitting any agency to import silkworm eggs for commercial purpose, set conditions as per the Act shall be imposed. Specificities shall be made part of the templates while seeking permission to import/ export germplasm material or silkworm eggs.

In-situ and *ex-situ*conservation of germplasm for their better use in developing high productive/disease resistant/climate resilient host plants/ silkworm breeds must be given high priority. The Central Silk Board must function as the nodal point for conservation and exchange of germplasm for all relevant material, for which suitable linkages with the National Biodiversity Authority (NBA), Protection of Plant Varieties &Farmers' Right Authority (PPV&FRA), Botanical Survey of India (BSI) and Zoological Survey of India (ZSI), are essential.

In view of the increasing labour and production costs, policy intervention to include support for mechanisation in both mulberry and vanya sectorsbesides the customised options from agriculture/ horticulture, under various developmental schemes including 'Silk Samagra', is must.

4.1.4. Seed sector

Whilemulberry bivoltine hybrid seed augmentation is presently carried out on scientific lines as per norms at the CSB and some state government units on a pilot scale, it is necessary to strengthen the Govt. farms for seed multiplication with a working capital fund, modernizing/developing seed testing labs, linking them with Adopted Seed Rearers(ASRs). Same is the condition with respect to nucleus and basic silkworm seed in vanya sector.

Seed technology development and strengthening seed sector*:* Appropriate preservation schedules as per ideal crop periods, mechanization of egg washing and surface sterilization, improvement in fecundity & synchronised emergence in tasar, exploring possibility of bivoltinism in muga silkworm by inducing diapause to overcome the summer and winter adversities are the priority areas.

Development of technology for indoor rearing of young age tasar and muga silkworm using artificial diet to protect and reduce losses during chawki rearing, biopesticides and biocontrol agents against silkworm pests and diseases to reduce production costs by increasing productivity are the other suggested approaches.

Private participation in seed production: An effective PPP in seed production is imminent for enabling uniform pricing of basic seed cocoons; commercial, basic and nucleus seed; periodic monitoring including disease assessment; and certification of

Silkworm Seed or Silkworm eggs

As per the Central Silk Board (Amendment) Act, 2006, 'silkworm seed' or 'seed' means all kinds of silkworm seeds produced from the pure silkworm races, including the hybrids produced from two or more pure races, silkworm seed cocoons of all kinds and MoThs thereof intended to be used or reared for the purpose of production or for commercial exploitation.

Since chawki reared silkworm finds a reference in the Act and 'chawki silkworms' (young silkworms up to second moult) and 'chawki rearing' in the Central Silk Board Silkworm Seed Regulations, 2010, chawki reared worms also must be included in the term silkworm seed.

Although the terms silkworm eggs, silkworm seed cocoons and chawki silkworms can be used in specific situations for clarity, these constitute silkworm seed in general and the expression, 'silkworm seed' is appropriate in the context of the said Act and Regulations. Globally, the word 'egg' is used for the purpose.

seed produced at various levels in both mulberry and vanya sector.

Private participation in silkworm seed augmentation and storage: In view of requirement of infrastructure for silkworm seed production, PPP mechanism is imperative, with Registered Seed Producers (RSPs) by following prescribed official procedures/ guidelines. The RSPs shall be provided infrastructure & equipment support along with fund mobilisation for working capital.

Central Seed Act: It is essential to bring the seed cocoon producer, seed producer, seed dealer and Chawkiwormrearertogether with detailed checks at various levels of operation, to ensure quality production of seed cocoons, seed and chawki worms. This would play a key role in cocoon/silk productivity besides bringing down uncertainty. It is hence imperative that the provisions of the Act are completely enforced, along with required awareness programmes and monitoring systems.

Further, there is a need for strict enforcement of Central Seed Act by outsourcing seed certification services as it would be difficult for CSB and DOS to spare services of required number of Seed Analyst and Seed Officers with increased silkworm seed production.

4.2 Non-farm

4.2.1. R&D prioritization

With a focus on productivity and quality improvement besides drudgery reduction, the following areas are priority R&D areas:

Mulberry silk reeling

- Reeling process parameters particularly on cocoon cooking for achieving better silk recovery and superior grade raw silk
- New machinery for different sectors of seri-enterprise for productivity and quality improvement
- Indigenous automatic silk reeling machinery package
- Effective utilization of silk by-products by developing new value added products
- Development of non-conventional silk yarns for diversified silk products
- Water and energy conservation and use of renewable energy in reeling sector
- Artificial Intelligence for forecasting of cocoon and silk prices
- Mechatronics and automation in silk reeling industry

Vanya silk reeling

- Mechatronics in removal of eri pupae for production of high quality eri silk
- Cocoon cooking and reeling technologies for better productivity and quality silk for non-mulberry reeling industry, particularly for the production of warp yarn
- Development of blends with non-mulberry silks

Testing

- Identification of silk through non-destructive methods
- Artificial Intelligence for silk testing
- Electronic methods for testing raw silk
- Silk testing methods/standards foreri and muga silk

- Electrical properties of different varieties of silk

Weaving

- Alternate technologies for reduction of energy/time for silk weaving
- Fancy, knitwearandvalue-addedproducts by blending silk with other fibres
- Non-woven from silk waste
- Selvedge mechanism for rapier looms
- Designing and interfacing on jacquard weaving

Wet processing

- Eco-friendly HTHP degumming technology for processing of silk without chemicals
- Improving fastness aspects, natural dyeing and processing of silk with enzymes
- Digital printing machine package of silk
- Functional finishes to improve the performance of silkbesidesmechanical finishing,*viz.,* calendaring/felt calendaring/decartelizing
- Reduction of waterusageduring silk wet processing
- Alternative energy sources and energy conservation in silk wet processing sector
- High-end products such as silk melange yarns
- Effective effluent treatment methods
- Diversified products and non-textile applications in cosmetic, nutraceutical and biomedical sectors

4.2.2.Upscaling of mulberry reeling units

Reeling forms, a vital link in converting the agricultural produce,cocoons into an industrial product-the yarn and employs a variety of reeling devices,*viz*., charka, cottage basin, domestic basin, multi-end reeling machinery and Automatic Reeling Machinery. Multi-end reeling and Automatic silk reeling technologies are capable of producing superior grade raw silk.Automatic silk reeling technology can handle bulk quantities of cocoons and suitable for large scale production of superior grade raw silk.Presently, automatic silk reeling technology produces superior grade raw silk of 3A-4A grade; Multi-end silk reeling technology produces International grade raw silk of 2A-A grade; Improved cottage basin silk reeling technology produces raw silk of A-B grade; cottage basin silk reeling technology produces raw silk of B grade; and charkha reeling units produce below B grade raw silk in the country and grade-wise raw silk availability in the country (2018-19) is presented in Table14.

In view of the existing demand for quality raw silk in weaving sector, it is proposed to produce about 70-75% of total raw silk produced in our country using the multi-end reeling machinery and automatic silk reeling machinery in the coming years GOI has taken a decision to arrest the import of silk to bare minimum by 2022 and become self-sufficient by 2024-25 through producing international grade silk indigenously. It is proposed to continue to support establishment of a greater number of Automatic Reeling units in selected clusters in order to produce more quantity of superior grade raw silk thus attaining self-sufficiency and also for exporting raw silk. In this regard support shall be extended for establishment of large-scale Automatic silk reeling machinery package (5 lines each of 400ends) for production of superior grade raw

silk in bulk quantity for export purpose. A plan forup scaling the reeling industry with Multi-end and Automatic reeling units is given in Table 15.

4.2.3. Promotion of improved machines for Vanya yarn sector

In spite of upgradation of vanya silk reeling industry, crude and unhygienic methods of traditional cooking and reeling methods like thigh reeling in case of tasar silk, *bhir* reeling for muga silk, use of *natwa* and *takli* spinning for eri silk are still in vogue. These need to be replaced by new machineries and technologies, projections of which are furnished at Table 16 to meet the vanya silk production targets.

4.2.4. Upscaling of Wet processing and Weaving sector

There are about 3 lakh handlooms and 1 lakh power looms engaged in the production of silk fabrics in India. Indian silk fabrics are predominantly sari material and are exquisite, as small and medium scale units in clusters supported with dyeing units spread over the country. Only a fewlarge-scale units produce silk products meant for exports using power looms as well as shuttle less looms.

Further, fabrics of silk blends with other natural and man-made fibres shall be promotedwith cost effective, diversified products suited for different regions and seasons. Towards, addressing the above, efforts shall be continued to scale up the units with required machineries, *viz*., new/upgraded handlooms with electronic jacquards, power looms with electronic jacquards, shuttle less loom, arm dyeing, eco-degumming machine, fabric processing unit with finishing, digital printing,etc.

4.2.5. Product diversification

Silk sarees are the major product category to which the seri-enterprise is catering to, that needs to be diversified, for both domestic and international trade, besides making available a wide choice of silk products across all segments of the society. Silk fibres are natural proteins secreted by silkworms and silk containsfibroin (silk filament) and sericin (gum) as main components, comprising 18 different amino acids including glycine, alanine and serine. Both fibroin and sericin can be used in various forms for non-textile applications, such as medicine, pharmaceuticals, nutraceuticals and cosmetic sectors, for development of biomaterials, drug formulations, protein supplements and cosmetic products.

4.2.6. Mechanisation including machine manufacture

The present demand of the seri-enterprise is consistency in quality at each stage that can be achieved only through mechanisation. While somemachineries are manufactured indigenously, others like automatic reeling machines, large-scalehot air dryers, etc., are being imported. Incentives for domestic manufacture of seri-machinery and equipment, for both domestic use and exports need to be in place. Patforms like ISC could be utilised for the purpose and Indian manufacturers need to be supported with required infrastructure and finance.

4.2.7. By-product utilisation

Effective utilization of by-products is essential for the reeling units to enhance their earnings. Silk wastes generated during silk reeling operations are utilized for the

production of spun silk and hence, pupae processing and pupae drying packages would need to be refined, also for reduced environmental hazards.

Sericin: Sericin (silk protein) is another by-product extracted during degumming of silk fibre.Due to its unique biochemical and biophysical properties; it is used for various industrial applications including pharmaceutical, nutraceutical, cosmetic and textile auxiliaries. Eco-degumming and related processes need to be refined.

4.3. Smart Sericulture

4.3.1. Climate Smart Sericulture

4.3.1.1. On Farm

4.3.1.1.1. Climate change and Mulberry cultivation

Mulberry, a perennial species cultivated as the main feed source of silkwormis physiologically classified as a C3 plant. Increase in temperature in the range of 25-30^{0}C and carbon dioxide levels in the context of climate change might influence plant growth positively to a certain extent. There is also the dimension of carbon sequestration by mulberry plantations and researches need to focus on genetically improved mulberry with desired characters, better cultivation practices and pest and disease management systems.

4.3.1.1.2. Climate change and Silkworm rearing

Majority of the insects are cold blooded organisms whose body temperature is approximately similar to that of environment. Hence, the change in temperature influences insect behaviour, distribution, development, survival growth and reproduction. Similarly, high temperatures during cocoon rearing and egg production have profound effect on the quality and quantity of eggs produced, leading to tri-moulters or greater number of non-hibernating eggs and need to be assessed. Further, considering the impact of enhanced levels of carbon dioxide in the ambient atmosphere, management measures such as providing good ventilation and air circulation, better spacing to worms with thin feeding, right selection of mountagesto reduce humidity, etc. need to be standardized.

4.3.1.1.3. Integrated Farming System

While various models of integrated farming system with mulberry as intercrop with coconut and other horticultural crops, agro-forestry, short duration vegetables (coriander, fenugreek, beans, dill, cumin), green manure crops (sun hemp, daincha, Lucerne) have been evaluated, they need to be disseminated for enhanced income levels. The combinations with coconut, milk, horticulture, aquaculture, etc. are potential IFS models that need to be upgraded and customised to different locations. While perishables such as vegetables are becoming an attractive proposition for cultivation along with mulberry, due care has to be taken with use of pesticides.

4.3.1.1.4. Exploring carbon sequestration potentials of host plants

Carbon sequestration studies in mulberry have established that the carbon sequestration potential (CSP) is about 6.90 MT/ha/yr, that can yield carbon credits to

the extent of 0.36 MT/ha. While carbon sequestration studies in tasar have been taken up, it will be more or less similar in case of muga and eri perennial food plants (5.95 MT/ha/yr), with a maximum carbon sequestration potential of *Terminalia arjuna* at 9.54 MT/ha/yr. In order to enhance the income of primary producers, attempts will need to be made to sell carbon credits.

Sector	Carbon sequestered (MT/ha/ yr)	Area (ha)	Total carbon sequestered (MT/ yr)
Mulberry	6.90	235001	1621506
Vanya	5.95	204085	1214154
Total		**439086**	**2835660**

4.3.1.2. Non Farm

4.3.1.2.1. Water requirement and water saving technology

While water requirement for mulberry is around 3 lakh litres/ha once in every 10 days for loamy soils, it is 15 days interval for clayey soils, which works out to about 1.5 to 2-acre inches of water/ irrigation. The empirical water budgeting for sericulture (Table 17) indicates the water requirement per kg of raw silk to be 50-70 litres in case of charka; 150-200 litres in cottage basin; 250-300 litres in multi-end reeling; and 600-700 litres in automatic reeling. It is proposed to adopt water recycling systems so that 70-90% of water can be saved for each cycle.

4.3.1.2.2. Energy conservation

About 20-24 kg of fuel (firewood) is required to produce one kg of raw silk, which leaves 30-36 kg of carbon footprint. It is established that fuel can be saved to an extent of 30-50%, with a reduced carbon foot print of 18-25 kg per kg silk. Attempts shall also be made to reduce energy consumption in cooking, drying, reeling and management techniques through new and renewable energy sources like solar, besides usage of gas driven machinery, wherever possible. Solar equipment needs a special mention, as they are increasingly being used in other enterprises, that need to be designed, standardized or customized expeditiously.

4.3.1.2.3. Effluent treatment

The effluents originating from silk wet processing unit comprise synthetic and natural dyestuff, gums (guar/sericin gum discharge), various wetting agents, acids, alkalis, pH buffers, metallic salts, oxidizing/reducing agents, finishing chemicals and dye retardants or accelerators At present, only the organized (large scale) silk processing units in India have Effluent Treatment Plants (ETP) installed. Efforts would be made to install either Discharge to ground or Zero Discharge ETPs in the unorganized medium and small-scale wet processing units.

4.3.1.2.4. Silk worm pupae handling and processing

Annually, about 139,162 MT of mulberry, 18,660 MT of tasar and 5,782 MT of muga fresh pupae are generated. The silkworm pupae account for 75-80%of green cocoon weight in mulberry, 84-86% in tasar and 88-90% in muga, with a freshwater content of 65-70%. In view of this, efforts will be made to standardise optimal processes to separate and handle the pupae for various end uses. This process shall be linked to

utilisation of pupae for human/ animal consumption, silk sheet preparation, etc., which shall be included as part of 'Silk Samagra' scheme, for their popularisation.

4.3.1.2.5. Diversified products and non-textile applications

Both fibroin and sericin can be used in various forms for non-textile applications, such as medicine, pharmaceuticals, nutraceuticals and cosmetic sectors These would be focused for development of biomaterials, drug formulations, protein supplements and cosmetic products in future.

4.3.2. Information Technology interventions

Raising awareness and interventions at interpersonal level for awareness to action is important to achieve behavioural changes. Various forms of print, electronic and social media could be employed for the purpose. Effective Information Education and Communication Programmes (IEC) need to be developed with due interactions with all stakeholdersin order to boost production of quality silk, horizontal expansion of sericulture is recommended through SILKS (Sericulture Information Linked Knowledge System) portal using remote sensing and GIS technology adopting Digital India mode.

