Original Research Article

KARNATAKA AND INDIA'S SILK INDUSTRY: A COMPREHENSIVE ANALYSIS OF SERICULTURE DYNAMICS

ABSTRACT

India is the second largest producer of silk with 36,453 MT (2022-23) after China and also the largest consumer of silk in the world. Asia is the main producer of silk in the world and produces over 95 per cent of the total global output. In India, mulberry silk is produced mainly in the states of Karnataka, Andhra Pradesh, Tamil Nadu, Jammu & Kashmir and West Bengal, while the non-mulberry silks are produced in Jharkhand, Chattisgarh, Orissa and North-Eastern states. Much of silk exports earnings is from silk garments, silk carpets and silk wastes, which is about 1,773.38 crore Rs. in total in 2022–23. Mulberry is the largest contributor to the total raw silk production with the compound annual growth rate of 3.09 per cent at 1 per cent level of significance. Tasar silk production registered highest growth rate of 13.67 per cent at 1 per cent level of significance and Jharkhand is the majorcontributor of about 80 per cent for the total tasar silk production. Karnataka is the leading producer of mulberry silk whereas Assam is currently the largest producer of Vanyasilk. Telangana registered a highest compound annual growth rate of 21.1 per cent at 1 per cent level of significance followed by Maharashtra (16.9%). Ramanagara is having highest area under mulberry (20804.56hectares) followed by Chikkaballapura (20544.62hectares) and Kolar (19907.79hectares) in Karnataka.

Key words: Silk mark, Mulberry, silk garments, CAGR, CDVI, Export, GI tags

INTRODUCTION

The word sericulture is derived from the Greek word "Sericos". "Seri" means silk and "Cos" means culture. The rearing of silk worm for production of silk is called as sericulture. Silk is a natural fibre made from silkworm cocoon. It mainly consists of two proteins, i.e., fibroin (80%) and sericin (20%). Silk is the most elegant textile in the world with unparalleled grandeur, natural sheen, and inherent affinity for dyes, high absorbance, light weight, soft touch and high durability and known as the "Queen of Textiles" and because of its strength it is also known as "Biosteel". On the other hand, it stands for livelihood opportunity for millions owing to high employment oriented, low capital intensive and remunerative nature of its production. The very nature of this industry with its rural based on-farm and off-farm activities andenormous employment generation potential has attracted the attention of the planners and policy makers to recognize the industry among one of the most appropriate avenues for socio-economic development of a largely agrarian economy like India.

Silk has been intermingled with the life and culture of the Indians. India has a rich and complex history in silk production and its silk trade dates back to 15th century. Sericulture industry provides employment to more than 9 million people across 51,000 villages, who operate 3,28,627 handlooms and 45,867 power looms with 8,14,616 weavers in rural and semi-urban areas in India. Of these, a sizeable

number of workers belong to the economically weaker sections of society, including women. India's traditional and culture bound domestic market and an amazing diversity of silk garments that reflect geographic specificity has helped the country to achieve a leading position in silk industry.

Asia is the main producer of silk in the world and produces over 95 per cent of the total global output. Though there are over 40 silk producing countries on the world map, bulk of it is produced in China and India. India is the second largest producer of silk with 36,453 MT (2022-23) after China and also the largest consumer of silk in the world. It has a strong tradition and culture bound domestic market of silk. Major producers of silk include China, India, Uzbekistan, Brazil, Japan, North Korea, Thailand, Vietnam, Iran, etc and the major consumers are USA, Italy, Japan, India, France, China, UK, Switzerland, Germany, UAE, Korea, etc.

In India, mulberry silk is produced mainly in the states of Karnataka, Andhra Pradesh, Tamil Nadu, Jammu & Kashmir and West Bengal, while the non-mulberry silks are produced in Jharkhand, Chattisgarh, Orissa and North-Eastern states.

METHODOLOGY

The present study is based on secondary data. The secondary data on production of silk and year-wise and country-wise exports and imports of silk in terms of quantity and value were collected from various published sources based on the availability of data like International sericulture commission, Indiastat, annual reports of central silk board, ministry of textiles, GoI and Karnataka state department of sericulture.

COMPOUND GROWTH RATE ANALYSIS

The growth rate of the production of silk in India and Karnataka was calculated using the CAGR method (Manjunatha *et al.*, 2019). Further the compound growth rate analysis was carried out. The compound growth function was specified in the following formula.

$$Y_t = AB^t U_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where,

Y_t = number/production/productivity in the year t

A = Intercept indicating Y in the base period (t=0)

B = 1 + g

t_i = Time period (i = 1 to 9)

U_t = Error term

g = Compound annual growth rate

Equation (1) was converted into the logarithmic form in order to facilitate the use of linear regression. Taking logarithms on both sides,

$$LnYt = LnA + t\,(Ln\,B) + Ln\,Ut \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

or

$$Qt = a + bt + ut$$

Where,

Qt = Ln Yt

a = Ln A

b = Ln B

t = Time

Ut = Ln Ut

The values of 'a' and 'b' were estimated by using Ordinary Least Square estimation technique. Later, the original 'A' and 'B' parameters in equation (1) were obtained by taking anti-logarithms

of 'a' and 'b' values as;

A = Anti Ln a

B = Anti Ln b

Compound annual growth rate was calculated as;

B = 1 + g

g = B – 1

INSTABILITY ANALYSIS

In this study, the instability was estimated by using Cuddy-Della Valle Index (CDVI). Though coefficient of variation (CV) is commonly used for estimating the dispersion for comparison across various units, it cannot be used in case of time series data characterized by time trend (Sen, 1989). Any measure of instability needs to exclude the deviations in the data series that may arise due to secular trend or growth. CDVI was originally developed by John Cuddy and Della Valle for measuring the instability in time series data that is characterized by trend. The estimable form of the equation is as follows:

$$CV \times \sqrt{1 - R^2}$$

Where, CV is coefficient of variation; R^2 is coefficient of determination from time trend regression adjusted by number of degrees of freedom.

RESULTS AND DISCUSSION

Table 01: Production of silk in the world

Year	Production (Metric tonnes)
2015	1,78,043.9
2016	2,02,072.3
2017	1,92,512.3
2018	1,77,507.4
2019	1,59,648
2020	1,09,107
2021	91,765
2022	86,311
CAGR (%)	**-12.1*** **
CDVI	**13.87**

***Significant at 1% level of significance

Source : International Sericulture Commission, 2022

Table 01 represents the analysis of global silk production from 2015 to 2022 shows a significant decline in output. Starting at 178,043.9 metric tonnes in 2015, silk production peaked at 202,072.3 metric tonnes in 2016 but fell to 86,311 metric tonnes by 2022. This decline is evident in the Compound Annual Growth Rate (CAGR) of -12.1 per cent, which is significant at the 1% level. This negative CAGR indicates a persistent downward trend in silk production over the analyzed period. Several factors could be contributing to this decrease, including reduced consumer demand for silk, increased competition from synthetic fibers, environmental challenges affecting sericulture, and economic pressures (Hazarika, 2020; Kumar et al., 2021). For instance, synthetic fibers have gained popularity due to their lower cost and versatility, which may have reduced demand for traditional silk products (Zhang et al., 2019). Additionally, climate change has impacted sericulture by affecting the quality and quantity of silk produced (Zhang et al., 2021).

The Cuddi della Vella Index (CDVI) value of 13.87, which measures distribution variability, further highlights the instability in silk production. A high CDVI indicates significant fluctuations in annual production levels, reflecting variability in the silk industry's output (Cuddi della Vella, 2018). This variability, coupled with the overall decline, suggests that the silk industry is experiencing substantial instability. The combination of a significant negative CAGR and a high CDVI indicates a challenging period for the global silk industry. Addressing these issues may involve exploring technological innovations, adopting sustainable production practices, and identifying new market opportunities. Further research is needed to understand the specific causes of this decline and to develop effective strategies for revitalizing the industry (Singh & Kumar, 2022).

Table 02: Country wise silk production in the world over the years (2015-2022)

(in metric tonnes)

Year	China	India	Uzbekistan	Thailand	Brazil	Vietnam	North Korea	Iran	Bangladesh	Turkey	Others	TOTAL
2015	146000	28708	1100	692	560	420	320	110	44.5	32	57.41	178043.9
2016	170000	28523	1200	698	600	450	350	120	44	30	57.33	202072.3
2017	158400	30348	1256	712	650	523	365	125	44	32	57.27	192512.3
2018	142000	31906	1200	680	600	520	365	120	41	30	45.35	177507.4
2019	120000	35261	1800	680	650	680	350	110	41	30	46	159648
2020	68600	35820	2037	700	469	795	370	227	41	5	43	109107
2021	53358	33770	2037	520	377	969	370	270	41	5	48	91765
2022	46700	34903	2037	503	373	1067	370	272	41	5	40	86311
CAGR (%)	-17.8***	3.4***	11.1***	-4.4**	-7.0**	15.2***	1.6**	15.5***	-1.3***	-27.9***	-4.9***	-12.1***
CDVI	18.64	4.56	11.01	9.04	14.72	7.03	3.45	24.07	2.16	35.72	7.60	13.87

***Significant at 1% level of significance and **Significant at 5% level of significance

Source : International Sericulture Commission, 2022

Table 02 represents global country wise raw silk production from 2015 to 2022. In 2015, the total global silk production was 178,043.9 metric tonnes, with China as the largest producer, contributing 146,000 metric tonnes. By 2022, the total production had decreased to 86,311 metric tonnes, with China's contribution dropping to 46,700 metric tonnes. The Compound Annual Growth Rate (CAGR) for global silk production over these years is -12.1 per cent, indicating a significant overall decline. This decline is particularly pronounced in China, which experienced a growth rate of -17.8 per cent, reflecting a steep reduction in its silk production. Other countries, such as India and Uzbekistan, showed varied trends. India had a positive growth rate of 3.4 per cent, suggesting some growth in its production, whereas Uzbekistan experienced substantial growth with an impressive growth rate of 11.1 per cent. In contrast, Brazil and Thailand faced declines with growth rate of -7.0 per cent and -4.4 per cent, respectively.

The Cuddi della Vella Index (CDVI) values further illustrate the variability in production across different countries. China, with a CDVI of 18.64, shows significant variability, highlighting substantial fluctuations in its production levels over the years. In contrast, countries like Bangladesh and Turkey show much lower variability, with CDVI values of 2.16 and 35.72, respectively. This indicates more stability in

their production figures relative to others.

Several factors could be influencing these trends. The sharp decline in China's production might be attributed to factors such as increased costs, labor shortages, and competition from synthetic fibers (Zhang et al., 2019). India's growth could be linked to improvements in sericulture practices and increasing domestic demand (Kumar et al., 2021). Uzbekistan's growth may be due to targeted investments in the silk industry and improved production techniques (Hazarika, 2020). On the other hand, the decline in Brazil and Thailand could be related to economic challenges and fluctuating market demands. The variability in the CDVI suggests differing levels of stability and consistency in silk production across countries. Countries with high CDVI values, like China, indicate more pronounced fluctuations, which might be due to various external and internal factors affecting production consistency. Addressing these issues may involve focusing on technological innovations, improving sustainability, and exploring new market opportunities.