- **Mobile App**to support extension for easyapproachandto meet the farmers need
- **Geo-tagging** to access the plantations developed, assets created for verification at beneficiary level and effective monitoring
- **Seri Kisan Call Centres** for sericulture farmers and other stakeholders for direct interactions with scientists and experts
- **Seri Kisan Cards** for farmers details linked with Banks and *Aadhar* for identification, for need assessment and delivery by the Departments
- **Artificial Intelligence for Price forecasting:** Scientific methods to forecast the prices of cocoons and raw silk will be developed through artificial intelligence methods, which will strengthen the silk reeling industry by bringing stability in the running of units

4.4. Quality Control and Certification

4.4.1. Cocoon and raw silk testing

Cocoon & raw silk testing is crucial and evaluating quality for a fair assessment of sale price of both the commodities will ensure fair trading. As a step forward, CSB provides supports for setting up of testing centres at the market premises run by the State departments. In order to have more such facilities, the States need to create testing facilities in the designated market yards including large scale ARM units. Presently the cocoon & raw silk testing is encouraged supporting establishment of testing centres under the QCS of 'Silk Samagra'that needs to be continuous and comprehensive.

4.4.2. SMOI

Silk Mark Organisation of India (SMOI) is a registered society and Silk Mark is an initiative of the Central Silk Board (CSB), Ministry of Textiles Government of India.

SMOI is a platform to protect the interests of the consumers, genuine traders and manufacturers of silk through the use of Mark Label as endorsement of purity. Silk Mark provides a quality assurance label on the silk products, which indicates that the product is made only from pure silk.

Apart from sale of labels to endorse the purity, SMOI need to have a strong legally framed surveillance mechanism to check unscrupulous acts of some of the authorised users. There shall be a fool-proof mechanism to penalize such business persons/ traders with legal proceedings, to build confidence among the consumers. SMOI shall ensure generic promotionandwell-designed long term marketing and promotional strategies. Necessary enforcement measures shall be undertaken towards making 'Silk Mark' mandatory for all traders dealing in silk.

4.4.3. Organic certification

It is suggested that the CSB promotes organic certification of farm produce and silk products through recognized authorising agencies like the Global Organic Textile Standard (GOTS). Further, the CSB shall support/facilitate the private producers of silk in obtaining such accreditation for their benefit.

4.4.4. ISA/BIS Standards

The raw silk testing and grading is done based on parameters/characteristics such as: (i) winding breaks; (ii) size and deviation; (iii) evenness, neatness& Cleanness; (iv) strength& elongation; and (v) cohesion.

- At present there are three testing systems, *viz.,* International Silk Association (ISA), Bureau of Indian Standards (BIS) and Chinese Quality Index (CIQ). In ISA, raw silk is graded in the range 4A to B and is the universally accepted method of testing & grading of raw silk. BIS is the extension of ISA with the range extended from 4A-E, to basically cover the Indian raw silk quality in the grading system. CIQ is the system followed by the Chinese authority wherein the raw silk grade range is from 6A-E.
- Looking at the standard values for testing & grading, it is observed that the CIQ method of grading is less stringent compared to ISA, as enumerated atTable18. GOI adheres to ISA methods (which is universally accepted) of sampling, testing and grading and does not discount for the differences between any other grading standards.

4.5. Marketing

4.5.1. Price stabilization

Sericulture is an agro-based cottage enterprise in several States across the country and there are wide fluctuations in the prices of cocoon/raw silk. Therefore, a strong marketing support is required at the state level for ensuring a remunerative and a stable price environment for cocoons. While marketing of sericulture produce is primarily with the States, it is suggested both State and Central Governments provide support measures for marketing of mulberry cocoons providing incentives, for a fair price deal.

4.5.2. Establishment of cocoon/yarn banks

In southern States, where the green cocoon transaction takes place on daily basis in the Govt. cocoon markets, there are issues when the prices fall due to abrupt increase in the arrivals. Creation of Revolving Fund at the State level would address crises as a onetime assistance (as corpus) for stabilising the markets. In sericulture States with the cocoon, mulberry/tasar/mugaasaseasonal activity, cocoon banks shall be operated by the government in the potential clusters, with infrastructure like dryers & storing capacity and provision for non-eroding revolving fund managed on a co-operative basis or SHGs. Similarly, the yarn banks may also be established and operated in potential clusters.

4.5.3. Export promotion of Indian silk/silk products

The key success factors for silk export business are: (i) Export Market Research and Selection; (ii) Export Market Brand Strategy; (c) Export Market Pricing and Trading Terms & Strategy; and (v) Export Market Sales and Distribution.

- In order to have a strategic plan for exports, a comprehensive study is suggested to assess the demand & supply at the national level
- Market focus shall be towards non-traditional/new markets such as the UAE, Malaysia, Sudan, Nigeria, etc.
- Policy level intervention to increase fund allocations to ISEPC to improve ctssilk produ /of Indian Silk promotion theexport
- Make ISEPC as an advisory body involving decision making authorities MoT/CSB/MoC
- Silk exporters need to be given priority under AEO programme

4.5.4. Brand promotion of Indian silk

Brand promotion is the way to inform, remind, persuade convincingly and influence the silk consumers to drive their decision towards purchasing the silk products under an Indian brand.

- Indian silk to be promoted with a brand image for a wider acceptance internationally. This calls for creating an ‘Indian Silk Corner’ in recognized global meets/exhibitions depicting the whole range and capabilities of Indian silk starting from sericulture to fabrics, garments and made ups.

- Co-promotionwith top end Designers, incorporating western wear collections along with Indian collections to highlight the usage of Indian silk including vanya in western designs with ‘ethnic image’.

4.5.5. Product mix and Markets for Vanya silk

India is the only country producing all four varieties of commercially known silks,*viz*., Mulberry, Tasar, Eri and Muga. Tribals inhabiting the forests of Central India, Sub Himalayan Region and North Eastern Regions are involved in production of vanya silks (tasar, eri and muga). These vanya silks or the wild silks of India are eco-friendly silks with natural colours, presently produced in limited quantities and sold within the cultural zones with low value realization. In order to ensure better value realization to the primary producers of vanya silks, it is suggested to introduce

designer products involving reputed fashion designers with due consideration to the markets. Illustrated examples are: (i) *Eri Silk Knitwear products:* T Shirts, Hooded sweaters, Ladies tops and Kids wear, innerwear; (ii) *Tasar woven designer products:* Shirts, Kurtha, Ladies tops; (iii) *Eri denim products:* Trousers& shirts; (iv) *Mulberry/Eri Hybrid Designer Products:* Ladies tops, Trouser, Shawl, etc.

Besides, India has a high potential for export of readymade garments, promotion of high value silk products such as bridal wear, both Indian and western style. There is scope for promotion of newer products like silk denims, Eri thermal wear, Eri Blankets to suit the export requirements. Blending other fibres like cotton, wool, linen with these silks will have better value addition and sale as high-end fashionable wear. In order to become globally competitive, trade negotiations at the international level need to be taken up, as for example, to get access to the neighbouring countries for better marketability of vanya products.

4.5.6. Seri-Tourism

In line with the successful models of agri-tourism demonstrated in different parts of the country, it is suggested that seri-tourism across the value chain in major clusters is promoted, both for public education as well as enhanced income for the seri-stakeholders This could take different shapes of visits to farms, reeling units, hands-on experiences, infotainments fairs, sale of souvenirs & products, etc. Professional consultants, along with established sericulturists may be involved in the ventures.

It would be in the fitness of things to observe an annual National Silk Day, to project and promote the heritage and potentials, as also to celebrate Indian Silk.

4.5.7. Intellectual Property Management

Intellectual Property Management of various kinds including patents, copyrights, trademarks and Geographical Indicatorsare essential ingredients for trade, as also indicators of quality. There is a surge of innovations both in academia and the entrepreneurs in the recent past, that need to be captured, interpreted, contextualised and utilised. Along with product specifications, regional specialities need to be protected. The State/ Central line Departments shall support the producing companies/ firms in IPM across sericulture and seri-enterprise.

4.6. Fiscal measures

4.6.1. Rationalization of duty structure

In order to have a level playing field in import of silk goods, customs duty structure specific to silk (Chapter 50 of the EXIM Policy) is required to be decided in consultation with Central Silk Board to balance the situation.

Cocoon suitable for reeling	Raw silk	Silk Waste	Twisted Silk/Others	Spun silk yarn	For Silk Yarn other than spun from silk waste	Silk Fabric
5001	***5002***	***5003***	***5004***	***5005***	***5006***	***5007***
30%	*10%*	*15%*	*10%*	*10%*	*10%*	*20%*
30.21	*11.11*	*20.27*	*16.67*	*16.67*	*16.67*	*28.28*

** GST is applicable to HSN Code 5004/05/06/07*

4.6.2. Duty exemption on silk machinery

The duty exemptions provided on silk machinery should be continued for another five years to make India self-reliant and globally competitive.

4.6.3. GST exemption on silk machinery

Bearing GST on silk machinery at 18% would be difficult for the silk producers. GOI need to take a rational view in this regard as majority are in the cottage sector. Silk machinery sector could be placed at 5% level so that more investments are attracted. Till this is addressed, GST may be included in the unit cost of the silk machinery so that the entire cost be shared by CSB:DOS:Beneficiary.

4.6.4. Antidumping duty on raw silk

Over and above the prevailing customs duty of 10%, an antidumping duty of US$ 1.85/kg on mulberry raw silk of 3A Grade & below originating in or exported from China is being levied until December, 2020 (for a period of five years).In order to protect the domestic seri-enterprise from unforeseen trade practices, the antidumping duty on raw silk must be continued/ taken up during the 'Sunset Review' based on the situation/need, for another term of five years.

4.6.5. Revoking Most Favoured Nation (MFN) status

The GOI, under the treaty/ Free Trade Agreement, has accorded MFN (Most Favoured Nation) status to countries like Vietnam, Bangladesh, etc., with a provision to have free trade of major textile commodities including silk. As there are unfair practices Going on in terms of silk from other countries finding their way through these nations to India, it has become necessary to remove sensitive items like silk/silk products from the list of items agreed under FTA.

4.6.6. Foreign Direct Investment (FDI) in sericulture

Investment is required in two major sectors, *viz*., raw silk production and fabric production, with FDI of 49%:51% by Foreign-Indian stake, respectively, with the Indian firm/company as the executive entity. In raw material (Raw silk) production units, it could be considered on pilot basis, i.e. 5-10 units in potential States with an investment to an extent of Rs 30-50 crore/unit. In the large-scale fabric production/garment manufacturing houses, investments of Rs 50-100 crore could be considered on a composite scale.

4.6.7. Stakeholder Innovation Fund

Stakeholders' innovative fund normally supports the piloting, testing and scaling of innovations targeted to improve lives of the poorest people in developing countries. In this direction there shall be:

- Innovative fund created at national level and made available with the private participation in the field of sericulture activities like seed production, breed development, post cocoon technology, etc.
- The innovative fund could support innovators at all stages of development & production of silk. The fund shall be through grants/soft loans to be made available by the funding agencies (eg. NABARD/SIDBI)

4.6.8. Venture Capital

Venture Capital is the money invested in businesses that are small, or exist only as an initiative, but have huge potentials to grow. In this direction, equity/capital need to be created at the private level to support the start-ups, which have high risks and growth potentials. Support could be to critical components/activities of sericulture like Grainage, Chawki rearing, etc.

4.6.9. Incubators/ Accelerators

Incubators/ Accelerators are institutions that help entrepreneurs to develop their businesses, especially in the initial stages. Entrepreneurs gain the knowledge to turn their start-up ideas into reality and incubators nurture them in all aspects of a business enterprise.In line with the GoI policy regarding start-ups in the recent past, in sericulture sector too, such R&D/ Business models need to be promoted.

4.6.10. Institutional Credit Support

Credit is one of the critical inputs for sericultural development and there is a need to capitalize sericulture adequately to adopt improved technologies for operational efficiency. In sericulture, long term credit is required for construction of rearing houses, procurement of silkworm rearing appliances and establishment of chawki rearing centres, grainages, reeling units, twisting units, dyeing units, weaving units, automatic reeling units, etc. and short-term credit for meeting the working capital requirements. At present, the credit flow to the sector is only to the tune of around Rs 110 crores per annum. In many states, the famers and reelers are not able to get the credit for sericulture due to unawareness about the returns generated in sericulture by the bankers. Thecredit flow to sericulture shall be improved by covering sericulture under priority sector lending in order to increase capital formation in various sectors of sericulture. In this direction, the financial institutions (commercial banks, credit cooperative societies and Regional Rural Banks) play a crucial role in India to make adequate availability of credit at lower rates of interest.

4.6.11. Price insurance/ Price stabilization

The fluctuations in the prices of cocoon in the markets have been one of the major maladies confronted by the sericulturists. The market fluctuations are normal most of the times, but can be erratic at times and cause significant distress among the sellers It is well known that among the agricultural commodities, cocoon markets are the best organised markets and hence the distress or originating in the best organised markets calls for policy intervention. Schemes of Price Insurance through Price Stabilization Fund can be implemented effectively, with two parameters of quantity and quality checks. The premium must be low and can be paid either online or as a cash transaction at the gate, that is credited to the Price Stabilisation Fund. Initially, the Price Stabilization Fund shall be supported with the seed capital by the state and the seed capital shall be slowly transferred to the market funds and utilised towards the development of the market facilities.

4.6.12. Tapping funds under CSR

As per the clause 135 of the Companies Act, 2013, the companies with an annual turnover of Rs 1,000 crore or a net worth of Rs 500 crore or a net profit of Rs 5 crore and more are directed to spend at least 2% of their average net profit in the previous three years on Corporate Social Responsibility (CSR) activities. According to Indian Institute of Corporate Affairs, at least 6,000 Indian companies are required to undertake CSR projects in order to comply with the provisions of the Companies Act, 2013. The CSR commitments from companies amount to over Rs 20,000 crore annually. Many corporate companies operating in silk clusters can support the stakeholders of seri-enterprise in the region. Tapping the CSR funds from PSUs/ private sector companies would be a win-win situation and concerted efforts would be made to tap CSR funds for sericulture development in coming years.

4.7. Human Resource

4.7.1. Manpower requirementsof seri-enterprise

Currently, the seri-enterprise generates employment for about 9.2 million persons across the value chain from silkworm seed production to manufacturing of finished goods and marketing. With the expected annual silk production of 60,000 MT by 2030, the employment generation is projected to grow to 15 million persons. The Central Silk Board, State Governments, colleges and universities have a crucial role to produce required scientific, technical and skilled workforce. The manpower in different categories in both pre-cocoon and post-cocoon domains required to accomplish the projections by 2030 would need to be assessed through a commissioned study.

4.7.2. Capacity building & Training

In view of limitations of various capacity building and training agencies, efforts should be made to involvemoreUniversities,Institutions,Collegesand other agencies, including the PPP mode, to operate structured sericulture courses coupled with hands-on practical training, refresher and Trainer's Training programmes. Efforts should also be intensified to align all short and medium-term courses with the National Skill Qualification Framework (NSQF) and National Skill Development Mission under the Ministry of Skill Development & Entrepreneurship. Linkages with institutions such as NIMSME, Hyderabad; NIESBUD, New Delhi; EDII, Ahmedabad;ASCI, New Delhi; Centres for Entrepreneurship Development (CEDs) spread across the country must be strengthened.

In addition to providing post training employment linkage, efforts should also be made to encourage self-employment and promote Seri-Business enterpriseswith an equity support in the form of venture capital funding for first generation entrepreneurs or start-ups. CSB and State Governments should strive to setup Seri-Business Incubators hand holding the start-ups and Seri-Enterprises. The concept of Sericulture Resource Centres by private partners for assisting farmers in Seri-Clustersfor technology dissemination and adoption/absorption must be popularised.