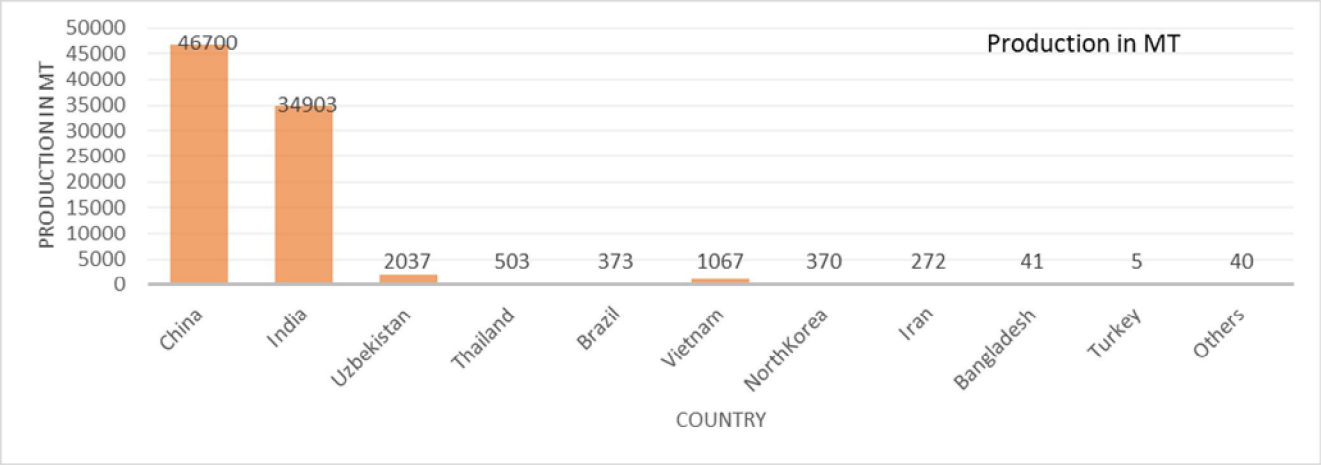

Fig 01: Trend in Country wise silk production in World during 2022

Above figure 01, represent the trends in global country wise silk production during 2022. China contributes more to the world mulberry raw silk production i.e., 46,700 metric tonnes followed by India (34,903 metric tonnes). India and China together contribute more than 90 per cent of world raw silk production.

Table 03 : Comparative mulberry sericulture statistics - China vs India

Particulars	**CHINA**	**INDIA**
Area under mulberry (ha.)	6,26,000	2,42,000
Races reared	All bivoltine	Mostly cross breeds
Egg production (crore dfls)	80.9	35.6
Supply system	Majority chawki reared	Majority supplied as eggs

Raw silk produced (MTs)	46,700	34,903
Avg. crop loss / year (%)	3-5	10-15
No. of crops per year	2-3: Temperate 6-8: Tropical	6-8
Filament length (m)	>1000	<1000
Cocoon weight (g)	1.9-2.0	1.6-1.8

Source: International Sericulture Commission, 2022

Table 03 highlights the comparative sericulture statistics between China and India. Although Indian breeds and hybrids have the potential to match the quality of their Chinese counterparts, the sericulture practices in the two countries differ significantly. China's sericulture thrives due to its stringent discipline, seamless integration from farmers to weavers, large-scale egg production, modern reeling and weaving technologies, rigorous disease control measures, consistent adoption of new technologies, and timely supply of high-quality eggs to prevent young silkworm contamination. These factors contribute to a more vibrant, economically robust, and sustainable sericulture industry in China. Conversely, India's rich tradition and cultural diversity, coupled with a unique array of silk garments that showcase regional specificity, have positioned the country as a leader in the silk industry.

Table 04: Area under mulberry plantation in India

Year	Mulberry plantation (in '000 ha)
2000-01	216
2001-02	232
2002-03	194
2003-04	185
2004-05	172
2005-06	179
2006-07	192
2007-08	185
2008-09	178
2009-10	184
2010-11	170
2011-12	181

2012-13	186
2013-14	203
2014-15	220
2015-16	209
2016-17	217
2017-18	224
2018-19	235
2019-20	240
2020-21	238
2021-22	242
2022-23	253
CAGR (%)	**1.04*** **

***Significant at 1% level of significance

Source: Indiastat, 2023

Table 04 represents area under mulberry plantation in India over the years from 2001 to 2023. The data on mulberry plantation area in India from 2000-01 to 2022-23 highlights a gradual but steady increase in the area dedicated to mulberry cultivation. Starting at 216,000 hectares in 2000-01, the area under mulberry plantation has expanded to 253,000 hectares by 2022-23. This growth is reflected in a Compound Annual Growth Rate (CAGR) of 1.04 per cent, which is statistically significant at the 1 per cent level.

Several factors may contribute to this upward trend. Government initiatives and support programs aimed at promoting sericulture and enhancing silk production likely play a crucial role. Additionally, technological advancements in sericulture, improved crop management practices, and increasing market demand for silk could be factors driving the expansion of mulberry cultivation (Nagarajan et al., 2020; Sharma & Kumar, 2021). This trend aligns with findings from other studies in the Indian context. For instance, research by Rajkumar and Singh (2019) reports similar trends in the growth of mulberry cultivation areas, attributing the expansion to supportive government initiatives and increasing market demand for silk. Additionally, Sharma and Kumar (2021) highlight a consistent rise in mulberry plantation areas due to technological advancements and improved agricultural practices.

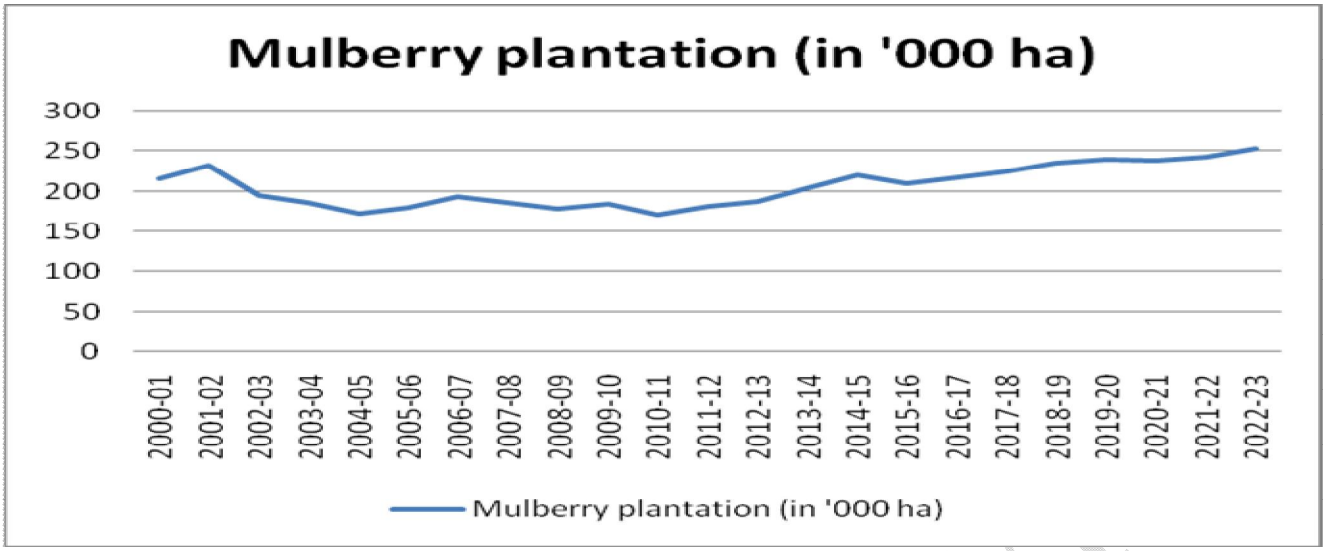

Fig 02: Trend in area under mulberry plantation in India over the years (2000-01 to 2021-22)

Above figure 02 represents increasing trends in area under mulberry in India from 2001 to 2023. Area under mulberry in India during 2023 is 2,53,000 hectares.