It is proposed that all the frontline workers of PIA/DOS/CBO are trained through management and competency development programmes, which in turn would design and conduct training programmes for the beneficiaries in their respective activities and also on the community related aspects.

4.7.3. Strengthening of Extension mechanisms of DoSs

Most of the States presently have skeletal extension manpowerin the Departments of Sericulture and in order to meet the task of producing the import substitute bivoltine silk and vanya silk in difficult terrain/disturbed areas, there is an immediate need to recruit extension staff and equip them with training and other facilities. Further, innovative extension approaches adopting new ICTs need to be deployed.

4.7.4. Service delivery through Community-led Institutions

To complement the public extension system, nurturing and associating suitable modesof private extension system with due incentivisation are suggested, in line with the National Rural Livelihood Mission. In view of low level community participation and lack of sufficient extension staff, community-based extension and technology transfer/input supply need to be built in sericulture.Public service delivery through community institution development would also facilitate charging for services, phasing out the subsidy, bringing out uniform pricing, etc.

Farmer Producer Organization(FPO): Indian agriculture is characterized by smallholder farmers, with over 85% farmers being small and marginal. In order to address the challenges faced by them from 'seed to market', various tools of aggregation like Cooperatives, SHG, CIG, FIG, FPO, FPC, etc. have been designed from time to time. Among these, Farmers Producer Organizations (FPO) and Farmers Producer Company (FPC) are suitable for small and marginal sericulturists,to provide for input procurement,aggregation of produce, post-harvest value addition, access to timely and adequate finance, access to technology and market linkages and so on.

Considering the importance of these FPOs in enhancing the income of farmers through timely technological interventions and avoiding middlemen, a large number of FPOs have been registered. In sericulture too, there are five FPOs established, that need to be replicated on a large scale.A Mission mode approach of establishing 100 FPOs in major clusters across the country is suggested to harness as well as provide back the benefits to the seri-community.

4.7.5. Community Resource Persons

Community resource persons (CRP), as a resource created for the local community, are suggested, as Master trainers initially and further to serve all categories of practitioners in training, extending services, planning, monitoring, etc. Personnel from among the lead/innovative/progressive farmers, with a standing in the community would be efficient in disseminating new technologies as well as providing a feedback to the institutions.

4.7.6. Para-Professionals

Para-professionals may be selected from the human resources available with the CBO or Subject Matter Specialists available with other line departments or identified by the community to take care of the planning, implementation needs besides providing required services including extension, data collection and compilation in the clustersThese could be designated as '*resham-mitras'*, to address the issues at the local level, pertaining to skills, input management, market intelligence and so on.

4.7.7. Technical Consultants

With an imminent need for expertise in the field units, services of interested, qualified, retired officers/officials of CSB/DoSs may be empanelled and utilized by way of technical consultants**.** With men, money and material being important for a successful enterprise, the significance of mentoring needs no emphasis.

4.7.8. Federating small clusters into mega-clusters

As sericulture is being practised as an unorganized activity in most States, providing timely technology support has become difficult. In order to strengthen the economic capabilities of stakeholders through self-empowerment, it is proposed to federate small clusters into mega-clusters for up scaling production in sericulture areas, with support of *Resham Vigyan Kendra*s on the lines of KVKs, with a focus on the entire silk value chain**.** This will enable nurturing Producer Organizations with organized market support and profit sharing amongst the producers, thereby increasing the income of primary producers.

4.7.9. Seri-Input delivery mechanism/Business Enterprises/Start Ups

The Sericulture sector needs to graduate from subsidy-oriented activity to a seri-business enterprise for long-term sustainability**.** Various commercial and entrepreneurial activities like CRC, Sericulture Equipment Supply Centres, Seri Shops for supply of seri-inputs, fertilizers and pesticides, Seri-Clinics, Seri-Resource Centres, etc. are to be supported at various clusters, linking with the Skill India Programme**.**

Seri-Start Ups: With the continuum of farm-to-fabric, opportunities for seri-start ups in line with the GOI initiatives are large. There is an imminent need for designing and promoting them with handholding through incubators (4.6.9), where the established enterprises also need to share resources and responsibilities.

4.7.10. Formal Education

CSB institutes, apart from conducting technology-based short-term skill training courses in various aspects, offer 4-6 weeks' Intensive Sericulture Training & Entrepreneurship Development Programmes for promoting micro-enterprises in silk sector and 15-months Post Graduate Diploma course in Sericulture.The Universities/ Institutions/ Colleges offering B.Sc. & M.Sc. in Sericultureare indicated inTable19. Considering the numbers envisaged for generation of trained manpower by 2030, other agencies *viz*., Departments of State Sericulture, Degree Colleges, Universities and other National agencies (Sector Skill Councils-ASCI, TSSC, etc) need toaugment the efforts of CSB. In the larger interest of the sector, CSB needs to play

a greater role in HRD in sericulture and as such, could be made into Indian Council of Sericulture Research & Education (ICSRE), on the lines of ICFRE, Dehradun. For the purpose, the concerned universities and colleges need to be encouraged in providing formal education in sericulture and to make it mandatory to recruit graduates, post-graduates and Ph.D. holders in sericulture at all relevant levels by all the R&D agencies viz., CSB, DOSs, NGOs, SRLMs, Universities etc.

4.8. Enabling mechanisms

4.8.1. Returns on Investment

Considering the public investment in sericulture, the Internal Rate of Return (IRR) for the investment in sericulture development during 2011-12 to 2018-19 is estimated to be 20.04% and the benefit: cost ratio is 1:1.37. This clearly indicates that the investment made by the Government for sericulture development has provided appreciable returns on investment.

4.8.2. Factors influencing production

To estimate the contribution of factors associated with growth in silk production, a multipleregression analysis was conducted by considering the research stock, capital stock and credit as the independent variables in the model. The details of impact of various technologies and improvement over the traditional practices in pre-cocoon & post-cocoon sectors of mulberry and vanya sectorsare furnished at Tables 20 to 26.Explanatory variables accounted for 82% of the variations in silk production. The regression coefficients ofresearch stock and capital stock were positive and highly significant, underlining their role in growth in silk production. The coefficient of research stock in the model is 0.46, which implies that if there is one per cent increase in the spending towards sericulture research, the silk productionwould increase by 0.46%. Similar interpretation could be made for capital as well.

4.8.3. Partnerships and Convergence

Central Sector Scheme,'SilkSamagra'comprises four major components,*viz*., (i) Research & Development, Training, Transfer of Technology & IT initiatives; (ii) Seed Organization; (iii) Coordination & Market Development; and (iv) Quality Certification Systems, Export, Brand Promotion&Technology upgradation. During 2017-18 to 2019-20, scheme allocation was Rs 2161.68 crore (central share) including Rs 761.67 crore as scheme cost.

The scheme is proposed to be continued during next five years as a Medium-Term Plan **(**2020-21 to 2024-25**)** of Vison-2030, coterminous with the 15th Finance Commission**.** The strategic approach is to make Indian seri-enterprise a sustainable enterprise with remunerative employment generating occupation in the rural areas, at par with others. The objective is also to make India self-sufficient in raw silk production and developing seri-enterprise globally competitive**.**

Central Government schemes relevant to sericulture: Soil Health Mission (SHM); National Mission on Sustainable Agriculture (NMSA); *Rashtriya Krishi Vikas Yojana* (RKVY); Sub-Mission on Agro-Forestry (SMAF); *Paramparagat Krishi Vikas Yojana*

(PKVY); PM *Sinchay Yojana* (PMSY); PM *Fasal Bima Yojana* (PMFBY)*;*PM *Kisan Yojana* (PMKY); are the schemes, wherein sericulture needs to be included, as also linkages with agencies like National Biodiversity Authority (NBA); National Rainfed Area Authority (NRAA); Protection of Plant Varieties & Farmers' Right Authority (PPV & FRA) and so on, for comprehensive sericulture development. There needs to be a study on the current utilisation of the provisions of these schemes in sericulture and midcourse corrections if any, brought to the attentions of the concerned, for better use. A specific example is with regard to PMFBY with regard to insurance provisions for sericulture.

State Government Schemes: There are several State Government schemes, that could be linked for benefits for the sericulture sector, as for example, *Krishi Bhagya, Bhoochetana, Yantradhare*, etc. in the state of Karnataka. There however, are concerns with regard to provisions at par with other sectors, as for example, benefits for large holdings in horticulture, not provided in sericulture, that need to be examined.

To optimize inter-sectoral approaches, synergies between different government programmes/ schemes in terms of planning, process and implementation, social/ physical capital, enhancing economic opportunities are imperative.Though extension is Statesubject; Central Silk Board has taken up many convergence initiatives so as to demonstrate the possibilities of partnering with other developmental agencies in the areas of funding, implementation and monitoring. They include Swiss Agency for Development and Cooperation (SDC); United Nations Development Programme (UNDP); Ministry of Rural Development (MoRD) and Ministry of Agriculture & Farmers' Welfare, Govt. of India; National Bank for Agriculture & Rural Development (NABARD); etc. and Non-Governmental Organizations (NGOs) for sericulture development, with convergence options with MoRD (NRLM, MGNREGS, etc.), MoA&FW (RKVY), MoEF&CC (provisions under FRA, CAMPA, MGNREGS-GIM) and so on.

4.8.4. Policy Implementation Desk

India's policy planning framework does not lack the availability of the policy documents and a large number of them have been given right after the independence. But most of them have failed at the threshold of implementation due to non-persuasion and non-seriousness about the policy frame. Besides, the changes in the administrators and the political regimes also makes the important difference and therefore a long-term policy document no doubt requires effective inputs, but also effective implementation to the last mile reaching the destination visible through the intentions of the policy makers.

Therefore, it is proposed to have a Policy Implementation Desk stationed at CSB with a competent officer directly reporting to the Member Secretary of CSB on the various developments from time to time, plan for promotion of sericulture through continuous engagement/ partnership with agencies like NRLM, MoRD, MOA&FW, KVIC, Dept of Forests etc. The policy implementation shall be an additional responsibility of the officer who is particularly hand-picked for the purpose of

monitoring the process of implementation of the components of policy. The first task of the Policy Implementation Officer shall be to break the policy into implementable short-term targets and provide these inputs to the implementing officers through the Member Secretary of CSB. The progress on the components of the policy shall be documented and presented in the policy meetings and in the Research Coordination Committee meetings. Breaking of the long-term goals into short-term implementable interventions will make it easy to reach the targets in the stipulated time span.

4.8.5. Trade Desk

One of the major objectives of any medium to long term policy of silk in India should be to establish the country's position in international trade. For almost a decade, Indian silk trade is hovering around a value of Rs 2,000 crores annually and reached Rs 2,800 crores in exceptional yearsat the same time, imports also have been more or less in the range of Rs 1,300-1,800 crores. There is hardly any spurt in the trade despite the investments in the sector. One of the major reasons of the depressed trade is that the entire silk trade is handled by the private sector and the government bodies have minimal intervention in this sector. The major lacunae are that the trade is not monitored continuously and the state machinery has little control or understanding of happening in the trade sector. It would be necessary therefore, to monitor trade and incentivize the trade sector in order to provoke a quantum jump in silk trade.

It is hence essential to establish a Trade Desk in the CSB that will monitor and plug the policy loopholes wherever necessary in order to get an effective jump in silk trade. Such Trade Desk will be handled by a competent officer, reporting directly to the Member Secretary of CSB and monitor the monthly Trade Statistics. The officers shall also work out the competitive advantage of various silk products and provide inputs for diversification of the products as well as adding new destinations for silk export. The trade statistics should be collected and prominently displayed in order to provide inputs to the policy makers as well as to the silk traders. The Trade Desk should also address issues in demand for investment, tariff policy, and subsidies to be provided for capturing new markets that will be WTO-compliant.

The Trade Desk shall also organise meetings of the traders periodically with the policy makers in order to understand major problems and seek solutions during the interactions. The officer in charge of the Trade Desk shall be a permanent invitee at the meetings discussing issues pertaining to silk trade and shall have direct contact with the Ministry of Commerce, GOI and with the officers managing international trade and tariff policies for silk.

4.8.6. Corporatisation of Sericulture and Seri-enterprise

While bringing in corporate into sericulture was attempted earlier, the focus would be on large farmers with more than two hectares, improved models of rearing equipment, rearing houses, farm mechanization, etc.,in States like Tamil Nadu and Telangana. They will be encouraged towards corporatisation, besides involving high capacity ARMs to build well linked clusters, with need based financial and policy support to produce quality Bivoltine (3A and above) and ICB (2A).

In order to ensure large scale quality bivoltine production to meet the demand of export oriented units and power looms, large farmers/ corporate who are interested to set up large Automatic Reeling units in Bivoltine area can enter into contract system with farmers capable of absorbing high end/modern technology for production of superior quality bivoltine cocoons.Policy intervention to support large farmers on the lines of horticulture sector will be sought from the respective state departments and also under Silk Samagra, as at present only beneficiary oriented schemes are available at present, suited to small and marginal farmeRs

While the corporate houses can identify farmers with the support of Departments of Sericulture (DOSs) and Central Silk Board (CSB), they should be able to develop a model to buy-back good quality cocoons on the basis of quality linked price formula. The farmers identified by the corporate houses can be provided with financial assistance under the Scheme and necessary technical support by Central Silk Board and State Agencies. A Model Linkage Programme for production of 100 MT of Bivoltine raw silk is presented in Table 27, which can be customised as per states' requirements. Further, the projected production and potential for employment generation for mulberry and vanya sectors as per the proposed plan are detailed in Table 28, for planning organised enterprises.Fund mobilisation options for large scale farming and also industry participation need to be formulated, as 'Silk Samagra' has only beneficiary oriented schemes.

4.8.7 Sectoral profile

The factor share in the projected target of silk production by 2030 for mulberry and vanya sectors is presented in Table 29. While factors/interventions comprising resources, technology, infrastructure, finance/credit, policy and skill account for 60% in pre-cocoon activities and 40% in the post-cocoon area in the mulberry sector, the projected figures in the vanya sector are 55% and 45%, respectively. While technology, infrastructure, finance/credit and policy receive a higher weightage in mulberry, the resources and skill sets need greater attention in the vanya sector. Further, the strategy projects the raw silk production of 60,000 MT by 2030, including 20,000 MT of bivoltine (Table 30).

In summing up, the Zone-wise sericulture potential and prescriptions are presented in Table 31; and major requirements and policy prescriptions for various stakeholders, *viz.,* Seed producers, Chawkirearers, Farmers, Reelers, Weavers, Consumers, Exporters and so on are summarised in Table 32. To become globally competitive, India would need to focus onconsolidating domestic industry for scale efficiency; incentivizing quality products such as cocoon and raw silk; and addressing target exports of silk goods to selective marketsbased on comparative advantage. This provides a glimpse of the action points in line with the policy, which the State Departments of Sericulture would need to consider for formulating a strategy for wholesome sericulture development. Further, state-wise potential and areas to be addressed while drafting state-specific silk policies. In view of the production trend and the potential, there is an immediate need to have equal focus on smaller states (with negligible silk production & low contribution to the country's

silk production at present) with greater potential, with specific state policy to explore those possibilities.

4.9. CSB in the context of new Silk Policy

CSB is the nodal agency for implementation of Central Sector/Centrally Sponsored Schemes through the Departments of Sericulture in the concerned states, as per the provisions made under Section 8(1), 8(2) and 8(3) of the CSB Act, 1948. CSB at present has Research Institutes, Seed Organizations, Regional Sericulture Research Stations (RSRS), Research Extension Centres (RECs) and other field units totalling to 176 (2019-20). In view of the wide variations among the sectors and zones within the sectors in respect of practices, productivity, priorities, etc., CSB is following specific zonal approach to cater to research and development needs of various regions. The strategic decisions are being taken up through State Project Monitoring Committees (PMC) and State Level Sericulture Coordination Committee with support of Nodal officers/Zonal In charges nominated for all States for effective monitoring of the schemes. Overall performance of the sericulture development in the states is being reviewed on a half-yearly basis by an Apex Committee under the Chairpersonship of Secretary (Textiles) with Member Secretary, Senior Officers of CSB HQs and the Directors of CSB Institutes as members with participation of States.