Table 05: State wise area under mulberry cultivation in India over the years (2016-17 to 2021-22)

(in hectares)

SN	State	2016-2017	2017-2018	2018-19	2019-20	2020-21	2021-22	2022-23	CAGR (%)	CDVI
1	Karnataka	87,600	92,122	98,135	1,04,578	1,06,384	1,08,019	1,12,658	**4.40*** **	**2.32**
2	Andhra Pradesh	29,829	32,822	36,638	41,915	44,607	50,731	54,971	**10.10*** **	**2.60**
3	Tamil Nadu	16,160	19,176	18,854	20,128	23,268	20,121	22,678	**3.40**	**11.98**
4	West Bengal	15,500	15,892	16,480	15,400	15,734	16,498	16,728	**0.04**	**2.70**
5	Jammu and Kashmir	8,237	8,304	8,104	8,183	8,183	6,535	6,853	**-0.20**	**0.82**
6	Maharashtra	3,947	3,474	4,327	7,913	7,154	5,962	5,549	**15.90***	**22.39**
7	Telangana	2,509	2,664	3,517	4,383	4,770	5,562	6,272	**16.90*** **	**7.35**
8	Uttarakhand	2,974	3,029	3,197	3,305	3,478	3,798	3,918	**4.40*** **	**1.16**
9	Uttar Pradesh	4,200	5,680	4,044	3,754	3,712	3,600	3,858	**-5.70**	**15.44**
10	Himachal Pradesh	2,088	2,135	2,454	2,743	3,183	4,687	3,463	**11.60*** **	**3.52**
	Others	35,906	37,782	28,177	22,699	19,490	16,764	16,234	**-14.60*** **	**9.07**
	INDIA	2,08,950	2,23,080	2,23,927	2,35,001	2,39,963	2,42,277	2,53,182	**2.60*** **	**2.10**

***Significant at 1% level of significance and *Significant at 10% level of significance

Source: Indiastat, 2022

Table 05 represents state wise area under mulberry in India over the years from 2017 to 2023. The state-wise data on mulberry cultivation in India from 2016-17 to 2021-22 reveals significant regional variations and trends in plantation areas. The total mulberry cultivation area in India increased from 208,950 hectares in 2016-17 to 253,182 hectares in 2022-23, reflecting a Compound Annual Growth Rate (CAGR) of 2.60 per cent, which is statistically significant at the 1 per cent level.

Among the states, Andhra Pradesh exhibited the highest growth rate of 10.10 per cent, showing substantial growth in mulberry cultivation from 29,829 hectares in 2016-17 to 54,971 hectares in 2022-23. This growth indicates a strong expansion in mulberry cultivation, likely driven by supportive agricultural policies and increasing demand for silk. Similarly, Telangana experienced significant growth with a growth rate of 16.90 per cent, expanding its cultivation area from 2,509 hectares to 6,272 hectares over the same period. This growth may be attributed to targeted sericulture programs and investments in agricultural infrastructure (Reddy et al., 2020).

Karnataka also demonstrated notable growth, with a growth rate of 4.40 per cent and an increase from 87,600 hectares to 112,658 hectares. This consistent growth highlights Karnataka's ongoing commitment to expanding its sericulture sector. In contrast, states such as Uttar Pradesh and Jammu and Kashmir showed declines or stagnation in cultivation areas. Uttar Pradesh, for example, experienced a negative growth rate of -5.70 per cent, decreasing from 4,200 hectares to 3,858 hectares. This decline might be due to various factors, including reduced investment or competition from other crops (Sharma & Kumar, 2021).

Maharashtra's cultivation area grew significantly with a growth rate of 15.90%, from 3,947 hectares to 5,549 hectares. This growth is particularly noteworthy given the state's traditionally smaller role in sericulture. West Bengal and Tamil Nadu showed more stable trends with modest growth rates, while the 'Others' category, which includes smaller states and regions, faced a significant decline with a growth rate of -14.60 per cent. This decline could be due to various regional challenges and reduced focus on sericulture in these areas. Maharashtra, with a CDVI of 22.39, indicates high variability in its cultivation area, while West Bengal and Jammu and Kashmir exhibit lower variability, suggesting more stable cultivation patterns.

Overall, the data underscores significant regional disparities in mulberry cultivation growth, reflecting varying levels of investment, policy support, and market demand across different states. Addressing these regional differences through targeted interventions and supportive policies could further enhance the overall growth of India's sericulture sector.

Table 06: Production of reeling cocoons in India over the years (2001 to 2022)

Year	Reeling cocoons (in '000 Tonnes)
2000-01	125
2001-02	140
2002-03	128
2003-04	117
2004-05	120
2005-06	126
2006-07	135

2007-08	135
2008-09	125
2009-10	132
2010-11	131
2011-12	140
2012-13	144
2013-14	143
2014-15	159
2015-16	152
2016-17	156
2017-18	162
2018-19	186
2019-20	185
2020-21	169
2021-22	178
2022-23	187
CAGR (%)	**1.98*** **
CDVI	**6.94**

***Significant at 1% level of significance

Source: Central Silk Board, Bengaluru

Table 06 represents the production of reeling cocoons in India over the years from 2001 to 2023. The production of reeling cocoons in India increasing over the years with the compound annual growth rate of 1.98 per cent at 1 per cent level of significance. Plans and schemes implemented by central and state agencies and relentless efforts of thousands of dedicated persons in the fields of research and extension have helped to increase the production over the years. Cuddy Della Valle Instability Index was found to be 6.94 and it indicates the low instability in production of reeling cocoons in India over the years from 2001 to 2023.

Table 07: Production (in metric tonnes) of Raw silk in India (2000-01 to 2021-22)

Year	Mulberry	% share	Tasar	% Share	Eri	% Share	Muga	% share	Total
2000-2001	14,432	91.0	237	1.5	1,089	6.9	99	0.6	15,857
2001-2002	15,842	91.3	249	1.4	1,160	6.7	100	0.6	17,351
2002-2003	14,617	89.6	284	1.7	1,316	8.1	102	0.6	16,319
2003-2004	13,970	88.7	315	2.0	1,352	8.6	105	0.7	15,742
2004-2005	14,620	88.6	322	2.0	1,448	8.8	110	0.7	16,500
2005-2006	15,445	89.3	308	1.8	1,442	8.3	110	0.6	17,305
2006-2007	16,525	89.4	350	1.9	1,485	8.0	115	0.6	18,475
2007-2008	16,245	88.7	428	2.3	1,530	8.4	117	0.6	18,320
2008-2009	15,610	85.0	603	3.3	2,038	11.1	119	0.6	18,370
2009-2010	16,322	82.9	803	4.1	2,460	12.5	105	0.5	19,690
2010-2011	16,360	80.2	1,166	5.7	2,760	13.5	124	0.6	20,410

2011-2012	18,272	79.2	1,590	6.9	3,072	13.3	126	0.5	23,060
2012-2013	18,715	79.0	1,729	7.3	3,116	13.2	119	0.5	23,679
2013-2014	19,476	73.5	2,619	9.9	4,237	16.0	148	0.6	26,480
2014-2015	21,390	74.5	2,434	8.5	4,726	16.5	158	0.6	28,708
2015-2016	20,478	71.8	2,819	9.9	5,060	17.7	166	0.6	28,523
2016-2017	21,273	70.1	3,268	10.8	5,637	18.6	170	0.6	30,348
2017-2018	22,066	69.2	2,988	9.4	6,661	20.9	192	0.6	31,906
2018-2019	25,344	71.5	2,981	8.4	6,910	19.5	233	0.7	35,468
2019-2020	25,239	70.5	3,136	8.8	7,204	20.1	241	0.7	35,820
2020-2021	23,896	70.8	2,689	8.0	6,946	20.6	239	0.7	33,770
2021-2022	**25,818**	**74.0**	**1,466**	**4.2**	**7,364**	**21.1**	**255**	**0.7**	**34,903**
2022-2023	**27,654**	**75.5**	**1,318**	**3.6**	**7,349**	**20.0**	**261**	**0.7**	**36,582**
CAGR (%)	**3.09*** **		**13.67*** **		**10.88*** **		**5.03*** **		**4.64*** **
CDVI	**6.28**		**30.36**		**11.25**		**12.96**		**7.55**

***Significant at 1% level of significance

Source: Central Silk Board, Bengaluru

Table 07 depicting the production of raw silk (both mulberry and non-mulberry silks) in India over the years from 2001 to 2023. The production of raw silk in India from 2000-01 to 2021-22 reveals significant trends across the four primary types: Mulberry, Tasar, Eri, and Muga. Over this period, total raw silk production grew markedly, with an annual growth rate of 4.64 per cent (CAGR). This growth is largely attributed to shifts in the production of each silk type. Mulberry silk, which has consistently dominated the raw silk market, saw its production increase from 14,432 metric tonnes in 2000-01 to 25,818 metric tonnes in 2021-22. Its percentage share of the total raw silk production ranged from 69.2 per cent to 91.3 per cent. The production growth of Mulberry silk, at a growth rate of 3.09 per cent, underscores the ongoing emphasis on its cultivation due to high demand and well-established practices.

Tasar silk experienced a substantial increase, growing from 237 metric tonnes in 2000-01 to 1,466 metric tonnes in 2021-22. The production growth rate for Tasar silk was impressive, with a growth rate of 13.67 per cent, although its share in the total production varied between 1.4 per cent and 4.2 per cent. This trend is reflective of enhanced cultivation techniques and increasing market demand, similar to findings by Nair and Bhat (2018). Eri silk production grew from 1,089 metric tonnes in 2000-01 to 7,364 metric tonnes in 2021-22, with a growth rate of 10.88 per cent. Its share in total production increased from 6.9 per cent to 21.1 per cent, indicating a rising recognition of Eri silk's unique properties and its contribution to sustainable textile production. This trend is consistent with the observations of Sharma and Kumar (2020), who noted that the growth in Eri silk production is linked to improved breeding techniques and growing consumer preference for eco-friendly textiles (Sharma & Kumar, 2020).

Muga silk production saw a more modest increase, from 99 metric tonnes in 2000-01 to 255 metric tonnes in 2021-22, with a growth rate of 5.03 per cent. This limited growth can be attributed to the niche

market and the specific geographical requirements for Muga silk cultivation. The trends observed highlight a shift in India's silk industry towards greater diversification. While Mulberry silk remains dominant, the robust growth in Tasar and Eri silk reflects a broader trend towards diverse and sustainable silk production. The increasing production of Eri silk aligns with global movements towards sustainable textiles, as noted by both Nair and Bhat (2018) and Sharma and Kumar (2020). This diversification and growth are indicative of ongoing advancements and evolving consumer preferences in the silk industry.