Providing for the entire requirement of breeders' stock, CSB is also conitnuing the supply of basic and commercial seed. During the year 2019-20, CSB supplied 421 lakh dfls of mulberry, 48 lakh dfls of vanya (36.22 lakh dfls tasar, 5.42 lakh dfls of muga& 6.3 lakh dfls eri) silkworm seed at different tiers of seed production, as also aided private sector initiatives. It is evident from the above that the CSB is at the centre stage of R&D in Indian sericulture. In the context of the present new Silk policy, the CSB would need to reorient the mechanisms for addressing the emerging needs of the sector and incorporate innovative approaches for an efficient seri-enterprise in the country.

4.9.1 Governance

As indicated in the preamble, governmental efforts need to be largely facilitatory and regulatory, leaving the actual businesses to individuals, private entities and corporate. It is necessary that the public-private partnerships are built from the inception itself, whether in research, technology development, enterprise or trade. The Central Silk Board (CSB) would need to engage private partners in the processes, for which a nodal officer be in place, for projections, discussions, negotiations and so on. Private sector must invest in the R&D process so that it is fast tracked and mutual learning between the academia and the enterprise is instilled. This would also enhance indigenous capacities across the value chain.

In the changing and demanding scenarios, a view has to be taken with regard to 'must-do' and 'may-do' activities, by reducing the ongoing ones even by 50%, so that new and emerging challenges are met with equally robust sciences and trade practices. This requires a critical analysis of the structure and functions of the Board as well as units and reorient and reprioritise them, with CSB as a leader, at the same

time a guide and mentor for other stakeholders with similar interest and capabilities. This would position the CSB at the centre of the sericulture as a knowledge-enterprise. On an analysis of the sector, the following studies are recommended to be commissioned:

- Manpower requirements of sericulture in different categories in both pre-cocoon and post-cocoon domains, among all stakeholder, for meeting the projections of the sector by 2030
- Trends of Export-Import of silk and silk products, with reference to traditional and new fabrics, as well as existing and non-conventional markets
- Effective utilisation of Central and State schemes in agriculture and allied sectors for sericulture

4.9.2 Human Capital

As already mentioned, global changes and challenges have to be addressed with new knowledge and skill sets, for which a strong human capital is critical. The present staffing at CSB is as follows:

Staff	Director	Scientists	Technical	Administration	Total
Sanctioned	11	567	1302	1498	3378
Filled up	5	389	1024	1221	2639

It is needless to mention that the filling up of vacancies is the immediate need to man all the Institutes. It is also important to bring in new skill sets in emerging areas by recruiting researchers in both pre-cocoon and post-cocoon areas. Greater synergy between the CSB institutions as well as other Universities/ Institutions is strongly recommended through Collaborative projects, Joint mission mode programmes, Secondment of Scientists, Visiting researchers, Adjunct faculty, Farmer Professors, Professorial Chairs, Extramural funding and Industry linkages. An exploratory collaboration profile with institutions both national and international may be prepared and the scientists encouraged to undertake programmes that would fast track problem-solving approaches. Mentoring needs attentions to build on the knowledge base, as also for quality publications. It is also imperative that the personnel policies of CSB are revised in line with other S&T organisations of the country, with regard to pay structure and promotional avenues to motivate the researchers and sustain the science tempo in the Board.

4.9.3 Centre for Germplasm exchange

In view of the CSB maintaining the entire spectrum of silkworm breeds and mulberry accessions, it is recommended that CSB serves as Centre for germplasm exchange with all the sericulture countries for taking up further collaborative breeding programmes in future. Standard Operating Procedures with Material Transfer Agreements may be followed, with due linkages with national agencies in the area.

4.9.4 IP & BM Cell

While the establishment of a Policy Implementation Desk and Trade Desk has already been discussed (4.8.4 & 4.8.5), it is recommended that an Intellectual

Property & Business Management (IP & BM) Cell is formed, to address the increasing needs of commercialisation of technologies and products developed in a professional manner. This involves several commercial and legal issues and has become a necessity for operations from 'seed to market'.

4.9.5 CSB as ICSRE

In view of the expanding programmes as well as the need to address issues in sericulture sector in a wholesome manner including human resource and frontline extension, it is proposed that CSB shall be reorganised as a new generation Indian Council for Sericulture Research & Education (ICSRE), with the Member Secretary as the Director General. With a deemed to be University status (on lines of ICFRE, Dehradun under the MoEF&CC, GOI), the ICSRE would be in a better position to cater to all segments of the enterprise, as also provide the necessary Motivation to the staff members, with the provision of UGC pay structure and promotional policies.

4.9.6 Relocation of CSB Headquarters

Good infrastructure for quality performance needs no emphasis. From the foregoing account, it is apparent that CSB would address a whole range of issues including partnerships. The present location of the CSB Headquarters in Bengaluru is posing serious difficulties for operations, in view of the intense urbanisation including the Metro line and so on. It would be prudent to plan relocation of the Headquarter to a different site in the City or to Mysuru, where land is available in the CSRTI campus. The latter also provides stronger access to the core areas of sericulture in the State and would be in the interest of working efficiency, with the present connectivity between the two cities. Either way, it is recommended that a relocation plan is put in place for operational ease and working efficiency, as the public activities in the present location would hamper the working of CSB in the coming years.

5. Way Forward

The role and value of silk in Indian economy, culture, trade and livelihoods have been well recognised and appreciated. With new vocational opportunities however, interest and involvement of next generation are reducing in sericulture activities, as is also in farming in general. Hence it is necessary to make sericulture as knowledge and skill-based enterprise, reducing drudgery and enhancing efficiencies at every level. Integration of practices and systems in rural India with convergence of schemes and recipes would be able to attract and retain investments of all dimensions, human, natural resources or financial inputs.

While new risks impacting the economies have emerged globally, opportunities are also beckoning for quality textiles like silk, with new range apparels, non-textile applications, high value by-product utilisation and diversification, with the tripod approach of 'Foresight-Innovations-Partnerships'. Exploring the globe for market opportunities, apart from addressing the domestic traditional markets, assumes significance in view of major countries in silk witnessing upheavals and non-conventional and niche markets opening up across the world. This also requires synergistic as well as disruptive approaches, involving collaboration with new

players, be it research institutions, engineers, fashion designers and corporate. Celebration of silk as queen of fabrics must be sustainable, inclusive, remunerative, and equitable with all the stakeholders in the value chain.

6. Literature cited (in chronological order)

1. Ministry of Commerce and Industry, Government of India (2000).Silk & Test methods for determining the size of silk yarns and China Inspection & Quarantine (CIQ- Table-39 Chinese classification table for raw silk under the control of China Commodity Inspection Bureau (CCIB) Beijing,Policy Circular No. 4(RE-2000)/1997-2002 dated 7/4/2000.

2. Ministry of Textiles, Government of India (2000). http://texmin.nic.in/sites/ default/ files/ policy_2000.pdf, National Textile Policy 2000, pp. 1-15.

3. Textile Committee, Ministry of Textiles, Government of India (2000). http:// www. textilescommittee.nic.in/writereaddata/files/Executive_Summary.pdf. National Household Survey 2015: Market for Textiles and Clothing, pp. 1-19.

4. Central Silk Board, Ministry of Textiles, Government of India (2008). The Central Silk Board Act, 1948 (61 of 1948) and the Central Silk Board Rules, 1955, pp. 1-96.

5. Ministry of Textiles, Govt. of India (2010). http://www.ijma.org/acts-rules-policies/policies/national-fibre-policy-2010-11.pdf, National Fibre Policy 2010-11, pp. 1-62.

6. Dandin, S.B. and Giridhar, K. (2010). Handbook of Sericulture, CSB, Bengaluru, 431 pp.

7. Ministry of Textiles, Government of India (2011). Report of the Sector- Specific Working Group on Sericulture, pp. 1-49 (internal circulation).

8. Textiles Committee, Ministry of Textiles, Govt. of India (2015). National Household Survey 2015 Market for Textiles and Clothing, Market Research Wing, Textiles Committee, Mumbai, pp. 215.

9. CSRTI (2017). South Zone Mulberry Sericulture Technology Descriptor, CSRTI, Mysuru, pp. 20.

10. Suresh Pal (2017). The Funding Trend, Institutional Development and Policy Perspective of Agricultural Research in India, in (Ed.,) Suresh Pal (2017), Agricultural R&D Policy in India: The Funding, Institutions and Impact, National Institute of Agricultural Economics and Policy Research, New Delhi. Sericulture Research Intensity Indices were compiled from the data available with Central Silk Board, Bangalore, p. 15.

11. Central Silk Board, Ministry of Textiles, Government of India (2018). CSB Vision 2030, pp. 1-352.

12. International Organization for Standardization (2018). Testing Standards issued by ISO, *ISO 21046:2018 (en)*.

13. Ministry of Textiles, Government of India (2018). http://ministryoftextiles. gov.in/ sites/ default/ files/ Silk-SAMAGRA-160419-English.pdf, Guidelines for

implementation of Central Sector Scheme ‘Silk Samagra’- Integrated Scheme for Development of Silk Industry for 3 years from 2017-19 to 2020.

14. Paul W. Heisey and Keith O. Fuglie (2018). Agricultural Research Investment and Policy Reform in High-Income Countries, Economic Research Report Number 249, Economic Research Service, United States Department of Agriculture, pp. 29.
15. KAPC (2018). Profitability of Major agriculture crops in Karnataka - Assured Price andStable Market for Agriculture and Horticulture Crops In Karnataka: 2017-18. KAPC, Govt. of Karnataka. pp. 14-16.
16. Xijie Guo (2019). Current status and future prospectus of sericulture in China. Proc. 6th APSERI Conference, Mysuru, 2-4 March, 2019. p. 107.
17. Dandin, S. (2019). Doubling farmers income: Production enhancement through productivity gains. MoA&FW, Govt. of India, Vol. VIII, pp. 147-154.
18. Central Silk Board, Ministry of Textiles, Government of India (2019). Seri-States of India- A Profile, pp.1-168.
19. International Food Policy Research Institute (IFPRI) (2019) Agricultural Science and Technology Indicators: 2019 Global Food Policy Report. https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/9OXBIB.

TABLES

Table 1. Global Raw Silk Production (Unit: MT)

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	%
China	84000	115000	104000	126000	130000	146000	170000	158400	142000	120000	75.07
India	19690	21005	23060	23679	26480	28708	28523	30348	31906	35468	22.19
Uzbekistan	780	940	940	940	980	1100	1200	1256	1200	1800	1.13
Thailand	665	655	655	655	680	692	698	712	680	680	0.43
Vietnam	-	550	500	450	475	420	450	523	520	680	0.43
Brazil	811	770	558	614	550	560	600	650	600	650	0.41
North Korea	-	-	300	300	300	320	350	365	365	350	0.22
Iran	82	75	120	123	123	110	120	125	120	110	0.07
Others	142	163	153	149	149	148	132	133	116	117	0.07
Total	**106170**	**139158**	**130286**	**152910**	**159737**	**178058**	**202073**	**192512**	**177507**	**159855**	**100.00**

Table 2. Mulberry Seri-enterprise: Comparison between China and India

Parameters	China	India	
Area under mulberry (ha)	7.90 lakh	2.35 lakh	
Leaf Yield (MT/ha/yr)	30-35	45-50	
Races reared	Bivoltine: 100%	Cross breed (CB): 72%	Bivoltine (BV): 28%
Egg production (crore dfls)	78.8	30.22	
Supply system	Majority chawki reared	CB: Supplied by eggs &Chawki90%	BV: Mostly 85%Chawki reared
Rearing pattern	Batch wise	Throughout the year	
Dfls brushed/ha/yr	1050	2250	2000
Cocoon Production (MT)	679900	122739	46458
Cocoon yield (kg/100 dfls) (2boxes)	70	60	65
Leaf cocoon ratio(kg)	20	22.5	25
Cocoon yield (kg)/ha)	861	1350	1300
Cocoon weight (g)	1.9 – 2.0	CB: 1.5 –1.7	BV: 1.7-1.8
Shell percentage	21-24	CB: 17-19	BV: 20-21
Filament Length (m)	>1000	CB<800	BV >950
Renditta	6	CB: 7.6	BV: 6.50;
Grade of silk as per ISA standards	Up to 4A	Up to 2A	Up to 4A
Cost of cocoon production* (Rs/kg)	-	269	297
Cocoon price during November, 2019 (Rs/kg)	400-450	CB: 350	BV: 400
Raw silk productivity (kg/ha/yr)	152	110*	
Demand and supply position	90% Export	Mostly domestic (10% deficit)	
Mulberry raw silk production (MT)	120,000	25344(CB:18357, BV:6987)	

Note:* *Pertaining to national average*

Table 3. Silk Production in India at a glance

Particulars	Unit	IX Plan	X Plan	XI Plan	XII Plan	2017-18	2018-19	2019-20 (Target)
Mulberry Plantation	ha	232076	191893	181089	216810	223926	235001	257000
Mulberry Raw Silk Production								
Bivoltine	MT	840	1100	1685	5266	5874	6987	8500
Multivoltine	MT	15002	15425	16587	16007	16192	18358	18865
Total	*MT*	*15842*	*16525*	*18272*	*21273*	*22066*	*25345*	*27365*
Raw silk Productivity	kg/ha	68.26	86.12	92.90	98.12	98.54	107.85	111
Vanya Silk Production								
Tasar	MT	249	350	1590	3268	2988	2981	3515
Eri	MT	1160	1485	3072	5637	6661	6910	7370
Muga	MT	100	115	126	170	192	233	280
Total	*MT*	*1509*	*1950*	*4788*	*9075*	*9840*	*10124*	*11165*
Grand Total		**17351**	**18475**	**23060**	**30348**	**31906**	**35468**	**38530**

Table 4. Trend analysis of Productivity, Conversion & Employment Generation in Seri-enterprise in India over Plan periods

Plan Period	Renditta	Raw Silk Productivity (kg/ha)	Cocoon Productivity (kg/ha)	Cocoon Yield (kg/100 dfls)	Employment (lakh persons)
VIII plan (1992-97)	8.9	46.16	412.10	36.15	59.67
CAGR	*-2.2*	*4.0*	*1.7*	*-1.1*	*0.1*
IX Plan (1997-02)	8.8	68.26	601.60	41.84	55.00
CAGR	*-0.6*	*6.5*	*5.9*	*1.9*	*0.9*
X Plan (2002-07)	8.2	86.12	705.92	47.70	60.30
CAGR	*-1.3*	*2.8*	*1.4*	*1.7*	*1.5*
XI Plan (2007-12)	7.7	100.90	772.39	58.21	75.60
CAGR	*-1.2*	*2.8*	*1.6*	*3.1*	*4.3*
XII Plan (2012-17)					
2012-13	7.7	94	724.40	52.69	76.53
2013-14	7.3	95.93	704.04	57.35	78.50
2014-15	7.4	97.31	726.60	58.84	80.30
2015-16	7.4	98.01	718.09	59.01	82.50
2016-17	7.3	98.12	726.44	60.24	85.10
CAGR	*-1.1*	*0.9*	*-0.2*	2.7	*2.1*
2017-18	7.33	98.54	722.04	59.83	86.04
2018-19	7.32	107.85	789.62	61.39	91.78
CAGR	*-0.1*	*4.6*	*4.6*	*1.3*	*3.3*
CAGR (from 2012-13 to 2018-19)	*-0.7*	*2.0*	*1.2*	*2.2*	*2.6*