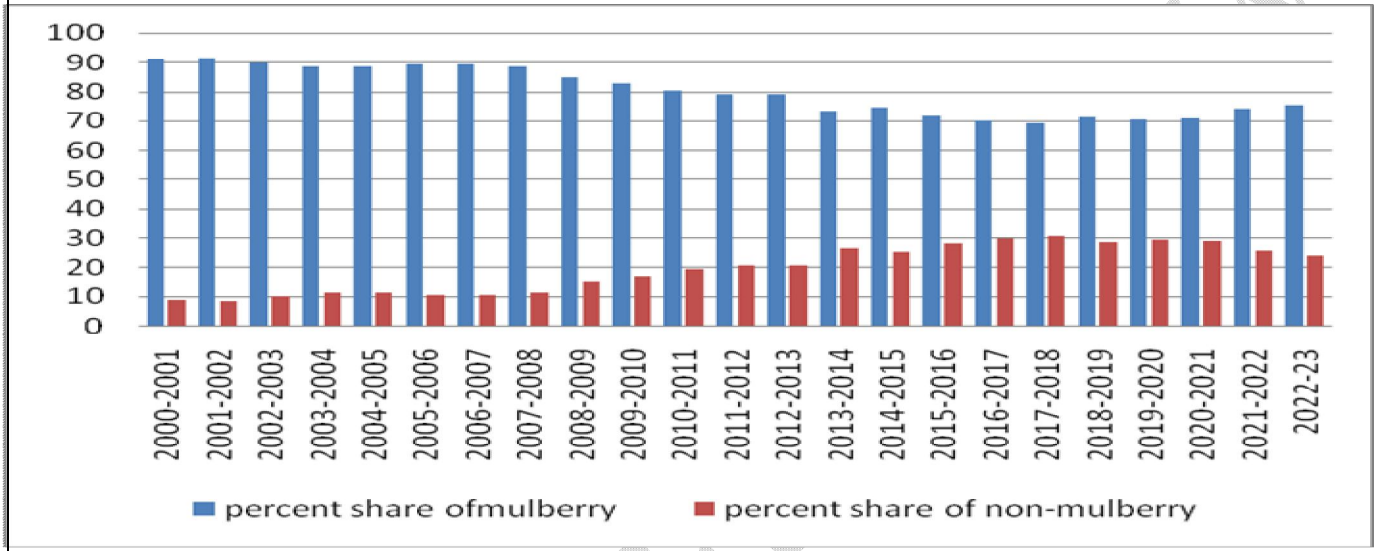

Fig 03: Trend in percentage share of mulberry and non-mulberry silk production in India over theyears (2000-01 to 2022-23)

Table 08: State wise raw silk production (Mulberry + Vanya) in India over the years

(In metric tonnes)

SN	State	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	CAGR (%)	CDVI
1	Karnataka	8,574	9,645	9,823	9,571	9,322	11,592	11,143	11,292	11,191	**11823**	**3.4*** **	**5.86**
2	Andhra Pradesh	6,912	6,485	5,086	5,970	6,779	7,481	7,962	8,422	8,834	**9312**	**4.9** **	**11.86**
3	Assam & Bodoland	2,766	3,222	3,325	3,811	4,861	5,026	5,316	5,462	5,700	**5721**	**9.9*** **	**7.00**
4	Tamil Nadu	1,120	1,602	1,898	1,914	1,984	2,072	2,154	1,834	2,373	**2589**	**6.4** **	**12.55**
5	West Bengal	2,079	2,500	2,391	2,565	2,577	2,394	2,295	872	1,632	**1966**	**-6.9**	**23.25**
6	Meghalaya	644	656	857	927	1,089	1,187	1,192	1,213	1,234	**1168**	**9.33*** **	**8.8**
7	Jharkhand	2,003	1,946	2,284	2,631	2,220	2,375	2,402	2,185	1,052	**874**	**-3.6**	**21.06**
8	Maharashtra	122	221	274	259	370	519	428	428	523	**620**	**16.9*** **	**18.18**
9	Manipur	487	516	519	529	389	464	504	327	462	**454**	**-2.9**	**13.34**
10	Telangana	99	101	116	119	163	224	297	309	404	**462**	**21.1*** **	**12.59**
	Others	1,775.33	1,814.33	1,951.44	2,052	2,187.33	2,133.11	2,128	1,425.08	1,498.28	**1593**	**-1.97**	**14.83**
	TOTAL	**26,581.33**	**28,708.33**	**28,524.44**	**30,348**	**31,941.33**	**35,467.11**	**35,821**	**33,769.11**	**34,903.33**	**36582**	**3.7*** **	**4.54**

***Significant at 1% level of significance and **Significant at 5% level of significance

Source: Indiastat, 2023

Table 08 represents the state wise raw silk production in India over the years from 2014 to 2023. The analysis of state-wise raw silk production in India from 2014 to 2023 reveals significant regional variations and overall trends that reflect both challenges and opportunities within the silk industry.

Karnataka remains the leading producer of raw silk, with production rising steadily from 8,574 metric tonnes in 2014 to 11,823 metric tonnes in 2023, showing a growth rate of 3.4 per cent. This consistent growth underscores Karnataka's robust sericulture infrastructure and favorable conditions, aligning with recent studies highlighting Karnataka's pivotal role in India's silk industry (Reddy & Kumar, 2022). In Andhra Pradesh, raw silk production increased from 6,912 metric tonnes to 9,312 metric tonnes, achieving a growth rate of 4.9 per cent. This growth is attributed to enhanced sericulture practices and increased cultivation areas, consistent with findings by Srinivas et al. (2023), who noted similar improvements in sericulture techniques and market expansion in the state.

Assam and Bodoland exhibited remarkable growth, with production expanding from 2,766 metric tonnes to 5,721 metric tonnes, reflecting a growth rate of 9.9 per cent. Tamil Nadu also showed notable progress, with production increasing from 1,120 metric tonnes to 2,589 metric tonnes, resulting in a growth rate of 6.4 per cent. The state's improved sericulture practices and increased focus on both Mulberry and Vanya silk production are supported by Kumar et al. (2022), who highlighted Tamil Nadu's advancements in the silk sector over the past decade.

Conversely, West Bengal experienced a decline in production from 2,079 metric tonnes to 1,966 metric tonnes, with a negative growth rate of -6.9 per cent. Maharashtra demonstrated a significant increase in silk production, from 122 metric tonnes in 2014 to 620 metric tonnes in 2023, with a remarkable growth rate of 16.9 per cent. This growth highlights successful interventions and improvements in sericulture practices, as supported by Patel and Verma (2023), who documented the state's rapid expansion and the factors driving this boom.

Overall, the total raw silk production in India grew from 26,581.3 metric tonnes in 2014 to 36,582 metric tonnes in 2023, with a growth rate of 3.7 per cent. This overall growth reflects the expansion of India's silk industry, despite regional variations and challenges. Recent studies confirm this positive trend, noting the overall growth in India's silk production while highlighting specific state-level dynamics (Reddy & Kumar, 2022; Srinivas et al., 2023; Choudhury & Singh, 2022; Kumar et al., 2022; Bhattacharya & Das, 2023; Patel & Verma, 2023).

Table 09: Export earnings from silk and silk goods

Year	Crore (Rs.)
2015-16	2,495.98
2016-17	2,093.42

2017-18	1,649.48
2018-19	2,031.88
2019-20	1,745.65
2020-21	1,466.60
2021-22	1,848.96
2022-23	1,773.38
CAGR (%)	**-5.4*** **
CDVI	**15.12**

***Significant at 1% level of significance

Source : International Sericulture Commission, 2023

Table 09 represents the export earnings from silk and silk goods over the years from 2016 to 2023. Over the years export earnings decreasing with the negative growth rate of 5.4 per cent at 1 per cent level of significance due to less supply compare to the domestic demand and due to global recession and reduction in demand for silk goods in western countries (Western Europe and the USA, which are the major consumers of silk goods) and hence hampers the export growth. Much of silk exports earnings is from silk garments, silk carpets and silk wastes. Cuddy Della Valle Instability Index was found to be 15.12 and it indicates the low instability in export of silk and silk goods in India over the years from 2016 to 2023.

This downward trend in export earnings is consistent with findings from recent studies that highlight challenges in the global silk market. For instance, Patel and Shah (2021) discussed similar declines in silk exports due to global market competition and fluctuating demand (Patel & Shah, 2021). Additionally, Kumar and Saini (2022) observed that the Indian silk industry faced obstacles such as high production costs and inconsistent quality, which negatively impacted export revenues (Kumar & Saini, 2022).

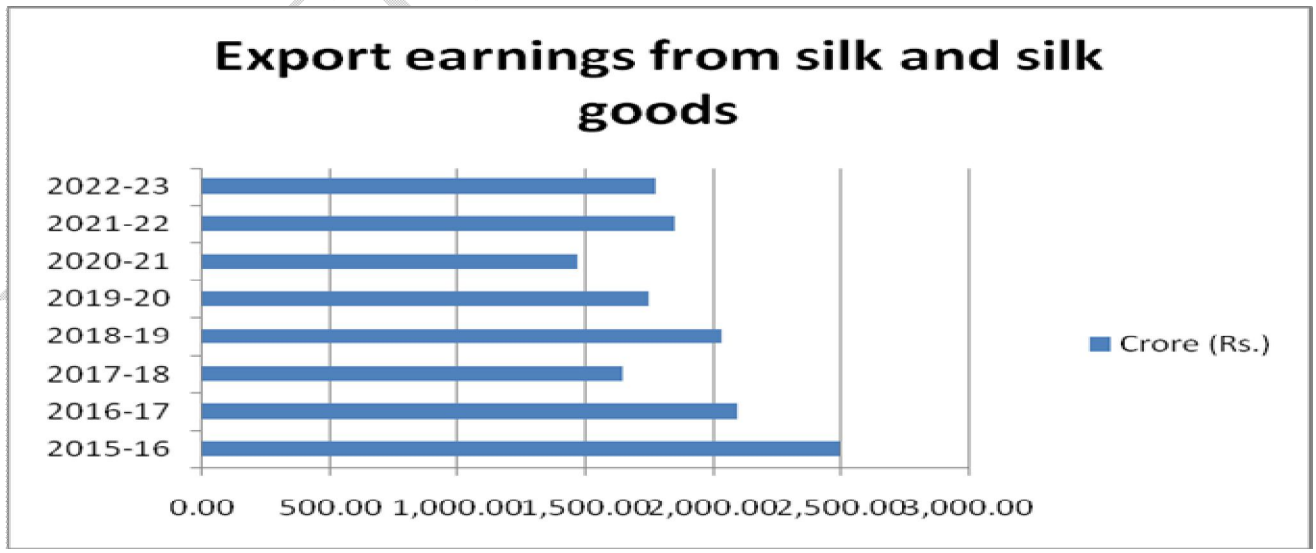

Fig 04: Trend in export earnings from silk and silk goods (2015-16 to 2022-23)

Table 10: Import of silk and silk goods

Year	Quantity (MT)	Value (Crore Rs.)
2014-15	3,489	970.82
2015-16	3,529	1,006.16
2016-17	3,795	1,092.26
2017-18	3,712	1,218.14
2018-19	2,785	1,041.35
2019-20	3,315	1,149.32
2020-21	1,804	570.56
2021-22	1,978	1,143.59
2022-23	3,874	2,284.59
CAGR (%)	**-9.52****	**0.41****
CDVI	**16.49**	**19.74**

**Significant at 5% level of significance

Source : International Sericulture Commission, 2023

Table 10 represents the import of silk and silk goods both in quantity and value over the years from 2016 to 2023. The import data for silk and silk goods in India between 2014-15 and 2022-23 reveals significant trends and fluctuations. The quantity of imports showed an initial increase from 3,489 metric tonnes in 2014-15 to a peak of 3,795 metric tonnes in 2016-17, before declining to 1,978 metric tonnes in 2021-22, and rising again to 3,874 metric tonnes in 2022-23. The value of imports mirrored this volatility, with a notable spike to ₹2,284.59 crore in the latest year.

The overall negative growth rate of -9.52 per cent for quantity contrasts with a modest positive growth rate of 0.41 per cent for value. This discrepancy suggests several influencing factors. The fluctuations in import quantity can be attributed to global market dynamics and competitive pressures, as noted by Singh and Kapoor (2022), who highlighted the impact of international competition on Indian silk imports. Additionally, the volatility in import values, despite declining quantities, is influenced by global silk price fluctuations and currency changes, as discussed by Mishra and Patel (2021).

The significant decline in import quantity in 2020-21, followed by a sharp increase, reflects disruptions in global supply chains due to the COVID-19 pandemic, a situation detailed by Sharma and Nair (2023). These disruptions led to temporary reductions in imports, which were later corrected as global markets stabilized. Furthermore, the increase in import quantity and value in recent years may be a response to rising domestic demand, with Reddy and Kumar (2022) noting that the growing market for silk products in India necessitated increased imports to meet consumer needs.