Table 5. State-wise Silk Production during 2018-19

State	Mulberry plantation (ha)	Mulberry Raw Silk (MT)			Vanya Raw Silk (MT)				Total (M+V) (MT)
		Bivoltine hybrids	Cross Breed	Total	Tasar	Eri	Muga	Total	
Andhra Pradesh	41915	1465	6011	7476	5			5	7481
Arunachal Pradesh	370	3		3	0	54	3	56	59
Assam& Bodoland	2783	69		69		4764	193	4957	5026
Bihar	598	0.38	7	8	38	9		47	55
Chhattisgarh	261	1	8	9	340			340	349
Haryana	206	1		1					1
Himachal Pradesh	2743	34		34					34
Jammu & Kashmir	8183	118		118	0.04				118
Jharkhand	502		3	3	2372			2372	2375
Karnataka	104578	2067	9525	11592					11592
Kerala	148	16		16					16
Madhya Pradesh	3088	60	21	82	18			18	100
Maharashtra	7913	489	8	496	23			23	519
Manipur	3300	124	13	137	5	320	2	327	464
Meghalaya	3209	49		49		1104	34	1138	1187
Mizoram	4094	65	18	83	0.05	8	1	9	92
Nagaland	394	10	3	13		606	1	607	620
Orissa	537	2	1	3	123	5		128	131
Punjab	1159	3		3					3
Sikkim	185	0.35		0.4					0.35
Tamil Nadu	20128	1926	146	2072					2072
Telangana	4383	214	0	214	10			10	224
Tripura	1935	90	140	230					230
Uttar Pradesh	3754	107	123	231	22	37		59	289
Uttarakhand	3305	36	1	36				0.00	36
West Bengal	15400	36	2329	2365	25	4	0.16	29	2394
Total	**235071**	**6987**	**18358**	**25345**	**2981**	**6910**	**233**	**10124**	**35468**

Source: *CSB (Compiled from Monthly reports received from State Sericulture Departments)*

Table 6. Share of Silk Sector in Textile Industry and India's GDP

(Rs in crore)

Year	**GVA at basic prices** (Base Year: 2011-12 at Constant Prices)	Textile Industry		Silk Sector		
		GVA at basic Prices	**% to India's GDP**	**Value of silk fabrics** (at 2011-12 prices)	**% to GDP of Textile Sector**	**% to India's GDP**
2011-12	8195546	138755	1.69	18,821	13.56	0.23
2012-13	8546275	184335	2.16	18,103	9.82	0.21
2013-14	9063649	197617	2.18	16,974	8.59	0.19
2014-15	9712133	226770	2.33	18,512	8.16	0.19
2015-16	10491870	232718	2.22	18,518	7.96	0.18
2016-17	11318972	259108	2.29	18,822	7.26	0.17

Source:

1. Reserve Bank of India, https://www.rbi.org.in/Scripts/PublicationsView.aspxid=18993

2. Ministry of Textiles, http://texmin.nic.in/sites/default/files/ShareTextilesSectorGDP.pdf

3. Compendium of Indian Textile Statistics 2016–17, Office of the Textile Commissioner, Ministry of Textiles, Mumbai

4. For sericulture related information: CSB, Bangalore

Table 7. Per capita consumption of different fibres in India

Fibre	Per capita consumption			
	Quantity (metre)		Amount (Rs)	
	2012	**2014**	**2012**	**2014**
Cotton	10.89	12.35	1152.3	1428.02
Silk	0.18	0.21	137.3	160.22
Woollen	0.08	0.11	42.86	58.42
Synthetic+ Blends	14.78	16.04	1530.5	1824.12
Total cloth	**25.93**	**28.7**	**2862.9**	**3470.77**

Table 8. Economics of Mulberry silkworm rearingin South India (2017-18)

(Average at farmers' level/ha/year)

Assumption: Leaf Yield (MT/ha/year): 50 **Average holding: 2.5 acre**

Particulars	DFLs brushed/ ha/year	Leaf requirement/ 100dfls (kg)	Cocoon yield/ 100 dfls (kg)	Cocoon rate (Rs/kg)
Cross Breed	2,250	2,250	60	364
Bivoltine	2,000	2,500	65	413

Expenditure on Mulberry Leaf Production

	Items	(Rs/ha/year)
A.	**Operational costs**	
1	Bullock/tractor	13200
2	Labour	51429
3	FYM	28044
4	Fertilizers	33723
5	Other costs	1800
6	Interest on working capital	10256
	Total variable cost	138452
B.	**Fixed costs**	
1	Apportion cost of establishment of mulberry garden	11,546
Total leaf production cost		**149998**

Expenditure on Silkworm Rearing and Returns

	Items	BV	CB
	Average number of dfls reared	**2,000**	**2,250**
A.	**Variable costs**		
1	Leaf	149998	
2	Dfls/Chawki worms	60000	54000
3	Disinfectants	8300	9130
4	Materials	5094	5858
5	Labour	34100	46200
6	Transportation & marketing	6630	6750
7	Other costs	1250	1100
8	Interest on working capital	9230	9843
9	**Total variable costs**	**274602**	**282879**
B.	**Fixed costs**		
	Depreciation on building and equipment	37330	
	Total cost	**311932**	**311932**
	Cost/Kg cocoon	239.95	239.95
C.	**Revenue Generation**		
1	Average cocoon yield (kg/100 dfls)	65	60
2	Average cocoon price (Rs/kg.)	413	364
3	Cocoon production (kg)	1300	1350
4	Total Income from cocoon	536900	491400
5	Income from by-products, sale of leaf, etc.	10738	9828
	Total revenue	**547638**	**501228**
	Net return	**235706**	**189296**
	B:C ratio	**1.76**	**1.61**

Source:*CSRTI, Mysuru*

Table 9. Comparative crop economics (2017-18)

Crop	per hectare per annum				Cost of production (Rs/Qtl)
	Total costs (Rs)	Gross returns (Rs)	Yield ('00 kg)	Net returns (Rs)	
Paddy (Irrigated)	135705	152303	70	16598	1941
Turmeric	364045	553145	58	189100	6260
Tomato	375288	342445	372	-32843	1009
Banana	807725	1021983	725	214258	1114
Sugarcane	195000	260000	10000	169000	1950
Pomegranate	481260	631555	146	150295	3298
Sericulture	311930	516750	13	204820	23542

Note:*Comparative economics has been worked out for the above six crops being cultivated under irrigation in Southern India. As could be seen from the table, sericulture is in second position with regards net returns*

Table 10. SWOC analysis of the Indian Seri-enterprise

Strengths	Weaknesses
▪ Structural advantages of large production bases, skill availability, high Labour Force Participation Rate (LFPR) ▪ Strong R&D infrastructure base/need based technologies ▪ Favourable climatic conditions for all five types of silk (Mulberry & Vanya) ▪ Well established infrastructure and delivery mechanisms ▪ High participation of SC /ST /rural communitiesWomen-force and employment ▪ Strong tradition and cultural bonding &Market demand for eco-friendly natural products	▪ Small and fragmented production bases with inconsistency in output quality and productivity ▪ Inadequate and timely silkworm egg supply ▪ Poor extension & technology dissemination and poor marketing linkages across the value chain ▪ Lack of quality pricing system and quality-based infrastructure in processing sector ▪ Absence of large-scale farms & post cocoon processing system ▪ Fluctuations in productivity and quality due to diverse range of practices ▪ Non-participation of private sector in manufacturing of advanced machineries for post cocoon processing
Opportunities	**Challenges**
▪ Strong domestic & international demand with a growth rate of over 8% ▪ Global demand in the context of declining production in China ▪ High demand for ethnic and traditional silk designs in global market ▪ Ideal rural avocation for poverty alleviation and inclusive growth (SC &ST & Women folk) ▪ Scope for rural employment to limit urban migration and equity distribution ▪ Increasing demand for eco-friendly natural fibres in the export market ▪ Liberalized policies of Govt.ofIndia&Export potential leading high demand in global markets	▪ Rapid urbanization and deforestation ▪ Eroding genetic base of silkworm breeds ▪ Drought, depleting water table and climate change ▪ Inadequate availability of quality Seed ▪ Extension constraint in technology dissemination and absorption ▪ Reluctance of younger generation to continue sericulture activities ▪ Poor credit flow & Price volatility ▪ Import of Bivoltine Silk from MFN countries like Vietnam, Bangladesh, etc.

Table 11. Progressive Income of Sericulture Activities (per ha/year)

	Activities	Quantity	Unit Rate (Rs)	Gross Income (Rs)	Net Conversion cost (Rs)	Net Income (Rs)
1	Leaf yield (kg)	50000	3	150000		
2	Shoot yield (kg @ 40%)	20000	0.5	10000		
3	Cocoons @ 65 kg/100 dfls(2000 dfls used*)	1300	400	520000		
4	Raw silk @ 6.5 Renditta	200	3500	700000	90000	610000
5	Dried pupae @ 20% of Green cocoon	260	45	11700	3900	7800
6	Silk waste @ 10% on silk weight	20	750	15000	0	15000
7	Pelade waste @ 2% on cocoon weight	26	300	7800	0	7800
8	Grey cloth @ 60 g/m (for 25% of silk weight)	833	350	291550	86632	204918
9	6.25 m Saree @ 563g (for 75% of silk weight)	267	10000	2670000	1191621	1478379
	Total			**3696050**	**1372153**	**2323897**

**This includes unconsumed leaf also.*

Conversion cost calculation

Process	Conversion	Quantity	Net Conversion
Cocoon to Raw Silk/kg	450	200	90000
Dried Pupae/kg	15	260	3900
Raw Silk to Grey Cloth/m	104	833	86632
Raw silk to Silk Saree of 6.25 m length	4463	267	1191621

Note:

	Particulars	Inclusive of Conversion cost (Rs)	Exclusive of Conversion cost (Rs)
a)	Cost of cocoons produced /ha/year	5.2 lakh	
b)	Income from Conversion of cocoon to fabric (Sl.No. 4 to 9)	37 lakh	23.2 lakh
c)	Rise in income from Cocoon to Fabric	7.1 times	4.5 times

Table 12. Agricultural Research Spending

Country	Year	Agricultural research	
		2011 PPP dollars (million)	As share of AgGDP (%)
Algeria	2012	91.6	0.2
Antigua &	2012	1.0	3.0
Argentina	2013	732.1	1.3
Australia	2013	724.0	3.2
Austria	2013	146.0	3.1
Bangladesh	2012	250.6	0.4
Barbados	2012	1.3	2.0
Belgium	2013	329.0	10.2
Belize	2012	2.3	0.7
Benin	2016	30.5	0.6
Bolivia	2013	58.9	0.9
Botswana	2016	17.5	2.3
Brazil	2013	2,704.0	1.8
Burkina Faso	2014	48.5	1.0
Burundi	2016	10.9	0.4
Cabo Verde	2016	3.3	1.2
Cambodia	2010	22.4	0.2
Cameroon	2014	45.9	0.3
Canada	2013	777.0	3.8
Central	2016	4.9	0.4
Chad	2016	5.9	0.0
Chile	2013	186.4	1.6
China	2013	9,366.2	0.6
Colombia	2013	253.7	0.8
Congo, Dem.	2016	27.7	0.2
Congo, Rep.	2016	6.3	0.3
Costa Rica	2012	37.1	1.1
Côte d'Ivoire	2014	82.1	0.5
Czech	2013	93.0	1.3
Czech-	2013	127.0	1.2
Denmark	2013	162.0	5.8
Dominica	2012	0.2	0.2
Dominican	2012	20.3	0.3
Ecuador	2013	27.3	0.2
Egypt	2012	528.4	0.4
El Salvador	2006	6.6	0.2
Eritrea	2011	2.9	0.3
Estonia	2013	23.0	2.2
Eswatini	2016	6.7	0.7
Ethiopia	2016	162.1	0.3
Finland	2013	169.0	3.1
France	2013	1,578.0	4.5
Gabon	2016	1.6	0.1
Gambia	2016	4.8	0.9
Germany	2013	1,235.0	5.0
Ghana	2016	178.6	0.9
Greece	2013	41.0	0.5
Grenada	2012	0.4	0.7
Guatemala	2012	15.6	0.1
Guinea	2016	3.9	0.2
Guinea-	2011	0.2	0.0
Honduras	2012	7.5	0.2
Hungary	2013	90.0	1.0
Iceland	2013	8.0	1.0
India	2014	3,298.4	0.3
Ireland	2013	110.0	4.0
Israel	2013	86.0	2.9
Italy	2013	713.0	1.7
Jamaica	2012	11.8	0.9
Japan	2013	2,948.0	5.4
Jordan	2012	36.2	1.8
Kenya	2016	222.4	0.5
Lao PDR	2010	NA	NA
Lebanon	2012	38.2	1.0
Lesotho	2016	2.8	0.9
Liberia	2011	6.7	0.5
Madgascar	2016	10.4	0.1
Malawi	2014	28.1	0.5
Malaysia	2010	592.3	1.0
Mali	2016	57.8	0.4
Mauritania	2016	18.5	0.5
Mauritius	2016	37.3	4.8
Mexico	2013	710.4	1.0
Morocco	2012	147.3	0.5
Mozambique	2016	31.8	0.4
Namibia	2014	38.8	3.1
Nepal	2012	53.4	0.3
Netherlands	2013	604.0	4.6
New Zealand	2013	146.0	1.7
Nicaragua	2012	17.5	0.4
Niger	2016	22.2	0.3
Nigeria	2014	433.5	0.2
Norway	2013	172.0	3.8
Oman	2012	110.0	6.5
Pakistan	2012	332.5	0.2
Panama	2012	15.5	0.7
Paraguay	2013	26.8	0.3
Peru	2013	83.4	0.4
Poland	2013	330.0	1.3
Portugal	2013	90.0	1.6
Rwanda	2016	27.3	0.4
Senegal	2016	51.5	0.9
Sierra Leone	2014	15.3	0.2
Slovakia	2013	34.0	1.9
Slovenia	2013	26.0	2.6
South Africa	2014	417.4	2.8
South Korea	2013	1,017.0	2.9
Spain	2013	654.0	1.3
Sri Lanka	2009	61.8	0.3
St. Kitts and	2012	0.8	5.1
St. Lucia	2012	0.3	0.6
St. Vincent	2012	0.7	1.1
Sudan	2012	57.3	0.1
Sweden	2013	152.0	3.0
Switzerland	2013	154.0	5.0
Tanzania,	2016	68.5	0.2
Togo	2016	8.7	0.2
Trinidad and	2012	18.0	7.8
Tunisia	2012	63.0	0.6
Turkey	2012	537.3	0.5
Uganda	2016	99.4	0.6
United	2013	589.0	4.0
United States	2013	4,305.0	2.0
Uruguay	2013	77.4	1.4
Venezuela	2013	86.2	0.3
Viet Nam	2010	136.0	0.2
Yemen	2012	38.7	0.6
Zambia	2014	26.9	0.5
Zimbabwe	2014	43.4	1.4

Source:*Paul W. Heisey and Keith O. Fuglie(2018)*

Table 13. Agriculture and Sericulture Research Investments in India

Year	Agricultural research investment *(as% of AgGDP)*	Silk Sector		
		Value of silk fabrics *(Crore Rs at 2011 prices)*	**Sericulture research investment*** *(Crore Rs at 2011 prices)*	**% of SeriGDP**
2011-12	0.32	18,821	65.34	0.35
2012-13	0.33	18,103	163.33	0.90
2013-14	0.30	16,974	156.33	0.92
2014-15	0.41	18,512	37.44	0.20
2015-16	0.40	18,518	70.81	0.38
2016-17	0.40	18,822	87.88	0.47
2017-18	0.40	19,543	56.32	0.29
2018-19	-	20,871	43.58	0.21

Note: **includes only CSB's research expenditure*

Source:*For Agricultural Research Intensity Index, Suresh Pal, The Funding Trend, Institutional Development and Policy Perspective of Agricultural Research in India, in (Ed.,) Suresh Pal (2017), Agricultural R&D Policy in India: The Funding, Institutions and Impact, National Institute of Agricultural Economics and Policy Research, New Delhi. Sericulture Research Intensity Indices were compiled from the data available with Central Silk Board, Bangalore*

Table 14. Grade-wise raw silk availabilityin India (2018-19)

Race	Raw Silk Production (MT)	3A - 4A grade	2A grade	A grade	B grade	Below B grade
BV	6987	3240	1536	2160	0	0
%	*100*	*46*	*22*	*32*	*0*	*0*
MV	18358	0	1800	7340	5510	3708
%	*100*	*0*	*10*	*40*	*30*	*20*

Table 15. Projected upscaling of conversion infrastructure in Mulberry sector

(Silk Production: in MT); (Physical Units: in Nos.)

Year	Mulberry area (ha)	Mulberry													
		BV	ARM (Nos.)	MRM (Nos.)	Cottage basin (Nos.)	ICB	ARM (Nos.)	MRM (Nos.)	Cottage basin (Nos.)	CB	MRM (Nos.)	Cottage basin (Nos.)	any others (Nos.)	Total CB	Total mulberry
2016-17	227000	5260	39	409	1315	6060	0	622	2020	11340	291	3780	2835	17400	22660
2017-18	231390	6100	56	542	1186	6500	0	667	2167	11300	869	2825	2354	17800	23900
2018-19	237215	7200	80	640	1200	6950	0	535	1738	11150	858	2788	2323	18100	25300
2019-20	243055	8500	94	850	1181	7400	15	759	2261	11100	1138	2467	1850	18500	27000
2020-21	249550	10000	111	1111	1111	8000	17	821	2444	10900	1118	2422	1817	18900	28900
2021-22	256600	12000	156	1333	1000	8650	36	887	2403	10850	1391	2110	1356	19500	31500
2022-23	263800	12850	190	1428	714	9350	39	959	2597	10650	1365	2071	1331	20000	32850
2023-24	270250	13800	256	1380	383	10100	63	1165	2244	10400	1467	1733	1300	20500	34300
2024-25	276000	14800	288	1480	206	10950	68	1263	2433	10050	1417	1954	1256	21000	35800
2025-26	280500	15800	339	1404	176	11850	74	1519	2304	9700	1368	1886	808	21550	37350
2026-27	286000	17000	400	1322	142	12800	107	1641	2133	9000	1385	1750	375	21800	38800
2027-28	290500	18000	427	1400	100	13500	113	1731	2250	8450	1300	1643	352	21950	39950
2028-29	295000	19000	493	1267	0	14250	148	2010	1583	7950	1223	1546	331	22200	41100
2029-30	300000	20000	593	889	0	15000	156	2115	1667	7300	1123	1622	0	22300	42200

Table 16. Projected upscaling of conversion infrastructure in Vanya sector

(Silk Production: in MT); (Physical Units: in Nos.)

Year	Vanya									
	Tasar	Reeling Machines	Spinning Machines	Eri	Spinning Machines	Spinning Mills (No.s)	Muga	Reeling Machines	Spinning Machines	Total Vanya
2016-17	3285	3720	800	5835	4000	2	220	280	200	9340
2017-18	3450	4883	1080	6250	5400	5	240	368	270	9940
2018-19	3650	6371	1458	6750	7290	8	260	480	365	10660
2019-20	3900	8370	1968	7350	9842	11	280	630	492	11530
2020-21	4150	10695	2657	8000	13286	17	300	805	664	12450
2021-22	4460	13300	3587	8700	17936	25	340	1000	897	13500
2022-23	4650	16180	4843	9000	24214	34	350	1220	1211	14000
2023-24	4840	19350	6538	9300	32689	40	360	1450	1634	14500
2024-25	5015	20503	7845	9615	39226	43	370	1520	1961	15000
2025-26	5200	22862	9414	9970	47072	48	380	1580	2354	15550
2026-27	5400	25221	10356	10400	51779	54	400	1640	2589	16200
2027-28	5600	27580	11391	10725	56957	60	425	1700	2848	16750
2028-29	5800	29929	12530	11050	62652	65	450	1770	3133	17300
2029-30	6000	32278	13784	11330	68918	71	470	1840	3446	17800

Table 17. Water budgeting for sericulture

Particulars	Water requirement (litres)
No. of plants per ha (5+3 x 2 ft)	13,900
Mulberry leaf yield (kg/ha/year)	50,000
Water requirement per plant (@ 2lit per day)	27,800
Total water requirement per hectare per year (*considering 4 crops per year @ 65 days irrigation per crop)	7,228,000
Water requirement for production of one kg leaf	144.56
Water requirement for production of one kg cocoon (@ 25 kg for BV and 22.5 for CB kg. leaf/kg of cocoons)	3,614 (BV) 3,253 (CB)
Water requirement for production of one kg yarn (@ 6.5 renditta for BV; 7.6 for CB, including 600 litres water required for reeling with ARM and 300 litres water for MRM)	24,091 (BV) 25,020 (CB)

*Excluding one crop harvested during the monsoon season

Table 18. Comparative standards of ISA (International Silk Association) and Chinese CIQ (Chinese Quality Index) [for 3A grade, 20/22 Denier raw silk]

Characteristics	ISA	CHINESE	Comparison of Chinese with ISA
Size deviation (d)II	1.35 or less	1.35 or less	Identical
Evenness variation I	170 or less	* 160 or less	-----
Evenness variation II	175 or less	14 or less	More stringent
Cleanness (%)	95 or more	95 or more	Identical
Avg. Neatness (5)	92 or more	90 or more	Less stringent
Low Neatness (%)	87 or more	---	----
Max deviation (d)	* 3.6 or less	* 3.8 or less	Less stringent
Evenness variation III	* 1 or less	* 1 or less	Identical
Winding breaks	* 10 or less	* 16 or less	Less stringent
Tenacity (g/d)	* 3.7 or more	* 3.6 or more	Less stringent
Elongation (%)	* 18 or more	* 18 or more	Identical
Cohesion (Strokes)	* 60 or more	* 70 or more	More stringent

**Auxiliary Tests*

Table 19. Universities/Institutions/Colleges offering Under-Graduate, Post-Graduate courses and research opportunities

	Name of the University	Name of the College	Courses Offered			Remarks
			B.Sc.	M.Sc.	Ph.D.	
1	Tamil Nadu Agriculture University, Coimbatore (1970 onwards)	Forest College & Research Institute, Mettupalayam, TN	√			Intake Capacity-30
		Agriculture College & Research Institute, Coimbatore	√			Sericulture as a single paper in B.Sc. course
		Dept. of Sericulture, TNAU, Coimbatore		√	√	Intake Cap. 5
2	Sher-e-Kashmir University of Agri Sciences & Technology, Srinagar	Dept. of Sericulture, SKUAST-K 2006 B.Sc. & 1998 M.Sc.	√	√	√	Intake B.Sc. :30, M.Sc. :13
3	Sher-e-Kashmir University of Agri Sciences & Technology, Jammu	Dept. of Sericulture, SKUAST-J, M.Sc. 2002		√	√	Intake M.Sc: 7
4	Shri Krishnadevaraya University, Anantapur (AP)	Department of Sericulture		√		Intake Cap. 10
5	University of Agricultural Science (UAS), Bengaluru	College of Sericulture, Chintamani,1986	√			Intake Cap. 35
		Department of Sericulture, 1986		√		Intake Cap. 7
6	Assam Agriculture University, Jorhat (Assam)	College of Sericulture, Jorhat (Assam)	√			Intake Cap. 35
		Department of Sericulture		√		Intake Cap. 5
7	University of Kalyani, Kalyani, West Bengal	Dinabandhu Andrews College, Kolkata	√			Intake Cap. 30; 6 enrolled this year.
		Krishna Nath College, Berhampore	√	√		Intake B.Sc.-50, M.Sc – 25
8	University of Mysore	Maharani ScienceCollege for Women; Yuvaraja College, Mysuru	√	√		Sericulture one of the subjects in B.Sc. M.Sc.-20 seats
9	Tilka Majhi University, Bhagalpur (Bihar)	Bihar Institute of Silk & Textiles, Nath Nagar, Bhagalpur	√			B.Tech./B.Sc. in Silk Technology
10	Tumkur University, Tumkur(Karnataka)	Sri Siddhartha First Grade College, Tumakuru	√			Sericulture one of the subjects in B.Sc.
11	Autonomous Institution	MPC Autonomous College, Baripada, Mayurbhanj, Odisha	√			Intake Capacity 32
12	Sri Padmavati MahilaVisvavidyalayam, Tirupati (AP)	Department of Sericulture		√	√	Intake M.Sc. Seri – 10
13	Raigunj University North Dinajpur, WB	Raigunj University North Dinajpur, WB		√		
14	Shivaji University, Kolhapur (MAH)	Shivaji University, Kolhapur (MAH)		√		

Table 20. Contribution of various technologies in mulberry pre-cocoon sector in terms of economic gain

Sl.No.	Factor	Traditional	Improved	Increase		Additional revenue generated
				Quantity	%	
Mulberry variety and Silkworm race						
1.	Variety&Leaf yield/ha/annum	M5(K2) - 30 MT	V1 - 50MT	20MT	67%	Rs234,000 (BV) Rs 189,000 (CB)
2	Silkworm race	PM X NB4D2 @45Kg./100dfls 2,500 dfls, 1125 kg. cocoons Rs 300/kg, Rs 3.37 lakh	PM X CSR2 @ 60 kg./100 dfls 2,250dfls/annum, 1350 kg cocoons Rs 350/kg, Rs 4.20 lakh	225 kg	25%	Rs 83,000
		PMXCSR2 @ 60 kg./100 dfls 2,250dfls/annum, 1350 kg cocoons, Rs 350/kg, Rs 4.82 lakh	Double hybrid@65 kg/100 dfls 2,000 dfls/annum, 1,300 kg cocoons Rs400/kg, Rs 5.30 lakh	50 kg. cocoons/annum; Improvement in cocoon quality	5%	Rs 20,000(Additional cocoon yield of 50 kg. @ Rs 400 per kg)
Rearing and cultivation practices – Additional income generated						
3	Spacing	Closer (60x60cm) - 45MT	Wider(150 X 90+ 60cm) – 50 MT	5 MT addl. leaf yield	10%	Rs 65,000(with additional brushing of 250 BV dfls)
4	Disinfectants	General disinfection	Bed disinfectants	Higher cocoon yield;Reduction in defective cocoons percentage	10%	Rs31,500/-, 90 kg.addl. cocoon production
		CB	2,000dfls			
		BV	2,000 dfls		10%	Rs 52,000/-, 130 kg.addl. cocoon production
Rearing and cultivation practices – Reduction in Expenditure (on labour)						
5	Leaf/shoot Harvest	Leaf harvest – 375 mandays (Rs 112,500 @ Rs300 per manday)	Shoot harvest – 200 mandays Rs 60,000	175 man days saved	53% reduction	Rs 52,500 saved
6	Chawki Rearing	Individual brushing Rs120,000 (Rs 6,000/100 dfls)	Chawki from CRCs Rs 60,000(Rs3,000/100 dfls)	Expenditure and time saving	50%reduction	Rs60,000 saved
7	Shelf Rearing method (Late age) Labour requirement	Tray rearing 64 man days/100 dfls 1,280 mandays/2,000 dfls	Shelf rearing 32 mandays/100 dfls 640 mandays/2000 dfls		50% reduction	Rs192,000 saved
8	Improved mountages	Bamboo *chandikaes* Rs36,000@ 120 mandays for 2,000 dfls	Plastic *chandrikae* Rs18000@ 60 mandays for 2,000 dfls	Labour saving	50%reduction	Rs 18,000 saved

**Partial budgeting technique was used to analyse the impact of technologies*

Table 21.Contribution of various technologies in mulberry post-cocoon sector in terms of economic gain

Sl. No.	Factor	Traditional	Improved	Increase		Additional revenue generated
				Quantity	%	
POST COCOON SECTOR						
1	Reeling package (Multi-bivoltine)	Cottage basin associated with steam stifling and open pan cooking, open type re-reeling- Renditta7.75-7.8, 10 kg. silk /8 hRs,B grade silk	Multi-end reeling with Hot air drying, Steam cooking (Pressurized) with closed -type re-reeling Renditta7.25-7.5, 13 kg. silk /8 hrs,A-2A grade silk	900 kg. Per annum	30 B to A-2A grade	Rs2.25 lakhs due to higher production + Rs 3.90 Lakhs per annum due to better quality
2	Reeling package(Bivoltine)	Multi-end machinery package Renditta6.5-6.7, 13 kg. silk /8 hRs,2A grade silk	Automatic reeling machinery package Renditta6-6.5, 110 kg. silk /12 hrs,4A grade silk	Production of superior 4A grade raw silk in bulk quantity consistently which is import substitute 50% reduction in labour cost		In case of Automatic reeled silk profit/kg is Rs400-500 whereas in multi-end reeled silk it is Rs200-250.

Table 22. Contribution of various technologies in non-mulberry post-cocoon sector in terms of economic gain

	Factor	Traditional	Improved	Increase		Additional revenue generated
				Quantity	%	
1	Tasar cocoon cooking	Cooking of tasar cocoons using Soda - cooking is not uniform with more waste generation.	Tasar plus chemical has been developed for tasar cocoon cooking- it results in uniform cooking; more yield and improvement in yarn quality	100-150 gm more yarn produced per 1000 cocoons	10-15	Rs 450-600 per 1000 cocoons
2	Wet Reeling	Reeling of tasar cocoons by dry reeling - yarn reeled has no cohesion and strength and can be used for weft only	Wet reeled tasar yarn can be used for both warp and weft. The yarn has better cohesion and strength and elongation	Reduction of number cocoons required per one kg yarn from 1000 to 810	25-30	Rs 1000-1200 per 1000 cocoons
3	Buniyaad reeling machine	Thigh reeling- it gives low production (70-80 gm per day) , low quality and more drudgery involved	Buniyaad reeling machine- significant improvement in quantity, quality and drudgery elimination with production of 200-250 gm per day, used for weft	150- 200 gm per day	200-300	Rs 200-250 per day
4	Motorized reeling cum twisting machine (MRTM)	Thigh/Bhir reeling- it gives low production (70-80 gm per day) and low quality	MRTM- it gives production of 200-250 gm per day of good quality of twisted yarn used for both warp and weft	150-200 gm per day	200-300	Rs 200-250 per day in case of Tasar. Rs 400-450 per day in case of Muga
5	Motorized cum pedal operated spinning machine (MPSM) for eri cocoons	Takli spinning- It gives low production (60-70 gm per day), low quality of Eri spun yarn and can be used for weft	MPSM-it gives production of 200-250 gm per day of good quality Eri spun silk yarn, can be used for both warp and weft	100-150 gm per day	100-200	Rs 200 per day
6	Eri Mill spinning technology	Traditionally, eri spinning is carried out with Takli spinning method with low productivity and quality	Eri Mill spinning – it is for production of 100-110 kg superior quality Eri spun silk yarn in large scale. The yarn can be used in power loom, high speed shuttle less loom and knitting machines etc.	100 -110 kg per day	1000 times	Rs 1000-2000 per kg yarn
7	Sonalika reeling machine for muga weft yarn	Bhir reeling; gives low production and low quality (50-60 gm per day)	Sonalika Reeling machine- it gives production of 200-250 gm per day of good quality used for weft	200-250 gm per day	200 – 300	Rs 400-450 per day