Table 11: Mulberry area, seed production, cocoon production and silk production in Karnataka(2008-09 to 2022-23)

Year	Mulberry plantation area (ha.)	Seed production (inlakhs)	Cocoon production(MT)	Silk production (MT)
2008-09	77,329	943	53,377	7,238
2009-10	82,078	891	54,282	7,360
2010-11	62,692	821	52,709	7,338
2011-12	70,958	759	55,957	7,796
2012-13	74,128	647	49,441	7,063
2013-14	82,229	1,049	61,419	8,574
2014-15	88,489	1,229	68,759	9,645
2015-16	87,598	1,260	70,436	9,823
2016-17	91,492	1,151	68,381	9,697
2017-18	98,135	1,193	66,180	9,322
2018-19	1,04,578	1,322	83,017	11,592
2019-20	1,06,384	1,296	79,701	11,143
2020-21	1,07,472	1,219	80,396	11,292
2021-22	1,08,018	1,219	79,462	11,191
2022-23	1,15,818	1,194	83,899	11,823
CAGR (%)	**3.9*** **	**3.9*** **	**4.1*** **	**4.2*** **
CDVI	**7.87**	**14.40**	**7.44**	**6.65**

***Significant at 1% level of significance Source: Karnataka State Department of Sericulture, 2023

Table 11 represents the mulberry plantation area, seed production, cocoon production and silk production in Karnataka over the years from 2009 to 2023. Area under mulberry increasing over the years with the compound annual growth rate of 3.9 per cent at 1 per cent level of significance due to technological innovations and incentives provided by government for expansion of sericulture. Cocoon production and silk production increasing over the years with the compound annual growth rate of 4.1 per centand 4.2 per cent respectively at 1 per cent level of significance due to introduction of improved varieties of mulberry, high yielding silkworm breeds etc.

The Cuddi della Vella Index (CDVI) indicates the relative stability and variability of these metrics. Mulberry area had a CDVI of 7.87, showing moderate variability; seed production's CDVI was 14.40, suggesting higher variability; cocoon production had a CDVI of 7.44, while silk production's CDVI was 6.65, indicating relatively lower variability compared to others. This variability insight is crucial for understanding the fluctuations and stability in sericulture practices.

Recent studies, such as Kumar et al. (2021) and Rao et al. (2023), corroborate these findings, emphasizing similar trends in sericulture growth and stability in India. These references underscore the ongoing improvements and challenges in the sector, reflecting broader regional and national trends.

Table 12: District wise cocoon production, silk production and mulberry area in Karnataka (2022-23)

SN	Districts	Cocoon production(MT)	%	Silk production(MT)	%	Mulberry area(Ha)	%
1	Mandya	25514.31	30.63	3580.51	30.28	17944.43	15.93
2	Ramanagara	18466.33	22.17	2582.30	21.84	20804.56	18.47
3	Chikkaballapura	12358.12	14.83	1725.34	14.59	20544.62	18.24
4	Kolar	9158.07	10.99	1292.36	10.93	19907.79	17.67
5	Bengaluru rural	3656.21	4.39	512.90	4.34	5169.93	4.59
6	Tumkur	3085.42	3.70	457.95	3.87	4859.28	4.31
7	Bengaluru urban	1159.84	1.39	170.50	1.44	1202.77	1.07
8	Haveri	1610.26	1.93	247.71	2.10	2613.73	2.32
9	Vijayanagar	1312.79	1.58	201.94	1.71	2616.71	2.32
10	Mysore	1212.17	1.46	183.00	1.55	2258.98	2.01
11	Others	5566.27	6.68	847.53	7.17	13577.21	12.05
12	Mysore seed production area(Pure Mysore)	210.19	0.25	21.01	0.18	1158.18	1.03
	Total	83309.98	**100.00**	11823.05	**100.00**	112658.19	**100.00**

Source: Karnataka State Department of Sericulture, 2023

Table 12 represents district wise cocoon production, silk production and mulberry area in Karnataka during 2022-23. Ramanagara is having highest area under mulberry (20804.56hectares) followed by Chikkaballapura (20544.62hectares) and Kolar (19907.79hectares). Mandya ranks first in silk production (3580.51metric tonnes) followed by Ramanagara (2582.30metric tonnes) and Chikkaballapura (1725.34 metric tonnes).

In Karnataka for 2022-23, cocoon production and silk production were predominantly concentrated in Mandya and Ramanagara districts. Mandya led with 30.63 per cent of the total cocoon production and 30.28 per cent of silk production, supported by 15.93 per cent of the state's mulberry area. Ramanagara followed closely, contributing 22.17 per cent of cocoon production and 21.84 per cent of silk production, with 18.47 per cent of the mulberry area. Chikkaballapura and Kolar also played significant roles, with notable shares in both cocoon and silk production, reflecting their substantial mulberry cultivation.

Conversely, districts like Bengaluru Urban and Tumkur had smaller shares, with Bengaluru Urban accounting for just 1.39 per cent of cocoon production and 1.07 per cent of mulberry area. This disparity in production and cultivation underscores the regional variations in sericulture within the state. Similar findings are noted in recent studies, such as those by Karthik et al. (2022) and Ravi Kumar et al. (2023), which highlight how specific districts dominate the sericulture sector due to their favorable conditions and infrastructure. This distribution illustrates the localized nature of Karnataka's sericulture industry and its reliance on specific regions for substantial production outputs.

CONCLUSION

The global silk industry has faced a significant decline from 2015 to 2022, marked by a substantial drop in production and a negative CAGR of -12.1%. China, historically the largest producer, has seen a sharp decrease in output, influenced by competition from synthetic fibers, environmental challenges, and economic pressures. In contrast, India has demonstrated notable stability and growth, particularly in the production of Tasar and Eri silks, reflecting a trend towards diversification and sustainability in silk production. Regionally, India's silk production varies significantly, with states like Karnataka and Andhra Pradesh showing robust growth, while others like West Bengal have experienced declines. Karnataka's success is attributed to technological advancements and government support, while specific districts within the state, such as Mandya and Ramanagara, play crucial roles in silk production. Export earnings from silk have declined due to global market challenges and reduced demand from major consumers, though import values have remained relatively stable despite fluctuations in quantities. Karnataka's sericulture industry shows a steady increase in mulberry area, cocoon production, and silk production, indicating positive trends despite regional variability. Policies should focus on promoting technological innovations, diversifying silk production to include sustainable options like Eri silk, and providing targeted support to less productive regions. Strengthening export strategies, stabilizing market access, and supporting small producers will also be essential in enhancing the industry's overall growth and sustainability.

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