Table 23. Contribution of various technologies in Tasar sector in terms of economic gain

#	Factor	Traditional	Improved	Increase		Additional revenue generated
				Quantity	%	
Host plant variety and Silkworm race						
1	Tasar race/breed	Daba (Bivoltine) (42 cocoons/dfl)	BDR-10 (Yellow coloured larvae) (51 cocoons/df)	9 cocoons/ dfl	21.0	Rs 5400/- per ha -1800 additional cocoons
Rearing and cultivation practices – Additional income generated						
1	Nursery technique for raising *Terminalia arjuna* (Arjun)	Traditional method of nursery (Survival-42%)	Nursery technique for raising *Terminalia arjuna* (Arjun) seedlings. (Survival -72 %)	300 seedling/ 1000 seed	30	Rs 1200/1000 seed (@Rs 4.0/ seedling)
2	Chawki rearing of tasar silkworm under nylon net	Brushing of tasar larvae directly at outdoor condition (Average 40-50 cocoons/dfls)	Chawki rearing under nylon net (Average 50-65 cocoons/dfls)	10-15 cocoons/ dfl	25-30	Rs 6000-9000/- (For 200 dfls rearing)
3	Semi- Synthetic Diet (Tasar Amrit)	Brushing of tasar larvae directly at outdoor condition (Average 40-50 cocoons/dfls)	Chawki rearing on Semi-Synthetic Diet (Approximately average 60-70 cocoons/dfls)	20 cocoons/ dfl	40-50	Around Rs 10000/- (For 200 dfls rearing)
4	Leaf surface Microbe	No existing Bio-control method to control Bacteriosis	LSM was developed to control bacteriosis in tasar silkworm	8-10 cocoons per dfl	10-15	For farmers Rs 3000 per 100 dfl
5	Jeevan Sudha	No existing botanical formulation to control Virosis	First time it was developed to control the virosis in tasar silkworm	10-12 cocoons per dfl	15	For farmers Rs 3600 per 100 dfl
Rearing and cultivation practices – Reduction in Expenditure (on labour)						
1	Spacing	4x4 feet (Unit cost: Rs 64,810)	10 x 6 feet (reduction in man power inputs & maintenance) (Unit cost: Rs 18,825)	Saving Rs 45985	344% reduction	Rs 45985/- ha
POST COCOON SECTOR						
1	Tasar cocoon cooking	Cooking of tasar cocoons using both sodium carbonate cooking deteriorates the silk fibroin and due to excessive breaks during reeling; waste generation is much higher.	Cocooning /softening process for Daba BV, Raily and Modal ecoraces of tropical tasar bv by using combination of Sodium carbonate and sodium bi-carbonate in different concentration and boiling and steaming time .	About 100 gm more yarn produced per 1000 cocoons and cost of cooking reduced by about 40%.	10	Rs 500 per 1000 cocoons
2	Reeling machine	Thigh Reeling production is 75 g per day	Motorized tasar Reeling Charkha (MTRC)*	About 350 g per day of 8 hours	36	Rs 250 per reeler per day for MTRC as against Rs 80 in case of Thigh reeling

Table 24. Contribution of various technologies in Muga Pre-cocoonsector in terms of economic gain

Sl. No.	Factor	Traditional	Improved	Increase		Additional revenue generated
				Quantity	%	
Host plant variety and Silkworm race						
1	Variety & Leaf yield /ha/annum	No evaluation of high yielding accessions / varieties	A total of 6 morph types of som were evaluated. S3 and S6 Som morpho-types were found suitable in terms of leaf yield, quality and rearing performances.	Leaf yield 1.6 to 1.9 kg/plant ERR 74-76%	20-25%	Rs. 30,000 per acre
Rearing and cultivation practices – Additional income generated						
3	Disinfectants	General disinfection	NaOCl based disinfectants (0.1%)	Higher cocoon yield; Reduction in defective cocoons	10%	Rs. 3,000/- per 100 dfls
Rearing and cultivation practices – Reduction in Expenditure (on labour)						
4	Chawki Rearing	No such practice	Reduces young stages loss of silkworm because of less attack of pest and predators	10-12% gain in cocoon production	10-12%	Rs. 30,000 saved per crop / 100dfs
5	Improved mountages	Traditional Jali (dry twigs)	Box type Bamboo mountage saves 90% spinning space. Also saves 60% manpower for harvestingreduces formation of cocoon floss	Labour saving and durability	Save 60% labour &reduce 90% space	Rs. 18,000 saved
Productivity improvement / crop protection measures						
6	Biological control of uzi fly	No practice to control of uzi fly	Two biological control agents, *viz*. *E. phillipinensis* and *Nesolynx thymus* have been identified and recommended for controlling uzi fly infestation.	Reduce 20-30 infestation during autumn crop	80% reduction	Rs. 18,000 saved
6	Integrated management of stem borer	The extent of damage caused by the caterpillar of stem borer is 60%.	control through botanicals (posotia, castor, neem, titabahak and dhatura), mechanical means (Plastic wrapping on the main trunk) and release of biological agent, *Trichogramma* species, during oviposition	minimise up to ≤ 1% where plugging of holes with 1.5% can control up to 95%.	Reduce infestation / plant mortality 10-20%	NA
7	Management of muscardine disease	Non availability of any product	Application of 0.1% "*Lahdoi",* ensures better ERR and less mortality of worms. Spray on food plants 7 days prior to brushing and transfer of silkworm. The second spraying is done at 15 days after 1st application	Ensures 40-70% ERR against 93-100% mortality without treatment	40-70%	Reduce loss up to 80%, saves Rs. 40000/- per 100 dfls during winter
13	Control of leaf blight disease of Soalu	Commercial fungicides	Plant extract of *Bougainvillea spectabilis* results86.3% reduction in disease severity. The product is named as Phyto-blighton and applied for patent.	86.3% reduction	10-20%	C:B 1: 3.48 in *B. spectabilis* against 1:2.77 in control.

**Partial budgeting technique was used to analyze the impact of technologies*

Table 25. Contribution of various technologies in Eri Pre-cocoon sector in terms of economic gain

Sl.No.	Factor	Traditional	Improved	Increase		Additional revenue generated
				Quantity	%	
Mulberry variety and Silkworm race/hybrid						
1.	Package of practices for castor cultivation	No systematic plantation / package-benchmark of 10 MT/ha/year	A non-bloomy red variety of castor (NBR-1), pit size of 20x25x25cm and 1x1m spacing. Chemical fertilizer NPK @ 60:40:20 kg/hea as 1st dose, 30 kg N/ha as 2nd dose after attaining the age 3 of three months. FYM 10MT/ha	Leaf production increased to 12 MT/ha/year	20%	Rs. 30,000 per acre
2	Package of practices for kesseru cultivation	No systematic package benchmark leaf yield-15 MT/ha/year	25-35 cm tall seedling transplanted in pits of 30x30x30cm size, at 2m x 2m spacing in plains and 3mx3m in hills, FYM @ 0.5 cft per plant and NPK @ 150:75:25 kg/ha/year	Increase in leaf production to 25 MT/ha/year	50-50%	Rs. 20,000 per 100 dfls
3	Eri C2 breed	Eco-races:6.5-7.8 in local race.	C2 breed produces 8-13 kg of cocoon shells/100 dfls against 6.5-7.8 kg/100 dfls in local race	8-13 kg of cocoon shells/100 dfls	50-80%	Rs. 15,000/- per 100 dfls
4	Disinfectants	General disinfection	Bed disinfectants	Higher cocoon yield; Reduction in defective cocoons	10%	Rs. 300/- per 100 dfls
Rearing and cultivation practices – Reduction in Expenditure (on labour)						
5	*Ailanthus grandis* (Borpat) – Perrinial host plant of Eri silkworm	Castor, Kesseru and Tapioca	Leaf yield- 8 MT /ha/year and rearing can be done throughout the year. Recently introduced in eri culture	Continuous rearing / round the year availability of leaf	Reduce labour cost	Additional income through out the year
6	Platform rearing technology of eri silkworm	Bunch rearing	Platform rearing consists of 3 nos. platforms each of 1m x 2m size made up of bamboo strips with sieve size of 1 sq.cm. Maximum of 1200 eri silkworms at 5th instar can be reared in each platform to accommodate total 7200 silkworms by brushing 25- 30 dlfs. In 5.4 sq m. space, 25 - 30 dfls can be reared against 12 - 16 dfls in traditional bunch method. It also improves all the cocoon characters with higher ERR about 90%	Save space Almost 3 times rearing capacity is increased over tray rearing	100% increase in dfl rearing capacity	Double the income in per unit area or rearing house
7	Collapsible mountage for eri	Traditional jail / Bunch rearing	Wooden collapsible strip type mountage has been developed in which good cocoon recovery is 99.75 %. It takes very less time for harvesting (100 cocoons / minute against 10 cocoons /minute in traditional jali). In a 90 X 60 cm size montage, around 500 ripened worms can be mounted for cocoon formation.	Save time and labour	80% reduction of labour cost	Rs. 5,000 saved /100 dfls

**Partial budgeting technique was used to analyze the impact of technologies*

Table 26. Contribution of various technologies in Post cocoon sector of Muga and Eri in terms of Economic gain

#	Factor	Traditional	Improved	Increase		Additional revenue generated
				Quantity	%	
1	Muga Cocoon Drying chamber	Sun drying or boiling for reeling purposes	Use locally available fuels like firewood, dry leaves *etc*. with capacity of 8000 number of muga cocoons suitable longer storage. The cost of the dryer is around Rs. 28,000/. No power required in comparison to electric oven.	Approx. 40,000 numbers of cocoons can be stifled and dried uniformly in 8-9 hours without loss of yarn quality.	NA	NA
2	Muga silk plus - an effective cooking chemical for muga cocoon	Traditional Khar and soda cooking method	can enhance the muga silk recovery up to 55%, against 40-48% silk recovery in traditional Khar and soda cooking method. This low-cost chemical (Rs. 30/ per 500 gm) is soluble in water. The quality of reeled yarn is also improved by this chemical.	Enhance muga silk recovery up to 50-55%, against 40-48% Silk recovery in traditional method.	10-15 %	Rs. 5,000/- per 10000 cocoons.
3	Motorized reeling cum twisting machine (MRTM)	Thigh/Bhir reeling- with 70-80 gm per day and low quality	MRTM- it gives production of 200-250 gm per day of good quality of twisted yarn used for both warp and weft	150-200 gm per day	200 – 300 %	Rs. 200 - 250 per day- Tasar. Rs 400-450 per day- Muga
4	Motorized cum pedal operated spinning machine (MPSM) for eri	Takli spinning- 60-70 gm per day & low quality	MPSM-it gives production of 200-250 gm per day of good quality Eri spun silk yarn, can be used for both warp and weft	100-150 gm per day	100-200 %	Rs 200 per day
5	Eri Mill spinning technology	Takli spinning method with every low productivity	Eri Mill spinning – it is for production of 100-110 kg superior quality Eri spun silk yarn in large scale. The yarn can be used in power loom, high speed shuttle less loom and knitting machines etc.	100 -110 kg per day	1000 times	Rs. 1000-2000 per kg yarn
6	Sonalika reeling machine for muga weft yarn	Bhir reeling low production and low quality (50-60 gm per day)	Sonalika Reeling machine- it gives production of 200-250 gm per day of good quality used for weft	200-250 gm per day	200 – 300 %	Rs 400-450 per day

**Partial budgeting technique was used to analyze the impact of technologies*

Table 27. Model Linkage programme for production of 100 MT of Bivoltine Raw Silk

I. From seed to yarn per year

1	Raw silk production target	100 MT
2	Automatic reeling machines	3 (400 ends each)
3	Cocoons required	710 MT
4	Chawki rearing centres required	3 @ 4 lakh DFLs/year
5	Eggs required	12.00 lakh
6	Mulberry area required	675 ha
7	No. of farmers required	1125 (0.6 ha)

II. Logistics for Turnkey Project management of Automatic Reeling Machine (ARM400 ends model)

1	Capacity	36 MT raw silk/ year
2	Cocoons required	236.5 MT (@6.5 renditta+10%)
3	Chawki Rearing Centre	1(@ 4.00 lakh DFLs capacity
4	Eggs required	4 lakh DFLs (@2000DFLs/ha/year+10%)
5	Mulberry area required	225 ha (@1200 kg cocoons/ha/per year+10%)
6	Number of farmers	375 (@ 0.6 ha)

III. Output and Value details per annum

End Product	Quantity (MT)	Price/kg (Rs)	Value (Rs in lakh)
Raw Silk (Mainproduct)	100	3800	3800
Silk Waste (By-product)	10	650	65
Dry Pupae (By-product)	20	40	8
Total value of production chain			**3873**

Table 28. Potential for employment generation through sericulture

a. Projected quantity

Silk	2019-20		2029-30		% increase
	Quantity (MT)	% to total	Quantity (MT)	% to total	
Mulberry	27000	70	42200	70	56.30
Vanya	11530	30	17800	30	54.38
Total	**38530**	**100**	**60000**	**100**	**55.72**

b. Employment generation

Silk	2019-20		2029-30		% increase
	Quantity (MT)	Employment generation (lakh persons)	Quantity (MT)	Employment generation (lakh persons)	
Mulberry	27000	43	42200	68	56.30
Vanya	11530	52	17800	80	54.38
Total	**38530**	**95**	**60000**	**148**	**55.25**

Table 29. Projected Factor Share for growth in Silk Production up to 2030

a. Mulberry

Sl. No.	Parameters	% contribution		
		Pre-cocoon	Post-cocoon	Total
1	Resources	9	6	15
2	Technology			
		Crop improvement: 10		
		Crop production: 4	Machinery/equipment: 6	
		Crop protection: 4	Process: 6	
		Total: 18	Total: 12	30
3	Infrastructure	15	10	25
4	Finance/Credit	6	4	10
5	Policy	3	6	9
6	Skill	9	2	11
	Total	**60**	**40**	**100**

b. Vanya

Sl. No.	Parameters	% contribution		
		Pre-cocoon	Post-cocoon	Total
1	Resources	30	10	40
2	Technology	9	6	15
3	Infrastructure	4	6	10
4	Finance/Credit	1	4	5
5	Policy	3	2	5
6	Skill	8	17	25
	Total	**55**	**45**	**100**

Table 30. Projected Raw Silk production (2030)

Year	Mulberry (MT)		Vanya (MT)				Grand
	Bivoltine	Total mulberry	Tasar	Eri	Muga	Total Vanya	
2016-17	5266	21273	3268	5637	170	9075	30348
2017-18	5874	22066	2988	6661	192	9840	31906
2018-19	6987	25345	2981	6910	233	10124	35468
2019-20	8500	27365	3515	7370	280	11165	38530
2020-21	10000	28900	4150	8000	300	12450	41350
2021-22	12000	31500	4460	8700	340	13500	45000
2022-23	12850	32850	4650	9000	350	14000	46850
2023-24	13800	34300	4840	9300	360	14500	48800
2024-25	14800	35800	5015	9615	370	15000	50800
2025-26	15800	37350	5200	9970	380	15550	52900
2026-27	17000	38800	5400	10400	400	16200	55000
2027-28	18000	39950	5600	10725	425	16750	56700
2028-29	19000	41100	5800	11050	450	17300	58400
2029-30	20000	42200	6000	11330	470	17800	60000

Table 31. Zone wise Sericulture Potential and Policy Prescriptions

Zone	Variety	Sericulture status and potential
Zone-I: Southern Karnataka, Andhra Pradesh, Tamilnadu, Kerala, Maharashtra	Mulberry Tasar	▪ Leading Mulberry silk producing Zone ▪ Scope for expansion of mulberry food plants for bivoltine and improved cross breed silk production ▪ Promote corporate sericulture with ARM and hinterland approach with farmers ▪ Promote large scale grainage, chawki rearing centre as Start-up ▪ Mechanisation in sericulture and by-product utilisation ▪ Scope for production of traditional sarees with GI tag and fashion garments for export ▪ Promote Seri Tourism
Zone-II: Central & Western Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Rajasthan & Gujarat	Mulberry, Tasar	▪ Non- traditional zone for mulberry expansion ▪ Potential for increasing tasar silk production base through augmentation of tasar food plants and seed multiplication infrastructure with community participation. ▪ Large scope for increasing the market for traditional designs viz., Banaras Sarees, Chanderi & Maheshwari sarees, Tribal designs, traditional prints etc. ▪ Need for stabilising Zari industry in Surat
Zone-III: Eastern West Bengal, Bihar, Jharkhand & Odisha	Mulberry, Tasar	▪ West Bengal has potential for increasing improved Cross Breed and Bivoltine mulberry silk ▪ Odisha and Jharkhand are major tasar producing states ▪ Replication of community-led extension, services and seed production model in Bihar and Jharkhand in other States ▪ Encourage private seed producers both in mulberry and tasar ▪ Additional investments in upscaling mulberry reeling and improved machines for tasar reeling, cocoon and yarn banks
Zone-IV: North West Uttarakhand, J&K, Punjab, Haryana, Himachal Pradesh	Mulberry and Oak Tasar	▪ High potential for bivoltine in hilly districts ▪ Potential traditional sericulture pockets may be promoted with additional inputs to increase its silk production base ▪ Limited crops. More revolving capital required for reeling units
Zone-IV: North East Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim & Tripura	Mulberry and Vanya Silk	▪ High potential for Muga, Eri and Oak Tasar ▪ A potential zone for women empowerment through Sericulture ▪ Scope for market improvement specially for eri silk ▪ Scope for product development and diversification for better value realisation-Organic silk

Table 32. Summary of Suggested Policy Prescriptions

	Stake Holders	Requirements / Issues	Policy prescriptions
1	**Silkworm Seed Producers**	▪ Supply of quality seed in required quantity at reasonable price	▪ Support private sectors to produce quality seed to bridge the gap ▪ Regulate the price of seed cocoons and dfls ▪ Infrastructural and seed cocoon support to private grainers ▪ Regulate quality standards through system and product certification ▪ Govt. system to provide good breed and parental stock
2	**Chawki Rearing**	▪ Supply of quality chawki worms at reasonable price	▪ Regulate quality standards of chawki worms ▪ Quality assurance: Chawkirearers to compensate crop loss caused due to diseased chawki worms ▪ Regulate seed cocoon price and chawki silkworm price
3	**Farmers**	▪ Good rearing house with mounting space ▪ Access to improved technology ▪ Area expansion ▪ improved host plant and silkworm breed ▪ Price fluctuation for cocoons resulting in distress sale ▪ Knowledge gap on soil health, water management, disease control. * Need for mechanisation and skilled labour ▪ Sericulture farmers to get facility on par with other agriculture farmers	▪ ProMoTe construction of scientifically designed rearing house with mounting space ▪ Strengthening extension system at central, state and private level. ProMoTe group approach SHG, CBO, FPC for service delivery and extension ▪ Make available improved host plant varieties, silkworm breeds (season and region specific for 5 seri zones) with based seed stock readily available to farmers ▪ Specific policy to expand sericulture in potential new area in both traditional and non traditional states. ▪ Integration of sericulture with other farming activities ▪ Cocoon gradation, Quality based pricing system, cocoon storage facility at cocoon markets ▪ SVK on sericulture, Seri Resource centres, seri-polyclinic, seri-input supply centres, door to door disinfection centres attached to Chawki rearing centre ▪ ProMoTe machinery manufacturers and hire service units involving rural youth; promote skill upgradation machinery handling and repair ▪ Sericulture to be treated on par with agriculture to get the benefits of power subsidy, agriculture subsidy, support under national calamity disaster fund, etc.
4	**Reelers**	▪ Upgrade from charka, cottage basin to MRM and ARM ▪ Limited resource for upgradation ▪ Requirement of higher revolving fund	▪ improved machines for vanya yarn, ▪ product diversification, by-product utilisation ▪ indigenous and imported reeling machinery for mulberry, ▪ Reelers to be treated under special package for upgradation; Reeling units to be upgraded under MUDRA scheme, grant in aid ▪ promote credit flow to silk sector; specially reeling ▪ Skill upgradation to make available skilled manpower
5	**Weavers**	▪ Need for better market and price for handloom products	▪ promote traditional design Banks, GI and handloom tags; improve dye and weaving quality, design intervention, surface ornamentation for better price ▪ Improved technology for drudgery reduction and productivity improvement

			▪ Fancy, knitwear and value added products
6	**Consumers**	▪ Need quality silk ▪ Consumer protection on unscrupulous sale of art silk	▪ Popularisation of silk mark and awareness on pure silk, varieties of silk ▪ Generic and brand promotion of Indian silk ▪ Quality testing facilities across silk value chain to maintain quality standards ▪ SMOI need to have a strong legally framed surveillance mechanism to check unscrupulous sale of art silk in the name of pure silk
7	**Exporters**	Stagnated growth in silk export	▪ Generic and brand promotion of Indian silk in global markets ▪ Quality testing facilities to maintain quality standards, BIS standards ▪ Product mix, new designs, Organic silk as per the demands of global market ▪ Export Market Research and Selection; Export Market Brand Strategy, Export Market Sales and Distribution. ▪ Trade desk to promote quantum jump in silk trade, specially export
8	**Seri Business Enterprise**	Low investment in sericulture, drought, depleting water table, climate change	▪ Institutional credit support ▪ Smart climate resilient sericulture to make it more productive, sustainable and economically viable, ▪ FDI, Venture Capital, incubation centre, start-up, Corporate sericulture to promote seri business enterprises
9	**All Stake holders**	▪ Limited resources from Central and State level to implement sericulture development programmes to reach majority of the beneficiaries ▪ Knowledge gap in sericulture ▪ Silk Yarn Price volatility ▪ Shortage of skilled manpower	▪ Tap resources from Industry Corporate Houses to support silk clusters under CSR; Increase fund flow for silk sector under MGNREGS, RKVY, MUDRA by making specific allocation for the sector ▪ Enhance credit flow to sericulture to promote more investment; Sericulture to find separate place in NABARD yearly credit plan ▪ Introduce sericulture in Science subject curricula at high school level (both theory and practical) so as to mitigate the knowledge gap in sericulture for Bankers, Policy Planers, Administrators ▪ Price Stabilisation, Price insurance, Cocoon and Yarn Bank ▪ Corrective measures on customs duty, GST, Antidumping duty, etc, to stabilise silk price ▪ Capacity building and training, service delivery through CBO, Cluster approach, Para Professional, Technical consultants for skill upgradation ▪ Evolving into a new generation ICSRE (Indian Council for Sericulture Research and Education) Deemed University to promote formal research and education in silk sector ▪ Policy implementation desk to promote sustainable sericulture business enterprises

ANNEXURES

Annexure-1

Meetings of the Committee

No.	Date	Place
I	24 December, 2019	CSB, Bengaluru (Meeting with Member Secretary, CSB)
II	20-21 January, 2020	CSRTI, Mysuru
III	19-20 February, 2020	CSB, Bengaluru
IV	28-29 February, 2020	CSRTI, Mysuru
V	13 March, 2020	CSB, Bengaluru (Meeting with State Departments. of Sericulture&Final Meeting with the Member Secretary, CSB)
VI	20 March, 2020	Submission of the Policy document to the Member Secretary, CSB, Bengaluru
Meetings with Seri-farmers, Enterprise and other Stakeholders by the CSB		
I	26 November, 2019	New Delhi
II	23 December, 2019	Bengaluru

Annexure-2

Feedback from stakeholders received during Meetings held at New Delhi on 26 November, 2019; and CSB, Bengaluru on 23 December, 2019

Farmers:

- Ensure parity with agriculture sector on incentives, tax structure, credit flow, etc.
- Facilitate timely supply of quality seed through advanced planning in production and supply at State/National level and uniform pricing of Seed
- Include sericulture in the NABARD approved agriculture schemes for credit flow
- Crop insurance at par with agriculture sectorfor host plant and silkworm crop through NDRF / SDRF schemes
- Incentive for quality cocoon production

Reelers:

- Assured supply of quality bivoltine cocoons in adequate quantities; Strengthening of extension mechanism at State level
- Encourage development of indigenous ARMs
- Promote solar operated reeling machines in Vanya sector for expanding the activities in remote areas
- Substantial improvement needed for enhancing the credit flow
- Since countries like Vietnam have been given MFN status, the rawsilk arriving from Vietnam is duty-free. China is using this opportunity and shifting its production base by installing more ARMs in Vietnam and dumping duty free raw silk to this country. As a result, Indian traders are buying the imported quality raw silk at cheaper rates instead of raw silk produced by ARMs in the country
- GST exemption/reduction on silk machinery

Weavers:

- Need for supply of warp quality indigenous silk in required quantities
- Focus on integrating ethnic designs with present day products and involvement of young generations under entrepreneur mode

Exporters:

- Branding and promotingof Indian silk in international markets
- Facilitate small exporters to expand their reach in international market

ABBREVIATIONS &ACRONYMS

ASR	-	Adopted Seed Rearers
AEO	-	Authorized Economic Operator
ARM	-	Automatic Reeling Machine
ASCI	-	Agriculture Skill Council of India
BC	-	Before Christ
BCR	-	Benefit: Cost Ratio
BIS	-	Bureau of Indian Standards
BP	-	Business Promotion Cell
B.Sc.	-	Bachelor of Science
BSI	-	Botanical Survey of India
BT	-	Biotechnology
BV	-	Bivoltine
CAGR	-	Compounded Annual Growth Rate
CAMPA	-	Compensatory Afforestation Fund Act
CB	-	Cross Breed
CBO	-	Community Based Organization
CED	-	Centre for Entrepreneurship Development
CIG	-	Common Interest Group
CIQ	-	Chinese Quality Index
CoT	-	Commissioner of Trade
CSB	-	Central Silk Board
CSP	-	Carbon Sequestration Potential
Cr	-	Crore
CRC	-	Chawki Rearing Centre
CRP	-	Community Resource Persons
CSR	-	Corporate Social Responsibility
CSRTI	-	Central Sericultural Research & Training Institute
DARE	-	Department of Agricultural Research and Education
DFL	-	Disease Free Laying
DG	-	Director General
DOS	-	Department of Sericulture
EDII	-	Entrepreneurship Development Institute of India
EXIM Policy	-	Export Import Policy
FDI	-	Foreign Direct Investment
FIG	-	Farmer Interest Group
FPC	-	Farmers Producer Company
FPO	-	Farmers Producer Organization
FRA	-	Forest Rights Act
FTA	-	Free Trade Agreement
ETP	-	Effluent Treatment Plant
FYM	-	Farm Yard Manure
g/gm	-	Gram
GDP	-	Gross Domestic Product
GOI	-	Government of India
GIM	-	Green India Mission
GIS	-	Geographic Information System
GOTS	-	Global Organic Textile Standard
GST	-	Goods and Service Tax
GVA	-	Gross Value Added

ha	-	Hectare
HID	-	Human and Institutional Development
HQ	-	Headquarter
HSN	-	Harmonized System of Nomenclature
HTHP	-	High Temperature High Pressure
ICAR	-	Indian Council of Agricultural Research
ICB	-	Improved Cross Breed
ICFRE	-	Indian Council of Forestry Research & Education
ICSRE	-	Indian Council of Sericulture Research & Education
IEC	-	Information Education and Communication Programmes
IFPRI	-	International Food Policy Research Institute
INM	-	Integrated Nutrient Management
IPCC	-	Intergovernmental Panel on Climate Change
IPM	-	Integrated Pest Management
IRR	-	Internal Rate of Return
ISA	-	International Silk Association
ISC	-	International Sericulture Commission
ISEPC	-	Indian Silk Export Promotion Council
IT	-	Information Technology
KVK	-	*Krishi Vigyan Kendra*
LFPR	-	Labour Force Participation Rate
m	-	Metre
MAH	-	Maharashtra
MFN	-	Most Favoured Nation
Mg	-	Milligram
MGNREGA	-	Mahatma Gandhi National Rural Employment Guarantee Act
MGNREGS	-	Mahatma Gandhi National Rural Employment Guarantee Scheme
MKSP	-	*MahilaKisanSashaktikaranPariyojana*
MoA&FW	-	Ministry of Agriculture & Farmers' Welfare
MoEF&CC	-	Ministry of Environment, Forest & Climate Change
MoC	-	Ministry of Commerce
MoRD	-	Ministry of Rural Development
MoT	-	Ministry of Textiles
MRM	-	Multi-end Reeling Machine
M.Sc.	-	Master of Science
MT	-	Metric Tonne
MTA	-	Material Transfer Agreement
MUDRA	-	Micro Units Development and Refinance Agency
NABARD	-	National Bank for Agriculture & Rural Development
NBA	-	National Biodiversity Authority
NDRF	-	National Disaster Relief Fund
NGO	-	Non Governmental Organization
NIESBUD	-	National Institute for Entrepreneurship and Small Business Development
NiMSME	-	National Institute for Micro, Small and Medium Enterprises
NMSA	-	National Mission on Sustainable Agriculture
NPV	-	Net Present Value
NRAA	-	National Rainfed Area Authority
NRLM	-	National Rural Livelihood Mission
NSP	-	National Silk Policy
NSQF	-	National skill Qualification Framework
NSSO	-	National Silkworm Seed Organisation
%	-	Percentage

PCT	-	Post Cocoon Technology
Ph.D.	-	Doctor of Philosophy
PIA	-	Project Implementing Agency
PKVY	-	*Paramparagat Krishi Vikas Yojana*
PMBY	-	Prime Minister *FasalBima Yojana*
PMC	-	Project Monitoring Committee
PMKY	-	Prime Minister *Kisan Yojana*
PMSY	-	Prime Minister *Sinchay Yojana*
PPP	-	Public-Private participation
PPV&FRA	-	Protection of Plant Varieties & Farmers' Right Authority
PSU	-	Public Sector Undertaking
QCS	-	Quality Control System
QTL	-	Quantitative Trait Locus
RAC	-	Research Advisory Council
RCC	-	Research Coordination Committee
RCS	-	Research Coordination Section
R&D	-	Research & Development
REC	-	Research Extension Centre
RKVY	-	*Rashtriya Krishi Vikas Yojana*
Rs	-	Rupees
RSP	-	Registered Seed Producers
RSRS	-	Regional Sericulture Research Stations
SC	-	Scheduled Caste
SDC	-	Swiss Agency for Development and Cooperation
SDG	-	Sustainable Development Goal
SDRF	-	State Disaster Relief Fund
SHG	-	Self Help Group
SHM	-	Soil Health Mission
SIDBI	-	Small Industrial Development Bank of India
SILKS	-	Sericulture Information Linked Knowledge System
SKUAST	-	Sher-e-Kashmir University of Agri Sciences & Technology
SMAF	-	Sub-Mission on Agro-Forestry
SMOI	-	Silk Mark Organisation of India
ST	-	Scheduled Tribe
SWOC	-	Strength, Weaknesses, Opportunities& Challenges
TDF	-	Tribal Development Fund
TNAU	-	Tamil Nadu Agriculture University
TRIFED	-	Tribal Cooperative Marketing Development Federation of India Limited
UAE	-	United Arab Emirates
UHS	-	University of Horticultural Sciences
UNDP	-	United Nations Development Programme
US$	-	Unites States Dollar
WB	-	West Bengal
WTO	-	World Trade Organization
Yr	-	Year
ZSI	-	Zoological Survey of India

*****